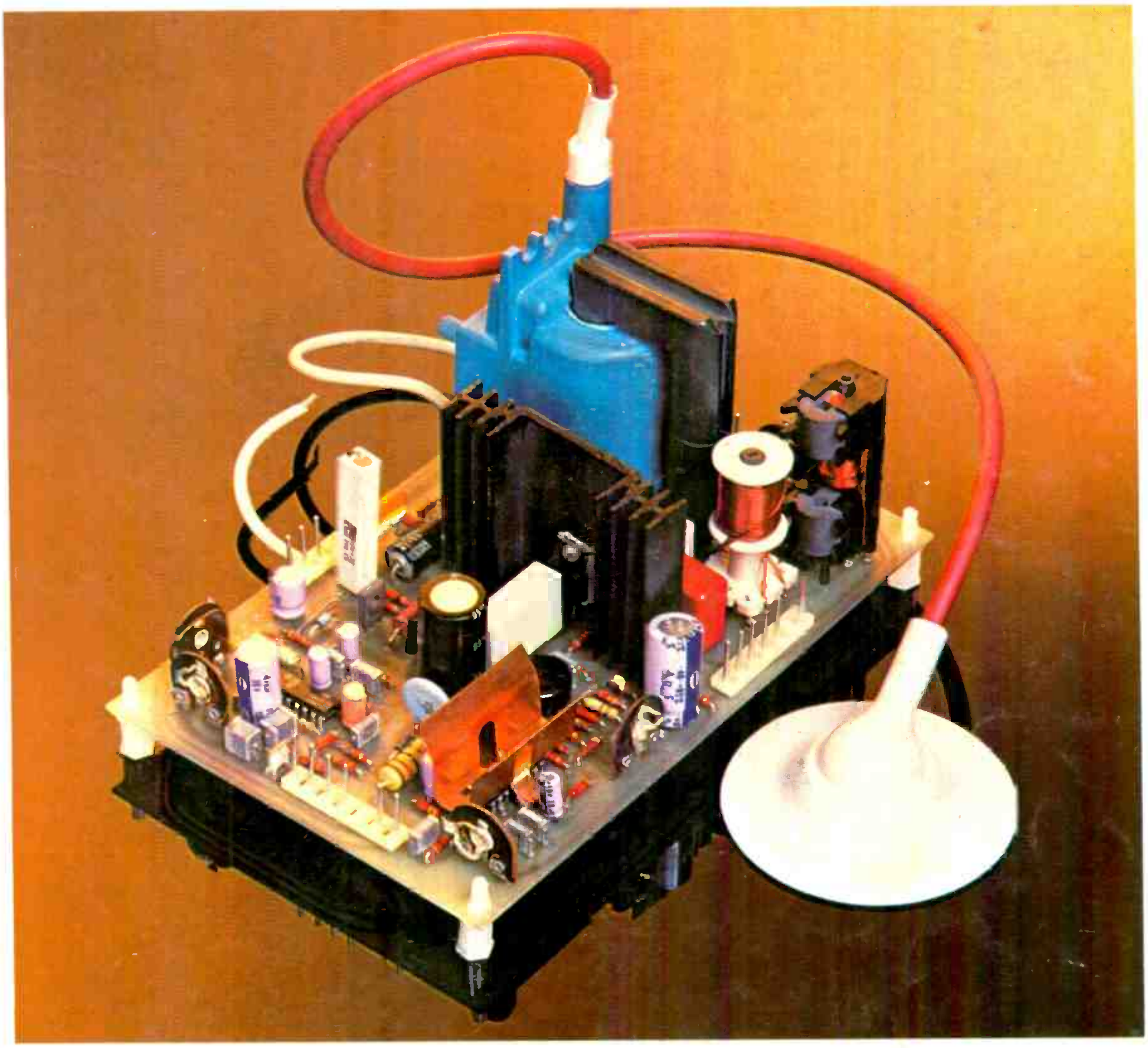
AUGUST 1981



# TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



SERVICING
THE PHILIPS G9 CHASSIS

CRT TESTER/BOOSTER

AERIAL STACKING

ACTIVE RIPPLE FILTERS

# TELEVISION

August 1981 — Vol. 31, No. 10 — Issue 370


## this month



**OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 19**



*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, Lavington Street, London SE1 0PF.

*SUBSCRIPTIONS*
An annual subscription costs £10 in the UK, £11 overseas ($24.20 Canada or USA). Send orders with payment to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

*BINDERS AND INDEXES*
Binders (£4.40) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders, add 60p.

*BACK NUMBERS*
Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at 85p inclusive of postage and packing.

*QUERIES*
We regret that we cannot answer technical queries over the telephone nor supply service sheets. We will endeavour to assist readers who have queries relating to articles published in *Television*, but we cannot offer advice on modifications to our published designs nor comment on alternative ways of using them. All correspondents expecting a reply should enclose a stamped addressed envelope.
Requests for advice in dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

# TV LINE OUTPUT TRANSFORMERS
## (ALL NEW AND FULLY GUARANTEED)

### (Prices include VAT at 15%)

**Discount to Trade    Post and Packing 85p**

| RANK BUSH MURPHY | |
|---|---|
| Z146 A640 dual std mono | 9.48 |
| Bush A792, A793 single std mono | 9.48 |
| A774 single std mono | 9.48 |
| A816 solid state mono | 10.43 |
| Z712 T16a T16b mono portable | 10.43 |
| A823 A823b A823av colour | 11.98 |
| Z179 Z722 series colour | 18.06 |
| Z718 18" series | 24.57 |
| Z718 20" 22" 26" series | 24.57 |
| T20a T22 series colour | 16.00 |
| **DECCA** | |
| MS2000 MS2400 mono | 6.80 |
| MS1700 2001 2020 2401 mono | 9.26 |
| MS2404 2420 2424 mono | 9.26 |
| 1210 1211 1511 portable | 11.09 |
| GYPSY portable | 10.24 |
| CS1730 1733 colour | 10.00 |
| CS1830 1835 colour | 10.00 |
| '30' series BRADFORD colour | 10.00 |
| 80 series colour | 10.00 |
| 100 series colour | 10.00 |
| **G.E.C** | |
| 2000 to 2064 dual std mono | 9.50 |
| 2047 to 2105 3112 to 3135 | 9.50 |
| "GAIETY" FINELINE | 9.50 |
| 2114 portable mono | 9.50 |
| 3133 3135 M1501H portable mono | 9.50 |
| DUAL STD hybrid colour | 11.59 |
| SINGLE STD hybrid colour | 11.59 |
| SINGLE STD solid state 90° or 110° | 10.00 |
| **INDESIT** | |
| 20EGB 24EGB mono | 9.90 |
| **PHILIPS** | |
| 170 series dual std mono | 9.20 |
| 210 300 series mono | 9.20 |
| 320 series solid state mono | 10.00 |
| G6 single std colour | 19.88 |
| G8 series colour | 10.35 |
| G9 series colour | 10.35 |
| G11 series colour | 17.36 |
| **KB-ITT** | |
| VC2 to VC10 VC12 to VC100 | 9.20 |
| VC200 VC205 VC207 mono | 9.20 |
| VC300 VC301 VC302 portable | 9.20 |
| CVC1 CVC2 colour | 10.35 |
| CVC5 CVC7 CVC8 CVC9 colour | 10.35 |
| CVC20 series colour | 10.74 |
| CVC30 CVC32 series colour | 10.00 |
| CVC40 series | 15.90 |
| **GRUNDIG** | |
| HYBRID 717 1500 3010 colour | 12.57 |
| 5010 6010 5011 6011 6022 2222 | 12.57 |
| 1510 2210 2252 5012 colour | 12.57 |

| PYE | |
|---|---|
| 169 173 569 573 769 series | 9.26 |
| RV293B 368 series | 9.20 |
| 691 692 693 697 series colour | |
| Two types see below | |
| Wired in version | 21.41 |
| Printed circuit version | 15.26 |
| 713 715 570 series colour | 12.32 |
| 731 735 737 741 colour | 10.10 |
| 725 colour | 10.00 |
| **FERGUSON HMV MARCONI ULTRA THORN** | |
| 950 mk2 1400 mono | 8.50 |
| 1500 20" 1500 24" 1580 mono | 8.50 |
| 1590 1591 1592 1593 mono | 9.50 |
| 1612 1613 1712 mono | 8.50 |
| 1690 1691 mono | 11.85 |
| 1600 1615 series mono | 14.64 |
| 3000 3500 EHT or SCAN | 8.50 |
| 8000 8000a series colour | 12.14 |
| 8500 8800 series colour | 12.14 |
| 9000 series colour | 12.14 |
| 9800 series colour | 23.85 |
| **TELPRO** all models | 10.00 |
| **TANDBURG** CTV 2-2 colour | 10.00 |
| **NORDMENDE** solid state | 10.00 |
| **TELEFUNKEN** 637 647 | 10.00 |
| **ZANNUSI** | 10.71 |

## WINDINGS
### WIRED TO TAG PANELS

Post & Packing **40p**

| RANK BUSH MURPHY | |
|---|---|
| Colour hybrid quadrupler type | 5.60 |
| T20a T22 Z719 Z722 Pry & Sec | 6.83 |
| Z718 series primary | 5.60 |
| Z718 series EHT overwind | 7.20 |
| **PHILIPS** | |
| G6 eht overwind | 7.20 |
| G6 primary | 4.60 |
| **KORTING** hybrid series | 7.60 |
| **WALTHAM** 125 EHT overwind | 3.00 |
| **PYE** | |
| 691 to 697 EHT overwind* | 3.07 |
| 691 to 697 primary* | 4.60 |
| *Please state printed circuit or wired version | |
| **FERGUSON HMV MARCONI ULTRA THORN** | |
| 8000 8000a primary | 4.50 |
| 8500 8800 primary | 4.50 |
| 8500 8800 EHT overwind | 6.00 |

**Contact your nearest depot for service by return.**
**Callers welcome. Please phone before calling.**
**If the Transformer you require is not listed please phone.**

**Tidman Mail Order Ltd.,**
**236 Sandycombe Road,**
**Richmond, Surrey.**
Approx 1 mile from Kew Bridge.
**Phone: 01-948 3702**
Mon-Fri 9 am to 12.30 pm.
1.30 to 4.30 pm.
Sat 10 am to 12 pm.

**Hamond Components**
**(Midland) Ltd.,**
**416, Moseley Road,**
**Birmingham B12 9AX.**
**Phone: 021-440 6144.**
Mon-Fri 9 am to 1 pm.
2 pm to 5.30 pm.

---

**THE VERY LATEST SC110 LOW POWER, FULLY PORTABLE OSCILLOSCOPE.**

The new Thandar SC110 represents a break-through in oscilloscope development. The SC110 is LESS THAN TWO INCHES thick and weighs under two pounds, yet retains the standard features and controls of a bench oscilloscope.

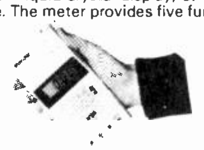
**1980 GOLD MEDAL** winner of the B.R.N.O. EXHIBITION, the largest Trade Fair held in Eastern Europe.

**Full Sized Performance**
- 10 MHz bandwidth.
- 10 mV per division sensitivity.
- Full trigger facilities are provided including TV frame, or TV filtering.
- Runs on 4 to 10V DC via disposable batteries, re-chargeable cells, or AC adaptor.
- Size 255mm × 148mm × 50mm.

'Scope **£139.00** + £20.85 V.A.T.
Carry case **£7.70** + £1.16 V.A.T.
× 1 Probe **£8.50** + £1.28 V.A.T.
× 10 Probe **£10.00** + £1.50 V.A.T.
(AC Adaptor **£4.95** + £0.74 V.A.T.)
(Overseas purchasers please state voltage.)
Re-chargeable cells **£7.50** + £1.13 V.A.T.

**THANDAR TM354 HAND HELD LCD DIGITAL MULTIMETER**

The TM354 is a compact $3\frac{1}{2}$ digit hand held multimeter featuring a **LARGE** 0.5" liquid crystal display, 0.75% basic accuracy and a **2000 HOUR** battery life. The meter provides five functions in fourteen ranges.



- DC voltages 1mV to 1000V
- AC voltages 1V to 500V
- DC current 1μA to 2Amps
- Resistance 1Ω to 2MΩ
- Diode check

Complete with test prods and vinyl pouch.
**£39.95** + £5.99 V.A.T.

World-wide post free service. Overseas orders welcome. Please deduct U.K. V.A.T. Mail Order only. Callers by appointment. Barclaycard/Access orders welcome, Cheque/Bank draft etc., with order please.
Large S.A.E. for technical leaflet and complete Thandar list.

## B. K. ELECTRONICS, Dept. 'T',
**37 Whitehouse Meadows, Eastwood,**
**Leigh-on-Sea, Essex SS9 5TY.**
**Tel: (0702) 527572.**

---

# QUALITY TV's ALWAYS AVAILABLE

GOOD STOCKS OF MODERN COLOUR
PLENTY OF SINGLE STANDARD MONO
VERY COMPETITIVE PRICES
COME TO THE BEST IN THE WEST

## TELETRADERS

**ST. LEONARDS WAREHOUSE**
**ST. LEONARDS ROAD, NEWTON ABBOT, DEVON**
**Telephone: (0626) 60154**

---

# SOLE SCOTTISH AGENTS 'Liver' Quality Colour Tubes

**2 YEAR GUARANTEE! 4 YEAR OPTION**

| | |
|---|---|
| A56/120X 22" only | £28.00 |
| A66/120X 26" only | £31.00 |
| A67/120X 26" only | £31.00 |
| A51/110 20" only | £28.00 |

ALL PRICES PLUS VAT. OLD GLASS RETURNABLE. PERSONAL CALLERS WELCOME

**TRITEL**

**THE MILL,**
**PEACOCK CROSS**
**INDUSTRIAL ESTATE,**
**32 BURNBANK ROAD,**
**HAMILTON.**
**TEL: (0698) 282141.**

# BRIARWOOD

## QUALITY SELECTED EX EQUIPMENT SPARES

**MISC** **S/Output Trans. £1** + VAT + P&P F/Output Trans. £1.25 + BAT + £1 P&P Scancoils £1.50 + VAT + £1 PIP. Other spares available, please write or phone for details.

**MONO TUNERS**

6 button integrated all at **£4.00**
U.H.F. P/Button D/S **£3.50.** U.H.F. P/Button S/S **£4.00.** Rotary **£3.00** + £1 P&P

**MONO TUBES**

(tested)

| | | |
|---|---|---|
| 19" | Rimguard | £3.00 |
| 23" | Rimguard | £4.00 |
| 20" | Rimguard | £5.00 |
| 24" | Rimguard | £6.00 |

+ £5.00 P & P

**MONO LOPTS**

All D/Standard Lopts at **£4.00** + £1 P&P.
All S/Standard at **£4.00** + £1 P&P.

**MONO PANELS**

i.e. Philips, Bush, etc. **£3.50** + £1 P&P.
Quotations for complete S/hand chassis if required. (Diff. prices)

PLEASE ADD 15% V.A.T. TO ALL ITEMS AND OVERSEAS AT COST. CASH WITH ALL ORDERS.

### VALVES (MONO & COLOUR)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PCL82 | 0.10 | 30C1 | 0.10 | PCC189 | 0.10 | EF183 | 0.10 | PL504 | 0.25 | ECL80 | 0.10 |
| PCL83 | 0.25 | 30C17 | 0.10 | 30C15 | 0.10 | EF184 | 0.10 | 6/30L2 | 0.10 | PL509 | 1.00 |
| PCL84 | 0.10 | PCF802 | 0.10 | 30C18 | 0.25 | 6BW7 | 0.10 | 30PL1 | 0.25 | PY500 | 1.00 |
| PCL85 | 0.10 | PCF805 | 0.25 | PC97 | 0.20 | EH90 | 0.10 | 30PL13/4 | 0.10 | GY501 | 1.00 |
| PCL86 | 0.10 | PCF806 | 0.10 | PC900 | 0.10 | DY802 | 0.10 | 30FL1/2 | 0.25 | PL508 | 0.50 |
| PFL200 | 0.10 | PCF808 | 0.25 | EF80 | 0.10 | PY800/1 | 0.10 | ECC82 | 0.10 | PCF200 | 0.50 |
| PCF801 | 0.10 | PCF80 | 0.10 | EF85 | 0.10 | PL36 | 0.25 | ECC81 | 0.10 | EY51 | 0.15 |

Please note there is 50p Postage and Packing per order.

WE DO NOT SELL RUBBISH AT BRIARWOOD TV

## BRIARWOOD TV LTD (Export Division)

*TEL: 0274-306018 FOR PRICES & FREIGHT DETAILS*

### COLOUR & MONO TV'S ALWAYS AVAILABLE FOR WORLDWIDE USE

Briarwood T.V. Ltd., have international experience in quality used T.V. supply. Fully tested & converted where necessary – by our experienced Export Division.

### S/STANDARD COLOUR SPARE PANELS

| | IF | LUM | CHROMA | VIDEO | CON | POWER | L/TB | F/TB |
|---|---|---|---|---|---|---|---|---|
| Bush 184 | 9.50 | — | 12.00 | — | 6.00 | 6.00 | 12.00 | — |
| GEC Hybrid | 6.00 | 6.50 | 9.00 | — | 5.00 | — | — | 12.00 |
| Philips G6 S/S | 9.50 | — | 10.00 | — | 5.00 | — | — | 6.00 |
| Thorn 3000 | 6.00 | 6.00 | 6.00 | | 5.00 | 20.00 | 20.00 | 6.00 |
| Pye 691/693 | 6.00 | 6.00 | 8.00 | — | 5.00 | — | 15.00 | 5.00 |
| Thorn 3500 | 6.00 | 6.00 | 6.00 | 6.50 | 12.00 | 20.00 | 20.50 | 6.00 |

Korting and other foreign panels available on request.

Postage & Packing £1.25

**COLOUR TUBES**

| | |
|---|---|
| 17" | £15.00 |
| 18" | £15.00 |
| 19" | £15.00 |
| 19" A49/192 | £18.00 |
| 20" | £18.00 |
| 22" | £20.00 |
| 25" | £15.00 |
| 26" | £22.00 |

**Plus P&P £6.00**
**New rebuilt tubes available on request.**

**COLOUR TUNERS**

| | |
|---|---|
| Bush | £5.00 |
| GEC | £5.00 |
| Philips G6 S/S | £5.00 |
| Pye 691 | £5.00 |
| Thorn 3000 | £5.00 |

Some new tuners in stock, can supply on request. Many Foreign Tuners also available on request. Plus P&P £1.

**COLOUR LOPTS**

Most Lopts available from £5.00. Both British & Foreign makers. Please ring or write.
P&P per Lopt £1.00

**MISC.**

S/Output transformer from £1.50.
F/Output from £1.25.
Scancoils from £5.00. P&P £1.00
Other spares available on request.

**THORN 1500 TUNERS**

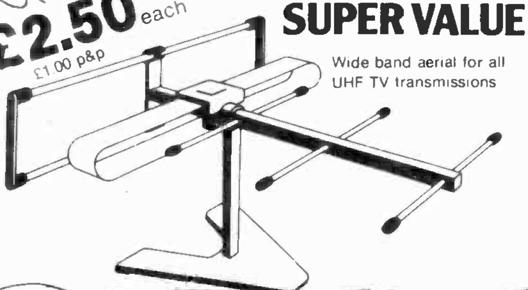
NEW SPECIAL OFFER AT £8.00

Postage & Packing £1.00

# NEW PRODUCTS!

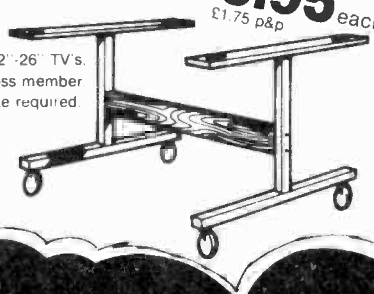
## SUPER VALUE - SUPER QUALITY

**£2.50** each
£1.00 p&p



Wide band aerial for all UHF TV transmissions

**£5.95** each
£1.75 p&p



Fits 22"-26" TV's. wood finished cross member State size required.

# TV scores with quality

WHY NOT TRY OUR EXPRESS MAIL ORDER ON ANY OF THE ITEMS LISTED

## NEW SPARE SELECTION

| TYPE | PRICE £ |
|---|---|
| AC107 | 0.24 |
| AC113 | 0.22 |
| AC115 | 0.23 |
| AC117 | 0.30 |
| AC125 | 0.23 |
| AC126 | 0.23 |
| AC127 | 0.22 |
| AC128 | 0.22 |
| AC131 | 0.13 |
| AC141 | 0.24 |
| AC142 | 0.24 |
| AC141K | 0.31 |
| AC142K | 0.31 |
| AC151 | 0.21 |
| AC165 | 0.21 |
| AC166 | 0.21 |
| AC168 | 0.22 |
| AC176 | 0.22 |
| AC176K | 0.28 |
| AC178 | 0.23 |
| AC186 | 0.26 |
| AC187 | 0.23 |
| AC188 | 0.23 |
| AC187K | 0.30 |
| AC188K | 0.30 |
| AD130 | 0.58 |
| AD140 | 0.68 |
| AD142 | 0.80 |
| AD143 | 0.70 |
| AD145 | 0.70 |
| AD149 | 0.64 |
| AD161 | 0.42 |
| AD162 | 0.42 |
| AD161) | |
| AD162) | 1.00 |
| AF106 | 0.42 |
| AF114 | 0.37 |
| AF118 | 0.45 |
| AF121 | 0.37 |
| AF125 | 0.30 |
| AF126 | 0.30 |
| AF127 | 0.30 |
| AF139 | 0.40 |
| AF150 | 0.27 |
| AF151 | 0.30 |
| AF170 | 0.92 |
| AF172 | 1.00 |
| AF178 | 1.00 |
| AF180 | 1.00 |

| TYPE | PRICE £ |
|---|---|
| AF181 | 1.00 |
| AF186 | 0.90 |
| AF239 | 0.46 |
| AU113 | 1.40 |
| BA130 | 0.08 |
| BA145 | 0.14 |
| BA148 | 0.21 |
| BA155 | 0.08 |
| BAX13 | 0.05 |
| BAX16 | 0.08 |
| BC107 | 0.11 |
| BC108 | 0.11 |
| BC109 | 0.11 |
| BC113 | 0.11 |
| BC114 | 0.11 |
| BC115 | 0.11 |
| BC116 | 0.11 |
| BC117 | 0.12 |
| BC119 | 0.24 |
| BC125 | 0.15 |
| BC126 | 0.15 |
| BC136 | 0.15 |
| BC137 | 0.17 |
| BC137 | 0.23 |
| BC139 | 0.23 |
| BC140 | 0.24 |
| BC141 | 0.27 |
| BC142 | 0.27 |
| BC143 | 0.27 |
| BC147 | 0.10 |
| BC148 | 0.10 |
| BC149 | 0.10 |
| BC153 | 0.12 |
| BC154 | 0.12 |
| BC157 | 0.12 |
| BC158 | 0.12 |
| BC159 | 0.12 |
| BC160 | 0.26 |
| BC161 | 0.26 |
| BC167 | 0.11 |
| BC168 | 0.11 |
| BC169 | 0.11 |
| BC171 | 0.10 |
| BC171A | 0.10 |
| BC172 | 0.10 |
| BC173 | 0.12 |
| BC177 | 0.12 |
| BC178 | 0.12 |
| BC178A | 0.12 |

| TYPE | PRICE £ |
|---|---|
| BC179 | 0.12 |
| BC182L | 0.09 |
| BC183L | 0.09 |
| BC183LA | 0.10 |
| BC183LB | 0.10 |
| BC184L | 0.09 |
| BC186 | 0.21 |
| BC187 | 0.21 |
| BC209 | 0.11 |
| BC212 | 0.09 |
| BC212L | 0.09 |
| BC213L | 0.09 |
| BC214L | 0.09 |
| BC237 | 0.09 |
| BC238 | 0.09 |
| BC240 | 0.31 |
| BC249 | 0.35 |
| BC251 | 0.22 |
| BC257 | 0.20 |
| BC262 | 0.18 |
| BC263B | 0.20 |
| BC267 | 0.19 |
| BC281 | 0.24 |
| BC300 | 0.27 |
| BC301 | 0.27 |
| BC302 | 0.30 |
| BC303 | 0.27 |
| BC307 | 0.11 |
| BC307A | 0.11 |
| BC308A | 0.12 |
| BC309 | 0.14 |
| BC337 | 0.12 |
| BC338 | 0.15 |
| BC487 | 0.20 |
| BC547 | 0.10 |
| BC548 | 0.11 |
| BC549 | 0.11 |
| BC557 | 0.12 |
| BCX33 | 0.10 |
| BD112 | 0.39 |
| BD113 | 0.65 |
| BD115 | 0.32 |
| BD116 | 0.47 |
| BD124 | 1.30 |
| BD131 | 0.36 |
| BD132 | 0.36 |
| BD133 | 0.37 |
| BD135 | 0.30 |
| BD136 | 0.30 |

| TYPE | PRICE £ |
|---|---|
| BD137 | 0.30 |
| BD138 | 0.31 |
| BD139 | 0.40 |
| BD140 | 0.37 |
| BD144 | 1.39 |
| BD145 | 0.50 |
| BD177 | 0.50 |
| BD178 | 0.50 |
| BD203 | 0.40 |
| BD204 | 0.70 |
| BD222 | 0.73 |
| BD233 | 0.36 |
| BD234 | 0.34 |
| BD237 | 0.44 |
| BD238 | 0.44 |
| BDX22 | 0.73 |
| BDX32 | 1.98 |
| BDY18 | 0.80 |
| BDY60 | 0.80 |
| BF115 | 0.30 |
| BF121 | 0.29 |
| BF154 | 0.12 |
| BF158 | 0.19 |
| BF159 | 0.24 |
| BF160 | 0.23 |
| BF163 | 0.30 |
| BF164 | 0.30 |
| BF167 | 0.30 |
| BF173 | 0.21 |
| BF177 | 0.26 |
| BF178 | 0.24 |
| BF179 | 0.28 |
| BF180 | 0.30 |
| BF181 | 0.34 |
| BF182 | 0.30 |
| BF183 | 0.29 |
| BF184 | 0.27 |
| BF185 | 0.29 |
| BF186 | 0.32 |
| BF192 | |
| BF194 | 0.15 |
| BF195 | 0.13 |
| BF196 | 0.13 |
| BF197 | 0.13 |
| BF198 | 0.12 |
| BF199 | 0.14 |
| BF200 | 0.28 |
| BF216 | 0.12 |
| BF217 | 0.12 |

| TYPE | PRICE £ |
|---|---|
| BF218 | 0.12 |
| BF219 | 0.12 |
| BF220 | 0.12 |
| BF221 | 0.21 |
| BF222 | 0.12 |
| BF224 | 0.18 |
| BF256 | 0.37 |
| BF258 | 0.30 |
| BF259 | 0.30 |
| BF260 | 0.25 |
| BF262 | 0.28 |
| BF263 | 0.25 |
| BF271 | 0.27 |
| BF272 | 0.27 |
| BF273 | 0.16 |
| BF336 | 0.30 |
| BF337 | 0.29 |
| BF338 | 0.29 |
| BF479 | |
| BFT | 0.27 |
| BFT | 0.27 |
| BFX84 | 0.27 |
| BFX85 | 0.27 |
| BFX | 0.30 |
| BFY37 | 0.22 |
| BFY50 | 0.21 |
| BFY51 | 0.21 |
| BFY52 | 0.21 |
| BFY53 | 0.27 |
| BFY55 | 0.33 |
| BFX | |
| BHA0002 | 1.90 |
| BSX20 | 0.23 |
| BSX76 | 0.23 |
| BSY84 | 0.36 |
| BU105 | 1.00 |
| BU105 02 | 1.50 |
| BU105 04 | 2.00 |
| BU126 | 1.40 |
| BU205 | 1.20 |
| BU206 | 1.60 |
| BU208 | 1.60 |
| OC22 | 1.10 |
| OC23 | 1.30 |
| OC24 | 1.30 |
| OC25 | 1.00 |
| OC26 | 1.00 |
| OC28 | 1.30 |
| OC35 | 1.00 |

| TYPE | PRICE £ |
|---|---|
| OC36 | 0.90 |
| OC38 | 0.90 |
| OC42 | 0.45 |
| OC44 | 0.60 |
| OC45 | 0.50 |
| OC46 | 0.39 |
| OC70 | 0.39 |
| OC71 | 0.39 |
| OC72 | 0.39 |
| OC74 | 0.39 |
| OC75 | 0.39 |
| OC76 | 0.39 |
| OC77 | 0.50 |
| OC78 | 0.23 |
| OC81 | 0.26 |
| OC810 | 0.14 |
| OC82 | 0.26 |
| OC820 | 0.20 |
| OC83 | 0.30 |
| OC84 | 0.30 |
| OC85 | 0.28 |
| OC123 | 0.25 |
| OC169 | 1.20 |
| OC170 | 1.20 |
| OC171 | 0.92 |
| OA91 | 0.07 |
| BRC4443 | 0.65 |
| R2008B | 1.50 |
| R2009 | 1.30 |
| R2010B | 1.50 |
| R2265 | 1.50 |
| R2305 | 0.38 |
| R2305 | |
| BD222 | 0.37 |
| R2540 | 2.50 |
| S2802 | — |
| SCR957 | 0.65 |
| TIP31A | 0.38 |
| TIP32A | 0.36 |
| TIP3055 | 0.53 |
| TIP31B | 0.39 |
| TIS90 | 0.23 |
| TIS91 | 0.25 |
| TV106 | 1.09 |
| MJE340 | 0.50 |
| MJE520 | 0.45 |
| 2N2219 | 0.40 |
| 2N2646 | 0.40 |
| 2N2926 | 0.15 |

| TYPE | PRICE £ |
|---|---|
| 2N3053 | 0.21 |
| 2N3054 | 0.60 |
| 2N3055 | 0.60 |
| 2N3442 | 1.00 |
| 2N3702 | 0.15 |
| 2N3703 | 0.12 |
| 2N3704 | 0.18 |
| 2N3705 | 0.18 |
| 2N3706 | 0.14 |
| 2N3707 | 0.14 |
| 2N3708 | 0.14 |
| 2N3772 | 2.00 |
| 2N3773 | 2.50 |
| 2N3819 | 0.30 |

### VALVES

| | |
|---|---|
| DY87 | 0.60 |
| DY802 | 0.64 |
| ECC82 | 0.60 |
| EF80 | 0.55 |
| EF183 | 0.70 |
| EF184 | 0.70 |
| EH90 | 0.75 |
| PC86 | 0.85 |
| PCC89 | 0.65 |
| PCC189 | 0.80 |
| PCF80 | 0.80 |
| PCF86 | 0.72 |
| PCF801 | 0.70 |
| PCF802 | 0.85 |
| PCL82 | 0.75 |
| PCL84 | 0.80 |
| PCL86 | 0.85 |
| PCL805 | 0.82 |
| PLF200 | 1.00 |
| PL36 | £1.10 |
| PL84 | 0.80 |
| PL504 | £1.30 |
| PL508 | 1.50 |
| PL509 | 2.45 |
| PL802 | £2.75 |
| PY88 | 0.75 |
| PY500A | 1.60 |
| PY81/800 | 0.70 |

### E.H.T. Trays Colour

| TYPE | PRICE £ |
|---|---|
| Pye 691 693 | 4.50 |
| Pye 715/731/735 | 5.50 |
| Pye 737 | 5.40 |
| Decca (Large Screen) CS2030/2232/2630/2632/2230/2233/2631 | 5.00 |
| Decca 80 | 5.30 |
| Decca 100 | 5.30 |
| Philips G8 520/540 | 5.30 |
| Philips G9 | 5.50 |
| Philips 550 | 5.30 |
| GEC C2110 | 5.50 |
| GEC Hybrid CTV | 5.10 |
| Thorn 3000/3500 | 5.00 |
| Thorn 800 | 2.42 |
| Thorn 8500 | 4.75 |
| Thorn 9000 | 5.50 |
| GEC TVM25 | 2.50 |
| ITT KB CVC 5/7/8/9 | 5.10 |
| ITT KB CVC 20/25 30/32 | 5.50 |
| Bush CTB25 MK3 | 0.85 |
| Quadrupler | 8.00 |
| Bush X179 | 4.50 |
| RRI (RBM) A823 | 5.00 |
| Bang & Olufsen 4/5000 Grundig 5010/5011/5012/6011/6012/7200/2052/2210/2252R Tandberg (radionette) Autovox | 6.60 |
| Grundig 3000/3010 Saba 2705/3715 Telefunken 709/710/717/2000 | 6.80 |
| Korting | 6.80 |

### E.H.T. TRAYS MONO

| | |
|---|---|
| 950 MK2 Single Stick Thorn TV 11, 16K 70V | 0.75 |
| TV 20 2 MT | 0.75 |
| TV 2016K 18V | 0.75 |
| BUSH 718 | 1.30 |

All transistors, IC's offered are new and branded. Manufactured by Mullard, I T T, Texas, Motorola etc.
Please add 15% VAT to all items and overseas at cost
P & P U.K. 50p per order, overseas allow for package and postage. Cash with all orders. All prices subject to alteration without notice

## MAIL ORDER TV BARGAINS

| | |
|---|---|
| PYE 691 | 22" @ £55.00 |
| PYE 691 | 26" @ £55.00 |
| PYE 697 | 22" @ £65.00 |
| PYE 697 | 26" @ £65.00 |
| BUSH 184 | 19" @ £70.00 |
| BUSH 184 | 22" @ £70.00 |
| BUSH 184 | 26" @ £70.00 |
| GEC 2040 | 19" @ £55.00 |
| GEC2040 | 22" @ £55.00 |
| GEC 2040 | 25" @ £55.00 |
| GEC 2040 | 26" @ £65.00 |
| KORTING | 22" @ £70.00 |
| KORTING | 26" @ £80.00 |
| THORN 3000 | 19" @ £70.00 |
| THORN 3000 | 25" @ £60.00 |

Good working mono's Pye, GEC, Bush etc.

| | |
|---|---|
| 20" & 24" S/S | £20.00 |
| 20" & 24" D/S | £18.00 |
| 19" & 23" D/S P/Button | £15.00 |
| 19" & 23" D/S Rotary | £12.00 |

Cheques, P.O. or Cash with orders Please. Please note there is 15% VAT on all the above prices. Plus £10.00 p & p for colour TV, £5.00 for mono. ENGLAND, WALES and SCOTLAND Inland N & S IRELAND £15.00 for colour, £7.00 for mono.

### IC's

| TYPE | PRICE £ |
|---|---|
| BTT6018 | 1.00 |
| CA3605 | 1.20 |
| MC7/c | |
| MC14016 | 0.50 |
| SN76003N | 1.40 |
| SN76023N | 1.20 |
| SN76110N | 1.00 |
| SN76226DN | 1.50 |
| SN76227N | 1.20 |
| SN76532N | 1.30 |
| SN76550N | 0.30 |
| SN76666N | 0.70 |
| TAA570 | 1.38 |
| TBA120AS | 1.00 |
| TBA120S | 0.75 |
| TBA120SQ | 0.75 |
| TBA395 | 2.20 |
| TBA341 | 0.97 |
| TBA520 | 1.40 |
| TBA520Q | 1.10 |
| TBA530Q | 1.10 |
| TBA540 | 1.30 |
| TBA540Q | 1.45 |

| | |
|---|---|
| TBA550Q | 1.40 |
| TBA560C | 1.50 |
| TBA560CQ | 1.50 |
| TBA570 | 1.00 |
| TBA570Q | 1.00 |
| TBA800 | 1.00 |
| TBA810 | 1.50 |
| TBA920 | 2.00 |
| TBA920Q | 1.50 |
| TBA990Q | 1.50 |
| TCA270SQ | 1.45 |
| TCA270SA | 1.45 |
| TCA270Q | — |
| TCA1327B | 1.00 |
| TCA800 | 2.00 |
| TDA1010 | — |
| TDA1327B | 1.00 |
| SBA750 | 1.75 |
| SC9503P | 1.20 |
| SC9504P | 1.20 |
| SL901B | 5.00 |
| SL917B | 7.00 |

### DIODES & THYRISTORS

| | |
|---|---|
| OA47 | 0.06 |
| OA81 | 0.06 |
| OA90 | 0.06 |
| OA91 | 0.07 |
| BA130 | 0.10 |
| BA145 | 0.16 |
| BA148 | 0.18 |
| BA154 | 0.18 |
| BA155 | 0.10 |

| | |
|---|---|
| BAX13 | 0.08 |
| BAX16 | 0.10 |
| BY126 | 0.10 |
| BY127 | 0.10 |
| BY164 | 0.40 |
| BY179 | 0.57 |
| BY226 | — |
| BY227 | 0.12 |
| BYF206 | 0.14 |
| 1N4001 | 0.04 |
| 1N4002 | 0.05 |
| 1N4003 | 0.06 |
| 1N4004 | 0.07 |
| 1N4005 | 0.07 |
| 1N4006 | 0.08 |
| 1N4007 | 0.08 |
| 1N4148 | 0.05 |
| 1N4751 | 0.14 |
| 1N5401 | 0.12 |
| 1N5403 | 0.12 |
| 1N5404 | 0.14 |
| 1N5405 | 0.14 |
| 1N5406 | 0.14 |
| 1N5408 | 0.25 |
| BR100 | 0.22 |
| BR101 | 0.28 |
| BT106 | 1.19 |
| BT108 | 1.23 |
| BT109 | 1.09 |
| BT116 | 1.60 |
| BT120 | 1.60 |
| 2N4444 | 0.90 |

## BRIARWOOD TELEVISION LTD

Briarwood House, Preston Street,
Bradford West Yorkshire BD7 1LU
Tel: (0274) 306018

# P. V. TUBES

Telephone: Accrington (0254) 36521

**38A WATER STREET, ACCRINGTON, LANCS BB5 6PX.**

WHOLESALE SUPPLIERS
OF TELEVISION COMPONENTS

**TRADE COUNTER OPEN MON-FRI 9 a.m.-4.30 p.m. SAT MORN. 9.30 a.m.-12 noon.**

## INTEGRATED CIRCUITS

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MC1307 | 1.00 | ML920 | 4.12 | SN76115N | 2.27 | TA7074P | 1.00 | TBA120SA | 70 | TBA5500 | 1.58 | TCA270SQ | 1.25 | TDA2541 | 2.65 |
| MC1327 | 1.00 | ML922 | 3.29 | SN76131N | 1.30 | TA7176P | 75 | TBA120AS | 70 | TBA5600 | 1.59 | TCA800 | 1.99 | TDA2560 | 1.90 |
| MC1330P | 90 | ML926 | 2.18 | SN76226(D)N | 1.55 | TA7205 | 2.95 | TBA120B | 1.30 | TBA570 | 1.00 | TCA940 | 1.60 | TDA2581 | 2.25 |
| MC1349 | 1.20 | ML928 | 2.18 | SN76227N | 1.10 | TAA350A | 60 | TBA120SB | 1.30 | TBA641-B11 | 2.40 | TDA440 | 2.20 | TDA2590 | 3.25 |
| MC1350 | 96 | SA5560S | 1.80 | SN76532N | 1.50 | TAA300 | 58 | TBA120U | 1.00 | TBA690 | 1.50 | TDA1004A | 2.95 | TDA2591 | 2.75 |
| MC1351 | 1.00 | SA5570S | 1.80 | SN76533N | 1.30 | TAA310 | 2.83 | TBA395 | 2.20 | TBA673 | 1.10 | TDA2540 | 3.15 | TDA2593 | 2.50 |
| MC1352 | 1.00 | SA5580S | 2.90 | SN76033N | 1.53 | TAA320 | 59 | TBA396 | 80 | TBA700 | 2.12 | TDA1170 | 1.99 | TDA2600 | 3.25 |
| MC1358PQ | 1.50 | SA5590S | 2.90 | SN76544N | 1.35 | TAA550 | 28 | TBA440N/TBA1441 | 2.75 | TBA7200 | 2.12 | TDA1190 | 2.60 | TDA2611A | 1.95 |
| MC1495L | 1.00 | SL901B | 4.45 | SN76650M | 89 | TAA570 | 1.80 | TBA440 | 2.50 | TBA750 | 2.05 | TDA1327 | 1.00 | TDA2640 | 2.25 |
| MC14011BCP | 42 | LS917B | 6.25 | SN76660N | 60 | TAA630 | 2.50 | TBA480 | 1.20 | TBA800 | 99 | TDA1352B | 1.60 | TDA2690 | 1.00 |
| MC14049BCP | 43 | SL1310 | 1.80 | SN76666N | 70 | TAA630S | 2.50 | TBA4800 | 1.20 | TBA810AS | 1.35 | TDA1412 | 1.20 | TDA3950 | 2.36 |
| ML231B/ETTR6016 | 2.20 | SL1327Q | 1.20 | SW153 | 2.74 | TAA840/S1 | 1.96 | TBA500P | 1.58 | TBA820 | 1.70 | TDA2020 | 4.66 | UPC566H | 2.95 |
| ML232/ETT6016 CA3065 | 2.20 | SL76544 | 2.00 | TA7141P | 95 | TAA700B | 1.70 | TBA510 | 3.00 | TBA920 | 1.80 | TDA2030 | 2.80 | UPC575C2 | 3.40 |
| | | SN76003N | 1.75 | TA7050P | 95 | TAA700 | 1.70 | TBA520Q | 1.20 | TBA9200 | 1.80 | TDA2522 | 2.40 | UPC1025HI | 4.50 |
| ML236 | 5.35 | SN76013N | 1.50 | TA7051P | 95 | TAA661B | 1.20 | TBA530Q | 1.28 | TBA950(2X) | 2.40 | TDA2523 | 2.20 | | |
| ML237 | 1.95 | SN76023N | 1.45 | TA7171P | 1.80 | TAA840 | | TBA530 | 1.20 | TBA990 | 1.49 | TDA2530 | 1.95 | | |
| ML238 | 4.20 | SN76023ND | 95 | TA7172P | 1.80 | TBA120A | 70 | TBA540 | 1.49 | TCA160 | 1.20 | TDA2532 | 2.45 | | |
| ML239 | 2.50 | SN76110N | 89 | TA7173P | 1.45 | TBA120S | 70 | TBA550 | 1.58 | TCA760 | 2.30 | TDA2524 | 2.25 | | |

**SOCKETS IC**

8 pin 24 · 16 pin 20
14 pin 18 · 14 pin Dil/Quil 28

## SEMICONDUCTORS

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AC126 | 22 | AU110 | 2.00 | BC171 | 9 | BC261B | 15 | BD138 | 23 | BF115 | 35 | BF259 | 24 | BFY90 | 75 | DC79 | 20 | 2N3706 | 10 |
| AC127 | 22 | AU113 | 1.40 | BC171A | 10 | BC262A | 15 | BD139 | 28 | BF117 | 36 | BF262 | 84 | BR100 | 17 | R2008B | 1.80 | 2N3708 | 17 |
| AC128 | 20 | BC107 | 20 | BC171B | 10 | BC262B | 15 | BD140 | 31 | BF125 | 26 | BF263 | 50 | BR101 | 30 | R2010B | 1.80 | 2N2904 | 30 |
| AC128K | 32 | BC107A | 20 | BC172 | 9 | BC300 | 33 | BD144 | 1.20 | BF127 | 26 | BF271 | 24 | BRC4443 | 80 | R2265 | 1.40 | 2N5294 | 48 |
| AC141K | 34 | BC107B | 20 | BC172B | 10 | BC301 | 28 | BD159 | 65 | BF154 | 12 | BF273 | 12 | BRX46 | 40 | R2322 | 58 | 2N5296 | 48 |
| AC142K | 30 | BC108 | 20 | BC172C | 10 | BC303 | 28 | BD160 | 1.30 | BF158 | 18 | BF310 | 30 | BRY39 | 30 | R2323 | 67 | 2N5298 | 69 |
| AC176 | 25 | BC108A | 20 | BC173C | 12 | BC307 | 10 | BD166 | 52 | BF160 | 27 | BF311 | 30 | BRY56 | 57 | R2461 | 1.50 | 2N5496 | 53 |
| AC176K | 32 | BC108B | 20 | BC174A/B | 10 | BC308A/B | 17 | BD179 | 52 | BF167 | 24 | BF336 | 36 | BT106 | 1.00 | R2540 | 2.80 | 2N6107 | 75 |
| AC187 | 26 | BC108C | 20 | BC182 | 9 | BC327 | 11 | BD182 | 72 | BF173 | 22 | BF337 | 30 | BT108 | 1.24 | RCA16334 | 90 | 2SC643A | 1.50 |
| AC187K | 28 | BC109 | 20 | BC182LB | 10 | BC328 | 9 | BD183 | 75 | BF177 | 35 | BF338 | 34 | BT116 | 1.21 | RCA16335 | 80 | 2SC1172Y | 2.20 |
| AC188 | 25 | BC109B | 20 | BC183LB | 10 | BC337 | 11 | BD201 | 85 | BF178 | 26 | BF355 | 37 | BU104 | 2.00 | TIP29C | 43 | | |
| AC188K | 37 | BC109C | 20 | BC184 | 9 | BC338 | 9 | BD202 | 80 | BF179 | 28 | BF362 | 37 | BU105 | 1.25 | TIP30C | 43 | | |
| AD143 | 82 | BC114 | 12 | BC184 | 10 | BC461 | 30 | BD203 | 80 | BF180 | 36 | BF363 | 33 | BU108 | 1.80 | TIP31C | 41 | | |
| AD149 | 79 | BC116A | 12 | BC204 | 10 | BC547 | 10 | BD204 | 84 | BF181 | 36 | BF371 | 30 | BU124 | 1.30 | TIP32C | 42 | | |
| AD161 | 42 | BC117 | 20 | BC208 | 13 | BC548 | 10 | BD222 | 46 | BF182 | 30 | BF457 | 35 | BU126 | 1.49 | TIP33B | 75 | **THERMISTORS** | |
| AD161/2 | 1.15 | BC119 | 24 | BC209 | 10 | BC549 | 8 | BD223 | 56 | BF184 | 30 | BF458 | 28 | BU204 | 1.50 | TIP41C | 46 | VA1104 | 62 |
| AD162 | 42 | BC140 | 32 | BC212 | 9 | BC550 | 7 | BD225 | 47 | BF185 | 30 | BF459 | 35 | BU205 | 1.34 | TIP42C | 47 | VA8650 | 55 |
| AF114 | 40 | BC141 | 26 | BC212L | 9 | BC557 | 8 | BD232 | 45 | BF194 | 11 | BF639 | 28 | BU206 | 1.80 | TIP47 | 70 | VA1039 | 35 |
| AF118 | 62 | BC142 | 21 | BC213 | 9 | BC558 | 9 | BD233 | 35 | BF195 | 11 | BFT42 | 28 | BU208 | 1.60 | TIP2955 | 90 | GEC Dual | |
| AF121 | 56 | BC143 | 24 | BC213B | 10 | BCY72 | 13 | BD234 | 37 | BF196 | 10 | BFT43 | 28 | BU208A | 1.65 | TIP3055 | 63 | Posistor | 1.50 |
| AF124 | 34 | BC147 | 9 | BC213L | 9 | BD115 | 32 | BD235 | 33 | BF197 | 11 | BFW10 | 60 | BU208/02 | 2.10 | TIS91 | 21 | GEC Dual | |
| AF125 | 35 | BC148 | 9 | BC214 | 9 | BD116A | 65 | BD236 | 40 | BF198 | 18 | BFX29 | 30 | BU326A | 1.42 | TV106/02 | 1.55 | 2040 | 1.50 |
| AF126 | 34 | BC149 | 10 | BC214L | 10 | BD124P | 60 | BD237 | 33 | BF199 | 15 | BFX84 | 27 | BU407 | 1.25 | 2N696 | 21 | | |
| AF127 | 32 | BC157 | 11 | BC2378 | 12 | BD131 | 33 | BD238 | 35 | BF200 | 30 | BFX85 | 28 | BU500 | 1.95 | 2N2905 | 28 | | |
| AF139 | 42 | BC158 | 10 | BC238A/B/C | 8 | BD132 | 35 | BD410 | 55 | BF241 | 15 | BFX86 | 30 | EI222 | 28 | 2N3054 | 60 | | |
| AF239 | 45 | BC159 | 10 | BC251A | 12 | BD133 | 40 | BD434 | 55 | BF256LC | 28 | BFX88 | 25 | MJE340 | 40 | 2N3055 | 60 | | |
| AL102 | 2.00 | BC160 | 25 | BC252A | 12 | BD135 | 26 | BD517 | 60 | BF256 | 28 | BFY50 | 20 | MJE520 | 44 | 2N3702 | 11 | **CRYSTALS** | |
| AU106 | 2.50 | BC161 | 28 | BC252B | 12 | BD136 | 27 | BD520 | 75 | BF257 | 28 | BFY51 | 22 | MJ3000 | 2.36 | 2N3703 | 10 | 4 3Mhz | 1.30 |
| AU107 | 2.00 | BC170B | 15 | BC261A | 18 | BD137 | 26 | BDX32 | 1.50 | BF258 | 25 | BFY52 | 20 | OC71 | 27 | 2N3705 | 10 | 8 8Mhz | 1.30 |

## NEW VALVES

| | | | | | |
|---|---|---|---|---|---|
| 30FL2 | 1.21 | EY500A | 1.33 | PCL85/805 | 79 |
| DY802 | 72 | EZ80/1 | 56 | PCL86 | 81 |
| DY86/7 | 66 | GY501 | 1.45 | PD500 | 2.93 |
| ECC81 | 60 | GZ34 | 1.56 | PFL200 | 1.35 |
| ECC82 | 68 | KT66 | 5.00 | PL36 | 1.15 |
| ECC83 | 60 | KT88 | 6.00 | PL81 | 94 |
| ECC84 | 80 | PC86 | 81 | PL82 | 46 |
| ECC85 | 98 | PC88 | 81 | PL83 | 1.43 |
| ECC88 | 1.35 | PC92 | 80 | PL84 | 84 |
| ECF80 | 80 | PC97 | 1.14 | PL95 | 1.00 |
| ECF82 | 88 | PC900 | 80 | PL504 | 1.32 |
| ECH81 | 1.04 | PCC84 | 70 | PL508 | 1.43 |
| ECH84 | 1.13 | PCC85 | 85 | PL509 | 2.39 |
| ECL80 | 84 | PCC88 | 82 | PL519 | 2.78 |
| ECL82 | 77 | PCC89 | 79 | PL802 | 2.15 |
| ECL86 | 84 | PCC189 | 1.02 | PY33 | 61 |
| ECF86 | 78 | PCC805 | 1.40 | PY88 | 81 |
| EF80 | 68 | PCF80 | 75 | PY500A | 1.40 |
| EF85 | 68 | PCF86 | 1.13 | PY800/1 | 69 |
| EF86 | 1.19 | PCF200 | 1.23 | UCF80 | 67 |
| EF89 | 1.43 | PCF800 | 1.38 | UCH81 | 1.43 |
| EF183 | 68 | PCF801 | 1.13 | UCL82 | 84 |
| EF184 | 68 | PCF802 | 86 | UCL83 | 94 |
| EH90 | 1.02 | PCF805 | 1.63 | UL84 | 1.02 |
| EL34 | 1.63 | PCF806 | 1.30 | U26 | 1.30 |
| EL81 | 86 | PCF808 | 1.63 | U191 | 95 |
| EL84 | 68 | PCH200 | 1.45 | 6F23 | 85 |
| EL90 | 82 | PCL82 | 78 | UY85 | 80 |
| EL509 | 2.22 | PCL83 | 2.00 | PL802T | 2.50 |
| EY86/7 | 68 | PCL84 | 81 | | |

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

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

## DIODES

| | | | | | |
|---|---|---|---|---|---|
| AA119 | 9 | BY298 | 22 | IN5401 | 12 |
| BA102 | 17 | BY299 | 22 | IN5402 | 14 |
| BA115 | 13 | BYX10 | 20 | IN5403 | 12 |
| BA145 | 17 | BYX36/10 | 30 | IN5404 | 12 |
| BA148 | 17 | BYX36/600 | 35 | IN5405 | 13 |
| BA154 | 6 | BYX55/60 | 30 | IN5406 | 16 |
| BA155 | 14 | BYX71/350 | 90 | IN5407 | 16 |
| BA156 | 15 | BYX71/600 | 90 | IN5408 | 16 |
| BAX13 | 4 | OA47 | 9 | ITT44 | 4 |
| BAX16 | 8 | OA90 | 5 | ITT2002 | 11 |
| BB105B | 30 | OA91 | 6 | Y969 | 89 |
| BB105G | 30 | OA95 | 6 | | |
| BY126 | 12 | OA202 | 11 | | |
| BY127 | 11 | IN914 | 4 | | |
| BY133 | 15 | IN4001 | 4 | | |
| BY164 | 45 | IN4002 | 4 | | |
| BY176 | 85 | IN4003 | 4 | | |
| BY182 | 87 | IN4004 | 5 | | |
| BY184 | 55 | IN4005 | 5 | | |
| BY223 | 90 | IN4006 | 5 | | |
| BY199 | 28 | IN4007 | 6 | | |
| BY206 | 14 | IN4148 | 2 | | |
| BY210/800 | 33 | IN4448 | 10 | | |

## 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**

## WE NOW HAVE THESE SPECIAL CB INTEGRATED CIRCUITS

| | | | | | |
|---|---|---|---|---|---|
| TA7025AP | 3.72 | AN240 | 3.84 | TA7310P | 2.78 |
| 2SC1909 | 1.41 | MSN5807 | 7.87 | PLL2A | 9.89 |
| 2SC495 | 1.10 | AN715 | 3.97 | MC1351P | 1.00 |
| LC7130 | 5.93 | TA7222 | 4.07 | | |

Please enquire for others

## RECTIFIER TRAYS

| | |
|---|---|
| THORN 950 Mk II | 4.25 |
| THORN 1400 3 Stick | 4.25 |
| THORN 1500 3 Stick | 3.85 |
| THORN 1500 5 Stick | 4.25 |
| THORN 1600 | 3.45 |
| THORN 2000 | 6.60 |
| THORN 3000/3500 | 6.89 |
| THORN 8000 | 3.56 |
| THORN 8500/8800 | 5.40 |
| THORN 9000 | 7.43 |
| DECCA CTV 19/25 | 5.35 |
| DECCA 1730/1830 | 3.68 |
| DECCA 1910/2213 Bradford | 5.92 |
| DECCA 30 | 5.92 |
| DECCA 80 | 6.28 |
| DECCA 100 | 6.04 |
| UNIVERSAL I.T.T | 5.40 |
| GEC 2040/2028 | 5.64 |
| GEC 2110 Pre Jan '77 | 6.96 |
| GEC 2110 Post Jan '77 | 6.65 |
| PHILIPS G8 Short Focus Lead | 5.85 |
| PHILIPS G8 Long Focus 550 | 5.85 |
| PHILIPS G9 | 6.33 |
| PYE 691/3 | 5.13 |
| PYE 713 4 Lead | 7.00 |
| PYE 731/25 | 5.95 |
| R.B.M. A823 (plug in) AV | 5.98 |
| R.B.M. A823 | 5.78 |
| KORTING (similar to Siemens TVK1) | 6.65 |
| ITT KB CVC5/9 | 5.35 |
| ITT KB CVC20/25/30 (Mullard Type) | 5.35 |
| RRI T20 | 6.80 |

## RECTIFIER STICKS

| | |
|---|---|
| TV11 | 74 |
| TV18 | 81 |
| 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 | 11.30 |
| PHILIPS 210/300 Mono | 10.00 |
| PHILIPS G8 | 10.00 |
| PHILIPS G9 | 7.50 |
| PHILIPS G11 | 13.50 |
| PYE 691/697 Printed Circuit | 14.00 |
| PYE 731 | 10.00 |
| PYE 169 Mono | 9.00 |
| DECCA 80 | 8.58 |
| DECCA 100 | 8.58 |
| DECCA 1730 | 8.58 |
| DECCA 2230 | 8.58 |
| GEC 2110 | 9.00 |
| GEC 2040 | 9.50 |
| ITT CVC 1-9 | 9.20 |
| ITT CVC 25/30/32 | 8.00 |
| ITT CVC 20 | 7.16 |
| THORN 3000 EHT | 6.38 |
| THORN 3000 SCAN | 6.38 |
| THORN 8000 | 9.85 |
| THORN 8500 | 10.00 |
| THORN 9000 | 10.65 |
| THORN 3000/3500 Mains Trans | 10.00 |
| THORN 1591 | 8.68 |
| THORN 1691 | 8.68 |

## PANELS

| | |
|---|---|
| I.F. Gain Module (Pye, Philips) | 9.00 |
| C.D.A. PANEL (Pye, Ecko, Invicta, Dynatron) | 20.00 |
| CONVERGENCE PANEL Philips G8 | 17.85 |

## NEW MONO TUBES

| | |
|---|---|
| MULLARD A31/510 110° | 17.00 |
| MULLARD A34/510 110° | 18.50 |
| VEGA A50/120WR 20" | 13.50 |
| VEGA A61/120WR 24" | 15.00 |
| VEGA 12" 90° | 15.00 |

## REBUILT COLOUR TUBES

| | |
|---|---|
| 17"-18"-19"-20"-22" | £30.00 |
| 26"-25" | £34.00 |
| 26" 110° | £38.00 |

Glass for Glass exchange
2 year warranty

## MULLARD COLOUREX TUBES OR THORN NEW LIFE TUBES

| | |
|---|---|
| 18" A47/342X-A47/343X | 59.00 |
| 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 |
| 26" A67/120X | 53.00 |

Glass for Glass exchange
1 year warranty or 4 year option.

**CARRIAGE ON TUBES** £5.50 incl VAT
(except) 12", 14" – £4
(£1 extra for N. Ireland)

## NEW TELEVISION SETS
**CASH AND CARRY ONLY**

| | |
|---|---|
| Philips 14" colour | £172.00 |
| Philips 16" colour | £197.00 |
| Philips 20" 933 colour | £206.00 |
| Philips 22" 1002 colour | £235.00 |
| Philips 26" 1009 colour | £297.00 |
| Ferguson 20" TX9 | £210.00 |
| Ferguson 22" TX9 | £230.00 |
| Ferguson 22" TX10 30AX | £240.00 |
| Ferguson 26" TX10 30AX | £300.00 |

# P. V. TUBES

Telephone: Accrington (0254) 36521

## REPLACEMENT ELECTROLYTICS

| | |
|---|---|
| DECCA 30 (400/400/350V) | 2.82 |
| DECCA 80 (400/350V) | 3.00 |
| DECCA 100 (800/250V) | 3.00 |
| DECCA 1700 (200/200/400/350V) | 4.80 |
| PHILIPS G8 (600/300V) | 2.11 |
| PHILIPS G9 (600/300V) | 2.11 |
| PHILIPS G11 (470/250V) | 2.56 |
| PYE 691/7 (200/300/350V) | 2.28 |
| PYE 731 (60/300V) | 2.20 |
| RBM A823 (2500/2500/30V) | 1.20 |
| (2500/2500/25V) | 1.10 |
| RBM A823 (600/300V) | 2.10 |
| RBM Z146 (300/300/350V) | 3.00 |
| ITT CVC5/9 (200/200/75/25) | 2.36 |
| ITT CVC 20 (220/400V) | 1.92 |
| GEC 2110 (600/250V) | 1.85 |
| GEC 2040 (1000/2000/35V) | 1.14 |
| GEC 2040 (300/300/150/100/50) | 3.90 |
| THORN 3500 (400/40V) | 28 |
| THORN 950 (100/300/100/16/275V) | 1.75 |
| THORN 1400 (150/100/100/100/150/320V) | 2.60 |
| THORN 1500 (150/150/100/300V) | 1.92 |
| THORN 1500 (12/300V) | 30 |
| THORN 3500 (175/100/100/400/350V) | 2.34 |
| THORN 3500 (1000/63V) | 82 |
| THORN 3500 (1000/70V) | 80 |
| THORN 8000/8500 (2500/2500/63V) | 1.47 |
| THORN 8000/6500 (700/250V) | 2.20 |
| THORN 8000/8500 (400/350V) | 2.44 |
| THORN 9000 (400/400V) | 2.80 |

## WIREWOUND RESISTORS

PREFERRED VALUES

| | | price each |
|---|---|---|
| 4W/5W | 1R-1K5 | 16 |
| | 2K2-3K3 | 18 |
| | 4K7-6K8 | 20 |
| | 10K | 25 |
| 7W | 1R-4K7 | 18 |
| | 5K6-12K | 21 |
| | 15K-22K | 20 |
| 11W | 1R-6K8 | 18 |
| | 10K-15K | 21 |
| | 22K | 24 |
| 17W | IR-10K0 | 27 |
| | 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 | 38p |
| 2W | 10R to 150K | 82p |

## MIXED DIELECTRIC CAPACITORS

| Volts DC | | |
|---|---|---|
| 600V | 0.1 mFd | 38 |
| 1000V | 0.01 mFd | 20 |
| | 0.047 mFd | 28 |
| | 0.1 mFd | 32 |
| | 0.22 mFd | 48 |
| | 0.47 mFd | 76 |
| 1250V | 0.1 mFd | 45 |
| 1500V | 0.0022 mFd | 19 |
| | 0.0047 mFd | 20 |
| | 0.022 mFd | 24 |
| | 0.033 mFd | 69 |

## SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

**MINIATURE** price each 12
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K-100K
220K-470K-1M0

**STANDARD** price each 12
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K
100K-220K-470K-1M0-2M2-4M7

## 'MIOGET' 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 61p
250K. 500K. 1M. 2M
**Lin**: 5K-50K-500K

## CAPACITORS

AXIAL TYPE

| Volt | MF | Price | Volt | MF | Price |
|---|---|---|---|---|---|
| 10 | 22 | 7 | | 4.7 | 7 |
| | 47 | 7 | | 100 | 19 |
| | 100 | 8 | | 220 | 30 |
| | 220 | 11 | | 470 | 38 |
| | 470 | 16 | | 1000 | 53 |
| | | | | 2200 | 85 |
| 16 | 1000 | 20 | | | |
| | | | 100 | 10 | 12 |
| 25 | 10 | 7 | | 22 | 14 |
| | 22 | 7 | | 47 | 19 |
| | 47 | 9 | | 100 | 29 |
| | 100 | 10 | | 220 | 35 |
| | 220 | 17 | | | |
| | 470 | 22 | 300 | 12 | 30 |
| | 1000 | 36 | 450 | 1 | 23 |
| | 2200 | 46 | | 4 7 | 28 |
| | 4700 | 80 | | 10 | 28 |
| 40 | 22 | 9 | | 22 | 56 |
| | | | | 33 | 82 |
| 50 | 500 | 38 | | | |
| 63 | 1 | 7 | 500V | 1 | 30 |
| | 2.2 | 7 | | | |

## SLIDER POTENTIOMETERS

Lin or Log

| | | | |
|---|---|---|---|
| 470R | 50p | 4K7 | 50p |
| 1K | 50p | 10K | 50p |
| 2K2 | 50p | 47K | 50p |

## MULTITURN POTENTIOMETERS

| | |
|---|---|
| 100K | |
| GEC/TCE | 50p |
| PHILIPS G8 | 50p |
| DECCA/RANK | 50p |

## THICK FILM RESISTOR NETWORKS

| | |
|---|---|
| THORN 3500 (5 pin connection) | 1.12 |
| PYE 731 (6 pin connection) | 1.45 |
| THORN 9000 (Circuit Ref. R704/7) | 1.50 |

## DISC CERAMIC CAPACITORS

High Voltage

| | | | |
|---|---|---|---|
| 8KV d.c.-12KV d.c. | 22 | 180pF | 22 |
| 39 pF | 22 | 200pF | 22 |
| 68pF | 22 | 220pF | 22 |
| 140pF | 22 | 250pF | 22 |
| 150pF | 22 | | |

## CONVERGENCE PRE-SET POTS

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

## TEST EQUIPMENT

| | |
|---|---|
| Portable Oscilloscope | 149.00 |
| TF200 Frequency Metre | 155.00 |
| CRT Tester/Rejuvenator | 150.00 |
| LABGEAR Colour Bar/Cross Hatch | 210.50 |
| LABGEAR Pattern Generator (Pocket Size) | 97.50 |

## METRIC CONVERGENCE POTS

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

## EAGLE PRODUCTS

| | |
|---|---|
| SE500 Headphones | 3.25 |
| SE540 Headphones with Volume Control | 4.95 |
| SE600 Lightweight Headphones | 8.95 |

## EAGLE PRODUCTS

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

**Multimeters**

| | | |
|---|---|---|
| KEW 7N | 2,000 opv | 4 99 |
| EM5 | 5,000 opv | 8 95 |
| EM10 | 10,000 opv | 10.95 |
| EM50 | 50,000 opv | 19.95 |
| EMC321 Carrying Case for above | | 2.00 |
| Digital Meter TS1000 | | 42.50 |
| KHP 30N Measuring Probe (30kV) (E.H.T.) | | 29 95 |
| T1206 2 Station Intercom. | | 5.95 |

## ELECTRONIC TUNERS AND ASSEMBLIES

| | |
|---|---|
| NSF173 Replaces ELC 1043/05/06 | 7.20 |
| 4 P/B DECCA/GEC/ITT | 5.80 |
| 6 P/B DECCA/GEC/ITT | 7.00 |
| 4 P/B PYE | 8.00 |
| 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 | 8.00 |
| ITT/PYE/GEC 7 Button P/B | 13.95 |
| GEC 2110 6 way P/B | 7.75 |
| U321 UHF Tuner | 8.00 |

## SUNDRY TUNER ACCESSORIES

| | |
|---|---|
| RANK Tuner Push Button 1½" × ½" dia. | 30p |
| RANK Tuner Push Button 2" long × ⅜ dia. | 30p |
| RANK Tuner Push Button 2" long × ½" dia | 30p |
| GEC Tuner Neons 2110 chassis. | 14p |
| ve Cams | 10p each |

## SWITCHES

| | |
|---|---|
| 4A Double Pole On/Off Switch General Purpose Push/push | 82 |
| Philips G8 Push On/Off Switch. | 1.38 |
| 4A Double Pole Rotary On/off | 82 |
| A1 Beam Switch (THORN 3500) | 50 |
| A1 Controls 5m (THORN 3500) | 89 |

## THERMAL CUT OUT

| | |
|---|---|
| THORN 3000 2A Metal | 1.30 |
| THORN 8500 2.5 Plastic | 1.30 |
| GEC 2040 Metal | 2.24 |

## PYE LABGEAR

| | |
|---|---|
| CM6001 Power Unit (16V or 24V) | 11.75 |
| CM6019/WB UHF Masthead Amp(ch21-68) | 8.58 |
| CM6040/WB UHF Masthead (ch21-68) | 18.06 |
| CM6020 Power Unit (16V) | 10.20 |
| CM7025 UHF High Gain M.H.A. 24V (specify group A. B or CD) | 14.81 |
| CM7061 Power Unit (12V) | 10.84 |
| CM7065/WB VHF/UHF M.H.Amp (12V) | 12.80 |
| CM7073 VHF/UHF Dist Amp (8+1) | 37.00 |
| CM7053 'Behind the set' UHF Amp. (mains) | 10.73 |
| CM7043 'Behind the set' 2nd Set Amp. (UHF-2 outputs) | 10.08 |
| CM6006 UHF 6 way Passive Splitter | 10.72 |
| CM7042 TV Games Combiner | 3.31 |
| CM9003 Flush Mount Single Outlet Isolated | 1.75 |
| CM9009 Flush TV/FM Diplex Outlet Isolated | 3.00 |
| CM7069 Tri Star Amplified Set Top Aerial (ch21-68) UHF | 17.50 |
| CM6038 VHF/UHF 625 TV Patt Generator | 97.50 |
| CM6052 UHF/VHF Pal Colour Bar Generator | 210.50 |
| 7056 **TELETEXT ADAPTOR** (Converts any set to remote) | 208.00 |
| AMPLIFIED CARAVAN AERIAL (All Channels) | 18.50 |

## FUSES

| | Pack of 10 |
|---|---|
| **1¼" QUICK BLOW** | |
| 100ma | 48 |
| 250ma-500ma-750ma-1A | 49 |
| 1.5A-2A-2.5A-3A-5A | 40 |
| **1¼" ANTISURGE** | |
| 250ma. 500ma 600ma. 630ma. 750ma. 850ma. 1A. 1.25A | |
| 1.5A. 2A | 1.41 |
| 2.5A. 3A. 5A | 2.16 |
| **20m ANTISURGE** | |
| 80ma | 3.11 |
| 100ma. 160ma. 200ma | 2.08 |
| 315ma. 500ma. 630ma. 800ma. 1A. 1.25A. 1 6A. 2A | 1.07 |
| 2.5A. 3.15A | 1.43 |
| **20mm QUICK BLOW** | |
| 100ma | 45 |
| 250ma. 500ma. 630ma. 800ma. | 37 |
| 1A. 1.25A. 1.6A. 2A. 2.5A. 3.15A. 5A | 37 |
| **1" MAINS** | |
| 2A. 3A. 5A. 10A. 13A | 84 |

## MAINS DROPPERS

| | |
|---|---|
| DECCA 20 | 2.20 |
| R.B.M. A823 | 77 |
| R.B.M. 161 | 85 |
| GEC 2000/2018 | 70 |
| GEC27840 | 84 |
| PYE 713/15 3R5/15/45R | 1.45 |
| PYE 725/31 3R0/56R/27R | 84 |
| PYE 725 56R/27R | 82 |
| PHILIPS 50501 | 88 |
| PHILIPS 210/50511/LINK | 84 |
| PHILIPS G8/50832 | 85 |
| PHILIPS G8 47R section | 39 |
| THORN 1500 | 95 |
| THORN 3500 | 75 |
| THORN 8000 | 86 |
| THORN 8500 | 86 |

## SUNDRIES

| | | |
|---|---|---|
| ANTIFERENCE Super Set Top | | 6.80 |
| ANTIFERENCE Car antenna | | 7.80 |
| ANTIFERENCE Xtra Boost UHF Amp. | | 15.40 |
| ANTIFERENCE SB11 Splitter | | 2.40 |
| Surface Mounting Aerial Outlets | | 86 |
| Cable Clips | per 100 | 1.18 |
| Transductor 90° | | 2.08 |
| EHT Final Anode Cap | | 63 |
| Delay Line CTAV 82/DL50/5DL141 | | 2.20 |
| EHT Cable 30kV | | 25p per mtr. |
| 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 | | 48 |
| KEW Pocket Size 1000 OPV Meter | | 4.89 |
| Line Connectors | | 35 |
| 6.3V CRT boost trans. | | 4.35 |
| ANTIFERENCE XG8 High Gain Aerial (State Channel) | | 17.00 |

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

## SOLDERING EQUIPMENT

| | |
|---|---|
| WELLER Iron Kit 15W | 3.80 |
| WELLER Iron Kit 25W (inc. tips) | 4.89 |
| WELLER Iron 25W | 3.80 |
| WELLER 3/16" Single Flat Tips | 51 |
| MIN Soldering Iron | 5.00 |
| WELLER Heat Gun Kit | 14.00 |
| WELLER Heat Gun | 11.00 |
| (Pair) Tips for Gun | 38 |
| WELLER Cordless Iron | 24.78 |
| ANTEX Soldering Iron 25W | 4.89 |
| Solder Remover Sucker | 6.50 |
| Solda Mop | 70 |
| 500G Reel Solder | 7.00 |
| DIY Type Solder | 43 |

## DATA BOOKS

| | |
|---|---|
| Transistor Equivalent | |
| TVT 80 A-Z only | 3.25 |
| TVT 80 2N/2S series only | 3.50 |
| TVT 80/80 A-Z and 2N/2S together | 6.60 |
| LIN IC Books LIN 1 | 5.50 |
| LIN 2 | 5.50 |

## SERVICE AIDS

| | |
|---|---|
| SERVISOL Freeze-It | 80 |
| SUPER SERVISOL | 75 |
| SERVISOL Foam Cleanser | 70 |
| SERVISOL Plastic Seal | 68 |
| SERVISOL Silicone Grease | 78 |
| SERVISOL Tubes Silicone Grease | 1.60 |
| SERVISOL Aero Klene | 83 |
| SERVISOL Aero Duster | 78 |
| SERVISOL Excel Polish | 52 |
| Penetrating Fluid | 70 |
| Fire Extinguisher 640G | 1.88 |
| Heat Sink Compound 25G | 1.00 |
| Silicone Rubber Tube | 1.98 |

## ELECTROLUBE PRODUCTS

| | |
|---|---|
| Electro-Mech lubricant | 1.39 |
| Elect. cleaning solvent | 1.60 |
| 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 | 69 |

## HOW TO ORDER

**Add 15% VAT to all Prices.**
**Add 75p per order P&P – First Class Mail is used whenever possible.**

For orders of very small odd items i.e. IC's, Trans, diodes. – Customers need send only 30p

For Aerosol's please add 30p per can. (These are very heavy!)

Orders over £25 before VAT are Post Free except when the order contains AEROSOLS.

Carriage on Tubes is as stated on list

ALL ENQUIRIES SAE PLEASE

VAT invoice on request

We do regret any postal increases but we try our best to give a speedy, and efficient service, at a fair price

## TRANSISTORS, ETC.

| Type | Price (£) |
|---|---|
| AC107 | 0.48 |
| AC117 | 0.38 |
| AC126 | 0.36 |
| AC127 | 0.54 |
| AC128 | 0.46 |
| AC128K | 0.55 |
| AC141 | 0.65 |
| AC141K | 0.70 |
| AC142 | 0.60 |
| AC142K | 0.65 |
| AC151 | 0.31 |
| AC152 | 0.36 |
| AC153 | 0.42 |
| AC153K | 0.52 |
| AC154 | 0.41 |
| AC176 | 0.45 |
| AC178 | 0.51 |
| AC179 | 0.55 |
| AC187 | 0.56 |
| AC187K | 0.65 |
| AC188 | 0.52 |
| AC188K | 0.61 |
| AC193K | 0.70 |
| AC194K | 0.74 |
| ACY17 | 1.20 |
| ACY19 | 0.95 |
| ACY28 | 0.98 |
| ACY39 | 2.02 |
| AD140 | 1.79 |
| AD142 | 1.90 |
| AD143 | 1.78 |
| AD149 | 1.42 |
| AD161 | 0.66 |
| AD161/162 | 1.22 |
| AD162 | 0.71 |
| AF114 | 1.32 |
| AF115 | 1.26 |
| AF116 | 1.28 |
| AF117 | 1.32 |
| AF118 | 0.98 |
| AF121 | 0.68 |
| AF124 | 0.38 |
| AF125 | 0.38 |
| AF126 | 0.36 |
| AF127 | 0.86 |
| AF139 | 0.58 |
| AF147 | 0.52 |
| AF149 | 0.45 |
| AF178 | 1.35 |
| AF179 | 1.36 |
| AF180 | 1.35 |
| AF181 | 1.33 |
| AF186 | 1.48 |
| AF202 | 0.27 |
| AF239 | 0.73 |
| AF240 | 1.40 |
| AF279S | 0.91 |
| AL100 | 1.30 |
| AL103 | 1.58 |

| Type | Price (£) |
|---|---|
| AU103 | 2.40 |
| AU107 | 2.75 |
| AU110 | 2.40 |
| AU113 | 2.60 |
| BC107* | 0.16 |
| BC108* | 0.15 |
| BC109* | 0.16 |
| BC113 | 0.22 |
| BC114 | 0.22 |
| BC115 | 0.24 |
| BC116* | 0.25 |
| BC117 | 0.30 |
| BC118 | 0.24 |
| BC119 | 0.34 |
| BC125* | 0.30 |
| BC126 | 0.30 |
| BC132 | 0.20 |
| BC134 | 0.22 |
| BC135 | 0.21 |
| BC136 | 0.22 |
| BC137 | 0.30 |
| BC138 | 0.35 |
| BC140 | 0.36 |
| BC141 | 0.44 |
| BC142 | 0.35 |
| BC143 | 0.38 |
| BC147* | 0.12 |
| BC148* | 0.12 |
| BC149* | 0.13 |
| BC152 | 0.42 |
| BC153 | 0.38 |
| BC154 | 0.41 |
| BC157* | 0.13 |
| BC158* | 0.12 |
| BC159* | 0.14 |
| BC160 | 0.52 |
| BC161 | 0.58 |
| BC167B | 0.15 |
| BC168B | 0.14 |
| BC169C | 0.15 |
| BC170* | 0.15 |
| BC171* | 0.15 |
| BC172* | 0.14 |
| BC173* | 0.22 |
| BC174A & B | 0.26 |
| BC176 | 0.22 |
| BC177* | 0.20 |
| BC178* | 0.22 |
| BC179* | 0.28 |
| BC182* | 0.15 |
| BC182L* | 0.15 |
| BC183* | 0.14 |
| BC183L* | 0.14 |
| BC184* | 0.15 |
| BC184L* | 0.15 |
| BC185 | 0.36 |
| BC186 | 0.25 |
| BC187 | 0.27 |

| Type | Price (£) |
|---|---|
| BC192 | 0.56 |
| BC204* | 0.39 |
| BC205* | 0.39 |
| BC206* | 0.37 |
| BC207* | 0.39 |
| BC208* | 0.37 |
| BC209* | 0.39 |
| BC211* | 0.36 |
| BC212* | 0.17 |
| BC212L* | 0.17 |
| BC213* | 0.16 |
| BC213L* | 0.16 |
| BC214* | 0.18 |
| BC214L* | 0.18 |
| BC225 | 0.42 |
| BC237* | 0.16 |
| BC238* | 0.15 |
| BC239* | 0.22 |
| BC251* | 0.25 |
| BC252* | 0.26 |
| BC253* | 0.38 |
| BC261A* | 0.28 |
| BC262A* | 0.28 |
| BC263* | 0.26 |
| BC267* | 0.20 |
| BC268* | 0.28 |
| BC286 | 0.40 |
| BC287 | 0.49 |
| BC291 | 0.27 |
| BC294 | 0.37 |
| BC297 | 0.36 |
| BC300' | 0.62 |
| BC301 | 0.38 |
| BC302 | 0.86 |
| BC303 | 0.64 |
| BC304 | 0.44 |
| BC307* | 0.17 |
| BC308* | 0.14 |
| BC309* | 0.18 |
| BC317* | 0.15 |
| BC318* | 0.15 |
| BC319* | 0.19 |
| BC320 | 0.17 |
| BC321A&B | 0.18 |
| BC322 | 0.28 |
| BC323 | 1.15 |
| BC327 | 0.16 |
| BC328 | 0.18 |
| BC337 | 0.17 |
| BC338 | 0.17 |
| BC340 | 0.19 |
| BC347* | 0.17 |
| BC348A & B | 0.17 |
| BC349B | 0.17 |
| BC350* | 0.24 |
| BC351* | 0.22 |
| BC352A* | 0.24 |
| BC360 | 0.59 |

| Type | Price (£) |
|---|---|
| BC377 | 0.29 |
| BC394 | 0.39 |
| BC440 | 0.52 |
| BC441 | 0.59 |
| BC461 | 0.78 |
| BC477 | 0.30 |
| BC478 | 0.25 |
| BC479 | 0.33 |
| BC547* | 0.13 |
| BC548* | 0.13 |
| BC549* | 0.15 |
| BC550 | 0.24 |
| BC556 | 0.23 |
| BC557* | 0.16 |
| BC558* | 0.16 |
| BC559* | 0.17 |
| BCY10 | 0.30 |
| BCY30A | 1.06 |
| BCY32A | 1.19 |
| BCY34A | 1.02 |
| BCY72 | 0.27 |
| BD115 | 1.35 |
| BD123 | 1.50 |
| BD124 | 1.85 |
| BD130Y | 1.56 |
| BD131 | 0.58 |
| BD132 | 0.68 |
| BD133 | 0.70 |
| BD135 | 0.37 |
| BD136 | 0.38 |
| BD137 | 0.40 |
| BD138 | 0.42 |
| BD139 | 0.46 |
| BD140 | 0.50 |
| BD144 | 2.24 |
| BD145 | 0.75 |
| BD150A* | 0.51 |
| BD155 | 0.90 |
| BD157 | 0.51 |
| BD158 | 0.75 |
| BD159 | 0.68 |
| BD160 | 2.69 |
| BD163 | 0.67 |
| BD165 | 0.66 |
| BD166 | 0.88 |
| BD175 | 0.90 |
| BD177 | 0.58 |
| BD178 | 0.92 |
| BD181 | 1.94 |
| BD182 | 2.10 |
| BD183 | 1.34 |
| BD184 | 2.30 |
| BD187 | 1.20 |
| BD188 | 1.25 |
| BD189 | 0.71 |
| BD222 | 0.91 |
| BD225 | 0.91 |
| BD232 | 0.91 |
| BD233 | 0.62 |

| Type | Price (£) |
|---|---|
| BD234 | 0.68 |
| BD235 | 0.63 |
| BD236 | 0.63 |
| BD237 | 0.68 |
| BD238 | 0.68 |
| BD253 | 1.58 |
| BD410 | 1.65 |
| BD433 | 0.65 |
| BD435 | 0.70 |
| BD436 | 0.71 |
| BD437 | 0.74 |
| BD438 | 0.75 |
| BD519 | 0.88 |
| BD520 | 0.88 |
| BD599 | 0.87 |
| BD600 | 1.23 |
| BD663BR | 0.86 |
| BDX18 | 1.55 |
| BDX32 | 2.95 |
| BDY16A | 0.63 |
| BDY18 | 1.55 |
| BDY20 | 2.29 |
| BDY38 | 1.38 |
| BF115 | 0.48 |
| BF117 | 0.45 |
| BF120 | 0.55 |
| BF121 | 0.85 |
| BF123 | 0.48 |
| BF125 | 0.55 |
| BF127 | 0.51 |
| BF137F | 0.78 |
| BF152 | 0.19 |
| BF158 | 0.25 |
| BF159 | 0.27 |
| BF160 | 0.20 |
| BF161 | 0.84 |
| BF163 | 0.65 |
| BF164 | 0.95 |
| BF166 | 0.50 |
| BF167 | 0.38 |
| BF173 | 0.35 |
| BF177 | 0.36 |
| BF178 | 0.46 |
| BF179 | 0.58 |
| BF180 | 0.53 |
| BF181 | 0.53 |
| BF182 | 0.44 |
| BF183 | 0.52 |
| BF184 | 0.44 |
| BF185 | 0.42 |
| BF186 | 0.42 |
| BF194* | 0.14 |
| BF195* | 0.13 |
| BF196 | 0.14 |
| BF197 | 0.15 |
| BF198 | 0.29 |
| BF199 | 0.29 |
| BF200 | 0.25 |
| BF218 | 0.42 |

| Type | Price (£) |
|---|---|
| BF222 | 0.51 |
| BF224 & J | 0.22 |
| BF240 | 0.32 |
| BF241 | 0.31 |
| BF244* | 0.51 |
| BF245* | 0.43 |
| BF254 | 0.48 |
| BF255 | 0.58 |
| BF256L* | 0.49 |
| BF257 | 0.44 |
| BF258 | 0.52 |
| BF259 | 0.54 |
| BF262 | 0.73 |
| BF263 | 0.88 |
| BF270 | 0.47 |
| BF271 | 0.42 |
| BF272A | 0.80 |
| BF273 | 0.33 |
| BF274 | 0.34 |
| BF336 | 0.63 |
| BF337 | 0.65 |
| BF338 | 0.68 |
| BF355 | 0.72 |
| BF362 | 0.49 |
| BF363 | 0.49 |
| BF367 | 0.29 |
| BF451 | 0.43 |
| BF457 | 0.46 |
| BF458 | 0.49 |
| BF459 | 0.52 |
| BF594 | 0.16 |
| BF596 | 0.17 |
| BF597 | 0.27 |
| BFR39 | 0.30 |
| BFR40 | 0.29 |
| BFR41 | 0.30 |
| BFR50 | 0.29 |
| BFR52 | 0.33 |
| BFR61 | 0.29 |
| BFR62 | 0.28 |
| BFR79 | 0.30 |
| BFR80 | 0.29 |
| BFR81 | 0.30 |
| BFR88 | 0.42 |
| BFT41 | 0.48 |
| BFT43 | 0.55 |
| BFW11 | 1.02 |
| BFW30 | 2.58 |
| BFW59 | 0.19 |
| BFW60 | 0.20 |
| BFW90 | 0.65 |
| BFX29 | 0.38 |
| BFX84 | 0.42 |
| BFY50 | 0.38 |
| BFY51 | 0.37 |
| BFY52 | 0.36 |
| BFY53 | 0.36 |
| BFY90 | 1.98 |
| BPX25 | 1.62 |

| Type | Price (£) |
|---|---|
| BPX29 | 1.62 |
| BR101 | 0.53 |
| BR103 | 0.64 |
| BR303 | 1.06 |
| BRC4443 | 1.76 |
| BRY39 | 0.60 |
| BRY56 | 0.44 |
| BSS27 | 0.92 |
| BT106 | 1.50 |
| BT109 | 1.99 |
| BT116 | 1.45 |
| BT119 | 5.18 |
| BU102 | 3.35 |
| BU105 | 1.80 |
| BU105/02 | 1.95 |
| BU108 | 2.98 |
| BU126 | 2.91 |
| BU204 | 2.50 |
| BU205 | 2.58 |
| BU206 | 2.59 |
| BU208 | 2.75 |
| BU407 | 1.38 |
| BUY77 | 2.50 |
| C106D | 0.80 |
| C106F | 0.43 |
| C111E | 0.46 |
| D40N1 | 0.64 |
| E300 | 0.42 |
| E1222 | 0.47 |
| E5024 | 0.19 |
| GET872 | 0.46 |
| ME0402 | 0.18 |
| MF0404/02 | 0.18 |
| ME6001 | 0.18 |
| ME6002 | 0.18 |
| MJ2955 | 1.30 |
| MJ3000 | 1.58 |
| MJE340 | 0.68 |
| MJE341 | 0.72 |
| MJE370 | 0.74 |
| MJE371 | 0.79 |
| MJE520 | 0.85 |
| MJE521 | 0.95 |
| MJE2955 | 1.20 |
| MJE3000 | 1.95 |
| MJE3055 | 1.22 |
| MPF102 | 0.40 |
| MPS3702 | 0.33 |
| MPS3705 | 0.30 |
| MPS6521 | 0.36 |
| MPS6523 | 0.36 |
| MPS6566 | 0.44 |
| MPSA05 | 0.30 |
| MPSA06 | 0.32 |
| MPSA55 | 0.43 |
| MPSA56 | 0.45 |
| MPSA93 | 0.56 |
| MPSL01 | 0.33 |
| MPSU01 | 0.61 |

| Type | Price (£) |
|---|---|
| MPSU05 | 0.66 |
| MPSU06 | 0.76 |
| MPSU55 | 1.26 |
| MPSU56 | 1.32 |
| MPSU60 | 0.82 |
| MPU131 | 0.59 |
| OC26 | 1.90 |
| OC28 | 1.49 |
| OC29 | 1.60 |
| OC35 | 1.25 |
| OC36 | 1.25 |
| OC42 | 0.90 |
| OC44 | 0.68 |
| OC45 | 0.63 |
| OC70 | 0.65 |
| OC71 | 0.73 |
| OC72 | 0.73 |
| OC81 | 0.83 |
| OC81D | 0.95 |
| OC139 | 1.30 |
| OC140 | 1.35 |
| OC170 | 0.80 |
| OC171 | 0.82 |
| OC200 | 3.90 |
| OC201 | 3.95 |
| OC202 | 2.40 |
| OC205 | 3.95 |
| OCP71 | 1.98 |
| ON236A | 0.94 |
| R2008B | 2.72 |
| R2010B | 2.79 |
| R2322 | 0.75 |
| R2323 | 0.85 |
| ST2110 | 0.49 |
| ST6120 | 0.48 |
| TIC44 | 0.25 |
| TIC46 | 0.35 |
| TIC47 | 0.45 |
| TIP29A | 0.47 |
| TIP30A | 0.50 |
| TIP31A | 0.51 |
| TIP31C | 0.67 |
| TIP32A | 0.56 |
| TIP32C | 0.72 |
| TIP33A | 0.77 |
| TIP34A | 0.84 |
| TIP41A | 0.72 |
| TIP42A | 0.80 |
| TIP2955 | 0.77 |
| TIP3055 | 0.58 |
| TIS43 | 0.44 |
| TIS73 | 1.36 |
| TIS90 | 0.23 |
| TIS91 | 0.28 |
| ZTX108 | 0.14 |
| ZTX109 | 0.16 |
| ZTX213 | 0.23 |
| ZTX300 | 0.16 |
| ZTX304 | 0.26 |

| Type | Price (£) |
|---|---|
| ZTX500 | 0.18 |
| ZTX502 | 0.22 |
| ZTX504 | 0.28 |
| 2N404 | 1.30 |
| 2N696 | 0.46 |
| 2N697 | 0.46 |
| 2N706A | 0.33 |
| 2N708 | 0.29 |
| 2N914 | 0.32 |
| 2N916 | 0.46 |
| 2N918 | 0.54 |
| 2N930 | 0.29 |
| 2N1164 | 10.29 |
| 2N1304 | 1.40 |
| 2N1305 | 1.29 |
| 2N1306 | 1.49 |
| 2N1307 | 1.32 |
| 2N1308 | 1.53 |
| 2N1711 | 0.47 |
| 2N1893 | 0.52 |
| 2N2102 | 0.71 |
| 2N2217 | 0.55 |
| 2N2218 | 0.38 |
| 2N2219 | 0.42 |
| 2N2221A | 0.26 |
| 2N2222A | 0.41 |
| 2N2369A | 0.40 |
| 2N2401 | 0.80 |
| 2N2484 | 0.35 |
| 2N2570 | 0.74 |
| 2N2646 | 0.82 |
| 2N2784 | 1.15 |
| 2N2869 | 2.08 |
| 2N2894 | 0.45 |
| 2N2904* | 0.40 |
| 2N2905* | 0.39 |
| 2N2906* | 0.36 |
| 2N2926G | 0.15 |
| 2N29260 | 0.14 |
| 2N2926Y | 0.14 |
| 2N2955 | 1.12 |
| 2N3053 | 0.48 |
| 2N3054 | 0.66 |
| 2N3055 | 0.72 |
| 2N3250 | 0.52 |
| 2N3254 | 0.58 |
| 2N3391A | 0.38 |
| 2N3633 | 0.60 |
| 2N3703 | 0.17 |
| 2N3704 | 0.19 |
| 2N3705 | 0.17 |
| 2N3706 | 0.16 |
| 2N3707 | 0.18 |
| 2N3708 | 0.17 |
| 2N3715 | 1.70 |
| 2N3771 | 2.09 |
| 2N3772 | 2.08 |
| 2N3773 | 2.90 |
| 2N3794 | 0.40 |

| Type | Price (£) |
|---|---|
| 2N3819 | 0.47 |
| 2N3820 | 0.72 |
| 2N3866 | 1.08 |
| 2N3904 | 0.20 |
| 2N3905 | 0.20 |
| 2N3906 | 0.20 |
| 2N4036 | 0.94 |
| 2N4123 | 0.17 |
| 2N4124 | 0.17 |
| 2N4126 | 0.17 |
| 2N4236 | 2.20 |
| 2N4289 | 0.32 |
| 2N4292 | 0.32 |
| 2N4416 | 0.85 |
| 2N4444 | 1.90 |
| 2N4921 | 0.80 |
| 2N5042 | 1.65 |
| 2N5060 | 0.28 |
| 2N5061 | 0.30 |
| 2N5064 | 0.63 |
| 2N5086 | 0.49 |
| 2N5087 | 0.50 |
| 2N5208 | 0.59 |
| 2N5294 | 0.66 |
| 2N5296 | 0.68 |
| 2N5298 | 0.71 |
| 2N5322 | 1.16 |
| 2N5449 | 0.18 |
| 2N5457 | 0.46 |
| 2N5458 | 0.40 |
| 2N5459 | 0.58 |
| 2N5494 | 0.85 |
| 2N5496 | 1.05 |
| 2N6027 | 0.55 |
| 2N6107 | 0.71 |
| 2N6122 | 0.60 |
| 2N6178 | 1.07 |
| 2N6180 | 1.39 |
| 2N6211 | 2.74 |
| 2SB337BP | 4.28 |
| 2SC458C | 0.78 |
| 2SC643A | 2.25 |
| 2SC930D | 1.50 |
| 2SC1061 | 1.45 |
| 2SC1172Y | 3.55 |
| 2SD234 | 1.48 |
| 3N128 | 1.60 |
| 40250 | 0.98 |
| 40251 | 1.14 |
| 40327 | 0.67 |
| 40361 | 0.48 |
| 40362 | 0.50 |
| 40410 | 0.94 |
| 40429 | 0.88 |
| 40530 | 0.79 |
| 40595 | 1.39 |
| 40603 | 1.13 |
| 40636 | 1.25 |
| 40654 | 0.89 |

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

## LINEAR IC's

| Type | Price (£) |
|---|---|
| BRC1330 | 0.93 |
| CA810QM | 2.44 |
| CA3005 | 1.85 |
| CA3012 | 1.45 |
| CA3014 | 2.23 |
| CA3018 | 0.71 |
| CA3020 | 1.89 |
| CA3028A | 0.80 |
| CA3028B | 1.09 |
| CA3045 | 3.75 |
| CA3046 | 0.70 |
| CA3065 | 1.74 |
| CA3068 | 1.90 |
| CA3130S | 1.57 |
| FCH161 | 2.40 |
| FCJ101 | 3.32 |
| LM309K | 1.98 |
| LM380N-14 | 1.65 |
| LM1303N | 1.03 |
| MC1307P | 1.82 |
| MC1310P* | 1.84 |
| MC1312P | 2.34 |
| MC1327P* | 1.86 |
| MC1330P | 0.83 |
| MC1350P | 1.22 |
| MC1351P | 1.42 |
| MC1352P | 1.42 |
| MC1357P | 2.92 |
| MC1358P* | 2.30 |
| MC1458G | 1.43 |
| MC1496L | 1.15 |
| MC3051P | 0.58 |
| MFC400B | 0.85 |
| MFC4060A | 0.98 |
| MFC6040 | 1.11 |
| MFC8020A | 1.10 |
| ML231 | 3.57 |
| ML232 | 3.57 |
| NE555 | 0.72 |
| NE556 | 1.34 |
| NE566 | 1.95 |
| SAA1024 | 5.70 |
| SAA1025 | 10.35 |
| SAS560A | 2.01 |
| SAS570 | 2.01 |
| SC9503P | 1.40 |
| SC9504P | 1.38 |
| SL414A | 1.91 |
| SL432A | 2.52 |
| SL450 | 5.10 |
| SL9018 | 4.20 |
| SL917B | 5.60 |
| SL918A | 5.95 |
| SN72440N | 2.21 |
| SN76001N | 1.67 |
| SN76003N | 2.20 |

| Type | Price (£) |
|---|---|
| SN76008KE | 2.56 |
| SN76013N | 1.56 |
| SN76013ND | 1.40 |
| SN76018KE | 2.56 |
| SN76023N | 1.56 |
| SN76023ND | 1.40 |
| SN76033N | 2.20 |
| SN76110N | 1.20 |
| SN76115N | 1.62 |
| SN76116N | 1.78 |
| SN76131N | 2.10 |
| SN76226N | 2.60 |
| SN70227N | 1.61 |
| SN76228N | 1.80 |
| SN76502N | 1.92 |
| SN76530P | 0.97 |
| SN76533N | 1.38 |
| SN76544N | 1.85 |
| SN76546N | 1.85 |
| SN76570N | 1.81 |
| SN76620AN | 0.99 |
| SN76650N | 1.48 |
| SN76660N | 0.64 |
| SN76666N | 0.96 |
| TA7073P | 3.51 |
| TAA263 | 2.20 |
| TAA300 | 3.85 |
| TAA320 | 1.10 |
| TAA350A | 2.48 |
| TAA370A | 3.18 |
| TAA435 | 1.70 |
| TAA450 | 3.39 |
| TAA521 | 1.10 |
| TAA522 | 2.09 |
| TAA550 | 0.35 |
| TAA560 | 1.93 |
| TAA570 | 2.20 |
| TAA611A | 1.67 |
| TAA611B | 1.89 |
| TAA621AXI | 2.33 |
| TAA630Q | 3.91 |
| TAA630S | 4.18 |
| TAA661A | 2.39 |
| TAA661B | 1.75 |
| TAA700* | 2.80 |
| TAA840 | 3.38 |
| TAA861A | 0.95 |
| TAA930A | 1.43 |
| TAA930B | 1.43 |
| TAA960 | 3.20 |
| TAA970 | 2.81 |
| TAD100 | 2.66 |
| TBA120A | 0.90 |
| TBA120S* | 0.99 |
| TBA120SA | 1.02 |
| TBA231 | 1.12 |

| Type | Price (£) |
|---|---|
| TBA240A | 3.98 |
| TBA281 | 2.07 |
| TBA395* | 2.58 |
| TBA396 | 2.40 |
| TBA400 | 2.20 |
| TBA480Q | 1.84 |
| TBA500* | 2.21 |
| TBA510* | 2.21 |
| TBA520* | 2.98 |
| TBA530P | 2.24 |
| TBA540* | 2.88 |
| TBA550* | 3.13 |
| TBA560C* | 3.18 |
| TBA570* | 1.29 |
| TBA611B | 2.68 |
| TBA641 | 2.55 |
| TBA641A12 | 2.55 |
| TBA641B11 | 2.90 |
| TBA651 | 2.42 |
| TBA673 | 2.31 |
| TBA700* | 2.50 |
| TBA720AQ | 2.38 |
| TBA720Q | 2.38 |
| TBA750* | 2.18 |
| TBA800 | 2.05 |
| TBA810AS | 2.00 |
| TBA920* | 2.80 |
| TBA940 | 3.52 |
| TBA950 | 2.08 |
| TBA990* | 2.90 |
| TCA270A* | 3.55 |
| TCA280A | 1.43 |
| TCA290A | 3.46 |
| TCA420A | 2.10 |
| TCA440 | 1.67 |
| TCA640 | 4.26 |
| TCA650 | 4.26 |
| TCA660 | 4.26 |
| TCA730 | 4.10 |
| TCA740 | 4.04 |
| TCA750 | 2.53 |
| TCA760 | 1.52 |
| TCA820 | 3.29 |
| TDA440 | 4.16 |
| TDA1003 | 1.68 |
| TDA1004 | 2.73 |
| TDA1005 | 3.04 |
| TDA1022 | 6.89 |
| TDA1024 | 0.97 |
| TDA1034 | 2.98 |
| TDA2610 | 2.86 |
| TDA2640 | 2.86 |
| ZN414 | 1.45 |

* Indicates Q version is also available.

## DIODES

| Type | Price (£) |
|---|---|
| AA113 | 0.17 |
| AA119 | 0.21 |
| AA129 | 0.28 |
| AA143 | 0.18 |
| AAY30 | 0.28 |
| AAZ13 | 0.42 |
| AAZ15 | 0.36 |
| AAZ17 | 0.28 |
| AY102 | 3.85 |
| BA100 | 0.24 |
| BA102 | 0.36 |
| BA104 | 0.19 |
| BA110 | 0.80 |
| BA111 | 0.70 |
| BA115 | 0.17 |
| BA116 | 0.56 |
| BA121 | 0.85 |
| BA129 | 0.45 |
| BA145 | 0.19 |
| BA148 | 0.19 |
| BA154 | 0.06 |
| BA155 | 0.17 |
| BA156 | 0.12 |
| BA157 | 0.25 |
| BA158 | 0.28 |
| BA159 | 0.40 |
| BA164 | 0.14 |
| BA182 | 0.27 |
| BA201 | 0.13 |
| BA202 | 0.14 |
| BA203 | 0.14 |
| BA216 | 0.08 |
| BA219 | 0.11 |
| BA243 | 0.45 |
| BA317 | 0.06 |
| BA318 | 0.07 |
| BAV10 | 0.10 |
| BAV21 | 0.18 |
| BAW62 | 0.06 |
| BAX13 | 0.07 |
| BAX16 | 0.10 |
| BAX17 | 0.19 |
| BAY72 | 0.16 |
| BB104B | 0.52 |
| BB105B | 0.33 |
| BB105G | 0.30 |
| BR100 | 0.40 |
| BY100 | 0.35 |
| BY103 | 0.35 |

| Type | Price (£) |
|---|---|
| BY114 | 0.60 |
| BY118 | 1.10 |
| BY126 | 0.20 |
| BY127 | 0.21 |
| BY133 | 0.35 |
| BY140 | 1.40 |
| BY164 | 0.75 |
| BY176 | 2.80 |
| BY179 | 0.83 |
| BY182 | 1.14 |
| BY184 | 0.44 |
| BY189 | 5.30 |
| BY190 | 4.90 |
| BY206 | 0.26 |
| BY238 | 0.25 |
| BYX10 | 0.30 |
| BYX38/600 | 0.70 |
| BYX70/500 | 0.53 |
| ITT44 | 0.08 |
| ITT210 | 0.63 |
| ITT827 | 0.80 |
| MCR101 | 0.48 |
| MR854 | 1.10 |
| OA5 | 0.88 |
| OA10 | 0.58 |
| OA47 | 0.20 |
| OA81 | 0.19 |
| OA90 | 0.13 |
| OA91 | 0.15 |
| OA95 | 0.20 |
| OA200 | 0.13 |
| OA202 | 0.13 |
| OA210 | 0.89 |
| TIL209 | 0.14 |
| TIL211 | 0.18 |
| TV20 | 2.25 |
| IN914 | 0.06 |
| IN916 | 0.06 |
| IN4001 | 0.06 |
| IN4002 | 0.07 |
| IN4003 | 0.08 |
| IN4004 | 0.08 |
| IN4005 | 0.09 |
| IN4006 | 0.10 |
| IN4007 | 0.12 |
| IN5400 | 0.15 |
| IN5401 | 0.17 |
| IN5402 | 0.20 |
| 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 (£) |
|---|---|
| E295ZZ | |
| /01 | 0.28 |
| /02 | 0.28 |
| E298CD | |
| /A258 | 0.25 |
| E298ED | |
| /A258 | 0.22 |
| /A260 | 0.22 |
| /A262 | 0.22 |
| /A265 | 0.22 |
| /P268 | 0.22 |
| E298ZZ | |
| /05 | 0.25 |
| /06 | 0.22 |
| 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 |
| VA1055s/56s/66s/67s | all 0.23 |
| VA1074 | 0.20 |
| VA1077 | 0.31 |
| VA1091 | 0.29 |
| VA1096/97/98 | all 0.20 |
| VA1103 | 0.32 |
| VA1104 | 0.66 |
| VA1108/09/10/11/12 | all 0.24 |
| VA8650 | 1.20 |
| 2322 554 02221 | 0.59 |
| 2322 662 98003 | 0.88 |

## 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 | 0.60 |
| 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 | 2.00 |
| PCL82 | 0.93 |
| PCL83 | 1.12 |
| 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 | 3.10 |
| PL519 | 3.10 |
| PL802 | 3.25 |
| 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

Mixes of a minimum of 10pcs of any value:

| Carbon Film (5%) | 10 of one value Ea | 50pc | 100pc | 500pc |
|---|---|---|---|---|
| ¼W 5.6Ω-330kΩ (E12) | 3p 25p | 95p | £1.49 | £6.40 |
| ½W 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 | £3.60 | £6.40 | £26.90 |

**Wirewound (5%)**

| | |
|---|---|
| 2½W 0.22Ω-270Ω | 18p |
| 4W 1.0Ω-10kΩ | 22p |
| 7W 0.68Ω-22kΩ | 24p |
| 11W 1.0Ω-22kΩ | 28p |
| 17W 1.0Ω-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, 2.5MΩ all 14p each
0·2W (Vertical and Horizontal) †values as 0.1W all 14p each

## FUSES (all packs of 10)

**20mm Time Delay (BEAB)**

| | |
|---|---|
| 40mA | £3.68 |
| 50, 63mA | £2.55 |
| 100mA | £1.86 |
| 160, 200, 250mA | £1.44 |
| 315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A | all £1.19 |

**20mm quick-blow (BEAB)**

| | |
|---|---|
| 100mA | 68p |
| 200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A | all 56p |

2A circuit breakers metal £1.52, plastic £1.48

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

**TELETEXT ADAPTOR 7056.** An amazing box which can be used with any UHF Receiver. **£213** + £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. **£223.37**

## PLEASE NOTE OUR NEW ADDRESS

Still at your service, but with less space and some amazing things we have discovered in stock that we didn't know we had, we have produced a Special Offer List which we will update every month.
Please send a S.A.E. or ask with your order.

**P. & P.** UK: £0.20 per order. **Overseas:** At cost.
Please add VAT at 15%.
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.
**Giro A/c 23 532 4000.** *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 (†)**

| | | |
|---|---|---|
| 1kV | 1.5nF | 18p |
| 3kV | 1.5nF | 20p |
| 8kV | 10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF | 30p |
| 8kV | 270, 300pF | 39p |
| 10kV | 1nF | 67p |

**CONVERGENCE POTENTIOMETERS**
5, 7, 10, 15, 20, 50, 100, 200, 500Ω †38p each

**VHF to UHF CONVERTER** CM6022/RA. "Televerta" for DX-ing or uhf receiver use on relay systems, Eire etc. †£28.37

# EAST CORNWALL COMPONENTS

WEM, SHROPSHIRE SY4 5PQ.
TEL: WEM (0939) 33680. TELEX: 35544.
OFFICE OPEN: 11.00 AM–3.00 PM MON–FRI AND 7.30 PM–9.00 PM MON–SAT (EXCEPT WED).
No callers, please, unless by appointment.

# TELEVISION



## The March of Progress

In a letter in our correspondence column in January 1955, a certain L. Lawry-Johns, commenting on TV receiver servicing know-how at the time, ended by saying "Mr. Editor, I have a feeling that the subject will not end here." Prophetic words indeed! In recent months we've published a number of vintage TV articles on the sets of years ago, and it's clear that many readers are interested in the sets that were around in the early days of television and the way in which Neanderthal TV man designed his sets. Even by 1955, the transistor had yet to appear in a commercial product in the UK, while although colour had made a tentative start in the USA it was still some twelve years away in Europe. The components used in the sets one would encounter in 1954-5 were all comparatively huge: the resistors and capacitors, the transformers and coils, and those long tubes, many with round bowls. Even the valves were often not of the sort we subsequently became used to. Instead, many had strangely shaped glass envelopes, often with huge Bakelite bases, or were odd metal things, proclaiming their wartime origin. The faults were similar in some respects to those of today – shorts, open-circuits, horrid joints and instability – yet often subtly different in their root causes – a can that would screen a single valve would today house the entire i.f. strip.

We've come a long, long way since then, and the subject has indeed not ended. One recalls the earliest all-transistor TV receivers that appeared in the UK in 1960 – complex things packed with strange germanium devices and with elaborate circuitry in the signals stages to achieve stability. One remembers also a certain firm telling us that circuit diagrams for their transistor portable radios would not be issued since transistors would never go wrong. Some of those early transistor and hybrid TV sets must have been so expensive to make that one feels they were being produced mainly to gain experience with new technology rather than to make a profit. In due course transistors became cheaper, their power and voltage ratings rose, and we really did have to start redirecting our minds to think in solid-state terms, instead of, or rather as well as, in terms of thermionics. By that time, in the late 60s, two more things had presented themselves for our attention: colour, and little black lozenges that we were told contained a dozen or more transistors.

Colour was really going to separate the men from the boys. How would we ever manage to cope with wrong colours, no colour, unlocked colour and so on whilst still dealing with the daily deluge of open-circuit dropper resistors? It didn't turn out nearly as badly as we feared however. We soon got used to the three primary colours, PAL ensured that our reception was nice and steady, and the use of semiconductor devices kept much of the circuitry cool and hence reliable – though the hybrid colour sets were still consuming 250W or so (the B and O 3400 110° chassis gobbled a massive 360W).

And what were we to advise our readers to do? It's one thing to explain how a circuit works, another to say what's likely to go wrong. I remember when the first colour enquiry arrived, and how we looked at it suspiciously, passed it around and vaguely wished it would go away! Also the first i.c. query. "I've tried everything else and suspect the i.c." Were we to advise going to all the trouble and expense of getting another one and carrying out the replacement? The freezer and hot air technique, solder braid and suckers, were still to come.

The next little diversion that came along to claim our attention was a sudden burst of creativeness amongst the designers of power supply circuits. Forget the simple half-wave rectifier with an *LC* filter. Forget the simple series regulator. Before you could say dried up electrolytic, we'd series choppers, shunt choppers, isolating choppers, self-oscillating choppers, choppers combined with the line output stage (Wessel, Syclops, Ipsalo), converter stages and the transistor pump – there seems to be no end to the possibilities in what was once thought of as the simplest part of the set – if you bothered to think about it at all.

No sooner had we got to feel reasonably confident about colour, semiconductor devices of all sorts and the initial switch-mode power supplies than another spectre loomed before us – video. One's mind went back to those massive record changers and the 78 r.p.m. records that would get stuck fast, and the difficulty of adjusting the screw so that the pickup arm would lift at the end of the track instead of half way through or not at all. It'd never work! Not domestic video, combining precision engineering with sophisticated electronics. Except that it has of course. Something else to take in our stride – you're not weakening, are you? We now have to think about servo systems as well as our signals, timebases and power supplies. Oh yes, and digital servos and digital control systems of various kinds.

What started all this off? Well, whilst going through Steve Beeching's latest VCR items, your editor choked and broke out in an awful sweat. Good god, the micro's got us. No, not that!

As the man said, "the subject will not end here"!

### COVER PHOTO

What's that lurking there in our cover photo this month? Your editor's first guess was that it might be something to do with electronic street sweeping. On second thoughts he felt it may be a sophisticated metal/mine detector. Not so. It's simply the timebase board of the colour portable project.

# Teletopics

### SATELLITE BROADCASTING OPTIONS

The Home Office study on direct-to-home broadcasting via satellite, mentioned in our leader last month, suggests five options: (1) the use of five DBS (direct broadcast satellite) channels by about 1987; (2) the use of five channels but starting in 1990 (five is the number of channels in the 12GHz band, at orbital point 31°W, allocated to the UK at the 1977 World Administrative Radio Conference); (3) a more modest start in 1986 with two channels; (4) a similar modest start, but later (1990); (5) no DBS services in the foreseeable future. The study ("Direct Broadcasting by Satellite", published by HMSO at £4·50) discusses each of these options in detail. Option (3) seems to be favoured officially, provided the service could be financed by industry rather than the government.

Meanwhile, British Aerospace and bankers N. M. Rothschild & Sons have formed the Satellite Broadcasting Company while a consortium consisting of bankers Guiness Mahon and Barclays, British Aerospace, Ferranti and Trident TV have formed Satellite Television Ltd. Granada TV is also interested in taking part in satellite broadcasting, and the BBC have put forward proposals. Since the satellites themselves pose no great problems and the money seems to be on offer, we might well find ourselves with satellite TV by the end of the decade.

### DECCA-TATUNG

After a last-minute hiccup, Tatung have completed the takeover of Decca Radio and Television from Racal, and have announced their intention to increase production. One advantage they already have is the new Decca 120 and 130 series chassis we mentioned last month. The basic chassis is a neat single panel (plus c.r.t. base panel) design using just six i.c.s and sixteen transistors. The 120 drives the latest 14-22in. pincushion distortion free 90° tubes, the 130 being modified to drive 22-26in. 110° 30AX tubes. A microprocessor based remote control system has been designed for use in some of the models in the range, and at least one model will incoporate frequency-synthesized tuning, again using a microprocessor based system.

### VHD VIDEODISC PLANT

Thorn EMI have acquired a factory at Swindon for the mastering and pressing of discs for the VHD videodisc system, which is due for launch in the UK in June 1982. The plans are for the factory to be operational by next January, with full production by April, by which time there will be some 100 employees. The plant will also supply metal stampers to EMI Electrola in Cologne, West Germany, where a disc pressing only operation is being set up. The initial investment in the two plants will be around £5m, giving a combined production capacity of three million discs annually and the ability to double production by 1983.

Thorn EMI point out that the choice of a suitable site for the plant was extremely difficult, since videodisc mastering requires, amongst other things, minimum ground vibration. The information is first recorded on 1in. C-format tape, then transferred to a signal pattern of some 10,000 million pits per disc. Each 0·3 micron pit is cut in a coated glass blank by a laser head – hence the need for a vibration free location. A metal master disc is made from the cut glass blank by sequential electroforming processes, the metal stampers which are used for disc pressing being produced from this metal master. The VHD discs provide an hour's playing time per side. Thorn EMI are developing and producing the disc presses at Cologne, supported by materials technology and signals processing groups at the Hayes Central Research Laboratories. All the basic materials used in VHD disc manufacture are to be produced in Europe.

Meanwhile the joint European video venture discussions (see *Teletopics* last month) continue, and progress is reported. It seems likely that the European location for VHS VCR manufacture will be W. Berlin – preliminary work has already started in fact.

### VCR PROMOTIONS

Currys and Televideo, who advertise their mail order videocassette rental service on television, are running a joint campaign to promote the Philips V2000 VCR system. Those who join the Televideo Club will be able to purchase a VR2020 machine at any Currys branch for £20 less than the usual price, or rent one at £10 off the first year's rental. Televideo now have a substantial catalogue of movies on V2000 cassettes.

The Sony C5 and C7 betamax VCRs are being made available through Rediffusion outlets. This is the first time that the Sony machines have been released through one of the major rental organisations.

### GRUNDIG SPARES

Grundig are moving their Central Spare Parts Department from the Sydenham headquarters to a new, purpose built complex at Rugby. Distribution, warehousing, central workshops and sales administration will also be based at Rugby. Hot lines are: service 0788 61377; spares orders 0788 61342; spares enquiries 0788 61354.

### NEW CATALOGUE FROM ANGLIA COMPONENTS

One firm that's been expanding despite the present gloomy economic conditions is Anglia Components (Burdett Road, Wisbech, Cambs. PE13 2PS, telephone 0945 63281). A new, much expanded catalogue has been issued, designed for easy reference to the wide stock range. Anglia, whose turnover passed the £1 million mark last year, now employ computerised stock control.

### TELESOFTWARE EXPERIMENT

The telesoftware system has been mentioned in these pages before – the basic idea is to transmit computer programmes on a teletext basis so that they can be recorded and used by anyone with a suitable receiver. Development work is being carried out by Brighton Polytechnic in conjunction with the BBC and IBA, with hardware designed and provided by Mullard Ltd. As part of the development programme, a live experiment is being conducted with nine secondary schools who have been supplied with experimental telesoftware receivers. Each receiver consists of a 22in. colour set incorporating a teletext decoder which is interfaced with a Mullard microcomputer system.

The computer, based on a Z80 microprocessor, has a 32kbyte RAM and 24k extended BASIC interpreter in ROM form. The system has a graphics capability of 240 ×

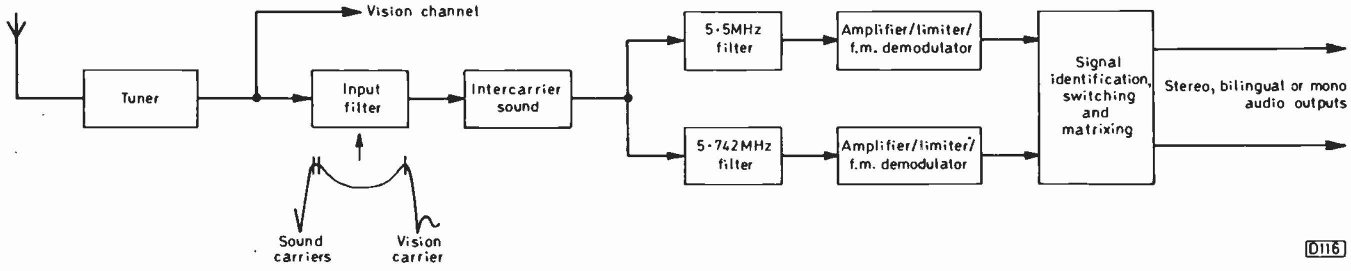



*Fig. 1: Block diagram of a sound channel for use with the two-carrier, two-channel TV sound system, using the "quasi-split-sound" technique, i.e. with both the vision and sound carriers applied to an intercarrier sound section.*

240 picture elements and uses an alphanumeric keyboard in addition to the teletext remote control. A minicassette system provides programme and data storage, operating under full software control. A bidirectional RS232C port enables printers and other peripheral devices to be attached.

The technical team at Brighton hope to show that telesoftware can provide a useful, economic system for a wide range of educational uses. An important aspect of the work will be to investigate linking telesoftware with schools' TV broadcasts. The findings are expected to be available towards the end of next year.

## CETEX '82

Instead of the now traditional London hotel trade shows, next year will see a combined Consumer Electronics Trade Show (CETEX) at Earls Court. The dates are May 30th-June 2nd, and the organisers expect some 16,000 (trade only) visitors.

## TUBE TESTER/REACTIVATOR

Werneth Electronics have introduced a new c.r.t. tester/reactivator (Model TX80S), which comes complete with a variety of tube base adaptors mounted on two printed circuit boards and provides automatic reactivation and emission measuring. The instrument, complete with adaptors and a plastic carrying wallet, costs just under £50 and is available direct from Werneth Electronics Ltd., PO Box 9, Marple, Cheshire SK6 6YE. The use of triac reactivation gives fast, reliable and accurate results, and in addition to testing most types of colour (including in-line gun types) and monochrome tubes, a special adaptor enables small-screen tubes with 11V heaters to be handled.

## TWO-CHANNEL TV SOUND RECEPTION

Two-channel TV sound (for stereo or bilingual transmissions) has been discussed in *Television* on a couple of occasions in recent months (see the November 1980 and February 1981 issues). West German broadcasters are planning to start regular transmissions later this year, using the two-carrier system, i.e. with a second sound carrier spaced at approximately 242kHz above the existing sound carrier. Philips have been developing i.c.s to cater for these transmissions, and an account of the present receiver options devised by Philips is included in the latest issue of *Electronic Components and Applications*.

Reception of a TV transmission with two-channel sound presents a number of problems. To start with, Philips consider the use of the standard intercarrier sound technique to be unsuitable. Simply splitting the sound and vision signals at the tuner output brings back the old problem of detuning due to local oscillator drift however. The solution adopted by Philips is the use of the "quasi-split-sound" system. In this, there are separate sound and vision i.f. channels following the tuner (see Fig. 1), but the sound channel accepts the full vision-sound channel bandwidth. The filter at the input to the sound channel has a response with two peaks, at the sound and vision i.f.s, and a trough between. The idea is to be able to generate the 5·5MHz and 5·742MHz intercarrier sound signals (these would be at 6MHz and 6·242MHz for a UK transmission of course) later in the sound channel. The sound i.f. channel thus requires an intercarrier section (amplifier/limiter/demodulator) followed by filters to separate the two sound signals then separate amplifier/limiter/f.m. demodulator circuits.

The type of signal (stereo, bilingual or monaural) being transmitted then has to be identified. To enable this to be done, a pilot carrier frequency modulates the second sound carrier at 2·5kHz. This enables the receiver to generate an identification signal which can then be used for stereo/bilingual/mono switching. With a stereo transmission, matrixing has to be carried out to get the L and R signals – the first carrier is modulated with L + R (so that it can be received in the normal way by a standard single sound channel receiver) while the second carrier is modulated with 2R.

Amongst the i.c.s developed or under development by Philips to provide two-channel sound reception are the TDA2545, the TDA2546, the TDA3800 and V5630B. The TDA2545 contains an intercarrier sound section, while the V5630B carries out signal identification, switching and matrixing. These two i.c.s could thus be used with a couple of standard TBA120S i.c.s for amplification/limiting/f.m. demodulation of the two sound signals to carry out all the processes shown in Fig. 1. The TDA2546 contains an intercarrier sound section plus a single amplifier/limiter/f.m. demodulator channel, and is complemented by the TDA3800 which contains the second amplifier/limiter/f.m. demodulator channel plus the identification, switching and matrixing circuitry required. These plus various audio i.c.s provide the following options: economy two-channel sound, hi-fi two-channel sound, or a flexible two-channel system.

## BOOK NOTES

The 1981 International Video Yearbook has been published by the Blandford Press, Poole, Dorset at £19·50 net (post and packing 95p extra). This is the fifth fully up-dated edition of the yearbook, and is the largest yet with 633 pages and some 7,000 separate entries. Just about everything you might need to refer to by way of video equipment and services is listed.

Newnes-Butterworth have published the fourth edition of the Electronics Pocket Book. This almost entirely new edition has been compiled by Andrew Parr, B.Sc., C.Eng., M.I.E.E., who will be known to readers as a regular contributor to *Television*. The book manages to contain a vast amount of basic material on all aspects of electronics in its 350 pages, and does so in an eminently readable fashion. Well worth it at £5·60 for the soft cover version we'd say.

### *STATION OPENINGS*

The following relay transmitters are now in operation:

**Backwell** (near Bristol) BBC-1 ch. 22, HTV West ch. 25, BBC-2 ch. 28, TV4 (future) ch. 32.

**Broad Haven** (Dyfed) Sianel 4 Cymru (future) ch. 54, BBC Wales ch. 58, HTV Wales ch. 61, BBC-2 ch. 64.

**Cartmel** (Cumbria) BBC-1 ch. 22, Granada Television ch. 25, BBC-2 ch. 28, TV4 (future) ch. 32. Note: horizontal polarisation.

**Delph** (near Oldham) Granada Television ch. 23, BBC-2 ch. 26, TV4 (future) ch. 29, BBC-1 ch. 33.

**Hawkshead** (Cumbria) Granada Television ch. 23, BBC-2 ch. 26, TV4 (future) ch. 29, BBC-1 ch. 33.

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

**Llanfihangel Crucorney** (Gwent) BBC Wales ch. 21, HTV Wales ch. 24, BBC-2 ch. 27, Sianel 4 Cymru (future) ch. 31.

**Staveley-in-Cartmel** (Cumbria) BBC-1 ch. 40, Granada Television ch. 43, BBC-2 ch. 46, TV4 (future) ch. 53.

**Union Mills** (Isle of Man) BBC-1 ch. 39, TV4 (future) ch. 42, BBC-2 ch. 45, Border Television ch. 52.

**Urswick** (Cumbria) Granada Television ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.

The above transmissions are vertically polarised unless otherwise stated.

The ITV breakfast TV service is now due to start in May 1983.

### *BOB WALKER PLEASE CONTACT!*

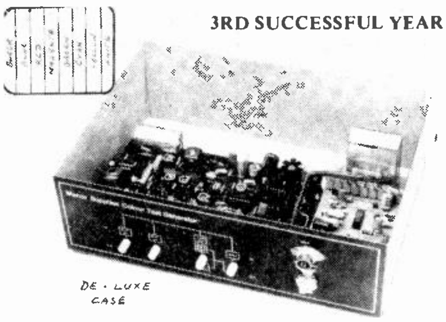
Many thanks for your interesting article – but we seem to have mislaid the covering letter. Please write in to the editor so that we can confirm acceptance.

# MANOR SUPPLIES

## PAL COLOUR BAR GENERATOR

### plus CROSS HATCH KIT (Mk. 4)

**3RD 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).**

---

**ALSO THE MK3 COLOUR BAR GENERATOR KIT FOR ADDITION TO MANOR SUPPLIES CROSS HATCH UNITS. £28.75 + £1.60 p.p. CASE EXTRA £2.00. BATT. HOLDERS £1.70.**

★★ Kits include drilled P.C. board, with full circuit data, assembly and setting up instructions.

★★ All special parts such as coils and modulator supplied complete and tested, ready for use.

★★ Designed to professional standards.

★★ Demonstration models at 172 West End Lane, NW6.

★★ Every kit fully guaranteed. Technical back-up service.

**MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.**
**MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.80 P & P.**
**VHF MODULATOR (CH1 to 4) FOR OVERSEAS £4.60.**
**EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.**

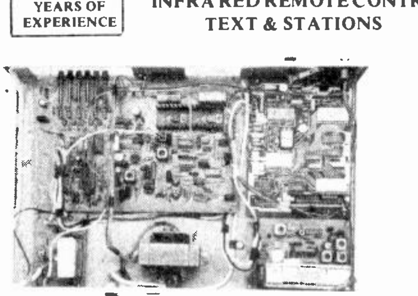
**(ALL PRICES INCLUDE 15% VAT)**

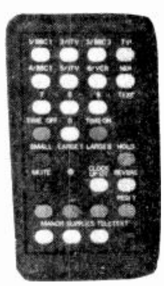
# MANOR SUPPLIES
# TELETEXT KIT (MK2)

(INCORPORATING MULLARD DECODER 6101VML)

**BACKED BY YEARS OF EXPERIENCE**

**INFRA RED REMOTE CONTROL TEXT & STATIONS**






- EXTERNAL UNIT, PLUGS INTO AE SOCKET OF TV RECEIVER.
- LATER SPEC (DOUBLE HEIGHT, BACKGROUND COLOUR ETC).
- INFRA RED REMOTE CONTROL (MULLARD 5000 SYSTEM) STATION SELECTION. TEXT, MIX, TIME, DOUBLE HEIGHT, HOLD, CLOCK, REVEAL RESET ETC, ETC.
- INCLUDES COMPLETE & TESTED 6101 VML (MULLARD) DECODER, SAW FILTER IF PANEL & 32 BUTTON REMOTE CONTROL HANDSET.
- SUITABLE FOR BBC DEAF SUB TITLE TRANSMISSIONS REMODULATES PICTURE.
- CONVERTS ANY UHF RECEIVER TO STATION SELECTION REMOTE CONTROL AND TELETEXT. (SIMPLIFIED KIT AVAILABLE FOR REMOTE CONTROL ONLY).
- FACILITIES FOR VIDEO OUTPUT, MONITORS, CCTV ETC.
- AUDIO OUTLET FOR EXTERNAL HI-FI AMPLIFIER.
- EVERY KIT EASY TO ASSEMBLE & FULLY GUARANTEED. TECH. BACK-UP SERVICE.
- DE-LUXE CASE MEASUREMENTS APPROX. 15¾ × 10¼ × 3¾.
- WORKING MODEL AT 172 WEST END LANE, N.W.6.

*FURTHER DETAILS ON REQUEST*

**ALSO, MANOR SUPPLIES TELETEXT MK1 KIT (TEXAS) NOW WITH REMOTE CONTROL PRICE £181.70 P/P £2.80.**

## TELEVISION PROJECTS & SERVICE SPARES

**"TELEVISION" NEW COLOUR PORTABLE PARTS AVAILABLE** (PHONE, CALL, SEND FOR LIST). FULL TECHNICAL ADVICE & PANEL TEST SERVICE FOR OUR CUSTOMERS, BACKED BY YEARS OF EXPERIENCE ON PREVIOUS MAGAZINE TV PROJECTS.
**"TELEVISION" NEW MONITOR PARTS AVAILABLE.**
**"TELEVISION" MONO PORTABLE RECEIVER PARTS AVAILABLE. WORKING MODEL & PANEL TEST SERVICE.**
**NEW CTV SIGNALS BOARD** PARTS NOW AVAILABLE.
**SPECIAL OFFER** TEXAS XMII TELETEXT MODULE NEW & TESTED, LIMITED QUANTITY AT HALF PRICE **£69.00** p.p. £1.60.
**"TELEVISION" COLOUR RECEIVER** (LARGE SCREEN) PROJECT ALL PARTS AVAILABLE. SEND OR PHONE FOR LIST. WORKING MODEL ON SHOW WITH TELETEXT. (PANEL TEST SERVICE AVAILABLE).
NEW SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND TESTED FOR T.V. SOUND & VISION **£32.80** p.p. £1.20.
**TELETEXT** 5V STABILISED MAINS POWER SUPPLY (FOR TEXAS OR MULLARD DECODERS) **£6.70** p.p. £1.00.
**TELETEXT** 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£11.30** p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
**CROSS HATCH UNIT KIT,** AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 60p. (ALUM CASE **£2.60** p.p. 80p.)
ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
**UHF SIGNAL STRENGTH METER KIT £20.00** (VHF VERSION **£21.60**). ALUM CASE **£2.00** DE LUXE CASE **£5.95** p.p. £1.80.
**CRT TESTER & REACTIVATOR PROJECT KIT** FOR COLOUR & MONO **£28.00** p.p. £2.00.
**BUSH Z718 BC6100 SERIES** IF PANEL **£5.75** p.p. 90p.
**BUSH A816** IF PANEL (SURPLUS) **£1.90** p.p. 90p.
**BUSH 161** TIMEBASE PANEL A634 **£3.25** p.p. £1.40.
**DECCA "GYPSY"** IF + TUNER **£14.38** p.p. £1.60.
**GEC SERIES 1** MONO PANELS **£2.10** p.p. £1.30.
**GEC 2110** DECODER, IF, RGB PANELS (EX RENTAL) **£5.75** EACH p.p. £1.00.
**GEC 2010** SERIES TIMEBASE PANEL **£1.15** p.p. £1.00.
**GEC 2040** (TYPE) CDA PANEL **£2.88** p.p. £1.25.
**PYE 713/715** Decoder, convergence **£5.75 each** p.p. £1.40.
**PYE 697** Frame T.B. ex Rental **£2.88** p.p. 90p.
**PYE 697** Line T.B. P.C.B. type salvaged **£4.80** p.p. £1.50.
**THORN 3000** LINE TB PCB **£5.75 each** p.p. 85p.
**THORN 3000** VID, IF, DEC, Ex Rental **£5.75 each** p.p. £1.30.
**THORN 8000/8500** IF/DECODER PANELS salvaged **£5.52** p.p. £1.60.
**THORN 8000/8500** FRAME T.B. PANELS salvaged **£5.52** p.p. £1.40.
**THORN 8000/8500** POWER/SALV. SPARES **£2.88** p.p. 60p.
**THORN 9000** LINE T.B. (incl. LOPT etc.), SALV., SPARES **£8.62** p.p. £1.60.
**THORN 9000** IF/DECODER PANELS Salvaged **£8.90** p.p. £1.60.
**PHILIPS 210, 300** Series Frame T.B. Panels **£1.15** p.p. 80p.
**PHILIPS G8/G9** IF/DECODER Panels for small spares **£4.80** p.p. £1.30.
**PHILIPS G6** Single standard convergence panels **£2.90** p.p. £1.20.
**G8** IF Panels for small spares **£1.75** p.p. 95p.
**G8** Decoder panels salvaged **£4.25.** Decoder panels for spares **£2.00** p.p. £1.35.
**VARICAP, U321,** ELC 1043/06 **£7.82,** ELC 1043/05 **£6.35** p.p. 60p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. Control units, 3PSN **£1.40,** 4PSN **£1.75,** 5PSN **£2.00,** 6PSN **£2.10, Special Offer** 6PSN **£1.15** p.p. 50p.
**BUSH** "Touch Tune" and Varicap Control Unit **£5.75** p.p. 85p.
**VARICAP UHF-VHF** ELC 2000S **£9.80.** BUSH TYPE **£9.00** p.p. 85p.
**VARICAP VHF** MULLARD ELC 1042 **£7.95** p.p. 60p.
**UHF/625** Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, **£3.28.** Mullard 4 position push button **£4.80** p.p. £1.30.
**TRANSISTORISED 625 IF** for T.V., sound, tested. **£7.82** p.p. 95p.
**MULLARD EP9000** Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
**LINE OUTPUT TRANSFORMERS.** New guar. p.p. £1.25.

| | |
|---|---|
| **BUSH** 145 to 186SS series | **£8.80** |
| **BUSH, MURPHY** A816 series | **£9.80** |
| **DECCA** 20/24, 1700, 2000, 2401 | **£8.50** |
| **FERG., HMV, MARCONI, ULTRA** 850 to 1580 | **£6.80** |
| **GEC** 2000, 2047 series, etc | **£8.50** |
| **INDESIT** 20/24FGB | **£8.50** |
| **ITT/KB** VC1 200, 300 | **£8.50** |
| **MURPHY** 1910 to 2417 series | **£8.50** |
| **PHILIPS** 19TG 170, 210, 300 | **£8.50** |
| **PYE, INVICTA, EKCO, FERR.** 368, 169, 569, 769 series | **£8.50** |
| **SPECIAL OFFER** | |
| **GEC** 21 4J/FINELINE | **£5.50** |
| **PYE** 40, 67 | **£5.50** |
| **THORN** 1590/1591 | **£5.50** |
| **KB** VC ELEVEN (003) | **£3.25** |

| **COLOUR LOPTS p.p. £1.30** | |
|---|---|
| **R.B.M.** A823 | **£5.60** |
| **R.B.M.** Z179 | **£6.70** |
| **DECCA** Bradford (state Model No.) | **£10.15** |
| **DECCA** 80, 100 | **£9.50** |
| **GEC** 2028 | **£7.82** |
| **GEC** 2040 | **£11.30** |
| **GEC** 2110 Series | **£12.20** |
| **ITT** CVC 5 to 9 | **£10.15** |
| **ITT** CVC 30 Series | **£10.15** |
| **PYE** 691 697 (BOBBINS) | **£7.60** |
| **PYE** 713 715 | **£7.85** |
| **PHILIPS** G8, G9 | **£10.15** |
| **PHILIPS** 570 | **£7.85** |
| **THORN** 3000/3500 SCAN, EHT | **£7.85** |
| **THORN** 8000/8500 | **£14.80** |
| **THORN** 9000 | **£10.15** |

**OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.**

**THORN** 950 3 Stick Tray **£1.15** p.p 55p. Most others available.
**THORN** 3000/3500, 8000, 8500, MAINS TRANSF. **£10.15** p.p. £1.80
6·3V CRT Boost Transformers **£5.00,** Auto Type **£3.20,** p.p. £1.20.

**CALLERS WELCOME AT SHOP PREMISES Telephone 01-794 8751/7346**
**THOUSANDS OF ADDITIONAL ITEMS AVAILABLE, ENQUIRIES INVITED**

**LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS**

# MANOR SUPPLIES

**172 WEST END LANE, LONDON, N.W.6.**

**NEAR: W. Hampstead Tube Stn. (Jubilee) Buses 28, 159, C11 pass door W. Hampstead British Rail Stns. (Richmond, Broad St.) (St. Pancras, Bedford) W. Hampstead (Brit. Rail) access from all over Greater London.**

**Mail Order: 64 GOLDERS MANOR DRIVE, LONDON N.W.11.**

ALL PRICES INCLUDE VAT AT 15%

# Interested in Television Servicing?

## Try a ZED Pack. Effect Repairs at Minimum Cost.

| | | |
|---|---|---|
| Z1 | 300 mixed $\frac{1}{4}$ and $\frac{1}{2}$ watt resistors | £1.95 |
| Z2 | 150 mixed 1 and 2 watt resistors | £1.95 |
| Z3 | 300 mixed capacitors, most types amazing value | £3.95 |
| Z4 | 100 mixed electrolytics | £2.20 |
| Z5 | 100 mixed Polystyrene Capacitors | £2.20 |
| Z6 | 300 mixed Printed Circuit Components | £1.95 |
| Z7 | 300 mixed Printed Circuit resistors | £1.45 |
| Z8 | 100 mixed High Wattage Resistors, wirewounds etc. | £2.95 |
| Z9 | 100 mixed Miniature Ceramic and Plate caps | £1.50 |
| Z10 | 25 Assorted Potentiometers | £1.50 |
| Z11 | 25 Assorted Presets, Skeleton etc. | £1.00 |
| Z12 | 20 Assorted VDR's and Thermistors | £1.20 |
| Z13 | 1 lb Mixed Hardware, Nuts, Bolts, Selftappers, "P" clips etc. | £1.20 |
| Z14 | 100 mixed New and marked transistors, all full spec. includes: PBC108, BC148, BF154, BF274, BC121L, BC238, BC184L and/or Lots of similar types | ONLY £4.95 |
| (Z14A) | 200 Transistors as above but including power types like BD131, 2N3055, AC128, BFY50 etc. | £9.95 |
| Z15 | 100 Mixed Diodes including: Zener, Power, Bridge, Signal, Germanium, Silicon etc. All full spec. | £4.95 |
| Z16 | 20 IN4148 Gen Purpose Diodes | £1.00 |
| Z17 | 20 IN4003/10D2 | £1.00 |
| Z18 | 20 Assorted Zeners. 1 watt and 400 mw | £1.50 |
| Z20 | 10 Assorted switches including: Pushbutton, Slide, Multipole, Miniature etc. Fantastic Value | £1.20 |
| Z21 | 100 Assorted Silver Mica caps | £2.20 |
| Z22 | 10 Mixed TV convergence Pots | £1.00 |
| Z23 | 20 Assorted TV Knobs including: Push Button, Aluminium and Control types | £1.20 |
| Z24 | 10 Assorted Valve bases B9A, EHT, etc. | £1.00 |
| Z25 | 10 Spark Gaps | £1.00 |
| Z26 | 20 Assorted Sync Diode Blocks | £1.00 |
| Z27 | 12 Assorted IC Sockets | £1.00 |
| Z28 | 20 General Purpose Germanium Diodes | £1.00 |
| Z29 | 20 Assorted Miniature Tantalum Capacitors. Superb Buy at | £1.20 |
| Z30 | 40 Miniature Terry clips, ideal for small Tools etc. | £1.00 |
| Z31 | 5 CTV Tube Bases | £1.00 |
| Z32 | 10 EY87/DY87 EHT bases | £1.00 |
| Z33 | 20×PP3 Battery Connectors | £1.00 |
| Z34 | 6×Miniature "Press to Make" Switches, Red Knob | £1.00 |
| Z35 | 12 Sub Min S.P.C.O. Slide Switches | £1.00 |
| Z36 | 12 Min D.P.C.O. Slide Switches | £1.00 |
| Z37 | 8 Standard 2 Pole 3 Pos Switches | £1.00 |
| Z38 | 4×HP11 Batt Holders (2×2 Flat type) | 4 for £1.00 |
| Z39 | 3.5mm Jack Sockets, switched, enclosed Type | 8 for £1.00 |
| Z40 | 100 Miniature Reed Switches | £2.30 |
| Z41 | 100 Subminiature Reed Switches | £4.20 |
| Z42 | 20 Miniature Reed Switches | £1.00 |
| Z43 | 12 Subminiature Reed Switches | £1.00 |
| Z44 | TO3 Mounting kits (BU208) | 8 for 60p |
| Z45 | TO220 Mounting kits (TIP33) | 10 for 60p |
| Z46 | TO126 Mounting kits (BD131) | 12 for 60p |
| Z47 | Pack of each Mounting kit. All include insulators and washers | £1.50 |
| Z48 | 3a 1000v Diodes (IN5408 type) | 8 for £1.00 |
| Z49 | Brushed Aluminium Push Button Knobs, 15mm long × 11mm Diam. Fit standard 3½mm square shafts | 10 for £1.00 |
| Z50 | Chrome finish 10mm × 10mm Diam as above | 10 for £1.00 |
| Z51 | Aluminium Finish. Standard Fitting Slider Knobs. (Decca) | 10 for £1.00 |
| Z52 | Decca "Bradford" Control Knobs Black and Chrome. ¼" Shaft | 8 for £1.00 |
| Z53 | Tuner P/B Knobs, Black and Chrome. Fit most small Diam Shafts, ITT, THORN, GEC etc. | 8 for £1.00 |
| Z54 | Spun Aluminium Control Knobs (ITT) ¼" Shaft, suitable for most sets with recessed spindles | 8 for £1.00 |
| Z55 | 14 Pin DIL I.C. Sockets | 12 for £1.00 |
| Z56 | 16 Pin Quil I.C. Sockets | 12 for £1.00 |
| Z57 | 16 Pin DIL TO QUIL I.C. Sockets | 10 for £1.00 |
| Z58 | 22 Pin DIL I.C. Sockets | 10 for £1.00 |
| Z59 | B9A Valve Bases P.C. Type | 20 for £1.00 |
| Z60 | 0.47Ω ½ Watt Emitter Resistors | 40 for £1.00 |

### ELECTROLYTIC

| | |
|---|---|
| 1μf 63v | 20 for £1.00 |
| 1μf 350v | 10 for £1.00 |
| 2.2μf 63v | 20 for £1.00 |
| 4.7μf 63v | 20 for £1.00 |
| 4μf 350v* | 10 for £1.00 |
| 10μf 400v | 8 for £1.00 |
| 22μf 16v | 20 for £1.00 |
| 100μf 25v | 20 for £1.20 |
| 160μf 25v* | 20 for £1.50 |
| 330μf 25v | 10 for £1.00 |
| 400μf 40v* | 8 for £1.00 |
| 470μf 25v | 10 for £1.00 |
| 470μf 35v | 8 for £1.00 |
| 1000μf 16v | 10 for £1.00 |
| 1000μf 25v* | 8 for £1.00 |
| 1000μf 35v | 6 for £1.00 |

*Axial. All others are Radial.

### CAN TYPES

| | |
|---|---|
| 100+200 350v | £1.00 |
| 2000μf 100v | £1.00 |
| 1000μf 100v | 60p |
| 2,200μf 40v | 60p |
| 2,200μf 63v | 70p |
| 3,500μf 35v | 50p |
| 220μf 400v ITT/RBM | £1.00 |
| 10,000μf 35v 2½"×1¾" with fixing stud and nut. £1.00 | 6 for £5.00 |

### THYRISTOR

SS106 (BT106) 65p each
3 for £1.50, 10 for £4.50

### 33v REGULATOR

Equivalent to TAA550, SN76550, ZTK33 etc. 8 for £1.00

### EHT STICKS

TV18 KV 50p each, 3 for £1.00
Replacement Tripler Sticks (Thorn) 10 for £1.00

### TANTALUM

| | |
|---|---|
| 0.15μf 40v | 12 for £1.00 |
| 0.22μf 10v | 12 for £1.00 |
| 0.33μf 40v | 12 for £1.00 |
| 0.47μf 40v | 12 for £1.00 |
| 0.68μf 40v | 12 for £1.00 |
| 2.2μf 40v | 12 for £1.00 |
| 3.3μf 16v | 12 for £1.00 |
| 12 of each value | £6.00 |
| Pack of 20 Assorted, our selection | £1.20 |

### SPECIAL OFFERS

100 Assorted Polyester Capacitors. Mullard C296's and others 160v-400v only £2.00
100 Assorted Mullard C280's Cosmetic imperfects etc. £2.00
200 Mullard Miniature Electrolytics Cosmetic imperfects etc. £2.00
PACK OF EACH £5.00

### TRANSISTORS

BC154, BC149, BC157, BF195, BF495, PBC108, BF393S

| | |
|---|---|
| 12 of one type | £1.00 |
| 12 of each | £6.00 |
| 2N3055H | 60p each |
| BD181 | 50p each |
| BD132 | 4 for £1.00 |

### CONVERGENCE POTS

5Ω, 10Ω, 20Ω, 30Ω, 50Ω, 100Ω, 200Ω, 1K. 8 of one type £1.00. 8 of each type £6.00.

### ZENER DIODES

0v7, 2v7, 4v3, 4v7, 5v6, 6v2, 6v8, 7v5, 27v, 30v. ALL 400mw.

| | |
|---|---|
| 10 of one value | 80p |
| 10 of each | £6.60 |
| 1.3 watt, 12v, 13v, 18v | |
| 10 of one value | £1.00 |
| 10 of each | £2.50 |

### DIODES

| | |
|---|---|
| 25 × IN4002 | £1.00 |
| 10 × SKE 4F2/06 (600v 2a fast switching) | £1.00 |
| 12 × BY127 | £1.00 |
| 10 × BA158 (600v 400ma) | £1.00 |
| IN5402 3a 200v | 8 for £1.00 |
| BY142 3a 1,750v | 5 for £1.00 |

### I.C.'s

| | |
|---|---|
| CA270AE £1.00 | 6 for £5.00 |
| MC1327P £1.00 | 6 for £5.00 |
| TBA810P £1.00 | 6 for £5.00 |
| 555 Timer 50p | 3 for £1.00 |

### LEDS

3mm Crystal Clear, very pretty. Red, Green, Yellow.

| | |
|---|---|
| 10 of one colour | £1.00 |
| 10 of each | £2.50 |
| TIL209 3mm Red | 12 for £1.00 |
| 5mm Red | 10 for £1.00 |
| Red Triangle | 8 for £1.00 |
| Green Rectangle | 8 for £1.00 |
| Infra Red, LED Transmitter, Til 38. Hi-Power. | 50p each, 3 for £1.00 |

### THORN SPARES

| | |
|---|---|
| "9000" Tripler on Mounting Plate complete | £4.50, 3 for £12.00 |
| "3500" Transductor | £1.20, 3 for £3.00 |
| "3500" Focus Assembly with VDR | £1.50 |
| "8500" Focus Assembly. Rotary type | £1.50, 3 for £4.00 |
| "8500" .0022 2000v Line Capacitor | 10 for £1.00 |
| "1590/91" Portable metal boost Diode (W11) | 5 for £1.00 |
| "1500" Bias Caps 160μf 25v | 20 for £1.50 |
| "1500" Jellypot. L.O.P.T. Pinkspot | £3.50 |
| "900/950" 3 stick triplers | £1.00, 3 for £2.50 |
| "1600" Dropper 18 + 320 + 70 + 39Ω | 3 for £1.50 |
| "950" Can. 100 + 300 + 100 + 16μf | £1.00 |

### SURPRISE THE MILKMAN

With our 24 tune computerized doorchime. Battery operated. Amaze your friends with a different tune every time they call. Tunes include: Colonel Bogie, God Save The Queen, William Tell, and lots of others. ONLY £14.95

TRADE ENQUIRIES WELCOME

### MISCELLANEOUS

| | |
|---|---|
| Line output transformer for RBM 823A | £4.25 each, 3 for £10.00 |
| ITT VC200 4P/B Transistor Tuner. Suitable for some Pye and Philips sets. 3 hole fixing | £2.75 each |
| Decca Bradford Tuners. 5 button type | £3.00 each, 5 for £12.50 |
| Decca Bradford Triplers | £3.00 each |
| Philips K70 Varicap Tuner | £6.45 |
| UHF Modulator UHF out Video in. Ch. 36. 2¼"×2"×½" complete with 9 foot coaxial lead and plug. With connection data | £3.00 each, 2 for £5.00 |
| Video Game Boards. All new but incomplete. Hundreds of useful components. C.M.O.S. IC's, transistors, diodes, sockets, switches etc. Pack of five assorted boards | £2.50 |
| GEC Hybrid 2040 series Focus Assembly with lead and VDR rod | £2.00 each, 3 for £5.00 |
| 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 |
| PYF 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 |
| Anti Corona Caps | 3 for £1.00 |
| 4.433 Mhz CTV Crystals | £1.00 each, 3 for £2.50 |
| Cassette Mains Leads, 7ft with fig 8 plug | 60p each, 3 for £1.50 |
| 6 MHZ sound filters, ceramic 3 pin "TAIYO" type | 50p each, 3 for £1.00 |
| 10.7 MHz Ceramic Filters "Vernitron" FM4 | 50p each, 3 for £1.00 |
| PYE CT200 Control Knobs | 8 for £1.00 |
| High quality Metal Coax Plug. Grub screw fixing | 5 for £1.00, 100 for £12.50 |
| Cassette/Calc Leads. 2m long, figure 8 skt. to flat pin. American plug | 60p each, 3 for £1.50 |
| 3.5mm Jack Plug on 2m of screened lead | 5 for £1.00 |
| T.V. Game Remote Controls. Contains 22k thumbwheel pot on 2m of screened lead with 3.5mm plug | 2 for £1.00 |
| Mains Neons | 10 for £1.00 |
| Mini Grundig Motors. Regulated, variable. 9/16" × 1¼" 1 6V | 60p each, 3 for £1.50 |

## GEMINI ELECTRONIC COMPONENTS

**Dept. TV, The Warehouse, Speedwell Street, London S.E.8.**

**Please quote ZED code where shown. Send cheque* or Postal Order. Add 60p P&P and 15% VAT.**

***Schools etc. SEND OFFICIAL ORDER**

**ZED PACKS now available for CALLERS at 50 Deptford Broadway, London, S.E.8.**

# Service Notebook

*George Wilding*

## The ITT FT110

Two of the imported ITT colour sets with the FT110 chassis have come our way recently. The complaint with the first was that although the sound would come up as soon as the set was switched on, the picture might take up to ten minutes to appear. On removing the back and switching on, we found that the e.h.t. was present but that the tube heaters were not warming up. The heaters were intact, so we checked the base connections. These were impeccable, and we then recalled that the heaters are fed via a 4A fuse which is mounted on the inside of one of the line output transformer panels. On levering one end of this free, we had the glass and the fusewire but the other end cap was still in its clip. There must have been a very poor soldered connection between the free end of the wire and this end cap.

The other set was completely dead when switched on – or appeared to be, since there was no light from any of the touch-button channel indicators, no sound and no raster. A check across the mains plug produced a comparatively high-resistance reading, suggesting that there might be an open-circuit input fuse or a defective switch contact. We removed the back and found that the mains fuse was intact, and this time a low-resistance reading was obtained across the mains plug. So we plugged in and noticed a distinct rustling noise. Clearly power was reaching the set, and as there's no mains transformer in these sets it was clear that our previous high-resistance reading had been due to the fact that the degaussing posistor had warmed up by the time we'd made the reading, and had thus been in its high-resistance condition.

The big h.t. carrying resistors all had ample voltage on them, so it seemed that an l.t. supply was probably absent. These sets are unusual in having a converter stage between the line driver and output stages. The converter stage produces the h.t. supplies and plus and minus 28V l.t. supplies. The other source of l.t. is the EW modulator circuit, and it was found that the latter supply (28V across C506) was absent, due to one of the EW modulator diodes (D507, BYX55-350) being open-circuit.

## No Sound or Raster

There was no sound or raster on a solid-state Bush colour set – one of the later versions of the A823 series, with varicap tuning. There was a strong hiss from the speaker however, suggesting that the signal stages were working. On examination we found that the h.t. fuse was open-circuit, thus removing the supplies to the line output stage and the tuning system. The fuse wasn't blackened, so the odds were excessive current due to an overload in the line output stage.

The first suspect was naturally the tripler, which on these sets is connected via a plug-in lead. We disconnected this, fitted a new fuse, and switched on. A few seconds later the new fuse blew, but by keeping a sharp lookout on the line scan department we noticed that before this happened a tiny plume of smoke came from 6R7. This is the 2·7kΩ surge limiter resistor in series with the rectifier that produces the tube's first anode supply, so it was likely that either the rectifier or its reservoir capacitor 6C13 was short-circuit. The capacitor turned out to be the culprit, though both the diode and 6R7, which had fallen in value to around 800Ω, had to be replaced as well.

## Lack of Height

The problem with a Philips T-Vette 11in. portable was insufficient height. In view of the set's age, our first suspicion was that maybe the 1,000μF field scan coupling capacitor (C4113) had dried up. Shunting it with a 470μF capacitor produced negligible improvement however. The two linearity controls and the height control seemed to operate normally, so we turned attention to the components in the field charging circuit. The cause of the trouble was found to be the 6·8kΩ resistor R4127, which is in series with the height control. It had, rather surprisingly in view of its comparatively low rated value, increased in value, a replacement restoring more than adequate height.

## No Raster

Sound but no raster was the not uncommon fault with a Pye hybrid colour set. There was no e.h.t., and only a slight suggestion of an arc could be obtained from the anode of the PL509 line output valve. As both this and the PY500A boost diode seemed to be getting hotter than usual, we switched off. The next move was to apply the meter, on an ohms range, between the PL509's top cap and chassis – a low reading would indicate capacitor trouble in the line output stage. Everything seemed to be in order however, so our next suspect was the tripler. The connections to this are soldered, and unsoldering them involves a lot of edge connector removal etc. So we fingered both sides to see whether there were any hot spots, or maybe a variation of temperature between one side and the other. Though it was not particularly noticeable, there was a definite temperature difference on one side, and since the set had been on for only a few minutes this was sufficient evidence to merit disconnection.

Having done this, we discovered that there was a dead short between the two leads on the input side. I can't recall having had this happen before with one of these triplers, which by and large don't have a high failure rate. Anyway, a replacement restored the picture, though the focus control had to be at almost one end of its travel for optimum results – due to the 5·6MΩ series resistor R234 having risen in value to something like 10MΩ.

## Intermittent Height Troubles

When you get the symptoms of intermittent height variation plus occasional field collapse in a hybrid set you immediately make a beeline for the field output valve and give it a tap or two to see whether the fault condition puts in an appearance. We did this recently with the PCL805 valve in a set fitted with the Thorn 1500 chassis, but the picture remained perfect for the first ten minutes or so after switching on. The height then suddenly reduced to about half. This was followed by a few spasmodic shudders, after which there was complete collapse. Voltage checks revealed that the pentode cathode was at zero instead of 16·5V, and on touching the pentode's control grid pin the 50Hz buzz that came from the output transformer told us the scan had been restored even though we couldn't see the screen. After a few minutes the field again collapsed, and the same symptoms were discovered. Clearly the output pentode was being biased off, due to a faulty resistive component in the control grid circuit leaving the grid intermittently floating. The fixed resistors in the circuit looked all right and were perfectly soldered: the grid is returned to chassis via the linearity feedback loop however, which includes the two linearity presets R104 and R106. The latter was found to have a hairline crack in its carbon track, right at one end. No further field trouble was experienced after fitting a replacement.

### Loss of Colour Sync

An ITT hybrid colour set would loose colour sync after it had been on for an hour or so. With the set on the bench and the back removed, the fault took two hours to develop – since the chassis was taking longer to reach its normal working temperature. We found that colour sync could be restored by adjusting the reference oscillator preset R311, but after a further period it would again need adjustment.

There were quite a number of possibilities, for the fault could have been in the reference oscillator circuit itself or in the extensive control loop. As a first move we changed the discriminator diodes, since any shift in their balance or change of characteristics would alter the control voltage produced. This gave no improvement however. There are a couple of other obvious suspects in the control loop – the 6·8μF electrolytic C208 in the filter circuit, and the 1·5V zener diode D36 in the discriminator bias network. Since the set had had several years' use, the electrolytic was changed, but again there was no improvement. Replacing the zener diode completely cleared the trouble however. The diode is used with forward bias incidentally, being employed to counter the effect of temperature on the oscillator transistor rather than as a zener stabiliser. We should have known!

# Letter from America

***Jim Edwards***

As I'd a few spare hours between paperwork, dashing to an airport, sleeping, learning to drive and buying an aeroplane I figured I'd take time off to have a beer and write another "letter from America". I've been here for three and a half months now and have covered many thousands of miles by flying. I've also seen a few more hotel room PIL tube TV sets with large convergence errors. How do they do it? Anyway, the theme this time is video, or "is there really more to video than a Kenny Everett TV Show?" . . .

### VCRs

As the publicity blurb says, "video will be the colour television of the future" – what they mean is growth and revenue. It all started quite some years ago now of course, with the Philips N1500 system in Europe and the Sony U-matic system in Japan and the USA. These never really caught on as domestic video systems, the cost being too great – initial cost, servicing costs and the price of the tape. Both systems are still with us, mainly in the form of their derivatives, the N1700 and Betamax systems respectively. These Philips systems have never been on offer here in the US, where by far the largest share of the VCR market has been taken by the VHS system. Amongst others, RCA and the N. American Philips brands (Magnavox, Philco and Sylvania) have backed the VHS system.

So the present VCR battle here is between the VHS and Betamax formats, with Betamax claiming to offer "superior facilities" and VHS an extra hour's playing time (six hours against five). From what I can see of it you can get any feature you're likely to want on a VHS machine – fast forward with picture, stop action and fourteen-day timer. In fact it looks as if Sony are losing out, which is especially significant when one considers that they've declined so far to get into the domestic video disc scene.

I'll now attempt to make you green with envy by quoting some current prices, in real dollars and converted to pounds (the pound averaging around $2 in recent weeks). At the lower end of the market you can get a VHS machine giving six hours' playing time and having a 24 hour timer for only $600 (£300). At the top end, with fast wind pictures, fourteen day timer and remote control, you'd pay $1,200 (£600). That may explain why getting on for a million VCRs were sold here in 1980 and 1·5 million are expected to find homes in 1981, despite the poor economic climate.

### Bar TV

As an aside, most bars here have a TV set of some sort, tube or projection, usually tuned in to some soap opera, Dave Allen or a sports event. The latter means basketball around here, as the local Boston Celtics have won the World Champions title for the fourteenth time. This provides the male populace with a good excuse to go out drinking, and of course the VCR can record the whole match so you don't miss it should you fall off your bar stool or the bar TV breaks down. The penalty for being drunk in charge of a bar is the same here as at home but seems to be far more common – or maybe I just go to the wrong places.

### Video Discs

The VCR now has a contender here in the form of the video disc. So we've two more battles – disc versus tape and an even more bloodthirsty disc format versus disc format. Will manufacturers never get together to start off with? The first of these battles is not being hard fought, as the two are regarded as catering for rather different needs – tape is more versatile but a cassette costs substantially more than a disc, even here.

The Magnavox (Philips) video disc system was introduced in the US in 1978. More recently RCA introduced their Selectavision "Capacitance Electronic Disc", or CED for short. Promised is the JVC VHD system, which has been backed by a number of manufacturers all over the world, including Thorn-EMI in the UK with its large library of available software – films to the ignorant! The three systems are totally incompatible with each other of course.

The Philips system is the most sophisticated one (and therefore the most expensive). A high-power laser is used to cut the master disc, from which copies are pressed. The player uses a low-power laser, currently gas but eventually semiconductor, to read the vision and sound signals on the disc. A servo system keeps the laser beam centred on the information track as the laser scans the disc. This totally contactless system has a number of advantages. No wear of course, while fast forward or reverse with picture, jumping from frame to frame by number and freeze frame are features easy to incorporate. The wide optical bandwidth gives excellent picture quality, and dual-language or stereo sound has been possible from the start. These features have made it a natural choice for educational use, and the system has recently gained the backing of a company called IBM for just that purpose.

The RCA CED system was second on the scene earlier this year but is number one so far as the publicity is concerned. The information is stored in the form of capacitance variations between a metalised layer within the disc and the metalised stylus used to track it. The concept is far simpler than the Philips one in terms of the electronics required, but offers far fewer features, stereo sound being a notable absentee at present. An estimated $20 million has been earmarked for publicity this year alone. Zenith are also backing the system, and since the two companies control 50% of the US colour TV market it stands a good chance. This is something it will need – RCA admit that it took 17 years and $150 million to develop (some industry sources put the figure at double that).

The US colour TV market is remarkably buoyant at present despite the 85% saturation and the recession, and manufacturers are looking to video to give them a boost. RCA expect to sell around 200,000 CED players this year, so the publicity alone works out at nearly $1,000 a player, which is not shown up in the selling price. Hitachi, Sanyo and Toshiba have also introduced CED players.

Due next year is the JVC VHD (Video High Density) disc system. JVC's parent company Matsushita is the world's largest consumer electronics company, and in the US the system is being backed by General Electric, which has the fourth largest share of the US TV market. Technically the VHD system sits between the other two, offering more features than CED but less than LaserVision (as Philips now call their system), at intermediate sophistication and end price. The information is again capacitively stored, and the metallised stylus is in contact with the disc. It doesn't ride in a shallow groove as in the CED system, being servo controlled instead.

The pricing of the LaserVision and CED systems is known, but that of the VHD system has yet to be announced. The published prices for the Philips and RCA players are $700 and $550 respectively, though I've seen them both at under $400 in special sales – and there seems to be one of these every week of the year here.

### Video Separates

Something that seems to be popular here is "video separates" – a no frills, portable VCR with another module that provides the tuner and timer functions. Portable sound/colour video cameras are starting to sell well as a better alternative to cine – no processing delays, longer recording time (if you can afford the batteries) and easy sound editing. For the future, the talk is of thinner and thus longer playing tape and of small cassettes, possibly using metal particle tape, for combined camera/cassette systems. The latter could really upset the 8mm. film market, so the cine camera firms are beginning to participate actively in video developments. Be prepared for more developments to come: the video age is here!

# *There's a Funny Smell . . .*

***Les Lawry-Johns***

THEY say that lightning never strikes twice in the same place. This isn't true. I don't mean that lightning has struck me – it's about the only thing that hasn't, and perhaps a quick flash might buck me up a bit. No, you know what I mean. Unusual things that anyone else would remember happen to me, but on the second occasion I find myself muddling through as usual until it suddenly dawns on me that I've had it all before and that I've spent several hours beavering away quite unnecessarily. There's probably something wrong with my prostate gland because . . . oh well, never mind.

I was trying to work out why this Bush colour set (A823 chassis) wouldn't start. A.C. was present at both ends of the surge-limiting thermistor and up to the anode of the thyristor h.t. rectifier/regulator, but I couldn't establish the h.t. supply. Anyway, someone came in with an urgent job and all the a.c. outlets were full up with soak test items that were happily doing whatever they were supposed to be doing. So I disconnected the Bush set and put it to one side, plugging in the Minivox portable that this chap who was going on holiday in an hour or two and wanted to take with him had brought in. Now I'm not all that familiar with these small Yugoslavian TV sets, having had only a single tussle with one of them before.

Since time was limited, I did it all wrong from the start. I plugged it in and there was a hum and some noise on the sound side with the tube's heater lighting up. So I concluded that the l.t. line was o.k. and that the fuse on the top right rectifier/smoothing panel was intact, as it appeared to be. I removed the tube base socket to allow the panel to be swung open, and started to check the supplies around the line output transistor. The result was that I became confused by a collection of negative readings of a low order and in the wrong places, though I didn't have the circuit to see what the readings should have been.

After much shilly shallying, I found a supply on a socket but nothing on the next pin which should have fed the line output stage. So I chased the plug wires back, and guess where they went? All the way back to the fuseholder on the top right supply panel. The fuse was open-circuit, though the spring was clearly intact. It wasn't the l.t. fuse at all of course: it was in series with the supply to the line output stage. A meter across it gave a normal reading, i.e. no excessive current, so a new fuse was fitted and a job that should have taken minutes had, once again, taken half an hour.

"Never mind" said the owner, Basil. "We all make mistakes and I suppose some take longer to do things than others. Don't blame yourself."

"Take it back to Yugoslavia next time if you want it done quickly" I growled petulantly.

So off he went on his holiday. Who wants a holiday anyway? People get hurt on those things. You should hear them moaning when they get back. This was wrong, that was wrong. Good job I can't afford one really. We may have a half day at the seaside later in the year, to find out what Madam Martine has to say about the problems the future holds for us.

### The Smell

Honey Bunch then popped in to see if any money had gone in the till. "You haven't done much today – what's that funny smell?"

"Must be the dog" I suggested.

"It's not Ben. He's out here with me and doesn't smell any differently from usual. It's a smell like you make – I mean it's a smell like a set cooking up."

"I can't smell anything unusual" – and in truth I couldn't. So off she went to set her hair or whatever women do all day long, and I put the Bush set up again to renew the battle. This time I didn't use the isolating transformer socket, plugging it into a direct mains outlet instead – more for convenience than for anything else. The set came on straight away, so I plugged it back into the isolated bench supply and it didn't.

Like a flash my lightning quick mind grasped the reason for all this. As it had done not all that long ago when precisely the same thing happened – the mains isolating transformer had developed shorting turns, with the result that it wouldn't start up a thyristor power supply. I too could smell the smell. Anyone with half a nose could smell it. The transformer was hot to the touch when I touched it, so I didn't touch it any more. I gave it to the dustman, who apparently does a bit of totting on the side to bring his salary up to that of the prime minister.

### Return of Beardy and Non-beardy

I hadn't seen Beardy and Non-beardy for some time. On the last occasion they brought in a Bush monochrome set (TV161 I think) whose main electrolytic hissed all over me, which made them laugh no end until they got the bill. "Oh dear oh dear, such a lot of money." This time they brought in a 26in. Ferguson colour set – one fitted with the 9800 chassis.

"The picture keeps going down to a line you see, and I hit it bang on the top like that and it comes back again. My friend says it's a loose wire. We'll come back to collect it later."

When I got around to it I put the set up on the bench, with just a raster showing, and noted that the volume control slider shaft (and thus the knob as well) was missing, necessitating a finger nail to obtain adjustment. Child-proof provision I thought. Vibration caused the raster to collapse, and we were soon under the line output stage panel at socket PL851 looking for dry-joints. A couple of likely contenders (the 47V supply to the field timebase comes from the line output stage) were found and dealt with, and just for luck we checked the plug as we've found poor contacts here in the past. Replace panel and screws, plug in aerial, everything fine. So I wrapped it up and wrote out my charge for service.

When they returned, Beardy immediately looked at the set and said "where is the knob which is missing?"

"The knob was missing when you brought it in, so don't try pulling that one on me."

"No no, the knob was there earlier you see."

"You probably knocked it off in the car then, when you put it in or got it out. It's probably still there, but it won't do you much good if you find it because the shaft has snapped off as well."

Non-beardy went to look in the car but couldn't find it. Beardy started "you will put on a new knob, and find the old one here in the shop later perhaps."

"It doesn't need just a new knob, it needs a new control since you snapped off the shaft getting the set out of the car."

This exchange continued for some little time, then lapsed. "Let us see the set working" said Beardy. I sighed and wished them gone, but heaved the set back up to show them my fine work. The raster came up nicely and remained steady, but there was no picture on it.

"Where is the picture?" asked Non-beardy.

"Buggered if I know. It was there a minute ago" I grunted, removing the rear cover again.

"The picture is on" said Beardy. "You haven't put the set right because this is why we brought it to you."

"Oh no it wasn't. You brought it in because the picture collapsed to a line and came back when you bashed the set, which was probably when you knocked the volume control off."

"No no, the picture never comes on straight away. How much have you charged us for not doing the TV?"

I whipped the bill into my pocket. "If I haven't done the job, as you say, I can't give you the bill." Obviously while tackling the field collapse fault something had had time to warm up and start working, which it didn't want to do when cold. The signals panel (i.f. strip, decoder etc.) varied slightly over the years, with the 8000, 8500 and 8800 series, but retained the basic arrangement with transistors to provide i.f. amplification followed by a chip or two. So I tried the freezer, but the thing wouldn't stop working. Eventually I found that, paradoxically, from cold there were no signals until the upper left TCA270SQ video detector etc. i.c. was sprayed with freezer, when signals burst through – not by heating it as I'd thought.

"What is that stuff?" demanded Beardy.

"Hold your hand up" I suggested.

Beardy half held his hand up and I gave it a blast of freezer. Beardy howled with surprise more than anything else, and Non-beardy fell about laughing, just as he did when the capacitor sprayed all over me.

"Right" I said firmly. "We've had our little laugh, let's get down to it. If you want the set to start straight away, we've got to put one of these funny black things in and however much you shout and bawl you'll have to pay for it."

"How much will you allow us off for the volume knob you broke?"

I'll draw a veil over what followed. Suffice it to say that Beardy and Non-beardy will not be seeking our help in future, and will not therefore adorn these pages again, despite the fact that the editor seems to find them very entertaining and appears to have an affectionate regard for everyone who gives us a lot of trouble. Funny that ... (Bring back Grace and Sid I say – editor.)

### Woman's Instinct

A Pye hybrid set (697 chassis) was brought in with the complaint no sync. Since the picture was there, though the colour was intermittent, my amazing powers of deduction led to an instant diagnosis. The reasoning went along the following lines. Since the sound is o.k. and the picture is present, the fault must lie in the very small area between the second video transistor VT6 and the sync separator VT7 (see Fig. 1). The sound and the chrominance signals are tapped off at an earlier point, and the fact that the colour is touchy must be due to the fact that in these chassis the burst gating pulse is derived from the sync pulse. So the sync separator just had to be at fault, probably because its base bias resistor R33 had increased in value. Without a second's hesitation, I swung open the i.f. panel and deftly removed the resistor. Didn't even bother to check it, just fitted a replacement and quickly checked the sync separator transistor VT7.

Full of confidence we switched on, and got exactly the same symptoms – no sync and no colour. Things were no better after I'd been around the sync separator stage with a fine tooth comb.

By now Honey Bunch had done her hair or whatever it is that women do all day long, and was standing in front of the Pye, fiddling as usual.

"It's the contrast control" she pronounced.

"Oh yes?" I said. "What leads you to this clever diagnosis when I've been sweating here for an hour or more?"

"The picture steadies and the colour comes on when I move the contrast control sideways."

I was about to make some smart remark when realisation burst upon me. The 697 has a printed panel to which the controls are directly connected (no leads). If the earthy end of the contrast control was dry-jointed at the panel, picture information would still get through since there'd be circuit continuity, albeit at high impedance, via the colour control, but VT6's collector would not have much to offer the sync separator by way of a signal. Out came the panel and the diagnosis was proved. All systems were restored with a dab of the soldering iron.

"Now that I've sorted that one out for you, I'll go and get supper ready" she said. How I hate self-satisfied women.

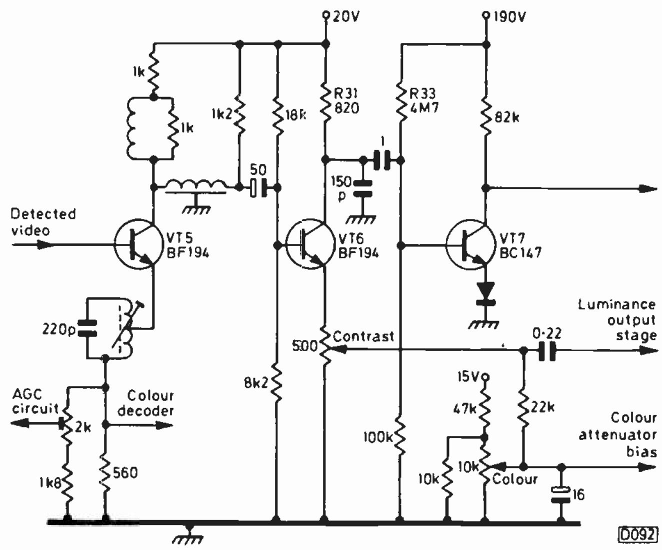



*Fig. 1: Video and sync separator circuits used in Pye hybrid colour chassis. The detected video is fed to VT5, which drives VT6 from its collector and provides feeds to the decoder and a.g.c. circuits from its emitter – a separate detector is used for sound. VT6 in turn drives the luminance output stage from its emitter, via the contrast control, and the sync separator transistor VT7 from its collector. R33 provides VT7 with base bias so that it saturates when a sync pulse arrives.*

## A Visit to Mr. Nasty

I thought I was selfish till the other day. I can now tell you that you and I are absolute angels, full of consideration and compassion for our wives and families, who should think far more of us than they do. Our wives should treasure us indeed. But for the wheels of fate, they too could be married to a chap like Mr. Nasty.

I called at his house because he couldn't possibly bring his set in. In fact he had to be taken everywhere by relatives in their cars, because he had difficulty walking. Except to the pub and back, which didn't seem to be any effort at all to him. As a matter of fact he was down at the pub when I called, and his wife seemed very agitated.

"Do you think you could repair the set before he gets back? Otherwise he'll say he doesn't want it done and can make do with the little portable, which he won't let me watch. He says there's only room for him to watch it, but I can listen if I sit back out of the way."

I listened to this affront to the rights of women with some doubt, but agreed to hurry up if I could. She dashed off to the kitchen, saying that she had to put the oven up high again because he wouldn't eat his dinner unless it was piping hot.

I took the back off the set: it was a Thorn 3000, with a blank raster and faint sound. A quick check on the i.f. panel showed that all the i.f. transistors except the final one (BF197) were functioning. I'd just finished fitting a replacement when there were signs of Mr. Nasty's approach. His wife became even more agitated, and snatched his dinner from the oven.

A small man came in, looked at the table for his dinner, and then looked at me.

"How much is that going to cost? Because if it's too much don't bother – I'll watch my portable."

"You haven't much option" I told him. "I've already done it and don't propose to undo it." The change was remarkable. "'Course not old chap. You've done it and want paying. Why not?"

At this he sat down at the table and surveyed his steak and kidney pie. "Muuum" he bawled, "you can come and cut the pie up now."

I couldn't believe it. His wife came back from the kitchen, leant over, and cut up the pie on his plate.

"Well put some sauce on it then" he commanded. And she did.

"Good darts match we had" he commented, dispelling any fears of mine that he'd had a stroke or something that stopped him using his hands. "Oh yes, nip next door and tell that bloke not to mow his lawn this afternoon. I want some sleep."

"Can't seem to sleep properly at night" he confided in me.

"Perhaps it's because you sleep in the afternoon" I said shortly. By now there was a fair picture on the 3000.

"How much is that little job going to cost?" he asked, his mouth full of hot pie and sauce. I quoted what I thought was a very reasonable figure (too reasonable to tell you), whereupon he stopped chewing and started to choke.

Recovering, he told me he'd phone his son who would call round to the shop and pay me. At the same time his wife reappeared and continued the conversation about his inability to sleep at night.

"He doesn't get his rest. Every hour he tells me to get up and open the window because he can't breathe properly, or close it because he's too cold."

It was all too much for me. I just had to rush home to tell Honey Bunch that Frankenstein's monster is alive and well.

# CRT Tester/Booster

**James Dilworth**

WITH the tubes in many older sets failing, it's useful to have a means of checking tube emission. This can be particularly helpful when there's a colour fault and it's not too obvious whether the tube, the decoder or a colour output stage is responsible. In addition to checking tube emission, the tester/booster described in this article checks for interelectrode shorts. Different types of tube can be checked by rearranging the leads from the tube base.

### Circuit Description

The circuit (see Fig. 1) uses the live chassis technique, so the usual precautions should be observed. Since the circuitry is housed in a plastic case however the unit should be safe. Rectifier D1 produces 300V across C1. This h.t. supply is applied to the c.r.t. grids via LP2, the boost button switch S6 and S2A/1. Transformer T1 provides the heater voltage and has a +20% (8V) tapping to give a boosted heater supply. Switch S5 originally had a centre off position, the idea being to leave the heaters off when checking the tube for shorts. Experience has shown however that shorts are more likely to show up with this switch in the 6·3V or 8V positions, so a two-position switch can be used instead. The transformer also feeds rectifier D2, which produces an l.t. supply across C2. This supply is used to obtain half-scale deflection on the meter, via the tube grid, with adjustment provided by VR1. Another voltage is taken from the 300V line and applied to the relevant first anode via R5 and VR2. These voltages combine to give full-scale deflection of the meter, which is protected against overloads by D4.

To check for shorts, neon lamp LP3 is connected to the 300V rail and switched by S3 between the tube electrodes and earth. S3 provides three tests: heater to cathode, cathode to grid, and grid to first anode. These tests are applied to each gun individually by S4.

R3/D3 provide an 18V supply for processing or soft boost – this voltage is used with the boosted heater supply to coax the cathode into greater conduction.

### Setting Up

To set up the meter initially, connect the unit to a known good colour tube, an A56-120X say. Select the emission check position for the red gun, disconnect the lead from pin 4 of the tube base to the block connector and short together pins 2 and 3 on the c.r.t. base. Adjust VR1 for half-scale deflection on the meter. Remove the short and reconnect the lead from pin 4. Adjust VR2 for full-scale deflection. If the meter will not reach full scale, decrease the value of R5 to 3·9MΩ or increase the setting of VR1. The unit is now ready for use. Other meters, e.g. 500μA, can be used, with the value of R5 decreased and VR1 readjusted as necessary.

Table 1 shows the pin connections for two common types of c.r.t. To test an A56-120X, connect pin 2 to connection KR on the block connector and pin 3 to GR. Proceed similarly for the green and blue guns.

### Use

In use, the test base is fitted to the tube to be checked/boosted. Set S2 to EM (emission), S3 to NM (normal), S4 to R (red – assuming the tube is a colour one) and S5 to 6·3V. Plug in and switch on. Allow a minute or two for the heater to warm up. The meter needle should then rise up the scale. A reading of 90-100 is good; 80-90 means that the gun could do with a soft boost; below 80 means that the gun may need repeated attempts at boosting. If the meter reads below 50, it's possible that the first anode is open-circuit. Switch S4 to B and G to check the emission of the blue and green guns.

To process or soft boost, set S2 to PR and S5 to 8V. Select the appropriate gun with S4, and apply the boost for two or three minutes. To check the emission, switch S5 back to 6·3V and S2 to EM. If little improvement is noticed, try a full boost. Return S5 to 8V and switch S2 to RE (reactivate). Use S6 to apply a couple of pulses of h.t. to the grid, until LP2 glows. If the gun shows no response, hold down button S6 and carefully tap the neck of the tube to assist in getting conduction to start. This is not usually necessary, but may help in a stubborn case. If lamp LP2 glows brightly, release S6 and repeat the procedure as necessary with the blue and green guns. To recheck the emission, return S2 to EM and S5 to 6·3V. Leave S3 in the NM position during this procedure.

If an interelectrode short is suspected, this can be quickly proved by switching S5 to 8V, S2 to EM, then S3 slowly to H-K, K-G and G-A. If LP3 doesn't glow the tube is o.k. Select the guns with S4. If LP3 does glow there's a short and the tube may have to be replaced. The meter is inactive while these tests are being made.

### Alternative Circuitry

There's room for experimentation with this design. For example, in place of the pygmy bulb LP2 the arrangement shown in Fig. 2 could be tried, with S6 replaced by a two-way push button or relay contacts. R6 charges C3 from the h.t. line, and then discharges it via the c.r.t. grid when the relay contacts move. This is the pulsed method of c.r.t. reactivation – circuitry for a suitable oscillator etc. was published in the April 1978 issue of *Television*. The fourth

**Table 1: Colour tube pin connections.**

| Pin | Delta-gun tube, e.g. A56-120X, A56-410X, A63-120X, A66-120X, A66-410X, A67-120X | Toshiba RIS tube, e.g. 470ERB22, 510KCB22P, 560AKB22P, 670XB22P |
|---|---|---|
| 1 | Heater | Heater |
| 2 | Red cathode | Green A1 |
| 3 | Red grid | Green grid |
| 4 | Red A1 | Green cathode |
| 5 | Green A1 | Red A1 |
| 6 | Green cathode | Red cathode |
| 7 | Green grid | Red grid |
| 8 | — | — |
| 9 | Focus | Focus |
| 10 | — | — |
| 11 | Blue cathode | Blue grid |
| 12 | Blue grid | Blue cathode |
| 13 | Blue A1 | Blue A1 |
| 14 | Heater | Heater |

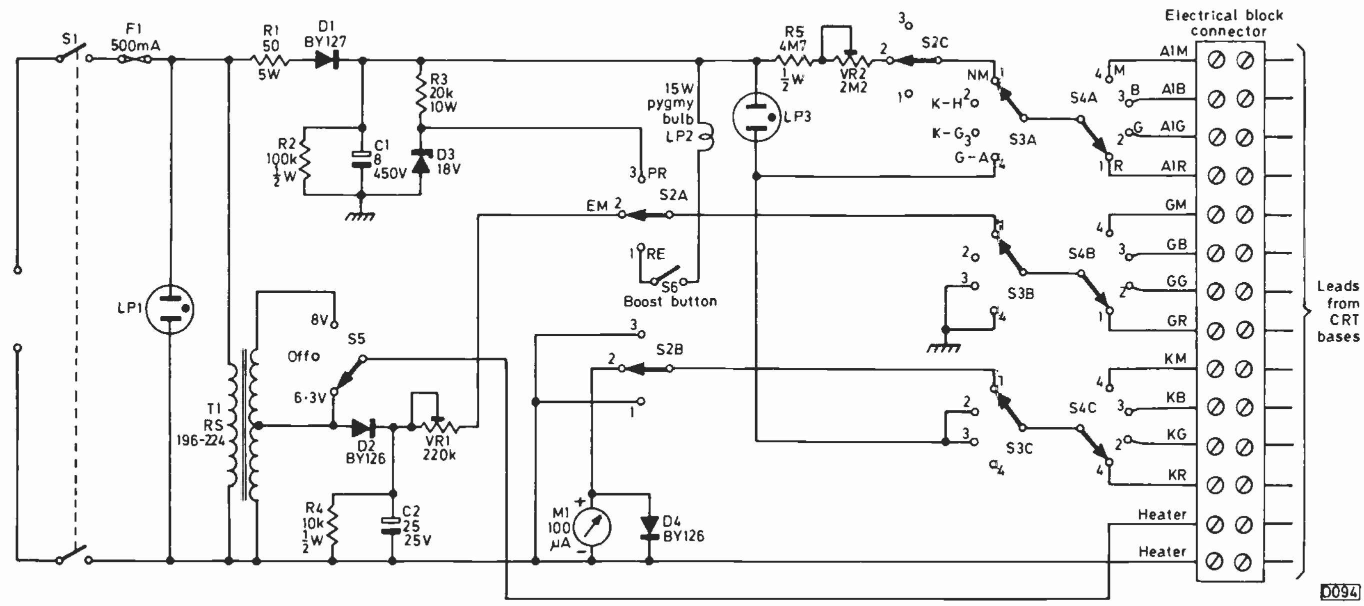



*Fig. 1: Circuit diagram. LP1 and LP3 are 250V miniature neons with series resistors included. SW2 is a 4-pole, 3-way wafer switch; SW3/4 are 3-pole, 4-way wafer switches; SW5 is a single-pole 3- or 2-way switch; SW6 is a miniature push-to-make switch.*

pole on S2 could be used to switch the oscillator on.

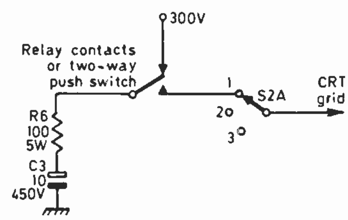
If S2B is rewired as shown in Fig. 3, the meter will operate during reactivation and processing. R7 should be a good quality component with a rating of 2-4W.

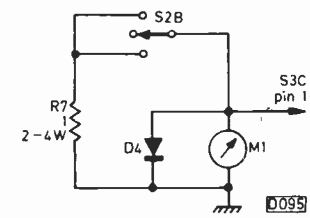
## Construction

The prototype was housed in an 8 × 10½in. plastic lunch box – with the lid as the bottom of the unit or the other way round as you like. It's simple to punch holes through the plastic from the outside and trim off the surplus from the inside, using a sharp knife. The holes for the mains and c.r.t. leads are best left untrimmed, with the cable forced through – the cable is thus retained. The plastic block connector is mounted on the inside, by inserting self-tapping screws from the outside. The two nuts and bolts holding T1 should have large washers inside and outside the case to give support. One of these bolts holds a tagstrip for R1/D1/C1/R2/R3/D3/R5/VR2.

The tube connector is made from a suitable plastic base and 11/0·1 miniature stranded cable. This cable is light but adequate, and can be taped up to make a flexible base lead. Label the individual leads in accordance with the c.r.t. base pin numbers after insertion through the plastic case. The leads are then connected to the block connector in accordance with the type of tube being tested. It takes less than a minute to rearrange the leads for different types of tube.

Use lockwashers above and below the plastic case to prevent the rotary switches becoming loose. ■




*Figs. 2 (left) and 3 (right): Possible modifications.*

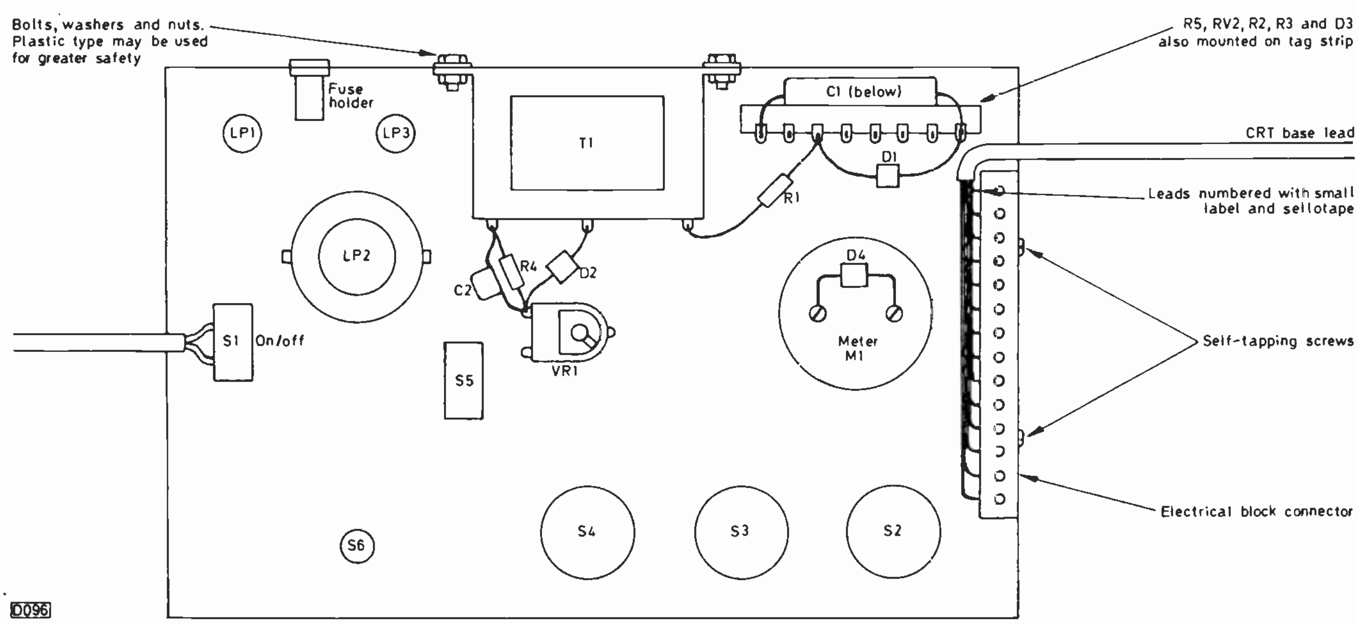



*Fig. 4: Layout within the case, viewed from below.*

# Active Ripple Filters

S. George

THE use of a series regulator circuit in mains/battery monochrome portables with screen sizes of 10in. or above has been standard practice for many years, the main exception being those few sets that use a transistor pump circuit. The series regulator is used to provide a stabilised l.t. supply of around 10·4-11·5V in mains/battery portables. In smaller-screen and combi sets however there's a growing tendency to use an active filter circuit (see Fig. 2 for example) instead of a feedback controlled regulator. In such receivers the battery is simply switched in across the l.t. rail and chassis, while on mains operation the active filter smooths the output from the rectifier circuit and contributes towards voltage stabilisation, though not to anything like the high degree achieved with a feedback regulator.

The big snag with series regulators is the fact that the voltage range over which they operate must be subtracted from the unstabilised input. This is not a problem on mains operation – you simply arrange for the mean rectified output obtained across the reservoir capacitor to be sufficient to enable the regulator to compensate for any anticipated variations in the mains voltage. With an unstabilised supply of say 15·5V and a stabilised l.t. rail of 11V, the mains voltage would have to fall by an absurd percentage for the regulator to be unable to maintain the 11V supply. With battery operation however it's a different story. Although the no-load terminal voltage of a fully charged 12V battery may be 13·2V, this quickly falls to the nominal 12V in use and once below 11V the battery will be in need of a recharge. So if 11V is the stipulated l.t. rail voltage for a set, around 15% of the input from a fully charged battery may have to be wasted. This represents a power wastage where it can least be tolerated. There are good grounds therefore, especially in smaller-screen and "miniature" sets, to take the l.t. supply directly from the battery and employ a simple active filter to provide a reasonably stable and well smoothed output on mains operation.

Active filters have also found use in full-sized colour receivers – the Philips G11 chassis for example. The big bonus here is that the smoothing electrolytics required to provide any given degree of smoothing can be a fraction of the value of those required in a conventional *RC* filter. Since high-value electrolytics are bulky, expensive, and tend to lose their capacitance or become leaky after some years of service, the advantage of using an active ripple filter can be readily appreciated.

### Basic Principles

Consider the basic zener diode/resistor voltage stabiliser arrangement used in nearly all TV sets to provide a stable voltage for the tuning circuit – see Fig. 1(a). Should the h.t. voltage rise, the zener diode D will conduct more heavily. As a result, the increased current flowing through the feed resistor R will increase the voltage developed across this resistor, thus holding the 33V line steady. Since most zener diodes have only a small wattage rating, if you want to stabilise the voltage applied to a circuit that draws a relatively large current the arrangement shown in Fig. 1(b) is convenient. Here the zener diode stabilises the base voltage of an emitter-follower transistor, whose output voltage will thus remain constant at some 0·6V less than the diode's zener voltage. From the current point of view, the output will be the stabilised base current multiplied by the gain of the transistor. If the requirement is simply a smooth d.c. output without voltage stabilisation, the transistor's base current need be smoothed only to the degree required of the emitter current, so we can use the arrangement shown in Fig. 1(c), where an *RC* filter provides the emitter-follower transistor with a smoothed base voltage. If the current gain of the transistor is say 100, the resistor can be a hundred times the value and the capacitor one hundredth the value of the simple *RC* circuit required to give the same degree of smoothing. For higher output currents, a Darlington pair can be used instead of a simple emitter-follower transistor.

Here then is the basic active filter circuit: an emitter-follower (or Darlington pair) with a well smoothed base voltage provides a highly smoothed d.c. output. This action arises since when a transistor is operated above the knee of its collector current/voltage characteristic, variations in collector voltage have negligible effect on the collector/emitter current. When operating in this region therefore a transistor can be regarded as a constant-current source.

The degree of smoothing provided by a simple *RC* filter depends on the value of the series resistor compared to the capacitor's reactance at the frequency concerned. With full-wave rectification, the ripple frequency is 100Hz. At this frequency, a 100μF capacitor has a reactance of 15·92Ω, a 750μF capacitor a reactance of just over 2·12Ω and a 3,000μF capacitor a reactance of 0·53Ω. So if an *RC* filter consists of say a 10Ω resistor and a 3,000μF capacitor, most of the 100Hz ripple will be developed across the resistor. Assuming that the current flowing is 1A however, there would be an unacceptable voltage drop across the resistor. Reducing the value of the resistor to 5Ω implies doubling the value of the capacitor to maintain the same degree of filtering. Unless that is an active filter is used, when a comparatively high resistance value, in kilohms, can be used in conjunction with a relatively low value capacitor to smooth the low current requirement for the base of the transistor(s) in the circuit.

### Practical Circuits

As an example, take the active ripple filter (see Fig. 2) used in the JVC 3040 5in. mains/battery monochrome portable – the filter is used on mains operation only. The active components in the filter consist of the Darlington pair X502/X501, with the base of the first transistor fed via the current limiting resistor R204 from the *RC* filter comprising C506 with R503 and the top section of the set l.t. control R501. The base voltage of X502 is thus particularly well smoothed, since the reactance of C506 at 100Hz is only about 32Ω, compared with the 6·8kΩ of R503 plus say 1kΩ of R501. This simple filter provides some measure of voltage stabilisation, since a reduced proportion of any input voltage change appears at the slider of R501.

Another JVC example, this time used in the 3430 12in. mains/battery portable, is shown in Fig. 3. There's a double

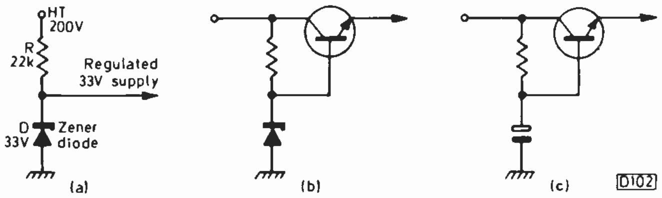



*Fig. 1: (a) Use of a zener diode to provide a regulated 33V supply from a 200V h.t. rail. (b) Zener diode voltage stabiliser with an emitter-follower transistor to provide a stabilised voltage supply for a circuit with a greater current demand. (c) Basic active ripple filter circuit – an emitter-follower with a well smoothed base voltage.*

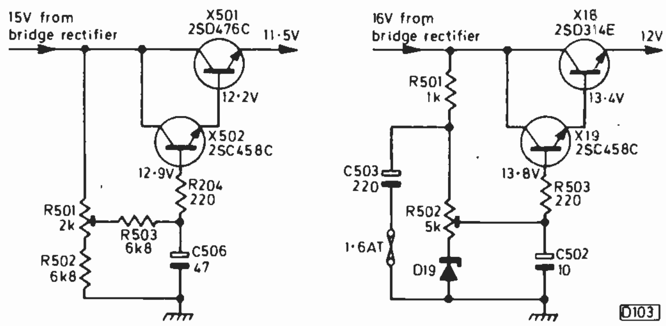



*Fig. 2 (left): Active ripple filter circuit, with Darlington pair X501/2, used in the JVC 3040 5in. portable.*
*Fig. 3 (right): Active ripple filter circuit used in the JVC 3430 12in. portable, with a degree of voltage stabilisation provided by zener diode D19.*

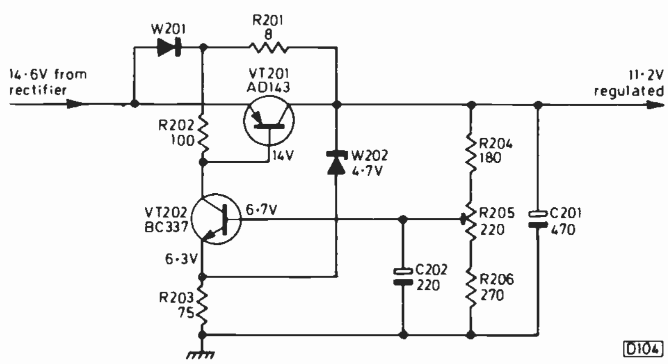



*Fig. 4: Series regulator circuit used in the Thorn 1612 chassis. The set l.t. control R205 provides output voltage adjustment. Output voltage variations are sensed across R203.*

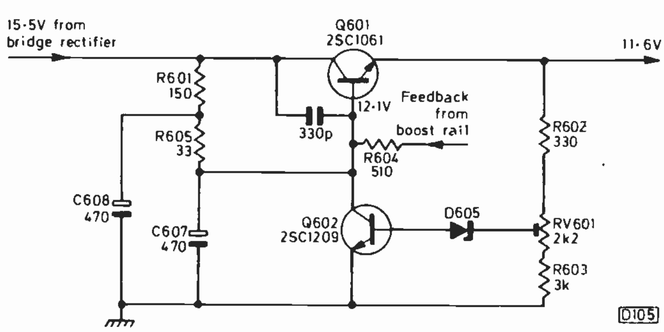



*Fig. 5: Active filter/series regulator circuit used in the Sony TV121 12in. portable.*

filter, R501/C503 and R502/C502, in this case, whilst a zener diode is added in the potential divider circuit. The use of the zener diode gives improved voltage stabilisation.

The more commonly encountered series regulator circuit provides smoothing as well as d.c. stabilisation of course, since any ripple on the output will tend to be cancelled by feedback action. Fig. 4 shows a typical example, as used in

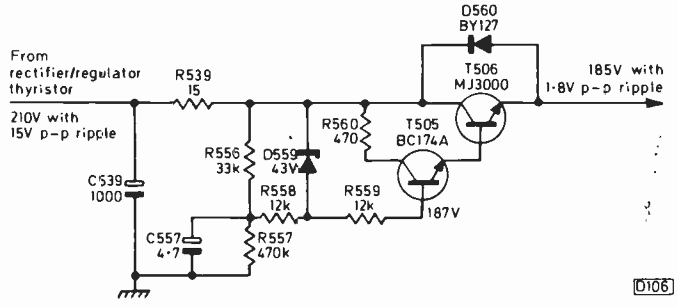



*Fig. 6: Active h.t. ripple filter circuit used in the NordMende F IV large-screen colour chassis.*

the Thorn 1612 chassis. Variations in the output are sensed at the emitter of the error amplifier transistor VT202 – since the voltage across the zener diode W202 remains constant at 4·7V, the variations will appear across R203. R201 in parallel with the series regulator transistor is included to reduce the dissipation in the transistor and to enable the circuit to start up when switched on.

There are many variations on this type of circuit. In earlier designs it was usual for the error amplifier to sense voltage variations at its base, the zener diode being used to hold its emitter voltage steady. This arrangement is not so sensitive since only a potted down proportion of any error appears at the base. To improve the smoothing performance, the base was sometimes a.c. coupled to the output.

The circuit shown in Fig. 5, used in the Sony TV121 12in. portable, is of interest in comprising a combined active filter/series regulator arrangement. The base voltage of the series transistor Q601 is smoothed by the double filter R601/C608 and R605/C607. The output from the error amplifier transistor Q602 is superimposed upon this smoothed bias. Stabilisation of the voltages in the set is further assisted by feedback from the line output stage derived boost rail to the base of the series regulator transistor via R604.

Fig. 6 shows an example of an active filter used for smoothing in an h.t. supply circuit (NordMende F IV chassis). Once again a Darlington pair is used, with a high-voltage transistor as the series element (T506). The voltage developed by the rectifier/regulator thyristor across its reservoir capacitor C539 is 210V, with 15V peak-to-peak ripple. The active filter provides an output voltage of 185V with the ripple reduced to 1·8V peak-to-peak. The smoothing capacitor C557 has a value of only 4·7μF, but forms a highly effective filter in conjunction with the 33kΩ resistor R556. What's the zener diode D559 for? At switch on D559 conducts, applying forward bias to the base of T505 so that the circuit comes into operation. Once C557 has charged to the voltage set by the potential divider R556/7, D559 switches off. The idea is to protect the transistors from excessive collector-emitter potentials at switch on.

## Servicing Aspects

These circuits are simple but prone to the sorts of faults you'd expect. The series transistor is in a vulnerable position, and can go open-circuit, short-circuit or leaky. A leaky series transistor will cause hum bar problems. More often however hum bar troubles are due to one of the diodes in a bridge rectifier going open-circuit, so that the output ripple is at 50Hz instead of 100Hz, or leaky, or the reservoir capacitor losing capacitance.

Small, intermittent changes in picture width can be caused by a badly contacting slider in a set l.t. control. This can usually be put right by using switch cleaner, though replacement is preferable. An open-circuit zener diode is sometimes the cause of a small picture with low voltages.

Suddenly reduced width is often caused by a resistor shunting the series regulator transistor going open-circuit – the transistor will then be called upon to pass excessive current and may also fail. Conversely, the transistor may go open-circuit leaving its shunt resistor to pass excessive current. In modern designs the resistor is fusible and in these circumstances goes open-circuit.

Due to the relatively low value of the resistors used in series regulator circuits, it's usually essential to isolate a suspect transistor in order to make reliable tests.

When the l.t. fuse has blown, the cause is more likely to be in the line output stage or possibly the field timebase or audio circuit than in the regulator/filter. Remember that indirect shorts in the line output stage can cause the fuse to blow, i.e. a short across one of the windings on the line output transformer. Suspects are the diodes and capacitors that provide the c.r.t. first anode and video output stage supplies.

In mains/battery monochrome portables the tube's heater is usually connected across the l.t. rail. This can be misleading where a short-circuit is suspected, so it's worth disconnecting the base when making checks.

Finally, when there's no output from a series regulator circuit though there's adequate input and no apparent cause of the trouble, make sure there's not a dry-jointed start-up resistor. Active filters start themselves of course, but a series regulator needs some means of getting voltages at the output in order to start up. The resistor in shunt with the regulator transistor may provide this function, or another feed path may be used. In the Thorn 1690-1691 series for example the 22kΩ start-up resistor R66 links the bases of the two transistors in the regulator circuit.■

# Servicing the Philips G9 Chassis

**Mike Phelan**

THIS chassis, the 110° counterpart to the Philips G8 chassis, first appeared in early 1975, in the 26in. size only. The models encountered are the 581, which has rotary controls, and the 585, which has touch tuning and slider controls. The 26in. tube is the quick-heat type A66-410X. In appearance, these models are not unlike the later models in the G8 series. We'll start with a brief outline of the main features of the chassis.

## Circuit Features

The power supply is of the half-wave thyristor rectifier/regulator variety, as in the G8, but with two additional safety circuits and slow start. The latter consists of Tr8020 and the associated components. At switch on, Tr8020 conducts, shorting out the 7·5V zener diode D8017 so that the control transistor Tr8007 conducts heavily. As C8021 charges, so Tr8020 switches off and the h.t. rises. The main over-voltage protection circuit is of the same type as used in the G8 chassis, with Tr8023 conducting should the h.t. voltage rise excessively, thus discharging the thyristor trigger circuit charging capacitor C8015. This action produces a pulsating picture. The additional protection circuits are as follows. First, in the event of excessive e.h.t. the 45V line, which is derived from the emitter of the line output transistor, will also rise. When it reaches 51V, zener diode D5134 on the line scan panel and diode D8025 on the power supply panel conduct. As a result Tr8007 saturates and the h.t. falls. The other trip reduces the h.t. when there's no l.t. supply, i.e. in the event of failure of the line output stage. In normal operation D8026 is reverse biased by the 45V line. In the absence of the 45V line D8026 and zener diode D8024 conduct, shorting out D8017 so that the voltage at the emitter of Tr8007 falls below 7·5V.

The line output stage is conventional, with a BU208 line output transistor, a tripler, and a diode modulator for EW correction. Three l.t. supplies are obtained from the line output stage. The EW modulator produces a 32V output across the reservoir capacitor C5155. This voltage is fed out at pin 2 of socket H: it's also dropped to 25V at pin 8 of plug K via R5151/C5160, and is applied to the junction of R5413 and R5142 which are connected in series with the emitter of the line output transistor. As a result, a "boosted" 45V line is produced at the junction of R5142 and C5138. This voltage is fed out at pin 1 of plug K.

The field timebase consists of a BRY56 silicon controlled switch oscillator, a linearity stage (BC158), a BD131 phase-splitter driver and a pair of BD343 transistors in a class B output stage.

The signals panel is identical to that used in the later versions of the G8 chassis (the G8 chassis was covered in the June-August 1978 issues of *Television*), with the well-known Philips/Mullard four i.c. (TBA560CQ/TBA540Q/TBA990Q/TBA530Q) decoder. The class A RGB output stages use BF337 transistors. The class A audio output stage employs a pair of BD131 transistors. A voltage regulator circuit, using a BD131 transistor (Tr3401), provides the 12V supply for the signals circuits (check at TP97) from the 25V input fed to the panel at pin 4 of edge connector A.

Touch tuning models incorporate an ETT6016 i.c. in the tuning head and a remote control amplifier to change channels only, the remote control transmitter being of the mechanical variety.

## Power Supply Faults

Now for the trouble spots. Isn't it amazing how, on some chassis, one component stands out above all the other stock faults as causing more trouble than all the rest put together (remember that 10kΩ video load resistor in the Bush TV125 series?). The item concerned in the G9 chassis is C5138 (2,200μF): let it be imprinted in your memory, since every G9 you'll encounter will need C5138 checking and probably replacing. As we've already seen, it's the 45V supply reservoir/BU208 emitter decoupling capacitor. When it dries up, you get a small, pulsating picture. Since the main use of the 45V rail is to power the audio output stage, R3141 in the feed to the latter overheats, due to line pulses on the rail, and finally D8024, D8025 and D8026 on the power supply board will go short-circuit, with one or two blown fuses to add to the confusion. The line scan panel has to be removed or tilted to replace C5138, as the connections are behind the chassis rail.

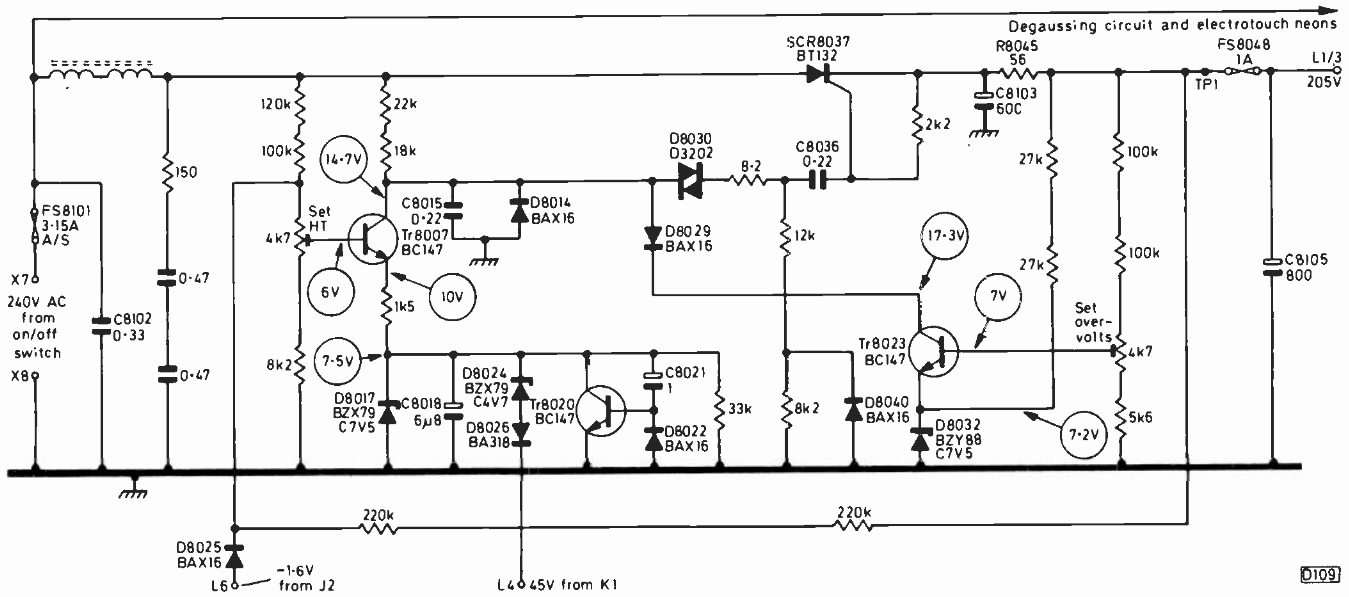



*Fig. 1: Mains input and h.t. supply circuitry, Philips G9 chassis.*

If the 3·15A anti-surge mains fuse FS8101 has gone open-circuit, check the thyristor for leakage, although mains fuses on this set do sometimes blow for no apparent reason.

If the mains fuse is intact but there's no h.t. at TP1, check the 56Ω power resistor R8045 for being open-circuit as a first step, though it's fairly unlikely to be at fault on this chassis. The next thing to do is to remove the 1A h.t. fuse FS8048 and disconnect D8025. If the h.t. (approximately 205V) returns at TP1, check D8025 and D5134 for leakage – the latter is the 51V zener diode on the line scan panel. This is one of those cases where it's more likely that the fault is in the trip circuit rather than something causing the trip to operate. If neither is faulty however check our friend C5138. Incidentally the 45V line is shown as 42·8V at the emitter of the line output transistor in the circuit diagram in the official manual: in practice the voltage is usually about 48-50V.

Returning to the power supply, if there's no life with D8025 disconnected, disconnect D8024 and check it for being short-circuit – if it is, check C5138 (again!). If there's still no h.t., check the thyristor (SCR8037, type BT132) for being open-circuit, then the control circuit. The over-voltage circuit can be isolated by disconnecting D8029. The two prime suspects in the G9 chassis are zener diode D8017 and clamp diode D8014.

A word of warning here: it's easier to get to the left-hand power supply panel after placing the convergence panel in its slots in the top cabinet rail, but ensure that the two screws are tight when refitting it otherwise it can collide with the thyristor's heatsink and shatter the mains fuse.

## Line Scan Panel

If the h.t. is about half the value it should be, this means that no l.t. is being produced, due to a line timebase fault or FS8048 being open-circuit. If this fuse (or maybe FS5114 on the line scan panel) has blown, check the BU208, the flyback tuning capacitor C5131 (0·0091μF) and the tripler for shorts and examine the line output transformer closely for burn marks.

Another common fault, which is sometimes intermittent, occurs when either of the BYX55-600 diodes D5150/D5156 in the EW modulator circuit goes open-circuit. The l.t. rails fall, giving a 4in. field scan and no video.

The beam limiter circuit (Tr5169/Tr5172 etc.) seems to be more reliable than its counterpart in the G8 chassis, though the 12V zener diode D5174 fails on occasion. When it goes open-circuit, there's no brightness – this can be intermittent.

If the picture looks as if the tube is flat and the width alters with the brightness, examine the EW modulator transformer L5161 at the top of the line scan panel for dry-joints. The shift transformer L5159 also suffers from this problem.

The line driver transistor Tr5120 and the preceding trigger amplifier transistor Tr5102 form a Schmitt trigger to give a good squarewave current through the primary of the driver transformer L5119. Unlike their counterparts in the G8 chassis, these stages give little trouble, being required to drive only one output transistor.

The c.r.t. first anode supply is obtained, in the now conventional way, from the earthy end of the e.h.t. overwiding, C5157 (0·047μF) providing the reservoir. If this capacitor becomes leaky, the tripler will be destroyed.

## Timebase Panel

The lower right-hand panel carries the EW raster correction circuit, the line oscillator and the field timebase. The line oscillator is of the Hartley type, and the only problems we've had here have been with the 18V zener diode D4240 which stabilises the supply to the oscillator. If it goes short-circuit the oscillator stops of course, but often it goes intermittently open-circuit, giving line speed drift. The oscillator is powered from the 25V rail once the line timebase has come into operation: to start it up, there's a 10kΩ resistor (R4218) which is connected to the 205V h.t supply (via pin 1 of plug G).

The field timebase is very reliable indeed, but as these sets get older troubles with electrolytics are to be expected. C4048 (1,000μF) couples the output to the scan coils, while C4038 (220μF) provides bootstrap action in the output stage. C4022 (10μF) is the charging capacitor (with C4020, 1·5μF); C4055 (100μF) is incorporated in the scan current earth return path, and both C4051 (47μF) and C4053 (33μF) affect the linearity.

If R4106 (15Ω) is found open-circuit (it's a spring-off type) the EW modulator driver transistor Tr4105 (BD131) is probably short-circuit.

Also on the timebase panel are the field and line flyback blanking transistors Tr4071 and Tr4075 (both type BC148). If either of these goes short-circuit, the result will be a bright raster with flyback lines and no video due to the absence of the composite blanking pulse required by the TBA560C i.c. on the signals panel. If the fault is intermittent, check Tr4075 (by substitution) and the edge connector.

## Convergence

Apart from the odd noisy potentiometer, the convergence panel does not give a lot of trouble. Reasonable convergence can be achieved, though the procedure may have to be gone through a few times. Trouble with red/green convergence can be due to dry-joints and print problems around the transductor on the line scan panel.

## Signal Faults

The signals panel is identical to that used on the later versions of the G8 chassis, and the faults tend to be the same. Starting from the front, a grainy picture means tuner trouble or sometimes a defective transistor in the vision selectivity module. If the tuner is at fault, either the r.f. amplifier transistor or one of the BB105B varicap diodes is probably defective – an exchange unit is the best solution. Drifting may or may not be due to the tuner – first override the a.f.c. by flipping out the push-button (or touch-button) unit, then apply freezer spray (or slight heat) to IC3510 (TAA550): if drift is then apparent, replace IC3510.

If the a.f.c. is inoperative, remove the a.f.c. module (U2700) and check the resistance between pins 7 and 8. The reading should be about 35kΩ in one direction and 50kΩ in the other direction. If there's no continuity, one of the small chokes connected to pins 7 or 8 is open-circuit. Shorting it out will save the cost of a new module. This sometimes causes a hum bar that varies with tuning however.

If the set drifts but can be brought back on tune by selecting the same channel again, check the continuity of the red and black leads from plug C (white). In the touch-tuned version, the ETT6016 i.c. can cause drifting, sticking on one channel, and inability to select any channel with two or more neons lit. The usual precautions must be taken when replacing it since it's a MOSFET device. Unfortunately there's no room to fit an i.c. holder. If the entire head is replaced, check whether R1759 (100kΩ) is present – if not, a thermistor and a 390kΩ resistor should have been supplied to fit on the remote receiver panel. Failure to do so will result in inability to tune in anything, as there will be no return path for the current through the isolating diodes D1760-D1765 (i.e. whichever one is selected).

The remote control hand unit contains a metal bar which is struck by a hammer. The hammer spring is tensioned and released by four small pins rivetted to the framework. Two of these sometimes fall out. If they can be retrieved, press them in and solder them as well. Otherwise, small bits of steel rod can be used. Adjustment of the hammer is fairly critical.

To return to the tuner itself, both drifting and lack of a.f.c. action can be caused by one of the varicap diodes being leaky. If you don't want to fit a new unit without first having a go at repairing the old one, proceed as follows. Remove the tuner and check the resistance between pin B and the case. This should be in excess of 20MΩ in one direction. If not, disconnect the 33kΩ series resistors (little rectangular black things) connected to the diodes until the leaky diode is discovered. The diodes should really be replaced in matched sets, but it's permissible to replace the r.f. or mixer stage diodes singly – if a noisy picture results, give the appropriate trimmer a fraction of a turn (this is easier if a 12-18dB attenuator is inserted in the aerial lead). Purists will be muttering at this point about upsetting the tuner response etc., but we've carried out such repairs many times, even in the field, and as the tuner would otherwise be scrap nothing is lost.

No sound or vision faults in the i.f. strip can be fairly easily traced by applying a screwdriver to pin 2 of the vision gain can and pin 1 of the selectivity can – these are the input pins, and this action should give shortwave radio breakthrough. Apart from changing transistors, it's not really feasible to repair these modules – severe instability arises when the cans are removed. Cracked print in the gain module is sometimes responsible for weak field sync, low contrast and about 8-10V on sync lead XI.

No video but normal sound should lead to a check on the voltage at pin 10 of the TBA550Q "jungle" (a.g.c./video/sync) i.c. (IC3520). The voltage here should be negative, with a variation of a volt or so when the signal is interrupted. If not, check whether the sound take-off coil in can U2500 (sound selectivity) is dry-jointed – by shorting pins 4 and 5. This action should restore the picture but kill the sound. If the video is arriving at pin 10 of the TBA550Q i.c., check whether it's coming out – look for a 2-3V variation at pin 12 (TP83). If not, the i.c. is the first suspect – as it is in cases of no sync.

Some of the electrolytics in this part of the set give faults that can be the cause of much head scratching. If C3161 (150µF) which decouples the supply to the a.g.c. crossover and the line discriminator balance networks is open-circuit the result is weak sync and bent verticals, but the best one is C3111 (68µF) which is the i.f. a.g.c. reservoir capacitor. When this dries up the effect on the screen looks like either the Aquadag on the tube not earthed or the tripler breaking down!

Severe patterning can be caused not only in the tuner but also if the RGB output leads to the c.r.t. base are allowed to drape near the luminance delay line. If the patterning seems to be in colour, accompanied by loss of saturation, suspect C3244 (22µF) which decouples pin 12 of the TBA560CQ i.c.

## The Four-chip Decoder

The operation of the Mullard four-chip type of decoder should be fairly familiar by now. To recap however, in cases of no colour first measure the voltage at pin 9 of the TBA540Q i.c. (TP90). This should be at about 1-1·5V with a colour transmission, or 4-4·5V with a monochrome transmission or no signal. Zero or 8-9V indicates a stopped bistable, whereas if the voltage does not correspond to any of those quoted so far there's trouble in or around the TBA540Q or TBA990Q i.c. If the voltage is correct for colour, check at pin 7 (killer output) of the TBA540Q. The voltage here should be at least 3V: if this voltage is low, the TBA540Q i.c. is defective; if the killer voltage is o.k., the fault lies after the point where the burst is extracted (within the TBA560CQ i.c.), i.e. either the TBA560CQ i.c. is defective or there's a fault in the colour control circuit.

When TP90 (pin 9 of the TBA540Q i.c.) is at 4V, override the colour killer by unplugging PC5 and observe the results. An oscillator which is difficult to lock may be due to a defective crystal, or if accompanied by occasional phase reversal (misident) the cause will be either C3373 or C3374 (both 0·33µF) being open-circuit. Sometimes the colour-killer stage within the TBA540Q develops a fault, the voltage at pin 7 staying low when the voltage at pin 9 has

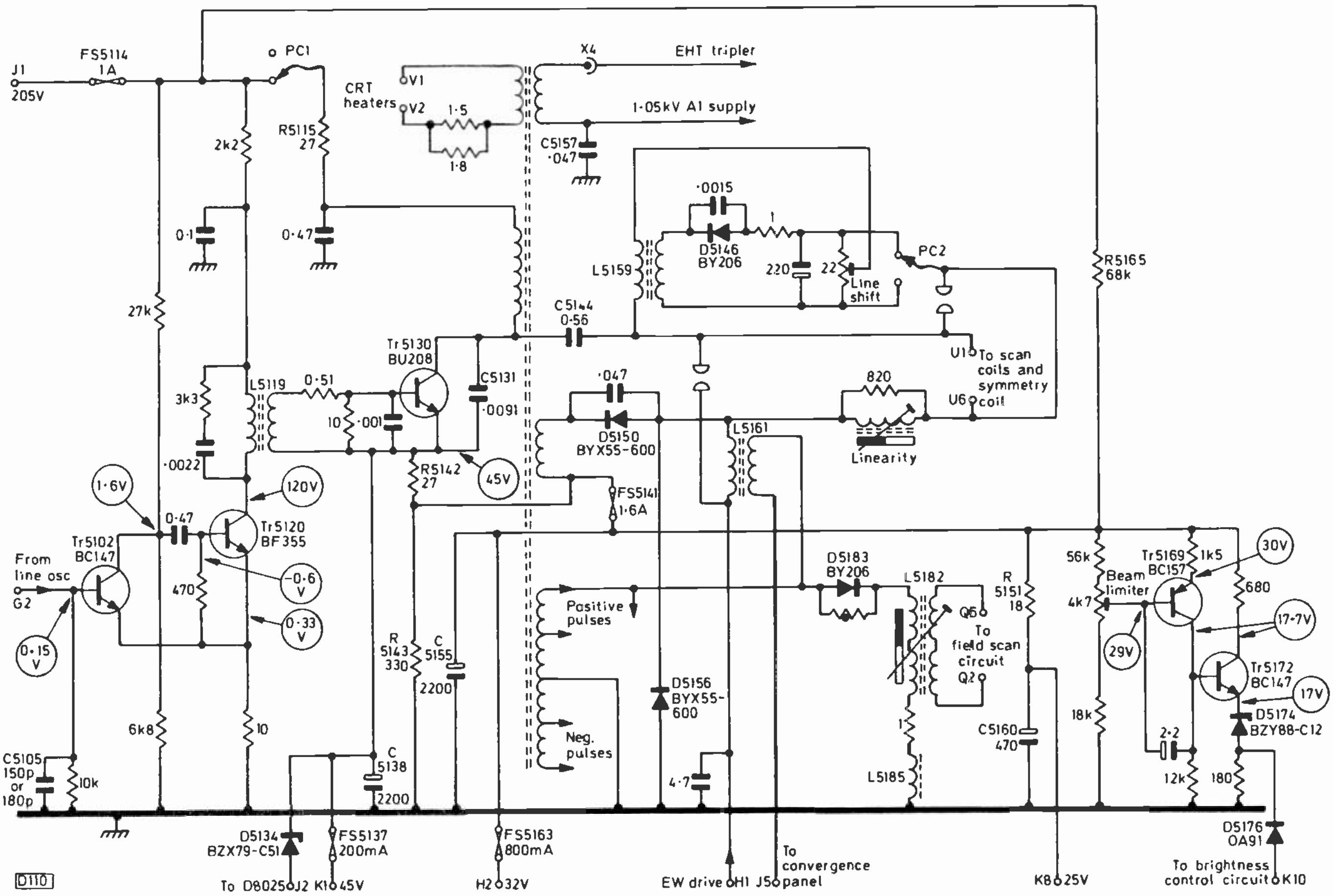



*Fig. 2: Circuitry on the line scan panel. C5105 was added to prevent line jitter.*

fallen below about 2V.

The TBA530Q matrixing i.c. develops the same faults as in the G8 chassis, i.e. one colour-difference signal missing, no luminance (but first check for 1-1·5V at pin 5), excess of one primary colour, or one primary colour missing from one side of the picture only.

Going off the subject slightly, it's useful to be able to recognise, in the absence of the R – Y or B – Y signal, whether the G – Y signal is correct, since this will show whether the fault lies before or after the G – Y matrix (within the TBA990Q i.c. here). If the G – Y signal is normal, the fault is *probably* within the TBA530Q i.c. When the fault is before the G – Y matrix, the G – Y signal will consist of a small portion of the remaining colour-difference signal, inverted, only. For example, with no B – Y the picture will be entirely pink and green, and with no R – Y bluish-green and yellow. If the result is after the G – Y matrix, i.e. the G – Y signal is correct, then with no B – Y the blues will be greenish and the yellows tending towards pink or orange, whereas with no R – Y the reds will be brownish purple and the greens almost correct. With no G – Y the greens are bluish and the flesh tones a sort of yellow ochre colour. Although it's unlikely on this chassis, for the sake of completeness excessive G – Y gives crimson flesh tones.

The RGB output transistors Tr3294, Tr3314 and Tr3334 can go open- or short-circuit, often intermittently, causing loss of or excess of one of the primary colours respectively. The other troublesome components in this part of the circuit are the 39kΩ resistors (R3331/R3311/R3291) connected to pins 1, 14 and 11 respectively of the TBA530Q i.c. If one of them goes open-circuit, that particular colour disappears. Often however one of these resistors goes high in value and the result, as with the G8 chassis, is not so easy to identify on first encountering it. The effect can quite easily be mistaken for a convergence error, but if a test card is displayed and one gun at a time is switched on it can be seen that the h.f. response is severely degraded on the colour concerned.

## Sound

There are not many troubles with the sound stages – the most common one is the sound becoming distorted or failing altogether when the set has warmed up. A new TBA750Q (IC3530) intercarrier sound i.c. will cure that. The BD131 audio output transistors fail occasionally, burning up the feed resistor R3141 – but don't forget what we said earlier about C5138 on the line scan panel. Very weak sound is the outcome when the audio output coupling capacitor C3147 (150μF) dries up.

## Conclusion

That about sums up the G9 chassis – one you either love or hate but is nevertheless quite reliable.

*Malcolm Burrell adds:* Quite a number of these sets have come my way recently. I've had trouble with both the 2,200μF electrolytics (C5138 and C3155) on the line scan panel – they are prone to leaking electrolyte on the board, and a burnup then occurs around the tags. A double capacitor can be taped to the chassis member and connected to the board with leads – this is more reliable. After servicing the line scan panel the set may well go dead a day or so later: to prevent this, check for dry-joints generally and for breaks in the print, especially on the narrow tracks and near those two 2,200μF capacitors!

# VCR Remote Control/Timer Unit

***David K. Matthewson, B.Sc., Ph.D.***

THE unit to be described provides automatic edit control, remote control and digital tape timing: it was devised for use with the Sony VO2850P U-matic VCR, an editing machine that's capable of very high standards of performance – all editing is done during the field blanking period so that there's minimum picture disturbance. The machine's tape transport and edit functions are controlled by solenoids, which are in turn controlled by switches on the front panel. This type of design lends itself to remote control, and Sony introduced three devices to do just this. They interface with the VO2850P by means of a 20-way socket at the rear of the machine.

Soon after we obtained a VO2850P we decided that a basic remote control unit would be useful, so that the operator could start the machine whilst sitting at a switching desk some ten feet away. We decided to build a hand-held device which would enable the following functions to be carried out: (1) start; (2) stop; (3) pause; (4) fast forward; (5) rewind; (6) slow speed; (7) record; (8) assemble edit; (9) insert edit; (10) finish edit; (11) digital tape timing accurate to 1/10 second for timing edits, total programme time etc.; (12) an automatic editing system to enable very accurate edits to be rehearsed and performed at a predetermined position on the tape. The system adopted is shown in simple block diagram form in Fig. 1: it was originally built for less than £50.

Design and construction of the device was simplified by the fact that most of the circuitry required is already present in the VO2850P itself, the particular action required being initiated by momentarily earthing the appropriate pin on the 20-way remote control socket. For example, if the edit deck is switched on but no function is selected, rewind is activated by earthing pin 11 on the connector. So all the tape transport and edit functions can be controlled by push-to-test switches. The control socket pins are as follows:

(1) 6·5V supply.
(2) Insert lamp.
(3) Record lamp.
(4) Edit.
(5) Record/assemble.
(6) Insert.
(7) Insert out.
(8) Stop.
(9) Pause.
(10) Earth.
(11) Rewind.
(12) Fast forward.
(13) Play.
(14) Earth.
(15) Control track pulse output.
(16) Function off.
(17) Pause lamp.
(18) Standby lamp.
(19) Slow.
(20) Slow lamp.

The lamp outputs can be used to drive LEDs to indicate which functions have been selected. Pins 4/5/6/7/8/9/11/12/13/19 are the ones switched for remote control and editing.

The tape timer is a bit more involved, the degree of complexity depending on the number of digits required etc. Pin 15 of the 20-way socket provides an output from the tape control track amplifier, and this can be used to drive a counter timer.

The normal frequency of the control track signal is 50Hz. It's available during play, rewind, fast forward and insert edit, but not during record or assembly edit, when the tape is being erased and re-recorded. In the fast forward or rewind modes the pulse frequency is obviously faster – the maximum is in fact 500Hz. The pulse is basically a TTL 5V pulse, but in the fast mode the shape is a bit distorted, with the result that it needs cleaning up prior to feeding to a counter.

The counter also needs to know in which direction the tape is travelling, so that it can add to or subract from the total count. Fortunately a signal for this purpose can be derived from the tape transport logic – whichever direction the tape is travelling causes the appropriate pin on the 20-way socket to go to logic zero and stay there until a different operation is selected. For example, say the machine is switched on but no command has been selected. All the control pins will then be at 5V, i.e. at logic one. If play is selected, pin 13 is grounded by the push-to-test switch. The pin then stays at zero as the tape plays. The signals from the control track will be at 50Hz, and the counter will add these to give an increasing count display. When the stop button is selected, the appropriate pin goes low, the play pin goes high, the tape stops and there are no pulses to count. If rewind is now selected, a similar sequence of events occurs, but the control pulse frequency is about 500Hz, the rewind pin being at logic zero. The latter fact can be used to tell the counter to subtract the incoming pulses from the total count.

A four digit counter was considered to be a good

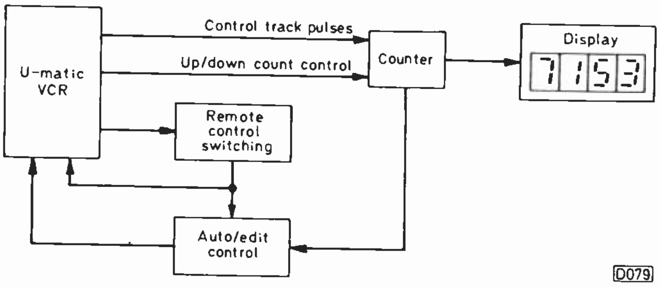



*Fig. 1: Block diagram of the remote control/timer system.*

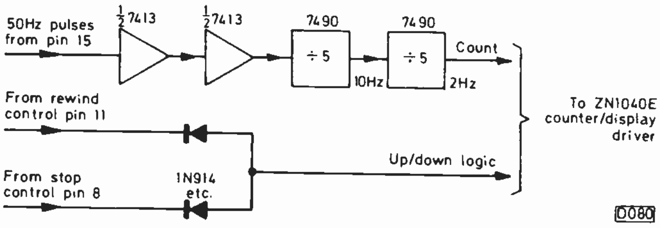



*Fig. 2: Counting system – pulse rate at play speed. The pin numbers apply to the Sony 20-pin connector used with the VO2850P U-matic VCR.*

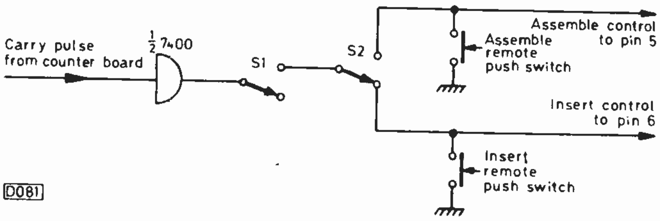


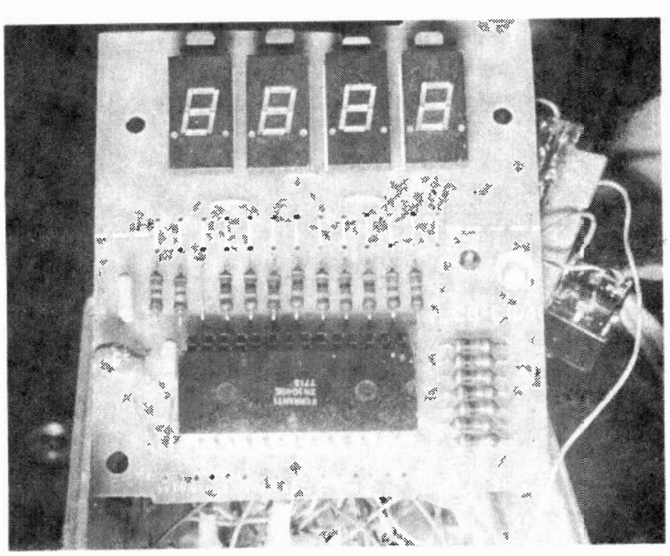

*Fig. 3: Automatic edit circuit. The auto/manual edit control switch S1 is shown in the manual position, the auto insert/assemble switch S2 in the insert position.*

compromise between cost and accuracy, a count of 9999 filling the display. With the control track signal at 50Hz, this equals 3·3 minutes playing time, which is adequate for editing but precludes the timing of entire programmes. The effective count time can be increased by dividing the control track signal before counting it, and this solution was adopted. If we divide by 25, the signal applied to the counter at the normal playing speed will be at 2Hz, giving a total count time of about one hour 23 minutes, which was felt to be adequate for our purposes.

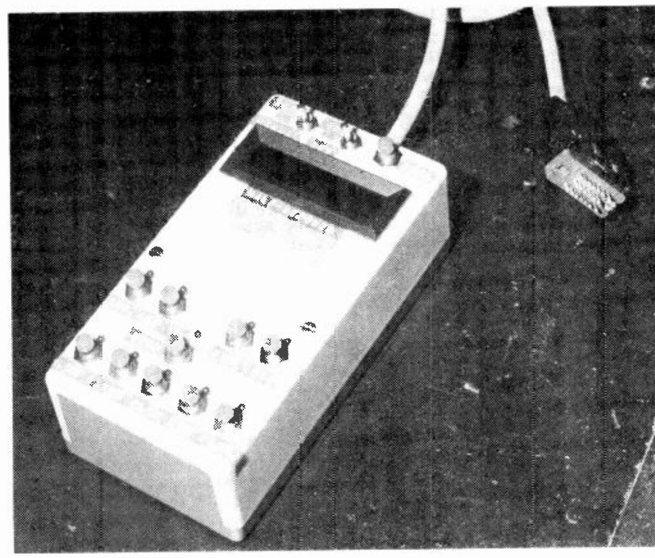
Design of the counter was greatly simplified by using the Ferranti ZN1040E universal count and display i.c., which is available through RS Components stockists. It's a TTL device that interfaces with seven-segment LED displays and contains all the necessary logic to count up/down, borrow/carry outputs, internal clock, etc. It's capable of driving four digits, and as 6·5V is present at pin 1 of the 20-way socket no other power supply is required. A number of other counter/driver i.c.s have since become available, and anyone thinking of following up the ideas presented here may wish to consider these.

We used two 7490 decade counters to achieve division by 25. These i.c.s can be hard wired to divide by any number between two and ten. In our application, both counters are set to divide by five, giving a total of division by 25. To use the 7490 as a divide by five counter, the input goes to pin 1, the output is taken from pin 11, and either pin 2 or 3 is earthed – the supply pin is pin 5 and pin 10 is the chassis pin. As previously mentioned, the control pulses from the VCR will be somewhat distorted when the VCR is operating in one of the fast modes. One of the NAND gates in a 7413 i.c. was used as a Schmitt trigger at the input therefore, the other gate in the i.c. being connected in series to preserve the polarity of the pulses. Fig. 2 shows the arrangement.

Next, the automatic edit function. Let's give an example. Suppose that a take on the tape is of a football match in which a goal is saved at the last minute. To give dramatic effect, it may be desired to edit back from the match to the studio presenter whilst leaving the viewer uncertain as to whether the goal was scored or saved. To do this it's necessary to edit out of the match scene at as late a point as possible. This can be achieved manually, but far more exact editing can be achieved by previewing the scene in slow motion (one fifth speed), electronically "marking" the desired edit point, then rewinding the tape and carrying out the edit.



*The assembled counter/display board.*

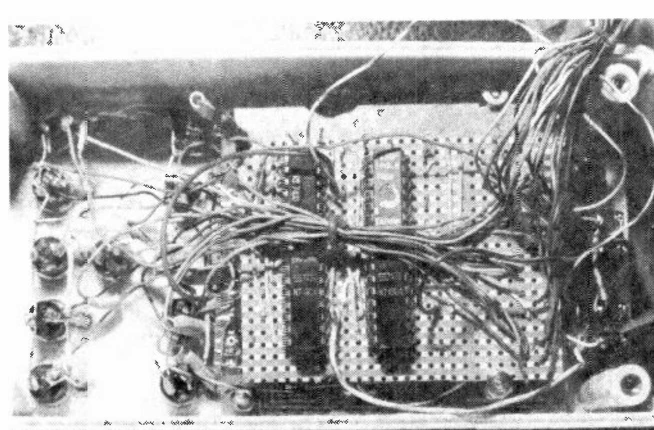


*The finished unit. In this prototype the manual and auto edit count rates are different – one of the 7490 divider i.c.s is switched out on auto.*

It's possible with some systems to add an edit pulse to the tape at the required point. In our system however the counter is zeroed at the desired point, the edit being effected when the counter changes from 9999 to 0000 on the playback. With the i.c. used here, this is easy to achieve as the chip gives a pulse as a carry signal at 0000. This can be inverted by a 7400 logic gate and fed to the insert or assemble edit control switch as required. Fig. 3 shows the automatic edit circuit.

Construction of the unit is simple. The circuit splits easily into two parts, the prescaler dividers and edit control unit and the timer/counter/display board (a suitably prepared board for use with the ZN1040E i.c. is available from RS Components stockists). The four prescaler and auto-edit i.c.s can be assembled on to a small piece of Veroboard mounted over the timer board. The accompanying photographs show the completed unit: all the electronics fit neatly into a small plastic case.

Whilst the unit described was designed for use with the Sony VO2850P, similar designs could be used with other machines. The 50Hz pulses required to drive the timer/counter board could be obtained from a sync separator, so that almost any VCR could be equipped with a very accurate tape timer. The remote control systems employed with different VCRs vary considerably, but a variation of the system presented here could be adopted to cover a number of different machines. ■



*The prototype divider/auto edit board, which is mounted over the counter/display board.*

# Long-distance Television

**Roger Bunney**

AT the time of writing, on May 27th, this year's Sporadic E season has unfortunately yet to arrive. The prevailing conditions in fact have been similar to those of the mid-60s, when due (I suspect) to increasing sunspot activity SpE seemed to decline. There have been a few openings, but they've been nothing of the intensity and duration one would expect at this time of year. What a dismal start to the season! Here's a combined report on the openings experienced so far:

29/4/81 RTVE (Spain) ch. E3 received for over three hours by Andrew Tett (Surbiton).
1/5/81 CST (Czechoslovakia) ch. R2 and MTV (Hungary) ch. R1 received by Clive Athowe (Norwich).
2/5/81 RAI (Italy) ch. IA received by Clive Athowe.
6/5/81 A widely reported opening with, during the afternoon, RAI chs. IA, IB; TVP (Poland) R1; CST R1, 2; TSS (USSR) R1; SR (Sweden) E2; NRK (Norway) E2. During the early evening I logged RTVE ch. E2.
8/5/81 NRK ch. E2 received for an hour during the mid-morning by Brian Fitch (Scarborough). Unidentified signals on chs. R1, E3 and E4 were received here at Romsey at 2000 BST.
14/5/81 Good signals logged by Brian Fitch and myself – during the early evening, ORF (Austria) E2a, MTV R1, RAI IA and TSS R2.
17/5/81 TSS R1 and 2 received early morning.
19/5/81 RAI IA and JRT (Yugoslavia) E4 received at 1730 BST.
21/5/81 RAI IB received at 0840.
25/5/81 Strong signals from RTP (Portugal) E2, 3 and RTVE E2. George North (Walton on Thames) also received these signals from 1500 BST – RTVE on chs. E2, 3 and 4.
26/5/81 George North reports TSS R1 at 1800 with a "local quality" news programme.
27/5/81 NRK E2, 3 and YLE (Finland) E2 (noted here at 0836 using the FUBK pattern).

The opening on May 6th was perhaps the most intense, with Italian f.m. radio stations being logged at up to 100MHz by Mr. Sexton (Southampton). Hugh Cocks (E. Sussex) and Andrew Tett (Surbiton) confirm the general pattern of reception noted above during the afternoon.

The increased sunspot activity provided an unexpected enhancement of F2/TE reception (see report from Australia below). ZTV (Zimbabwe) ch. E2 was received in the UK by John Tellick (Surbiton) on the 4th, by Hugh Cocks on the 6th and by myself at 1735 on the 17th – by SpE enhanced TE. Earlier, John May (Ashford) received ZTV on April 28th.

Tropospheric reception has been quiet. Hugh Cocks witnessed an unexpected but brief cold front lift during the bleak, wet weather on the 21st. This produced strong signals from Dutch and BFBS u.h.f. transmitters, from a sharply defined direction. Meteor scatter reception produced the usual brief signal pings, the most noteworthy being Clive Athowe's reception of the NRK Stord ch. E5 transmitter (identification noted on PM5544 pattern) on May 2nd.

### Australian Reports

As the Australian winter approaches, F2/TE reception there has improved dramatically. Todd Emslie (Sydney) has sent a log detailing a mass of low v.h.f. signal receptions, with Mexican two-way communications signals at 49·4MHz being the highest and African signals at up to 40MHz. New Zealand ch. 1 video buzz (45·25MHz) was received via F2 backscatter almost daily throughout April. The following log was sent by Anthony Mann (Perth):

21/4/81 Samoan/mid-Australian opening at up to 52MHz., 50MHz Mexican communications signals.
25/4/81 Strong signals from Malaysia ch. E2 and China/USSR ch. R1.
26/4/81 Hawaii 50·1MHz beacon. Mexican radio amateur (XE1TIS) heard at 50·11MHz.
1/5/81 US radio amateur in Pheonix, Arizona heard at 50MHz.
10/5/81 Gwelo (ZTV) ch. E2 logged for the first time in Perth. Apparently a South African radio amateur (ZS6BMS) received the Australian ch. A0 in Pretoria on the 9th, at 30μV.
17/5/81 With increasing solar flares, BBC ch. B1 and TF1 ch. F2 audio signals were received, also Gwelo E2, Malaysia E2 and various 50·1MHz African beacons.
18/5/81 South African signals at up to 50MHz, Gwelo with strong checkerboard pattern, Malaysia ch. E2 and Russia/China R1/C1/C2. Also E3/A2 signals.
19/5/81 Similar signals continue, along with French F2 audio, possibly enhanced via SpE at the European end.

It seems that the F2 openings are completely unpredictable, with mornings dead to the east but with intense signals from the west within an hour, or with good openings early to the east though not continuing to the west. The optimum single hop for F2 seems to be farther than one would expect, at 3-3,200 miles rather than the theoretical 2,800 miles (hence South Africa to Adelaide at 50MHz, but missing at Perth). The longest/highest frequency hop seems to have been the 6 metre (50MHz) radio amateurs received from Hawaii and South Africa on the 18th.

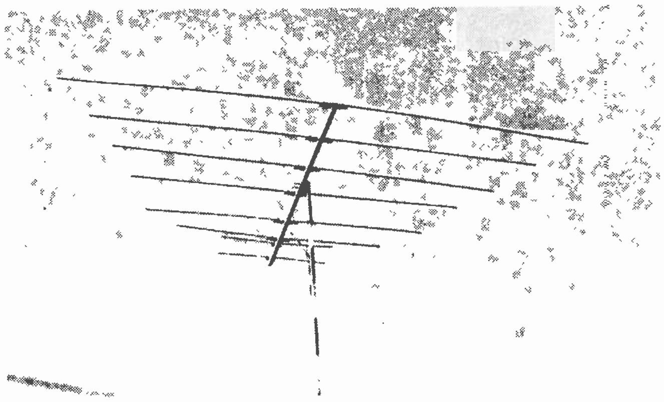
A remarkable month then for Australian DX enthusiasts!

### News Items

**New EBU listing:** France, Toulouse/Pic du Midi FR3 ch. E47, 625kW e.r.p., horizontal.

**Station closures:** The Swedish Uddevalla ch. E2 5kW station has closed. There are plans to replace the RTVE-2 Santiago ch. E2 transmitter with a ch. E45 outlet. These reports from the Benelux DX Club.

**USA:** As briefly mentioned in last month's leader, the Satellite Television Corporation is seeking FCC permission to start a commercial direct to subscribers broadcast service at 12GHz, on three channels. The service would initially cover the eastern time zone, four satellites (with two reserves) eventually covering the whole country (including Hawaii and Alaska). Control facilities to be at Santa Paula,



*A typical large TV aerial in use in Buenos Aires, Argentina. Photo from Cliff Dykes.*

California (uplink at 17GHz) and the programme centre at Las Vegas. The service would be expected to start within three-four years of permission being given. The home receiver terminals would use a 2·5ft dish with integral down converter and a descrambler/remodulation to v.h.f. unit at the receiver itself. If permission is received, development at 12GHz will certainly accelerate.

**Spain:** Alicante ch. E3 power reduced to 60kW, Izana (Canary Islands) to 300kW (from 350kW).

**Malta:** PAL colour transmissions are expected to start shortly. The import ban on colour receivers would then be lifted.

**Zimbabwe:** The Chief Engineer has written to Hugh Cocks advising that there are no immediate plans to close the ch. E2 Gwelo transmitter despite there being parallel transmissions from the same site on ch. E11. The normal test pattern is the PM5544, the checkerboard having been officially dropped. The latter still seems to get seen however, so is probably built into the ch. E2 Philips transmitter.

**South Yemen:** The Aden TV centre is now using colour, standard unknown.

**Italy:** RAI has been given permission to carry out teletext tests, but the "private" sector is likely to start first – the Berlusconi Company (network Rete Italia and Canale 5) is planning to provide teletext by the end of the year.

**Japan:** Although the BSE DBS experiment came to an end with the failure of the satellite's transponders, it's expected that a regular satellite direct broadcast service will be in operation by 1983.

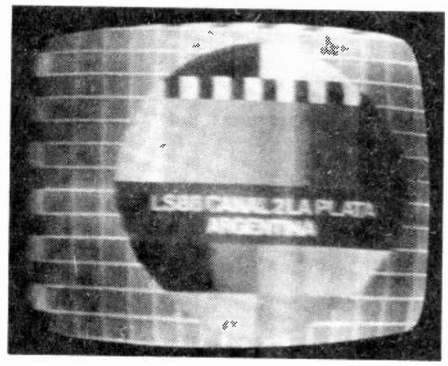
### *Dubai/UAE*

Dubai is currently listed as using ch. E2 with an e.r.p. of 25kW. That was the situation until late '78/early '79, when its elderly ex-Kuwaiti RCA transmitter was derated/widebanded for colour transmissions. This reduced the e.r.p. to 18kW. At that time the UAE offered the ch. E2 allocation to Iran, though the troubles in that country put an end to their ch. E2 aspirations. Dubai subsequently (in early 1980) took delivery of two Harris (USA) 20kW transmitters, which were installed atop the 35 storey International Trade and Exhibition Centre. The aerial mast is approximately 120ft high, the omni-directional four-stack dipole system giving, from the parallel 20kW transmitters, an e.r.p. of 240kW (the highest powered Band I unit in the Gulf).

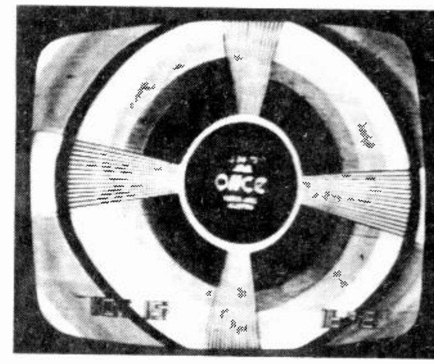
### *From our Correspondents . . .*

J. Menzies, using an Antiference XG21 aerial and Labgear masthead amplifier, reports receiving various


*The Hochsauerland ch. 40 identification slide – photo courtesy Henny Demming.*




*Rio de Plata ch. A2 test pattern photographed by Cliff Dykes.*



*Another off-screen test pattern photographed by Cliff Dykes in Buenos Aires.*

distant IBA u.h.f. outlets in Aberdeen during the good tropospheric conditions over the period April 15-17th.

Cyril Willis (Ely) also complains about the lack of SpE! He received Gwelo ch. E2 on April 25th, via TE – "very messy" from 1700 onwards – and Dubai ch. E2 during the late afternoon of April 28th. Nicholas Brown (Rugby) and Cyril both complain about CB interference. This is a topic I hope to go into in greater detail shortly. The main problems are harmonic interference, i.f. breakthrough and the generally poor filtering in CB equipment. I'd appreciate hearing from anyone who has or is experiencing interference from CB rigs therefore. The widespread use of the illegal 49MHz cordless phone is also a serious problem, and one that's increasing with advertisements for these units in various magazines. Nicholas, like J. Menzies in Aberdeen, did well during the mid-April tropospheric opening, with various W. German, Dutch and Belgian u.h.f. TV signals and Belgian f.m. radio.

An old friend of ours, A. Parameswaran, supplies manager of the Paranthan Chemicals Corporation, Paranthan, Sri Lanka is seeking contacts with enthusiasts in Sri Lanka/India.

Cliff Dykes (G8CKH, Bromley) has sent us an interesting letter describing his recent travels in S. America. In Paraguay/Argentina the TV standard is System N – 625 lines, 50 fields but slotted into a System M bandwidth (4·2MHz video bandwidth, with 4·5MHz sound-vision spacing). The PAL colour system is used. Five channels can be received in Buenos Aires, and when conditions are good Montevideo (Uruguay) ch. A4 can also be received. Huge wideband arrays atop lattice towers are to be seen in fringe areas. Equipment is much cheaper in Brazil, but problems arise when Argentinians bring back receivers etc. – the Brazilian supplies are generally at 110V/60Hz while the Argentine uses 220V/50Hz. Many motors burn out at 50Hz, since their inductance is insufficient.

### *Obituary*

I regret having to record the passing of Edgar Janes of Woodmancote, Cheltenham, who died in hospital in early May. A radio amateur and DX-TV enthusiast for many years, he leaves our hobby much the poorer. Our sympathies to his wife in her sad loss.

# Letters

## PHILIPS TS7 CHASSIS

I see that the problem of lack of brightness with the Philips TS7 monochrome portable chassis is mentioned in the June 1981 *Service Bureau*. The prime suspect in these sets is the brightness control itself: the two tags at one end are very close together, and get bridged by dust from track/wiper wear. To check, measure the voltage at the control end of the 820kΩ feed resistor R195 – if the control tags mentioned are shorting, the voltage at this point will fall as the wiper is moved. Removing the dust clears the fault.

*William Harrison,*
*Windsor.*

## SERVICING AIDS

I have found the following simple aids (see Fig. 1) of considerable help when working on printed circuit boards. The first is a hook for pulling components out for testing or removal (while being unsoldered of course). The second is for opening the component lead hole prior to fitting the new component (melt solder and pass point through). The third is for holding down the leads of components that are to be soldered directly to chassis in confined spaces. The fourth is a "shake proof" test probe for checking transistors from the component side while the power is on.

The first two items were made from suitable old spring steel wire, the hook being made by grinding after bending the wire while cold. The third item is made from mild steel wire strong enough not to bend under pressure. The fourth is made from a suitable sowing needle. Carefully grid the eye open while cold, then slightly open out the ends thus formed while heating to a dull red. The needle can then be forced down the test lead, which may consist of any desired length of PVC covered flexible wire.

I hope other readers will find these tools as helpful as I have.

*Victor Rizzo,*
*Msida, Malta.*

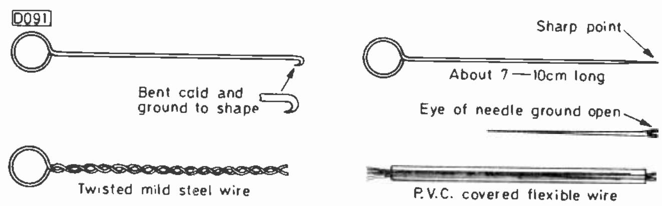



*Fig. 1: Servicing aids devised by Victor Rizzo for use with printed circuit boards.*

# Practical TV Servicing: Tackling Audio Faults

S. Simon

The sound stages of the average modern TV set rarely give trouble. As a result, the average TV engineer or would be engineer doesn't pay much attention to audio matters, preferring to concentrate on the more complex and more troublesome sections of TV sets in his pursuit of useful knowledge. When trouble does occur in the relatively simple audio circuit, he probably tends to feel vaguely irritated, particularly if his first line of attack fails to bear fruit.

### *Problem Portable*

An example of what we're talking about came along only the other day. The set was a Decca Gypsy mains-battery portable, and the complaint was that although it worked all right when powered from the mains, apart from some sound distortion, it would not operate at all when powered from a car battery. The sound was very croaky indeed, so we were inclined to link the two faults together, particularly when we discovered that the 2·5A battery fuse had failed. We pointed the finger of accusation at the audio circuit, which in this set consists of a TAA611B chip. Maybe it was drawing excessive current? It wasn't, so this red herring was quickly disposed of.

We also found that the sound was just as bad when an external loudspeaker was plugged in. Sticking with the sound fault for the time being, we decided to check the i.c. by injecting a signal at its input. This proved that the i.c. was behaving impeccably, and it then belatedly dawned on us that the sound detector quadrature coil was probably off tune. Half a turn of the core of L20 produced perfect sound. A replacement fuse then restored the battery operation, and we came to the conclusion that the battery leads had been accidentally reversed, with the result that the protection diode had switched on to blow the fuse.

We mention this little story simply to show how easy it is to be misled, and to point out that distorted sound is not necessarily due to a faulty component in the audio circuit itself or the loudspeaker.

### *Loudspeaker Troubles*

In the event of distortion being experienced at low volume levels, and perhaps after a period of operation, suspicion must fall upon the loudspeaker. This is particularly so if the loudspeaker is mounted high in the small cabinet of a portable set, where whatever heat there is will gather. It's even more likely if the speaker is mounted above a component that tends to run warm, such as the mains transformer. The effect of the heat over a period is to warp the speaker's speech coil, so that it no longer moves freely in the gap of the magnet. The effect shows up more at low volume levels because the amount of current applied to the coil is then low, so that the coil tends to "buzz" against the magnet instead of moving freely within it.

There can be a nasty result if this state of affairs is allowed to continue. If the speech coil is rubbing, its enamel insulation will eventually rub off. The magnet will then short the turns together, and the loudspeaker impedance will be drastically reduced. A 12Ω loudspeaker may then present an impedance of only one or two ohms, with disastrous consequences to the audio output stage if this consists of a chip or a pair of output transistors. Roughly speaking, this is equivalent to allowing the speaker leads to touch together on audio equipment, i.e. a very low impedance is presented, a heavy current flows, and if the output stage is not fuse protected extensive damage is caused.

Much has been written about the damage that can be caused when equipment is operated without the speakers connected. The operative word here is "can". There is no "can" about operating equipment with the speaker leads touching. One touch and it's all over. The classic illustration of this is when audio equipment is brought in with the complaint that "I extended the speaker leads and when I plugged in one side didn't work. So I changed over the plugs to check the speakers and the other side didn't work either. I think I've blown a fuse."

Fortunately we don't have these complications with our TV sets, except as I say when the loudspeaker's impedance has been drastically reduced by rubbing. It's not a common occurrence.

### *No Sound*

Far more often the complaint is no sound. This may not be strictly true: an ear to the loudspeaker may detect a background hum or noise, which may increase when the volume control is turned up. This demonstrates that the audio circuit is working from the volume control onwards. Quite often however the complaint is true, and no sound at all issues from the loudspeaker.

In a large number of sets the speaker is connected via a plug and socket, and this is the first checkpoint. If moving the plug doesn't restore the sound, remove the plug and check the speaker's impedance with a meter switched to the low ohms range. In addition to showing the resistance of the speech coil, this action should produce an audible click, proving that the speaker is able to respond. If it doesn't, the search has ended before it's begun. If the speaker does respond, refit the plug in its socket and, with the set switched off, prove the socket contact and its connection to the panel.

### *Voltage Checks*

Having carried out these simple checks, we next have to prove that the audio output stage is being supplied. The supply voltage depends on the set's design of course, but most audio stages today work from a fairly low voltage source of between 18-40V. Because the set is a completely solid-state one however there's no guarantee that the supply voltage may not be much higher. The popular Thorn 8000/8500/8800 series for example uses a single high-voltage transistor (type MJE340) which operates with some 100V at its collector and has a step-down transformer to

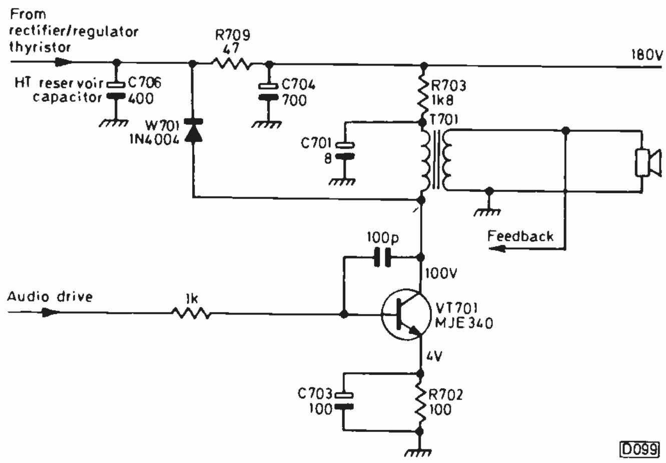



*Fig. 1: The audio output stage circuit used in the Thorn 8000/8500/8800 series chassis, with a high-voltage transistor (VT701) operated from the 180V h.t. line.*

match it to the loudspeaker. In such a circuit it's not unusual to find that the h.t. feed resistor to the audio output stage is open-circuit, since it's of fairly high value and dissipates quite a bit of heat (the resistor is R703, 1·8kΩ, in the Thorn 8000 etc. – see Fig. 1). So we must ascertain what the audio output stage's supply voltage should be, then check whether it's where it's supposed to be.

If the supply is not where it should be either the feed resistor will be stone cold because it's not passing any current, which means that it's open-circuit, or on the other hand it may be overheating due to excessive current flow if there's some sort of short-circuit at the amplifier side (check the electrolytic that decouples the feed resistor as well as the amplifier itself). If the supply voltage is found to be too high, the feed resistor will be cold even though it's intact since no significant current will be flowing. This occurs when the amplifier is not functioning.

All this can be checked in a couple of shakes, and we're soon on the track of the villain, be it an open-circuit transistor or chip (supply voltage present but little else by way of voltage readings of any significance), or an open-circuit resistor or short-circuit somewhere (no or very little supply voltage).

There's a joker in the pack so far as the Thorn 8000 series chassis is concerned. In these an overvoltage protection diode (W701) is connected between the collector of the audio output transistor and the full h.t. line, i.e. the output from the h.t. rectifier/regulator thyristor. The diode is normally non-conductive: it's there to take care of any excessive voltage produced by an unloaded audio output transformer (T701). In this event the diode conducts, damping down any oscillatory tendencies and thus protecting the audio output transistor which is fairly fragile at the best of times and is often the cause of the trouble we're concerned with (no sound with the h.t. supply present). If the diode goes short-circuit, the voltage at the collector of the audio output transistor VT701 will be higher than at the input end of the h.t. feed resistor R703. So this is a possible explanation of the no sound condition in this particular series of chassis, i.e. the diode is shorting out the feed resistor and the primary winding of the audio output transformer.

A similar single-transistor audio output stage is used in the Hitachi CAP160 and similar models, but in this case the protection consists of a VDR which is shunted across the primary winding of the audio output transformer. We've not known this to cause problems. Unfortunately, returning to the 8000 series, when W701 goes short-circuit VT701 often suffers the same fate. The emitter decoupling capacitor C703 will also be damaged and the cutout will operate or the mains fuse will blow.

## *Two-transistor Output Stages*

It's more common to find a pair of transistors used in the audio output stage. There may be two npn transistors or a complementary npn/pnp pair (see Fig. 2). The loudspeaker is driven from the centre point, via a fair sized electrolytic capacitor with a typical value of 220μF or 470μF. The electrolytic may be open-circuit (dried up or with a poor contact at the lead out), and this is the next point to check if the voltages are reasonable and the loudspeaker appears to be in order. Check simply by connecting a known good capacitor across the suspect one.

The mid-point voltage in a two-transistor output stage should be about that, i.e. about half way between the voltage applied to the top of the upper transistor and the bottom of the lower transistor: we would like to say half way between the supply line voltage and chassis, but some circuits operate with a positive and a negative supply line, the mid-point voltage being at approximately chassis potential. With the vast majority of such circuits however there's simply a positive supply, so that the mid-point voltage is approximately half way between this and chassis. Failure to obtain this reading gives you a fair idea of what is happening to stop the stage working.

Once again it's difficult to lay down hard and fast rules, due to the amount of variation in circuit design. Usually however there's a driver transistor – VT8 in Fig. 2(b) for example – that's responsible for turning on the output transistors. The resistors in the circuit can be damaged should a short-circuit occur, but otherwise seldom change value. Electrolytics can dry up or leak. Usually however it's the transistors that are the cause of faults in this area, which means that a quick check on them with a tester or ohmmeter will almost certainly reveal the cause of the trouble without any need to make a detailed study of the circuit. Since there will be d.c. connections between the output transistors and the driver transistor, with perhaps biasing diodes (or a transistor used for the purpose) as well, remove the solder from the connections so that each transistor can be checked separately – remove them altogether for test if needs be.

## *When You Find a Short-circuit*

If a charred resistor is found, there will almost certainly be a collector-emitter short in one or both of the output transistors. If you encounter this situation, don't just leave it at that, merely replacing the obvious items. Check back, looking for a possible cause. It's most disheartening to take the trouble to fit a new pair of output transistors carefully, together with shiny new resistors, only to find that they go up in smoke as soon as power is applied. If all the transistors in the audio circuit are found to be in order, extend the search to other possibilities. Leakage through a coupling capacitor is a prime cause of transistors turning on too hard – or of valves overheating for that matter. The capacitors need not be electrolytics to come under suspicion: the flat disc type often gives trouble, and when one is removed for test you may well discover that there's a leakage of a few thousand ohms if not a complete short.

## *Bias Problems*

The opposite of what we've just been talking about can

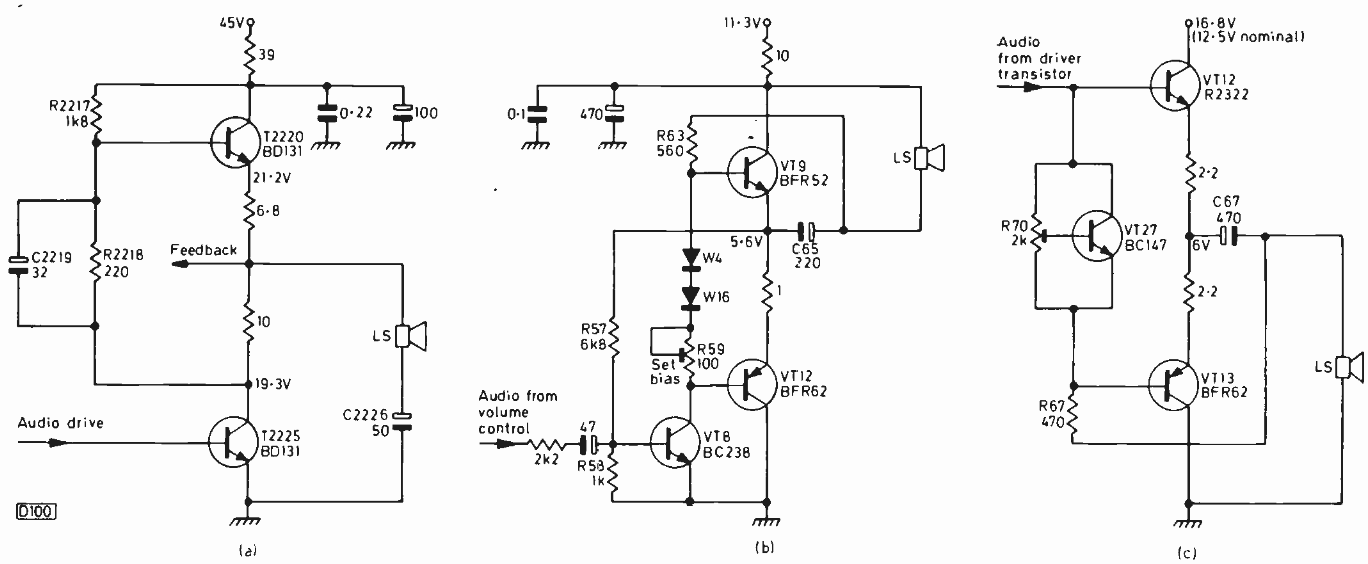



*Fig. 2: Two-transistor audio output circuits. (a) The class A circuit, with a pair of npn transistors, used in the Philips G8 chassis. The upper transistor T2220 receives its base drive from the collector of the lower transistor via R2218/C2219. A.C. and d.c. feedback from the junction of the two output transistors is applied to the emitter of the driver transistor (not shown). The loudspeaker is returned to chassis via the coupling capacitor C2226. (b) The driver and complementary-symmetry (class B) output circuit used in the Thorn 1690-1691 series portables. The driver transistor's load resistor is R63, and the loudspeaker is this time returned to the positive supply line. C65 serves as both coupling and bootstrap capacitor. W4, W16 and R59 provide the standing bias for the output transistors. (c) The audio output stage, another complementary-symmetry pnp/npn transistor arrangement, used in the Thorn 1590-1591 series portables. A pnp driver transistor (not shown) is used, making things look a bit upside down – R67 is its collector load resistor. This time the bias for the output transistors is provided by transistor VT27 and the preset R70. Note that these last two circuits have been simplified by the omission of the earphone sockets.*

also occur, i.e. instead of items being asked to work too hard they can be prevented from working hard enough. Restrictive practices you may say. Whilst the cause can often be traced easily enough, say to an open-circuit base-emitter junction in a transistor or in some cases a short, as a result of which succeeding stages are prevented from working, the cause of the trouble can be more obscure.

It's fairly obvious that resistors can go high in value, thus restricting the normal circuit operation, but when the resistor concerned is in a circuit far removed from the audio stage the plot thickens. This is not a point that needs to be considered with solid-state models: in some hybrid chassis however, e.g. the ITT CVC5-CVC9 series, the audio circuit is muted until the line output stage has started to operate. The relevant circuit was shown last month (Fig. 1, page 476). Basically, instead of the audio amplifier triode's 10MΩ grid leak/bias resistor (R75) being connected directly to chassis, it's linked to chassis via a small diode. Under the muting conditions the diode is cut off, but during normal operation the diode is forward biased to link the lower end of the 10MΩ resistor to chassis. If there's a fault in this part of the circuit, which is over in the line timebase department, shorting the lower end of R75 to chassis may restore normal sound. The diode may be open-circuit, or the foward bias may not be reaching it. If the diode goes short-circuit on the other hand the muting is inoperative and the sound comes on before the picture appears.

The 10MΩ grid leak/bias resistor can go high in value of course. The trouble is then in the audio circuit, where one expects it to be. In valve audio circuits resistors are responsible for quite a lot of trouble. In transistor circuits resistors play a less trouble making role (carefully worded, that). The same cannot be said of the small presets used in some transistor circuits to set the crossover point (as examples of these, see R59 and R70 in Fig. 2(b) and (c) respectively). Such presets seem to fall to pieces at the drop of a hat or perhaps the turn of a screwdriver, leaving the output transistors drawing far more current than they should. If the transistors don't have heatsinks, this spells doom where one is an pnp and the other an npn type. If there's a bias transistor, as in Fig. 2(c), it's essential that this transistor draws current. The demise of the preset in this circuit leaves the transistor (VT27) drawing no current. As a result, the bases of the output transistors are miles apart from the voltage point of view and the output stage passes excessive current. If this condition is suspected, connect a 22Ω resistor between the bases of the two output transistors. This will calm things down until the preset is replaced. We hasten to add that this applies only to the stated circuit configuration, where the emitters of the complementary (i.e. pnp/npn) output transistors are joined (usually via one or two low-value resistors). The bases of the output transistors must be at very different voltages where both are of the same kind, as in Fig. 2(a) – connecting these together via a low-value resistor will cause trouble rather than preventing it.

### *Crossover Distortion*

Crossover distortion occurs when one output transistor cuts off before the other one switches on, leaving a point of no current instead of a smoothly rising and falling current flow. This is generally caused by incorrect drive, due to a defective driver stage or a fault farther back in the amplifier channel. The result is croaky sound. Although one or both of the output transistors could be responsible for this, the earlier stages could well be at fault. So once again careful transistor checks, or perhaps general substitution since few are involved, is required. Substitution can save much time and patience since the act of testing a transistor will often restore it to apparently perfect working order, thus clearing the fault for a short period.

### *Heatsinks*

Whilst nearly all output devices, be they transistors or chips, used in audio equipment are in contact with some means of dissipating the heat they generate, such stabilising metalwork is not found in some TV designs. Some TV sets have quite elaborate and comparatively high-wattage output stages feeding a comparatively high-quality speaker system, but in this cost conscious field it's more likely that you'll find a rather flimsy speaker driven by a simple, low-wattage audio circuit. In this case a pair of silicon transistors of the type normally used (in audio equipment) to drive more powerful ones will be found, standing proudly without the benefit of any kind of heat dissipating metalwork. This is acceptable and works well enough under the circumstances for which the circuit was designed, i.e. a low sound output. The snag occurs when some small defect causes a correspondingly small increase in output current.

Whilst there's no perceptible difference in sound quality, the increased current causes a corresponding rise in temperature. If the rise is sufficient to cause thermal runaway, the output transistors will destroy themselves before you can say "heat conducting device". Enhanced reliability can be achieved by encasing the replacements in readily available close-fitting metal heatsinks. In some designs clips are used to hold the transistors in close thermal contact with a metal chassis member: it's not unknown for these clips to become loose, possibly as a result of careless handling. These are points to watch if future trouble is to be avoided.

The same remarks apply to integrated circuits which, although they may have built-in "wings", often have a heatsink plate clamped to them. For various reasons (hard silicone grease perhaps) the heatsink plate may not be giving effective protection after a period of use. It pays therefore to check up on the effectiveness of the thermal conductivity.

# VCR Clinic

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

## Microprocessors Ahoy!

Last month we had a little problem. A JVC HR2200 portable VCR was sent to us by a dealer, the complaint being "no operation and lots of flashing lights". I tried the recorder out. The drum motor spun for a short period, along with the rewind spool carrier, then the machine went into the "alarm mode". So did I. All the function lights on the front lit up in turn, strobing across the machine. Very pretty!

Many hours passed while we tried to evaluate the fault symptoms – it was necessary to try to keep the machine running while checks were made around the system control circuits. As you'll know by now, the microprocessor chip has very much arrived on the scene. The systems control in this VCR is microprocessor based, and the chip didn't want to know. Some parts of the logic are on one board and some on another, so as a start I decided to swap the microprocessor board temporarily with one from a working machine. Out came the suspect board and in went the good one. The results were just the same: after a few seconds of revolving motors, we were back with the alarm mode. So the fault's not on the microprocessor board. But, as a check, I decided to try out the board from the faulty machine in the good one. Guess what? It immediately went into the alarm mode. Oh dear.

After some deliberation I decided to take a look at some of the logic on the faulty machine and to try eliminating some paths. Now the microprocessor i.c. addresses two data selector i.c.s (see Fig. 1) which talk back to it. IC1 and IC2 check various functions and tell the microprocessor what the state of the recorder is and whether it's running all right – if this information is missing, the alarm mode is entered into. The approach we took was to disconnect inputs A0 and A1 by unsoldering pins 1206 and 1215 on the board connector. This would tell us, or at least give us an idea, whether IC1 or IC2 was responsible for the trouble. This worked out to a degree. A1 was found to be providing persistent information, and IC2 turned out to be faulty – pin 9 was stuck high, and the i.c. thought that the spools were not rotating. Changing IC2 restored normal operation with the microprocessor panel from the working machine fitted, so we swapped the panels back again. The good machine worked, but the faulty machine immediately went into the alarm mode. Time to start looking for the second fault. As a start we changed the microprocessor i.c. That didn't do any good.

The A0 and A1 inputs were opened again. Checks were made at the I outputs and everything seemed to be all right. I subsequently found however that the state of I2 at the microprocessor output pin was not that which reached IC2. There's a hex buffer i.c. on the microprocessor panel, and one of the stages in this wasn't working. So the buffer i.c. was changed, at last restoring normal operation.

It's becoming clearer as time goes by that with these new microprocessor controlled circuits the microprocessor i.c.s themselves are not the things that fail. I know that it's a temptation to change microprocessor i.c.s – I've done it myself to eliminate them from suspicion. This is all right if you can remove and replace the i.c. without damaging the print or the chip itself, but some of the latest VCRs use several microprocessor i.c.s – there are six in the JVC HR7700/Ferguson 3V23 – and great care is required since it's all too easy to cause serious and expensive damage.

## Toshiba's Digital Servo System

In the April *VCR Clinic* I included a note to say how reliable the Toshiba V5470 machines were. Following this, two things happened. First, predictably, one went wrong. Secondly their rep Tony came breezing in to announce a super new model that includes a four-head video drum to give perfect still frames and slow motion. Anyway, after that note of mine Tony said that a number of other dealers wanted to know how much he'd paid me. His face fell a mile when I told him I was about to reveal the darker side of life.

Apart from his timer clock losing about six minutes a week, the customer complained of intermittent speed variations, sometimes fast and sometimes slow. Andy fetched the V5470 and left a loan machine (aren't we nice?). Now the servo control systems, both drum and capstan, are buried in IC501 in this machine. As the tape speed was varying, the fault was obviously to do with the capstan servo side of things.

Compared to other domestic VCRs, the servo system used in this machine is unusual – very clever and requiring minimal adjustment. The operation is digital – the "ramp" is not an analogue one that's sampled at some point, as in

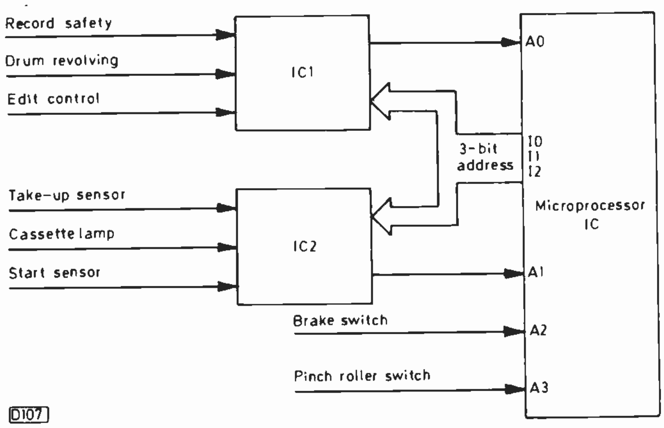



*Fig. 1: Block diagram showing the basic control system used in the JVC HR2200 VCR. IC1 and IC2 are on a different panel from the microprocessor i.c.*

previous VCRs, but a stored 0-10 bit count. The count in the store (see Fig. 2) is varied by two inputs, reference and sample. The stored count finally controls the mark-space ratio of a high-frequency squarewave – the mark-space ratio is varied at the reference/sample rate of 25Hz, the squarewave itself being at 1·46kHz.

The reference input resets the 15-bit counter and clears the 10-bit store. The counter then starts counting the 746·56kHz clock pulses fed to it. After a short period of time, approximately 1·3msec, a sample pulse arrives and tells the 10-bit store to hold the count attained at this point. The store retains this count until the next reference pulse arrives some 40msec later. During the 40msec period, the store's contents are presented to the comparator. Meanwhile another 10-bit counter counts the 1,493·12kHz clock pulses – continuously to the full count, then resetting. When this counter resets, it provides a reset output to the set/reset bistable, resetting the output high. Another output from this counter is fed to the comparator: when this count matches the contents of the 10-bit store, the bistable is set low.

The lengths of the bistable's high and low output states thus depend on the count in the 10-bit store. The longer the period between the reference and sample inputs, the greater the stored count and the longer the bistable's output remains high. The result is integrated to produce a d.c. control voltage whose level increases should the sample pulse arrive late. The increased voltage speeds up the servo, compensating for whatever slowed it down and caused the sample to arrive late in the first place.

The servo has in-built limiters – if the motor is running fast, out of lock, the output remains low, while if the motor is running slow the output remains high to maintain full drive to the motor.

The only problem with this system is that the lock-in time

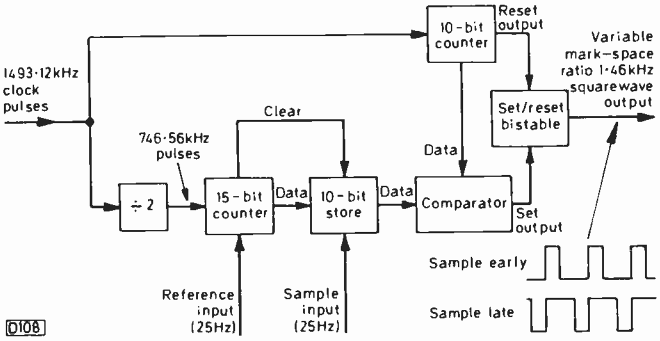



*Fig. 2: Block diagram of the digital servo system used in the Toshiba V5470 VCR.*

is slightly longer than with an analogue servo. As we've seen, the store is reloaded at 25Hz, or every 40msec. The bistable's switching rate is 1·46kHz, so the comparator output is about 60 times the store reload rate – or, to put it another way, the contents of the store are used 60 times between reference pulses. The input clock pulse rate to the 10-bit counter is 1·493120MHz: since a 10-bit counter divides by 1,024, the reset output rate is 1·458kHz.

Well now, back to the faulty machine. The problem was intermittent, so we monitored the capstan servo output. Fortunately when the fault at last occurred it stayed. The servo output was high, but the motor was nevertheless running slow. The d.c. voltage across the motor was checked and found to be more like 6V than the 4·5V it should have been, and when the motor was physically slowed the voltage fell, whereas in normal operation it should have risen.

This proved that although the servo was at its highest limit the motor was still running slow. It didn't need a genius to blame the motor and change it. Note that the customer had complained about the speed being fast and slow. This can be easily explained: the motor was running slow in the record mode, so when the tape was replayed with the motor behaving normally the audio would be fast would it not?

As regular readers of this column will know by now, capstan motors seem to be the weak point in these Toshiba machines. It also seems to take a long time to obtain replacements.

## Tape Damage

Meanwhile we've had another problem with a Toshiba V5470. The customer's complaint was that the machine damaged tapes. When still picture was selected, the machine would sometimes not release and, although the still picture had been held for only a short time, some tape damage would have occurred. The tape was jamming and being damaged at the point where the still frame had been held with no picture impairment – the cassette would also jam at the same place when tried in other machines. The customer also mentioned that after leaving the tape in the recorder overnight it would not start in play the following day.

An inspection of the damaged tape revealed longitudinal marks – not scratches, but larger areas of darkening where the smooth surface had been removed by abrasion. Added to all this, when still frame was selected the noise bar wasn't always shunted out of the way to the bottom of the picture, while frame advance didn't work.

I ran the suspect cassette in the recorder and all the faults were there – plus more besides. When I selected a still frame, the recorder made a ticking noise as the capstan motor was pulsed to shunt the noise bar out of the picture, but the tape was not moving! The tape was found to be very taut between the pinch wheel and the head drum, but not between the drum and the supply spool. This indicated extreme friction around the drum, so close inspection of the drum was required. The upper cylinder section was then seen to be slightly askew: this had resulted in premature wear, a new drum putting everything right.

## The Toshiba V8600B

I've subsequently (at the trade shows) seen the new Toshiba 8600 with its four video heads. Panic not though. There are two record/replay heads as usual for video tracks A and B. The extra heads are both for the B track and are slightly thicker, thereby ensuring continuous pickup from the track on replay. The result is a still frame that's really still, with no field flutter.

# Colour Portable Project

## *Part 4*

***Luke Theodossiou***

The copper track pattern for the timebase board is shown in Fig. 3, whilst Fig. 4 shows component locations. The timebase board is featured on the front cover and as can be seen it's very compact without making component access difficult.

Some further refinements to the design have been incorporated to optimise performance and these are detailed below. We suggest that the circuit diagram and component lists are amended accordingly.

**SMPS:** The required output voltages from the power supply are now +200V (was +190V), +118V (was +110V) and +24V (was +22V). This is simply achieved by adjusting VR1, but in order to optimise the preset's range of adjustment, R2 should be changed to 5k6.

**Signals board:** As mentioned above, the +22V rail is now +24V. A significant improvement to the low frequency response may be effected by changing the value of C29 to 470μF 6·3V. If the new, bulkier component is stood off the p.c.b. by about 10mm, it will not interfere with the adjustment of the adjacent preset.

**Timebase board:** Better sync performance is obtained by changing the value of R4 to 1k. Due to the slightly higher h.t. rail now used, the value of R17 should be 100k.

The latest Hitachi range of c.r.t.s was chosen for our project, primarily because they are technically the most advanced 90° tubes currently available. A comprehensive range of sizes is available, as detailed below:

14" (37cm): 370HUB22 – TC01
16" (42cm): 420ERB22 – TC01
20" (51cm): 510VSB22 – TC01
22" (56cm): 560EGB22 – TC01

Any size may be driven by our circuitry without any changes with the exception of the degaussing coil and the cabinet.

The tubes are fitted with a new saddle-toroid deflection coil assembly which reduces deflection power requirements, eliminates all dynamic convergence adjustments and is free from pincushion distortion. A magnet assembly on the tube neck takes care of static convergence and purity, but even this is preset by the tube manufacturer so there is absolutely nothing to adjust.

Other noteworthy features of these tubes include a black matrix screen with pigmented phosphors giving increased brightness and improved contrast; a new type of focus electrode which requires around 7kV instead of the usual 4kV, resulting in better overall focus performance; contoured-line screen; internal magnetic shield; and quick heat cathodes.

Arrangements are currently being made for a supply of these tubes to be made readily available to readers and we shall be giving details in a following issue.

The tube base board is a passive circuit which merely connects the tube's electrodes to the timebase board via some resistors for flashover protection. The circuit is shown in Fig. 1. It is important to adhere to the specified components to ensure that the board performs its task of providing the necessary protection. Fig. 2 shows the copper pattern.

In order to avoid high frequency oscillations at the end of the flyback period (which show up as striations on the left-hand side of the screen), a damping network is placed in parallel with the line coils, actually on the scan coil connector. It consists of a series *RC* network, and the values are given in the components list.

The scan coil connector details, together with the degaussing coil and Aquadag earthing information, will be given in a subsequent issue.

### ★ C.r.t. Base Board Components List

**Resistors**: 0·5W, ±10% carbon composition, except where stated

| | | | |
|---|---|---|---|
| R1 | 100k | R4 | 1k |
| R2 | 100k 1W | R5 | 1k |
| R3 | 1k | R6 | 10k |

**Miscellaneous**:

C1 10n 2kV ceramic disc
SG1 Welwyn 538902
C.r.t. base socket

**Line coil damping network**:

R = 2k2 0·5W carbon composition
C = 270pF 2kV ceramic disc

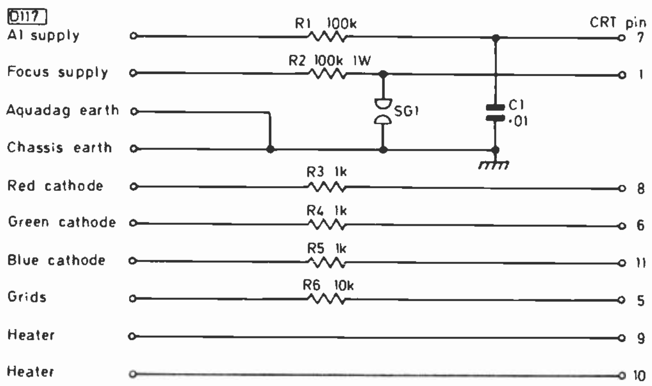



*Fig. 1: C.r.t. base board circuit.*

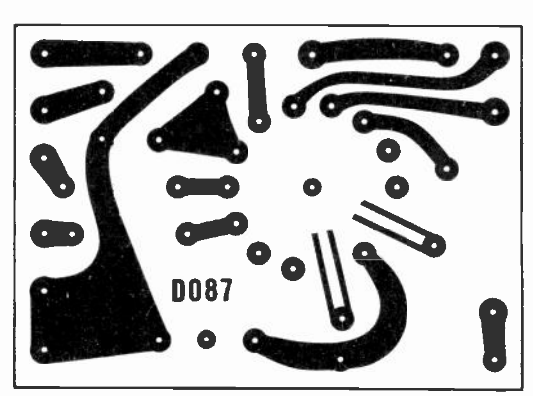



*Fig. 2: C.r.t. base board print pattern – the component layout will be shown next month. Shown full size.*

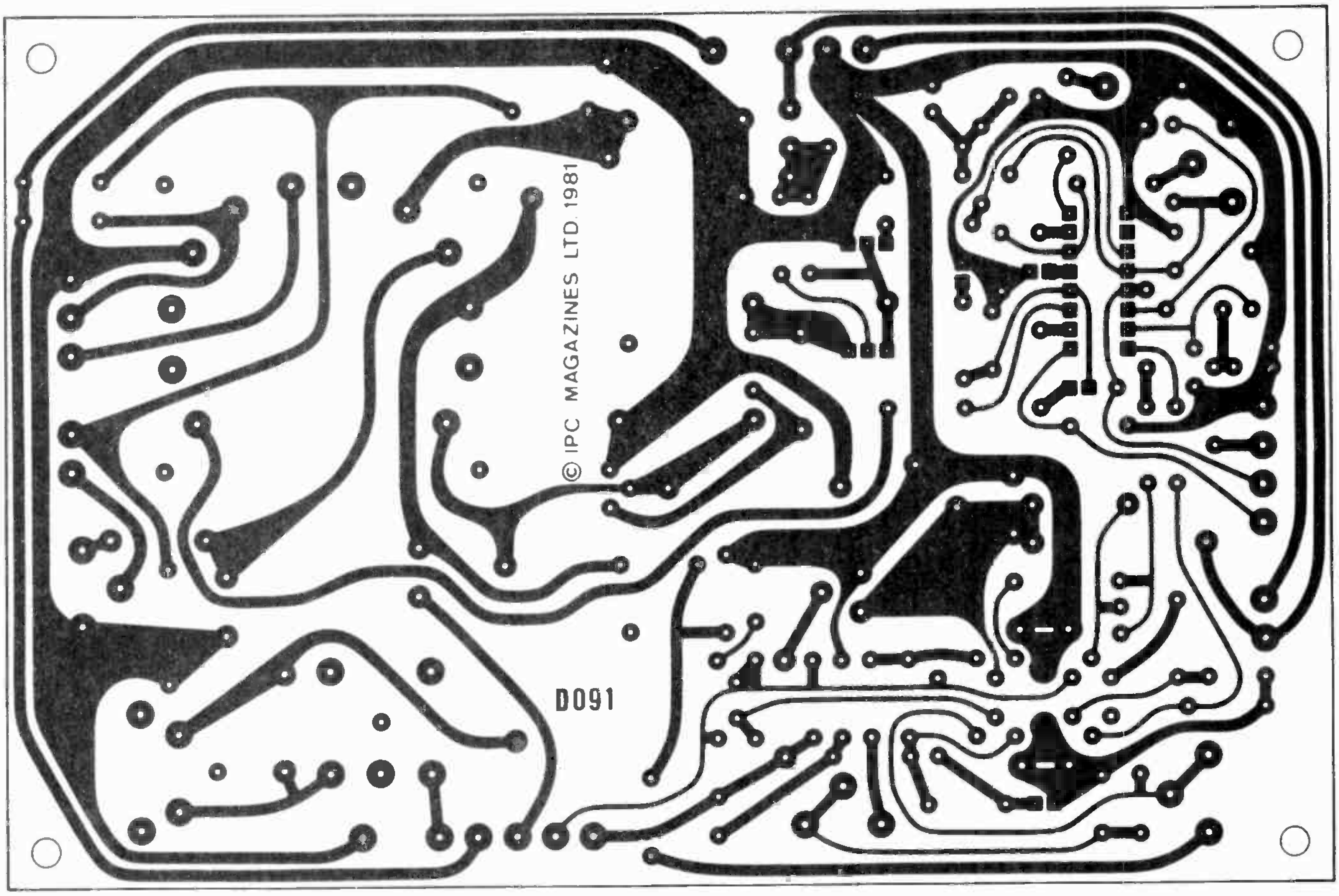



*Fig. 3: Timebase panel print pattern. Shown full size.*

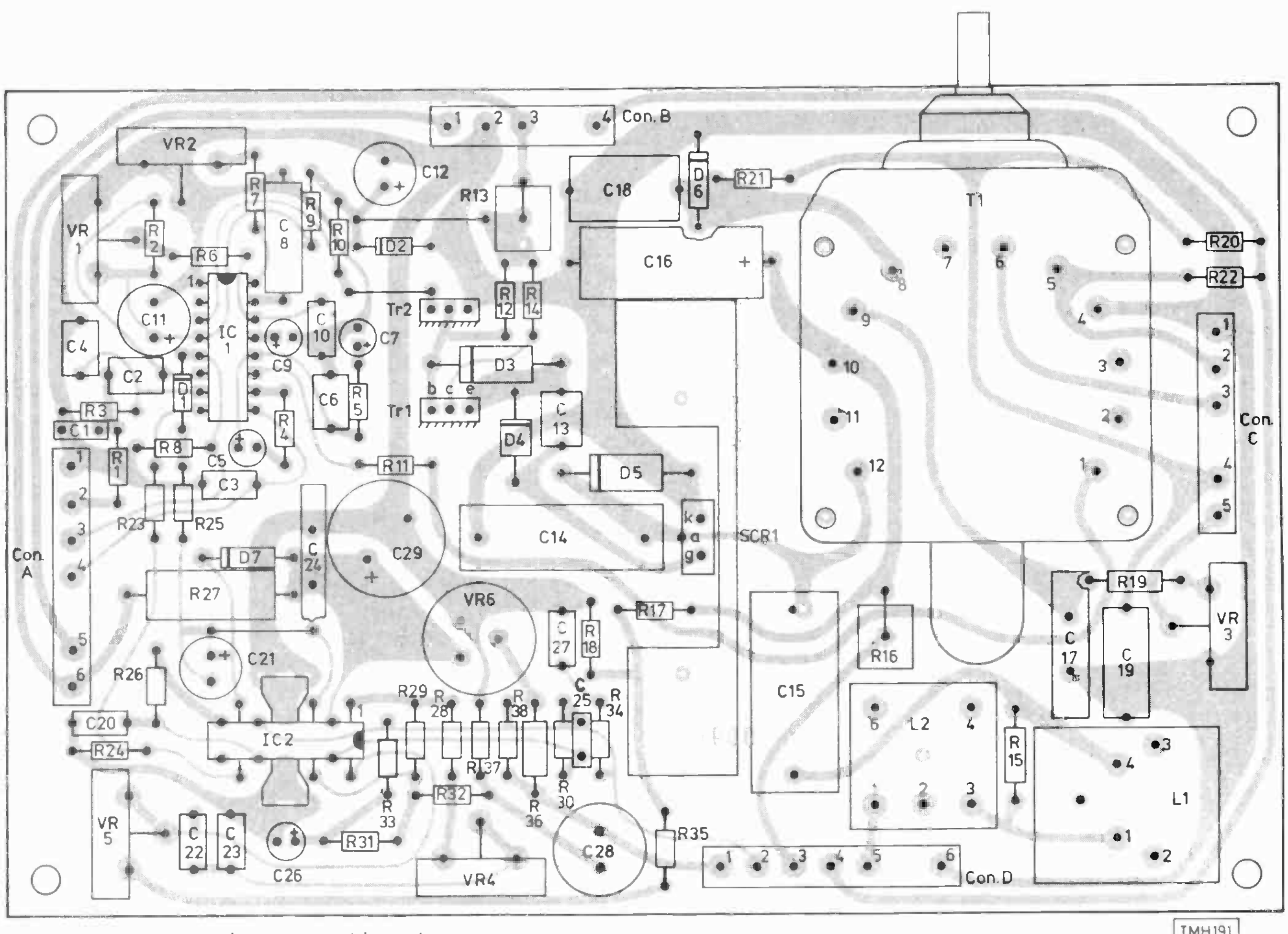



*Fig. 4: Timebase panel component layout.*

# Aerial Stacking

**Roger Bunney**

STACKING two identical aerials, i.e. mounting them side-by-side or one above the other and combining the outputs, gives two advantages. First, since the size of the aerial is effectively doubled, a 3dB power gain (i.e. double the signal) should be obtained – provided the aerials are mounted at the optimum distance apart. In practice, due to the method of combining the signals, the power gain will be slightly less. The second advantage is the improved directional characteristic obtained. With side-by-side stacking there's reduced signal pickup from the sides and a general sharpening of the main, forward acceptance lobe. If the aerials are stacked one above the other, there's a sharper response in the vertical sense, with reduced pickup from above and below. These comments assume that horizontal polarisation is being used.

Stacking fulfills two main requirements therefore, first to increase the gain with weak signal reception, i.e. for fringe reception or DXing, and secondly to tailor the aerial's response for interference reduction.

Wide aerial spacing at u.h.f. presents few problems due to the inherently small aerial dimensions. In Band I however wide spacing becomes impractical. The more elements we employ in an individual array, the higher the gain and the wider the capture area. For maximum gain with a stacked system, the capture areas of the two aerials must just touch without overlapping. Some years ago the WTFDA published several long articles on the practical and theoretical aspects of aerial stacking, and optimum stacking distances were given. At 55MHz (ch. A2) it was suggested that the spacing should be 145in. for aerials with up to five elements, assuming horizontal polarisation and vertical stacking. For a ten-element system, a spacing of 228in. was advised. For their (USA) high band (i.e. our Band III), centred at 200MHz (ch. A11), a spacing of 41in. for up to five elements and 64in. for ten elements was suggested. Unfortunately the sizes of Band I aerials mean that minimum spacings have to be used, in view of the mechanical constraints – this has been the shortcoming with two of the stacked Band I systems I've tried myself.

In the early days of u.h.f. transmissions in the UK Aerialite marketed a vertically stacked, horizontally polarised double-23 system using two wavelength spacing, the outputs being combined via rigid phasing bars. The range of aerials employed gold anodising and was marketed as the "Golden Gain" series. All had an optional five-element add-on extension to improve the forward gain. Generally, at u.h.f. we can achieve high gain with wide spacings, whereas v.h.f. arrays rarely have more than five elements in Band I and 12-13 elements in Band III.

The US Winegard company suggests that optimum results will be obtained at a spacing of 0·92 wavelength when stacking, but that in no case should the spacing be less than 0·5 wavelength. I've checked up on various publications and, depending on the reason for stacking, have found spacings from two wavelengths to 0·75 recommended. The WTFDA's figures were supplied by that well known DXer and MATV personality Bob Cooper however, so I would be guided by these.

The use of stacked systems to reduce interference is quite common, the spacing adopted varying with the type and source of the interference. The object is that the wanted signals should be received by both aerials in phase, whilst the unwanted signals arriving from the side or from below should be received by the aerials with a phase difference, thus reducing the interference when the signals are added or hopefully providing cancellation of the interference. The spacing required varies in accordance with the angle between the interfering and wanted signals, increasing as the angle decreases. This can be quite a complex business, and if a reader has a particular problem with interference I suggest he writes in to me for further consultation. As a rough guide, minimum side pickup is obtained with the horizontal spacing down to 0·5 wavelength.

### Combining the Outputs

So much for the basic reasons for stacking and the factors that have to be taken into account. There remains the problem of combining the outputs from the two stacked arrays in phase. We are fortunate in the UK that 75Ω coaxial cable is generally used (in North America 300Ω balanced ribbon feeder is extensively used). Coaxial cable can be taped directly to aerial booms and the support structure, whereas ribbon feeder has to be handled with care, using stand-offs etc. The advantage with ribbon is that the cable loss is much less.

Basically, to maintain the signals from the two stacked aerials in phase two identical lengths of cable must be used. Assuming that we have two aerials whose impedance at the connection point is 75Ω, to combine the two outputs we connect an identical length of 75Ω feeder to each dipole insulator and connect the free ends together. Since we've paralleled two 75Ω systems, we then have to bring the impedance back to 75Ω to match the 75Ω coaxial downlead. This is done by inserting a single quarter-wave section of 50Ω coaxial cable between the downlead and the junction of the cables from the individual aerials. Note that when calculating the length of the matching section the velocity factor of the cable must be taken into account (see note at end).

Simple though this cable matching arrangement may appear to be, problems arise with a wideband aerial system. The length of the matching section was calculated at a specific frequency, so for correct matching the length would have to vary with the frequency – certainly a group C/D matching section will be somewhat different from a group A section. The matching harness is thus frequency selective and bandwidth limiting. For Band I use the variation in length can be quite dramatic. At u.h.f., Jaybeam appears to be the only company that has available matching/combining harnesses in double or quad stack looms (harnesses for other bands are available to order).

There's an alternative approach however. Some two-three years ago both Labgear (type CM6011/OS) and Antiference (type CS100) introduced in the UK wideband ferrite couplers. These are intended for external mounting (usually in the ubiquitous plastic preamplifier type case) to combine the outputs from two aerials. The isolation between spurs (i.e. the two sets of input terminals when the device is used as a combiner) is 20dB, with an insertion loss of say up to 2dB. The main advantage however is the wideband characteristic (40-860MHz), with no dependence on calculated matching sections. This enables us to combine the outputs from wideband aerials and obtain a relatively

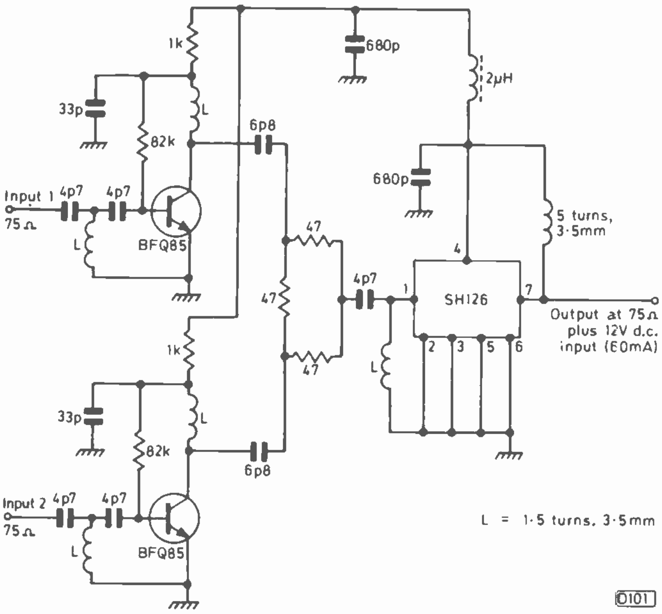



*Fig. 1: Wideband (470-860MHz) active aerial combiner circuit suggested by SGS-ATES.*

uniform performance over the bandwidth. Such combiners have been available in the USA for some years, versions being available with four inputs/outputs (depending on whether used for aerial combination or amplified signal splitting).

The seeker after perfection may be concerned with the insertion loss when using a ferrite coupler to combine signals. In this connection it's interesting to note the active device introduced by the Winegard company for use with their 300Ω aerials. This has a BFR91 transistor wideband u.h.f. amplifier connected to each conductor of a 300Ω ribbon feeder input. Since each amplifier is basically operating in the unbalanced input state, the system could well be used in countries that employ unbalanced aerial systems to combine the outputs from two separate arrays. The output from the two BFR91 stages in the Winegard device is fed to a mixing transformer, the in-phase signals being applied to an output stage and then passing to the downlead in the unbalanced state.

A similar device has been suggested by SGS-ATES, the circuit being shown in Fig. 1. The input from each aerial is fed to a very low noise (typically 2·2dB at 1GHz) BFQ85 transistor for wideband u.h.f. amplifiation, the outputs being combined and fed to a wideband hybrid chip in the SH series.

This enables us to employ stacked wideband u.h.f. arrays, with high gain and the advantages of a narrower forward beamwidth, instead of using separate, single Band IV/V arrays. I'd be interested to hear from anyone trying this out – in fact any comments on the subject of stacking generally would be welcome, since it's a complicated art that requires experience.

### Calculations

Finally, for calculations in free space the half-wave spacing in feet is given by the formula $492/f$ ($f$ = frequency in MHz). The velocity factor of coaxial cable, mentioned earlier, varies in accordance with the type of construction used. In general it can be taken to be 0·8. To find the length of a quarter-wave matching section quickly therefore, use the above formula, multiply the answer by 0·8, then divide by two. ■

# Service Bureau

*Requests for advice in dealing with servicing problems must be accompanied by a 75p postal order (made out to IPC Magazines Ltd.), the query coupon from page 547 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.*

## TELEFUNKEN 709 CHASSIS

**The set went dead after a lot of sparking, but the only fault I could find was the fusible resistor R535 open-circuit. On resoldering this, the valve heaters came on and a horizontal line, at reduced scan, appeared – with no sound. After two minutes the resistor opened again and the set went dead. One thing I did discover whilst the set was on was that the h.t. line was way below its correct 285V.**

In addition to supplying the heater chain, R535 provides an initial 104V start-up supply via diode Gr532 (BY112) to get things going at switch on. The set uses a voltage-doubling mains rectifier circuit, with the second rectifier a thyristor to provide a regulated h.t. line. Should the main power supply fail, only the start-up supply will be present: R535 will pass excessive current, and will spring open. Possible faulty components in the main h.t. supply are the surge limiter resistor R537 (2·5Ω, 15W), which tends to go open-circuit, and the first capacitor C539 (300μF) in the doubler circuit – it tends to arc over internally, causing the associated diode Gr533 (BY112) to blow (a loud cracking or sparking noise often indicates failure here). The thyristor could be faulty, though it's generally reliable (it's a Telefunken special incidentally). If the thyristor is not being triggered, check the control transistor T531 (BC213A or BC307A) which has been known to go short-circuit, also the protection diode Gr539 (BA147-220).

## THORN 8000 CHASSIS

**I'm using this set in conjunction with a Sanyo VTC9300P VCR. The problem is line hooking at the top of the picture – there's nothing wrong with the set otherwise. Can you suggest a modification?**

The modification required for using sets fitted with the 8000/8000A/8500/8800 series chassis with a VCR is simple – reduce the value of C243 in the flywheel sync filter circuit from 10μF to 2μF.

## SONY KV1340UB

**The two 2A mains fuses on the power supply panel blow at switch on. On checking around the board, Q601 and the series regulator transistor Q604 both appear to be short-circuit, also the thyristor Q602. The circuit is unusual to say the least. Any ideas?**

The circuit is unique so far as we know, employing a switched capacitor input arrangement. Q602 is a crowbar device, so the fuses will indeed blow should it be short-circuit. Make sure there are no shorts across the 110V line provided by the series regulator transistor Q604 – things to check are the converter transistor Q801, and the line output and pincushion correction transistors Q505 and Q802, which are in series, also the diodes and capacitors in parallel with Q801 and Q802. We feel that the trouble is probably confined to the power supply however, and suggest that in addition to replacing the defective devices mentioned you check D601-4 for leakage – these diodes, with Q601, comprise the capacitor switching system.

## THORN 8500 CHASSIS

**There's sound but no raster – the sound is difficult to hear however because of mechanical noise coming from the audio output transformer's laminations. When the fault occurred the mains fuse blew, but a replacement has held.**

It's likely that the line output stage is drawing excessive current – check whether the h.t. smoothing resistor R709 is overheating and the voltage across the smoothing capacitor C704 is less than the correct 197V or so. In this event the e.h.t. rectifier has probably failed. Disconnect to check – the h.t. current should then return to normal. If not, suspect the shift choke L401, the line output transformer or possibly the scan coils.

## GRUNDIG 5010

**The picture is sometimes faint and in monochrome when the set is first switched on, with slight interference on sound. After a minute or perhaps longer full colour and sound are present. The colour may snap on or appear slowly – at times it snaps off and on again. All joints around the line output transformer have been remade in case the trouble was due to a missing pulse (there'd been a short-circuit from the transformer to the junction of the tuning capacitors C516/C518 at some time).**

This sounds like dry-joint trouble in the signals circuits. We suggest you remove the i.f. board, take off its screening can and fit it to the rear of the main board. Then probe gently, looking for poor joints which should be remade using a small iron. Be careful around the small ceramic plate capacitors used, and bear in mind that because of the use of printed coils some of the components are soldered through the panel. Take care not to overheat the TBA440 i.c. If this doesn't cure the trouble, check the i.c. and preamplifier (Tr305) voltages: if these vary more than marginally as the fault comes and goes, try using freezer to obtain a positive diagnosis. The same technique can be used on the decoder board if necessary. The faults could also be caused by slight cracks on the main panel, possibly due to a previous rather heavy-handed search for dry-joints. A careful examination of the print may be required.

## KÖRTING HYBRID COLOUR CHASSIS

**The trouble with this set is no sync – neither the field nor the line timebase can be locked. The set is the Transmare, Model no. 54660.**

The usual cause of this fault is failure of the sync separator transistor T106 (BC147B), which is mounted on the video amplifier/beam limiter board. Alternatively its collector load resistor R233 (680kΩ) may have gone high in value.

## ITT CVC9 CHASSIS

**After 1½-2 hours the fusible resistor R381 in the supply to the audio circuit springs open, but I can't find any obvious cause of this. Two new PCL86 audio valves have been**

**tried, and the smoothing capacitor (C272, 25μF) associated with R381 has been checked by substitution.**

The most common cause of this problem is leakage in the audio coupling capacitor C77 (0·022μF), or in C78 (50μF) which decouples the cathode of the pentode section of the valve. We have known more subtle causes however – such as shorting turns in the audio output transformer, leakage across the print or at the valveholder, and R381 itself being faulty.

## *TELEFUNKEN 711 CHASSIS*

**The problem is height variation – starting some ten minutes after the set has been switched on. The change is gradual, but reaches a maximum after about half an hour, when there's a loss of about three inches at the top and bottom of the screen. There's no change in picture width, and the voltage at the height control doesn't vary.**

The 28V supply to the field output stage is obtained from the EW diode modulator in the line output stage. Height variations occur when the voltage on this line (U4) changes as the set warms up. The usual cause is the EW modulator diodes D562/3 (type BYX55), which tend to overheat. The same symptoms occur when the 28V supply reservoir capacitor C564 (2,200μF) dries up.

## *DECCA CTV25*

**This set is one of the single-standed ones and suffers from an a.f.c. fault – the a.f.c. button causes slight detuning, i.e. the set has to be manually tuned and left that way. Operation of the a.f.c. button shifts the tuning to such an extent that the picture is nearly a monochrome one. The fault started on BBC-2, but now affects all three services.**

Tune in the set accurately, then switch on the a.f.c. Carefully adjust L110 in the a.f.c. can on the i.f. panel, using a suitable trimming tool. This should give you spot-on tuning.

## *SONY KV2000UB*

**The mains fuse is o.k. but the set is dead – no sound or raster. A faint plop can be heard when the set is switched on, and the power neon glows.**

The fact that the neon glows indicates that the 132V h.t. line is all right. The chopper transformer also produces a 16V supply, which powers the line oscillator (IC502), so it would appear that this line is missing – or not arriving at IC502. Things to check are R638, D611, C626, D612 on the power supply board and R555, C532 on the timebase board.

## *DECCA 100 CHASSIS*

**The picture is perfect for about twenty minutes. It then begins to break up and for a few minutes performs all kinds of tricks. After this it steadies to give a rather shimmery picture, and a few minutes later we have a perfect picture again. This lasts for only a few seconds however, then away it goes again. A few minutes after this the picture stabilises for the rest of the day. I've changed the TCA270 video i.c. and the TBA920 sync/line oscillator i.c., and have checked thoroughly for dry-joints, but the fault is still there.**

If the video information is impaired during the fault conditions, i.e. with streaks, ringing, poor definition etc., the MC1349 vision i.f. amplifier i.c. (IC101) and the 15V zener diode D101 which stabilises its supply are suspect. If on the other hand the fault is confined to the line sync, check C315, C316 and C310 – these are connected to pins 4, 3 and 12 of the TBA920 i.c. If a scope is available, check for the presence of a line flyback pulse at panel connection point PTC5 when the fault is present (this is the feedback pulse for the i.c.).

## *GEC HYBRID COLOUR CHASSIS*

**Despite turning the contrast and brightness controls to maximum, no picture appears until the set has been on for 40-60 minutes. Two resistors (R704 680Ω and R705 1·8kΩ) on the raster correction panel had burnt out, but the replacements still get hot.**

It's likely that the trouble is due to a dry-joint on the line scan balance coil L701, the line scan coil connections or the raster correction transductor T701 – excessive current would then flow via R704/5. The transductor could be faulty, and it would be worth checking C702 (300pF) which is in series with R705. If the PL509 line output valve runs cool during the fault, try a replacement and check its screen grid feed resistor R54 (2·7kΩ).

## *PANASONIC TC2203*

**During a monochrome transmission, reception is ruined by alternating bouts of blue and white confetti. This can be stopped by turning the colour control down or increasing the width of the magic tuning line.**

This effect, assuming that the signal from the aerial is reasonably strong, sounds like an over-sensitive colour-killer circuit. The colour-killer is inside the TDA2522 i.c. (IC602): we suggest you check R633 (5·1kΩ, 2%) and C609 (2·2μF, 50V), which are connected to pin 16, then suspect the i.c. itself.

## *PURITY PROBLEM*

**There's a purity problem with this set (Decca 30 series hybrid chassis) – the centre section of the test card is excellent, but the bottom left- and right-hand corners have a greenish hue whilst the top centre is inclined to be slightly purple. The purity procedure laid down in the manual has been followed, moving the scan yoke forwards after obtaining a centre red area, but a completely pure red raster cannot be obtained. The same procedure has been carried out with the other two primary colours.**

The manual suggests pulling the scan coils back before adjusting the purity ring magnets: try pushing them fully forwards and then doing the purity ring adjustment. Assuming that there are no gross convergence errors, the loudspeaker is of the correct type, there are no large ferrous objects in or near the receiver, and that the c.r.t. has been manually degaussed, this should work. If not, try the effect of adding small bar or disc magnets (e.g. RS Components types) towards the rear of the degaussing shield. If this fails to cure the problem, a new c.r.t. will be necessary.

**QUERY COUPON**

*Available until 19th August, 1981. One coupon, plus a 75p (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 546.*

**TELEVISION AUG. 1981**

## THORN 9600 CHASSIS

**There's a vertical band, about 1/10th of an inch wide, slightly to the left of the centre of the screen. It takes on a wavy form. The decoder panel was replaced some months ago but the problem returned and has got worse. The band is most noticeable on dark indoor scenes, but is also present on bright outdoor scenes. There are also lines three quarters of an inch in from each side of the screen, i.e. three lines in all.**

The centre vertical line can be minimised as follows. The i.f. output lead from the tuner is connected to the signal panel via a two-pin plug, this area of the panel being covered by a metal screening can. Provide additional earthing here by connecting a heavy earthing lead from the screening can to the nearest chassis metal. The other two lines are probably due to ghosting.

## RANK A823A CHASSIS

**When the set is first switched on, the picture appears in monochrome. The colour takes another ten minutes or maybe longer to appear, then comes on suddenly.**

We suspect the transistors in the chroma amplifier can on the i.f. panel (can Z). There are three transistors, two BC148s and a BC158. Warming and cooling each in turn should reveal whether one of them is responsible for the fault. Otherwise, there's probably a poor contact – check the pins and the preset colour control 2RV6 and its connections.

# TEST CASE

# 224

*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.*

*Intermittent faults are seldom easy to cure: when they occur in the fairly complex circuitry used in VCRs, the stage is set for a battle of wits in the grand style! The spotlight this month falls on a Hitachi machine, Model VT8000E. It's a conventional (as conventional as anything can be in this age of fast moving technology) VHS format VCR, and the fault complained about was that the upper half of the picture was snowy. This apparently occurred only on rare occasions, enough to be a nuisance but not nearly enough so far as our engineer was concerned! There's no hope of tackling a fault like this in the home of course, so into the workshop the machine came, to be settled in a corner to run for eight hours a day.*

*After a day or two the fault suddenly appeared – the symptom was just as described by the customer. Faulty video heads we thought, so in went a new head drum. After a considerable time on soak test however the fault returned.*

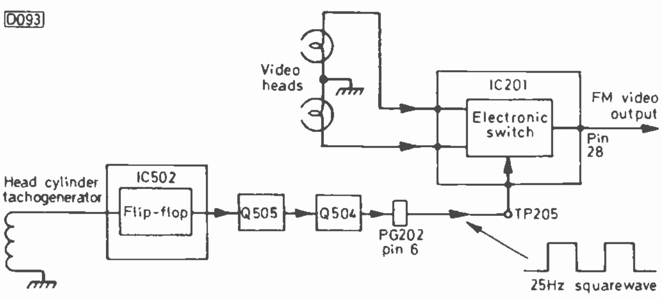



*Fig. 1: Block diagram of the head-switching arrangement used in the Hitachi VT8000E VCR.*

*We decided to run the machine with an oscilloscope connected to pin 28 of IC201 (see Fig. 1), the head amplifier chip's f.m. video output pin. After a while the snow effect returned, and we were rewarded with an oscillogram showing that the output from one video head consisted largely of noise. Attempts to trace the fault back any farther were then frustrated by the machine reverting to normal operation. It was some days before we saw the fault again, and by this time we'd replaced IC201 and hooked in a double-beam scope, with one beam modulated by the output from pin 28 of IC201 as before while the other beam monitored the head switching pulse input to the chip at TP205. This time the scope showed us that when the fault was present the head switching pulse was missing. Good, we're winning!*

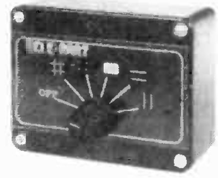
*While the fault was still present we confirmed that the 25Hz squarewave switching pulse was not arriving at its input point to the luminance/chrominance panel, i.e. at pin 6 of plug 202. Onwards and upwards we go! The flip-flop in IC502 (HA11711) on the servo panel produces this pulse, and after satisfying ourselves that the pulse was not being loaded down we suspected the chip – or the inverting buffers Q504/5. At this stage the fault became very elusive, and a great deal of time was spent tracking it down. Any ideas?*

### ANSWER TO TEST CASE 223
### – page 493 last month –

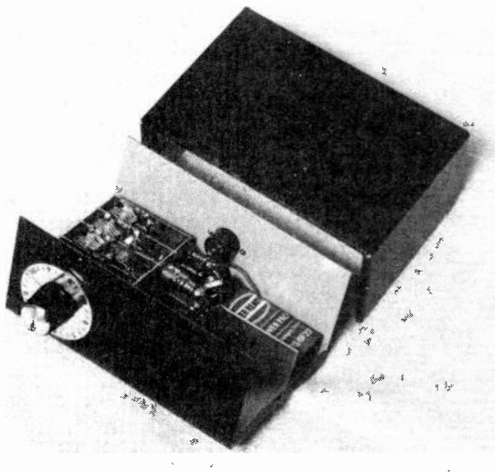
Our tale last month concerned a Bush Model BC6248 with remote control and touch tuning and the habit of occasionally jumping to channel one – though never in the sight of any of our engineers. You will recall that the touch-tune pads and the relevant selector i.c. had been investigated without success.

The man who eventually cleared up the problem went to the house and momentarily interrupted the mains supply to the set. It reverted to channel one of course, as it's designed to do, and the family confirmed that the effect was similar to that when the fault occurred. We gave a clue last month – remember the 15A mains plug? This was found to be corroded and latchety inside, the resulting poor contact being the cause of the problem. The house has since been rewired throughout. Not only is it safer: Crossroads and Coronation Street now flow uninterrupted!

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by Carlisle Web Offset, Newtown Trading Estate, Carlisle. Distributed by IPC Business Press (Sales and Distribution) Ltd., Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £10, Overseas £11 per annum payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.









# MAIL ORDER PROTECTION SCHEME

**INTRODUCTION**

The Office of Fair Trading have agreed that the notice of the Mail Order Protection Scheme to appear in periodicals carrying mail order advertising should appear as follows:—

"**MAIL ORDER ADVERTISING**

**British Code of Advertising Practice**

Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfill orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

**Mail Order Protection Scheme**

If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

(1) You have not received the goods or had your money returned; and

(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the Advertiser has been declared bankrupt or insolvent.

This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example, payment made in response to catalogues etc., received as a result of answering such advertisements. Classified advertisements are excluded."

## SMALL ADS

The prepaid rate for classified advertisements is 25p per word (minimum 12 words), box number 60p extra. Semi-display setting £4.80 per single column centimetre (minimum 2.5 cms). All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Television, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

### SETS & COMPONENTS

**BUSH 20" AND 24"** S/S Mono's. Working order £10 each. Minimum 10. C.O.D. available. (0706) 623404.

**CAMPBELL ELECTRONICS LTD.**
**Distributors of specialist spares to radio and television service depts.**

We stock semiconductors, I/Cs, special T.V. and audio spares, service aids, rebuilt CRTs etc.

Fast off the shelf delivery of stock items.

*Send S.A.E. or telephone for full catalogue and price list.*

**CAMPBELL ELECTRONICS LTD.,**
**Unit 5, Heath Hill Estate,**
**Dawley, Telford, Shropshire.**
**Telephone Telford (0952) 502422.**

**GOOD WORKING CTV's:** Thorn 19" 3K £55, 22" 3K5 £67. ITT CVE5 20" £65. Thorn 4K 22" £85, 26" £85. Bush 2718 20" £75. (No VAT) Tele-Q, Preston (0772) 792547.

***TELFURB T.V. LTD.***

**No. 1 in**

- ★ Used colour T.V.'s
- ★ Competitive prices
- ★ Technical expertise
- ★ Fully equipped premises
- ★ Export

*Phone or Call*

**51-53 HIGH STREET,**
**WHEATLEY, OXFORD.**
**086-77-3849**

**TURN YOUR SURPLUS** capacitors, transistors, etc. into cash. Contact Coles-Harding & Co., 103 South Brink, Wisbech, Cambs. 0945 4188. Immediate settlement.

# SUFFOLK TUBES LIMITED

**214 Purley Way, Croydon, Surrey.**
**Tel: 01-686 7951/2/3/4**

SUPPLIERS OF MONO AND COLOUR TUBES TO MAJOR RENTAL COMPANIES.

ALL COLOUR TUBES HOT PUMPED AT 385c AND REBANDED TO BRITISH STANDARD. 415 1972 CLAUSE 18-2.

19" and 22" TUBES APPROVED. OTHER TYPES PENDING.

BRITAINS LARGEST INDEPENDENT REBUILDER FOR 21 YEARS.

## VALVE BARGAINS

**BOXED & TESTED 30p EACH**

ECC82, EF85, EF183, EF184, PFL200, PCF80, PCF802, PCC84, PCC89, PC97, PC86, PC88, PCL84, PCL805, PCL86, PY800, PY88, PL36, PL504, 6F28, 30PL13, 30PL14.

**COLOUR VALVES 65p EACH**

PY500/A, PL508, PL509/519, PL802.

*Postage & Packing 30p, no VAT*

**VELCO ELECTRONICS**
**9 Mandeville Terrace, Hawkshaw, Via Bury, Lancs.**

**EX-RENTAL COLOUR T.V.'s.** Thorn 3000/3500 in working order. 19" £39, 22" £55, 22" Varicap £59. Cash and collect. Tel: Peterborough (0733) 253480.

## TV PATTERN GENERATOR

UHF output, plugs straight into aerial socket, provides cross-hatch and peak white and 8 bar grey scale. Size 100 × 75 × 40mm.

**£17.75**

price includes battery, P&P, and VAT.
*Further details of this and our other products on request.*

**C. L. JERVIS,**
**15 Mercer Grove,**
**Wolverhampton, WV11 3AN.**
**TEL (0902) 736606.**

**TELEFUNKEN.** We buy/sell T.V.'s, Hi-Fi and components (Supersonic receiver boards especially wanted). Turn your surplus items into cash, or contact us for that elusive component. K. H. GOULD, Ladburn Lane, Shilton, Oxford. Tel. (0993) 841999.

**BUSH 24"/20"** single standard mono's, good working! Clean! £10 each. Minimum ten. Delivery anywhere. C.O.D. (0706) 623404.

## QUALITY REBUILT TUBES

HIGH TEMPERATURE PUMPING

**COLOUR** (2 year Guarantee)

| | |
|---|---|
| 90° up to 19" | **£33** |
| 90° 20" – 22" | **£35** |
| 90° 25" – 26" | **£36** |
| 110° and PIL | **£40** |

**MONO** (including thin necks) from **£12.**

All prices + VAT

Delivery UK Mainland £6.

4 year Optional Guarantee

Send or phone for full list and terms.

**WELTECH PICTURE TUBES**
**Unit 3-10 Wembley Commercial Centre,**
**East Lane, Wembley, Middx.**
**01-908-1816**

**TVDX EQUIPMENT.** Vhf to Uhf converter, 12V supply required £10.50. Band I double notch filter, 40 db plus attenuation £18.30 (state channel). BI mosfet preamplifier, high gain, low noise, mains powered £25.95 BI/II version (to 88MHz) £1 extra. Tunable set side mosfet Uhf preamplifier, mains powered £25.95 Band III type £25.50. Sae data, lists: H. Cocks, Cripps Corner, Robertsbridge, Sussex. Tel. 058083-317.

## COLOUR PANEL EXCHANGE SERVICE

BRC 3000/3500, 8000/8500
GEC 2110 series
Philips G8, G9 and G11

Three months guarantee on all Exchange Panels. Free delivery in London area.

Also Ex-Equipment Panels Thorn 3500 for sale.

All guaranteed Perfect Working Order.

Phone or send SAE for Catalogue.

**KAY JAY TV SERVICE,**
**34, Clauson Avenue,**
**Northolt, Middlesex.**
**Phone 864-0350.**

# TRADE ONLY
# N. W. ELECTRONICS

Have for disposal large quantities of good class

# COLOUR TVs,

Bush, Pye, GEC, Thorn, Hitachi, Philips, etc, (Ex Co-op). Not junk, very clean cabinets.

**Genuine change over TVs and repossessions.**

**From only £20.** Delivery arranged.

**We export large quantities of TVs weekly, can we help you?**

Call now and see our selection, over 1000 TVs to choose from.

**N. W. Electronics, Bolingbroke Buildings,**
**Bolingbroke Street, Bradford 5.**
**3 Mins from Motorways.**
**Tel. 0274 390121.**

PHILIPS
## VIDEO CONVERSIONS
UP TO 5 HOUR DUAL SPEED RECORDING
FROM N1700 - 02 VIDEOS
EASY FIT KIT £65 OR FITTED £83 inc.
EXCELLENT PICTURE QUALITY
USES EXISTING TAPES · SEE DEMONSTRATION
VIDEO · AUDIO IN -OUT FACILITIES £85 inc
N1500-01-02 L.P. CONVERSIONS FROM £105
LVC150's £15 EACH – TAPES REPAIRED

**EVANS VIDEO SERVICES** 061 439 8696
Video Engineering Specialists

## NOTICE TO READERS

*Whilst prices of goods shown in classified advertisements are correct at the time of closing for press, readers are advised to check with the advertiser to check both prices and availability before ordering from non-current issues of the magazine.*

## ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Television for .......................... insertions. I enclose Cheque/P.O. for £ ........................
(Cheques and Postal Orders should be crossed Lloyds Bank Ltd and made payable to Television)

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

NAME ..........................................................................................
ADDRESS ..........................................................................................
..........................................................................................

*Send to:* Classified Advertisement Manager,
**TELEVISION,**
**Classified Advertisement Dept., Rm. 2337, King's Reach Tower, Stamford Street, London SE1 9LS. Telephone 01-261 5846.**
Rate
**25p** per word, minimum 12 words, Box No. **60p** extra.

Company registered in England. Registered No. 53626. Registered Office: King's Reach Tower, Stamford Street, London SE1 9LS.

## SERVICE SHEETS

**Thousands of different full size service sheets** **Thousands of different manuals of all kinds in stock.**
(Many of above are unique to us and obtainable nowhere else.)
**Updated collection of British colour TV circuits/layouts etc.** Contained in 3 huge binders – special price **£39.50.**
**Updated foreign colour TV repair system for £22.50.** (2 manuals, 1 binder) chassis from Grundig, Hitachi, Skantic, Luxor, Mitsubishi, Kuba, Zanussi.
**Complete set of 10 unique TV repair manuals – only £49.50.** Mono + colour from dual standards to latest models, McCourt & Tunbridge
*S.A.E. any quotation, also price lists, newsletter, bargain offers, details of our unique TV repair systems.* £1 – large S.A.E. any single service sheet.
**Phone: 0698 883334, anytime. Callers 4–6 pm. weekdays, Saturday from 10 am.**

**G.T.** **TECHNICAL INFORMATION SERVICE**
**76 CHURCH ST., LARKHALL, LANARKSHIRE ML9 1HE.**

**30,000 SERVICE SHEETS IN STOCK COLOUR MANUALS ALSO AVAILABLE**

**TV Monos, Radios, £1.25. Tuners £1.25. Tape Recorders, Record Players, Transistors and Stereograms+ S.A.E. from £1.25 each except Colour TV Circuits £2. Car Radios £2.00 + SAE. All Radiograms from £1.25.**

State if Circuit will do, if sheets are not in stock. All TV Sheets are full length 24 × 12, not in Bits & Pieces. All other Data full lengths. Free Fault Finding Chart or TV Catalogue with order. Crossed PO's Returned if Sheets Not in Stock.

C. CARANNA, 71 BEAUFORT PARK, LONDON NW11 6BX. 01-458 4882. MAIL ORDER SAE.

**SANDHURST PUBLICATIONS**

Television service sheet specialists. Workshop manuals. Large selection Japanese TV sheets. Thorn step by step repair guides. SAE for catalogue and enquiries.

**49c Yorktown Road, Sandhurst, Camberley, Surrey GU17 7AG.**

**SERVICE SHEETS** from 50p and S.A.E. Catalogue 25p and S.A.E. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

**SERVICE SHEETS,** Radio, TV, etc., 10,000 models. Catalogue 25p plus SAE with orders-enquiries. Telray, 5 Henderson Street, Preston PR1 7XP.

## VETERAN & VINTAGE

**"SOUNDS VINTAGE"**

The only magazine for all vintage sound enthusiasts, packed with articles by top writers, covering gramophones, phonographs, 78s, wireless, news, history, reviews, etc.
Bi-monthly. Annual subscription £6.60 (airmail extra). Send 75p for sample copy.

**28 Chestwood Close, Billericay, Essex**

**"PETO SCOTT VINTAGE TV."** Projection consol model. Working condition, buyer collects £30. Tel. (09064) 4300.

## BOOKS & PUBLICATIONS

**ANY SINGLE SERVICES SHEET £1.** L.S.A.E. Thousands different repair/service manuals/sheets in stock. Repair data your named TV £6 (with circuits £8). S.A.E. Newsletter, price lists, quotations. AUS (T), 76 Church Street, Larkhall, Lanarkshire. (0698 883334).

**DX-TV**

The **2nd EDITION** of 'Guide To World-Wide Television Test Cards' by Keith Hamer and Garry Smith is now available. Over 100 countries are featured with 240 photo's of Test Cards, Clock and Identification captions, etc plus additional information on transmission standards, colour systems and Services. Available, price **£2.85** fully inclusive World-wide (Air Mail Europe £3.25; Rest £3.60) from:–

**HS PUBLICATIONS**
**Dept. T(E), 7 Epping Close, Derby DE3 4HR.**

**OUT OF PRINT BOOK SERVICE,** 17, Fairwater Grove (E), Cardiff. Send S.A.E. for details.

**COMPLETE FAULT GUIDES** with circuits and step by step charts. Thorn 3K-8K-9K series, Philips G8, Pye 713/715 series, £4 each chassis type.

## WANTED

**THORN 1500 SETS WANTED,** working or not (22" or 24"). Nuneaton 382956.

**BACK ISSUES** "Television" Magazine wanted; November, December 1977, January 1978, June, July, August 1978. Phone Chelmsford 51232.

**NEW VALVES** and CRT's required, PCL805, PL504, PL509, PY500A etc. Cash waiting. Bearman, 6/8 Potters Road, New Barnet, Herts. Tel. 01-449 1934/5.

# N.G.T. COLOUR TUBES

*First* Independent Rebuilder with

**B.S.I. CERTIFICATION**

*(Certificate No. 004)*

**2 year guarantee: 4 year option**

All Colour Tubes are debanded, high temperature pumped and rebanded using new adhesives and new tension band.

19" **£30,** 20" **£32,** 22" **£33,** and 26" **£38.**

*Exchange prices: add VAT at 15%*

**N.G.T. ELECTRONICS LTD.,**
**120, SELHURST ROAD, LONDON S.E.25**
**Phone: 01-771 3535.**

*20 years experience in television tube rebuilding.*

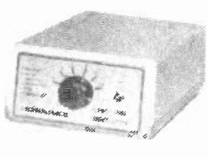
# MULLARD COLOUREX TUBES FULL MULLARD GUARANTEE

| | |
|---|---|
| 19" Special Offer | £26.00 |
| 20" A51/110 | £32.00 |
| 22" A56/120X | £34.00 |
| 26" A66/120X | £36.00 |

ALL PRICES PLUS VAT OLD GLASS RETURNABLE
5 PIECES OR OVER, ANY MIX, 5% DISCOUNT

TRITEL
CEDAR HOUSE, NOBEL ROAD, ELEY ESTATE, EDMONTON, LONDON N18.
TEL: 01-807 4090

## COLOUR BAR GENERATOR UHF AERIAL INPUT PATTERN GENERATOR



★ GREY SCALE
VERTICALS ★
★ WHITE
DOT MATRIX ★
★ HORIZONTALS
CROSS HATCH ★

★ ADD ON PAL COLOUR BARS ★

Send SAE for full specifications.
Batteries not included.

| | | | |
|---|---|---|---|
| PG6RF | Kit **£28.75** | Built **£37.95** | |
| C6 | Kit **£20.75** | Built **£29.90** | |
| CPG6RF | Kit **£48.30** | Built **£72.45** | |

ACCESS ORDERS ACCEPTED

Price includes P&P and 15% VAT.
VHF versions available.
Full 12 month guarantee on built units.

MAIL ORDER ONLY FROM

**TECHNALOGICS LTD. (Dept TV),**
**394 SCOTLAND ROAD,**
**TAYLOR STREET INDUSTRIAL ESTATE,**
**LIVERPOOL, 5.**
**051 207 3799**

**Equivalent**
**EQ TCA 270 series**

| | |
|---|---|
| CA270CE | 50p |
| CA270CW | 50p |
| CA3089Q | 50p |
| **I.C.'s** | |
| MC1327 | £1.00 |
| MC476P | 50p |
| MC1349 | 50p |
| MC1352P | 75p |
| MC1748CP1 | 50p |
| PUA758PC | £1.00 |
| S7246/N64100 | £5.00 |
| SAA1020 | £6.00 |
| SAA1021 | £5.00 |
| SAA1024 | £4.00 |
| SAA1025 | £5.00 |
| SAS560 | £1.00 |
| SAS570 | £1.00 |
| SBA750B | £1.00 |
| SL901 | £3.00 |
| SL918 | £3.00 |
| TAA320A | 50p |
| TAA470 | £2.00 |
| TAA550 | 20p |
| TAA570 | £1.00 |
| TAA700 | £2.00 |
| TBA120A | 40p |
| TBA120AS | 40p |
| TBA120B | 40p |
| TBA120C | 40p |
| TBA120SA | 40p |
| TBA120SB | 40p |
| TBA120U | 40p |
| TBA1441 | £1.00 |
| TBA396 | £1.00 |
| TBA480Q | £1.00 |
| TBA510 | £1.00 |
| TBA520Q | £1.00 |
| TBA530 | £1.00 |
| TBA540 | £1.00 |
| TBA550Q | £1.00 |
| TBA560CQ | £1.00 |
| TBA560Q | £1.00 |
| TBA570 | £1.00 |
| TBA625 | £1.00 |
| TBA641 | £1.50 |
| TBA651 | 80p |
| TBA673 | £1.00 |
| TBA720A | £1.00 |
| TBA750Q | £1.00 |
| TBA800 | 40p |
| TBA810S | £1.00 |
| TBA820 | £1 each |
| TBA890 | £1.00 |
| TBA920 | £1.00 |
| TBA920Q | £1.00 |
| TBA950 | £1.00 |
| TBA950Q | £1.00 |
| TBA990Q | £1.00 |
| TCA270 | £1.00 |
| TCA270Q | £1.00 |
| TCA270SQ | £1.00 |
| TCA4500A | £1.00 |
| TCA640 | £1.00 |
| TCA650 | £1.00 |
| TCA740 | £1.00 |
| TCA800 | £1.00 |
| TCA830S | £1.00 |
| TCE82 | 30p |
| TCE120CQ | £1.00 |
| TCE157 | 20p |
| TCE527 | 20p |
| TCEP100 | £1.20 |
| TDA1003 | £1.00 |
| TDA1170 | £1.20 |
| TDA1190Z | £1.20 |
| TDA1327 | £1.00 |
| TDA1412 | 50p |
| TDA2540 | £1.00 |
| TDA2002 | £1.00 |
| TDA2640 | £1.00 |
| TDA2680 | £1.00 |
| TDA2690 | £1.00 |
| TDA3960 | |
| SN1682AN | £1.00 |
| SN16964AN | 50p |
| SN29764 | £1.00 |
| SN29848 | 50p |
| SN75108AN | £1.00 |
| SN76001 | £1.00 |
| SN76003 | £1.00 |
| SN76003* | £1.50 |
| SN76008KE | £1.00 |
| SN76013* | £1.50 |
| SN76018KE | £1.00 |
| SN76023* | £1.50 |
| SN76033 | £1.00 |
| SN76033* | £1.50 |
| SN76115 | 50p |
| SN76131 | 50p |
| SN76226 | £1.00 |
| SN76227 | 50p |
| I.L.I. Infrared Led Phototransistor Opto Isolators | 50p |
| Breakdown Voltage 2.500V | |

**I.C.'s—cont.**

| | |
|---|---|
| SN7630P | 50p |
| SN7650N | £1.00 |
| SN76532 | 50p |
| SN76533 | £1.00 |
| SN76544N | £1.00 |
| SN76546 No. 7 | £1.00 |
| SN76550 | 15p |
| SN76570 | 50p |
| SN76650N | 50p |
| SN76660N | 50p |
| SN76666N | 50p |
| SN76707N | 50p |
| TBA820 | £1.00 |
| Touch Tune I.C. ML236E | £2.00 |
| FT3055 | 20p |
| Thorn 3500 A1 diodes | 15p |
| AD149 | £1.00 |
| BZW70 6·2 | 10p |
| BD116 | 25p |

*Denotes with heatsink.

**Semiconductors**

| | |
|---|---|
| AC128 | 25p |
| AC153K | 25p |
| AC176K | 25p |
| AC187/8K pair | 50p |
| AF139 | 25p |
| AU113 | £1.25 |
| BA159 | 7p |
| BA182 | 7p |
| BA248 | 7p |
| BAV10 | 7p |
| BB103VHF | 7p |
| BB105UHF | 7p |
| BC107 | 7p |
| BC108 | 7p |
| BC109 | 7p |
| BC116 | 7p |
| BC139 | 7p |
| BC142 | 15p |
| BC147C | 7p |
| BC148B | 7p |
| BC149C | 7p |
| BC154 | 7p |
| BC157 | 7p |
| BC158 | 7p |
| BC171 | 7p |
| BC171B | 7p |
| BC173 | 7p |
| BC173C | 7p |
| BC174 | 7p |
| BC182L | 7p |
| BC183 | 7p |
| BC183LB | 7p |
| BC207 | 7p |
| BC212LT | 7p |
| BC213LA | 7p |
| BC237B | 7p |
| BC238 | 7p |
| BC238A | 7p |
| BC238C | 7p |
| BC245 | 7p |
| BC250 | 7p |
| BC251A | 7p |
| BC252C | 7p |
| BC257 | 30p |
| BC300 | 30p |
| BC303 | 30p |
| BC307 | 7p |
| BC308B | 7p |
| BC327 | 7p |
| BC336 | 20p |
| BC337 | 7p |
| BC350 | 20p |
| BC365 | 10p |
| BC413C | 7p |
| BC454 | 7p |
| BC455 | 7p |
| BC460 | 20p |
| BC462 | 7p |
| BC463 | 7p |
| BC546 | 7p |
| BC548A | 7p |
| BC559 | 7p |
| BD124 | £1.50 |
| BD131 | 30p |
| BD132 | 30p |
| BD136 | 10p |
| BD207 | 30p |
| BD221 | 20p |
| BD228 | 25p |
| BD238 | 20p |
| BD239 | 12p |
| BD331 | 25p |
| BD332 | 25p |
| BD253B | 35p |
| BD416 | 25p |
| BD561/2 pair | 30p |
| BD595 | 35p |
| BD596 | 35p |
| BD681 | 25p |
| BD807 10/a/70V | |
| BD534 | 20p |
| NPN 9 watt | 25p |

**Semiconductors—cont.**

| | |
|---|---|
| BF127 | 20p |
| BF137 | 20p |
| BF157 | 20p |
| BF180 | 20p |
| BF181 | 20p |
| BF182 | 20p |
| BF185 | 20p |
| BF195 | 7p |
| BF198 | 7p |
| BF200 | 20p |
| BF237B | 7p |
| BF240 | 7p |
| BF245A | 7p |
| BF263P | 15p |
| BF264 | 20p |
| BF273 | 7p |
| BF274 | 7p |
| BF337 | 24p |
| BF355 | 30p |
| BF234 PNP | 7p |
| BF458 NPN | 12p |
| BF458T | 12p |
| BFR79 | 15p |
| BFT34 | 20p |
| BFT43 | 20p |
| BFY50 | 15p |
| BFY90 | 15p |
| BR100 | 30p |
| BSS68 | 20p |
| BSX20 | 5p |
| BSY79 | 7p |
| BT100 | 30p |
| BT106 | £1.00 |
| BT106 special | 50p |
| BT109 | £1.00 |
| BT116 | £1.00 |
| BT119 | £1.00 |
| BT138/10A | 70p |
| BT146 | 25p |
| BT151/800R | 70p |
| BTT822 | £1.00 |
| BTT8124 | £1.00 |
| BTT8224 | £1.00 |
| BTY80 | 20p |
| BU105 | 50p |
| BU105/04 | £1.00 |
| BU108 | £1.00 |
| BU124 | 50p |
| BU126 | £1.00 |
| BU137 | 60p |
| BU204 | 40p |
| BU205 | £1.00 |
| BU208 | 70p |
| BU208A | £1.00 |
| BU208/02 | £1.00 |
| BU326 | 60p |
| BU407 | 50p |
| BU500 | £1.00 |
| CA270 | 50p |
| CA270EW | 50p |
| E1222 | 20p |
| R2008B | £1.00 |
| R2010B | £1.00 |
| R2603 | 50p |
| RCA16573 | 30p |
| OA90 | 7p |
| OT112 | £1.00 |
| MJE51T NPN 300V 4A | 25p |
| MJE2955/15A | 50p |
| MJE1661 | 25p |
| MJE2801 | 30p |
| BY127 | 10p |
| BY133 | 10p |
| BY176 type | 25p |
| BY176 | 50p |
| BY179 | 35p |
| BY184 | 25p |
| BY187/01 | 10p |
| BY190 | 40p |
| BY204/4 | 7p |
| BY206 | 10p |
| Fast Recovery Diodes 2 amp 600 to 800 volts | 8p each |
| BY210/400 | 7p |
| BY210/800 | 10p |
| BY233 5A/1500V | 25p |
| BY226 | 10p |
| BY296 | 10p |
| BY298 | 12p |
| BY299 | 10p |
| BYF3123 wire end | 50p |
| BYF3126 wire end | 50p |
| BYF3214 20Kv | 50p |
| BYX36/600 | 10p |
| BYX38/600 | 50p |
| BYX55/350 | 10p |
| BY225 4.8 amps | 10p |
| BYX38/300 | 25p |
| BYX71/350 | 25p |
| BYX72/300 | 25p |
| 2N390 | 7p |
| 2N2222 | 7p |
| 2N3055 | 35p |
| 2N3566 | 7p |
| 2N4355 | 7p |
| 2N4442 | 60p |

| | |
|---|---|
| 2N4444 | £1.00 |
| 2N3983 | 30p |
| 2N6099 | 25p |
| 2N6348 | 50p |
| 2N6399A | 30p |
| 2SK30A | 7p |
| TIP29C | 20p |
| TIP29A | 20p |
| TIP30A | 20p |
| TIP31A/B | 20p |
| TIP32 | 20p |
| TIP33B 10A/80V | 25p |
| TIP41A-42 pair | 50p |
| TIP100 | 30p |
| TIP2955.S | 40p |
| NPN TIP130 60V/8A | 25p |
| IN60 | 3p |
| IN3899 | 50p |
| IN4003 | 5p |
| IN4004 | 5p |
| IN4005 | 5p |
| IN4006 | 5p |
| IN4007 | 5p |
| XK3123 4000 Thorne Diodes | £1.00 |
| IR106 | 40p |
| Y716 | 20p |
| Y827 | 30p |
| 1 amp/400V | 20p |
| 1 amp/1600V | 7p |
| 3 amp/100V | 7p |
| 3 amp/300V | 10p |
| 3 amp/1200V | 7p |
| W04 bridge | 15p |
| W005 bridge | 25p |
| ITT bridge 1½A C73 | 20p |
| 3 amp bridge | 25p |
| B30C 600A6 | 12p |
| B30C 500 | 12p |
| 1 amp/100V | 20p |
| NKT279, AC128 | 12p |
| MC7724CP | 40p |
| **Condensers** | |
| 4700/25 | 25p |
| 470/25 | 10p |
| 220/40 | 5p |
| 1500/40 | 10p |
| 1250/50 | 10p |
| 220/63 | 10p |
| 1000/63 | 15p |
| 700/250 | 35p |
| 800/250 | 30p |
| 4/350 | 5p |
| 8/350 | 8p |
| 400/350 | 50p |
| 220/450 | 50p |
| 10/500 | 10p |
| 33/500 | 10p |
| .1/800 | 10p |
| .047/1000 | 10p |
| .01/1000 | 10p |
| .47/1000 | 30p |
| .0047/1500 | 10p |
| 1N8/1500 | 10p |
| 2N2/1500 | 10p |
| .1/2000 | 15p |

**Tuner Units Varicap and Mechanical repaired. Please ask for estimate.**

8 mixed gun switches £1.00

**Various Mixed Packs**

| | |
|---|---|
| 20 Mixed Convergence Pots | £1.00 |
| 100 Mixed EHT Rectifier Sticks | £1.00 |
| 10 Thermistor | 50p |
| 20 Slider Pots | £1.00 |
| 30 Presets | 50p |
| 40 Pots | £1.50 |
| 300 Condenser | £1.50 |
| 300 Resistor | £1.50 |
| 150 Electrolytic | £2.00 |
| 15 bulbs | 45p |
| 100 diodes | £1.00 |
| 100 20mm fuses | £2.00 |
| 100 W/W resistors | £1.50 |
| 200 ceramic and plate condensers | £1.00 |
| 2·7 meg & 4·7 meg 10% resistor 100, OFF | 50p |
| 300 Carbon film ¼W 1R to 2M ITT | £1.50 |
| 20 slider knobs | £1.00 |
| 1800/4KV | 5p |
| 4·7NF/5KV | 10p |
| 180PF/6KV | 10p |
| 210PF/8KV | 10p |
| 270PF/8KV | 10p |
| 330PF/8KV | 10p |
| 1000PF/10KV | 10p |
| 1200PF/12KV | 10p |
| 1000PF/12KV | 10p |
| 6200PF/2000V | 10p |
| BYW56 1000V/2A BDX32 | £1.20 |
| TIC126N Thyristors 800V/12A | 65p |
| 4000 Thorn Set Thick Films in Stock. | |
| 8″ Insulated Pliers | £2.00 |
| 7 Lamps for Push Button Units | 25p |
| Stereo Headphone SH870Q 4 Channel | £5.00 |
| U322 V/Cap T/Unit U.H.F. | £6.00 |
| 47M/250V | 10p |
| 680M/40V | 10p |
| 8M/300V | 5p |
| 9000 Thorn Line O/P Transistors with Heatsink T903 8V | £1.00 |
| SW150 Surface Acoustic Wave Colour T.V. Filters | £1.00 each |

We have a number of ITT spares panels for CVC 25, 30, 35, 40 and 45. 400+200+200 350V **£2.00.**
Varicap tuner unit 50mgs. 2300mgs. **£3.50.**

# SENDZ COMPONENTS

**63 BISHOPSTEIGNTON, SHOEBURYNESS, ESSEX, SS3 8AF**

**Reg. Office Only.**
**Callers by appointment only.**
**Add 15% VAT and 50p P. & P.**
**All items subject to availability.**
**Add postage for all overseas parcels.**