JULY 1986

Australia $2, New Zealand $2.50, Malaysia $5.75 £1·20

# TELEVISION

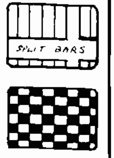
SERVICING·PROJECTS·VIDEO·DEVELOPMENTS


Servicing the Panasonic NV7000
Colour CRT Electron Gun Technology
Servicing Notes on Sonatel and Morphy Richards Mono Portables
Line Output Stage Operation
The Grundig CUC Chassis • DX-TV
VCR Clinic • TV Fault Finding

# MANOR SUPPLIES

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

**TEST DEMONSTRATIONS AT 172 WEST END LANE**



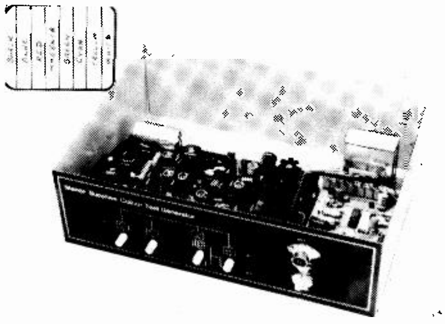

- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
-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

| | |
|---|---|
| Price of Kit | **£70.00** |
| Case (10″×6″×2¼″) app. | **£8.60** |
| Optional Sound Module (6MHz or 5.5MHz) | **£3.90** |
| Built & Tested in Case including Sound Module | **£108.00** |

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.50
Add VAT 15% TO ALL PRICES

## PAL COLOUR BAR GENERATOR (Mk4)



- ★ 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 MK 4 COLOUR BAR GENERATOR KIT £30.00. CASE £8.60. BATT HOLDERS £4.20. MAINS SUPPLY KIT £4.20 (Combined P&P £2.20).**

**MK 4 (BATTERY) BUILT & TESTED £58.00 + £2.20 P & P.**
**MK 4 (MAINS) BUILT & TESTED £68.00 + £2.20 P & P.**
**VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £5.75.**
**EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.**

**ADD VAT 15%**

**THORN TX9 MK2/3, TX10, teletext**
Mullard Decorder panel + Interface **£35.00** p.p. £1.80
**THORN TX10, PHILIPS G11 PRESTEL, TELETEXT**
Mullard Units VM 6230, 6330 plus Line Coupler & Interface **£38.00** p.p. £2.50
**EXTERNAL TELETEXT ADAPTOR**
(RADOFIN) with cable remote control. Fully tested. **£150.00** p.p. £3.00. Plugs into aerial socket of any T.V.
**SPECIAL OFFER** (shop customers only).
**SURPLUS 'AYR' TELETEXT EXTERNAL ADAPTOR UNITS.**
Ideal for experimental use **£50.00.**

# TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

**SPECIAL OFFER** Ex rental T.V. Sound & Vision Tuner Units. Ideal as front end for Monitors, Portable Video, HiFi, etc. Deluxe Cabinet, mains operated, 8 position selector, Saw Filter IF. Only **£15.00** p/p £2.80.
**SPECIAL OFFER** Mullard/Philips quality UHF modulator (audio & video input) ex new equipment **£5.00** p.p. £1.00.
**PHILIPS G11 PANELS** (tested).
Power, frame, IF, decoder **£18.00** each p.p. £2.00. Scan Panel **£28.00** p.p. £2.80.
**PHILIPS G11 PANELS** ex rental (untested).
Power, frame, IF, decoder **£10.00** each p.p. £2.00.
**PHILIPS HANDSETS** Ex rental, Teletext, Untested. KT3, K30, CTX, KT4, K35 etc. **£5.00** p.p. 80p.
**THORN 9000** Fault Finding Guide **£1.00** p.p. 30p.
**THORN REMOTE CONTROL HANDSETS**
**8800/9800** (2-button) **£10.00; TX9 ULTRASONIC** (3-button) **£15.00; TX9, TX10** Infra red **£18.00; TX9, TX10** Infra red Teletext **£20.00,** p.p. £1.20.
**TX10** Remote & Tuning control panel (1515) **£9.40** p.p. £1.50
**TX9/TX10** Teletext interface panel (1524) **£5.00** p.p. 80p.
**THORN TX9** Ultrasonic Remote/Control/Receiver panels. **£8.50** p.p. £1.50.
**THORN TX10** Series Facia Control Panel with 8 position Channel Selector **£6.50** p.p. £1.50.
**SAW FILTER IF AMPLIFIER PLUS TUNER** complete and tested for T.V. Sound & Vision. **£28.50** p.p. £1.20.
**THORN TX9, TX10** Saw Filter IF Panel. **£5.00** p.p. 80p.
**PAL DECODER KIT** (Video to RGB) for Monitors **£27.00** p.p. £1.00.
**PAL ENCODER KIT** (RGB to Video) **£18.50** p.p. £1.30.
**TELETEXT DECODERS** New & Tested Mullard VM 6101 **£30.00,** Texas XM11 **£40.00,** KT3 Tested **£30.00,** Untested **£5.00** p.p. £1.60
**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. **£12.00** p.p. 80p. (Alum. Case **£2.90,** De Luxe Case **£6.80** p.p. £1.40.) **ADDITIONAL GREY SCALE** Kit **£2.90** p.p. 45p.
**UHF SIGNAL STRENGTH METER KIT £22.00** Alum. Case **£2.90.** De Luxe Case **£8.60** (Built & Tested **£48.00**) p.p. £2.30.
**CRT TESTER & REACTIVATOR KIT** For Colour & Mono complete with Case, Panel Meter Indicator – can be adapted for latest CRTs **£29.50** p.p. £2.80.
**BUSH A823** Convergence, Time Base Panels **£5.00** each. p.p. £1.80.
**BUSH Z718** BC6100 series IF Panel **£5.00** p.p. 90p.
**BUSH A816** IF Panel (Surplus) **£1.00** p.p. 90p, 5 for **£4.00** p.p. £1.40.
**GEC 2040** Decoder Panels, **£1.50** p.p. £1.80.
**GEC 2110 PANELS** Frame **£8.50** p.p. £1.40. Sound **£2.50** (tested) p.p. 80p.
**GEC 20AX** Line Time Base **£18.00.** IF-Decoder **£12.50** p.p. £2.00.
**PYE 691-7** CDA Panels. Makers tested stock. **£6.00** p.p. £1.45.
**THORN TX9** Panels ex factory for small spares. Includes I.Cs & Semiconductors etc. **£3.00** p.p. £1.80.
**THORN TX9** Panels salvaged ex factory for spares incl. LOPT & Mains Transformers. **£10.00** p.p. £2.80.
**THORN TX9** Panels ex factory salvaged complete cond. **£20.00** p.p. £2.80.
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**THORN 8000/8500** IF/Decoder Panels salvaged **£3.20** p.p. £1.80.
**THORN 9000** IF/Decoder Panels Salvaged. For spares **£2.50** p.p. £1.80.
**THORN 9000** Frame Time Base **£8.50** p.p. £1.80.
**PHILIPS G8/G9** IF/Decoder Panels for small spares incl ICs **£2.50** p.p. £1.60.
**PHILIPS G8** Line Driver Panel incl. Equalizing Coil. **£1.00** p.p. 60p.
**G11 PANELS,** Ex Rental SCAN (incl LOPT) **£28.00** p.p. £2.50 (tested).
**G11 PANELS,** Power, Frame, IF, Decoder, **£18.00** each. p.p. £2.00 (tested).
**GRUNDIG 8630** Series Varicap Tuners **£5.00** p.p. £1.00.
**U321**, ELC1043/5 **£7.80** p.p. 80p. Makers Controls PYE CT200 4PSN **£7.50,** BUSH 4PSN **£4.80,** DECCA 4PSN **£5.80,** 6PSN **£6.80** p.p. 80p. etc.
**BUSH "TOUCH TUNE"** Varicap Control Z585, 710 **£3.80** p.p. £1.00.
**VARICAP UHF-VHF** ELC 2000S **£9.80** p.p. £1.00.
**UHF/625 TUNERS,** many different types in stock. DECCA Bradford 5 position, MULLARD 4 position **£2.50,** JAP Rotary **£4.80** p.p. £1.80.
**TV SOUND** IF Panels **£6.80** p.p. £1.00.
**LOPT TESTER,** Service Dept approved **£15.90** p.p. £1.20.
**LOPTS** New and guar. P/P Mono **£1.35,** Colour **£1.50,** Bobbins **80p.**

| | | | |
|---|---|---|---|
| **BUSH, MURPHY** 774 series | **£9.80** | **R.B.M.** T20, T22 | **£9.80** |
| **BUSH, MURPHY** A816 series | **£9.80** | **R.B.M.** T20, T22 Bobbin | **£5.60** |
| **FERG., HMV, MARCONI, ULTRA** | | **DECCA** Bradford (state Mod No) | **£8.80** |
| 1500.1590.1591.1612,1613,1712 | **£4.80** | **DECCA** 80, 100 | **£8.80** |
| **THORN** 1600, 1615, 1690, 1691 | **£9.15** | **FIDELITY** ZX2000, 3000 | **£16.00** |
| **GEC** series 1 & 2 | **£8.00** | **GEC** 2110 series | **£10.60** |
| **INDESIT** 20/24EGB | **£7.65** | **ITT** CVC 5 to 9, CVC20 | **£9.80** |
| **ITT/KB** VC200, 300 | **£7.90** | **ITT** CVC25, CVC30 series | **£8.80** |
| **PHILIPS** 170, 210, 300 series | **£7.65** | **ITT** CVC45 | **£9.80** |
| **PYE, INVICTA, EKCO.** | | **PYE** 691-697 (state model no.) | **£10.00** |
| 368, 169, 569, 769 series | **£7.65** | **PYE** 725 (90°) 731 to 741 | **£9.20** |
| **SPECIAL OFFER** | | **PHILIPS** G8 | **£8.80** |
| **DECCA** 1700, 2001, 2020, 2401, 2420 | **£3.80** | **PHILIPS** G9 | **£9.80** |
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| **PHILIPS** 320 | **£2.80** | **THORN** 3000/3500 SCAN, EHT | **£6.90** |
| **RBM** A823 | **£4.80** | **THORN** 8000, 8500, 8800 | **£12.80** |
| **GEC** 2028, 2040, 2100 | **£4.80** | **THORN** 9000 to 9600 | **£12.90** |
| **PYE** 713, 715 | **£6.80** | **THORN** 9800 | **£19.80** |
| **PHILIPS** 570, 571 | **£6.80** | **THORN** TX9 | **£14.80** |

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**TRIPLERS** Full range available. Mono & Colour.
**Special Offer:** THORN 3000/3500 EHT Tripler **£2.50** p.p. £1.30.
6·3V CRT Boost Transformers for Colour & Mono **£5.90** p.p. £1.40.
**THORN TX10** focus control **£8.80** p.p. 80p.

**CALLERS WELCOME AT SHOP PREMISES**
**THOUSANDS OF ADDITIONAL ITEMS, ENQUIRIES INVITED**
**LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS**

Goods available if in stock immediately over shop counter (Mail order between 3 days and 1 week from receipt of order). ADD VAT 15%

**Telephone 01-794 8751, 794 7346**

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**W. Hampstead Brit Rail Stn. (St Pancras, Bedford)**
**Access from all over Greater London.**
**Mail Order: 64 GOLDERS MANOR DRIVE, LONDON NW11 9HT**
**PLEASE ADD VAT 15% TO ALL PRICES INCL P+P**

# TELEVISION

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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., King's Reach Tower, Stamford Street, London SE1 9LS.

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Some back issues published during the last six months are available from the Editorial Office at £1·40 inclusive of postage and packing. Address as above.

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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 on 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").

# this month



**OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 16**

# P. V. TUBES

**104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.**
**Tel: 0254 36521/32611 Telex: 635562 Griffin G (For P.V.)**

### HOW TO ORDER

ADD 87p per order P+P (U.K.). Heavier parcels e.g. cable, service aids, degaus. coils please allow £1.50 P+P (U.K.). Export orders charged at cost. First Class Mail is used whenever possible. Add 15% VAT to total except where it states zero rate.

Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible. We try our best to give a speedy, fair and efficient service. V.A.T. invoice on request. Give us a ring – we'll give you service. Please ask if what you need is not listed – we will try to help. Prices are subject to change without notice. In some cases we may have to supply an equivalent.

## SEMICONDUCTORS

| | |
|---|---|
| AC107 | 35 |
| AC126 | 34 |
| AC127 | 34 |
| AC128 | 34 |
| AC128K | 40 |
| AC141 | 62 |
| AC141K | 39 |
| AC176 | 35 |
| AC176K | 35 |
| AC186 | 41 |
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| AC188 | 35 |
| AC188K | 46 |
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| AD143=OC28 | 82 |
| AD161 | 54 |
| AD162 | 54 |
| AD161/62 MP | 1.15 |
| AF106 | 49 |
| AF114 | 89 |
| AF118 | 1.20 |
| AF121 | 75 |
| AF124 | 48 |
| AF125 | 53 |
| AF126 | 53 |
| AF127 | 53 |
| AF139 | 63 |
| AF178 | 1.54 |
| AF239 | 60 |
| AF279 | 1.56 |
| AL102 | 4.90 |
| AU106 | 7.50 |
| AU110 | 3.01 |
| AU113 | 5.20 |
| BC107 | 20 |
| BC108 | 20 |
| BC109 | 20 |
| BC114 | 12 |
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| BC172 | 15 |
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| BC177 | 27 |
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| BC183L | 15 |
| BC184L | 15 |
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| BC300 | 50 |
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| BC303 | 33 |
| BC307 | 20 |
| BC308 | 25 |
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| BC328 | 18 |
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| BC461 | 42 |
| BC527 | 35 |
| BC547 | 13 |
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| BCX32 = BC637 | 39 |
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| BC550 | 10 |
| BC557 | 10 |
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| BC635 | 19 |
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| BCY72 | 13 |
| BD115 | 45 |
| BD116A | 90 |
| BD124P | 84 |
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| BD132 | 49 |
| BD133 | 60 |
| BD135 | 38 |
| BD136 | 38 |
| BD137 | 38 |
| BD138 | 35 |
| BD139 | 35 |
| BD140 | 44 |
| BD144 | 1.70 |
| BD150 | 60 |
| BD159 | 65 |
| BD160 | 1.60 |
| BD166 | 52 |
| BD179 | 70 |
| BD182 | 1.20 |
| BD183 | 1.18 |
| BD201 | 85 |
| BD202 | 91 |
| BD203 | 80 |
| BD204 | 99 |
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| BD238 | 65 |
| BD243 | 85 |
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| BD434 | 74 |
| BD437 | 86 |
| BD438 | 94 |
| BD507 | 69 |
| BD508 | 80 |
| BD509 | 86 |
| BD510 | 86 |
| BD278A | 81 |
| BD517 | 60 |
| BD519 | 1.08 |
| BD520 | 75 |
| BD535 | 82 |
| BD536 | 91 |
| BD696A | 1.49 |
| BD697 | 1.24 |
| BD698=702 | 1.50 |
| BD701 | 1.63 |
| BD707 | 95 |
| BDX32 | 2.10 |
| BF115 | 38 |
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| BF154 | 15 |
| BF158 | 18 |
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| BF167 | 24 |
| BF173 | 36 |
| BF177 | 52 |
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| BF181 | 39 |
| BF182 | 36 |
| BF183 | 29 |
| BF184 | 42 |
| BF185 | 36 |
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| BF196 | 16 |
| BF197 | 16 |
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| BF199 | 21 |
| BF200 | 35 |
| BF224 | 40 |
| BF225 | 20 |
| BF241 | 38 |
| BF256 | 60 |
| BF257 | 34 |
| BF258 | 34 |
| BF259 | 34 |
| BF262 | 84 |
| BF263 | 81 |
| BF271 | 24 |
| BF273 | 24 |
| BF274 | 24 |
| BF336 | 40 |
| BF337 | 41 |
| BF338 | 41 |
| BF355 | 56 |
| BF362 | 68 |
| BF363 | 72 |
| BF371 | 30 |
| BF392 | 35 |
| BF422 | 34 |
| BF423 | 46 |
| BF435 = BF491 | 35 |
| BF457 | 35 |
| BF458 | 43 |
| BF459 | 58 |
| BF460 = BF462 | 86 |
| BF469 | 63 |
| BF470 | 66 |
| BF597 | 16 |
| BF757 | 54 |
| BF758 | 54 |
| BFR39 | 27 |
| BFR40 | 30 |
| BFR79 | 85 |
| BFR90 | 1.74 |
| BFT42 | 42 |
| BFT43 | 42 |
| BFW10 | 60 |
| BFX29 | 40 |
| BFX84 | 42 |
| BFX85 | 30 |
| BFX86 | 30 |
| BFX88 | 46 |
| BFY50 | 32 |
| BFY51 | 32 |
| BFY52 | 32 |
| BFY90 | 95 |
| BR100 | 34 |
| BR101 | 95 |
| BR103 | 83 |
| BR303 | 1.46 |
| BRC4443 | 94 |
| BRC4444 | 98 |
| BRY39 | 56 |
| BRY55 | 45 |
| BRY56 | 57 |
| BSR59 | 1.80 |
| BSV57B | 89 |
| BT100 | 1.65 |
| BT101 | 1.20 |
| BT102/500 | 1.20 |
| BT106 | 1.60 |
| BT108 | 1.69 |
| BT109 | 1.31 |
| BT116 | 1.87 |
| BT119 | 3.66 |
| BT120 | 3.66 |
| BT151/800 | 2.07 |
| BU104 | 2.00 |
| BU105 | 1.58 |
| BU124 | 1.90 |
| BU126 | 1.75 |
| BU204 | 1.50 |
| BU205 | 1.87 |
| BU206 | 1.80 |
| BU208 | 1.60 |
| BU208A | 1.65 |
| BU208D =BU800 | 2.20 |
| BUW81A | 3.84 |
| BU208/02 | 2.10 |
| BU326A | 2.00 |
| BU407 | 1.70 |
| BU426 | 3.07 |
| BU500 | 2.50 |
| BU526 | 2.46 |
| BU508 | 3.20 |
| BU806 | 1.40 |
| BU807 | 2.94 |
| BU826 | 4.95 |
| BUW84 | 1.45 |
| BUX84 | 1.50 |
| E1222 | 40 |
| MCR101 | 45 |
| MCR220 | 1.50 |
| ME0411 | 20 |
| MJE340 | 68 |
| MJE520 | 50 |
| MJ3000 | 1.98 |
| MPSA92 | 35 |
| MR814 | 45 |
| MR854 | 55 |
| MR475 | 2.46 |
| MR479 | 2.60 |
| OT112 | 1.91 |
| OT121 | 1.91 |
| R2008B | 1.90 |
| R2010B | 1.92 |
| R2265 | 1.50 |
| R2322 | 84 |
| R2323 | 67 |
| R2461 | 1.50 |
| R2540 | 3.20 |
| RC4558 | 2.20 |
| RCA16334 | 90 |
| RCA16029 | 1.18 |
| RCA16039 | 1.18 |
| RCA16092 | 1.18 |
| RCA16040 | 96 |
| RCA16041 | 84 |
| RCA16334 =ON447 | 90 |
| RCA16335 =ON448 | 90 |
| RCA16957 | 2.88 |
| TIC45 | 90 |
| TIC46 | 60 |
| TIC47 | 72 |
| TIL32 | 65 |
| TIL78 | 48 |
| TIP29C | 43 |
| TIP30A | 47 |
| TIP30C | 43 |
| TIP31C | 55 |
| TIP32C | 42 |
| TIP33B | 75 |
| TIP34B | 1.06 |
| TIP41C | 47 |
| TIP42C | 50 |
| TIP47 | 93 |
| TIP120 | 65 |
| TIP161 | 2.15 |
| TIP2955 | 90 |
| TIP3055 | 63 |
| TIS91 | 32 |
| TU106/02 | 1.80 |
| 2N696 | 21 |
| 2N918 | 82 |
| 2N2904 | 51 |
| 2N2905 | 28 |
| 2N3054 | 60 |
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| 2N3702 | 16 |
| 2N3703 | 16 |
| 2N3705 | 10 |
| 2N3706 | 10 |
| 2N3708 | 17 |
| 2N5294 | 48 |
| 2N5296 | 48 |
| 2N5298 | 69 |
| 2SB337 | 1.86 |
| 2N5496 | 53 |
| 2N6107 | 75 |
| 2N6109 | 81 |
| 2SA715 | 1.98 |
| 2SC495 | 1.10 |
| 2SC496 | 1.31 |
| 2SC643A | 1.82 |
| 2SC1096 | 1.72 |
| 2SC1172Y | 5.50 |
| 2SC1173Y | 1.69 |
| 2SC1306 | 2.73 |
| 2SC1307 | 3.00 |
| 2SC1449 | 1.67 |
| 2SC1520 | 68 |
| 2SC1678 | 2.67 |
| 2SC1909 | 2.90 |
| 2SC1953 | 1.44 |
| 2SC1986 =2SC1061 | 2.94 |
| 2SC2028 | 1.82 |
| 2SC2029 | 2.60 |
| 2SC2078 | 2.90 |
| 2SC2091 | 1.34 |
| 2SC2166 | 2.73 |
| 2SD870 (Sony) | 6.35 |
| DEC1 | 2.20 |
| DEC2 | 2.20 |
| THY15/80 | 2.20 |
| THY15/85 | 2.20 |
| Transistor mounting kit TO66, TO3, TO220AB | 30 |
| STR441 | 6.50 |
| STR451 | 6.50 |
| STR6020 | 8.50 |

## INTEGRATED CIRCUITS

| | |
|---|---|
| AN214Q | 3.91 |
| AN240 | 3.84 |
| AN318 | 6.37 |
| AN262 | 4.10 |
| AN301 | 5.15 |
| AN715Q | 3.97 |
| AN6340 | 7.85 |
| AN6341N | 8.97 |
| AN6344 | 7.85 |
| BA521 | 2.80 |
| BA536 | 3.00 |
| CA555 | 46 |
| CA556 | 84 |
| CA741 | 25 |
| CA748 | 45 |
| CA1532 | 4.20 |
| CA3065 | 1.80 |
| HA1151 | 3.89 |
| HA1342 | 2.49 |
| HA1306N | 2.60 |
| HA1366WR | 2.80 |
| HA1392 | 3.95 |
| HA11219 | 4.21 |
| HA11244 | 4.04 |
| LA3350 | 1.59 |
| LA4031P | 3.21 |
| LA4032P | 3.15 |
| LA4102 | 3.37 |
| LA4112 | 3.25 |
| LA4400 | 3.05 |
| LA4422 | 3.28 |
| LC7130 | 5.93 |
| LC7120 | 5.87 |
| LC7137 | 5.50 |
| LM1011 | 3.25 |
| LM1340T | 75 |
| LM8361= MM5387ANN | 3.69 |
| MB3712 | 2.60 |
| MC1307 | 1.99 |
| MC1310P | 1.84 |
| MC1327 | 1.70 |
| MC1330P | 1.47 |
| MC1351P | 2.93 |
| MC1349 | 1.99 |
| MC1350 | 1.50 |
| MC1352 | 1.75 |
| MC1358P | 1.50 |
| MC1495L | 3.00 |
| MC14011BCP | 66 |
| MC14049UB | 43 |
| MC7742 | 1.35 |
| MC7812 | 1.35 |
| ML231 ETTR6016 | 2.20 |
| ML232 | 2.20 |
| ML236 | 5.35 |
| ML237 | 2.50 |
| ML238 | 6.00 |
| ML239 | 2.50 |
| ML920 | 4.12 |
| ML922 | 3.29 |
| ML928 | 2.18 |
| MM5387ANN | 4.15 |
| MRF475 | 2.50 |
| MRF477 | 10.00 |
| MSN5807 | 7.87 |
| MS1513L | 2.80 |
| MS1515L | 3.28 |
| SAA1025 | 8.50 |
| SAA1124 | 5.34 |
| SAA1250 | 4.99 |
| SAA1251 | 5.75 |
| SAA5000 | 6.15 |
| SAA5010 | 6.30 |
| SAA5012 | 6.50 |
| SAA5020 | 5.90 |
| SAA5030 | 8.25 |
| SAA5050 | 8.50 |
| SAA3210 | 2.93 |
| SAF1032 | 6.30 |
| SAF1039 | 7.77 |
| SAS560S | 2.07 |
| SAS570S | 2.07 |
| SAS660 | 3.25 |
| SAS670 | 3.25 |
| SAS580 | 2.90 |
| SAS590 | 2.90 |
| SL901B | 7.00 |
| SL917B | 9.25 |
| SL1310 | 1.80 |
| SL1327Q | 1.20 |
| SL1430 | 1.58 |
| SL1432 | 3.36 |
| SL76544 | 2.05 |
| SN76023N | 2.00 |
| SN76110N | 1.42 |
| SN76115N | 2.27 |
| SN76131N | 2.00 |
| SN76226DN | 2.72 |
| SN76227N | 1.18 |
| SN76533N | 1.70 |
| SN76033N | 2.49 |
| SN76544N | 2.35 |
| SN76650N | 1.24 |
| SN76660N | 80 |
| SN76666N | 1.52 |
| SN76530A | 1.47 |
| STK015 | 7.36 |
| STK032 = STK078 | 13.25 |
| STK433 | 5.65 |
| STK435 | 9.06 |
| STK436 | 6.50 |
| STK437 | 7.85 |
| STK439 | 8.40 |
| STK459 | 9.50 |
| STK441 | 11.57 |
| STK461=465 | 12.60 |
| STK463 | 14.30 |
| STR441 | 6.50 |
| STR451 | 6.50 |
| STR6020 | 8.60 |
| SW153 | 3.90 |
| TA7050P | 95 |
| TA7051P | 95 |
| TA7063P | 2.20 |
| TA7074P | 3.46 |
| TA7108P | 3.43 |
| TA7120P | 2.43 |
| TA7129AP | 3.76 |
| TA7130P | 1.93 |
| TA7146P | 4.67 |
| TA7193P | 5.67 |
| TA7171P | 8.90 |
| TA7172P | 8.90 |
| TA7173P | 8.90 |
| TA7176P | 2.50 |
| TA7202P | 4.27 |
| TA7204P | 3.77 |
| TA7205AP | 3.72 |
| TA7208P | 3.40 |
| TA7210P | 6.60 |
| TA7222 | 2.42 |
| TA7223P | 3.74 |
| TA7227P | 5.98 |
| TA7228P | 5.98 |
| TA7310P | 2.78 |
| TA7609P | 4.39 |
| TA7611AP | 2.92 |
| TAA570 | 3.98 |
| TAA310 | 2.83 |
| TAA320 | 2.00 |
| TAA550 | 55 |
| TAA630 | 3.90 |
| TAA8400S1 | 1.96 |
| TAA661B | 1.20 |
| TBA120A (A),(S),(AS),(SA). | 1.49 |
| TBA120B | 1.30 |
| TBA120SB | 1.37 |
| TBA120T | 1.49 |
| TBA120U | 1.49 |
| TBA1440G | 1.56 |
| TBA395 | 1.75 |
| TBA396 | 1.75 |
| TBA440N (TBA1441) | 2.75 |
| TBA440P | 2.50 |
| TBA480Q | 1.82 |
| TBA510 | 3.00 |
| TBA520(Q) | 1.68 |
| TBA530(Q) | 1.38 |
| TBA540 | 1.76 |
| TBA560(Q) | 1.93 |
| TBA570 | 1.79 |
| TBA690 | 1.50 |
| TBA641BX1 | 3.50 |
| TBA673 | 2.45 |
| TBA700 | 2.12 |
| TBA720 | 2.64 |
| TBA750 | 2.98 |
| TBA800 | 1.62 |
| TBA810AS | 1.38 |
| TBA820 | 1.70 |
| TBA820M | 1.25 |
| TBA890 | 3.94 |
| TBA920(Q) | 3.00 |
| TBA950(2X) | 3.25 |
| TBA970 | 4.09 |
| TBA990 | 1.90 |
| TBA14406 | 2.44 |
| TCA760 | 2.30 |
| TCA270SQ | 2.50 |
| TCA800 | 5.95 |
| TCA830 | 3.44 |
| TCA900 | 2.20 |
| TCA910 | 2.20 |
| TCA940 | 1.95 |
| TDA440 | 2.20 |
| TDA1002 | 1.95 |
| TDA1003A | 5.50 |
| TDA1006A | 2.50 |
| TDA1005 | 3.60 |
| TDA1010 | 3.30 |
| TDA1011 | 4.00 |
| TDA1035 | 4.70 |
| TDA1037 | 2.95 |
| TDA1044 | 4.37 |
| TDA1060A | 4.44 |
| TDA1062 | 1.56 |
| TDA1083 | 1.68 |
| TDA1170S | 3.00 |
| TDA1190 | 3.50 |
| TDA1190P | 3.50 |
| TDA1180 | 2.91 |
| TDA1200 | 2.95 |
| TDA1220A | 2.12 |
| TDA1270 | 3.95 |
| TDA1327 | 1.70 |
| TDA1352B | 1.60 |
| TDA1412 | 1.50 |
| TDA1415 | 1.40 |
| TDA1470 | 4.67 |
| TDA1770 | 5.60 |
| TDA1908A | 1.95 |
| TDA2002 | 2.80 |
| TDA2003 | 1.20 |
| TDA2004 | 2.52 |
| TDA2006 | 1.78 |
| TDA2010 | 2.40 |
| TDA2140 | 5.95 |
| TDA2150 | 2.22 |
| Superceded by TDA2151 | 3.25 |
| TDA2190 | 3.30 |
| TDA2020 | 4.66 |
| TDA2030 | 2.80 |
| TDA2522 | 2.66 |
| TDA2523 | 3.40 |
| TDA2524 | 2.25 |
| TDA2525 | 4.00 |
| TDA2530 | 2.70 |
| TDA2532 | 2.90 |
| TDA2540 | 3.84 |
| TDA2541 | 3.84 |
| TDA2560 | 3.50 |
| TDA2571 | 4.90 |
| TDA2576 | 3.75 |
| TDA2576A | 3.75 |
| TDA2577 | 4.73 |
| TDA2581 | 3.30 |
| TDA2582 | 2.60 |
| TDA2593 | 2.95 |
| TDA2600 | 6.90 |
| TDA2610 | 3.20 |
| TDA2611A | 2.35 |
| TDA2640 | 2.92 |
| TDA2652 | 7.31 |
| TDA2653 | 5.90 |
| TDA2680 | 3.40 |
| TDA2690 | 2.72 |
| TDA2710 | 5.67 |
| TDA2720/1 | 6.77 |
| TDA3190 | 2.00 |
| TDA3500 | 6.90 |
| TDA3560 | 6.00 |
| TDA3561 | 6.66 |
| TDA3562 | 8.60 |
| TDA3571 | 3.75 |
| TDA3651A | 4.50 |
| TDA4420 | 5.55 |
| TDA4600 | 2.95 |
| TDA4600-2D | 2.95 |
| TDA9503 | 4.21 |
| TEA1002 | 3.50 |
| TEA1009 | 1.86 |
| UPC554 | 2.63 |
| UPC566H | 2.95 |
| UPC575C2 | 3.40 |
| UPC576H | 2.60 |
| UPC585 | 3.06 |
| UPC587C2 | 2.34 |
| UPC1025H | 2.95 |
| UPC1026H | 1.24 |
| UPC1028H | 2.52 |
| UPC1032H | 94 |
| UPC1042C | 1.56 |
| UPC1156H | 4.26 |
| UPC1158H | 3.50 |
| UPC1163H | 2.48 |
| UPC1167C2 | 2.70 |
| UPC1168C | 3.20 |
| UPC1176C | 2.53 |
| UPC1177H | 3.15 |
| UPC1178C | 4.21 |
| UPC1180C | 1.84 |
| UPC1181H | 1.62 |
| UPC1182H | 2.95 |
| UPC1183H | 2.48 |
| UPC1185H | 3.66 |
| UPC1186H | 1.60 |
| UPC1188H | 4.99 |
| UPC1190G | 1.20 |
| UPC1198C | 4.00 |
| UPC1200V | 1.18 |
| UPC1211V | 2.70 |
| UPC1212V | 1.34 |
| UPC1215V | 1.66 |
| UPC1216V | 1.20 |
| UPC1217G | 2.24 |
| UPC1218H | 1.80 |
| UPC1223C | 2.20 |
| UPC1225H | 2.00 |
| UPC1226C | 1.50 |
| UPC1227V | 1.20 |
| UPC1228H | 54 |
| UPC1230H | 4.39 |
| UPC1238V | 1.89 |
| UPC1245V | 1.35 |
| UPC1350C | 4.15 |
| UPC1353C | 4.76 |
| UPC1365C | 6.38 |
| UPC1356C2 | 2.08 |
| UPC1367 | 2.08 |
| UPC1378H | 2.70 |
| UPC1358H | 1.88 |
| UPC1360C | 2.20 |
| UPC1363C | 2.16 |
| UPC1366C | 1.84 |
| UPC1368H2 | 2.15 |
| UPC1370C2 | 2.58 |
| UPC1382C | 1.08 |
| UPC1384 | 3.78 |
| UPC1447H | 58 |
| UPC41C | 2.80 |
| UPC5743 | 38 |
| UPC577H | 2.46 |
| UPC585C | 1.28 |

### COMPUTER SPARES

| | |
|---|---|
| 27256 | 4.75 |
| 2732 | 3.30 |
| 2764 | 1.87 |
| 27128 | 3.13 |
| 4116 | 1.10 |
| 4532/20NL | 3.00 |
| 4164 | 1.60 |
| 6264 | 2.75 |
| 6522 | 4.09 |
| Z80ACPU | 2.14 |
| 8271 | 60.00 |
| ZTX213 | 17 |
| ZTX313 | 27 |
| ZTX650/1 | 35 |
| LM1889 | 2.00 |
| 74LS260 | 0.55 |
| UHF modulator UM1233 | 2.20 |
| Double sided heavy duty tape | 5.75 |
| Micro pliers | 4.80 |
| Micro cutter | 5.00 |
| Solder suckers anti static Min. | 4.50 |
| Std. | 5.40 |
| Large | 6.20 |

### VOLTAGE REG.

| | |
|---|---|
| 7805 | 78 |
| 7808 | 78 |
| 7812 | 78 |
| 7815 | 78 |
| 7818 | 78 |
| 7824 | 78 |
| 78L05 | 68 |
| 78L08 | 68 |
| 78L12 | 68 |
| 78L24 | 68 |
| 7905 | 98 |
| 7906 | 98 |
| 7908 | 98 |
| 7912 | 98 |
| 7915 | 98 |
| 7918 | 98 |
| 7924 | 98 |
| 79L05 | 72 |
| 79L12 | 72 |
| 79L15 | 72 |
| 79L24 | 72 |

### DIODES

| | |
|---|---|
| AA119 | 9 |
| BA102 | 17 |
| BA115 | 13 |
| BA145 | 17 |
| BA148 | 17 |
| BA154 | 6 |
| BA155 | 14 |
| BA156 | 15 |
| BA157 | 20 |
| BA317 | 26 |
| BAX13 | 4 |
| BAX16 | 8 |
| BB105G | 30 |
| BY122 | 96 |
| BY126 | 12 |
| BY127 | 11 |
| BY133 | 15 |
| BY164 | 45 |
| BY176 | 85 |
| BY179 | 63 |
| BY182 | 87 |
| BY184 | 55 |
| BY199 | 28 |
| BY206 | 14 |
| BY210/600 | 28 |
| BY210/800 | 33 |
| BY223 | 90 |
| BY227 | 28 |
| BY298 | 22 |
| BY299 | 22 |
| BYX10 | 20 |
| BYX36/10 | 30 |
| BYX55/600 | 30 |
| BYX71/600 | 90 |
| BY224 | 2.00 |
| OA47 | 20 |
| OA91 | 10 |
| OA95 | 6 |
| OA202 | 11 |
| IN914 | 4 |
| IN4001 | 4 |
| IN4002 | 4 |
| IN4003 | 4 |
| IN4004 | 5 |
| IN4005 | 5 |
| IN4006 | 10 |
| IN4007 | 10 |
| IN4148 | 5 |
| IN4448 | 10 |
| IN5401 | 12 |
| IN5402 | 14 |
| IN5403 | 12 |
| IN5404 | 12 |
| IN5405 | 13 |
| IN5406 | 16 |
| IN5407 | 16 |
| IN5408 | 20 |
| ITT2002 = BAX16 | |
| Y969 – Disc. | |
| REP BZX85 30V | |
| General Purpose Triac | 95 |
| SKE4F | £1.19 |
| SKE5F | £1.19 |

### ZENER DIODES

| | |
|---|---|
| BZV15 C12 | 1.24 |
| BZX61 130V | 28 |
| BZX61 Range (1.3W) | 20 |
| BZX79 Range (400mV) | 10 |
| BZY88 Range (400mV) | 10 |
| BZY93, 90 (18V) | 1.18 |

### I.C. SOCKETS

**DIL to DIL**

| | |
|---|---|
| 8 way | 22 |
| 14 way | 29 |
| 16 way | 32 |
| 18 way | 32 |
| 20 way | 32 |
| 24 way | 34 |
| 28 way | 45 |
| 40 way | 84 |

**DIL to QUIL**

| | |
|---|---|
| 14 way | 32 |
| 16 way | 34 |
| 18 way | 37 |

**QUIL to QUIL**

| | |
|---|---|
| 14 way | 32 |
| 16 way | 36 |

**We try very hard to stock all that we advertise but if for any reason beyond our control we do run out of anything we will inform you as quickly as possible. Some prices may change because of product availability.**

### THERMISTORS

| | |
|---|---|
| VA1104 | 90 |
| VA1040 | 75 |
| VA8650 | 55 |
| VA1039 | 35 |
| GEC DUAL POS. | 1.68 |
| GEC DUAL THERM. CKI | 1.98 |

### COMMOOORE SPARES

| | |
|---|---|
| 6510 CPU | 15.50 |
| 6526 | 15.50 |
| 6569 | 15.50 |
| 6581 | 15.50 |
| 901225 | 15.50 |
| 901226 | 15.50 |
| 901227 | 15.50 |
| 906114 | 15.50 |

### CRYSTALS & FILTERS

| | |
|---|---|
| 6MHz | 74 |
| 5.5MHz | 74 |
| 4.3MHz | 1.39 |
| 8.8MHz | 1.48 |
| 9.94MHz | 6.00 |
| 10.692MHz | 6.00 |

### L.E.D.'s

| | |
|---|---|
| 5mm Red, Green, Yellow | 14 |
| T1 ¾ Amber | 22 |
| T1 3mm Red, Green, Yellow | 14 |
| Flashing Red CQX21 | 62 |
| CQX22 | 66 |
| Panel Clips 3mm | 04 |
| 5mm | 04 |

# P. V. TUBES

**TEL: 0254 36521/32611**

**104 ABBEY STREET, ACCRINGTON**

## SUNDRY EQUIPMENT

| | |
|---|---|
| Test Lead Set | 4.20 |
| Degaussing Coil Stick | 19.00 |
| Signal Ejector | 4.00 |
| Elect. Circuit Tester | 1.50 |
| 5A Choc Bloc (12) | 40 |
| Fuse Wire 5A, 15A, 30A | 05 |
| 4-way 13A Mains Conn. | 5.00 |
| Safe Block (mains) | 8.50 |
| 13A Plug Top (box 10) | 4.80 |
| Probes (x10) | 10.90 |
| Probes (x1) | 10.90 |
| Micro Pliers | 4.20 |
| Micro Cutters | 5.00 |
| Philips Switchable Probes (×1. 2×10) | 13.25 |
| Factory recon. Avo meters | 119.00 |
| Avo Battery | 2.95 |
| Vero Board | 2.59 |
| LG Solder Sucker | 6.20 |
| Solder 500g | 7.00 |
| D.I.Y. Solder | 45 |
| Solder Sucker Antistatic | 5.40 |
| Nozzles | 81 |
| Trim Tools | |
| Metal End | 30 |
| Solda Mop Stnd. | 74 |
| Sidecutters sm. | 1.20 |
| Long Nose Pliers | 1.20 |
| Surge Protector Plug | 12.50 |
| Quick Set Adhesive | 75 |
| Sm. Neon Screwdriver | 40 |
| Lg. Neon Screwdriver | 65 |
| I.C. Inserters | 1.18 |
| Automatic Wire Strippers | 6.95 |
| Scart Plugs | 2.95 |
| Scart Leads | 3.50 |
| TA81 Car Battery Leads/port. TV Thorn 1690/91 | 4.47 |
| TA51 Car Battery Leads/port. TV Thorn 1613/1615 | 3.66 |
| Car Battery Leads/port. TV Philips | 3.95 |
| Universal Car Accessory Cable | 1.99 |
| Dynascan 467 Rejuv. | 399 |
| Dynascan 470 Testers | 299 |

B+K tube bases Dynascan

| | | | |
|---|---|---|---|
| No. 1 | 9.09 | No. 14 | 16.63 |
| No. 3 | 9.50 | No. 15 | 16.44 |
| No. 5 | 9.09 | No. 18 | 10.83 |
| No. 6 | 11.08 | No. 19 | 10.83 |
| No. 7 | 9.09 | No. 21 | 14.40 |
| No. 8 | 10.08 | No. 23 | 13.86 |
| No. 9 | 9.09 | No. 24 | 27.07 |
| No. 13 | 11.11 | No. 25 | 12.57 |

| | |
|---|---|
| C15 computer cass. | 30 |
| C20 computer cass. | 33 |
| 5¼" floppy disc s/s s/d | 1.61 |
| 2M Fly Lead | 70 |
| 4M Fly Lead | 1.20 |
| 10M Fly Lead | 1.90 |
| Figure 8 Mains Lead | 62 |
| Computer to TV | 97 |
| 7 pin din to 5 pin din | 98 |
| 5 pin din to 5 pin din | 98 |
| Fluorescent Starter 4-80W) | 15p |
| Tinned Copper Wire | |
| 14SWG 100 Amp | 1.86 |
| 17SWG 60 Amp | 1.86 |
| 19SWG 45 Amp | 1.86 |
| 20SWG | 2.75 |
| 22SWG 25 Amp | 1.86 |
| Insulated Copper Wire (0.4mm dia.) | 9.11 |
| Battery Press Studs Min. | 11 |
| Std. | 15 |

## LOCKING CABLE TIES

| | |
|---|---|
| Up to 25mm diameter, | 100 at 54p |
| Up to 55mm, | 100 at £1.41 |

## SOCKETS ELECTRICAL BA

| | |
|---|---|
| 320A Single Gang | 1.30 |
| 320B Single Switched | 1.95 |
| 320C Two Gang | 2.53 |
| 320D Two Switched | 3.92 |
| **Switches** | |
| 320E One Gang/One Way | 80 |
| 320F One Gang/Two Way | 1.05 |
| 320G Two Gang/Two Way | 1.78 |

## CABLES 100m

| | |
|---|---|
| F031 2 Core Round .75mm² | 15.47 |
| F032 3 Core Round .5mm² | 15.75 |
| F035 3 Core Round 1.25mm² | 28.21 |
| F041 Speaker 7/0 2mm | 3.90 |
| Coaxial 75R | 13.50 |

## FILAMENT LAMPS

**HES ROUND BULBS** 15p
L23m x D11mm
6.5V 0.3A
12V 2.2W

**LILLIPUT (L.E.S.) BULBS** 12p
L20m x D5mm
6V 0.025A
12-14V 0.1A

**CAPLESS LAMPS** 28p
L11mm x D4m
6V 0.04A
12V 0.04A

**TUBULAR LAMPS CAPPED** 31p
L31mm x D6.3mm
6.3V 0.15A
6.3V 0.25A
6.3V 0.3A
8V 0.15A
8V 0.25A
8V 0.3A
12V 0.15A
12V 0.25A
12V 0.2A

**WIRE NEONS** 9p
65VAC/90VDC Series res
100K for 110V – 330K for 240V

**WIRE ENDED LAMPS** 25p
D3.2mm
6V 0.04A
8V 0.04A
12V 0.04A
14V 0.025A
14V 0.04A
D4.2mm
4.5V 0.06A
6V 0.06A
6.3V 0.025A
6.3V 0.08A
8V 0.04A
8V 0.06A
8V 0.08A
12V 0.04A
12V 0.06A
14V 0.06A
14V 0.08A

**TUBULAR LAMPS (Wire ended)** 31p
L22m x D4.25m
3V 0.06A
6V 0.05A
8V 0.05A
9V 0.045A
12V 0.05A
14V 0.05A

## PLUGS AND SOCKETS

| | |
|---|---|
| 5 pin DIN plugs 180° | 20 |
| 5 pin DIN chassis sockets 180° | 28 |
| 5 pin DIN line sockets 180° | 28 |
| 5 pin DIN plugs 360° | 20 |
| 5 pin DIN chassis sockets 360° | 28 |
| 5 pin DIN line sockets 360° | 28 |
| 6 pin DIN plugs | 28 |
| 6 pin DIN chassis sockets | 36 |
| 6 pin DIN line sockets | 28 |
| 7 pin DIN plugs | 35 |
| 7 pin DIN chassis sockets | 36 |
| 7 pin DIN line sockets | 30 |
| 8 pin DIN plugs | 56 |
| 8 pin DIN chassis sockets | 64 |
| 8 pin DIN line sockets | 55 |
| Phono plugs | 12 |
| Phono chassis sockets | 10 |
| Phono line sockets | 20 |
| 2.5mm Jack plugs | 11 |
| 2.5mm Chassis sockets | 14 |
| 2.5mm Line sockets | 17 |
| 3.5mm Jack plugs | 15 |
| 3.5mm Chassis sockets | 24 |
| 3.5mm Line sockets | 18 |
| 3.5mm Stereo jack plugs | 35 |
| 3.5mm Stereo chassis sockets | 18 |
| 3.5mm Stereo line sockets | 28 |
| 6.3mm Stereo jack plugs | 36 |
| 6.3mm Stereo jack line sockets | 25 |
| Standard mono jack plugs | 20 |
| Loud speaker plugs 2 pin | 10 |
| I.D.C. plugs 36 conn. | 5.90 |
| I.D.C. sockets 36 conn. | 6.90 |
| BNC plugs | 1.15 |
| Coax plugs Each | 18 |
| Pack of ten | 1.80 |
| Line connectors | 16 |
| Double ended female sockets | 1.20 |
| Car aerial plugs | 18 |
| PL259 with reducer | 1.30 |
| Reducers for the PL259 | 16 |
| FM plugs | 25 |
| Crocodile Clips | 25 |
| In Line Socket (Metal) | 25 |

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## VIDEO PINCH ROLLERS

| | | |
|---|---|---|
| PANASONIC | NV7000 | 4.35 |
| PANASONIC | NVB300-333-370-777 | 4.35 |
| SANYO | VTC9300:VBS7000 | 4.35 |
| SONY | C7:J7:SLT7 | 4.35 |
| JVC | TCE 3V00-01-06-16-23-24 JVC HR2200-3320-3330-3660-1100-7700 | 4.35 |
| AKAI | VS9700 | 4.35 |
| HITACHI | VT5000 | 4.35 |
| SHARP | VC6300-6500 | 4.35 |

## VIDEO BELT KITS

| | | |
|---|---|---|
| VEKIT 1 AKAI JVC TCE | VS9300:VS9500:VS9800 HR3300:HR3320: HR3330:HR3360 8903:3V00:3V16:3V22 | 3.50 |
| VEKIT 2 PANASONIC | NV7000B:NV7200B | 3.00 |
| VEKIT 3 SONY | SLC5:SLC5EC:SLC5CH: SLC5E1: SLC5E:SLC5SA:SLC5UB: SLC7E: SLC7UB:SLC7EC:SLC7F: SLC7: SLC5:SLC7:SLT9MER: | 3.75 |
| VEKIT 4 SONY | SL8000AS:SL8000E: SL8000SA: SL8000UB:SL8080AN: SL8500: SL8600:SL8600A: | 4.50 |
| VEKIT 5 SONY | SL3000UB | 4.00 |
| VEKIT 6 PANASONIC | NV3000B | 3.00 |
| VEKIT 7 SANYO | 9300P | 4.25 |
| VEKIT 8 PANASONIC | NV2000B | 3.75 |
| VEKIT 9 PANASONIC | NV8600B:NV8610B: V011 | 4.25 |
| VEKIT 10 TOSHIBA | V8600 | 3.00 |
| VEKIT 11 SHARP | VC7300 | 3.50 |
| VEKIT 12 SHARP | VC6300:VC6600 | 4.00 |
| VEKIT 13 SANYO | VTC5000 | 1.95 |
| VEKIT 14 SANYO | VTC5300 | 2.50 |
| VEKIT 15 JVC | HR7650 | 2.50 |
| VEKIT 19 HITACHI | VT8000 | 1.12 |
| VEKIT 20 HITACHI | VT11/33 | 2.15 |
| VEKIT 21 HITACHI | 9500 | 1.12 |

## VIDEO IDLER TYRES

| | O.Dia | I.Dia | Width | |
|---|---|---|---|---|
| SONY | 23.7 | 17.4 | 4.9 | 50p |
| SONY | 24.2 | 18 | 5.1 | 50p |
| HITACHI | 31.8 | 25 | 4.9 | 52p |
| HITACHI | 39.5 | 30 | 4.2 | 52p |
| PANASONIC | 37 | 27 | 3.9 | 52p |
| PANASONIC | 34.5 | 27 | 3.1 | 50p |
| AKAI | 26 | 20 | 3.9 | 50p |
| JVC | 32.8 | 3.4 | 3.9 | 56p |
| JVC | 23.9 | 4.8 | 4 | 56p |

## REPAIR KITS

Remote control handsets for Philips sets KT3/K30 chassis inc. foil unit button matrix and instructions.

**Philips part numbers:**
Foil 212 275 82 or 212 275 83.
Button matrices: 432 370 37 or 432 370 38.
No. 1 without Teletext,
No. 2 with Teletext £4.50

## REMOTE CONTROL HAND UNITS

Some are original some are compatible types.

| | | |
|---|---|---|
| DECCA 100/101 US Non T.Text | US8513 | 23.80 |
| GRUNDIG TELEPILOT 12 IR | RTP20 | 13.87 |
| GRUNDIG TELEPILOT 8 IR | RTP05 | 25.10 |
| GRUNDIG TELEPILOT 160 IR | RTP06 | 25.10 |
| GRUNDIG TELEPILOT 300 IR | RTP07 | 18.87 |
| PHILIPS G11 US Non Text | US8263 | 22.00 |
| PHILIPS G11 8 way.IR Text | IR8435 | 23.80 |
| PHILIPS G11 US 31 Button | 69117187 | 27.00 |
| PHILIPS G11 US 2 function | US8518 | 21.00 |
| PHILIPS KT3/30 IR Text 1234 | IR1234 | 19.87 |
| PHILIPS KT3/30 IR Non Text 1201 | IR1201 | 19.87 |
| THORN TX10/JVC IR Text | TP8431R | 22.00 |
| Remote Control Tester | | 29.94 |

## DATA BOOKS (Zero VAT)

| | |
|---|---|
| Pair of A-Z/2N2S TV180 | 8.50 |
| LIN IC Books (data only not Equiv.) LINI | 5.95 |

**IC equivalent booklet £3.25 and transistor equivalent booklet £3.25**

| | |
|---|---|
| TDV1 Trans. Data Dictionary | 7.50 |

## TURNTABLE DRIVE BELTS ALL £1.20

TB42 Most Thorens Models
TB23 Most Philips Models
TB50 Most Garrard Models
TB70 Most Hitachi Models
TB60 Some Sanyo Models
TB01 Most Panasonic, Sony, Pioneer, Technics and Sansui.
TB03 Most BSR

## SUNDRY VIDEO ACCESS.

| | |
|---|---|
| VHS Drum Motor | 25.50 |
| VHS Capstan Motor | 25.50 |
| Sanyo 5000 Reel Motor | 12.95 |
| VHS Idler | 5.95 |
| Video Lamps | 1.41 |
| 3V23 Lamps with Plug | 1.95 |
| Video Care Kit | 3.50 |
| Universal Copying Kit | 5.50 |
| Video Head Cleaner | 90 |
| Sharp Reel Motor | 15.60 |
| Reel Idler (Sharp) 381/383/386/9100/9300/9500 | 2.48 |
| Sanyo Reel Drive Pulley | 6.95 |
| JVC Clutch Ass. | 6.95 |

## VIDEO HEADS

| | |
|---|---|
| 3HSS UHS | 30.00 |
| 4HS VHS | 31.00 |
| PS3B Beta/Sony | 35.00 |
| Philips V2000 | 64.00 |
| Philips 1700 | 64.00 |
| Sanyo 9300/9455/9500 | 53.00 |
| Sanyo 5000/5300/5400 | 53.00 |
| Toshiba V5470A BDP | 50.00 |
| Toshiba 9600 Upper Ass. | 12.50 |
| Toshiba 9600 | 50.00 |
| Sharp 2300 | 58.00 |
| Sharp 6300 | 58.00 |
| Sharp 7300/7700/7750 | 58.00 |
| Sharp 8300 | 58.00 |
| Sharp 3300/9700 | 56.00 |
| Hitachi HIVI | 35.62 |
| Hitachi VT33E/GEC 4004 | 35.62 |
| Hitachi VT11/GEC 4100 | 35.62 |
| Beta eccentricity gauge | 50.00 |

## VIDEO TAPE

| | | |
|---|---|---|
| SKC | E180 | 3.20 |
| | L750 | 3.20 |
| Scotch | E30 | 3.66 |
| | E60 | 4.00 |
| | E120 | 5.00 |
| | E180 | 4.50 |
| Beta | L750 | 5.80 |
| VCC | 240 While | 6.20 |
| | 360 Stocks | 8.30 |
| | 480 Last | 10.21 |
| LVC 1700} Philips 1200 | | 17.50 |

## NEW LABGEAR

| | |
|---|---|
| • CM7271-MHA 15db | 8.66 • |
| • CM7274 4 Way Dist. | 21.45 • |
| • CM7082 UHF VHF DA | 65.69 • |
| • CM7080/10 UHF NHA | 15.71 • |

## SERVICE AIDS

| | |
|---|---|
| SERVISOL Freeze-It | 1.20 |
| SUPER SERVISOL | 1.04 |
| SERVISOL Foam Cleanser | 1.02 |
| SERVISOL Plastics Seal | 1.14 |
| SERVISOL Silicone Grease | 1.30 |
| SERVISOL Tubes Silicone Grease | 1.66 |
| SERVISOL Aero Klene | 94 |
| SERVISOL Aero Duster | 1.28 |
| SERVISOL Excel Polish | 96 |
| SERVISOL Video Head Cleanser | 90 |
| Super 40 | 1.66 |
| Fire Extinguisher 640G | 3.08 |
| Heat Sink Compound 25G | 1.10 |
| Silicone Rubber Tube 110G | 2.98 |
| Solda Mop standard reel | 77 |

## EVER READY BATTERIES

| | |
|---|---|
| R20S | 39 |
| R6B | 15 |
| R14S | 33 |
| R03B | 18 |
| PP3B | 54 |
| PP3S | 74 |
| PP6 | 1.15 |
| PP7 | 1.15 |
| PP9 | 1.17 |
| 1289 | 53 |

## RECHARGEABLES Ever Ready

| | |
|---|---|
| RX6 (HP7) | 1.31 |
| RX14 (HP11) | 2.31 |
| RX20 (HP2) | 2.61 |
| RX22 (PP3) | 4.89 |
| Universal Charger | 7.50 |

## WE HAVE A FULL RANGE OF AERIALS AND ACCESSORIES FROM TRADE COUNTER

## AERIAL EQUIPMENT

| | |
|---|---|
| Outdoor Splitter | 5.50 |
| Plastic Tape | 50 |
| F.M. Plugs | 25 |
| Set Top Aerial | 2.30 |
| Loop Aerial | 1.00 |
| Aerial Isolator Kit | 2.08 |
| Attenuator 6dB, 12dB, 18dB | 1.80 |
| 27MHz Filter 50dB | 2.10 |
| Cable Clips 7mm per 100 | 1.18 |
| Single Outlets | 80 |
| Surface Splitter | 1.70 |
| A Splitter | 70 |
| 100M Coax | 15.00 |
| Coax Plugs per 10 | 1.80 |
| 1" U Bolts | 30 |
| J Bolts | 25 |

## ANTIFERENCE

| | |
|---|---|
| SB11 Splitter | 2.37 |
| COB11 Outlet | 96 |
| CS1000 Combiner/Splitter | 6.15 |
| PU1240 Power Unit | 11.65 |
| UP1300 MHA | 9.09 |
| XS2U Xtraset | 14.56 |
| 4 way VHF/UHF Amp | 40.71 |
| 6 way VHF/UHF Amp | 50.68 |
| XG8 High Gain Aerial A-B-CD-WB | 17.10 |

## LABGEAR

| | |
|---|---|
| CM7261 Power Unit 12V | 11.80 |
| CM7262 Reg. Power Unit 12V | 12.86 |
| CM7065 VHF/UHF MHA W/B 12V | 15.05 |
| CM7066 | 14.04 |
| CM7067 UHF 12V MHA (Specify A-B or C/D) | 11.25 |
| CM7068 UHF 12V MHA High Gain (Specify A-B or C/D) | 16.74 |
| CM7253 Behind Set UHF Amp. (Mains) | 13.66 |
| CM7243 Second Set Amp. UHF | 12.72 |
| CM7093 Behind Set UHF Amp. 3 Sets | 16.03 |
| CM7063 Dist. Amp. VHF/UHF 17db/output 12V | 23.27 |
| CM7108 VHF/UHF 8+1 Dist. Amp. | 43.26 |
| CM9700 27mhz CB Suppress. | 4.45 |
| CM6011 Outdoor Splitter (2 way) W/B | 7.83 |
| CM9003 Flush Single Outlet | 1.95 |
| CM9010 Flush Twin Outlet | 2.04 |
| CM9034 UHF Group Filters with DC Through Pass (state A/B/CD) | 8.07 |
| CM9033 6 Way Passive Splitter | 9.72 |
| CM7042 TV Games Combin. | 3.09 |
| CM9009 Flush TV/FM Outlet | 3.20 |
| CM7091 Col. Bar Gen. | 133.98 |
| CM9006 VHF/UHF Diplexer | 3.78 |
| Televerta up converta CM7122 | 36.20 |
| Televerta down converta CM7057 | 41.01 |
| 7064 DA UHF VHF 28dB | 30.06 |
| 7094 DA 4 way | 19.50 |

## ANTEX SOLDERING EQUIPMENT

| | |
|---|---|
| **C15W Iron 240V** | 6.20 |
| C240 Element | 2.75 |
| Bits 102 | 1.10 |
| 106 | 1.10 |
| 820 | 1.10 |
| 821 | 1.10 |
| **CS17W Iron 240V** | 6.40 |
| CS240 Element | 2.75 |
| Bits 1100 | 1.10 |
| 1101 | 1.10 |
| 1106 | 1.10 |
| **XS25W Iron 240V** | 6.50 |
| XS240 Element | 2.75 |
| Bits 50 | 1.10 |
| 51 | 1.10 |
| **Temp. Controlled** | |
| 30W Iron CSTC | 16.95 |
| 40W Iron XSTC | 16.95 |
| Unit for above TCSU1 | 68.95 |
| Stand | 2.10 |
| **MLXS Auto Repair Kit** | 8.40 |
| Cordless Gas Iron | 15.99 |
| Tips for Gas Iron | 5.00 |
| 25 Watt Philips Iron | 5.50 |

## WELLER

| | |
|---|---|
| Heat gun | 15.95 |
| Heat gun tips (pair) | 57 |
| 3/16" Iron tips 25W (MT5) | 57 |

## AUDIO HEADS AND MOTORS

| | |
|---|---|
| Mono record/playback | 4.32 |
| Stereo playback | 4.79 |
| Stereo record/playback | 4.99 |
| Stereo record/playback (Dolby) | 6.90 |
| Mono/stereo erase | 2.25 |
| **Electronic/rotation clockwise motors** | |
| 6V MD6515 | 4.95 |
| 9V MD9516 | 4.95 |
| 12V MD12517 | 4.95 |

## CASSETTE DRIVE BELTS

| | | | | | |
|---|---|---|---|---|---|
| 35m | 35 | 46mm | 37 | 57m | 37 |
| 66m | 39 | 110m | 59 | 76m | 43 |
| 90m | 43 | | | | |

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### VARICAP TUNERS

| | |
|---|---|
| ELC1043-05 | 8.40 |
| ELC104305 Mullard | 12.50 |
| ELC1043-06 | 8.40 |
| ELC2003 | 16.50 |
| Philips G8/G9 | 10.50 |
| Philips G11 (U321) | 9.90 |
| U322 | 7.20 |
| U341 | 9.50 |
| U342 | 8.50 |
| TX10 Tuner | 8.75 |

### PUSH BUTTON ASS.

| | |
|---|---|
| Decca 4 way | 7.93 |
| 6 way | 9.17 |
| GEC 2110 6 way | 10.92 |
| GEC Slim 6 way | 10.29 |
| GEC/ITT/PYE 7 way | 16.67 |
| Pye 6 way (207/715) | 18.40 |
| Pye 697 repair kit | 10.35 |
| Pye 725-735 (also Red Mk.1) | 12.60 |
| Pye 725-735 tuning head with PCB | 12.50 |
| Philips G8 (early) | 17.82 |
| Philips G8 (late) | 18.97 |
| Rank A823 | 12.36 |
| Rank T20A | 11.21 |
| Hitachi 4 way | 12.36 |
| Philips G11 unit | 26.50 |
| Philips KT3 | 16.67 |
| Philips KT30 | 13.22 |
| ITT CVC 8/9 (mod) | 13.80 |
| ITT 6 way with VCR | 8.90 |
| Decca 7 way piano key replacement kit | 22.42 |
| GEC Conversion kit | 16.50 |
| Decca 4/6 way conversion kit | 17.50 |
| Thorn 8500 Push Button | 6.50 |

### SWITCHES & ACCESS

| | |
|---|---|
| On/off gen. purpose 4A | 80 |
| G8 on/off | 1.98 |
| G11 on/off | 1.58 |
| G11 on/off remote | 1.58 |
| Gen. purpose rotary | 66 |
| Thorn Tx 9/10 | 2.98 |
| GEC 2040 | 98 |
| Thorn 1591 push on/off | 2.90 |
| Rank tuner buttons (while stocks last) 1½"×½", 2"×½", 2"×⅜" | 20 |
| GEC 2110 tuner neons | 35 |
| Thorn 3500 A1 beam | 86 |
| GEC 2110 A1 cont. R/B/G | 58 |
| ITT CVC5 on/off | 1.24 |
| ITT mains switch + solenoid | 4.50 |
| Rank mains switch + solenoid | 4.50 |
| Rank T20 on-off switch | 1.95 |

### MIDGET CONTROLS

**Insulated Spindle Length 44mm**

| | |
|---|---|
| **Log or Lin Without Switch** 5K-10K-25K-50K-100K-250K-500K-1M | 54 |
| **With D.P.S.T. Switch** Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M | 1.26 |
| Dual gang Controls | 1.25 |
| 16mm Rotary Controls 10K, 22K, 10K, 100K, 1M | |

### THICK FILM RESISTOR NETWORK

| | |
|---|---|
| THORN 3500 (5 pin connection) | 1.98 |
| PYE 731 (6 pin connection) | 2.20 |
| THORN 9000 (Circuit Ref. R704/7) | 2.15 |

### CONVERGENCE POTS

| | |
|---|---|
| 3W/5R-6R8-10R-20R 50R-100R-200R-500R | 60 |

### METRIC CONVERGENCE POTS

| | |
|---|---|
| PHILIPS G8 5R-10R-15R-20R-50R | 60 |

### SKELETON PRE-SET POTS

Standard or miniature
Horizontal or Vertical
100R-2M2 16p

### SLIDER POTENT

Lin or Log
470R-1K-2K2
10K-47K-470K 75p

### MULTITURN POTS

| | |
|---|---|
| 100K | 65 |
| GEC TE | 65 |
| PHILIPS G8 | |
| DECCA, RANK | 65 |

### THERMAL CUT OUT

| | |
|---|---|
| THORN 3000 2A Metal | 2.68 |
| GEC 2040 Metal | 2.50 |

### LINE OUTPUT TRANS.

| | |
|---|---|
| R.B.M. T20A | 13.95 |
| R.B.M. A774 Mono | 11.74 |
| R.B.M. Z718 22" | 19.50 |
| PHILIPS 320 | 8.70 |
| PHILIPS 210/300 Mono | 10.00 |
| PHILIPS G8 | 8.75 |
| PHILIPS G9 | 9.50 |
| PHILIPS G11 | 15.00 |
| PYE 697 (Printed) | 14.50 |
| PYE 713/731 | 10.00 |
| PYE 725 90° | 10.50 |
| PYE 169 | 10.00 |
| DECCA 80 | 8.58 |
| DECCA 100 | 8.58 |
| DECCA 1700 | 9.00 |
| DECCA 1730 | 8.58 |
| DECCA 2230 | 8.58 |
| GEC 2110 | 16.75 |
| GEC 2040 | 9.50 |
| ITT CVC 1-9 | 10.85 |
| ITT CVC 25/30/32 | 8.65 |
| ITT CVC 20 | 8.60 |
| THORN 3000 EHT | 9.95 |
| THORN 3000 SCAN | 7.95 |
| THORN 8000 | 17.50 |
| THORN 8500 | 17.50 |
| THORN 3000/3500 Mains | 10.00 |
| THORN 1615 | 12.50 |
| THORN 1691 | 9.68 |
| THORN TX10 | 15.00 |
| THORN TX9 | 23.85 |
| THORN 1615 | 9.75 |
| PHILIPS KT3 | 9.70 |
| RANK BUSHRANGER Early T16A | £10.00 |
| RANK BUSHRANGER Late T18A | £10.00 |
| PYE 741 | 8.20 |
| B+O (2000, 3000) | 14.69 |
| B+O (3000 EHT) | 25.00 |
| ITT CVC 45 | 9.50 |
| Philips TX2 | 13.39 |
| Philips TX3 | 14.41 |

### RECTIFIER TRAYS

| | |
|---|---|
| THORN 950 Mk II | 4.25 |
| THORN 1400 3 Stick | 5.20 |
| THORN 1500 3 Stick | 5.20 |
| THORN 1500 5 Stick | 5.99 |
| THORN 1600 | 6.50 |
| THORN 3000/3500 | 7.98 |
| THORN 8000 | 6.95 |
| THORN 8500/8800 | 7.15 |
| THORN 9000 | 8.70 |
| DECCA 1730/1830 | 5.48 |
| DECCA 30 | 6.76 |
| DECCA 80 | 7.12 |
| DECCA 100 | 7.50 |
| UNIVERSAL | 6.00 |
| GEC 2100 | 7.40 |
| GEC 2200 (20AX) | 6.50 |
| GEC 2040/2028 | 6.60 |
| GEC 2110 Pre Jan '77 | 7.00 |
| GEC 2110 Post Jan '77 | 7.00 |
| PHILIPS G8 Short Focus Lead | 7.12 |
| PHILIPS G8 Long Focus 550 | 7.12 |
| PHILIPS G9 | 6.37 |
| Pye/Philips K3 Tripler | 12.50 |
| PYE 691/3 | 7.58 |
| PYE 713/4 Lead | 8.79 |
| PYE 713 Doubler 5 Lead | 8.79 |
| PYE 731/725 | 8.75 |
| R.B.M. A823 (plug in) AV | 8.75 |
| KORTING (similar to Siemens TVK1) | 7.32 |
| ITT KB CVC5/9 | 7.50 |
| ITT KB CVC20/25/30 (Mullard) | 7.12 |
| RRI T20 | 7.12 |
| ITT CVC45 | 8.65 |
| DECCA/TATUNG 120/130 | 6.50 |

### RECTIFIER STICKS

| | | | |
|---|---|---|---|
| TV11 | 90 | TV18 | 1.10 |
| TV13 | 1.26 | TV20 | 1.43 |

### REPLACEMENT ELECTROLYTICS

| | |
|---|---|
| PYE 169 (200/200/100/32) | 3.74 |
| PHILIPS 320 (400/400/200V) | 3.02 |
| DECCA 30 (400/400/350V) | 3.74 |
| DECCA 80 (400/350V) DECCA 100 (800/250V) | 4.37 |
| PHILIPS G8 (600/300V) | 2.53 |
| PHILIPS G9 (600/300V) | 2.44 |
| PHILIPS G11 (470/250V) | 3.19 |
| PYE 691/7 (200/300/350V) | 2.97 |
| PYE 731 (600/300V) | 2.55 |
| RBM A823 (2500/2500/30V) | 1.83 |
| RBM A823 (600/300V) | 3.12 |
| RBM Z146 (300/300/350V) | 3.91 |
| RR1 T20A (220/400V) | 2.20 |
| ITT CVC5/9 (200/200/75/25) | 3.28 |
| ITT CVC 20 (220/400V) | 2.20 |
| GEC 2110 (600/250V) | 2.14 |
| GEC 2040 (1000/2000/35V) | 1.31 |
| GEC 2040 (300/300/150/100/50) | 4.51 |
| THORN 3500 (400/40V) | 33 |
| THORN 1400 (150/100/100/100/150/320V) | 3.07 |
| THORN 1500 (150/150/100/300V) | 2.42 |
| THORN 1500 (12/300V) | 35 |
| THORN 3500 (175/100/100/400/350V) | 3.06 |
| THORN 3500 (1000/63V) | 95 |
| THORN 3500 (1000/70V) | 95 |
| THORN 8000/8500 (2500/2500/63V) | 3.72 |
| THORN 8000/8500 (700/250V) | 2.55 |
| THORN 8000/8500 (400/350V) | 2.82 |
| THORN 9000 (400/400V) | 3.61 |
| GEC (200/200/150/50) | 2.91 |
| PHILIPS 69 2200/63V | 1.38 |
| THORN 4700 P/C 25V | 1.32 |
| THORN 1591/1691 4700/25V | 1.32 |
| G11 Capacitor 7N5 1500V | 1.40 |

### MAINS DROPPERS

| | |
|---|---|
| DECCA 20 | 2.48 |
| DECCA 27R/47R | 1.40 |
| DECCA 56R/6R8 | 1.40 |
| R.B.M. A823 56R/68R | 94 |
| R.B.M. 161 | 82 |
| GEC 2000/2018 | 70 |
| GEC 27840 | 64 |
| PYE 725/31 3RO/56R/27R | 1.84 |
| PYE 725 56R/27R | 1.04 |
| PHILIPS 210/5050 30R/125R/2k85 | 1.75 |
| PHILIPS 210/5051 -/118R/148R | 1.93 |
| PHILIPS G8/5081 47R Section | 72 |
| PHILIPS G8/5083 2R2/68R | 1.38 |
| THORN 1400 | 1.52 |
| THORN 1500 | 1.47 |
| THORN 1600 | 1.77 |
| THORN 3500 | 1.20 |
| THORN 8000 | 1.24 |
| THORN 8500 | 1.36 |
| THORN 9800 | 1.30 |
| DECCA 2R5 | 96 |
| DECCA 3R9 Modulohm | 60 |

### WIREWOUND RESISTORS*

| | |
|---|---|
| 4W 1R-10K | 24p |
| 7W 1R-22K | 26p |
| 11W 1R-22K | 29p |
| 17W 1R22K | 32p |

(Preferred values)*

### CARBON RESISTORS*

| | |
|---|---|
| ¼W 3R3-8M2 | 30 |
| ½W 3R3-8M2 | 30 |
| 1W 10R-10M | 46 |
| 2W 10R-10M | 72 |

Sold in packs of 10 per type i.e. per value

**See extra advert on following pages re exciting prices on Thorn New Life Exchange**

## VIDEO HEADS.

**£22 + V.A.T. inc. post & packing.**

### SERVICE MANUALS

Please check for availability

| | |
|---|---|
| DECCA 80 | 5.35 |
| 70/90 | 3.90 |
| 100 | 4.80 |
| PHILIPS G9 | 4.20 |
| G11 now in stock | 3.90 |
| K30 | 3.90 |
| KT3 | 3.90 |

**See also SONY range. Zero VAT on Manuals**

### GEC SERVICE MANUALS VIDEO

| | |
|---|---|
| V4004 | 6.25 |
| V4100 | 6.25 |
| V4001H | 6.25 |
| V4000H | 6.25 |

### NEW VALVES

| | |
|---|---|
| 30FL2 | 1.70 |
| DY802 | 98 |
| DY86/7 | 66 |
| ECC81 | 1.08 |
| ECC82 | 98 |
| ECC83 | 1.07 |
| ECC84 | 80 |
| ECC85 | 98 |
| ECC88 | 1.35 |
| ECF80 | 1.30 |
| ECF82 | 88 |
| ECH81 | 1.60 |
| ECH84 | 1.66 |
| ECL80 | 84 |
| ECL82 | 1.30 |
| ECL86 | 1.99 |
| EF80 | 95 |
| EF86 | 2.20 |
| EF183 | 99 |
| EF184 | 1.09 |
| EH90 | 1.02 |
| EL34 | 3.50 |
| EL84 | 1.05 |
| EY86/7 | 68 |
| EY500A | 2.25 |
| EZ80/1 | 56 |
| GY501 | 1.45 |
| GZ34 | 3.50 |
| KT66 | 8.50 |
| KT77 | 8.50 |
| KT88 (Alternative type) | 12.00 |
| PC92 | 3.00 |
| PC97 | 1.65 |
| PCC85 | 85 |
| PCC805 | 1.40 |
| PCF80 | 1.00 |
| PCF200 | 1.35 |
| PCF800 | 1.38 |
| PCF801 | 1.13 |
| PCF802 | 1.12 |
| PCF805 | 1.80 |
| PCF806 | 1.30 |
| PCF808 | 1.63 |
| PCH200 | 1.45 |
| PCL82 | 1.20 |
| PCL84 | 1.20 |
| PCL86 | 92 |
| PCL805 | 1.09 |
| PD500 | 2.93 |
| PFL200 | 1.86 |
| PL36 | 1.87 |
| PL81 | 94 |
| PL83 | 1.43 |
| PL84 | 84 |
| PL504 | 1.65 |
| PL508 | 2.90 |
| PL509/19 | 5.30 |
| PY88 | 81 |
| PY500A | 2.30 |
| PY800/1 | 69 |
| UCH81 | 2.25 |
| UCL83 | 1.82 |
| UY85 | 1.35 |
| PL802T | 4.00 |
| 40KD6 | 5.30 |
| 21LU8 | 3.00 |
| 17DW4A | 4.50 |
| 3AT2B | 5.00 |
| 12BY7A | 3.75 |
| 12HG7 | 3.20 |

### FUSES

| | Per type | Pack of 10 |
|---|---|---|
| **1¼" QUICK BLOW** | | |
| 100ma | | 73 |
| 250ma-500ma-750ma-1A | | 60 |
| 1.5A-2A-2.5A-3A-5A | | 60 |
| **1¼" ANTISURGE** | | |
| 250ma, 500ma, 630ma, 750ma, 850ma, 1A, 1.25A, 1.5A, 2A | 1.70 | |
| 2.5A, 3A, 5A | 2.70 | |
| **20mm ANTISURGE** | | |
| 80ma | 4.80 | |
| 100ma | 2.50 | |
| 160ma, 200ma | 2.20 | |
| 315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A | 1.30 | |
| 2.5A, 3.15A, 4A, 400ma, 5A | 1.90 | |
| **20mm QUICK BLOW 315ma** | | |
| 100ma, 250ma, 500ma, 630ma, 800ma | 90 | |
| 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A | 60 | |
| **1" MAINS** | | |
| 2A, 3A, 5A, 10A, 13A | 1.00 | |

**Please add VAT 15% to all prices including P&P chg. except when purchasing books OR for exports.**

### NEW FIDELITY Spares

Fly back trans.
FCC2015BE £10.74
FCC2215AE £10.74

### CAPACITORS

| Volts | Mfd | Price | | | |
|---|---|---|---|---|---|
| 6V3 | 33 | 9 | 63V | 1 | 12 |
| 10V | 22 | 10 | | 2.2 | 12 |
| | 47 | 10 | | 4.7 | 12 |
| | 100 | 10 | | 10 | 11 |
| | 220 | 15 | | 15 | 12 |
| | 470 | 20 | | 22 | 13 |
| 16V | 33 | 11 | | 47 | 19 |
| | 68 | 11 | | 100 | 23 |
| | 220 | 16 | | 220 | 41 |
| | 1000 | 27 | | 470 | 56 |
| | 3300 | 53 | | 1000 | 85 |
| 25V | 10 | 11 | | 2200 | 1.10 |
| | 22 | 13 | 100V | 10 | 13 |
| | 47 | 15 | | 22 | 15 |
| | 100 | 15 | | 47 | 20 |
| | 220 | 29 | | 100 | 36 |
| | 470 | 30 | | 220 | 70 |
| | 1000 | 55 | 450 | 1 | 33 |
| | 2200 | 59 | | 4.7 | 30 |
| | 4700 | 98 | | 10 | 43 |
| 40V | 10 | 10 | | 22 | 80 |
| | 22 | 10 | | 33 | 94 |
| | 400 | 48 | 600 | 0.1 | 41 |

### T.T.L. 74LS SERIES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 74HTC160 | 1.12 | 74LS32 | 90 | 74LS85 | 98 | 74LS157 | 78 | 74LS244 | 2.20 |
| | | 74LS30 | 35 | 74LS90 | 1.22 | 74LS158 | 65 | 74LS245 | 2.30 |
| 74LS00 | 58 | 74LS37 | 35 | 74LS92 | 65 | 74LS160 | 90 | 74LS251 | 65 |
| 74LS02 | 58 | 74LS38 | 35 | 74LS93 | 60 | 74LS161 | 85 | 74LS253 | 95 |
| 74LS03 | 58 | 74LS40 | 35 | 74LS107 | 80 | 74LS162 | 4.04 | 74LS257 | 1.20 |
| 74LS04 | 58 | 74LS42 | 80 | 74LS109 | 58 | 74LS163 | 85 | 74LS258 | 95 |
| 74LS05 | 58 | 74LS47 | 85 | 74LS112 | 50 | 74LS164 | 85 | 74LS259 | 1.70 |
| 74LS08 | 58 | 74LS48 | 83 | 74LS113 | 44 | 74LS165 | 1.50 | 74LS273 | 1.90 |
| 74LS09 | 58 | 74LS49 | 33 | 74LS114 | 70 | 74LS173 | 1.32 | 74LS283 | 1.30 |
| 74LS10 | 58 | 74LS51 | 33 | 74LS122 | 96 | 74LS174 | 85 | 74LS293 | 1.20 |
| 74LS11 | 58 | 74LS54 | 43 | 74LS123 | 80 | 74LS175 | 85 | 74LS352 | 1.40 |
| 74LS13 | 37 | 74LS55 | 60 | 74LS125 | 85 | 74LS191 | 1.02 | 74LS353 | 1.40 |
| 74LS14 | 46 | 74LS73 | 60 | 74LS126 | 60 | 74LS192 | 1.30 | 74LS365 | 75 |
| 74LS15 | 33 | 74LS74 | 65 | 74LS132 | 63 | 74LS193 | 1.30 | 74LS366 | 82 |
| 74LS20 | 35 | 74LS75 | 65 | 74LS138 | 83 | 74LS194A | 75 | 74LS367 | 1.65 |
| 74LS21 | 35 | 74LS76 | 65 | 74LS139 | 65 | 74LS197 | 95 | 74LS368 | 65 |
| 74LS22 | 35 | 74LS78 | 65 | 74LS151 | 85 | 74LS240 | 2.20 | 74LS373 | 1.40 |
| 74LS26 | 44 | 74LS83A | 89 | 74LS153 | 85 | 74LS241 | 2.20 | 74LS374 | 1.55 |
| 74LS27 | 35 | 74LS86 | 39 | 74LS155 | 65 | 74LS242 | 2.20 | 74LS393 | 1.20 |
| | | | | 74LS156 | 1.02 | 74LS243 | 2.20 | 74LS670 | 1.78 |

### '4000 B' SERIES CMOS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 4026 | 1.99 | 4068B | 22 | 4510B | 76 | 4538B | 1.04 |
| | | 4027B | 39 | 4069B | 22 | 4511B | 76 | 4539B | 77 |
| 4001B | 21 | 4028B | 64 | 4070B | 22 | 4512B | 72 | 4541B | 96 |
| 4002B | 21 | 4029B | 90 | 4071B | 40 | 4513B | 1.68 | 4543B | 1.12 |
| 4008B | 72 | 4032B | 1.04 | 4072B | 22 | 4514B | 1.88 | 4551B | 96 |
| 4011B | 31 | 4035B | 80 | 4073B | 22 | 4515B | 1.88 | 4553B | 2.40 |
| 4012B | 21 | 4038B | 99 | 4075B | 22 | 4516B | 76 | 4554B | 1.20 |
| 4013B | 30 | 4040B | 72 | 4076B | 80 | 4518B | 76 | 4556B | 48 |
| 4014B | 74 | 4042B | 58 | 4077B | 22 | 4519B | 64 | 4560B | 1.76 |
| 4015B | 76 | 4043B | 71 | 4078B | 22 | 4520B | 76 | 4561B | 74 |
| 4016B | 42 | 4044B | 71 | 4081B | 22 | 4521B | 1.68 | 4566B | 1.20 |
| 4017B | 66 | 4046B | 96 | 4093B | 49 | 4522B | 88 | 4580B | 3.60 |
| 4018B | 72 | 4047B | 70 | 4094B | 1.56 | 4526B | 88 | 4581B | 1.84 |
| 4010B | 70 | 4049UB | 32 | 4099B | 1.20 | 4527B | 1.20 | 4582B | 80 |
| 4020B | 76 | 4050B | 32 | 4160B | 72 | 4528B | 88 | 4583B | 1.00 |
| 4021B | 70 | 4051B | 72 | 4161B | 72 | 4529B | 1.04 | 4584B | 40 |
| 4022B | 70 | 4052B | 72 | 4162B | 72 | 4530B | 62 | 4585B | 88 |
| 4023B | 21 | 4053B | 72 | 4163B | 72 | 4531B | 72 | 4597B | 1.84 |
| 4024B | 50 | 4060B | 96 | 4502B | 72 | 4532B | 1.00 | 4598B | 2.40 |
| 4025B | 21 | 4066B | 43 | 4505B | 1.88 | 4536B | 2.64 | 4599B | 2.00 |

### Volts D.C.

| | | | | | |
|---|---|---|---|---|---|
| 250V | 0.1mF | 38p | | | |
| | 0.91mF | 1.92 | 1250V | 0.1mF | 59 |
| 400V | 0.22mF | 29 | 1500V | 0.0047mF | 32 |
| 600V | 0.1mF | 38 | | 0.022mF | 30 |
| 1000V | 0.01mF | 24 | | 0.033mF | 62 |
| | 0.047mF | 46 | 2000V | 0.0052mF | 1.20 |
| | 0.033mF | 33 | 2500V | 0.0022mF | 50 |
| | 0.1mF | 35 | | | |
| | 0.22mF | 66 | | | |
| | 0.47mF | 98 | | | |

### TANTALUM

| | | |
|---|---|---|
| 6.3V | 47mF | 42 |
| | 100mF | 90 |
| 16V | 10mF | 22 |
| | 22mF | 28 |
| | 47mF | 1.03 |
| 25V | 22mF | 46 |
| 35V | 0.1mF | 13 |
| | 0.22mF | 13 |
| | 0.47mF | 13 |
| | 1mF | 13 |
| | 2.2mF | 17 |
| | 4.7mF | 26 |
| | 10mF | 57 |

### POLYESTER

| | | |
|---|---|---|
| 250V | 0.01mF | 13p |
| | 0.1mF | 16p |
| | 0.22mF | 16p |
| 400V | 0.01mF | 14p |
| | 0.1mF | 17p |
| | 0.22mF | 17p |

**We are now stocking a range of Thorn New Life tubes. Please ring for prices and carriage costs.**

### DISC CERAMIC CAPS

8kV (12kV) 40p
200pF, 150pF, 180pF
63V/100V 12p
A range of pref. values 22pF-4700pF

**Sheila says THANKS to her many valued customers and hopes the new additions are useful.**

**WE INVITE YOU TO COME AND SEE US! We make good tea.**

### NEW MONO TUBES

| | |
|---|---|
| MULL. A31/510 110° 12" | 22.00 |
| MULL. A34/510 110° 14" | 26.50 |
| A50/120WR 110° 20" | 18.50 |
| A61/120WR 110° 24" | 20.50 |

### NEW TUBES

| | |
|---|---|
| ATX 56-001 | 95.00 |
| ATX 51-00X | 95.00 |
| A56/610 | 95.00 |

### REBUILT COLOUR TUBES

**ALL AVAILABLE EX-STOCK ON GLASS FOR GLASS EXCHANGE FROM TRADE COUNTER. SOME TYPES AVAILABLE WITHOUT EXCHANGE FOR SMALL GLASS CHARGE**

| | |
|---|---|
| 17" A44/271X | 32.00 |
| 18" A47/342X (Low Focus) | 32.00 |
| 18" A47/343X (Stnd Focus) | 32.00 |
| 20" A51/110X | 30.00 |
| 19" A49/120X | 30.00 |
| 22" A56/120X | 30.00 |
| 22" A55/14X | 30.00 |
| 25" A63/200X | 34.00 |
| 26" A66/120X | 34.00 |
| 26" A67/120X | 34.00 |
| 22" A56/140X (410X) 110° | 36.00 |
| 26" A66/140X (410X) 110° | 36.00 |
| 20" A51/161X | 60.00 |
| 22" A56/510X | 50.00 |
| A56 540X | 89.00 |
| A66 540X | 75.00 |
| A66 500X | 64.00 |

P.I.L. TUBES – we can rebuild your own glass – please ring for quotes. Carriage cost on tubes £10 + VAT

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AN127Q | £1.75 | CX143A | £7.50 | HA11788 | £4.50 | M54543L | £2.75 | TA7136P | £1.00 | UPC1028H | £0.90 | 2SA899 | £0.75 | 2SC1427 | £0.30 |
| AN203 | £2.20 | CX157 | £3.95 | HA11816NT | £6.50 | M54548L | £6.75 | TA7137P | £0.80 | UPC1031H | £1.80 | 2SA940 | £0.80 | 2SC1505 | £0.70 |
| AN210 | £1.75 | CX158 | £3.50 | HA11828NT | £9.50 | MB3705 | £1.60 | TA7139P | £1.50 | UPC1032H | £0.50 | 2SA952 | £0.35 | 2SC1546 | £0.30 |
| AN211A | £2.25 | CX160 | £2.50 | HA12035 | £9.50 | MB3712 | £1.50 | TA7145P | £1.80 | UPC1035C | £1.20 | 2SA1015 | £0.30 | 2SC1664 | £2.50 |
| AN214Q | £1.80 | CX161A | £2.50 | HA12413 | £2.50 | MB3730 | £1.75 | TA7146P | £2.50 | UPC1037H | £0.75 | 2SA1102 | £1.90 | 2SC1682 | £0.30 |
| AN217B | £2.20 | CX162 | £3.40 | HA13402 | £3.50 | MB3731 | £2.50 | TA7150P | £1.80 | UPC1043C | £1.20 | 2SA1103 | £1.90 | 2SC1741 | £0.30 |
| AN228W | £2.75 | CX170 | £6.50 | HA13403 | £7.50 | MB3756 | £2.60 | TA7152P | £1.70 | UPC1156H | £1.40 | 2SA1104 | £1.90 | 2SC1815 | £0.25 |
| AN236 | £2.50 | CX181 | £8.50 | HA13430A | £3.50 | MB8719 | £3.50 | TA7173P | £1.60 | UPC1158H | £0.60 | 2SA1105 | £2.25 | 2SC1826 | £0.60 |
| AN239Q | £3.80 | HA1124A | £2.75 | LA1111P | £0.80 | PLL01A | £2.30 | TA7176P | £1.50 | UPC1161C | £0.75 | 2SA1106 | £2.50 | 2SC1849 | £0.30 |
| AN240P | £1.50 | HA1125 | £1.50 | LA1201 | £0.85 | PLL03A | £4.95 | TA7193P | £3.50 | UPC1163H | £0.60 | 2SA1198 | £0.35 | 2SC1945 | £3.50 |
| AN241P | £1.50 | HA1137 | £1.75 | LA1222 | £0.80 | SI-1125H | £7.50 | TA7200 | £2.00 | UPC1167C | £0.70 | 2SB22 | £0.40 | 2SC1946A | £9.50 |
| AN247P | £2.50 | HA1149 | £1.40 | LA1230 | £1.50 | STK011 | £3.75 | TA7201 | £2.00 | UPC1168C | £0.90 | 2SB54 | £0.70 | 2SC1957 | £0.80 |
| AN259 | £2.75 | HA1151 | £2.50 | LA1240 | £1.75 | STK013 | £6.25 | TA7202P | £2.00 | UPC1170H | £0.75 | 2SB75 | £0.60 | 2SC1969 | £1.30 |
| AN262 | £1.50 | HA1156 | £1.10 | LA1320 | £1.50 | STK014 | £6.25 | TA7203P | £1.80 | UPC1171C | £1.50 | 2SB341V | £2.60 | 2SC2021 | £0.30 |
| AN271A | £2.50 | HA1166 | £1.60 | LA1365 | £1.20 | STK015 | £5.00 | TA7204P | £1.10 | UPC1176C | £1.20 | 2SB405 | £0.80 | 2SC2026 | £0.65 |
| AN274 | £2.50 | HA1196 | £3.75 | LA1368 | £2.20 | STK016 | £4.75 | TA7205AP | £1.00 | UPC1177H | £1.20 | 2SB426 | £2.60 | 2SC2028 | £0.75 |
| AN295 | £3.25 | HA1197 | £1.50 | LA1460 | £1.95 | STK020 | £4.50 | TA7207P | £1.50 | UPC1178C | £1.00 | 2SB471 | £3/50 | 2SC2075 | £0.25 |
| AN303 | £2.50 | HA1199 | £1.40 | LA2200 | £1.75 | STK022 | £5.25 | TA7208P | £1.50 | UPC1180C | £1.40 | 2SB492 | £0.75 | 2SC2078 | £0.75 |
| AN313U | £2.75 | HA1306W | £1.60 | LA3101 | £1.60 | STK025 | £6.75 | TA7210P | £2.00 | UPC1181H | £1.00 | 2SB509D | £1.70 | 2SC2091 | £0.60 |
| AN315 | £2.00 | HA1319 | £2.00 | LA3155 | £0.95 | STK041 | £6.50 | TA7214P | £2.50 | UPC1182H | £1.00 | 2SB534 | £0.60 | 2SC2092 | £0.95 |
| AN316 | £3.50 | HA1322C | £1.60 | LA3160 | £0.90 | STK077 | £5.95 | TA7215P | £1.80 | UPC1183H | £1.20 | 2SB536 | £0.95 | 2SC2098 | £0.95 |
| AN318 | £4.75 | HA1339A | £1.60 | LA3201 | £0.95 | STK078 | £5.50 | TA7217AP | £1.20 | UPC1185H | £2.20 | 2SB546 | £1.50 | 2SC2166 | £0.95 |
| AN331 | £2.75 | HA1342A | £1.70 | LA3300 | £1.40 | STK080 | £7.20 | TA7220P | £1.75 | UPC1186 | £0.80 | 2SB561 | £0.30 | 2SC2238 | £0.65 |
| AN360 | £1.20 | HA1366W | £1.50 | LA3301 | £1.20 | STK082 | £7.75 | TA7222AP | £1.20 | UPC1187V | £1.30 | 2SB698 | £0.30 | 2SC2278 | £0.70 |
| AN362L | £1.30 | HA1366WR | £1.50 | LA3350 | £1.20 | STK086 | £9.25 | TA7223P | £1.95 | UPC1190C | £0.95 | 2SB754 | £0.95 | 2SC2335 | £1.50 |
| AN366P | £1.50 | HA1367 | £3.25 | LA3361 | £1.20 | STK430 | £4.75 | TA7224P | £2.75 | UPC1191V | £0.95 | 2SB755 | £2.50 | 2SC2365 | £4.25 |
| AN610P | £1.75 | HA1368 | £1.60 | LA4030P | £2.00 | STK433 | £4.50 | TA7225P | £2.50 | UPC1198H | £0.70 | 2SB772Q | £0.90 | 2SC2540 | £12.75 |
| AN612 | £1.75 | HA1368R | £1.65 | LA4031P | £1.40 | STK435 | £5.00 | TA7226P | £2.20 | UPC1200V | £0.80 | 2SC372 | £0.30 | 2SC2570 | £0.70 |
| AN5722 | £1.50 | HA1370 | £2.75 | LA4032P | £1.40 | STK436 | £5.00 | TA7227P | £1.50 | UPC1208C | £0.95 | 2SC373 | £0.30 | 2SC2577 | £1.90 |
| AN5730 | £1.85 | HA1374 | £2.50 | LA4051P | £1.50 | STK437 | £6.30 | TA7229P | £3.00 | UPC1211V | £1.90 | 2SC380A | £0.30 | 2SC2578 | £2.20 |
| AN5732 | £1.85 | HA1377A | £2.20 | LA4100 | £1.00 | STK439 | £5.50 | TA7230P | £1.75 | UPC1215V | £1.25 | 2SC458 | £0.20 | 2SC2579 | £2.20 |
| AN5753 | £1.95 | HA1388 | £2.35 | LA4101 | £1.00 | STK441 | £6.00 | TA7232P | £2.75 | UPC1216V | £0.95 | 2SC460 | £0.30 | 2SC2580 | £2.20 |
| AN6250 | £2.30 | HA1389 | £1.75 | LA4102 | £1.20 | STK443 | £6.95 | TA7310P | £1.40 | UPC1217G | £1.60 | 2SC461 | £0.30 | 2SD24 | £0.50 |
| AN6344 | £4.75 | HA1389R | £1.40 | LA4110 | £1.40 | STK457 | £5.50 | TA7312P | £1.30 | UPC1218H | £1.40 | 2SC503Y | £0.70 | 2SD170 | £0.60 |
| AN7105 | £2.20 | HA1392 | £2.30 | LA4112 | £1.30 | STK459 | £5.75 | TA7313AP | £1.30 | UPC1222C | £0.90 | 2SC536 | £0.20 | 2SD187 | £0.60 |
| AN7110 | £1.40 | HA1394 | £2.75 | LA4120 | £2.50 | STK460 | £7.50 | TA7315AP | £1.75 | UPC1223C | £1.75 | 2SC537 | £0.25 | 2SD313 | £0.95 |
| AN7114E | £1.60 | HA1397 | £2.50 | LA4125 | £2.00 | STK461 | £6.50 | TA7325P | £0.85 | UPC1225H | £1.60 | 2SC620 | £0.50 | 2SD325 | £0.65 |
| AN7115E | £1.60 | HA1398 | £2.40 | LA4140 | £0.70 | STK463 | £7.40 | TA7328 | £1.60 | UPC1226C | £1.25 | 2SC632 | £0.30 | 2SD348 | £4.50 |
| AN7120 | £1.40 | HA1457W | £0.90 | LA4182 | £2.00 | STK465 | £8.50 | TA7607AP | £2.75 | UPC1227V | £0.95 | 2SC681 | £2.20 | 2SD352A | £0.50 |
| AN7130 | £1.50 | HA11215A | £4.25 | LA4192 | £1.95 | STK0025 | £4.95 | TA7608 | £3.50 | UPC1230H | £2.50 | 2SC681A | £2.30 | 2SD371 | £1.30 |
| AN7145M | £1.80 | HA11221 | £2.30 | LA4200 | £1.50 | STK0029 | £4.35 | TA7609P | £2.30 | UPC1238V | £0.85 | 2SC710 | £0.30 | 2SD401 | £1.50 |
| AN7146M | £1.85 | HA11223W | £3.80 | LA4220 | £1.20 | STK0039 | £4.25 | TA7611 | £2.75 | UPC1245V | £1.00 | 2SC717 | £0.50 | 2SD467B | £0.30 |
| AN7154 | £1.75 | HA11225 | £1.95 | LA4230 | £1.75 | STK0040 | £5.50 | TA7658P | £1.50 | UPC1277H | £2.75 | 2SC732 | £0.30 | 2SD468B | £0.50 |
| AN7156N | £2.40 | HA11235 | £2.00 | LA4400 | £1.90 | STK0049 | £5.75 | UHIC001 | £4.80 | UPC1278H | £2.50 | 2SC733 | £0.30 | 2SD718 | £1.50 |
| AN7158N | £3.25 | HA11423 | £4.75 | LA4420 | £1.40 | STK0059 | £6.00 | UHIC004 | £4.80 | UPC1350C | £1.20 | 2SC792 | £2.85 | 2SD734 | £0.30 |
| AN7168 | £2.50 | HA11701 | £4.50 | LA4422 | £1.20 | STK0080 | £6.50 | UPC16C | £1.30 | UPC1353C | £1.75 | 2SC799 | £1.75 | 2SD916 | £0.95 |
| AN7310 | £0.80 | HA11702 | £4.90 | LA4430 | £1.30 | STK2028 | £6.50 | UPC20C | £2.20 | UPC1356C | £1.50 | 2SC828 | £0.20 | 2SD1133 | £1.75 |
| AN7311 | £1.00 | HA11703 | £4.50 | LA4440 | £2.20 | STK2029 | £3.75 | UPC30C | £1.80 | UPC1358H | £1.50 | 2SC840 | £1.50 | 2SD1276 | £1.50 |
| BA301 | £0.75 | HA11704 | £4.75 | LA4460 | £1.75 | STK2230 | £6.00 | UPC41C | £2.00 | UPC1360C | £1.60 | 2SC867 | £2.75 | 2SJ49 | £4.00 |
| BA311 | £0.95 | HA11705 | £6.50 | LA4461 | £1.75 | STK2240 | £9.75 | UPC554C | £1.25 | UPC1363C | £1.95 | 2SC900 | £0.35 | 2SJ50 | £4.00 |
| BA313 | £0.75 | HA11706 | £4.75 | LA4500 | £2.50 | STK3042 | £6.50 | UPC555 | £0.60 | UPC1365C | £3.00 | 2SC929D | £0.35 | 2SK19 | £0.50 |
| BA318 | £1.30 | HA11710 | £5.50 | LA4505 | £2.50 | STK5211 | £6.75 | UPC561C | £2.00 | UPC1366C | £1.50 | 2SC930D | £0.30 | 2SK38A | £2.70 |
| BA402 | £0.75 | HA11711 | £9.50 | LA6458 | £0.90 | STK5421 | £6.50 | UPC566H | £0.60 | UPC1367C | £1.50 | 2SC945 | £0.35 | 2SK49 | £0.60 |
| BA511A | £1.80 | HA11713 | £6.00 | LA7800 | £1.95 | STK5451 | £6.75 | UPC571 | £1.95 | UPC1368H | £1.75 | 2SC1034 | £3.75 | 2SK120 | £0.90 |
| BA514 | £1.75 | HA11714 | £5.75 | LA7806 | £2.50 | STK5720 | £6.80 | UPC573C | £2.20 | UPC1370C | £1.95 | 2SC1061 | £0.95 | 2SK134 | £4.00 |
| BA521 | £1.75 | HA11715 | £6.25 | LC7120 | £3.50 | STK5730 | £6.75 | UPC574J | £0.35 | UPC1373H | £0.75 | 2SC1096 | £0.60 | 2SK135 | £4.00 |
| BA527 | £1.50 | HA11716 | £6.25 | LC7130 | £3.50 | TA7050P | £0.80 | UPC575C | £1.00 | UPC1378H | £1.95 | 2SC1114 | £3.50 | 3SK22 | £1.75 |
| BA532 | £1.50 | HA11717 | £6.25 | LC7131 | £3.75 | TA7051P | £0.80 | UPC576H | £1.75 | UPC1382C | £0.75 | 2SC1115 | £3.75 | 3SK45 | £0.60 |
| BA536 | £2.25 | HA11718 | £4.75 | LC7136 | £2.75 | TA7054 | £1.70 | UPC577 | £0.70 | UPC1384C | £2.50 | 2SC1124 | £0.80 | 3SK88 | £0.50 |
| BA612 | £1.80 | HA11724 | £18.25 | LC7137 | £2.75 | TA7063 | £0.80 | UPC580 | £2.75 | UPC1458C | £0.90 | 2SC1162C | £0.80 | TDA1515 | £4.30 |
| BA1310 | £1.75 | HA11725 | £16.00 | M5106P | £2.25 | TA7066 | £1.50 | UPC585C | £0.95 | UPD277 | £4.50 | 2SC1170B | £2.95 | TDA2002 | £0.80 |
| BA1320 | £1.25 | HA11726 | £15.00 | M5115P | £3.50 | TA7070P | £1.40 | UPC592 | £0.95 | 2SA103 | £0.60 | 2SC1172 | £2.75 | TDA2003 | £0.90 |
| BA1330 | £1.75 | HA11727 | £9.50 | M5134P | £2.75 | TA7073 | £2.25 | UPC595C | £1.70 | 2SA350 | £0.60 | 2SC1307 | £1.25 | TDA2004 | £2.20 |
| BA6304 | £2.20 | HA11736 | £16.00 | M5135P | £2.30 | TA7074P | £1.95 | UPC596 | £1.50 | 2SA495 | £0.35 | 2SC1308 | £2.70 | TDA2005 | £2.75 |
| CX0642 | £8.50 | HA11745 | £9.00 | M5155 | £1.50 | TA7104P | £1.35 | UPC1001H | £2.00 | 2SA539 | £0.30 | 2SC1316 | £2.95 | TDA2006 | £1.20 |
| CX065B | £2.50 | HA11747 | £9.50 | M51513L | £1.50 | TA7108 | £1.50 | UPC1009C | £1.20 | 2SA562 | £0.30 | 2SC1317 | £0.30 | TDA2020 | £1.40 |
| CX075B | £2.20 | HA11747ANT | £9.50 | M51514AL | £1.75 | TA7109 | £2.30 | UPC1017G | £1.30 | 2SA634 | £0.60 | 2SC1342 | £0.75 | TDA2030 | £1.40 |
| CX095C | £2.80 | HA11749 | £4.50 | M51515BL | £2.50 | TA7119 | £1.75 | UPC1018C | £0.95 | 2SA643 | £0.65 | 2SC1364 | £0.40 | | |
| CX100D | £5.75 | HA11750 | £5.00 | M51516L | £2.50 | TA7120P | £0.50 | UPC1020 | £1.75 | 2SA673 | £0.35 | 2SC1417 | £0.30 | | |
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| FF/REW IDLER (HITACHI VT-11, ETC) | £6.50 | REEL DRIVE PULLEY (SANYO 5000) | £8.88 |
| FF/REW IDLER (HITACHI VT8000) | £4.72 | REEL MOTOR (SANYO 5000 ETC) | £14.20 |
| FF/REW IDLER (HITACHI VT9300) | £4.75 | REEL MOTOR (SHARP 9300, 381, ETC) | £15.30 |
| REEL IDLER (FERG, 3V29/30) | £3.45 | CAPSTAN MOTOR (SONY C5/C7) | £39.85 |
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TELEVISION


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## CAN YOU HELP?
Does anyone know where spares and/or service data can be obtained for Winthronics monochrome portables?

## FRONT COVER
This month's cover photograph shows a Panasonic NV7000 with the top casing removed. See servicing article on page 590.

# Broadcasting Changes

The control of broadcasting seems to be a perennial concern of governments and politicians. Rigid government control is of course a feature of totalitarian societies where broadcasting is a state organ used primarily to inform the population of the state's views, edicts and wishes, with some state approved entertainment thrown in to leaven the mixture. Many democratic countries do little better. Some try ever so hard and end up with monumental dullness. One thing we can be proud of in the UK is the independence of our broadcasters, both from detailed control by the government of the day and excessive commercial interests, and the general quality of the services they provide. The tradition of independence was established by the early leaders of the BBC and has been strengthened in more recent decades by the IBA. The system has served us well and we should be grateful for it.

But this doesn't stop governments and politicians from questioning the system and generating a certain amount of fuss from time to time. This usually starts when the subject of financing the broadcasters comes up for review. Primarily this means the licence fee and the BBC's budget. The rapid inflation of the seventies made matters a lot worse since the BBC kept having to ask for substantial increases. Last time round the problem wasn't so much money as the hope of a section of the advertising world that it could persuade the government to open up the BBC's services to advertising. This would have meant lots of work for agencies but in the event has been largely discounted by the view that spreading advertising, which is unlikely to expand greatly in total, too thinly across the various services would simply jeopardise the existing independent TV operators. Be that as it may the government's reaction last time round, in March 1985, was to set up the Peacock Committee on the future financing of the BBC.

The Committee is due to report to the Home Secretary this month (June), with publication of the report likely in July. In view of the amount of leaking and press comment on the Committee's deliberations the report should contain few surprises. It's understood that the main conclusions will be that advertising on BBC television would not be of overall benefit to TV broadcasting in the UK, that the BBC's licence fee should be linked to the cost of living for the next ten years, that Channel 4 should be financed independently of the rest of the ITV network, and that the radio broadcasting arrangements should be altered.

There's good reason to review the broadcasting arrangements from time to time. After all what's appropriate at one time is not necessarily suitable at another. Times change and in particular broadcasting technology is likely to evolve rapidly over the next few years as satellite systems are established. The BBC has been with us for nearly 60 years and the IBA was set up 30 years ago. They continue to do a good job and the Peacock Committee's recommendations don't sound particularly alarming. More like minor adjustments here and there. Publication of the report is nevertheless quite likely to cause a stir. That's inevitable considering the publicity conscious nature of broadcasters and the fact that a few interests are likely to feel they've not been treated fairly.

On the technical side the Peacock Committee may recommend joint transmitting operations for the BBC and the IBA services. It was logical to combine the provision of programmes with the technical side in the early days of broadcasting when the overriding concern was to put the two on a secure financial footing. It's less logical that the two should be so closely linked in today's changed circumstances. Both the BBC and the IBA run impressive technical operations that have been responsible for many major developments. Would their efforts be any less effective by being run on a joint basis? The decision appears to be one that will have to be taken on administrative rather than technical grounds.

The IBA's operations have also been in the public eye recently. Speaking at the Royal Television Society's recent dinner the IBA's director-general John Whitney called in question the present system of awarding eight-year franchises to the ITV companies. He proposed a system of "rolling contracts", with more rigid enforcement of public service broadcasting obligations and less strict control over the ownership of ITV companies. The present system in which the franchises have to be advertised every eight years is hardly popular. As the IBA's chairman Lord Thomson put it after the last franchise round "there has got to be a better way". The problems relate to the time, effort and expense required in making franchise applications and the fact that whatever it decides the IBA will come in for criticism. Just how do you judge a collection of promises and proposals? The present system is essentially a compromise that was considered to be a suitable approach in the early days of ITV. A different compromise would seem to be more appropriate in today's changed circumstances. Mr. Whitney also criticised the levy imposed on ITV profits, something that at its present level seems to reflect reaction to the earlier period of the famed "licence to print money".

Meanwhile changes are also afoot on the other side of the channel. The new French government plans to privatise TF-1, the largest and oldest network which is heavily indebted. The status of the regional network FR3 is to be reviewed. On the satellite TV front the government has decided to revise the financial arrangements and wants to cancel the agreements made by the previous government for the operation of the channels.

# Long-distance Television

**Roger Bunney**

Following months of winter gloom April at last produced increased reception. During the first half of the month there was little SpE or indeed any other activity apart from the usual meteor shower pings but the second half was considerably more active.

For those who made a note of the meteor shower predictions given in the February issue April 22nd was very rewarding. The active MS conditions lasted into the evening and reports were received from several enthusiasts. Since many of the signals received consisted of programme material identification was difficult. Those stations/countries definitely identified were as follows: RTP (Portugal) chs. E2 and 3; TVE (Spain) E2; TVP (Poland) R1, 2; TSS (USSR) R1, 2; CST (Czechoslovakia) R1. Unfortunately no Band III signals were reported.

SpE propagation improved towards the end of the month, suggesting a good season ahead. From 23 years of DX-TV experience I've noted that a good opening in April usually means that the summer months will be productive. There were excellent openings on the 28th and 29th at around midday. The SpE log is as follows:

10/4/86 SR (Sweden) ch. E3; NRK (Norway) E2; RUV (Iceland) E4.
24/4/86 TSS R1; MTV (Hungary) R1; SR E2, 4; NRK E2; DFF (E. Germany) E4.
25/4/86 CST R1.
27/4/86 TVP R1.
28/4/86 RAI (Italy) IA, B; RTP E3; SR E2; CST R1; TSS R1; TVP R1.
29/4/86 TVE E2, 3; RAI IA, B; ORF (Austria) E2a; JRT (Yugoslavia) E3; CST R1, 2; +PTT (Switzerland) E3; ARD (W. Germany) E2, 3, 4; TVP R1; DFF E4; DR (Denmark) E4; SR E3.
30/4/86 CST R1; DR E4.

Thanks to Cyril Willis (Norfolk), Simon Hamer (Powys), David Martin (Poole), Iain Menzies (Aberdeen), Derek Juniper (Angus), Bill Cotterill (Tipton), Tony Privett (Basingstoke) and Roger Pates (Nottingham) for sending in reception details.

Two things to look out for. First TVP-2 transmits Polish teletext for some ten minutes after close down, with about 25 pages. Secondly amongst the increasing number of French TV5 and TV6 stations being received in the UK there's now a Band I outlet: a French DXer reports that a ch. L4 transmitter is now operating in the Lille area, carrying TV6.

During the first few days of May Halley's comet passed by: increased MS reception had been expected but monitoring during the early morning hours was very unproductive.

## News Items

**UK:** The first programmes from London's latest pirate TV station Network 21 were transmitted on March 21st, using ch. E21. The transmission lasted for about half an hour from 2400 and the station has been on air on subsequent Fridays. There have been no reports to date of reception by DXers.

**Spain:** A bill being introduced will break TVE's present monopoly, at least three private channels being envisaged. There will be ten year contract periods with funding by either Spanish or EEC organisations. Several Spanish and one Italian group have already expressed interest.

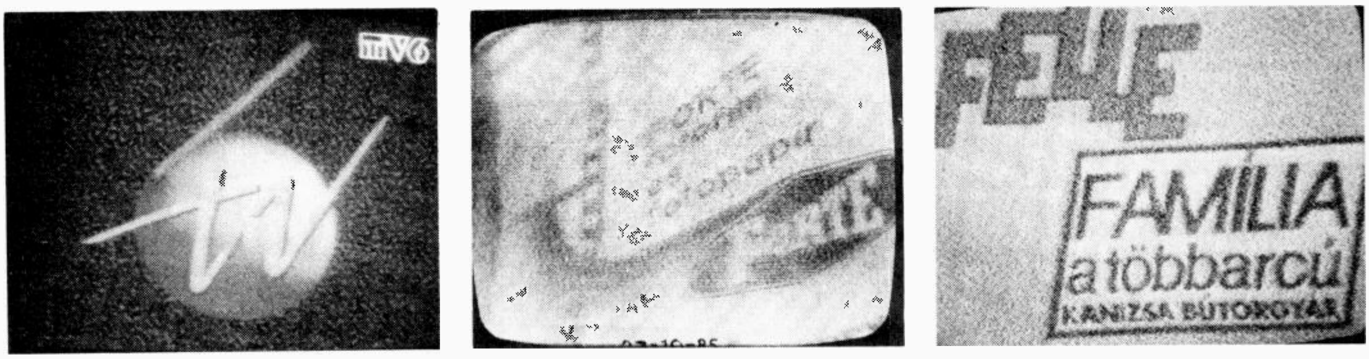
**France:** The new government is considering substantial revision of the arrangements for TV services.

**Belgium:** TV-Team, a subsidiary of RTL, could well start a third network. RTBF has encountered strong opposition to the installation of a high-power transmitter at Ittre, 20kM south of Brussels, as a replacement for Wavre (ch. E28). A new site may have to be found.

**In brief:** Commercials are now included in the Saudi English service (Channel 2), though initially only for locally produced goods . . . Nepal-TV began operations on December 29th last, with a fifteen minute daily news programme and other material received via satellite downlinks. The service area is at present restricted to the Kathmandu valley . . . Ghana TV (GBC-TV) began colour transmissions in early May.

## New Products

Tim Healey (Plymouth) tells us that he recently erected an inexpensive lattice mast produced by a small local company run by Ken Arnold of Portland Cottage, Pensilver, Cornwall. The range of towers is anti-corrosion painted but not galvanised, the prices being some 30-40 per cent below those of conventional communications masts. Examples include a telescopic lattice tower to say 42ft using 1in. vertical seamless pipe, ⅜in. strut and tiltover at £260 (usually around £410); a 40ft square tube tiltover with winch and ground post at £160 (usually




*Left: French TV6 network logo received by Dave Shirley (Hastings) from Lens on ch. E54. Centre: MTV-2 (Hungary) received in Holland by Ryn Muntjewerff – an advertisement on ch. R37. Right: Advertisement received from Hungary on ch. R9 by Keith Chaplin at Barrow-on-Soar, Leics. Both Hungarian signals were received on October 27th 1985.*

around £260); and a 32ft lattice tiltover at £160. Delivery can be arranged. For details write enclosing a foolscap s.a.e. plus two 12p stamps (UK only).

Brian Lee of 31 Merton Avenue, Farsley, Pudsey, W. Yorkshire LS28 5DX (0532 567 642) has produced a wall rotor bracket in ¼in. thick mild steel using a very strong triangular configuration. The upper bracket is fitted with two plastic bearing units that fit snugly around a 1½in. o.d. mast, the two bearings being welded in parallel to prevent side-by-side motion. The rotor fits at the bottom of the bracket: thus the plastic bearings replace the conventional alignment bearing. Each bracket is tailor-made to customer's dimensions (i.e. wall stand-off etc.) and variations in the brackets can be supplied. The wall rotor bracket costs £23·50 plus £4·50 post and packing, UK mainland. Please include s.a.e. with any enquiries.

### *Satellite Scene*

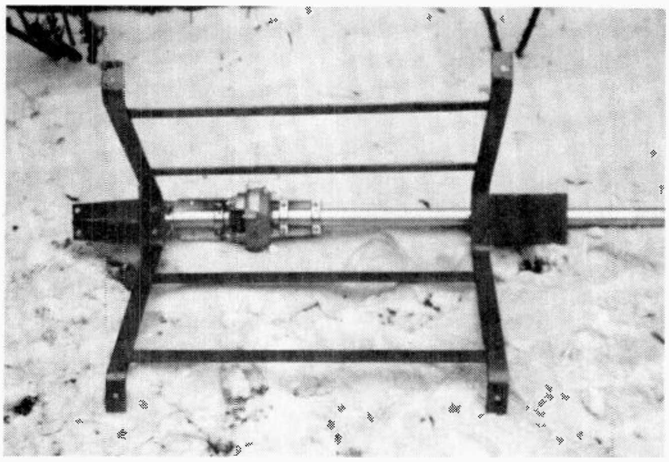
Channel Master is now selling a VideoCipher-II unscrambler in the USA at $395. Scrambling is a controversial matter in N. America at present. CNN recently reported that an HBO downlink was being jammed by an anti-scrambling lobbyist who beamed a signal on the 6MHz uplink frequency, resulting in complete loss of the 4GHz downlink signal. The VideoCipher-II system is likely to be adopted as an industry standard in the USA.

Tony Dunnett of SAT-Tel, Motueka, New Zealand is now receiving good signals from AUSSAT-1's transponder 7 (eastern time ABC network) and transponder 5 (SBS – intended for distribution, at 12W). He reports that Intelsat V at 180°E provides several programme sources in the 4GHz band, including CNN/NBC, JISO (Japan news feed from the USA), CBS/ABC, AFRTS and an Australian-New Zealand news feed. Most channels provide entertainment quality reception using a 5m dish, 55°K LNA and a home produced 27MHz bandwidth receiver.

Table 1 shows satellite TV signals at present available in the UK. ECS-1 is at 13°E, ECS-2 at 7°E, Intelsat V at 60°E and Intelsat VA-F11 at 27·5°W. The listing was accurate at the time of compilation (end April) but changes keep taking place.

The Neville Cresdee satellite location/bearing/azimuth service for all known TV transmitting satellites above your horizon in both the 4GHz and 11/12GHz bands now runs to twelve pages and includes predictions of solar "outrages" – when the sun aligns itself with the focal point of your dish, producing solar noise interference. The cost is £20 ($36 US), from 14 Arminers Close, Clayhall, Gosport, Hants PO12 2HB – send an s.a.e. with enquiries and if ordering include the co-ordinates of your location or, if these are not known, sufficient details to enable your location to be established.

Not exactly a DX-TV matter perhaps but worth men-



*Wall rotor bracket available from Brian Lee.*



**Table I: European satellite TV transmissions**

| *Programme/polarisation* | *Frequency GHz* | *Satellite* |
|---|---|---|
| Teleclub (V) | 10.9866 | ECS-1 |
| RAI-1 (H) | 11.005 | ECS-1 |
| WDR-3 (H) | 11.015 | Intelsat V |
| Premiere/ Children's Channel (H) | 11.015 | Intelsat VA-F11 |
| 3-SAT (H) | 11.057 | ECS-1 |
| RTL+ (V) | 11.087 | ECS-1 |
| Worldnet (H) | 11.093 | ECS-2 |
| Music Box (H) | 11.135 | Intelsat V |
| Screen Sport/Life Style/ ARTS (H) | 11.135 | Intelsat VA-F11 |
| Filmnet/ATN (H) | 11.1403 | ECS-2 |
| Eurovision (V) | 11.142 | ECS-2 |
| CNN (V) | 11.155 | ECS-2 |
| BR3 (H) | 11.175 | Intelsat V |
| Europa (H) | 11.175 | ECS-1 |
| MirrorVision (H) | 11.175 | Intelsat VA-F11 |
| EBU (H) | 11.176 | ECS-2 |
| SVT-1 (V) | 11.468 | ECS-2 |
| New World/TV5 (H) | 11.472 | ECS-1 |
| SAT-1 (V) | 11.507 | ECS-1 |
| Worldnet (H) | 11.512 | ECS-1 |
| SVT-2 (V) | 11.635 | ECS-2 |
| NRK (H) | 11.642 | ECS-2 |
| Sky (H) | 11.650 | ECS-1 |
| Music Box (V) | 11.674 | ECS-1 |

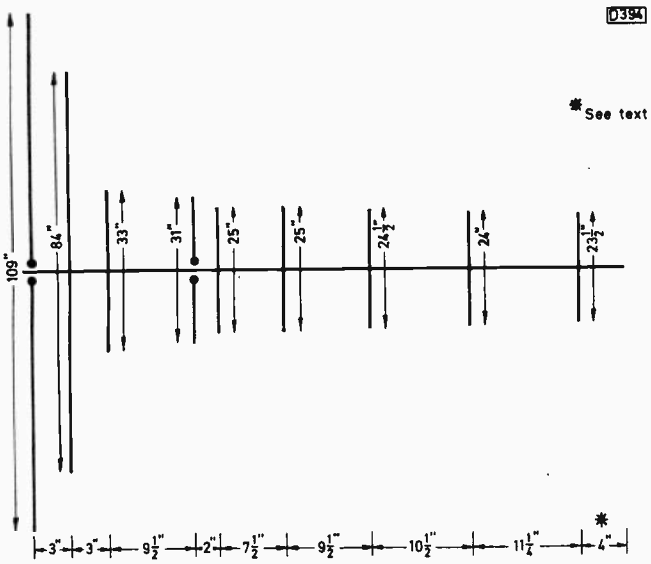



*Fig. 1: Basic wideband Band I/III DX-TV aerial design with u.h.f. add-on option.*

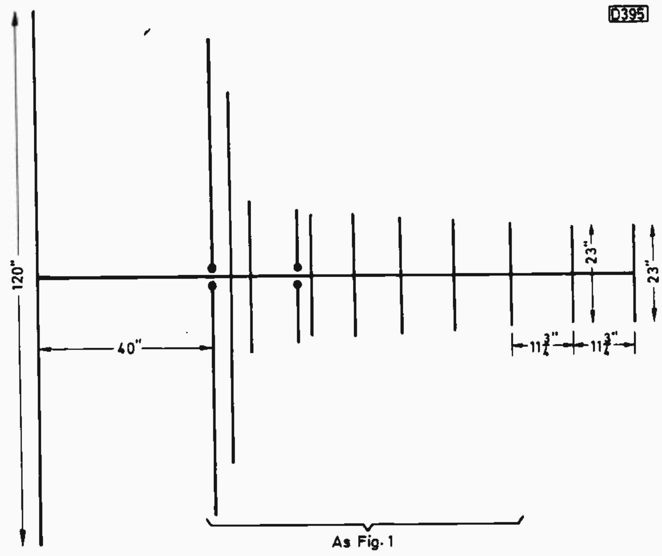



*Fig. 2: Wideband Band I/III DX-TV aerial with two-element Band I section and eight-element Band III section.*

tioning I feel: photographs of the UK taken from the Landsat satellite, using its thematic mapping system, are now available. The photograph of central, southern UK covers from Swanage to Chichester and from the coastline to Warminster and Haslemere. Even roads can be seen. A 10 × 8in. photograph costs £5, a 20 × 16in. photograph £20. If interested, enquire about your area at Space Frontiers Ltd., 30 Fifth Avenue, Havant, Hants PO9 2PL, enclosing a stamped, addressed envelope.

### From our Correspondents . . .

David Patuzzo (Nottingham) has sent us a report of his activities. He's been DXing for two and a half years and has assembled a wide range of equipment. The indoor part of his installation fits inside a wardrobe and consists of four TV sets – a system I Hitachi set, Plustron TVR5d, JVC CX601GB and a Sandra system L Band I/III/IV/V set purchased on a day trip to Boulogne. He uses a four-element Band I array, a ten-element Band III array and a Wolsey Colour King, with a variety of Fringe masthead amplifiers etc. David broke new ground with in-flight TV-DX using a 1in. Sony Walkman at 33,000ft while flying to Majorca. Using its telescopic whip he received French, W/E German, Swiss and Spanish stations. Particular catches were TVE-Catalunya and EBT in northern Spain – TVE was logged half way across France! All signals were in Band III or at u.h.f. Special permission for the set to be operated was given by the aircraft's captain. An unusual DXing feat!

Dave Shirley (Hastings) was the first UK TVDXer to receive the new French fifth and sixth network signals, from Lens in northern France. The accompanying photograph shows his TV6 reception on ch. E54: the fifth network signal consisted of the PM5544 pattern with identification RES.5.

### Compact DXing Aerial

Band I/III aerials tend to be rather conspicuous nowadays, with the result that it's often necessary to seek a compromise between signal performance and environmental impact. We've recently designed an aerial to meet these requirements – see Fig. 1. It's ideal for use on a flat balcony, as a portable aerial for a field day excursion or as an unobtrusive aerial for house/chimney fixing.

The signals received in Band I will generally be propagated via SpE or MS, with tropospheric reception as well in the east/south east. For this a wideband dipole should suffice. The array uses the proven unity-gain B1 design which gives coverage of 48-68MHz. Band III operation on the other hand calls for a measure of gain and directivity, especially in view of PMR signals. The Band III section of the array consists of a wideband (175-230MHz) six-element design based on the Tru-match dipole system (Antiference patent). The version shown should provide a gain of 5dB at 175MHz rising to 7dB at 230MHz, with a front-back ratio of typically 20dB and a −3dB beamwidth of 60° at mid-band. The boom extends ahead of the first Band III director to allow a lightweight clamp holding a 4in. or so vertical stub to be added to permit rear clamping of an Antiference TC10/W wideband u.h.f. Yagi array (obtainable from Tandy stores under the Archer label), thus creating an in-line boom array with wideband capability over Bands I/III/IV/V. The performance specification for the Antiference system is approximately 5·5dBd gain on ch. 21, 12dBd gain on ch. 60 with a front-back ratio of 21-25dB. For the more adventurous DXer Fig. 2 shows a design with a two-element Band I section and eight-element Band III section. This should provide a gain of 3dBd at 60MHz and 7dBd at 175MHz, rising to 9dBd at 230MHz.

The v.h.f. output can be taken via individual feeders or diplexed into a single downlead. It's recommended that the u.h.f. output be kept separate. A diplexing amplifier could be used to advantage provided it has good signal-handling capability and a low noise level – these characteristics are much more important than high gain.

The prototype has a 1in. o.d. boom – the 6ft × 1in. o.d. standard TV alloy mast is ideal. The elements are made of ½in. o.d. seamless tubing. Lengths of this are available from aluminium stockists, though these are usually upwards of 4m. The element ends should be plugged to stop whistling in the wind. For Band I hard-drawn should be regarded as essential, though this is more expensive. The Jaybeam 9892 alloy 1in. to 1in. clamp is recommended as a stub mast clamp.

If sufficient interest is expressed there's a possibility of obtaining dipole insulators etc. for the project (1in. boom, ½in. element fixtures only). Those interested should write in, with s.a.e., indicating requirements.

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| | |
|---|---|
| Thorn 10Ω 20W (3500) R751 Safety Resistor | 75p |
| Pye 713 Speaker 5" × 3" 70Ω | 1.00 |
| Pye 713 Complete Tube Base Panel with Focus Slider & Leads | 2.75 |
| Pye 725 Complete Tube Base Panel | 1.25 |
| TX9 Complete Tube Base Panel | 2.75 |
| TX10 Complete Tube Base Panel | 3.75 |
| TX90 Complete Tube Base Panel | 4.75 |
| Pye 713 Control Knobs | 4 for 50p |
| Tube Base Socket ITT CVC32 | 45p |
| Tube Base Socket Thorn 3000/8000 etc | 50p |
| IC Inserter 16 Pin | 50p |
| Large IC Extractor | 50p |
| Crystal 4.43MHz | 65p |
| EHT Lead & Cap for Split Diode Lopt | 90p |
| Anode Cap | 47p |
| Sanyo Anode Cap Assy + Lead. 12TCD-CT-1G | 65p |
| Degause VDR E299D/HP230 3000/8000 | 25p |
| Degause Thermister C8-ROH (TX90) | 1.80 |
| Control Knob Thorn TX90 | 4 for 2.00 |
| On/Off Knob Thorn TX90 | 65p |
| Push Button Assy Thorn TX90 | 9.80 |
| Tube Neck Correction Assy. 20AX AT1081 | 5.00 |
| EHT Cable | Metre 25p |
| BF259 with Heatsink | 14p |
| TIP110 with Heatsink | 40p |
| L129/130/131 Coil | 10p |
| 6MHz Ceramic Filter | 25p |
| DL700 (Philips) Chroma Delay Line | 1.00 |
| OL50 Chroma Delay Line | 1.00 |
| T9006A Lum Delay Line | 1.00 |
| 8K5/9K Lum. Delay Line | 65p |
| Plastic Cover for 3K5 SP8385 | 5p |
| TX9 Back Ground Control 10K | 15p |
| TX9 Gain Control 100R | 15p |
| Thorn 2000 Focus Pot | 1.00 |
| Thorn 9000 Focus Pot | 3.75 |
| Thorn 9600 Focus Pot | 2.00 |
| Thorn 8K5 Focus Pot | 2.40 |
| Thorn 4000 Focus Pot | 2.75 |
| Thorn TX10 Focus Pot (New Type) | 9.00 |

## SERVICE AIDS

| | | |
|---|---|---|
| Ambersil MS4 Silicone Grease | 12oz | 2.15 |
| Ambersil Freezer | 12oz | 1.99 |
| Ambersil Amberlube | 6oz | 1.89 |
| Ambersil Ambertron | 16oz | 2.25 |
| Ambersil Anti-Static Screen Cleaner | 7oz | 1.95 |
| Ambersil 40+ Protective Lubricant | 14.1oz | 2.15 |
| Ambersil Amberclens Foaming Cleaner | 13oz | 1.26 |
| Ambersil Circuit Lacquer | 14oz | 2.15 |

## THICK FILM RESISTOR UNITS

| | |
|---|---|
| 3500 Thorn (5 Pin Connection) video | 1.70 |
| 4000 Thorn (4 Pin Connection) | 1.90 |
| 725/731 Pye (6 Pin Connection) | 2.20 |
| 713 Pye (6 Pin Connection) | 2.20 |

## FUSES

| 20mm | | 1¼" | |
|---|---|---|---|
| 50MA | 10 for 70p | 250MA | 10 for 65p |
| 250MA | 10 for 50p | 750MA | 10 for 65p |
| 315MA | 10 for 50p | 7A | 10 for 50p |
| 500MA | 10 for 50p | 10A | 10 for 50p |
| 2.5A | 10 for 1.00 | 20A | 10 for 50p |
| 3.15A | 10 for 1.00 | 50A | 10 for 50p |

| | |
|---|---|
| Thorn Mains TX 3000/3500 | 7.50 |
| Thorn Mains TX 8000/8500 | 10.00 |
| Thorn Mains TX 9000 (T701) | 10.00 |
| Thorn Mains TX 9600 (T512) | 10.00 |
| Thorn S.O.P.T 8000/8500 | 3.50 |
| Thorn Scan TX 3000/3500 | 6.00 |
| Thorn EHT TX 3000/3500 | 6.00 |
| Thorn LOPT 9000 | 10.00 |
| Thorn LOPT 9600 | 12.00 |
| Thorn LOPT 1590/91 | 7.25 |
| Thorn LOPT 1690/91 | 7.25 |
| Thorn LOPT 8000 | 9.80 |
| Thorn LOPT 8500 | 9.80 |
| Thorn LOPT TX9 | 9.85 |
| Thorn LOPT TX10 | 19.00 |
| Thorn LOPT TX90 | 13.75 |
| Pye LOPT 713 | 10.00 |
| Pye LOPT 725 | 9.85 |
| Pye LOPT 731 | 10.18 |
| Philips LOPT G9 | 8.80 |
| Philips LOPT G11 | 13.75 |
| GEC LOPT 3113 | 7.40 |
| Diode Split LOPT AT2076/35 | 14.75 |
| Sanyo LOPT AM-WM-21 | 6.75 |
| Sanyo LOPT AM-WM-4 | 7.30 |
| Philips LOPT G8 | 7.80 |
| Sanyo LOPT (CW21) 4-2751-44700 | 5.00 |
| ITT LOPT CVC5-9 | 9.60 |
| ITT LOPT CVC30 | 8.75 |
| ITT LOPT CVC45 | 9.75 |
| Baird 8750 | 10.25 |
| Baird 8752 | 10.25 |
| Thorn Line Drive TX. TX9 (T2) | 3.00 |
| Thorn Line Drive TX. 8K etc. (T402) | 1.85 |
| Thorn Line Drive TX. 9K (T705) | 2.00 |
| Thorn Switch Mode TX. 9K6 (T511) | 3.75 |
| Thorn Input Choke TX9 (L64) | 4.00 |
| Thorn Choke TX90 (L120) | 2.95 |

| | | | |
|---|---|---|---|
| 300 Mixed Resistors | 1.50 | 10 Spark Gaps | 1.00 |
| 300 Mixed Capacitors | 1.50 | 10–16 pin Quil IC Socket | 90p |
| 150 Mixed Electrolytics | 2.00 | 20 Assorted TV Knobs | 1.00 |
| 100 W/W Resistors | 1.00 | 10–16 pin Quil to Dil IC Socket | 90p |
| 20 Mixed Conv Pots | 1.00 | 100 Mixed Diodes | 1.00 |
| 40 Mixed Pots | 1.50 | 50 Mixed Mica Washers | 65p |
| 20 Mixed Sliders | 1.00 | 300 Mixed Resistors & Capacitors | 1.50 |
| 40 Mixed Presets | 60p | 10–16 pin Dil to Dil IC Socket | 1.00 |
| 20 Mixed VDR & Thermistors | 1.00 | 50 Electrolytics & 50 Capacitors | 1.00 |
| 100 Mixed Ceramic Discs | 1.00 | 50 Mixed Poly Capacitors | 1.00 |
| 20 Mixed Valve Bases | 1.00 | 20 Mixed Valve Bases | 1.00 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | BF154 | 25 | BFR52 | 31 | NKT276 | 20 |
| | | | | | | BF167 | 24 | BFR62 | 28 | NKT453 | 1.65 |
| AC128 | 39 | BC174B | 23 | BCX33 | 22 | BF173 | 29 | BFR81 | 29 | OT112 | 1.92 |
| AC131 | 40 | BC177 | 24 | BCX34 | 11 | BF179 | 32 | BFR87 | 25 | OT121 | 2.08 |
| AC138 | 40 | BC182LB | 12 | BD115 | 49 | BF180 | 33 | BFR90 | 1.74 | R1038 | 80 |
| AC141K | 39 | BC183L | 12 | BD131 | 30 | BF181 | 30 | BFR91 | 2.08 | R1039 | 80 |
| AC142K | 38 | BC184L | 13 | BD132 | 46 | BF184 | 30 | BFT42 | 30 | R2008B | 1.40 |
| AC153 | 39 | BC187 | 24 | BD133 | 59 | BF185 | 30 | BFT43 | 30 | R2010B | 1.10 |
| AC176 | 33 | BC204 | 15 | BD139 | 36 | BF194 | 16 | BFX38 | 40 | R2030 | 70 |
| AC176K/ | | BC208 | 9 | BD140 | 38 | BF195 | 16 | BFY50 | 30 | R2265 | 1.30 |
| AC128K | 93 | BC212L | 9 | BD144 | 1.70 | BF196 | 16 | BFY51 | 34 | R2305 | 80 |
| AC188 | 38 | BC213L | 12 | BD150 | 50 | BF197 | 15 | BFY52 | 34 | R2322 | 50 |
| AD142 | 1.18 | BC237 | 12 | BD163 | 98 | BF198 | 19 | BRC116 | 1.50 | R2443 | 25 |
| AD143 | 1.08 | BC238B | 8 | BD201 | 74 | BF199 | 15 | BRC1693 | 1.43 | RCA16446 | 30 |
| AD149 | 98 | BC238L | 8 | BD203 | 78 | BF223 | 18 | BU105 | 1.00 | RCA16599 | 1.25 |
| AD161 | 32 | BC250A | 15 | BD204 | 99 | BF224 | 19 | BU126 | 1.10 | RCA16600 | 1.40 |
| AD162 | 32 | BC251 | 8 | BD222 | 48 | BF238 | 20 | BU207 | 1.05 | RCA16799 | 1.13 |
| AD263 | 1.05 | BC252A | 20 | BD225 | 52 | BF240 | 9 | BU208 | 1.15 | RCA16800 | 1.42 |
| AF127 | 45 | BC294 | 37 | BD232 | 50 | BF241 | 21 | BU208A | 1.15 | RCA16803 | 1.38 |
| AF139 | 38 | BC301 | 32 | BD233 | 60 | BF255 | 10 | BU326A | 1.30 | RCA16815 | 1.20 |
| AF239 | 41 | BC303 | 31 | BD234 | 60 | BF256LB | 38 | BU407 | 1.70 | SP8385 | 2.65 |
| BC107 | 15 | BC307 | 10 | BD237 | 55 | BF256S | 20 | BU408 | 2.76 | S1299 | 2.25 |
| BC108 | 15 | BC308 | 8 | BD238 | 65 | BF257 | 28 | BU500 | 2.30 | S28000 | 1.25 |
| BC109 | 15 | BC309 | 14 | BD241 | 59 | BF259 | 28 | BU526 | 2.46 | T6050V | 1.30 |
| BC115 | 16 | BC327 | 18 | BD244 | 85 | BF271 | 25 | BU806 | 1.80 | T6052V | 1.30 |
| BC117 | 21 | BC328 | 18 | BD278A | 81 | BF274 | 11 | BU807 | 2.94 | T9003V | 1.25 |
| BC125 | 26 | BC337 | 17 | BD386 | 68 | BF337 | 29 | C1129 | 9 | T9010V | 1.45 |
| BC126 | 23 | BC338 | 17 | BD433 | 71 | BF338 | 34 | C1172B | 9 | T9053V | 1.30 |
| BC139 | 27 | BC347 | 8 | BD437 | 83 | BF355 | 40 | E5386 | 54 | T9054V | 1.00 |
| BC141 | 34 | BC394 | 8 | BD592 | 1.20 | BF362 | 50 | E9003 | 28 | T9039V | 1.10 |
| BC142 | 30 | BC454 | 8 | BD589 | 1.20 | BF391 | 21 | E9005 | 25 | TIC45X | 50 |
| BC143 | 31 | BC455 | 8 | BD677G | 1.35 | BF394 | 16 | ME0404 | 10 | TIC46 | 48 |
| BC147 | 12 | BC456 | 10 | BD679 | 1.42 | BF422 | 47 | ME0412 | 10 | TIC106C | 40 |
| BC148 | 12 | BC460 | 40 | BD701 | 1.04 | BF423 | 53 | ME6002 | 10 | TIP29 | 42 |
| BC149 | 12 | BC463 | 22 | BD702 | 1.12 | BF450 | 43 | MJ2501 | 2.36 | TIP30 | 42 |
| BC153 | 16 | BC546 | 8 | BD707 | 95 | BF453 | 53 | MJ3001 | 2.21 | TIP31 | 35 |
| BC1540R | 16 | BC547 | 12 | BD708 | 95 | BF458 | 37 | MJE340 | 50 | TIP32 | 43 |
| BC154YL | 16 | BC548 | 12 | BD839 | 1.30 | BF459 | 40 | MJE520 | 50 | TIP33 | 61 |
| BC157 | 12 | BC549 | 8 | BDX10 | 93 | BF461 | 59 | MJE2955 | 1.40 | TIP41 | 42 |
| BC158 | 12 | BC557 | 10 | BDY20 | 1.09 | BF556B | 35 | MJE3055 | 1.50 | TIP42 | 45 |
| BC159 | 15 | BC558 | 10 | BDY82 | 99 | BF596 | 15 | NKT241W | 8 | TIP110 | 61 |
| BC171 | 9 | BC559 | 8 | BF137 | 20 | BF694 | 16 | NKT241G | 8 | TIS91 | 25 |
| BC172 | 9 | BC595 | 8 | BF153 | 20 | BF757 | 62 | NKT241Y | 8 | ZTX550 | 30 |

## INTEGRATED CIRCUITS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | TBA530 | 1.26 | TDA2030 | 2.10 |
| BRC1330 | 1.40 | SN76013ND | 1.80 | TBA540 | 1.00 | TDA2522 | 2.10 |
| BRC3064 | 1.00 | SN76023N | 1.80 | TBA550Q | 1.82 | TDA2530 | 2.61 |
| BRC/M/200 | 1.00 | SN76033N | 2.00 | TBA560C | 1.50 | TDA2540 | 3.50 |
| BRC/M/300 | 1.00 | SN76115 | 2.00 | TBA641 | 2.05 | TDA2560 | 3.50 |
| CA3060 | 1.58 | SN76131N | 1.58 | TBA651 | 2.50 | TDA2581 | 3.00 |
| LM1303P | 1.48 | SN76226N | 1.25 | TBA720A | 2.49 | TDA2591 | 1.96 |
| ML231B | 2.20 | SN76227N | 1.00 | TBA750 | 2.20 | TDA2611A | 1.95 |
| ML237B | 2.00 | SN76530P | 1.30 | TBA800 | 1.62 | TDA2640 | 2.90 |
| ML239B | 2.86 | SN76622N | 1.00 | TBA810S | 1.00 | TDA2690A | 1.50 |
| MC1327AP | 1.25 | SN76660N | 80p | TBA810AS | 1.00 | TDA3560 | 6.00 |
| MC1358P | 1.30 | SN76666N | 75p | TBA920 | 2.08 | TDA4500 | 5.40 |
| MC1455P | 18p | SN76744 | 1.92 | TBA950 | 2.54 | TDA9503 | 2.90 |
| MC14516BCP | 60p | SY153A | 2.50 | TBA1440 | 1.92 | TCEP100 | 3.48 |
| SAA1025 | 7.20 | TA7117P | 1.00 | TCA270SA | 1.05 | TEA1009 | 1.95 |
| SAA1124 | 4.50 | TA7109AP | 2.80 | TCA270C | 1.05 | MC14426P | 4.80 |
| SAA5010 | 6.00 | TAA611 | 1.40 | TCA270CQ | 1.05 | MC14429P | 4.50 |
| SL432A | 1.80 | TBA120B | 1.20 | TDA1035T | 3.50 | MC14514 | 5.00 |
| SL1430 | 2.50 | TBA120C | 1.20 | TDA1037 | 2.72 | UA758PC | 2.50 |
| SL1432 | 2.50 | TBA120CQ | 70p | TDA1170 | 2.15 | UAA1008A | 2.66 |
| SN15846N | 60p | TBA120S | 70p | TDA1170S | 1.76 | ULN2165 | 1.30 |
| SN74123N | 65p | TBA120U | 1.00 | TDA1200 | 2.42 | ULN2216A | 1.25 |
| SN74154N | 1.40 | TBA395 | 1.00 | TDA1270 | 2.76 | UPC1365C | 5.75 |
| SN76001N | 1.40 | TBA480Q | 1.40 | TDA1327 | 2.53 | SC9488P | 1.40 |
| SN76110N | 1.14 | TBA510 | 1.90 | TDA2002 | 2.80 | SC9511P | 1.40 |
| | | | | | | SW153 | 2.50 |

**Thorn 8/8K5 ex equip panels untested**

| | |
|---|---|
| PSU | 2.88 |
| FTB | 3.75 |
| Decoder | 4.00 |

**Thorn 9K ex equip panels untested**

| | |
|---|---|
| PSU | 12.00 |
| Decoder | 5.00 |

**Thorn 9K6 ex equip panel untested**

| | |
|---|---|
| Decoder | 5.75 |

**Thorn 3/3K5 ex equip panels untested**

| | |
|---|---|
| PSU | 3.75 |
| LTB | 3.75 |
| Video | 2.50 |
| Chroma | 2.00 |
| FTB | 2.75 |
| IF | 1.75 |
| Conv. 3K | 3.00 |
| Conv. 3K5 | 3.75 |
| Autovox Decoder FG/01 new boxed | 5.00 |

| | |
|---|---|
| Thorn 4000 Convergence panel ex-factory | 3.75 |
| Thorn 4000 PSU panel ex-factory | 2.50 |
| Thorn 3K5 beam limiter board new | 1.75 |
| Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip | 1.80 |
| Thorn 8/8K5 damaged FTB for spares | 1.25 |
| Thorn 8/8K5 damaged decoder for spares | 2.25 |

| | |
|---|---|
| UHF TV Aerial for portable | 50p |
| Indoor Aerial With Reflector to Help Combat Ghosting Problems | 2.50 |
| Line Connectors | 38p |
| Coax Plugs | 10 for 1.65 |
| Band Change Switch Assy, Pye 725 | 40p |
| Coax Cable Low Loss | per Metre 22p |
| Switched Flush Fitting Aerial Outlet | 1.00 |

| | |
|---|---|
| Pye 78+161 | 50p |
| Pye 147+260 | 50p |
| Thorn 56+1K+47+12 | 1.24 |
| Thorn 50+40+1K5 | 60p |
| Thorn 128+16+1K7+116+462+126 | 50p |
| Thorn 120+72+300 | 50p |
| RBM 250+14+58 (TV161) | 63p |
| Pye 3R5+15+45 (713) | 90p |
| Philips 2R2+682 | 90p |
| Philips 47R | 52p |
| Thorn 6+1+100 | 92p |

Thermal Cut-Out

| | |
|---|---|
| Thorn 3000 Metal | 1.45 |
| Thorn 8/8500 Plastic | 1.45 |

## EHT TRAYS

| | |
|---|---|
| Thorn 3000 | 5.50 |
| Thorn 8000 | 4.50 |
| Thorn 8500 | 6.00 |
| Thorn 9000 | 7.90 |
| Thorn 9600 | 6.00 |
| Thorn 900/950 | 1.50 |
| Thorn 1500 3 stick | 2.40 |
| Pye 713 4 lead | 5.83 |
| Pye 713 5 lead | 5.97 |
| Pye 725 | 6.35 |
| Decca Bradford | 5.00 |
| Baird 8750 | 7.10 |
| Korting AZ9100 | 7.10 |
| Philips G8 (520) | 6.50 |
| Philips G8 (550) | 6.50 |
| Universal | 5.00 |

## MULTISECTION CAPACITORS

| | | | | | |
|---|---|---|---|---|---|
| 220+47 | 350V | 65p | 200+200+100 | 350V | 55p |
| 200+150+50 | 350V | 60p | 200+200+75+25 | 350V | 60p |
| 200+200+100 | 325V | 54p | 50+50+8 | 300V | 55p |
| 32+32+16 | 275V | 52p | 100+50+100 | 350V | 55p |
| 200+200+100+32 | 350V | 70p | 100+150+50 | 350V | 55p |
| 100+50+150 | 350V | 58p | 2500+2500 (Thorn 8K) | 63V | 1.20 |
| 400+400 | 200V | 72p | 150+150+100 | 300V | 1.80 |
| 32+32+16 | 350V | 52p | 200+47 | 250V | 65p |
| 200+32+300+100 | 350V | 70p | 500+500 175V Thorn TX9 | | 1.00 |
| 225+25 | 350V | 50p | 175+100+100 350V Thorn 3K5 | | 2.25 |
| 200+200+100 | 350V | 70p | 400 400V Thorn 9K | | 2.50 |
| 200+100 | 325V | 65p | 470 250V Weldel Type Philips G11 | | 1.71 |
| 200+100+100+50 | 350V | 60p | | | |

## CAN TYPES

| | | | |
|---|---|---|---|
| 0.2MF 250V | 50p | 1250MF 40V | 50p |
| 2MF 250V | 50p | 1250MF 50V | 50p |
| 22MF 275V | 50p | 1500MF 100V | 1.05 |
| 50MF 275V | 50p | 2000MF 30V | 50p |
| 100MF 150V | 65p | 2200MF 40V Thorn 4K | 95p |
| 100MF 250V | 70p | 2200MF 63V Philips G9 | 1.25 |
| 220MF 450V Thorn 4K | 1.30 | 2500MF 35V | 65p |
| 400MF 350V Thorn 8K | 1.00 | 2500MF 40V | 65p |
| 400MF 400V Thorn 9K | 2.95 | 3000MF 30V | 65p |
| 800MF 250V | 70p | 3300MF 16V | 50p |
| 1000MF 100V Thorn TX90 | 2.90 | 3300MF 25V | 60p |
| | | 4700MF 16V | 72p |
| | | 4700MF 40V | 75p |

| | |
|---|---|
| Thorn/Decca/GEC On/Off Switch. Push to make | 75p |
| Philips G11 On/Off Switch. Push to make | 75p |
| ITT CVC9 On/Off Switch + Relay | 90p |
| Philips G8 On/Off Switch | 75p |
| Thorn 3/3500 A1 Switch | 50p |
| Thorn 4000 A1 Switch | 50p |
| Korting Shift Pot 50Ω | 65p |
| 2·5A Push to make on/off switch | 15p |
| Thorn TX90 On/Off Switch | 1.85 |
| 10K Lin Pot. TX9/TX90 | 75p |

## DIODES

| | | | |
|---|---|---|---|
| AA112 | 8p | IN4003 | 4p |
| AA119 | 8p | IN4004 | 5p |
| AA143 | 8p | IN4005 | 5p |
| BA115 | 8p | IN4006 | 5p |
| BA154 | 8p | IN4007 | 6p |
| BB103 | 8p | IN4148 | 2p |
| BB105B | 30 | IN4149 | 6p |
| BR103 | 52p | IN4742A | 8p |
| BT106 | 1.50 | IN5254B | 8p |
| BT116 | 1.00 | IN5349 | 14p |
| BT119 | 2.56 | IN5400 | 12p |
| BT120 | 2.82 | IN5401 | 12p |
| BT151 650 | 1.00 | IN5402 | 14p |
| BY127 | 12p | IN5404 | 12p |
| BY188 | 16p | IN5406 | 16p |
| BY204 | 26p | IN5408 | 16p |
| BY206 | 16p | IS025 | 8p |
| BY207 | 16p | IS131 | 8p |
| BY208/800 | 38p | IS1658 | 8p |
| BY223 | 95p | MR854 | 35p |
| BY225 | 1.20 | SKE1/02 | 20p |
| BY227 | 28p | MCR106/1 | 1.00 |
| BY298 | 22p | MCR406 | 35p |
| BYX22/400 | 30p | 2N4444 | 1.50 |
| BYX55/600 | 30p | Y827 | 80p |
| BYX71/350 | 80p | Y969 | 75p |
| BZV15 C12R | 1.16 | ZX150 | 12p |
| BZV15 C24R | 1.16 | OA91 | 5p |
| IN60 | 8p | MCR106/7 | 1.00 |
| IN2070 | 8p | MCR106/8 | 1.50 |
| IN4001 | 4p | BY255 | 30p |
| IN4002 | 4p | | |

# Servicing Sonatel and Morphy Richards Monochrome Portables

**Ian M. Rees**

The brand name Sonatel was used by House of Carmen, the monochrome portables sold under this name being amongst the first to break the £50 price barrier. They were sold widely through the big retail chains and mail order catalogues. When House of Carmen took over the electrical goods manufacturer Morphy Richards the Sonatel brand name was dropped in favour of the well known Morphy Richards name.

### Range Covered

The original Sonatel Model T750 12in. monochrome portable was at first continued in a restyled Morphy Richards cabinet and was given the model number T730. This chassis was of discrete component design. A subsequent chassis used mainly i.c.s: this was put in the T730 case and given the model number T730/2. When ordering spares for these models, be very careful to state whether the parts are for the T730 or the later T730/2. Model T739 followed, incorporating a digital clock/timer and a modified T730/2 chassis.

### Sonatel Model T750

We'll start with the T750 which employed conventional technology and apart from a few quirks was very reliable.

The fault you'll encounter most often is failure of the line output transistor TR801, especially if it's a BU409. Replace it with the better BU407. Other alternatives often fail after a time.

If the 15Ω, 0·5W feed resistor R716 in series with the line driver transformer shows signs of overheating, with no line drive, check the driver transistor TR703 and the associated components.

The B+ voltage (stabilised l.t. rail) should be set at 11·6V (VR901) otherwise the efficiency diode D801 (V06C) will fail – it becomes discoloured.

A gaggle of repetitive dry-joints occur on this chassis, showing up after movement of components or heavy handling of the set.

Intermittent line hold when tapped is usually the result of a poor joint on C801 (2,200μF) which decouples the supply to the line output and driver stages.

No line lock can be traced to a poor joint at pin 8 of the line output transformer (pulse feedback to the flywheel sync discriminator circuit).

For no line scan examine the connections to the line scan coupling capacitor C805 (6·8μF, 25V).

Horizontal cramping is caused by mis-setting of the line hold control T701 which has a wide locking range. The most accurate way to set it is to disable the sync input to the flywheel sync circuit by connecting an 0·1μF capacitor between the base of the phase-splitter transistor TR701 and chassis, then adjust T701 for a stationary lock.

The power supply gives few electrical faults. Rough handling causes the plastic battery panel to break, making the power supply chassis drop down and putting a strain on the front panel. Beware when working on the power supply panel as live mains is present at fuse F901 (0·5A). Failure of this fuse can be caused by a faulty primary winding on the mains transformer: the d.c. resistance should be a nominal 65Ω. Absence of the B+ supply is usually due to dry-joints at the external supply socket or failure of the socket itself.

A low-gain transistor in position TR604 (2SD476B) in the field output stage causes cramping at the top of the picture.

Some sets went out with the wrong value resistor in position R621 in the field flyback blanking circuit. If flyback lines are visible check that the value is correct (100Ω).

An improvement in field linearity can be made by increasing the value of the field scan coupling capacitor C611 from 1,000μF to 2,000μF.

No or distorted sound is in nearly every case due to failure of the pnp transistor TR403 (2SA673C) in the audio output stage. Loss of sound can also be due to failure of the earjack speaker cutout to remake after jack insertion. Note that this model uses a 25Ω speaker.

A very dark picture can be caused by incorrect a.g.c. level setting (VR301). This is adjustable from under the set with the back on.

Vertical black lines on the picture can be easily cured by repositioning the c.r.t. cathode lead away from the line output transformer.

A blank raster with flyback lines visible and low or no sound should direct attention to the 1N60 vision detector diode D101 and filter coils L106, L107 and L108 which go open-circuit. If the picture only is affected, check coil L203 in the video output stage.

Sound breakthrough on vision can be due to a dry-joint on C403 (100μF) which decouples the supply to the audio circuits: alternatively C403 may be open-circuit.

An effect similar to soot and whitewash can be due to peaking coil L202 in the video output stage being open-circuit – or, dare I say it, a faulty tube . . .

A small i.f. preamplifier stage rides on the back of the tuner. This is present to compensate for the loss of gain a v.h.f. tuner in a different version would have given. If the output coil L002 is not correctly set you can get a multitude of symptoms from lack of gain through to instability and ringing. A slotted adjustment tool is re-

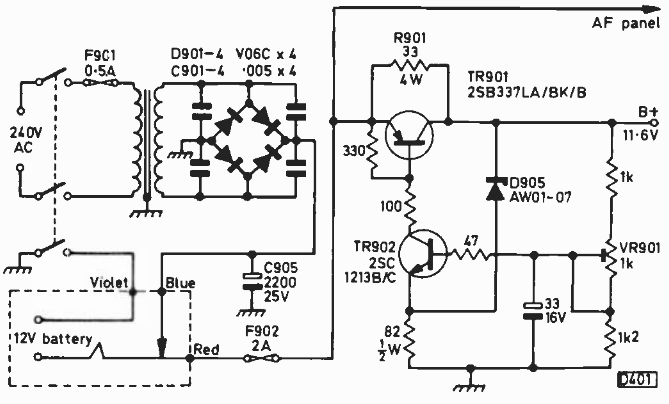


*Fig. 1: Power supply circuit used in the Sonatel Model T750 and Morphy Richards Model T730.*

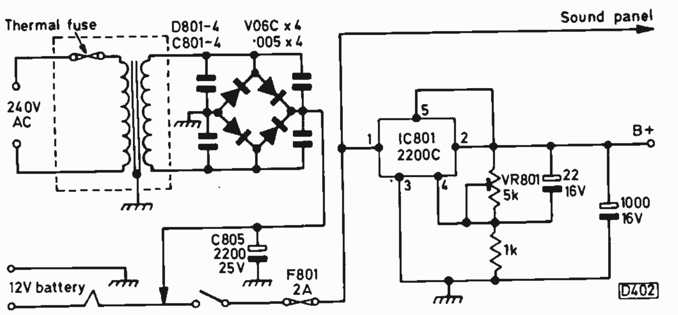


*Fig. 2: Power supply circuit used in the Morphy Richards Model T730/2.*

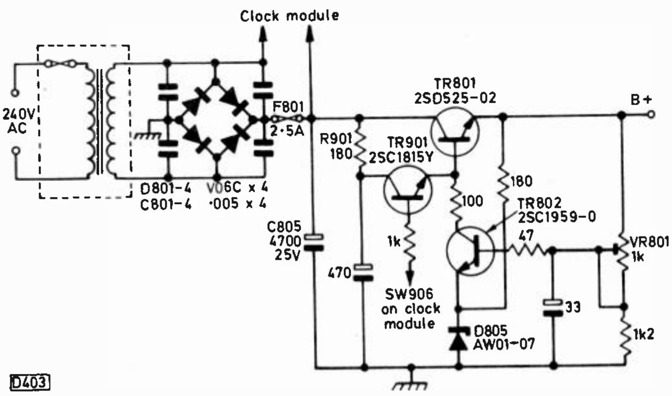


*Fig. 3: Power supply circuit used in the Morphy Richards Model T739 which incorporates a digital clock/timer.*

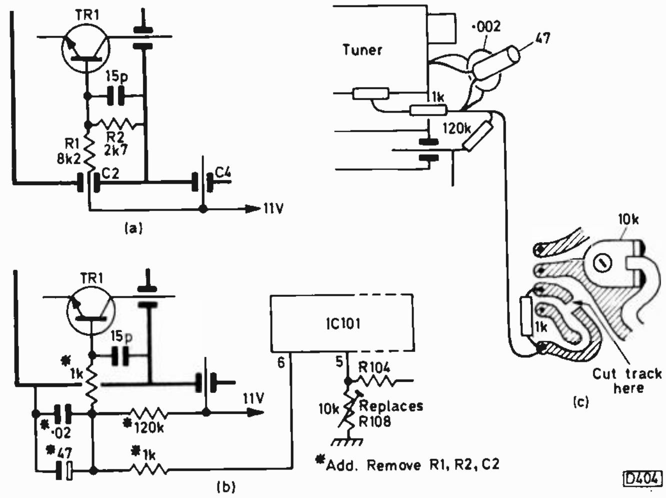


*Fig. 4: Tuner a.g.c. modification. (a) original circuit, (b) modified circuit, (c) physical details.*

quired to reset the core, which will break if the locking wax is not softened before adjusting. Don't screw the core down as it will jam against the PCB and be very difficult to remove. Normal setting will be found near the top of the former or even with the core protruding.

Transistors TR1 (2SC1070) and TR2 (2SC1730) in the tuner do give trouble and can be replaced provided care is taken to fit the replacements in exactly the same position (a new tuner is expensive). Look out for poor or unsoldered connections on the aerial panel and the phono type connector on the tuner in the event of low gain.

## Morphy Richards Model T730

The comments above also apply to the Morphy Richards Model T730. Spares should be distinguished by model however.

## Morphy Richards Model T730/2

The newer chassis used in Model T730/2 uses some of the same parts as the earlier chassis, including the c.r.t., the tuner, the line output transformer and the scan coils. As with any new model this one suffered from teething problems which were overcome in later production.

The most perplexing fault came about as a result of flashover in the tube, particularly when new. This will cause loss of most of the i.c.s and the tuner and some of the transistors. To reduce the likelihood of this pin 7 of the c.r.t. should be disconnected and linked to the earthy end of the heater. This is shown as pin 4 on the circuit diagram but in practice it may be pin 3.

To improve the field lock change C301 from 1$\mu$F to 0·1$\mu$F – this is the sync separator transistor's input coupling capacitor.

Video and field breakthrough on sound require a number of actions. Video breakthrough can be simply adjustment of the sound detector coil L401 or filter coil L201 (if L201 won't peak, check C201/2 – both 47pF). If still in trouble dress the video output transistor TR201 and coupling capacitor C207 away from the TDA3190 sound chip (IC401) by bending them and trapping the video lead to the c.r.t. between, taking care not to take it too close to the line output transformer. The problem can also be due to a defective video output transistor (2SC2229-0) or vision i.f. chip IC101 ($\mu$PC1366C).

A blank raster with flyback lines can be caused by IC101, TR201 or TR301 (2SA1015-Y) in that order of likelihood.

If C705 (3,300$\mu$F,16V) which decouples the supply to the line output stage becomes disconnected or faulty two or three vertical lines or bars will appear on the picture, visible only on certain scenes.

No line timebase operation with a charred 10Ω l.t. feed resistor R601 means a new TDA1180P line generator chip (IC601).

Check that the boost diode D702 (V09E) isn't overheating: if it is, check the boost capacitor C704 (330$\mu$F) for dry-joints.

The sound chip seems to be reliable but unstable or harsh sound can be due to C406 (47$\mu$F, 10V) in the feedback circuit being faulty. The speaker is a 16Ω type this time.

Failure of choke L105 in the l.t. line will give a blank raster, flyback lines and no B+ supply to the i.f. section.

The previous notes on tuner faults (Models T750/T730) also apply to this set.

The solid-state regulator chip IC801 (2200C) seldom fails but it should be noted that there is no switch in the supply to the mains transformer which has an internal thermal fuse (not removable). If the transformer fails, check the diode bridge and associated components and that the wiring to the 2A d.c. fuse F801 is in order.

## Morphy Richards Model T739

Apart from the power supply and the addition of a clock the T739 is identical to the T730/2, so the previous comments apply.

In later production additional modifications to those incorporated in the T730/2 were included in this model. These should be made to any set returned for service.

Drifting hum bars that move slowly down the screen can be cured by isolating the negative side of the mains bridge rectifier D801-4 by cutting the track. Make the connection via a short jump lead directly to the negative tag of the reservoir capacitor C805. If R901 (180Ω) overheats and falls in value, causing increased ripple on the supply, replace it with a 1W resistor. If R905 is positioned between the clock PCB and the front panel it should be removed and soldered on the top side to prevent it melting the plastic front.

The clock is built on a small PCB and mounted with its set switches directly on the front panel. A few problems do occur with this unit which by nature of its construction is difficult to service. The set buttons can get stuck in the on position, jamming in their cutouts. Release the PCB fixings and manipulate the panel until free operation is achieved. If the clock steps forward by itself this is usually because either C902 or C903 (both 0·01$\mu$F) is leaky.

Replacement of the Texas clock i.c. or display is tricky. It's probably better to replace the complete module.

If the set is dead but the fuses are intact have a look for a short between the clock PCB and the chassis.

### AGC Modification.

Late production versions of the T730/2 and T739 had improved a.g.c. fitted to compensate for very strong or weak reception conditions. This so improves performance that all sets will benefit from incorporating it. The change involves modifying the tuner to accept a.g.c. at the base of the r.f. amplifier transistor TR1: the a.g.c. comes from the vision i.f. amplifier chip.

Fig. 4 shows the relevant parts of the tuner and main PCB print. Proceed as follows:

(1) Open the top of the small i.f. preamplifier fitted to the tuner. If a 150Ω resistor is fitted in series with the output from the tuner remove it and terminate directly at C001/L001. Reset L002 as previously described.

(2) Remove the tuner from the chassis. Open the cover and carefully remove R1, R2 and C2.

(3) Fit a small-bodied 1kΩ resistor as shown in Fig. 4, allowing the body to come through the side of the tuner (without shorting).

(4) Add an 0·02$\mu$F capacitor, a 47$\mu$F (10V) electrolytic and a 120kΩ resistor external to the tuner as shown.

(5) Cut the track on the main PCB and add a 1kΩ resistor and 10kΩ preset as shown (the preset has to be reversed on the T730/2 – the diagram shows the T739).

(6) Connect an unscreened flylead as shown.

(7) Set the preset for best a.g.c. action, using strong and weak signals and noting the background grain.

### Spares

Spare parts for Sonatel and Morphy Richards sets are available from Morphy Richards Consumer Products Ltd., Technical Services, 6 Albany Parade, Brentford, Middlesex (01-560 5331).

# TV Fault Finding

*Reports from Steve Illidge, Mick Dutton, Chris Avis, Philip Blundell, Eng. Tech., Roger Burchett, Paul Hardy and D.R. Bracknell*

### Hitachi NP81CQ Chassis

The card was completely blank under the column marked "fault": the shop assistant had obviously intended this one to be a surprise! In fact the set was dead. In the past I've found that the best way to prove that the power supply in these sets is all right is to disconnect it from the rest of the set and provide it with a load consisting of a 100W bulb. We did this, switched on and found that the bulb lit and the h.t. was correct at 110V. To be able to work on the line timebase separately we connected an external 110V supply to the set. With the exception of a little hum on the picture caused by our supply's poor regulation the set worked perfectly. So why wouldn't the set work with its own power supply? The only conclusion we could come to was that the power supply wasn't able to deliver sufficient current to start the line output stage. Taking a closer look we discovered that the surge limiter resistor R901 measured 11Ω instead of 7·7Ω – though it looked as new as the day it was made. A replacement cured the fault. **S.I.**

### Lloytron 142C

A fault we've had on several of these colour portables is failure to start from cold – the power supply can be heard ticking. The problem is caused by R228 (1kΩ) going open-circuit or by dry-joints around this resistor or the line driver transformer. **M.D.**

### Fidelity ZX3000 Chassis

By now we are quite familiar with the chopper transistor going short-circuit at switch on when the collector load simulation resistor (usually 270kΩ) has gone high in value or open-circuit in self-oscillating chopper circuits using the TDA4600 control i.c. We were surprised to find that the relevant resistor (R91) in the Fidelity ZX3000 chassis is a tiny little half or even third watt type. In one set that came our way this resistor was open-circuit, the TDA4600 chip had been destroyed, the BU426A chopper transistor had gone short-circuit and R90 (22Ω) between the BU426A's base and emitter was open-circuit.

We've had to change a number of line output transformers in these sets. The symptoms in each case were no results with the h.t. low and the power supply making a noise to show its distress. A point to note is that the 20' and 22in. chassis use different transformers.

An improved mains filter panel was introduced to prevent medium-wave radio interference. **M.D.**

### Panasonic TC361

This set was tripping. It's an elderly model with a thyristor line output stage, but it has proved to be very reliable. The tripping problem with this one was due to the 24V supply rectifier D554 being short-circuit. **M.D.**

### Philips TX Chassis

This portable gave no results, though there was hum from the speaker. The 11V line was found to be high at 15V and couldn't be reduced. After fruitless checks on the transistors in the regulator circuit realisation dawned that there was no line whistle. The set was then powered more safely from the 11V bench supply and attention was turned to the line timebase. A scope check showed that there was line oscillation at the base of the line driver transistor but not at its collector. A replacement BC337 cleared the fault and restored correct regulation. To improve the e.h.t. regulation, the error detector transistor in the series regulator circuit samples the 26V boost line instead of the 11V rail. With no line drive the boost voltage was absent and the regulator circuit inoperative – the supply was coming via the parallel, unloaded resistor, hence the misleading 15V. **C.A.**

### Sanyo CTP6132 (80P Chassis)

At switch on or anything up to four hours later line lock would suddenly go out beyond the range of the main hold control. Adjusting the preset VR410 would then produce a locked picture displaced about 4in. to the right. A previous repairer had already replaced the LA7800 sync/timebase generator chip so the fault had to be elsewhere. Various strange faults on this chassis can sometimes be caused by poor connection of the metal strap from the line output transistor heatsink, but unfortunately not this time. After a lengthy search the culprit was found to be an erratically open-circuit capacitor (C4012, 0·039$\mu$F) in the "AV Control-2" circuit on the deflection subpanel. **C.A.**

### Teleton CPL144

This colour portable gave no picture until the sub-brightness preset VR305 was wound up, producing plenty of monochrome picture but no colour. Backing off the killer bias preset VR304 then produced unlocked colours. Waveform checks around the $\mu$PC1365 colour decoder i.c. revealed a lack of line pulses at pin 19. These pulses come from the line oscillator on the timebase subpanel via a 15mH filter choke, L502, which was open-circuit. **C.A.**

### ITT CP9210

This oddball 14in. portable of W. German origin had no line lock. Positive- and negative-going pulses from a centre-tapped winding on the line output transformer are fed to the flywheel line sync discriminator circuit via two 22k$\Omega$ resistors, R518 and R519. Both were open-circuit. The owner later confirmed that the picture had been "wriggling for several weeks". . . **C.A.**

### Philips CTX-S Chassis

I knew I'd got trouble as soon as I took the back off this one: there was the mains fuse, wrapped in blackened silver paper! The chopper transistor was short-circuit but when it was replaced the set was still dead. The trip transistors Tr7330 and Tr7331 were both short-circuit and the associated resistors R3334/7/8 were open-circuit: coil L5355 which is in series with the chopper transistor was also open-circuit. **P.B.**

### Thorn 3000 Chassis

This case is ideal as a reminder of what some people will put up with before requesting service. The trip was operating and the following faults were dealt with. The tripler had a number of pinholes; one video output transistor was short-circuit; all three driver transistors were leaky; one of the thick-film unit load resistors was open-circuit; two of the first anode supply switches were leaky; one of the 1M$\Omega$ first anode control feed resistors was open-circuit; most of the electrolytics in the field timebase had dried up; the volume control was noisy. Any idea what the owner could see on the screen? **R.B.**

### Philips G8 Chassis

I had a filthy, smelly, nicotine filled G8 in for overhaul recently and decided to add D.R. Bracknell's soft-start circuit suggestion (September 1985, page 613). I can confirm that the h.t. supply now builds up slowly and without the tendency to overshoot he describes, so I'll be modifying other suitable candidates that come in. Thanks Mr. Bracknell!

The problem with another G8 was picture size variations. The h.t. voltage was found to be varying and an examination of the power supply revealed that one of the charging/phase shift resistors, R1373, had a burn nearly right round. It was rated at 0·5W though all the panels I've checked since have had 1W resistors in this position. The h.t. reservoir capacitor C1385 (600$\mu$F) had already dried up. **R.B.**

### ITT CVC9 Chassis

Les isn't the only one (page 698, October 1985) to have trouble with the power supply electrolytics not being earthed: intermittent fuse blowing can be traced to an arc at the tags if these are dry-jointed. **R.B.**

### Grundig GCS100 Chassis

I must admit that I never got to the bottom of this one. The complaint was low contrast, and sure enough the picture had a washed out look with the customer contrast control doing nothing. It seemed that the beam limiter might be operating, but disconnecting this made no difference. Discrete component checks on the RGB board revealed nothing, so we decided to change the TDA2800 matrixing i.c. This is not the most common of chips, but I eventually found that Telepart of Wolverhampton had some. By this time I'd noticed an intermittent fault in the blue output stage and as business was pressing I decided to get a new RGB board. Sendz Components were able to supply a board at a much cheaper price than the Grundig exchange service (they were in short supply at Grundig anyway). Fitting this restored normal operation but whether it was the chip or the board that was at fault remains a mystery. Any comments?. **R.B.**

### Sony KV1810UB

To remove teletext interference on these sets check all the electrolytics in the field timebase, replacing any that are suspect. If this doesn't work increase the value of C559 from 1$\mu$F to 4·7$\mu$F. **P.H.**

### Sony KV1820UB

The problem with this set was a ripple on the line scan accompanied by a loud whistle from the power supply five-ten minutes after switching on. A check on the h.t. line during the fault condition revealed that the voltage was normal: reducing it by means of VR601 cleared the fault, producing a stable but smaller picture. Although the switch-mode power supply is normally locked to the line frequency I decided to check it out of circuit using a 100W bulb as the load, across pins 1 and 3 of connector CNF3. When operated in this way the power supply worked correctly, with an adequate range of h.t. adjustment. The same results were obtained using a 200W bulb as the load. It seemed therefore that the fault was independent of the output voltage and load.

After much examination of the power supply panel D612 in the kick-start circuit was found to be shorted, but replacing this didn't clear the fault. The pulse-width modulator waveforms were o.k. – but not when the power supply was restored to the set, with the line sync feed connected. There was now ripple, whistle and a horrible waveform. Further checks revealed that the 18V supply to the pulse-width modulator had a 2V ripple on it. Replacing the reservoir capacitor C612 (3·3μF, 25V) restored normal, "quiet" operation. **D.R.B.**

# Thorn 8000 Series PSU Modifications

**Tony Livesley, G8JAI**

The Thorn 17in. 8000 chassis has been around for a long time but continues to give good service – apart from its notorious power supply. Most of the trouble here is caused by failure of two h.t. resistors that are vertically mounted on the panel – R727 and R729. In the later 8000A/8500/8800 chassis these resistors are part of the mains dropper assembly. The fact that the 8000's power supply is not interchangeable with those used in its larger-screen relatives is also a problem.

Most 8000 chassis will by now have been fitted with a replacement dropper of the 8000/8000A type which has four sections. When this type of dropper is used in the 8000 chassis the 1kΩ and 56Ω sections are not used – in this chassis they are the previously mentioned vertically mounted R727 and R729. Using these sections of the dropper in the 8000 chassis gives improved reliability however: details are given below. The two types of dropper are shown in Fig. 1. A further modification enables the 8500 or 8800 power supply to be used in the 8000 chassis. This is the best course to adopt since it means that only one type of power supply needs to be kept in stock.

First the modification to use all sections of the dropper in the 8000's power supply. Having succeeded in coaxing the power supply from the bowels of the set, remove resistors R729 (1kΩ) and R727 (56Ω). Check the panel carefully for faulty connections and cracks, especially at plugs PL8/9/10 and resistors R701, R730 and R704. Refit the power supply in the set and turn the h.t. preset R725 fully anticlockwise (minimum h.t.). Disconnect and isolate the lead that goes to the collector of the line output transistor VT401 – this will ensure that it's not damaged in the event of excessive h.t.

Using the continental metric type push-on terminals at each end, make up a 2·5in. wire link covered with heat-resistant sleeving. Fit one end of this on to the double tag at one end of the 47Ω section of the dropper resistor. The existing lead here should be yellow: it goes to C704 (700μF). Fit the other end of the new link to the centre of the 56Ω/1kΩ sections of the dropper.

Using another terminal and sleeve, run a length of wire from the top tag of the dropper's 56Ω section to either one of the right-hand tags on L406, which is fixed to the chassis frame at the bottom of the timebase panel adjacent to the contrast control. The existing lead on the tag required is red/grey or red/white – depending on how faded the colour is!

By the same method fit another length of wire to the lower tag of the dropper's 1kΩ section and run this across the bottom of the chassis: solder it to the print side of pin 5 on plug 11 at the bottom of the timebase panel.

Now check your wiring! Monitor the h.t. at the double tag on the 47Ω section of the dropper. The reading should be about 120V when the set has been switched on. If o.k., switch off and reconnect the lead to the collector of VT401. Power up again and adjust the h.t. for a reading of 170V. This completes the dropper modification.

Now for the modification to enable an 8500/8800 power supply to be used in an 8000 chassis. You will first have to carry out the modification just described.

Remove the red/yellow lead and its socket pin from position one of plug 10 on the power supply. This can be done by inserting the blade of a very small screwdriver or a hat pin between the socket pin and plug moulding at the opposite end to the wire outlet and carefully pressing down the small tab which can be seen through the plug's semi-opaque material. Be careful not to distort the socket during this operation as it will then be impossible to remove.

By the same method remove the brown wire and its socket pin from position 8 of plug 10. Slightly retension the tab and insert this brown wire into position one of plug 10 – where the red/yellow lead previously went.

If difficulty is experienced the leads can be cut, the one from 10/1 about an inch from the top of the plug, that from 10/8 flush with the top. The brown wire can then be joined to the remaining stub of the red/yellow wire. A neater way of going about this is to remove the previously described wire to pin 5 of plug 11 on the timebase panel, shorten it as required and join it to the now dormant red/yellow wire that originally went to pin one of plug 10 on the power supply.

Now fit an 8500 or 8800 power supply to the set. Adjust R725 for minimum h.t. and set up as described for the 8000 panel.

Some 8000 series power supply panels can be converted to the 8500 arrangement simply be refitting R730 (8·2kΩ) in the alternative horizontal position indicated. R727 and R729 will of course have to be removed.

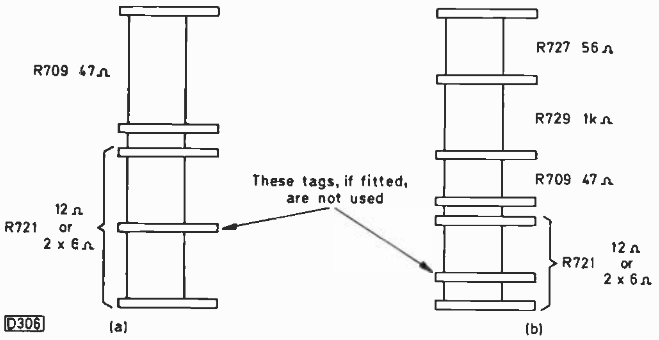


*Fig. 1: Different types of dropper used in the Thorn 8000 chassis. (a) Early type. (b) 8000A type.*

# Teletopics

### RESULTS FOR '85

1985 was another good year for CTV sales in the UK. Deliveries of colour sets to the trade rose by 4·3 per cent to 3,670,000, following a rise of 2·2 per cent in 1984. In contrast to 1984 however stocks at the end of 1985 were in line with current trading levels. An increase in sales of large-screen sets is put down to the advent of the FS tube. The percentage of imported sets fell to 34·5 per cent. VCR deliveries increased from 1,417,000 to 1,656,000 following a sharp fall (34·4 per cent) in 1984. Twenty per cent of the VCRs were UK manufactured. Deliveries of teletext equipped sets rose to 745,000 – 15 per cent of homes now have a teletext set. Camcorder deliveries increased to 50,000. Elsewhere CD player deliveries rose from 33,000 to 147,000 while deliveries of home computers fell from 1,700,000 to 945,000.

### JAPANESE FIRMS HIT BY YEN

The rise in the value of the yen, up from 214 to the dollar last October to about 160 to the dollar at present, has knocked the profits of many Japanese electronics firms. Most firms end their financial year on March 31st. Hitachi has reported a profit decrease of 38·2 per cent, the first for eleven years, Toshiba a 44 per cent decrease, JVC a 51 per cent drop, Mitsubishi a 52·6 per cent fall, Casio Computer a 21·1 per cent decrease and Fujitsu a fall of 68 per cent. All these percentages are on the pre-tax figures. Sharp on the other hand managed a 1·6 per cent increase. The profit falls are despite increased sales in many cases. Since the rise in the value of the yen occurred in the latter part of the year further profit falls are expected this year. Sony's chairman Akio Morita summed up the situation in pointing out that "at 200 yen to the dollar the hourly wages in our San Diego and our Japanese factories are the same". Despite all this Japanese firms have been slow to increase their prices in overseas markets: it seems that market share is the prime consideration, to maintain factory loading. Various measures are being taken to mitigate the effects of the increased value of the yen. Several firms have announced steps to increase overseas production. Sharp is to try to change its export/home sales ratio from 60:40 to 40:60. As a defensive measure Sanyo plans to merge with its associated company Tokyo Sanyo Electric.

### THORN SERVICE DEPARTMENT TO MOVE

Thorn EMI Ferguson Ltd. has announced plans to move the firm's service department from Edmonton, North London to a new location at its Enfield complex. An investment of some £1·5m is being made in the company's service activity. The new site will be designed and equipped to speed up the delivery of spares to dealers and improve the turnround time of customers' repairs. This will be achieved through automated spares handling procedures, new computer systems and additional test and repair equipment. The project is due for completion by the end of the year.

### 24-HOUR TV

The IBA has given Yorkshire Television permission to transmit all-night TV for a three-month trial period starting in June. Programmes from Virgin's Music Box pop music satellite TV channel are being broadcast from 12·30 a.m. to 6.15 a.m. when TV-a.m. comes on air. Advertising is being sold to cover the service's cost. YTV has a 20 per cent stake in Music Box.

Channel 4 has announced plans to move gradually to a 24-hour service over the next two years. IBA approval would be required. Channel 4 hopes to use the increased transmission hours for further educational broadcasts and programme repeats to enable viewers to record programmes they've missed.

### NO WORLD STANDARD FOR HDTV

The International Radio Consultative Committee (CCIR), meeting in Dubrovnik, Yugoslavia during May, failed to adopt a world standard system for high-definition TV. The Japanese developed 1,125 line, 60Hz system, which was backed by the USA and Canada, did not receive the necessary support due to opposition by European countries which favour the enhanced C-MAC system. The next plenary session of the CCIR will take place in 1990.

### CABLE TV DOES BETTER

According to the latest figures from the Cable Authority the number of UK households connected to a cable TV service increased by 12·8 per cent during the first quarter of 1986, to 143,877. The proportion of households connected to a cable TV service has risen to 14·5 per cent – almost a million homes now have access to a cable service.

Robert Maxwell's company British Cable Services is to be reorganised. The aim is to restore the older systems to profitability and develop new franchises. A senior management team from the US cable company Viacom is to join BCS on a contract basis.

### TV BRANDS

Fidelity's parent company Caparo Industries has entered into an agreement with Great Universal Stores' subsidiary company J.J. Silber to use the Murphy brand name on TV and video products. Silber, who acquired the brand name from Rank Radio International in 1981, will continue to sell Murphy branded merchandise including audio and telecommunications equipment. Silber had previously licenced the brand name to Rediffusion and a number of Murphy sets were sold fitted with the Rediffusion Mark 4 chassis. Fidelity have in the past had the rights to use the HMV brand name – the last HMV sets fitted with Fidelity chassis appeared in 1984. Caparo's chief executive James Leak says the firm will not rush into the release of Murphy brand sets: "a sensible, well thought-out marketing plan" is to be devised. The sets could be of UK manufacture though not necessarily produced in the Fidelity plant – Mr. Leak points out that "it's not going to be a simple job of badge engineering".

A 16in. transportable colour set is now being sold under the Hinari brand by Hinari Consumer Products Ltd., 20-22 Payne Street, Port Dundas, Glasgow G4 0LF (0413 327 795). The firm has also sold sets under the Trical brand name.

Network is now selling a range of Korean produced TV sets under the NEI brand name. During the course of May Network Industries and its associated company Network Marketing went into receivership and were subsequently bought by Network Electronic Industries.

Heron Electronics has given up the Thomson franchise which will probably be taken over by Oxford Audio. Heron will continue to market Ingersoll and York equipment.

A further correction to our TV/VCR spares guide (April 1986) is required. The Amstrad phone number should have been given as 0277 230 222 (the final 2 was omitted).

### *IEE's TV CONFERENCE*

An international conference on the history of television, from the early days to the present, is to be held by the Institution of Electrical Engineers at its headquarters, Savoy Place, London WC2 from November 13-15th 1986. The IEE is organising the conference to commemorate the 50th anniversary of the start of the world's first high-definition TV service in 1936. It will cover progress from the first proposals for television through the experiments of the twenties and the subsequent low-definition transmissions to the realisation of high-definition TV in the thirties and all subsequent advances. Contributions to the conference have been invited from people with first-hand experience of TV development, including its commercial and political aspects, in all parts of the world.

### *LCD TV SETS*

Matsushita (Panasonic) expects to launch a pocket TV set with a 3in. colour liquid-crystal display panel next year in Japan. The LCD panel has 89,280 pixels and the price of the set is expected to be around \$300. The individual pixels (240 × 372) are driven by thin-film transistors integrated on to the panel. Colour filters are used to produce triangular RGB elements which are set against a black background. Six AA alkaline cells would provide a viewing time of some five and half hours.

Citizen (see article on page 512 last month) is at present producing LCD TV sets at a rate of 50,000 a month, 20 per cent with colour. Production is to be doubled by the end of the year. It expects the price of monochrome LCD sets to fall to around £50 by 1988 as volume production builds up.

### *NEW FROM MULLARD*

Mullard has introduced a new delay line comb filter, type CF873, for use in European PAL standard VCRs. It offers optimum filtering, low insertion loss and low spurious reflection. Based on the DL872 the new delay line differs in incorporating a direct path resistor matched to the line. The nominal frequency at 25°C is 4·433619MHz with a minimum −3dB bandwidth of 1MHz: the delay time is 128$\mu$sec. The CF873 consists of a very thin slab of zero temperature coefficient glass provided with a split transducer, mounted in a shock-proof housing.

The new Mullard TDA4565 colour decoder chip features improved colour transient performance, reduced chroma bandwidth and enhanced definition and gradations.

### *UNDERWATER CAMCORDER*

An accessory pack has been introduced by Sony to enable its Handycam 8mm camcorder to be used for underwater filming – to a depth of 130ft. The MPKM8 marine pack sells at £450 and includes a piezoelectric microphone. Optional accessories include the HVL80D underwater lamp (£300), NP3000 battery (£70) and LC780 carrying case (£138) which holds the kit and a battery charger.



The alternative SPKM8 sports pack, at £80, is described as splashproof and is intended to provide protection for outdoor use.

### *ATV AERIAL*

On-glass Aerials Ltd. have developed a range of u.h.f. aerials that feature no-hole fixing. Though developed primarily for the private mobile radio market the OW432 version can be used on the 70cm band by amateurs not wishing to drill holes in their vehicles. The price is around £35 plus VAT and a v.h.f. version (2m band) is expected to become available shortly. Enquiries should be sent to B.D. Price G4DVB, 93 Highview, Vigo Village, Kent DA13 0TG.

### *FAST ACCESS TELETEXT*

It's hoped that a new chip plus new editorial techniques at Ceefax/Oracle will enable FAT – fast access teletext – to be introduced next year. The system gives instant access to four pages related to a selected page: cue marks appear at the bottom of the screen, relating to colour-coded buttons on the remote-control unit. The extra chip is used to keep the cue pages in store. A FAT decoder would add about £20 to the cost of a set. Work is at present being carried out on developing the editorial techniques required.

### *SATELLITE TV EQUIPMENT*

A new company has entered the satellite TV field. Satellite Technology Systems Ltd., Satellite House, Blackswarth Road, Bristol BS5 8AU (0272 554 535) has introduced two TVRO terminals, one aimed at the domestic market and the other providing for signal distribution to up to 200 standard TV sets. The domestic STS300 series system comprises a 1·2m offset parabolic dish aerial, low-noise converter and SSR7700 receiver unit. It sells at around £1,000. A polarotor is available as an optional extra. The company has set up a training centre for dealers at its Bristol headquarters.

Connexions Satellite Systems (125 East Barnet Road, New Barnet, Herts EN4 8RF (01-441 1282) is now offering a "starter" satellite TV receiving system at £895 including VAT. It has a 1·2m offset polar mounted dish that can be motorised at a later date if required.

Carlton Communications plans to market 10,000 satellite TV receiver systems in the UK and Europe this year through its Skyscan subsidiary. The system will include a 1·2m motorised dish aerial and the suggested price is around £1,150 including installation.

# Return of the French Lady

**Les Lawry-Johns**

You may recall the French lady whose ex-husband taught Scottish rig workers how to swim (she said). She has another set now and it's giving trouble. A Pye 731 which also gave me trouble, mainly because I didn't want to carry it from her flat, round the square and out to the car.

### The Pye 731

First there was intermittent sound which I thought was due to a dry-joint. It turned out to be a poor plug/socket connection. After getting this right the sound still wasn't clear – it sounded as if the speaker was rubbing. So I said I'd be back with another speaker as soon as I could. Shortly after I was back with a nice new speaker with a free floating cone and proceeded to fit it. She was nattering away and I vaguely heard something about the picture going off. With the speaker fitted the sound was fine and the picture showed no sign of going off. I tapped around but it wouldn't do anything wrong. So I left it at that.

Next day she phoned again and read out a long list of the times when the picture had gone off, apparently for very short periods and with no regular pattern. So I sallied forth again and this time managed to make the picture go off by applying pressure to the TBA990 chip on the decoder panel. I immediately resoldered every joint in the vicinity. After this I couldn't make it go off so I departed, thinking that that was the last of the matter. It wasn't. I had to return several times subsequently, replacing in turn the line output transformer, the BU208 line output transistor, the tripler and for good measure the $0{\cdot}1\mu F$ first anode supply reservoir capacitor C563 (1·25kV). It was a nightmare and every time the phone rings I dread hearing that voice "allo, allo, this is ze French woman talking". And talking, and talking.

### Mother-in-law's Set

A young fellow brought in this ITT hybrid colour set (CVC8 chassis) and said it belonged to his mother-in-law. I'd no idea whom he was talking about. The repair took some time as the boost capacitor had gone short-circuit (as usual) but had this time taken the PY500A boost diode and 56Ω h.t. feed resistor with it. I did all that was necessary and wrote out the bill, charging fifteen pounds. A fortnight later all hell broke loose.

A voice which I vaguely recognised phoned to say that the TV set I'd "thoroughly overhauled" was giving trouble after being moved round the room. So I got the car out and nipped over to see what I could do. I was appalled when she opened the door. I knew her all right, and knew the language to expect. Talk about that young girl with the long blonde hair, she was a saint in comparison. Leaving aside the language, the woman was demanding to know why a set that had been "overhauled" so recently should give trouble so soon. She waved the bill in my face.

"Look at this, fifteen **** quid. You should be ashamed of yourself."

"If I'd known it was your set I wouldn't have touched it in the first place" I bawled back.

Anyway, she insisted that I saw the set working. The picture was wavy and the colour was in bars. I thought that moving the set had disturbed a poor earth connection. It transpired however that the AD161 l.t. regulator transistor (left side) was leaky. I had one with me and it was in before you could say knife. The picture was now perfect.

"I wonder how long that will last. You people certainly know how to rob us poor ****s."

"Well this poor **** is going off now, having performed a miracle in front of your eyes. I don't intend to repeat the performance. Goodbye."

I got to the car while she stood at the garden gate waving the bill in the air and bawling about wanting her money back.

### Beardy's Brother

I thought I'd seen the last of beardy and hope I have. His brother came in however, struggling with a 26in. TX10. The back cover was held on by Sellotape and I felt sorry for myself.

"This television you see, there's very little wrong with it. Just a little something that stops it working properly. I'll leave it with you and call back later when you've fixed it for me."

I switched it on and the tube's heaters glowed. Oh well, that's a start. He'd left the remote control unit and although I pressed the brightness button no raster appeared. The first anode voltage was low at about 200V. I smelt a rat – someone had been messing about. I turned up the first anode control until the voltage measured 400V. The raster was now present but with an aerial plugged in there was no picture. I checked the tuning but nothing could be resolved. The tuner was suspect but a new one had recently been fitted. So I turned my attention to the i.f. module. Fitting a replacement made no difference. Back with the original and out with the tuner, using a yard of desoldering braid because whoever had fitted it had been over generous with the solder. I fitted a new 1043 and got a picture that was very grainy. A.G.C. I thought, so I adjusted the small preset on the i.f. panel and it made no difference at all.

I thought the new tuner might be faulty and like a fool fitted another. Again no difference. The aerial socket may be? I connected a new one to the tuner, just hung it on so to speak. The picture was best with only the inner connected, the braiding left off. This confused me so I fitted another aerial socket which did the same thing. I left it for a moment to serve a customer who wanted to know why he was getting severe interference in the shape of another picture floating around on top of the one he wanted.

"Continental interference" we advised him. "Leave it alone and it'll go away."

When I got back to the TX10 I'd forgotten what conclusion I'd reached, and came to the conclusion I'd not reached one. I then injected signals into the i.f. module and found that the output was weak. So I refitted the new one. This restored normal reception and I wrote out a bill for a very reasonable (I thought) £20. I was prepared for a performance and I got one.

"Both these things faulty? One I can understand but not two. Are you sure?"

"Yes I am sure and it took me long enough to work it out. In any case I've only charged you for one."

"Twenty pounds is a lot of money. Can you make it fifteen?"

"I'll make it nothing" I snapped, tearing off the Sellotape that held the rear cover. "I'll put back your tuner and your i.f. unit and you can take it elsewhere."

"Oh no, no. I was only joking. Here's your twenty pounds. I never argue about money."

I refitted the Sellotape and off went beardy's brother, nattering away in a language I didn't understand.

### *Fidelity Portables*

The 14in. Fidelity portables (ZX2000 chassis) are now using up line output transformers at a rate of knots. If you handle them you must keep a couple of transformers in stock, complete with the small subpanel that enables the newer type to be fitted to the older type of panel. A leaflet explains the steps to be taken – remove the focus unit and first anode control etc.

One came in the other day with the complaint that though it chattered away in various tongues it didn't show a picture. I didn't at first associate this with the line output transformer as the fuse usually fails when the transformer is defective. In this case it hadn't because the $10\Omega$, 2W h.t. smoothing resistor, in the feed to the line output stage, had gone instead. This left the chopper working and the supply to the TDA3190 sound i.c. intact.

### *Mrs Steadfast's New Set*

Mrs Steadfast has bought a new Fidelity from us. She complained because it didn't have a carrying handle and I complained because of the tuning arrangement. It has three buttons at the rear: up the scale, down the scale and store. It would have been easier if these had been at the front or on the side. It's easy once you've had a bit of practice however. Her old set, a 26in. Swedish monster, had to be carried out through the door, along a corridor and into the back room. I did it alone, though there was a male who didn't lend a hand present. I'll remember that Harold: the set was very heavy, and me in my condition. But I didn't complain. I never do.

### *Whatever Next?*

I had a shock the other morning. I got up fairly early to let the dog out and was pottering around in the kitchen when I heard a knock on the shop door. There was a large van outside, with Sheepless Nights on the side. The man at the door asked whether it would be all right to bring the bed in.

"I haven't ordered a bed" I said.

"I did" came Honey Bunch's voice from the toilet.

So in came this great big bed, which she assembled later in the day, and out went my nice comfortable favourite.

As we sat there that evening H.B. asked why I was knocking back the whisky (Cutty Sark this time).

"So I can face getting into that high, firm monster in there" I growled.

"We'd had that old one for twenty years. It had a dip in your side and was all misshapen."

So we went to bed and had a good night's sleep, much to my surprise. New bed – what next?

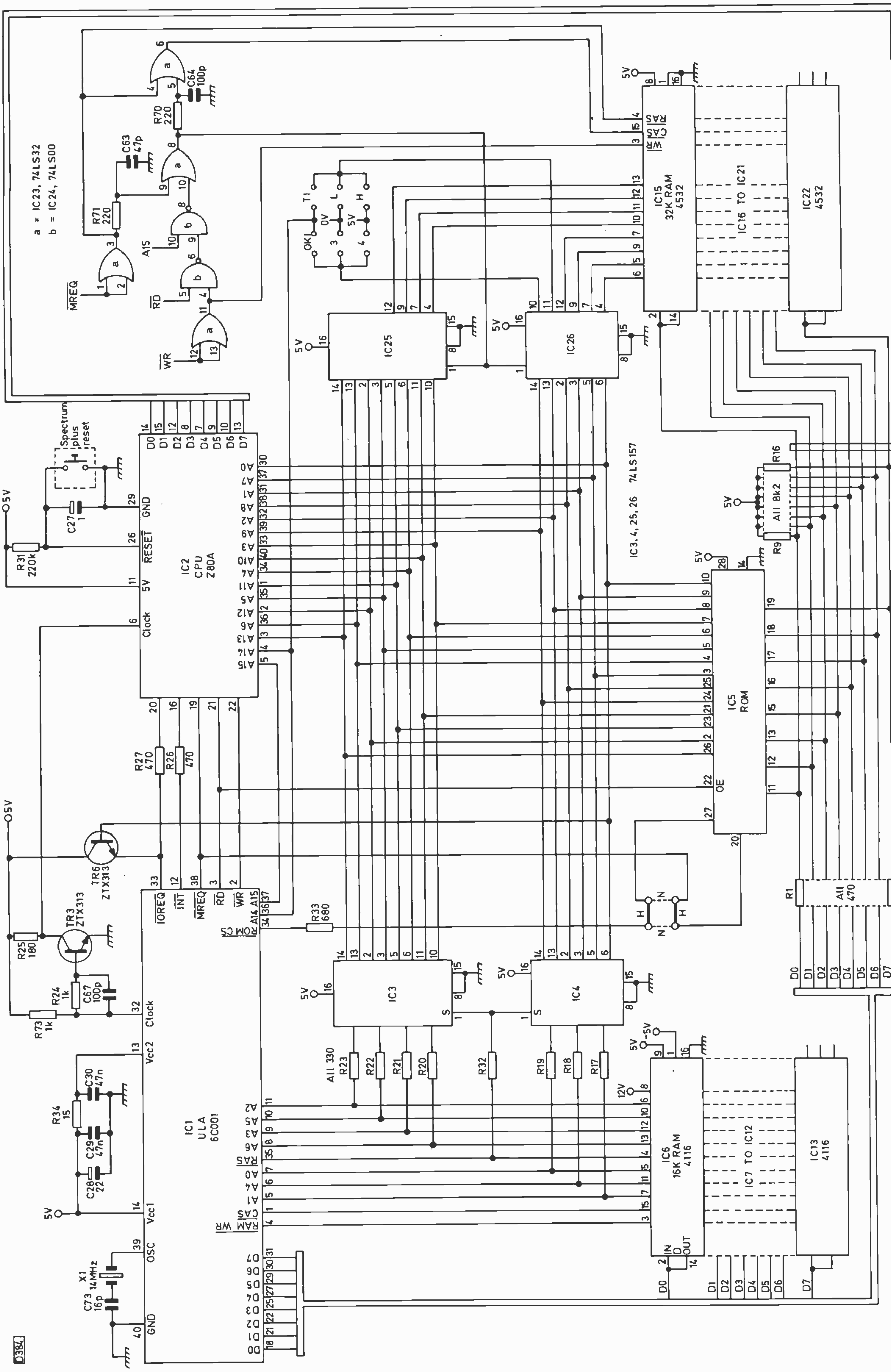


Fig. 1: The basic digital computing circuitry used in the Sinclair Spectrum microcomputer, issue 3 version.

# Servicing Sinclair Microcomputers

**Part 3** **Ken Taylor**

This month we start on the Spectrum. Let's first take a quick look at the development of this machine over the past few years. There have been four standard PCBs marked issue 1, 2, 3 and 3B. After each change a few modifications were generally required to make the new design operational or to implement further improvements – even the 3B board has now been modified. It's often possible to determine the issue number without opening the case. The clues are as follows:

(1) If the rubber keys are a light fawn colour it's an issue 1 board.

(2) If the keys are dark grey, look into the edge connector slot to see whether an aluminium heatsink is visible – especially at the power socket end. If you don't see the heatsink it's an issue 2 board which has the heatsink near the forward corner of the board, under the keyboard.

(3) If the heatsink is visible it's an issue 3 or 3B board – there is very little difference between them.

The Spectrum Plus usually has an issue 3B board, but watch for earlier models that have been fitted with a Spectrum Plus keyboard kit – this can now be obtained separately.

In this write-up I shall be dealing primarily with issue 3 and 3B models, though I hope to mention the earlier models where the differences are important.

### Circuitry

The Spectrum differs from the ZX81 (see last month) in two major respects. First it's designed to carry the full memory (48K RAM) on the PCB. Secondly the TV display is serviced automatically by the ULA chip and a dedicated i.c. (type LM1889) which also provides the video output in colour. This latter arrangement explains why with an otherwise dead machine a vertical striped pattern of "bricks" flickers up and down the screen and goes on working even when the CPU has been removed.

Which reminds me – I haven't explained why we're not providing a block diagram for the Spectrum. I don't see that this would be of much advantage. Apart from illustrating the two differences I've just mentioned it would be much the same as the block diagram given for the ZX81. Instead I'm showing most of the circuitry, which by now should be fairly self-explanatory.

The first circuit section is shown in Fig. 1. This includes the basic digital computing circuitry. For clarity, most of the decoupling and smoothing capacitors have been omitted. The input/output circuitry, including the TV output, tape input and output and the keyboard connections have also been omitted: these will be shown later.

Fig. 2 shows the layout of the issue 3 Spectrum to enable you to find the main components as we refer to them. The differences between this and the issue 2 board are not very great. Because of the changed position of the heatsink, the keyboard socket at the right-hand side of the board has been moved slightly rearwards and the regulator is in the middle of the right-hand edge. Most of these features become obvious when you compare an earlier issue board with the layout shown in Fig. 2.

### Access

You can't do that however till you open up the machine, so here goes:

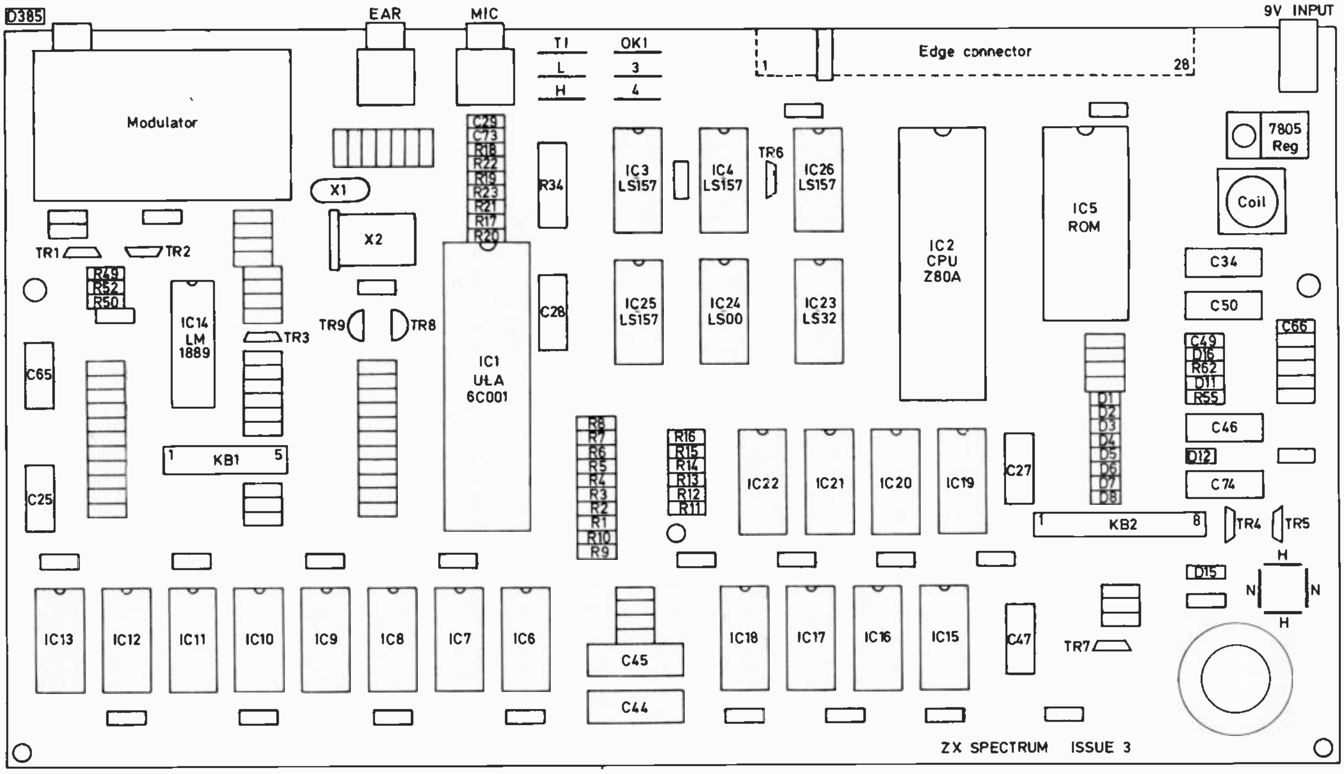


*Fig. 2: Layout of the issue 3 Spectrum panel.*

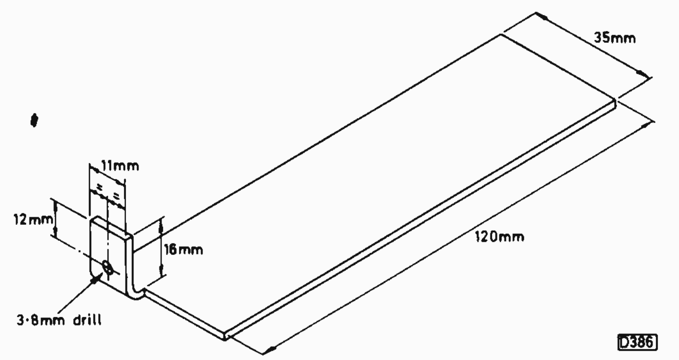


*Fig. 3: Temporary heatsink for use when carrying out servicing work on the Spectrum.*

(1) Turn the machine over and remove the five screws – eight with the Spectrum Plus.
(2) Turn it back, carefully holding the two parts together. Lift the top, tipping it on to its rear edge so that the keyboard tails can be removed from their sockets. Remember what we said when dealing with the ZX81 about the fragile nature of these tails: the Spectrum is just as vulnerable in this respect.
(3) As with the ZX81, the machine should still initialise when the keyboard has been disconnected, and on start up should display "c 1982 Sinclair Research Ltd." on the bottom line. The keyboard can be left disconnected until this has been achieved.
(4) Before much serious work can be undertaken the heatsink must be removed to provide access to the components beneath. This is even more important with issue 3 and 3B models which have a larger heatsink that covers many of the more important components. The temporary heatsink I use when working on any Spectrum board is shown in Fig. 3. Don't worry if you cannot find a piece of copper or aluminium exactly the right size – the only important section is the little bent-up end which has to fit under the regulator. Even here, if your metal is too thin you can stick another shim of metal to the back so that the regulator legs are not distorted when you screw the heatsink underneath it.

### Fault Finding

The internal voltage generator circuit is shown in Fig. 4. This is one of the circuit areas that often suffers when a fault develops. It consists of a 5V regulator and a blocking oscillator (TR4) whose output is rectified to produce the 12V and −5V lines required by the 4116 memory i.c.s that provide the initial 16K of RAM. An interesting regulation technique is used: the blocking oscillator's timing capacitor(s) are charged by the constant-current transistor TR5 whose base is controlled by feedback from the 12V line. The outputs are taken to the edge connector and perhaps this is the problem. It seems that TR4 dies when there's the slightest extra load. This is often caused by a joystick interface being removed or fitted while the machine is switched on and probably shorting out one of the supplies. But the 4116 memory i.c.s sometimes develop shorts and then the problems start.

I've shown the oscillator current in Fig. 4. It's often necessary to supply the board from a bench supply and monitor this current. With a supply provided for the 5V rail, wind up the supply to the oscillator slowly from zero. Monitor the current drawn by the oscillator: if the reading exceeds 300mA switch off quickly and remove one/some of the memory i.c.s or cut the 12V supply tracks to pins 8. Finding the faulty memory or memories is very hit and miss but if you've a good record at pontoon or the football pools you may be lucky!

Earlier circuits were slightly different from the issue 3/3B circuit shown but the differences were often only in the component values and it's worth noting that all issues use the same component reference number for components in the same circuit position.

One more point. Because of the omission in earlier versions of the asterisked 22$\mu$F electrolytic capacitor, unless you have the 3B version the 12V line will be at about 11V even when the oscillator is not working. This can present a very confusing situation, so ensure that your first check is always on the −5V line, which will be absent if the oscillator isn't working. The frequency of oscillation, which isn't very critical – or stable – is about 6·6kHz.

Having eliminated faults in the voltage generator circuit and hopefully in any of the 16K RAMs, why doesn't the thing work? Assuming that you are still getting the flickering vertical columns the ULA and the TV video generator chip appear to be o.k., so what else? Remember that your check on the memory i.c.s, made whilst

**Table 1: Signals on the i.c. pins**

| *Pin* | *IC1* | *IC2* | *IC5* | *IC6* | *IC15* |
|---|---|---|---|---|---|
| 1 | P | P | OC | L | L |
| 2 | PH | PH | PH | P | P |
| 3 | P | P | P | PH | PH |
| 4 | PH | P | P | P | P |
| 5 | P | P | P | P | P |
| 6 | P | P | P | P | P |
| 7 | P | P | P | P | P |
| 8 | P | P | P | H | H |
| 9 | P | P | P | H | H |
| 10 | P | P | P | P | P |
| 11 | P | H | P | P | P |
| 12 | PH | P | P | P | P |
| 13 | H | P | P | P | P |
| 14 | H | P | L | P | P |
| 15 | P* | P | P | P | P |
| 16 | P* | PH | P | L | L |
| 17 | PH | H | P | | |
| 18 | P | H | P | | |
| 19 | H | P | P | | |
| 20 | H | PH | P | | |
| 21 | P | P | P | | |
| 22 | P | PH | P | | |
| 23 | H | H | P | | |
| 24 | H | H | P | | |
| 25 | P | H | P | | |
| 26 | H | H | P | | |
| 27 | P | P | P | | |
| 28 | L | P | P | | |
| 29 | P | L | | | |
| 30 | P | P | | | |
| 31 | P | P | | | |
| 32 | P | P | | | |
| 33 | PH | P | | | |
| 34 | P | P | | | |
| 35 | P | P | | | |
| 36 | P | P | | | |
| 37 | P | P | | | |
| 38 | P | P | | | |
| 39 | † | P | | | |
| 40 | L | P | | | |

P = pulse, high and low LEDs lit.
P* = pulse LED only lit.
PH = pulse and high LEDs lit.
H = high LED lit.
L = low LED lit.
OC = no LED lit.
† = display affected.

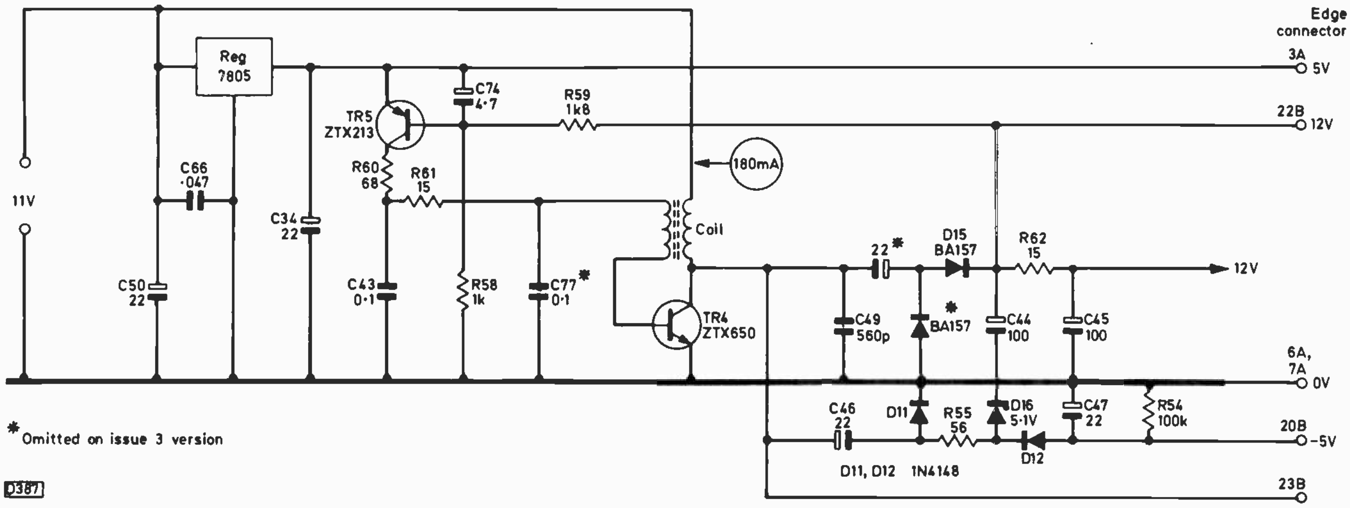


*Fig. 4: Voltage generator circuit used in the Spectrum – issue 3B version. With the issue 3 version R60 is 270Ω, C49 is 47nF and the asterisked components are omitted. Edge connector numbers suffixed A are on the underside of the board, those suffixed B are on the component side (top). The input from the power supply is approximately 11V on load (650mA).*

repairing the voltage generator (if necessary), detected only those i.c.s taking excessive current, not those with other faults. So first try the piggy-back check I suggested for the ZX81 last month. Clip a good 4116 on top of each of the remaining original memories and see whether this makes a difference. If the extension memory chips (IC15-IC26) are fitted they can be turned off either by removing the memory chips or IC25 (one of the 74LS157 multiplexer chips). Alternatively the 5V supply track to pin 16 of this i.c. can be cut, but this is not easy with the issue 3 board as the track is thicker than usual.

The 4116 memories are also addressed via the 74LS157 multiplexers IC3-4. You may recall our earlier comment that dynamic RAMs such as the 4116 are addressed by a row/column sequence so that only half the theoretically required number of address pins are needed. The internal system stores the first half of the address and then combines it with the second half to provide the full 16-bit address. The ULA has this facility built in, so it doesn't require multiplexers to address the RAMs.

Note the buffer resistors in the address lines between the ULA and multiplexers IC3-4. These allow the ULA to take control of the address bus when the screen needs updating, irrespective of the demands of the CPU. These buffer resistors are very useful when you are fault finding. Any loss of signal tends to be isolated to one side of the buffer, enabling the faulty i.c. to be detected. In this case, if the fault is on the ULA/RAM side removing the ULA or cutting the track will usually pinpoint the fault.

If you still have a fault, it's probably in the CPU or the ROM and a full check on the circuit will be necessary. Table 1 shows the signals that should be present at each pin of the main i.c.s, with the keyboard disconnected and the Sinclair logo displayed, when monitored using a logic proble (a Tandy Micronta was used). This should enable you to isolate and replace the faulty i.c.

Next month we'll look at the rest of the circuit and some of the variations and modifications.

# Letters

## SERVICING MATTERS

I would like to add some comments to S. Simon's note about the Thorn 1690 chassis (May issue, page 444). He is quite right in saying that when the e.h.t. rectifier goes short-circuit the line output transformer's windings are damped and the l.t. supply is severly reduced. But he fails to say what to do if, after removing the anode cap from the tube, normal operation is not restored. The answer is simple. Undo the two nuts on top of the transformer, lift off the overwinding, replace the top C core on the transformer and retighten the nuts. Switch on and you should find that the l.t. supply is back to normal. The reason for this is that when the e.h.t. rectifier diode goes short-circuit the overwinding overheats and does the same thing.

He also mentions adding an external diode, well insulated, when the internal diode has gone short-circuit. This is bad practice and not to be recommended when you are dealing with voltages of some 11kV, especially when a new overwinding with diode, lead and anode cap can be obtained from Sendz for only £2·50 and fitted in minutes.

In the April issue Alan Shaw mentioned loss of colour in the Rank T24 chassis when the pulse feed resistor R229 goes high in value (TV Fault Finding, page 372). We had this fault some months ago but the symptoms were more obscure. The initial complaint was loss of colour on changing channels. After a period of time on soak test the symptoms started to change: there was random colour drop-out, followed later by intermittent Hanover bars. As we were working without a manual many hours were spent on wild goose chases before R229 was located and changed – it was completely open-circuit.

*Michael Dranfield,*
*Buxton, Derbyshire.*

## RANK Z179 CHASSIS

We had a strange fault recently with an old Rank set fitted with the Z179 chassis. There are still a few of these sets around, producing acceptable pictures. This one wasn't – in fact it was brought into the workshop with the report "dead".

When we pressed the reset button the h.t. began to rise. Then "click" and the cutout had tripped. On disconnecting the cutout protection circuit, using the link provided in the crowbar thyristor's gate drive circuit, and switching the set on a picture was present and sound as well. A check on the h.t. voltage, using an Avo 8, produced a reading of some 290V – over 100V more than the correct figure of 187V. Thus the e.h.t. was running at a steady 36kV. In view of X-ray radiation the set was switched off pronto.

To cut a long story short, when the set e.h.t. control 4RV18 (1·5kΩ) was set to minimum e.h.t. the actual voltage was still 32kV. So we fitted a 3·3kΩ preset and were able to reduce the e.h.t. to approximately 24·8kV. Phew!! The h.t. was now correct.

I've mentioned this to several engineers in the Devon area and it seems that the fault is not unknown. Maybe just a few sets are prone to this, but I've not seen it mentioned before in *Television.*

*Mike Austin, Austin Electronics,*
*Bere Alston, Devon.*

## GRUNDIG 6010 SOUND PROBLEMS

In the April issue Service Bureau it was mentioned that gradually rising sound in the Grundig Model 6010 can be caused by leakage in either the paddle switch or the memory cell. It can also be caused by whistle from the line timebase. To check, disconnect the NS transductor from the TD panel. It appears that a harmonic and a subharmonic could be producing a beat frequency – the line frequency × 5/2 (third harmonic minus second subharmonic maybe?) gives 39·06kHz: the control frequency for sound increase is 38·5kHz.

I've also recently experienced a faulty PCL86 audio valve in an ITT set fitted with the CVC5 chassis – the triode's cathode had shorted to the pentode's cathode. The PCL86 has a shield between the two sections, connected to the pentode's cathode. The wire from the triode's cathode to pin 2 is dressed around this shield and in the faulty valve it was touching the shield. I hope these observations will be of help.

Incidentally woodglue is very good for damping the cores of line output transformer's etc. when whistling is suspected.

*S. Pearson,*
*Chipping Norton, Oxon.*

## GEC C2110 SERIES TIP

I recently had a GEC 2015H whose field timebase refused to lock. All the obvious checks proved fruitless so the relevant tracks etc. were visually examined using a magnifying glass. Pin 7 of the TBA 920Q sync separator/line generator chip (IC401) was found to have little solder around it: making this good restored normal operation.

*D. C. Robinson, Stronsay, Orkney.*

## LED INDICATION FOR BOOSTERS

Many tube reactivator designs have been published in *Television* over the years, most of them based on the circuit using a 15W pygmy sign bulb first published in the sixties. Two comments: first, many tubes won't respond to the process unless the heater voltage is raised; secondly a pulsed method is quicker.

I use a treasured antique sold in the early days under the name Radar. Its heater supply has six outputs switchable 2-13V plus a four-way switch that boosts the heater voltages by up to 50 per cent. When I bought it the booster was useless: it languished in my loft until that first booster article was published in *Television*. It was then "recycled" and has been in use for many years. Few tubes have failed to respond and none have been spoilt, despite the dire warning given with some designs.

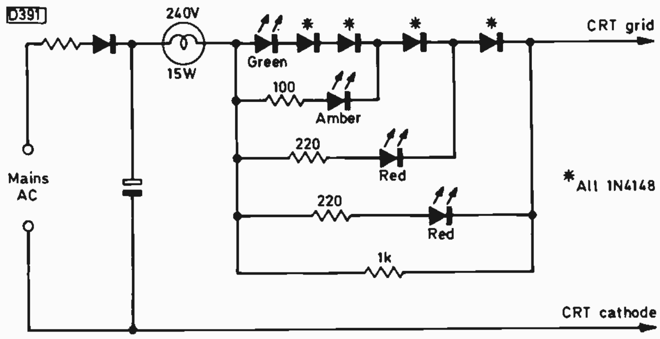

*Fig. 1: Use of LEDs to give goodness indication with a tube reactivator.*

The reappearance of a circuit of this type in the May issue made me think about possible improvements. A LED goodness indicator seemed a good idea (see Fig. 1). This may appeal to engineers using a booster when the punter is present. Four 5mm LEDs, two red, one amber and one green, work in traffic light sequence, the green LED indicating good cathode emission. Check the LEDs before fitting: a red 5mm LED should draw 20-25mA when operated with a 2V supply, the other colours requiring a slightly higher voltage.

This is an inexpensive addition. I've used it with the design published in the April 1978 issue but it's suitable for use with any similar reactivator.

*William Harrison*
*Windsor, Berks.*

## TEST CIRCUIT FOR THE COMMODORE 64

Alignment of the Commodore 64 microcomputer's cassette deck is made very difficult by the fact that it's powered from and controlled by the computer itself. If a load error is detected the computer stops the tape.

We've found that the easiest way to check the alignment is to use the test circuit shown in Fig. 2. If the circuit is made up on a small piece of tagstrip it's possible, with a bit of ingenuity, to make a plug connector to match the tape deck socket and connect the two with flexible leads. I used an old Siemens 365 daughter board to make my plug connector. The connections are 1 0V, 2 5V, 3 cassette motor, 4 cassette read – 5 and 6 are not used. The locating lug is between pins 2 and 3.

To use, all that's necessary is to plug the test circuit into the tape deck, insert an alignment tape and press play. The azimuth adjustment is then made for steady illumination of the LED. If a scope is available it can be used to monitor the test point where a continuous squarewave should be present.

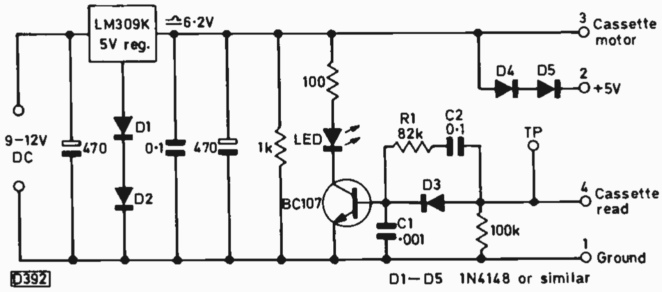

*Fig. 2: Cassette deck test circuit for use with the Commodore 64 microcomputer. Any type of LED can be used.*

The circuit's electronics are simple. An LM309K 5V regulator chip is used to provide a stable supply – since its earth pin is raised to 1·2V by diodes D1 and D2 the output is approximately 6·2V. This is used to power the deck motor. The deck's electronics require 5V which is obtained by using D4 and D5 to provide a 1·2V drop. The pulses coming from the deck are rectified and shaped by D3, C1, R1 and C2 and used to drive transistor Tr1 which in turn drives the LED. They are available for visual examination at the test point. When an azimuth tape is being played back there should be a square waveform with an even mark-space ratio at this point. If the azimuth is wrong either the mark-space ratio will change or dropouts will appear in the waveform. If alignment seems to be very critical the head is probably faulty. If the output waveform is noisy check whether the cassette motor is the cause by disconnecting it.

One further point. It's always worth making a final check that the deck loads, and especially saves, using a computer. We had a customer who brought in a six months old Sinclair machine with the complaint that it wouldn't save. In fact the machine hadn't saved a programme since the day it was made – the output coupling capacitor hadn't been fitted! Presumably it had spent the first six months of its life just playing games...
*Peter Richards,*
*Criccieth, Gwynedd.*

## G8 CONVERGENCE PANELS

There were a couple of articles on the Philips G8 chassis in *Television* last year. Both mentioned the poor performance of the later (550 series) convergence panel compared with the more reliable, front mounted 520 series panel. Some time ago I bought a batch of ex-rental 550 series sets and noticed that one of them had been fitted with a 520 series convergence panel hung down and mounted on the chassis crosspiece. As the set was performing correctly with good convergence I've since then on many occasions used the older type panel to replace a later type panel. All the plugs and sockets match up and the only action required is to drill one extra hole to match the panel and fasten the extra wiring carefully in the harness clips on the existing chassis. I hope that this tip proves useful to other readers.
*P. Smith,*
*Hathersage, Sheffield.*

## SPECTRUM ADD-ONS

Quite a lot on the Spectrum microcomputer has appeared in *Television* recently. Some add-ons can cause the computer to either crash or not work with various games. The Currah Microspeech and the Kempston interface are but two examples. Both of these can be successfully, easily and cheaply modified to work with all games however. First the Microspeech. Some games won't work because the game and the Microspeech try to occupy the same section of memory, so the computer crashes. The cure is to earth line A3: the Microspeech stays connected but the Spectrum ignores it. As this is a dead-ended device with no through connector most people who want to use more than one add-on will use some form of extender, the usual sort being a 56-way socket to fit the Spectrum's rear connector and two or more sockets on the end of a piece of ribbon cable. These extra sockets will require a printed circuit "back-to-back" to connect them to whatever accessory is being used. It's this piece of back-to-back that's

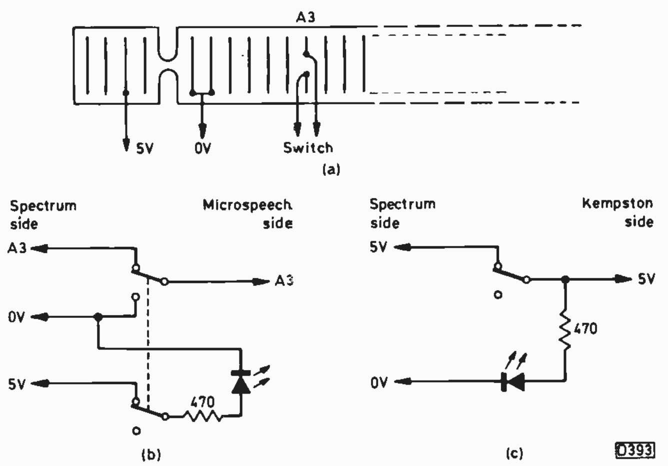

*Fig. 3: Modifications for use with Spectrum add-ons.*

modified. This has several advantages, the main ones being that modification can be done without connection to either the computer or the Microspeech, so that a careless solderer won't do any damage, and that neither the computer nor the Microspeech has to be dismantled so no guarantees are nullified.

Back to the Microspeech. Break the A3 line. Counting from the double-earth connections (taking these as one and two) at one side of the keyway A3 is the seventh – see Fig. 3(a). Fit a double-pole, two-way toggle switch with sufficient wire to enable it to be taped to the side of the Microspeech's case. Two poles are used – see Fig. 3(b) – so that one pole can be used for a LED to indicate on or off. The slider of one pole goes to the A3 line for the Microspeech, the fixed contacts going to earth and the A3 line from the Spectrum respectively. The other pole is used to connect a LED with a resistor of about 470Ω in series between the 5V line (the second edge connector from the keyway on the same side as the double earth) and 0V. Irrespective of whether the Microspeech is on or off the Spectrum sound will come from the TV set's speaker – and so sound a lot better than the Spectrum's own feeble beep.

The next device is the Kempston interface for joysticks. You'd think that games designers would take this into account as it has become an "industry standard" joystick interface, but no. The game "Chickin Chase" (their spelling, not mine!) will crash if the Kempston is connected. This modification – see Fig. 3(c) – is very simple. Just switch off the 5V supply to the interface and the Spectrum will ignore it. Although it's a bit late now the game "Ghostbusters" will, despite having a Kempston option in the menu, crash if the Kempston is connected – unless you moan to Activision who will replace the game with a Kempston compatible one (and also refund your postage if you ask nicely). To test the Kempston interface use the following short program:

```
10 PRINT IN 31;:PRINT "  ";:PAUSE 25: GOTO 10
```

With the interface switched off the answer should be 255. With it switched on you should get the following: up 8; down 4; left 2; right 1; fire 16 – or combinations thereof.

I know that the alternative to these modifications is to keep unplugging the devices but I feel sure that the Spectrum's rear connector was not designed for constant plugging and unplugging. I hope that Amstrad, having taken over Sinclair's computer range, will repackage the 128K and 48K with a built-in joystick interface.
*Michael Harris,*
*Cheadle, Cheshire.*

# VCR Clinic

**_Reports from Derek Snelling, Les Grogan, Steve Beeching, T. Eng., Mick Dutton and Philip Blundell, Eng. Tech._**

## Ferguson 3V29

On changing channels this machine would sometimes appear to drift off tune. Closer inspection however showed that the fault was more like a.g.c. instability. In addition the tuning was very critical and prone to smeary video, and the r.f. gain control wasn't working correctly. As the a.g.c. voltage to the tuner was correct we first tried a new tuner. This made no difference. The fault turned out to be due to the AN5111 i.f. chip. **D.S.**

## Mitsubishi HS318

There was a rather unusual fault with this machine: the TV picture went low gain when the VCR was switched on, though the channels through the machine were fine. A faulty aerial booster can cause this sort of problem but it doesn't usually depend on whether the machine is switched on or not. A check on the supply to the booster/converter showed that instead of being 9V it was at 10-12V with the VCR off, falling when the machine was switched on and the load on the lines increased. A new 9V regulator cleared the fault. **D.S.**

## Booster/converter Units

We've had four booster/converters fail recently, two in Toshiba V65Bs and two in Finlux VR1010s – all within a couple of miles of each other. Perhaps there's some environmental factor at work here. Like the Panasonics whose boosters would fail when there was a thunderstorm in the area. **D.S.**

## Mitsubishi HS304

This machine wouldn't play because the capstan motor didn't rotate, though all other functions appeared to be in order. A check at pin 17 of IC4A0, the capstan reverse output, revealed that this was permanently high. Disconnecting the pin proved that the high was coming from elsewhere – it was traced to an inverter in IC4A2. Replacing this i.c. cured the problem. **D.S.**

## Toshiba V65B

No play was the complaint with this machine. When play was selected the machine would lace up then after a few seconds it would unlace and stop. A quick check showed that the head drum wasn't rotating, though slight pressure on the plug and socket to the lower drum assembly would start it up. We stripped down the assembly and resoldered all the joints. This failed to produce a cure and no cracks could be found. A replacement lower drum assembly cured the fault. **D.S.**

## Mitsubishi HS700

Here's a tip for anyone with one of these machines that has a broken camera socket. This item is available from Mitsubishi only if you order a complete Y/C board. The later Model HS710 uses a similar camera socket however – in fact it's a better quality, metal one. This is available as part of a terminal assembly that's very reasonably priced. Simply remove the socket from the assembly and fit it as a direct replacement in the HS700. **D.S.**

## Grundig VS180

The symptoms were no tape transport, with the winding motors running fast. This fault is indicative of a power supply line failure. Water was evident on the inside of the bottom plate however – corrosion too. Some water was found around the upper case edges but as it had been raining heavily when Andy brought the machine in we didn't worry too much. The power supply lines were all correct at the power supply edge connectors, but there were tide marks about and it was damp beneath the tuner – green with open-circuit, corroded print. It took about half a day to strip everything out, repair the print, relacquer and test.

As it was a rental machine I was concerned about where the water had come from. More to the point I kicked up merry hell with the customer for spilling water/gin/vodka or whatever into the machine. Denials all round. The wife didn't like flowers in the house and the VCR was kept within a cabinet, so it was a mystery where the water had come from. When the VCR was returned to the customer he found water inside his cabinet and inside the aerial connectors which had been plugged together in the absence of the VCR. The water was coming down through the cable, which had to be replaced. **S.B.**

## Sony SLC7

The problem with this machine was that it wouldn't change channels after it had warmed up – the trouble was intermittent. It looked like a difficult fault and we approached it with trepidation. When the fault was present the machine wouldn't change channels and the programmable timer couldn't be set, though the clock could be. Panic set in! When a channel is selected the decoder chip IC1 on the tuning panel sets the binary conditions on lines ABCD. IC1 on the timer panel counts, and when its ABCD output back to the tuning panel matches the selected channel the count stops. Count start/stop is controlled by an AND gate in IC7 (pins 1/2/3). In the fault condition the output at pin 3 of IC7 was high, indicating count, but IC1 (timer panel) wasn't counting. Why? Because it was busy doing something else. One of its strobe inputs, pin 33, was active. This could be traced back to switch S20 (clear) which was faulty, with no spring return. It opened and closed when it felt like it, stopping the channel change. **S.B.**

## Grundig 2 × 4 Super

This machine came in for a new on/off switch – the latching spring was missing. I was not prepared for what followed. After completing the switch repair a check was made and we found that the drum servo wasn't locking up. Better lock was obtained as the machine warmed up, but the drum motor would then suddenly slow down. Everything was checked and we found that the trouble seemed to be associated with the comparator IC1501: a replacement made no difference however and for some reason output pin 13 would inexplicably go high, slowing the drum motor. Nothing was wrong with the inputs and nothing seemed to be amiss on the power panel. As a last resort agent 003·5, Grundig Pete, was contacted.

Pete said it was the power supply. Either C446 or C447 – or maybe both – had dried up. But you can't put just any capacitor in – it has to be a high-current PCB type, better still a direct Grundig replacement. Anyway replacements were fitted – and the problem remained. Pete was around like a shot. We found that there was about 0·5V peak-peak ripple across C447 – and at the chassis-connected negative pin! I didn't like this at all. Pete fitted a replacement power panel to prove that the cause of the trouble was on this panel, confirming that it was. So it was a case of narrowing down the source of a 32kHz ripple (it's a switch-mode power supply) that appeared to be everywhere on the faulty panel. It was Pete who discovered that the cause of the trouble was the 15V supply decoupler C451 (1,000$\mu$F) even though we had to put in a 470$\mu$F type temporarily until the correct type could be obtained. **S.B.**

## JVC HR7200/Ferguson 3V29

No sound on E-E and recordings was due to D14 on the audio-video board being leaky. This diode forms part of the circuit used to mute the sound in the still and shuttle modes. **L.G.**

## Hitachi VT8000

We've had a couple of faults recently on these machines. First no functions with the operate LED out was due to R054 (1·5k$\Omega$) being open-circuit. This resistor biases the regulator transistor Q053. Secondly absence of E-E sound and video with a normal test signal was due to the not-PB 12V line being absent – ZD053 in the regulator circuit was short-circuit. **L.G.**

## Sharp VC8581

Intermittent recording on one of these machines was traced to a defective HA11744NT1 video processor chip (IC401). A scope check revealed that the luminance was arriving at pin 20, but there was no f.m. oscillator signal at pin 12 – and thus no f.m. output to the video heads. **L.G.**

## Sharp VC7750

It's not very often that you get an electrical fault on this model – most faults are mechanical. This one was dead due to an open-circuit Darlington transistor, Q908. A replacement was fitted but on switching on the supplies were found to be low and the chopper transformer was making a squealing noise. C920 had gone low in value. **P.B.**

## Ferguson 3V32

This machine had a cassette inside. When this was played it looked as if the recording consisted of line tearing. An accompanying note said that the fault was intermittent and that when it occurred a noise came from within the machine. Sure enough after an hour or so of playing this tape a noise could be heard. So while it was still playing the top was removed. The noise was coming from the area of the audio/control head. No it wasn't the head (as with the early Hitachis) but a wire rubbing against the tape! **P.B.**

## JVC HR7200/Ferguson 3V29

Intermittently stops was the complaint with this one – every so often the capstan would stop, and it wasn't dry-joints around Q216 either! We found that the pause control line went high when the fault occurred. This comes from the mechacon board where Q17 had a dry-joint at its emitter. **P.B.**

## Ferguson 3V35

There was no colour on playback or record. A check at test point TP402 revealed that the amplitude of the 625kHz signal was low. Voltage checks at the pins of the HA11741 colour signal processing chip were then carried out. The voltage at pin 15 was found to be low due to C433 (0·022$\mu$F) being short-circuit. Several other cases of no colour with these machines have been traced to filter BPF401 – resoldering its connections often provides a cure. **P.B.**

## Hitachi VT9300

This machine would load but there was no tape rotation. We removed the top cover and noticed that the capstan wasn't moving. When we removed the bottom covers we found that the capstan motor wasn't running because its bearings had seized almost solid. Removing it, cleaning and oiling provided a cure. **M.D.**

## Ferguson 3V24

This portable would intermittently go into the alarm mode, with the mode indicators flashing sequentially. This would sometimes happen when the machine was switched on from standby, or if rewind or fast forward was selected. Play was normal but when we tried to select picture search the machine went into the alarm mode and we couldn't get it back into play. The machine had to be unloaded by hand before we could get anything to work. Checks were carried out on the various sensor inputs to the microcomputer chip: eventually we found that the pinch solenoid switch S17 was intermittently sticking on. Retensioning this provided a cure. **M.D.**

## Panasonic Clock Faults

The NV2000 seems to be prone to clock failure – we've changed four over the past few months for faults ranging from no display to alternating between 12- and 24-hour operation. Other Panasonic machines also suffer. We've had a couple of defective clock i.c.s in the NV333 – the symptom in both cases was no display. An NV366 came in with the same fault – no display. The 36V rail was found to be missing due to the 10$\Omega$ safety resistor R7632 being open-circuit. When this was repaired there was no hours display and the clock wouldn't set. We were just about to order a chip when we noticed a deposit on the print. Further investigation revealed that the back-up battery had gone rotten and leaked down the panel. A careful clean up and a new battery cured the problem. **M.D.**

# TEL 0902 712083 TELEX 338490

| | |
|---|---|
| HA1374 | 4.80 |
| HA1377 | 3.96 |
| HA1389R | 2.05 |
| HA1389 | 2.39 |
| HA1392 | 3.90 |
| HA1394 | 3.95 |
| HA1397 | 3.76 |
| HA1398 | 3.98 |
| HA1406 | 2.07 |
| HA1452 | 1.63 |
| HBF4030AF | 2.48 |
| HD14538 | 2.07 |
| HD38702-A2 | 7.45 |
| HD38750A53 | 8.71 |
| HD38750A-7 | 7.25 |
| HD38800A50 | 14.09 |
| HO44801A05 | 18.25 |
| HEF4001BP | 0.67 |
| HISH1010 | 8.59 |
| HISH1004 | 6.00 |
| HISH1002 | 9.50 |
| HM6231 | 9.81 |
| HM6232 | 8.89 |
| HM6251 | 5.70 |
| HM7103 | 2.46 |
| HM9032 | 3.22 |
| HM9012 | 3.22 |
| HM9015 | 3.24 |
| HT4207 | 17.16 |
| HT4208 | 18.25 |
| IN5401 | 0.11 |
| IR2403 | 4.25 |
| IR2C05 | 4.25 |
| IR3P06 | 2.25 |
| IR3P08 | 4.95 |
| IR94558 | 6.25 |
| IS751 | 2.85 |
| ITT425 | 0.18 |
| IZ0003GE | 5.37 |
| IZ0020GE | 5.93 |
| K174YP | 3.46 |
| KA2101 | 2.92 |
| KC581C | 6.32 |
| KC582C | 3.97 |
| KC583C | 5.54 |
| L200CV | 1.69 |
| LA1201 | 1.02 |
| LA1210 | 1.56 |
| LA1230 | 2.87 |
| LA1320 | 2.87 |
| LA1352 | 1.75 |
| LA1357N | 11.07 |
| LA1363 | 7.25 |
| LA1364 | 3.02 |
| LA1365J | 3.44 |
| LA1385 | 1.94 |
| LA1387 | 7.60 |
| LA3155 | 1.25 |
| LA3301 | 1.65 |
| LA3350 | 1.43 |
| LA3361 | 1.23 |
| LA3365 | 3.98 |
| LA3390 | 4.25 |
| LA4030P | 4.20 |
| LA4031P | 3.20 |
| LA4032P | 2.35 |
| LA4100 | 1.25 |
| LA4101 | 1.30 |
| LA4102 | 2.81 |
| LA4112 | 4.83 |
| LA4125 | 2.25 |
| LA4138 | 3.38 |
| LA4140 | 1.15 |
| LA4192 | 4.29 |
| LA4220 | 1.62 |
| LA4250 | 6.75 |
| LA4400 | 2.25 |
| LA4420 | 1.72 |
| LA4422 | 1.72 |
| LA4430 | 1.56 |
| LA4440 | 4.95 |
| LA4445 | 7.25 |
| LA4460 | 2.32 |
| LA4461 | 2.95 |
| LA4505 | 5.94 |
| LA5112N | 2.65 |
| LA7020 | 7.33 |
| LA7025 | 8.05 |
| LA7027 | 9.35 |
| LA7040 | 9.20 |
| LA7042 | 4.25 |
| LA7800 | 2.65 |
| LA7801 | 4.15 |
| LB1274 | 3.08 |
| LC7800 | 9.20 |
| LD3120 | 1.13 |
| LD3150 | 2.25 |
| LM1017N | 4.29 |
| LM1877 | 10.92 |
| LM224 | 1.75 |
| LM2808 | 5.94 |
| LM2877 | 4.93 |
| LM317CKC | 1.38 |
| LM324N | 0.75 |
| LM339N | 0.80 |
| LM340K | 11.85 |
| LM342P | 1.62 |
| LM342P | 1.62 |
| LM342P | 1.62 |
| LM348N | 2.15 |
| LM380N | 2.80 |
| LM384N01 | 3.25 |
| LM567CN | 1.71 |
| LM6402/011 | 10.23 |
| LM6402A093 | 10.15 |
| LM748 | 1.82 |
| LM8360 | 3.87 |
| LM8361 | 3.57 |
| LR2612 | 11.95 |
| LR3419 | 9.37 |
| LR3471 | 9.37 |
| LU1141 | 7.27 |
| LU52012 | 5.95 |
| LU52011 | 4.95 |
| LU03112 | 12.37 |
| M193 | 12.75 |
| M21C | 1.00 |
| M23C | 0.83 |
| M293 | 9.15 |
| M51102L | 6.35 |
| M5115P | 5.24 |
| M51203L | 3.15 |
| M51231P | 3.04 |
| M5134-9341 | 4.13 |
| M51353P | 5.25 |
| M51381P | 4.50 |
| M51393AP | 7.78 |
| M51394P | 11.97 |
| M5142P | 5.49 |
| M5144P | 4.25 |
| M51513L | 2.55 |
| M51515BL | 3.23 |
| M51517L | 3.71 |
| M5192 | 2.20 |
| M5194AP | 5.74 |
| M5231L | 1.95 |
| M53274P | 1.33 |
| M54532P | 2.15 |
| M54544L | 4.75 |
| M58478P | 6.75 |
| M58485P | 10.74 |
| MA06 | 1.07 |
| MA8001 | 0.82 |
| MA8003 | 1.16 |
| MB3705 | 1.98 |
| MB3712 | 1.85 |
| MB3713 | 1.69 |
| MB3730 | 3.25 |
| MC13002 | 3.55 |
| MC1310P | 2.25 |
| MC1327P | 1.33 |
| MC1330P | 1.69 |
| MC1350P | 1.61 |
| MC1351P | 3.96 |
| MC1352P | 2.50 |
| MC1357P | 2.15 |
| MC1358P | 1.55 |
| MC14001 | 2.40 |
| MC14013 | 0.41 |
| MC14493P | 3.44 |
| MC14494P | 2.15 |
| MC14497 | 3.65 |
| MC14510BAL | 3.75 |
| MC14511BCP | 1.10 |
| MC14528BCP | 2.70 |
| MC1712 | 3.88 |
| MC5192 | 13.50 |
| MC7724CP | 3.49 |
| MC7818C | 2.18 |
| MCR100/7 | 1.65 |
| MCR106-5/6 | 0.95 |
| MCR220/7 | 2.28 |
| ME0402 | 0.17 |
| ME0404/2 | 0.47 |
| ME0411 | 0.28 |
| ME6002 | 0.26 |
| ME6102 | 0.28 |
| ME8001 | 0.34 |
| ME0411 | 0.75 |
| MJ2501 | 3.30 |
| MJ3001 | 1.69 |
| MJ481 | 1.53 |
| MJ802 | 5.45 |
| MJE2955 | 1.89 |
| MJE3055 | 1.65 |
| MJE340 | 0.49 |
| MJE520 | 0.49 |
| ML231 | 3.33 |
| ML232B | 2.15 |
| ML237B | 2.51 |
| ML238 | 5.77 |
| ML923 | 3.30 |
| ML926 | 3.58 |
| MM5314N | 4.02 |
| MM5316N | 4.25 |
| MM5318N | 3.11 |
| MM5369N | 2.01 |
| MM5387AA/N | 6.20 |
| MM5841N | 6.64 |
| MN1400VL | 9.96 |
| MN1405 | 9.52 |
| MN1435VX | 11.48 |
| MN6016A | 20.56 |
| MP1192 | 5.07 |
| MP2794 | 4.00 |
| MP2812 | 5.07 |
| MP8512 | 1.57 |
| MPC596 | 2.13 |
| MPF256C | 0.60 |
| MPS6570 | 0.48 |
| MPSA42 | 0.65 |
| MPSA56 | 0.27 |
| MPSA92 | 0.45 |
| MPSU05 | 0.86 |
| MPSU10 | 1.56 |
| MPSU56 | 0.64 |
| MPSU60 | 1.33 |
| MR818 | 0.33 |
| MR854 | 0.72 |
| MR914 | 1.20 |
| MSM5816RS | 17.35 |
| MSM5840H | 9.15 |
| MVS460-02 | 0.61 |
| NE542 | 2.50 |
| NE545B | 4.86 |
| NE555 | 0.38 |
| NE556 | 0.95 |
| NE565N | 1.33 |
| NE645BN | 3.35 |
| NP1106 | 5.61 |
| OA202 | 0.11 |
| OA47 | 0.14 |
| OA91 | 0.09 |
| OA95 | 0.09 |
| OC28 | 2.95 |
| OC29 | 2.15 |
| OC36 | 1.28 |
| OC44 | 0.35 |
| OC45 | 0.18 |
| OC72 | 0.44 |
| OC75 | 0.44 |
| ON236 | 1.06 |
| ON782 | 1.98 |
| OT121 | 1.45 |
| PT6042 | 2.45 |
| PT8504 | 4.98 |
| R1038 | 2.19 |
| R1039 | 2.19 |
| R2008B | 1.33 |
| R2009 | 1.98 |
| R2010B | 1.33 |
| R2029 | 1.33 |
| R2030 | 1.33 |
| R2257 | 3.71 |
| R2265 | 1.49 |
| R2305 | 1.18 |
| R2322 | 0.59 |
| R2323 | 0.76 |
| R2354A | 2.01 |
| R2354B | 2.01 |
| R2443 | 0.88 |
| R2461 | 1.50 |
| R2540 | 2.31 |
| R2540X | 3.30 |
| R2615 | 0.67 |
| RCA16029 | 2.01 |
| RCA16600 | 1.38 |
| RCA16802 | 1.08 |
| RCA17074 | 6.60 |
| RCA17376 | 1.58 |
| RCA17524 | 0.83 |
| RCA17523 | 0.83 |
| RCA2060 | 2.00 |
| RGP01-15 | 0.70 |
| RGP10 | 0.50 |
| RGP30M | 0.59 |
| RT402 | 1.58 |
| RT905A | 2.38 |
| S1299 | 5.74 |
| S175 | 31.48 |
| S2062D | 2.07 |
| S2800D | 5.54 |
| S2802 | 3.47 |
| S2818 | 4.05 |
| S3702S | 6.15 |
| S40W | 10.89 |
| S6080B | 8.80 |
| SA8063 | 5.17 |
| SAA1006 | 1.75 |
| SAA1020 | 4.76 |
| SAA1025 | 4.40 |
| SAA1024 | 2.81 |
| SAA1075 | 6.25 |
| SAA1121 | 5.14 |
| SAA1124 | 3.25 |
| SAA1130 | 4.99 |
| SAA1174 | 7.77 |
| SAA1250 | 3.96 |
| SAA1251 | 9.85 |
| SAA11351 | 4.95 |
| SAA3027P | 10.03 |
| SAA5000 | 2.95 |
| SAA5010 | 5.39 |
| SAA5012 | 5.20 |
| SAA5020 | 5.78 |
| SAA5030 | 8.25 |
| SAA5050 | 7.74 |
| SAB1009B | 6.81 |
| SAB3011 | 7.34 |
| SAB3013 | 5.61 |
| SAB3021 | 7.90 |
| SAB3024 | 6.36 |
| SAB3209 | 5.82 |
| SAB3210 | 3.49 |
| SAF1032P | 6.50 |
| SAF1039 | 3.35 |
| SAS5010 | 8.39 |
| SAS560S | 2.26 |
| SAS560T | 5.42 |
| SAS570T | 5.42 |
| SAS570S | 2.61 |
| SAS580 | 2.85 |
| SAS6600 | 1.33 |
| SAS660 | 2.97 |
| SAS6700 | 1.33 |
| SAS670 | 3.96 |
| SAS6710 | 1.33 |
| SBA750 | 1.61 |
| SC84203 | 19.35 |
| SC9504P | 1.95 |
| SDA2006 | 18.95 |
| SDA2112/2 | 12.85 |
| SG264A | 5.26 |
| SG613 | 8.75 |
| SG629 | 8.27 |
| SG6533 | 10.31 |
| SI-1020H | 17.63 |
| SI-1125HD | 17.63 |
| SI1125H | 7.50 |
| SI1225HD | 17.73 |
| SI1630HD | 17.85 |
| SI6900 | 12.00 |
| SKE1/02 | 1.85 |
| SKE2F1/04 | 1.39 |
| SKE2G3/04 | 1.05 |
| SKE4F1/06 | 0.73 |
| SKE4F2/08 | 1.24 |
| SKE4F2/06 | 0.85 |
| SKE4F2/10 | 1.24 |
| SKE4G2/02 | 0.96 |
| SKE5F3/10 | 1.60 |
| SKS1/10 | 2.15 |
| SL1310 | 3.14 |
| SL1430T | 2.31 |
| SL414 | 3.69 |
| SL432A | 3.44 |
| SL439 | 2.48 |
| SL471 | 4.78 |
| SL480 | 3.14 |
| SL490 | 2.37 |
| SL901B | 8.32 |
| SL918A | 9.07 |
| SN16861AN0 | 4.95 |
| SN16862AN | 2.98 |
| SN16966N | 10.25 |
| SN29717N | 7.19 |
| SN29716N | 3.66 |
| SN29715N | 6.04 |
| SN29722 | 11.95 |
| SN29723AN | 7.65 |
| SN29764AN | 1.38 |
| SN29767 | 4.98 |
| SN29770BN | 4.24 |
| SN29772BN | 4.91 |
| SN29771BN | 4.93 |
| SN29791 | 1.67 |
| SN29798N | 5.56 |
| SN2709 | 0.44 |
| SN7400N | 0.34 |
| SN7401N | 0.36 |
| SN7402N | 0.65 |
| SN7404N | 0.24 |
| SN7408N | 0.27 |
| SN7410N | 0.27 |
| SN74121 | 1.60 |
| SN7413N | 0.37 |
| SN74141N | 2.65 |
| SN74151AN | 1.51 |
| SN74154N | 1.27 |
| SN74190 | 2.00 |
| SN7420N | 0.34 |
| SN7430 | 0.49 |
| SN7440N | 0.27 |
| SN7472 | 1.54 |
| SN7474N | 0.44 |
| SN7490AN | 0.93 |
| SN74LS26N | 0.53 |
| SN76001N | 1.65 |
| SN76013ND | 2.48 |
| SN76023N | 5.15 |
| SN76023ND | 3.96 |
| SN76033N | 4.15 |
| SN76110N | 0.90 |
| SN76115AN | 1.61 |
| SN76131 | 1.92 |
| SN76227N | 1.33 |
| SN76226DN | 1.98 |
| SN76228N | 3.27 |
| SN76242 | 8.95 |
| SN76243 | 5.23 |
| SN76396 | 2.90 |
| SN76533N | 2.47 |
| SN76532N | 2.95 |
| SN76545 | 4.87 |
| SN76546N | 3.47 |
| SN76549 | 2.59 |
| SN76570 | 3.08 |
| SN76611 | 2.59 |
| SN76620 | 2.59 |
| SN76660N | 2.48 |
| SN76666N | 1.41 |
| SN76708 | 4.86 |
| SN76709 | 5.12 |
| SN76709N | 5.45 |
| SN76707N | 5.11 |
| SN76705N | 1.34 |
| SN76730 | 5.36 |
| SN76810N | 0.60 |
| SN76832N | 3.25 |
| SN94041 | 5.54 |
| SN94042 | 4.35 |
| SP8385 | 0.55 |
| SPS5384 | 1.98 |
| ST1702L | 0.99 |
| STA401 | 6.76 |
| STA441C | 2.75 |
| STA471C | 6.76 |
| STK0029 | 5.54 |
| STK0039 | 5.35 |
| STK0040 | 12.00 |
| STK0050 | 7.67 |
| STK0080 | 9.16 |
| STK011 | 3.96 |
| STK013 | 9.25 |
| STK014 | 9.80 |
| STK015 | 7.75 |
| STK016 | 6.94 |
| STK022 | 5.25 |
| STK025 | 12.50 |
| STK031 | 12.95 |
| STK040 | 8.70 |
| STK043 | 13.44 |
| STK054 | 7.13 |
| STK058 | 18.25 |
| STK077 | 7.67 |
| STK078 | 8.52 |
| STK080 | 16.50 |
| STK082 | 11.86 |
| STK086 | 13.59 |
| STK1039 | 5.75 |
| STK2110 | 7.33 |
| STK2145 | 16.25 |
| STK2230 | 7.70 |
| STK2240 | 14.40 |
| STK2250 | 18.95 |
| STK3042 | 11.05 |
| STK3044 | 5.75 |
| STK4019 | 4.50 |
| STK430 | 11.75 |
| STK433 | 5.45 |
| STK4332 | 8.25 |
| STK435 | 5.94 |
| STK4352 | 12.25 |
| STK436 | 7.21 |
| STK437 | 7.80 |
| STK4372 | 3.85 |
| STK439 | 8.31 |
| STK441 | 11.28 |
| STK443 | 10.29 |
| STK457 | 13.45 |
| STK460 | 14.83 |
| STK461 | 9.68 |
| STK463 | 11.53 |
| STK466 | 11.77 |
| STK4833 | 16.95 |
| STK501 | 6.32 |
| STK502 | 5.74 |
| STK5314 | 9.48 |
| STK5730 | 3.95 |
| STK7216 | 12.67 |
| STK772 | 6.95 |
| STR1096 | 4.50 |
| STR4090 | 11.75 |
| STR440 | 7.85 |
| STR441 | 6.50 |
| STR451 | 4.95 |
| STR453 | 8.16 |
| STR454 | 7.50 |
| STR6020 | 8.31 |
| T6029V | 5.75 |
| T6035V | 0.73 |
| T6036 | 0.67 |
| T6037 | 2.11 |
| T6044V | 0.97 |
| T6045 | 1.20 |
| T6049 | 1.45 |
| T6052V | 0.87 |
| T6058 | 0.59 |
| T6059 | 0.65 |
| T9003V | 1.25 |
| T9005V | 2.38 |
| T9011V | 0.49 |
| T9013V | 7.96 |
| T9014V | 2.60 |
| T9016 | 1.02 |
| T9019W | 1.98 |
| T9034V | 1.38 |
| T9035V | 1.39 |
| T9051 | 7.45 |
| T9054V | 1.15 |
| T9057V | 0.70 |
| T9062V | 0.49 |
| T9064 | 1.51 |
| TA6002 | 4.35 |
| TA7027 | 4.80 |
| TA7050 | 1.74 |
| TA7051 | 1.74 |
| TA7054 | 2.55 |
| TA7060AP | 0.71 |
| TA7061AP | 1.27 |
| TA7069 | 3.13 |
| TA7070P | 1.83 |
| TA7072P | 2.57 |
| TA7073P | 5.86 |
| TA7074P | 1.98 |
| TA7076P | 7.50 |
| TA7089P | 1.50 |
| TA7092P | 7.50 |
| TA7093P | 3.99 |
| TA7102P | 5.88 |
| TA7108P | 1.61 |
| TA7109 | 3.71 |
| TA7122B/P | 0.92 |
| TA7124P | 2.34 |
| TA7129P | 1.50 |
| TA7130P | 1.27 |
| TA7136AP | 1.27 |
| TA7137P | 0.98 |
| TA7141AP | 3.87 |
| TA7146 | 2.50 |
| TA7146P | 4.23 |
| TA7148P | 1.67 |
| TA7149P | 3.26 |
| TA7152P | 1.72 |
| TA7153P | 7.47 |
| TA7161P | 5.45 |
| TA7162P | 2.98 |
| TA7169 | 9.54 |
| TA7172P | 1.41 |
| TA7176P | 2.48 |
| TA7193AP | 6.67 |
| TA7193P | 5.50 |
| TA7201P | 2.71 |
| TA7203P | 2.18 |
| TA7204P | 2.16 |
| TA7205P | 1.38 |
| TA7206P | 6.35 |
| TA7207P | 3.34 |
| TA7208P | 2.15 |
| TA7210P | 3.58 |
| TA7214P | 3.63 |
| TA7215P | 2.58 |
| TA7217AP | 1.45 |
| TA7222 | 1.95 |
| TA7226 | 10.25 |
| TA7227P | 2.81 |
| TA7229P | 4.45 |
| TA7230P | 4.98 |
| TA7232P | 6.60 |
| TA7233P | 5.32 |
| TA7240AP | 7.83 |
| TA7245P | 7.58 |
| TA7270 | 6.75 |
| TA7310P | 2.15 |
| TA7312P | 2.45 |
| TA7313AP | 1.50 |
| TA7314 | 5.94 |
| TA7323P | 3.15 |
| TA7325P | 1.15 |
| TA7339P | 1.35 |
| TA7340P | 5.06 |
| TA7607AP | 13.90 |
| TA7609 | 3.28 |
| TA7611AP | 4.80 |
| TA7616P | 5.25 |
| TA7622AP | 8.94 |
| TA7628P | 5.62 |
| TA7629P | 7.50 |
| TA7630P | 2.98 |
| TA7640AP | 1.19 |
| TA7672P | 1.75 |
| TA7676P | 2.81 |
| TA7726P | 10.25 |
| TAA320A | 1.27 |
| TAA350A | 0.80 |
| TAA570 | 1.74 |
| TAA621AX1 | 2.65 |
| TAA621A12 | 2.14 |
| TAA661B | 2.62 |
| TAA691 | 8.58 |
| TAA700 | 3.75 |
| TAA930 | 4.87 |
| TAA970 | 2.83 |
| TAA110 | 2.52 |
| TAG232-600 | 0.73 |
| TAG626-600 | 1.06 |
| TBA120AS | 1.24 |
| TBA120SB | 1.05 |
| TBA120T | 0.95 |
| TBA120U | 2.50 |
| TBA120A | 1.05 |
| TBA1440 | 2.03 |
| TBA1441 | 1.62 |
| TBA1440G | 5.20 |
| TBA1441 | 1.75 |
| TBA240A | 3.99 |
| TBA395 | 1.10 |
| TBA395Q | 1.10 |
| TBA396 | 0.80 |
| TBA400 | 2.39 |
| TBA440P | 2.45 |
| TBA480Q | 1.30 |
| TBA500P | 6.58 |
| TBA510 | 2.11 |
| TBA520 | 1.84 |
| TBA520Q | 1.68 |
| TBA530 | 1.30 |
| TBA530 | 1.30 |
| TBA540 | 1.15 |
| TBA540Q | 1.15 |
| TBA560C | 1.40 |
| TBA560CQ | 1.60 |
| TBA570Q | 1.60 |
| TBA570A | 1.71 |
| TBA641A12 | 4.13 |
| TBA641B72 | 3.03 |
| TBA651 | 1.76 |
| TBA673 | 2.60 |
| TBA700 | 1.85 |
| TBA720 | 1.55 |
| TBA730 | 3.55 |
| TBA750Q | 2.90 |
| TBA760 | 1.71 |
| TBA800 | 1.08 |
| TBA810S | 1.61 |
| TBA810T | 1.50 |
| TBA810AS | 1.50 |
| TBA820 | 1.52 |
| TBA820M | 0.82 |
| TBA890 | 2.50 |
| TBA920 | 1.89 |
| TBA920Q | 2.31 |
| TBA940 | 1.87 |
| TBA950 | 1.84 |
| TBA970 | 1.79 |
| TBA990 | 1.82 |
| TBA990Q | 1.68 |
| TC4001BP | 3.25 |
| TC4011BP | 3.50 |
| TC4013BP | 3.75 |
| TC4016BP | 3.15 |
| TC4053BP | 4.34 |
| TC4069 | 1.52 |
| TC4071BP | 2.76 |
| TC4081BP | 3.25 |
| TC40H000 | 1.98 |
| TC4514BP | 4.15 |
| TC9002BP | 11.95 |
| TCA270Q | 1.71 |
| TCA270S | 2.15 |
| TCA270SQ | 1.65 |
| TCA290A | 2.39 |
| TCA420A | 2.16 |
| TCA440 | 1.93 |
| TCA530 | 2.16 |
| TCA640 | 7.36 |
| TCA650 | 2.04 |
| TCA660B | 3.30 |
| TCA730 | 3.81 |
| TCA750 | 2.25 |
| TCA800Q | 6.95 |
| TCA830S | 2.38 |
| TCA890 | 5.44 |
| TCA900 | 2.04 |
| TCA910 | 1.65 |
| TCA940 | 1.80 |
| TCA940E | 2.93 |
| TCE330 | 3.89 |
| TCEP100Q | 10.25 |
| TCEP100 | 9.61 |
| TD3406AP | 3.98 |
| TD3F800R | 3.92 |
| TD3F900H | 4.16 |
| TD62105P | 2.50 |
| TD62104P | 2.50 |
| TD62706P | 4.50 |
| TDA1001B | 2.31 |
| TDA1003A | 2.25 |
| TDA1005A | 2.22 |
| TDA1006A | 2.11 |
| TDA1010AF | 4.25 |
| TDA1011 | 2.98 |
| TDA1010 | 1.15 |
| TDA1011A | 5.25 |
| TDA1028 | 2.45 |
| TDA1034B | 2.42 |
| TDA1035S | 2.95 |
| TDA1035T | 2.55 |
| TDA1037 | 1.98 |
| TDA1037O | 2.05 |
| TDA1044 | 2.62 |
| TDA1047 | 4.10 |
| TDA1059B | 0.80 |
| TDA1054M | 1.21 |
| TDA1060 | 2.60 |
| TDA1082 | 3.25 |
| TDA1151 | 1.22 |
| TDA1170S | 2.25 |
| TDA1190 | 2.11 |
| TDA1190Z | 3.96 |
| TDA1200 | 1.50 |
| TDA1235 | 3.88 |
| TDA1236 | 4.30 |
| TDA1270 | 3.76 |
| TDA1327A | 1.33 |
| TDA1412 | 1.05 |
| TDA1420 | 1.55 |
| TDA1440 | 3.45 |
| TDA1470 | 3.16 |
| TDA1470P | 4.25 |
| TDA1506 | 7.45 |
| TDA1510 | 5.90 |
| TDA1512 | 5.98 |
| TDA1515 | 16.60 |
| TDA1559 | 3.15 |
| TDA1670 | 4.48 |
| TDA1770 | 6.85 |
| TDA1905 | 1.76 |
| TDA1908 | 2.87 |
| TDA1940 | 1.95 |
| TDA1950 | 4.75 |
| TDA2005 | 5.08 |
| TDA2006 | 1.55 |
| TDA2004 | 2.27 |
| TDA2002 | 0.90 |
| TDA2003 | 1.75 |
| TDA2010 | 1.85 |
| TDA2020 | 2.77 |
| TDA2030 | 1.99 |
| TDA2140 | 1.59 |
| TDA2150 | 6.20 |
| TDA2151 | 1.93 |
| TDA2160 | 4.01 |
| TDA2161 | 1.85 |
| TDA2170 | 2.98 |
| TDA2190 | 4.95 |
| TDA2270 | 4.65 |
| TDA2510 | 7.85 |
| TDA2520 | 2.37 |
| TDA2522 | 3.46 |
| TDA2524 | 4.50 |
| TDA2521 | 3.71 |
| TDA2525 | 3.90 |
| TDA2532 | 2.50 |
| TDA2530 | 2.70 |
| TDA2541 | 2.48 |
| TDA2540 | 2.15 |
| TDA2545Q | 5.94 |
| TDA2560 | 2.17 |
| TDA2575A | 0.50 |
| TDA2571AQ | 3.60 |
| TDA2576A | 2.85 |
| TDA2571A | 3.66 |
| TDA2578A | 4.95 |
| TDA2576A+K | 12.35 |
| TDA2581 | 2.25 |
| TDA2582 | 2.18 |
| TDA2591 | 2.50 |
| TDA2594 | 3.26 |
| TDA2593 | 2.47 |
| TDA2591Q | 0.83 |
| TDA2595 | 5.26 |
| TDA2600 | 5.50 |
| TDA2611AQ | 2.98 |
| TDA2612Q | 4.68 |
| TDA2611A | 1.25 |
| TDA2610 | 2.79 |
| TDA2620 | 2.15 |
| TDA2630 | 1.96 |
| TDA2631 | 2.73 |
| TDA2640 | 2.59 |
| TDA2652 | 13.45 |
| TDA2653 | 3.65 |
| TDA2654 | 6.18 |
| TDA2670 | 2.48 |
| TDA2680 | 3.20 |
| TDA2690A | 2.65 |
| TDA2740 | 6.00 |
| TDA2780AQ | 5.14 |
| TDA2795 | 2.78 |
| TDA2791 | 2.5 |
| TDA2910 | 13.25 |
| TDA3000T | 2.55 |
| TDA3300B | 9.00 |
| TDA3330 | 3.30 |
| TDA3506 | 7.98 |
| TDA3501 | 7.25 |
| TDA3500 | 4.25 |
| TDA3510 | 6.55 |
| TDA3520 | 9.71 |
| TDA3540 | 2.98 |
| TDA3541 | 3.80 |
| TDA3560 | 5.25 |
| TDA3571Q | 2.97 |
| TDA3576 | 7.09 |
| TDA3590 | 5.79 |
| TDA3591 | 6.45 |
| TDA3650 | 7.50 |
| TDA3652 | 5.44 |
| TDA3651AQ | 2.96 |
| TDA3651 | 3.30 |
| TDA3651A | 2.65 |
| TDA3950 | 4.98 |
| TDA4050B | 3.95 |
| TDA4280 | 7.20 |
| TDA4290 | 4.47 |
| TDA4400 | 2.27 |
| TDA4420 | 5.01 |
| TDA4422 | 8.32 |
| TDA4427S | 9.00 |
| TDA4431 | 2.27 |
| TDA4440 | 2.87 |
| TDA4442 | 4.85 |
| TDA4500 | 7.30 |
| TDA4600 | 2.84 |
| TDA4610 | 4.80 |
| TDA4620 | 4.78 |
| TDA5500 | 4.78 |
| TDA5700 | 2.60 |
| TDA7270S | 2.25 |
| TDA8190 | 3.47 |
| TDA9403 | 3.15 |
| TDA9503 | 2.92 |
| TDA9513 | 5.44 |
| TDB1033 | 6.68 |
| TDE1081 | 6.61 |
| TE626 | 1.49 |
| TEA1002 | 3.47 |
| TEA1009 | 1.86 |
| TEA1014 | 3.15 |
| TEA1020SP | 8.21 |
| TIC106C | 0.61 |
| TIC106M | 0.77 |
| TIC116Y100 | 2.07 |
| TIC44 | 0.72 |
| TIC45 | 0.77 |
| TIC47 | 0.35 |
| TIP120 | 1.06 |
| TIP110 | 0.53 |
| TIP112E | 0.85 |
| TIP112 | 0.88 |
| TIP117 | 0.95 |
| TIP121 | 0.87 |
| TIP126 | 0.73 |
| TIP132 | 1.40 |
| TIP137 | 1.50 |
| TIP29 | 0.66 |
| TIP2955 | 0.95 |
| TIP29A | 0.46 |
| TIP29B | 0.63 |
| TIP29C | 0.40 |
| TIP29D | 0.75 |
| TIP3055 | 0.75 |
| TIP30A | 0.41 |
| TIP30C | 0.16 |
| TIP31A | 0.34 |
| TIP31B | 0.38 |
| TIP31C | 0.50 |
| TIP32A | 0.53 |
| TIP32B | 0.69 |
| TIP32C | 0.40 |
| TIP33 | 0.85 |
| TIP33A | 1.05 |
| TIP33C | 0.80 |
| TIP34 | 3.54 |
| TIP41A | 0.49 |
| TIP41B | 0.65 |
| TIP41C | 0.49 |
| TIP42A | 0.49 |
| TIP42B | 0.53 |
| TIP42C | 0.53 |
| TIP47 | 0.65 |
| TIP48 | 0.92 |
| TIP49 | 3.61 |
| TIP55A | 3.65 |
| TIS43 | 1.43 |
| TIS90 | 0.28 |
| TL011CP | 1.55 |
| TL072 | 2.85 |
| TL494CN | 6.74 |
| TL072CP | 2.55 |
| TMP4320 | 15.00 |
| TMS1024NLL | 6.86 |
| TMS1025N | 6.25 |
| TMS3720ANS | 19.50 |
| TMS3748NS | 14.95 |
| TMS3755 | 13.65 |
| TMS3894NL | 19.25 |
| MS5102NLL | 6.25 |
| TUA2000 | 8.98 |
| TV106 | 1.76 |
| TY6010B | 2.97 |
| U05G | 1.14 |
| ULN2204 | 11.45 |
| UPA53C | 4.94 |
| UPC1003 | 4.95 |
| UPC1009C | 6.32 |
| UPC1025H | 2.90 |
| UPC1026C | 1.24 |
| UPC1028H | 2.00 |
| UPC1020H | 2.77 |
| UPC1032H | 0.62 |
| UPC1042C | 8.95 |
| UPC1156H | 2.96 |
| UPC1158 | 5.84 |
| UPC1161C | 4.50 |
| UPC1182H | 1.82 |
| UPC1186H | 1.05 |
| UPC1181H | 1.25 |
| UPC1185H | 2.94 |
| UPC1188 | 6.95 |
| UPC1213C | 0.99 |
| UPC1212C | 1.72 |
| UPC1225H | 3.25 |
| UPC1230 | 7.24 |
| UPC1238 | 2.98 |
| UPC1263 | 3.45 |
| UPC1277H | 5.85 |
| UPC1278H | 4.85 |
| UPC1351C | 1.81 |
| UPC1350C | 1.40 |
| UPC1353 | 7.85 |
| UPC1355C | 2.13 |
| UPC1363 | 4.20 |
| UPC1362 | 7.75 |
| UPC1365C | 6.98 |
| UPC1366 | 7.25 |
| UPC1360C | 4.51 |
| UPC1378H | 4.25 |
| UPC141C | 3.75 |
| UPC1458 | 8.66 |
| UPC151C | 2.95 |
| UPC2002 | 1.48 |
| UPC30C | 2.51 |
| UPC324C | 4.70 |
| UPC32C | 4.94 |
| UPC339C | 4.90 |
| UPC41C | 4.10 |
| UPC4558C | 2.15 |
| UPC474 | 5.11 |
| UPC554C | 1.85 |
| UPC566H | 2.95 |
| UPC574 | 3.25 |
| UPC575C2 | 2.40 |
| UPC576H | 2.58 |
| UPC577H | 1.25 |
| UPC578C | 7.35 |
| UPC580C | 4.13 |
| UPC587C2 | 1.34 |
| UPC592H | 2.15 |
| UPC595 | 2.95 |
| UPC596 | 1.98 |
| UPO1514C | 8.95 |
| UPO2819C | 4.98 |
| UPO4013B | 4.00 |
| UPD4066B | 4.95 |
| UPD553-164 | 19.25 |
| UPD8049C-1 | 10.14 |
| X0007TA | 4.68 |
| X0022CE | 5.75 |
| X0029CE | 4.95 |
| X0031CE | 4.95 |
| X0035TA | 5.11 |
| X0040TA | 4.50 |
| X0042CE | 4.35 |
| X0043CE | 2.75 |
| X0056CE | 5.11 |
| X0057GE | 6.00 |
| X0062CE | 6.52 |
| X0065CE | 5.75 |
| X0074GE | 10.00 |
| X0077GE | 15.96 |
| X0079CE | 4.95 |
| X0092CE | 4.95 |
| X0096CE | 4.29 |
| X0109CE | 10.90 |
| X0113CE | 2.07 |
| X0195CE | 4.00 |
| X0204CE | 8.74 |
| X0261CE | 8.75 |
| X1222AF | 3.63 |
| IX0111CE | 2.95 |
| Y969 | 0.82 |
| TDA3310 | 2.15 |
| ZPY120 | 0.95 |
| ZTK33 | 0.43 |

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# Modern Receiver Circuitry

## Part 4: Line Output Stage Operation

J. LeJeune

The line scan and e.h.t. generator sections of a TV set have been linked since the early days of television, though many sets produced in the thirties and forties derived the e.h.t. from a mains transformer. This was a dangerous arrangement and had to be respected by the engineers of the day. The danger was reduced when the e.h.t. came to be produced by rectification of the line flyback pulse, though contact with the 10kV or so produced by early flyback e.h.t. systems was still a very unpleasant matter – and it's the same today. The other bonus of flyback e.h.t. is greater efficiency. This is also true of the technique of using an efficiency diode to recover the flyback energy to contribute to the scan. In older sets the line output transformer did what its title suggests, driving the scan coils via a secondary tap. The component that goes under the same title today acts mainly as a feed choke between the h.t. supply and the line output transistor.

Before we consider the line output stage it's as well to make clear that although the screen is scanned from the left-hand side to the right-hand side, with a rapid flyback to the left-hand side to start the following line, the scanning spot's rest position is at the centre of the screen. This is the position where the current flowing in the scan coils is zero.

### Basic Circuit

The basic elements of a modern transistor line output stage are shown in Fig. 1. Inductance Ly represents the scan coils which are connected in series with capacitor Cs. The latter is commonly referred to as the scan-correction capacitor or d.c. blocking capacitor: both terms are correct but the capacitor does more than this, as we shall see. T1 is the line output transformer, Q the line output transistor, D is the efficiency diode and Ct provides flyback tuning.

With transistor Q switched off capacitor Cs will be charged from the h.t. rail via T1 and Ly. When Cs has fully charged no current will flow in the scan coils and the spot will rest at the centre of the screen. To move the spot across to the right Q is switched on, discharging Cs via Ly. The transference of energy from Cs to Ly is what shifts the spot to the right-hand side. At this point Q is switched off to initiate the flyback. Ct, which had previously been short-circuited by Q, is now rapidly charged by the energy stored in Ly. The current flow is reversed, with the result that the spot moves rapidly from the right-hand side to the centre rest position. We want it back at the left-hand side of course, and since Ct and Ly form an oscillatory circuit this is precisely what we get from the second part of the half-cycle of oscillation that occurs when Q is switched off. During the flyback, a positive-going voltage pulse is produced at the junction of Ct and Cs. The second half-cycle of oscillation would produce a negative-going pulse at this point. The efficiency diode D is then forward biased, damping the tuned circuit Ct/Ly. The resultant decaying current flow moves the spot back from the left-hand side towards the centre of the screen.

During the forward scan, either D or Q is conductive. The charge on Cs is replenished during the flyback period, when both Q and D are off. Cs is in series with Ct but has little effect on the flyback action since its value is forty to fifty times that of Ct. The value of the latter capacitor is chosen so that it will receive and return all the energy stored in Ly during the 12$\mu$sec allowed for the flyback. D remains conductive for about the first 45 per cent of the forward scan, after which Q is switched on. In some designs the line output transistor's collector-base junction provides the efficiency diode action.

Looked at another way, Ly is made to resonate at two widely different frequencies – see Fig. 2. The forward scan is really a portion of a low-frequency sinewave ring produced by Cs and Ly. Since the value of Cs is large the frequency is low, probably just under half the line scan frequency. The portion of scan achieved by this action is shown between A and C in Fig. 2. At C the line output transistor is switched off, D is already off and Ct appears in series with Cs. Ct and Ly then provide a half-cycle of oscillation at a much higher frequency to produce the flyback. Switching between the two resonant frequencies is provided by D and Q. Flyback tuning is generally at an harmonic of the line scan frequency, up to the seventh.

### Flyback EHT

During all this action T1 plays the part of a feed choke, but more can be got from it. With D or Q conducting, the full h.t. appears across T1's primary winding. Current flows in the primary, causing a build-up of magnetic flux in the transformer's core. When Q is switched off to start the flyback the field rapidly collapses, producing a large back-e.m.f. in the primary and any secondary windings. By using a secondary winding with many more turns than the primary winding a useful e.h.t. voltage with adequate current for the c.r.t. is generated. The value of the e.h.t. voltage produced in this way depends on the flyback time. Thus if the flyback time varies for any reason the e.h.t. will also change. Returning to Fig. 1, diode G rectifies the flyback pulse produced across the secondary winding, charging the capacitance formed by the Aquadag coatings on the inside and outside of the c.r.t. bowl (with the glass as the dielectric). In many respects the operation of a flyback e.h.t. generator is that of a chopper circuit without any stabilisation measures.

### Raster Correction

Raster correction is required with most 110° tubes. The cause of the problem is illustrated in Fig. 3, which shows that uncorrected scanning produces a pincushion-shaped raster. When the electron beam is scanning the top or bottom line of the raster, A and C, the distance of the beam from the centre of the deflection coils to the screen is greater than when the beam is scanning the centre line B. With present-day 90° tubes the design of the yoke provides the compensation required, but this is more difficult with 110° tubes. Yokes for 110° tubes provide north-south correction but east-west correction must be done in the deflection circuit.

The fact that with a wide-angle tube the deflection centre is much closer to the screen than the screen radius

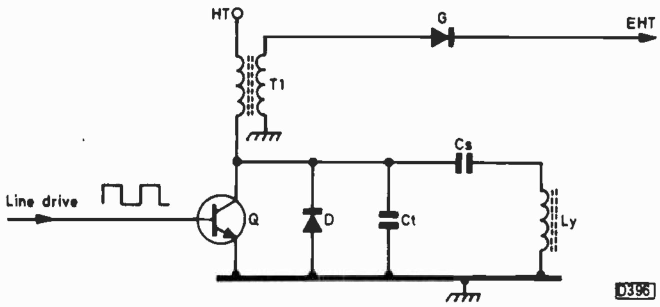


*Fig. 1: Basic transistor line output stage circuit.*

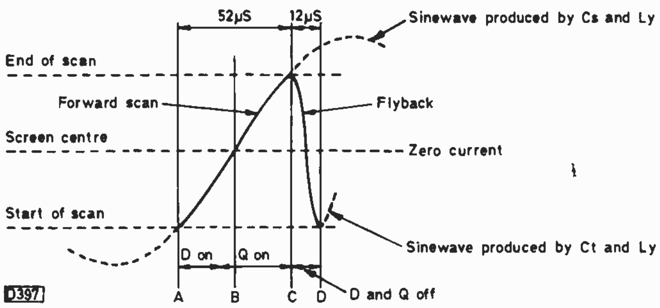


*Fig. 2: One cycle of line scan, showing the two resonant frequencies for scan and flyback.*

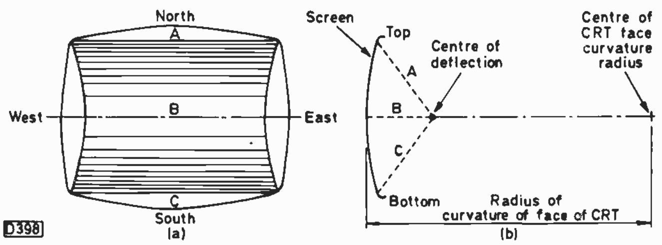


*Fig. 3: Pincushion distortion with a wide-angle tube. (a) The effect on the display. (b) Showing how the distance from the deflection centre to the screen varies during the course of the scan.*

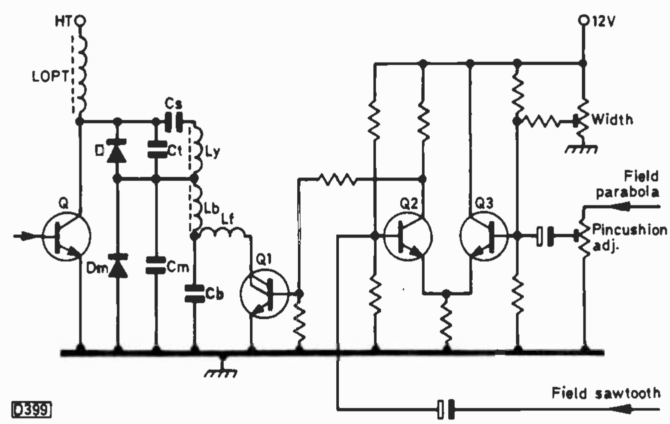
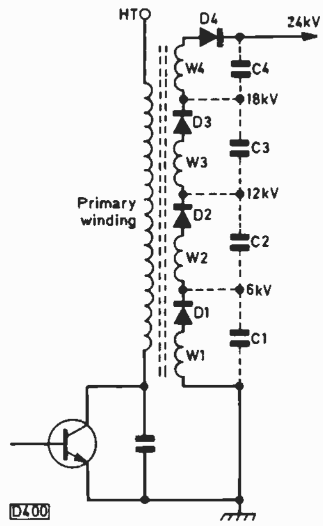


*Fig. 4: Diode modulator circuit to provide EW correction.*



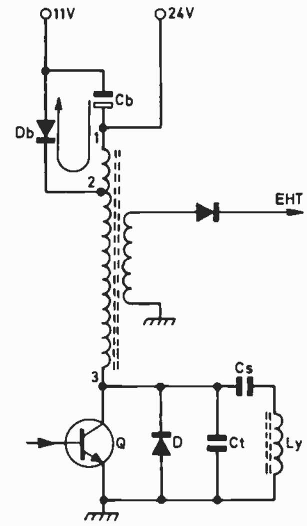



*Fig. 5 (left): Diode-split e.h.t. generator.*
*Fig. 6 (right): Line output stage with boost diode Db.*

also means that without correction the speed of the spot will vary as it scans the screen, i.e. the raster would be stretched towards the left- and right-hand sides. Correction for this is achieved by making the value of Cs less than that needed to give a linear scan waveform. This imposes curvature on the line scan ramp waveform – the effect is shown in Fig. 2.

## Diode Modulator Circuit

Whilst scan-correction is simple to achieve the way in which east-west pincushion distortion is overcome is somewhat less easy to follow. We come now to the EW modulator. In essence this places a variable impedance in series with the scan coils to modulate the scan current. Fig. 4 shows a typical arrangement. One of the problems with adding an impedance in the line scan circuit is that the flyback time will be altered. This will in turn vary the e.h.t. and thus the raster size. The diode modulator is designed to prevent this.

If the circuit shown in Fig. 4 is compared with that shown in Fig. 1 it will be noticed that the line scan coils Ly are now returned to chassis via Lb and Cb. You'll recall that Cs is charged during the flyback time, when Q and D are off. This charge will now be shared by Cs and Cb, i.e. the charge on Cs is reduced. Q1 provides the variable element. When fully conductive Cb is shorted out: hence the charge on Cs is increased and so is the width. By applying a variable field-frequency parabolic drive to the base of Q1 width correction throughout the field scan period is achieved. Cm is added in series with Ct and Lb in series with Ly to maintain the correct flyback tuning conditions. Cm and Cb have the same sort of relationship as Ct and Cs. Lf is simply a filter choke to protect Q1 against line-frequency transients.

The drive circuit is straightforward, consisting of the differential amplifier Q2/3. The width control sets the d.c. level at the base of Q3: since Q3/2/1 are d.c. coupled, moving the slider towards the 12V end increases the conduction of Q1 and thus the line scan amplitude. A field-frequency parabola is a.c. coupled to the base of Q3 via the pincushion control, which is adjusted to produce a raster with straight sides. A field-frequency sawtooth waveform is fed to the base of Q2 to counteract keystone distortion. Links to the h.t. line and to a point sensitive to beam current changes are often provided to stabilise the width.

## Diode-split LOPT

Trouble-free e.h.t. generation is a feature of modern colour sets and is very largely due to the use of a line output transformer with a "diode-split" e.h.t. winding. Fig 5 shows the arrangement. The e.h.t. secondary is divided into four identical windings each of which delivers a quarter of the required e.h.t. voltage. Each winding has its own built-in rectifier and is wound on a precision bobbin which controls the capacitance between the bottom ends of each of the four windings.

When the line flyback occurs the high pulse voltage developed by the primary winding causes each of the secondary sections W1-4 to produce a 6kV pulse. These pulses are rectified and added to give a final output of 24kV which, because of the good insulation, is available with greater safety – and also at a substantially lower output impedance than was available with previous methods of e.h.t. generation. The diodes are operated well within their ratings and the separate capacitors used in a tripler, with their attendant insulation problems, are done away with. Present day diode-split line output transformers go a step further in incorporating the first anode and focus controls within the transformer's encapsulation.

### *Circuit with Boost Diode*

Transistor line output stages in colour sets are normally operated from a stabilised h.t. supply of around 120V. With a mains-battery monochrome portable the main stabilised supply rail is only around 11V. It's desirable to operate the line output stage at a higher voltage than this and the incorporation of a boost diode and capacitor will provide an effective supply of around 24V which can also be used in other parts of the set. The boost technique was originally developed for valve receivers, where a single diode acted as both the boost and efficiency diode, providing energy recovery to contribute to the scan and a supply of up to 1kV for the output stage and other purposes.

Fig. 6 shows the type of circuit generally used in monochrome portables. D is the efficiency diode and Db the boost diode. During the forward scan either D or Q is conductive and pin 3 of the transformer is at chassis potential. Db is forward biased. By simple autotransformer action pin 1 of the transformer will be at a voltage multiplied by the turns step-up ratio. Db provides conventional rectifier action with current flowing in the direction shown. As a result a voltage of about 13V is developed across the boost capacitor Cb. This voltage is in series with the 11V supply, giving a total of 24V with respect to chassis. During the flyback Q, D and Db are all off and the charge on Cs is replenished from Cb. Thus in effect the line output stage is operated from the 24V boost line.

# *The Grundig CUC Series Chassis*

***Peter Stubb and Steve Beeching, T.Eng.***

CUC? Yes, it stands for Compact Universal Chassis. As my mate Steff said you either know these Grundigs or trust to luck. Well, as every engineer should know luck plays a very small part in electronics servicing. So to help understand these confounded Grundigs we'll provide a run-down on the section that's the usual cause of concern, the switch-mode power supply. The whole CUC range uses a simple but effective flyback converter circuit. The main elements in this are a transformer, a chopper transistor and a Siemens TDA4600 control i.c.

### Circuit Operation

The circuit is shown in much simplified form in Fig. 1. When the chopper transistor T634 switches on current flows in the primary winding of transformer TR651. As a result energy, in the form of a magnetic field, is stored in the transformer. During this process the h.t. rectifier D656 and the l.t. rectifier D661 are reverse biased. Therefore the secondary windings can draw only a maximum current whose value is related to the energy stored in the transformer while T634 is switched on. When T634 is switched off C634 provides circuit continuity and the rectifier diodes are forward biased by the collapsing field. The reservoir capacitors C657 and C662 are thus charged.

Pulse feedback is taken from pin 13 of the transformer to the bistable in the TDA4600. This toggles, switching T634 on when the magnetic field has completely collapsed. Thus T634 is automatically switched on and the only problem that remains is to time its switch-off to provide regulation. The on time is determined by the secondary current required.

Regulation is determined by feedback from winding 13-15 on the transformer. This monitors the rate of change of flux during T634's off period, providing a voltage proportional to the current being drawn. If the secondary current is low the induced voltage is high and vice versa. D647 provides rectification, producing across C647 a voltage which is subtracted from the reference voltage at pin 1 of the i.c. The resultant voltage is applied to the non-inverting input of the voltage comparator within the i.c. The output from this comparator resets the bistable and turns off T634 once the ramp voltage at its inverting input (pin 4) exceeds the voltage at its non-inverting input (pin 3).

The ramp is produced by C646 which is charged by R646 from the mains-derived 300V line – this gives stabilisation against mains voltage variations. This ramp forms part of T634's drive waveform. For correct timing, C646 must start at 0V at the beginning of each duty cycle. The second output from the bistable triggers a transistor within the i.c. to discharge C646 during T634's off time.

The output voltages obtained from the circuit are adjusted by setting R647 which controls the feedback to pin 3 of the i.c. With the CUC chassis this is always set with reference to the +A voltage (h.t.) required. This is the supply for the line output stage and varies according to the screen size and tube beam current requirements.

By counting the variable mark-space switching pulses the i.c. can ascertain the set's working conditions. The frequency of operation is approximately 35kHz for normal operation with a nominal load. For protection the i.c. checks this frequency which falls to about 20kHz if the load increases: if the load increases further the i.c. switches the bistable itself at a rate of about 18kHz, limiting the maximum output current. The power supply will run even with a short-circuit line output transistor, though a PTC thermistor ensures that a load of greater than 100Ω is present at all times.

For over-voltage protection, if a supply from the trans-

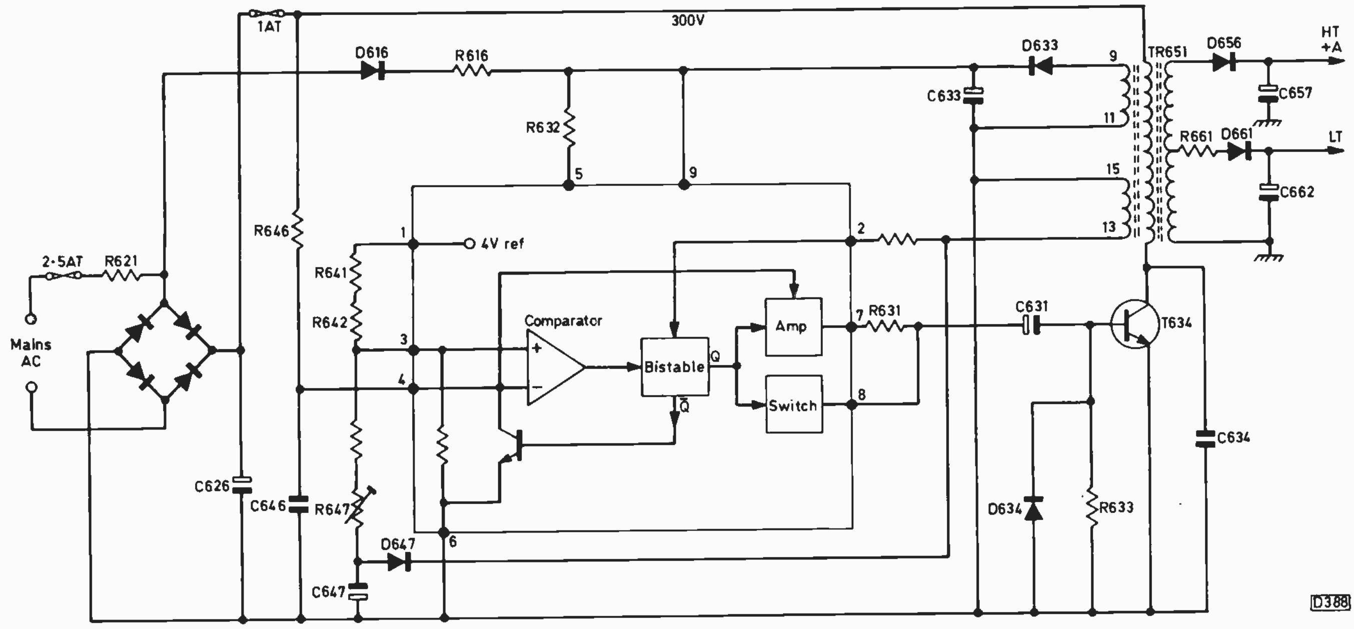



*Fig. 1: Switch-mode power supply used in the Grundig CUC series chassis – simplified circuit.*

former goes missing so that less current is drawn the frequency of operation increases. The upper limit is 60-70kHz, which equates with a remote control set in the standby condition or running the power supply with no load.

Note however that if all the rectifier diodes connected to the transformer's secondary windings are disconnected the result will be instant destruction of the power supply. This is because the transformer is without damping and the collapsing field is so large that the voltage pulses generated destroy T634 and the i.c.

In the event of the drive coupling capacitor C631 going low in value the i.c. will shut down: it will then cycle and keep trying to restart.

Further protection is necessary because the i.c. can operate effectively only with mains inputs between 165V and 265V. This protection is coupled with the start-up system. The i.c.'s supply pin 9 is provided with a start-up supply by D616. This supply is 9V with an internal cut-off at less than 7V. Further protection is provided by the link to pin 5 via R632. If the voltage here is less than 2·2V the i.c. shuts down. Because of the slow-start action the voltage across C633 does not initially reach 9V: the i.c. will try to get going five or six times before the charge on C633 rises above 7V. Once the circuit has started up D633 charges C633 to just over 12V.

## Fault Finding

So much for basic operation, now for fault conditions. With all chassis that use this type of circuit the charging resistor connected to pin 4 of the i.c. is notorious. If R646 goes high in value or open-circuit T634 is left switched on and instantly turns into a piece of wire. If C646 goes open-circuit switching will occur at a very high frequency – too fast for the i.c. to regulate – and T634 will turn into a heating element before again turning into wire. C631 or R631 open-circuit will cause the power supply to shut down and hunt, as will C633 low in value or D633 open-circuit.

Checking is best done in a systematic fashion as follows:
(1) Check the voltage at pin 9 of the i.c. To start up it must be greater than 7V and for normal running it should be 12V. If it's at 40V the i.c. is open-circuit.
(2) The voltage at pin 5 (safety circuit) of the i.c. must be greater than 2·2V.
(3) During start-up 4V squarewave pulses should be present at pin 1 of the i.c.
(4) Check that a squarewave of greater than 1V is present at pin 7 of the i.c. and the base of T634.
(5) If still in doubt check the frequency at which the power supply is running.

## Some Symptoms

Finally a résumé of symptoms with the power supply running.

**Uncontrollable h.t.:** D647 or C647 leaky or open-circuit.
**Intermittent start-up from cold:** C633 low in value (it was increased to 220$\mu$F in later production) or R647 intermittently open-circuit (faulty connecting rivet, usually with 110° remote control sets).
**Relay on 110° remote control sets chatters at switch on:** R647 faulty.
**All components in the power supply o.k. but won't start up:** One of the diodes fed from the transformer's secondary windings short-circuit.
**Screen patterning which varies in frequency with the brightness/contrast:** H.T. or l.t. reservoir capacitor open-circuit, i.e. 35kHz ripple on the l.t. line.
**Set intermittently goes to standby (C range remote control models):** D661 going high-resistance. Replace R661 at the same time and upgrade D661 to a Motorola MR824-400 or Siemens GI824.

D634 and R633 should be checked whenever it's necessary to replace T634. If T634 goes short-circuit base-to-collector C631 and the i.c. should also be replaced.

## Voltage Conditions

All voltage checks on the primary side of the power supply circuit are with reference to the −300V line, i.e. the negative side of C626: all voltage checks on the secondary side of the circuit, including the setting of R647, are with respect to chassis.

# The Development of Colour Tubes

## Part 2

**Eugene Trundle**

Last month we provided a brief outline of colour tube evolution, looking at the main features of successive types of tube. We intend next to consider in greater detail the various items that go to make up a tube and its deflection system. The best place to start is where the beams themselves do, at the electron gun.

The gun is an assembly of electrodes that produce, modulate, accelerate and focus an electron beam. The electrons that go to make the beam are produced at the coated surface of the cathode, as a result of thermal agitation caused by the heating element inside. The beam is controlled by the grid (really a cylinder or plate with a pinhole in its face) and accelerated towards the screen by a series of cylindrical anodes which together form an electron lens. We should perhaps qualify the phrase "controlled by the grid". The beam is modulated by varying the voltage applied between the cathode and the grid. So we can hold the cathode at a fixed voltage and vary the grid voltage or hold the grid voltage steady and vary the cathode voltage. The latter technique is generally used.

### Heater-cathode Assemblies

The heater is a spiral of tungsten wire coated with an insulating layer of alumina (aluminium oxide). The first colour tubes used gun assemblies similar to those in contemporary monochrome tubes, and for many years each colour tube heater drew 300mA at 6·3V. The cathode assembly was large and thermally inert, taking some thirty seconds to reach operating temperature. Modern heater-cathode assemblies are very small and light, with a typical energy requirement of 33mA each, corresponding to about 0·65W – see Fig. 14. The active part of the heater is concentrated in the "hot spot" immediately beneath the centre of the small, light cathode. This runs cooler than a conventional cathode while the operating temperature is reached in about five seconds – the normal operating temperature for a tube cathode is around 1,100°K. The cathode is coated with oxides, typically of barium and strontium, which at high temperatures are prolific emitters of free electrons.

The grid, still sometimes called a Weinhelt cylinder, is a cup-shaped nickel shroud or plate. For small spot size its central hole is of typically 0·5mm diameter. For high gain, i.e. lowest voltage drive requirement, the grid-cathode spacing when hot is around 0·1mm – not a lot!

### Electron Lens

In an optical lens system the paths of the light rays are modified by the characteristics of the glass through which they pass. In manipulating an electron beam the same effects are achieved by electrical fields produced by (usually) cylindrical anodes – hence the term electron optics. Except in the Trinitron, separate lenses are provided for each of the beams in a colour tube, whether the tube has separate (delta, 20AX and 30AX) or unitised (PIL, 45AX etc.) gun assemblies. In the description that follows we are concerned with focusing an individual beam to form a sharp spot at the tube's phosphorescent screen. Aiming the three separate beams so that the coloured images they produce overlay (convergence) is a deflection rather than a focusing process and will be dealt with separately.

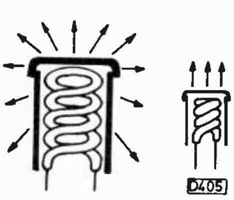



*Fig. 14: Progress in heater-cathode design. Left a 2W assembly, right the 650mW type.*

### Effect of Potential Gradient

Lines of electric force exist in the space between two electrically charged plates, each line forming an imaginary voltage boundary in similar fashion to the contour lines on a geographical map. When an electron, which has a negative charge, is present in this region it will be attracted to the positive plate. If it's travelling through the lines of force however (see Fig. 15) the effect will depend on its direction. When the electrons in a beam are travelling up a potential gradient, i.e. through regions of increasing voltage, the effect will be to straighten the beam and direct it at right-angles to the lines of force. The electrons are accelerated and set on a converging path to form a point of focus at some plane beyond the lens. Conversely when a beam is travelling through a field of decreasing electrical strength, i.e. travelling down a potential gradient, the electrons will experience a lateral deflection force that tends to align them with the lines of electric force.

### Unipotential Gun

A simple electron lens system is shown in Fig. 16. After leaving the cathode the electrons travel on a diverging path through the pinhole in the cylinder grid and are then rapidly accelerated by the high voltage applied to the first anode. The cathode-grid-first anode combination forms a strong positive lens (steep potential gradient) that brings the beam to a point of sharp focus in the vicinity of the first anode disc. This region is often called the prefocus lens, and since the spot at the tube's screen is an image of this beam crossover point it's important to have minimum aberration here.

After passing through the first anode disc the diverging beam is greatly accelerated by the second anode which, like the fourth anode, is at the full e.h.t. potential. As it approaches the third (focus) cylinder, which has about 500V applied to it, the beam finds itself travelling down a potential gradient. As a result, it decelerates and diverges. It soon comes under the influence of the fourth (final) anode which produces an increasing potential gradient, sending the outer electrons in the beam on a converging path, the focal point being at the screen. The A3 (focus electrode) region is called the main lens: its focal point can be varied by adjusting the voltage applied to this electrode. This is the principle of the unipotential lens, as used

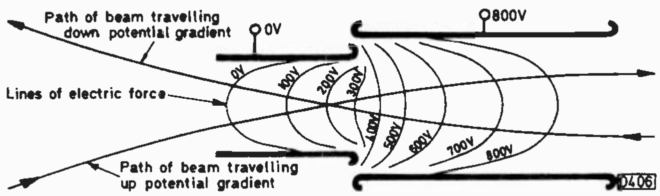



*Fig. 15: Electron trajectories through electric fields. The electron travelling to the left is decelerated and takes a divergent path. That travelling to the right is accelerated and aligned along the axis of the cylindrical electrodes.*

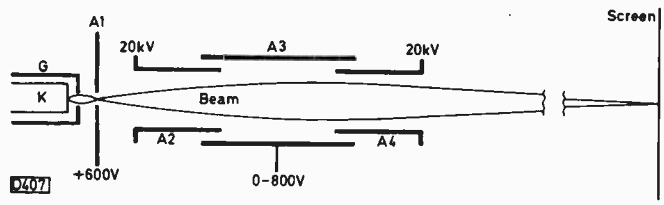



*Fig. 16: Unipotential electron gun.*

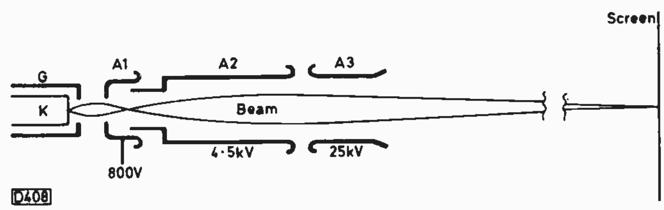



*Fig. 17: Bipotential electron gun.*

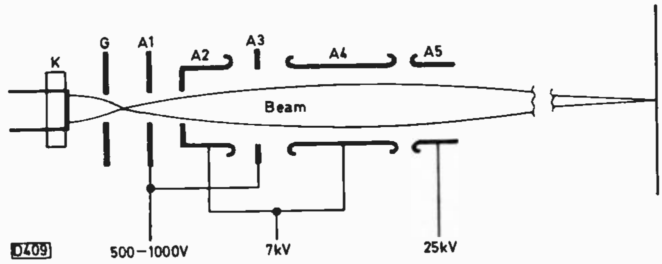



*Fig. 18: Hybrid lens with coupled unipotential and bipotential sections.*

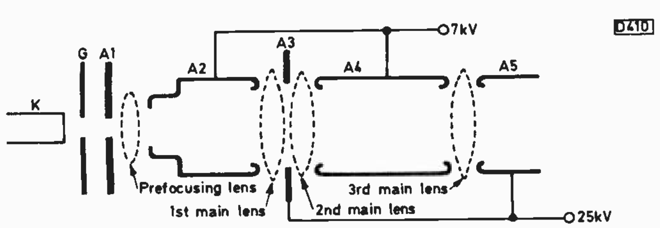



*Fig. 19: Multistage system consisting in effect of three bipotential lenses in series.*

in monochrome, many Trinitron and some types of delta-gun tubes. They are characterised by a low and non-critical focus voltage which is sometimes provided by fixed voltage taps rather than a potentiometer.

### Bipotential Gun

The widely used bipotential gun system requires a focus voltage approximately 20 per cent of the final anode voltage. See Fig. 17. Here the focus anode (A2) comes directly after the first anode and takes the form of a long cylinder, often with its rear end protruding into the cup-shaped first anode to give a steep potential gradient at this point. The final anode A3, at about 25kV, gives the electrons in the beam tremendous acceleration and sets them on a converging path.

### High Bipotential System

A refinement of the bipotential lens system is the high-bipotential focus (HBF) system in which the focus cylinder (A2) is made much longer (hence a longer gun and neck) to form a weaker lens with less beam aberration. This involves the use of a higher focusing voltage (between 27 and 32 per cent of the e.h.t. potential) and is capable of better performance. It's used in certain 90° PIL type tubes and also in 30AX tubes, which accounts for the longer tube neck and higher voltage requirement for these compared to the 20AX.

### Multi-lens Systems

There are more elaborate electron-lens systems in which multistage (compound) lens principles are used. A hybrid lens is formed by coupling a unipotential lens to a bipotential type, see Fig. 18. A multistage focus system can be made up as shown in Fig. 19. These more elaborate gun systems are generally required only for high-definition tubes with small screens, though consumer tubes with large deflection angles and narrow necks sometimes use them to compensate for the necessarily small lens diameter in mini-neck (22·5mm) systems – as in light optics, the larger the lens diameter the better the performance.

### Refinements

Since the lenses in modern tubes are side-by-side the diameter of each is limited to slightly less than one third of the internal diameter of the tube neck. In their 45AX system Mullard/Philips use a specially designed unitised gun incorporating an aberration reducing triode (ART) focusing system. With this the prefocusing lens is designed so that the aberrations in the cathode image, prefocus and main lens partially cancel each other: the main lens is a high-bipotential type requiring 31 per cent of the e.h.t. potential – approaching 8kV.

The design of the electron gun varies considerably between different manufacturers and depends on many variables – screen size, neck diameter, phosphor dot pitch and particularly the yoke characteristics. Sometimes the gun is called upon to predistort the beam shape to compensate for deflection distortion: this can be achieved by providing slit apertures rather than circular holes in certain of the gun's electrodes.

### Neck Diameter

The choice of tube neck diameter is a very difficult one. A wide neck (36·5mm) permits relatively large diameter electron lenses for minimum spot size and least aberration. The widely spaced beams are difficult to converge however, since they take such different paths through the deflection field. Much deflection power is needed to generate the required field strength in the large neck cross-section, particularly with wide-angle tubes. Narrow neck (29mm) and mini-neck (22·5mm) tubes require much less deflection energy and their closely spaced beams need less convergence correction. Their necessarily small diameter electron lenses do not make for a small spot size however, hence the multistage focus lenses described

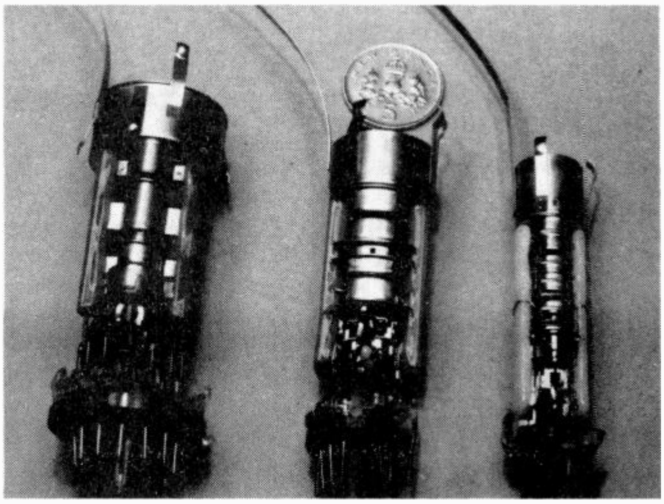


*Fig. 20: The three sizes of gun for in-line tubes – 36·5, 29 and 22·5mm. Note that the gun on the right has a multi-stage electron lens.*

above. New electron lens technology permits the effective lens discs to overlap each other however. In this way the 5·5mm lens diameter typical for a 29mm neck is effectively increased to 8·2mm (plus 50 per cent). Similar improvements have been made in mini-neck guns. Fig. 20 shows the three basic gun types – large, narrow and mini.

## Gun Flashover Protection

Two main flashover phenomena exist in a picture tube. They show up mostly during the first few hundred hours of operation. The rocky-point discharge (as it was called for many years) is due to high electrostatic field strength at a micro-protrusion on an electrode. This can break down the vacuum insulation to an adjacent electrode, the result being sparking. The likelihood of this is reduced by providing a high surface finish to all electrodes, by rounding the ends of anode cylinders (see gun on left in Fig. 20) to prevent steep voltage gradients, and by spot-knocking – the deliberate use of excessive voltage to induce flashovers and break down micro-protrusions.

The second main cause of flashovers is called the trigger arc and arises from a complex insulator charging phenomenon. It takes place on the inside surface of the glass neck, or more commonly on the multiform glass rods that support and space the gun electrodes. To prevent it the glass rods are fitted with an electrically floating conductive path or a wire conductor from a nearby anode. This prevents the build-up of high static charges and forestalls trigger arcing. The wires around the two support beads can be seen on the gun on the right in Fig. 20. More flashover-reduction technology will be described later in this series.

## Neck Magnets

On their journey through the tube's neck the beams encounter a series of carefully tailored fields produced by permanent magnets whose function is to prealign the beams so that they enter the deflection region correctly aligned and at the right angles. With in-line tubes the fields are provided by pairs of ring magnets which are adjusted and sealed by the tubemaker or at the TV factory.

## Purity

First we must orientate all three beams so that they pass through the points in the deflection centre corresponding to the positions of the light sources used to fix the phosphor on the screen. This requires a pair of two-pole ring magnets, see Fig. 21, by means of which the strength and direction of a simple vertical field can be set to move all three beams together horizontally so that they strike the correct phosphor stripes. This is the purity adjustment of course.

## Static Convergence

Since the centre beam (which we'll assume to be green) is always on the tube axis it undergoes least geometrical distortion in the scanning process and can be likened to the single beam in a monochrome tube. The images formed by the two outer beams, blue and red, are made to conform to that of the green beam in the convergence process, so the magnetic fields generated by the other rings (the static convergence rings) are designed to affect only the paths of the outer beams – no flux is set up at the tube's axis, so the trajectory of the centre, green beam is not affected.

To align the blue and red rasters so that they overlay the green raster exactly we need complete control over the positioning of the outer beams. First comes a pair of four-pole ring magnets (Fig. 22). Both are identical, so that by rotating them with respect to each other the effective fields can be cancelled or doubled to get the required field intensities: the direction of the fields thus established can be adjusted by rotating both magnets together. As the intensity of the four-pole fields is varied the outer beams are moved differentially in a horizontal plane: as the direction of the four-pole fields is varied the outer beams are moved differentially in a vertical plane. Thus by relative and co-adjustment of the four-pole rings the blue and red beams can be superimposed to give a magenta cross at the centre of a crosshatch display. This will not necessarily coincide with the green cross however, and this where the third ring magnet pair comes in.

The correction fields required this time come from a six-pole ring magnet pair. Once again the strength and direction of the fields can be set by relative and co-adjustment of the two rings as described for the four-pole pair. The six-pole pattern is shown in Fig. 23, where it can be seen that the outer beams only can be deflected together in the vertical and horizontal planes as required. This superimposes the magenta on the green cross at screen centre to complete the static convergence process.

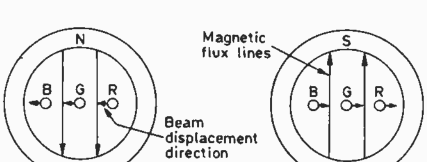



*Fig. 21: Effect of a two-pole ring magnet.*

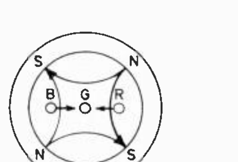



*Fig. 22: Effect of a four-pole ring magnet.*

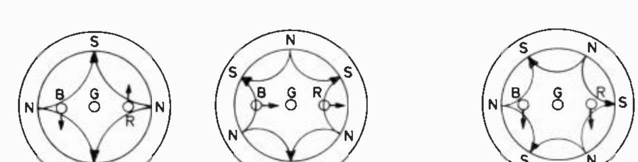



*Fig. 23: Six-pole field pattern.*

Fig. 24 shows the order of the ring magnets on the neck of a typical PIL type in-line gun tube (Hitachi).

### Raster Symmetry Magnet

The same two-, four- and six-pole fields are used with 20AX tubes. Also required is an additional ring magnet pair with a two-pole field to generate horizontal lines of force to deflect all three beams vertically. This raster symmetry control compensates for any curvature of the horizontal centre line of the raster due to the barrel-shaped vertical deflection field acting on an off-centre beam formation – the three individual guns used in this type of tube cannot be assembled and positioned with as much accuracy as with a unitised gun system.

The 20AX multipole assembly, as the ring-magnet cluster is called, incorporates gearwheels to give automatic contra-rotation of each ring pair, with the gearwheel frame rotatable by a second lever in each case. This greatly simplifies purity and convergence adjustments on the rare occasions when they're required. The sequence and effect of the ring magnets in the 20AX system is shown in Fig. 25.

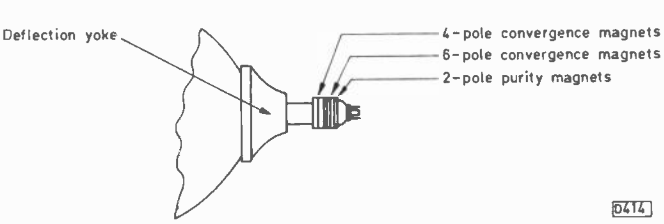



*Fig. 24: Assembly of magnets on the neck of a 90° PIL type colour tube.*

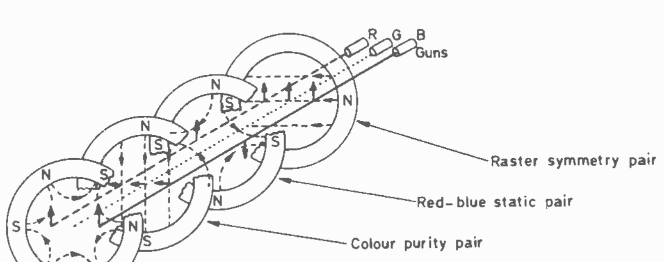



*Fig. 25: Multipole cluster on the neck of a 20AX tube, showing the effects on the electron beams.*

### Internal Magnet System

In later Mullard/Philips designs the multipole assembly is dispensed with altogether. The 30AX (triple gun) and 45AX (unitised gun) tubes have a single magnetic ring mounted at the end of the gun assembly. At a late stage in manufacture all beam-alignment tolerances are taken up by a computer-controlled magnetising jig which prints into the ring a combination of two-, four- and six-pole fields to bring beam alignment to centre tolerance. This not only eliminates all manual adjustments on the tube neck but also permits any 30AX/45AX deflection yoke (of the correct type for the tube size) to be used.

### Red Gun Centre

Note that with some PIL type tubes the red gun is the centre one.

Next month we will be considering deflection yokes.

# Servicing the Panasonic NV7000

**David Botto**

We've handled a fair number of these popular VHS machines which enjoyed a wide sale. Before tackling any repairs you'll find a little time studying the circuitry a good investment. We'll consider the various sections of the NV7000 and some of the fault conditions that can occur.

## Access

To gain access for servicing is straightforward. First remove the two non-magnetic screws from the cassette cover. These are special screws, so be careful not to lose them. Next remove the two screws at the top corners at the back of the machine. You'll then be able to lift off the whole top portion of the case. Should you need to remove the bottom metal plate to expose the printed boards at the bottom of the case, place the machine upside down on a soft surface, remove the six screws that hold the plate and lift it away. Of the two PCBs thus exposed the smaller is the servo and subsystem control board and the larger the luminance and chrominance signal processing board.

To open the bottom printed panels remove three screws at the front and three at the rear. These screws are usualy reddish-gold, making them easy to identify. By pushing back the front of the boards to clear the knobs and jacks etc. the boards are freed and can be swung outwards (hinged at the rear of the machine) for inspection. To remove the VCR's front panel – don't do this unless it's essential – remove three screws at the top and gently ease the panel off. It's best to start by removing just the cassette cover and top casing however.

In servicing these VCRs a special rubber bench mat, such as those supplied by Philips, RS Components, etc., is almost essential to avoid scratching or damage to the machine. You'll also find that a special magnetic screwdriver speeds things up and avoids screws being dropped into sections of the machine where they are difficult to retrieve.

## Power Supply Arrangements

Looking into the top of the machine with the top casing removed you'll see the power supply board (VEP0177A) mounted upright at the rear left-hand side. A plate behind it holds IC1501 (HA17806) and transistor Q1501 (2SA1061).

The power supply circuit, together with operating voltages, is shown in Fig. 1. The mains supply is fed via the power switch at the rear of the machine to connection points 13 and 14 on the panel, passing via the fuse, filter coil L1001 and connector P1008 to the mains transformer T1001 which has its windings so arranged that selector S1002 can provide adjustment for inputs from 110V to 240V a.c. – always check that the setting is correct.

T1001 has three secondaries providing a.c. outputs of 20V, 12V and 38V which are fed back to the board via connector P1007.

The 20V a.c. supply is fed via fuse F1002 (4A) to D1006 which produces 20V across C1007 and bridge rectifier D1001-4 which produces approximately 18·3V across C1002.

The voltage across C1002 is applied to two separate regulators. First Q1003 whose base voltage is held steady by zener diode D1015. The voltage at the emitter of Q1003 goes to pins 6 and 7 of P1002 and via D1008 to pin 1 of P1003. Secondly Q1501, via P1001/1, which produces a stabilised 12V supply at its collector. This voltage is present at P1001/5 and at pins 1-4 of P1004. The base of Q1501 is driven by a conventional control circuit whose main elements are Q1001, Q1002 and zener diode D1012. Preset R1007 provides adjustment. To set up, connect a digital voltmeter between the 12V line and chassis and adjust for exactly 12V with the machine in the stop mode. Recheck after half an hour. Get it accurate to within 0·1V. Always check this voltage before tackling obscure faults.

The 12V at pin 1 of P1003 goes via pin 1 of connector P1507 to power switch S1507 on the power/timer/NR select board which lives at the right-hand side of the front of the machine, behind the front panel. The switches on this little board are operated by three small pushbuttons on the front right-hand side of the machine. Pins 6/7 of P1002 supply pin 1 of connector P704 on the TV demodulator section board which is on the extreme right looking into the top of the machine.

The regulated 12V supply at P1004 goes to various parts of the VCR as follows. Pin 1 feeds pin 2 of connector P3007 on the luminance/chrominance board. Pin 2 feeds pin 1 of connector P2005 on the servo and subsystem panel. Pin 3 supplies pin 2 of connector P6203 on the system control II board. Pin 4 supplies pin 2 of connector P704 on the TV demodulator section.

The unregulated 20V supply produced across C1007 passes via pins 4/5 of connector P1006 to pin 3 of connector P2005 on the servo and subsystem control board and pin 1 of connector P6203 on the system control II board (this board is cunningly folded together with the system control I board and hidden inside the machine on the right-hand side, under the two main bottom PCBs – the larger is the I board and the smaller the II board). The 20V supply is also fed via the 4·7Ω, 10W resistor R1501 and connector P1006/3 to pin 2 of connector P2005 on the servo and subsystem board.

The 20V a.c. winding on the transformer also supplies pins 1-2 of P1006. This supply goes to pins 1-2 of connector P3008 on the luminance/chrominance board, emerging from this board at pins 1-2 of connector P003 to power the PTC heater inside the little cast fitting near the back of the video heads.

The output from the 12V winding on T1001 is fed via F1003 (1A) to a second bridge rectifier, D1009-10, which develops 12V across the reservoir capacitor C1013. This supply goes to pins 5-6 of connector P1004. Pin 5 supplies pin 1 of connector P1515 on the power transistor panel while pin 6 supplies pin 4 of connector P7501 in the timer section. It also goes to pin 4 of connector P1001, then to regulator IC1501 whose 6V output appears across C1027. This supply goes via P1003/2 to P7501/5 in the timer section. It's also reduced to 5V via D1007 and is then fed via P1003/3 to P6001/1 on the system control I board.

The output from the 38V winding on T1001 goes via

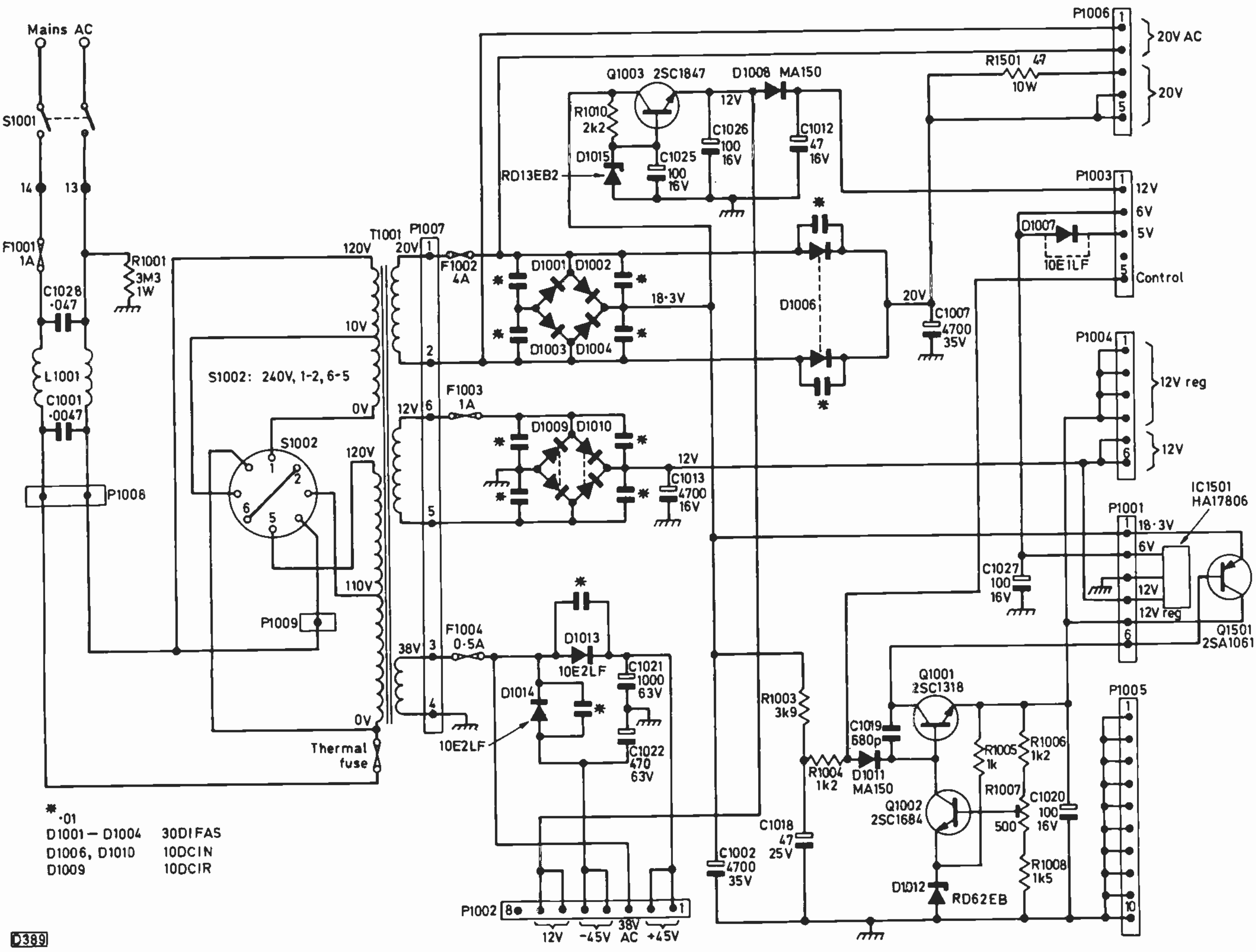


*Fig. 1: Power supply circuitry used in the Panasonic NV7000.*

F1004 (0·5A) to P1002/3 and to the full-wave voltage doubler circuit D1013/4/C1021/2. This produces 45V across C1021 and −45V across C1022. The positive supply goes via P1002/1 and 2 to power switch S1507 on the power/timer/NR select board. The negative supply goes via P1002/4 and 5 to P7501/3 on the timer section. The timer board can be seen from the top of the machine to the left of the TV demodulator section with the case removed.

Connector P1005 simply connects the chassis side of the power supply to all the various boards to ensure that all chassis connections are linked.

An appreciation of the power supply and its various outputs helps a great deal when servicing the NV7000.

## Power Supply Faults

A completely dead machine showing no signs of life can simply be due to failure of F1001 – it tends to die of old age. In this event fitting a new fuse will restore operation. If F1001 is blackened check the filter capacitors C1028 (0·047$\mu$F mylar) and C1001 (0·0047$\mu$F ceramic). These are usually extremely reliable but they have been known to go short-circuit.

If F1001 is in order and the machine is dead or not operating on all functions check fuses F1002-4. Before going on to check for the causes of involved faults do first ensure that the correct voltages are present at all the power supply outlets.

Regulator IC1501 sometimes fails, producing an upwards voltage surge on the 6V line. Protection diode D7542 (QA107R) on the timer board, just in front and parallel with IC7505, then goes short-circuit – probably permanently. With a new regulator and the 6V supply restored the machine will work normally with D7542 snipped out. Don't be tempted to leave it out – if IC1501 should fail at a later date the damage could be extensive. D7542 is a special zener diode and the correct replacement type from Panasonic must be used. When fitting, also test diode D7536 (EM1Z) on the timer board – at the right-hand side of connector P7509.

When the 12V regulator transistor Q1501 goes short-circuit the 12V supply becomes an 18-22V supply (this often happens when there's a tape in the machine). When you now press the play button nothing happens except that a rather interesting te-chunk, te-chunk noise is heard coming from somewhere inside the machine. Fortunately the excess voltage doesn't seem to do much harm. Just the same, disconnect the machine from the mains supply quickly, replace Q1501 and be sure to test transistors Q1001/2 and diodes D1011/2. With the regulated 12V supply restored and set up correctly you'll usually find that all functions are operating normally.

## Component Tester Checks

The fast easy way to check all power supply components is with a component tester (see *Television*, June

1984). With the mains supply removed and the plugs disconnected from the power board you can effectively test every transistor, diode and capacitor in minutes.

### Programmable Timer Board

We'll look now at some of the boards that have given us problems, starting with the programmable timer board. First ensure that all the supply voltages are present and correct. Measured between connector P7501 and chassis you should get readings of 3V a.c. at pin 2, −45V at pin 3, 12V at pin 4 and 6V at pin 5.

The usual cause of failure on this board, giving rise to various weird symptoms, is a faulty microcomputer chip. There are two, IC7505 (MN1400VL) and IC7506 (MN1405VM). A logic probe is ideal for fault tracing on this board: Table 1 shows the readings to expect at the pins of IC7505/6.

Before fitting a new microcomputer chip it's a good idea, after carefully removing the old one using a small, temperature-controlled soldering iron and good quality desoldering braid, to fit a forty-pin holder. If the fault should turn out to be elsewhere you can then easily replace the original chip – besides, it might fail at a future date . . .

If things seem to be otherwise in order but the clock display is rather strange the usual cause is one of the TA57 i.c.s (IC601-3). Check them with your logic probe or by replacement. There are four DN852 i.c.s on the board, IC7501-4, but we've so far never had any problems with these.

After you've carried out any repairs necessary on this board always check fuse F7601 (1AT). The clock will operate if this fuse is open-circuit but the back-up battery system won't.

The various diodes and transistors on the board can be quickly checked – they rarely fail – with your component tester. When testing be sure to desolder one end of each diode and two connections to each transistor. The small electrolytics dry up and corrode, causing mystifying faults, so examine them carefully for drying out.

**Table 1: Microcomputer pin conditions.**

| *IC7505* | | *IC7506* | |
|---|---|---|---|
| *Pin* | *Reading* | *Pin* | *Reading* |
| 1 | 0V | 1 | 0V |
| 2 | L | 2 | L |
| 3 | L | 3 | L+P |
| 4 | L | 4 | H |
| 5 | H+P | 5 | L |
| 6 | H+P | 6 | L |
| 7 | H+P | 7 | L |
| 8 | H+P | 8 | L |
| 9 | H+P | 9 | L |
| 10 | H+P | 10 | L |
| 11 | H+P | 11 | L |
| 12 | H+P | 12 | L |
| 13 | L | 13 | H |
| 14 | L | 14 | L |
| 15 | H | 15 | L |
| 16 | H+P | 16 | L |
| 17 | Slow pulse | 17 | L+P |
| 18 | L+P | 18 | P |
| 19 | H+L+P | 19 | P |
| 20 | H+L+P | 20 | Slow pulse |
| 21 | L+P | 21 | H+P |
| 22 | H+P | 22 | L+P |
| 23 | H+P | 23 | H+P+L |
| 24 | L | 24 | H+P+L |
| 25 | L+P | 25 | L+P |
| 26 | L | 26 | L+P |
| 27 | H | 27 | L |
| 28 | H | 28 | H |
| 29 | L+P | 29 | H |
| 30 | H+P | 30 | L+P |
| 31 | H+L+P | 31 | L+P |
| 32 | H+L+P | 32 | L+P |
| 33 | H+L+P | 33 | L+P |
| 34 | H+L+P | 34 | L+P |
| 35 | H+L+P | 35 | L+P |
| 36 | H+L+P | 36 | L+P |
| 37 | H+L+P | 37 | L+P |
| 38 | H | 38 | L+P |
| 39 | 5V | 39 | 5V |
| 40 | H+P+L(osc.) | 40 | H+P+L(osc.) |

Notes: H=high, L=low, P=pulse.
Taken with front on button pressed but no function button pressed. Clock operating normally, reading Sun 1-07 when the readings were taken.

### Luminance/Chrominance Panel

Fortunately few problems occur with the luminance/chrominance panel. When a fault does occur however it can be extremely puzzling due to the complex circuitry used. First a warning: don't disturb the highly critical adjustments on this panel unless this is absolutely essential – if you do you may well spend many a happy hour getting them right again!

A fault that can occur – first make sure that it's not due to the video heads – is the luminance being poorly recorded or not recorded. With a colour-bar input to the VCR, observe the waveform at TP3001 – all test points on this panel are clearly labelled. Use a 10:1 probe with the scope. You should see the complete picture signal. From here the signal goes via R3002 and C3002 to pin 1 of IC3001 (AN6310) which can fail – this i.c. contains the a.g.c., sync separator, f.m. modulator, clamp and emphasis clip stages. The signal emerges at pin 24 of this i.c. and goes via L3001/C3003 and C3005 (0·047$\mu$F, type VCY25473KX, order specially from Panasonic) back to pin 5 of the i.c. The output at pin 24 also goes via C3006, Q3031 etc. to pin 21, emerging at pin 22 and then going via the deviation control R3019 and C3018 (47$\mu$F, 6V) to pin 19. Make sure that C3018 has not dried out or lost capacitance. After passing through an internal amplifier the signal reappears at pin 18 and is then fed via a non-linear emphasis circuit and emitter-follower to pin 16. After clamping the signal goes to the emphasis clip section (see Fig. 2). The white and dark clip presets are connected to pins 10 and 12 – both these adjustments are critical. C3022 between pins 13 and 14 provides frequency adjustment (3·8-4·8MHz). Understanding what happens in this i.c. is important when servicing the luminance/chrominance panel. The output at pin 9 goes via C3025 to TP3009, where you should see the f.m. signal waveform (at approximately 5V p-p), then via the record level preset R3025 to the record amplifier which consists of transistors Q3005 (2SC2377), Q3006 (2SC2206), Q3007 (2SB641) and the associated components. Should you ever need to replace any of these transistors (they rarely fail) do use exact replacements or you may get all kinds of puzzling results.

The chrominance circuitry is reliable and despite the numbers of these VCRs we've serviced not many problems have been encountered. IC8001 (AN6360), a device used in various VCRs, can fail however. Whenever we meet this i.c. we regard it with suspicion. Perhaps we've just been unlucky.

Record signals arrive at pin 1 of IC8001 via filter FL8001 (VLF0113), the playback signals going to pin 18 via FL8002 (VLF0085). These filters – there are a number on the board – sometimes cause problems, but check the soldered joints before condemning them. You should see the standard cotton-reel colour-bar signal with burst information at TP8001 (pin 7 of IC8001).

A good monochrome playback signal with no colour may mean that the a.p.c. preset (C8050) and/or the reference oscillator preset (C8024) needs very slight adjustment. Don't turn either of these to find out because if the fault should prove to be elsewhere you'll make yourself a lot of work. Insert a tape, switch to record and set the input select switch (front of the VCR next to the tracking control) to the camera position. Connect a digital frequency counter to TP8008 via a 10:1 probe. It should indicate 4·433619MHz to within ± 50Hz (the figure in the service manual, 4·435572 MHz, is incorrect). Next switch to the stop mode. With the counter connected to TP8002 a reading of 4·433619MHz ± 10Hz should be obtained. If either or both of these frequencies is incorrect carefully adjust the preset capacitors as necessary. If the waveform at TP8002 is missing suspect IC8002 (AN6352). Before changing any i.c. on the board however always check the small surrounding electrolytics.

Puzzling effects can occur if one of the connector plugs on the board is not pushed right home into its socket. Check them all.



## System Control Boards

The system control I board contains the microcomputer chip IC6001 (MN1400VP) together with a variety of i.c.s packed with logic gates, inverters and other types of logic, plus the usual diodes and transistors. The only practical way to fault-find is to use a logic probe (see details given on pages 22-23 in the November 1985 issue) after first checking the board's supply voltages. All sorts of interesting problems can occur, such as indicator LEDs flashing on and off when they shouldn't, functions refusing to

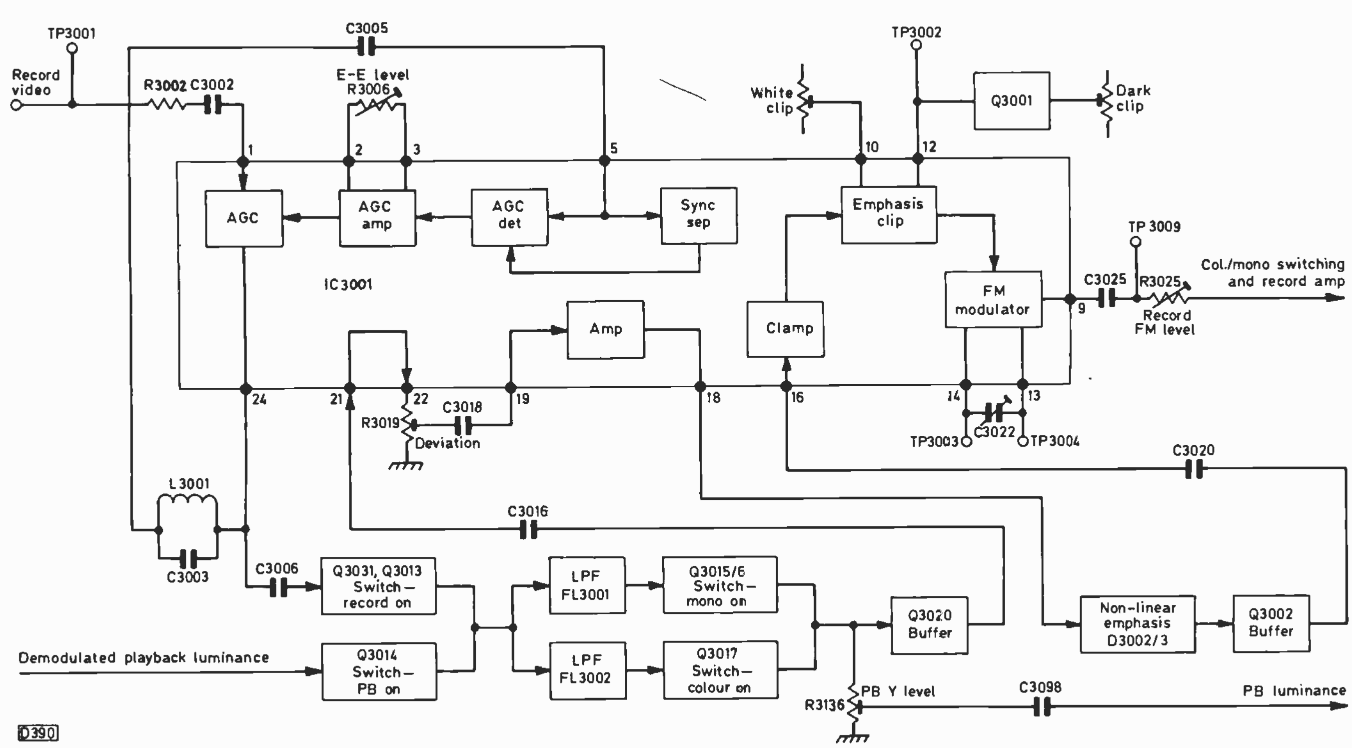



*Fig. 2: Block diagram showing the luminance signal processing in the record mode.*

work, motors turning on and off when they feel like it, etc. Often the fault lies in IC6001, but it can be due to a faulty logic gate or inverter in one or other of the various logic i.c.s. Favourite logic i.c.s to fail seem to be IC6002 (4081), IC6003 (4049) and IC6004/5 (both 4503s).

Interestingly, with so many of our customers owning NV7000s we've had no problems yet with the system control II board, nor with the little front panel that holds the selector switches operated by the front panel function select buttons.

In later models the system control I and II panels were replaced by a single board using a new specially developed microcomputer chip (IC6001, type MN1405VK). This seems to be more reliable that the system control I board microcomputer chip. You'll probably mostly encounter the two-board version however.

## Audio and Still Boards

The audio board has not troubled us yet and we've only rarely had faults on the still board. This latter board contains mostly NAND, AND, and OR gates plus D-type flip-flops so you need use only your logic probe and for the individual transistors your component tester.

## Servo and Subsystem Board

If the drum motor is running very fast indeed replace capacitors C2033 (0·01μF, 50V ceramic) and C2034 (0·068μF, 50V mylar) connected to pins 14 and 13 of IC2001 (AN6350). When the motor won't lock in properly first check diodes D2009/10 (both type MA150) and capacitors C2036 and C2037 (both 0·1μF, 50V mylar) connected to pins 11 and 9 of the i.c. If these components are in order you'll have to try replacing the i.c.

Other servo problems that cause failure of the drum motor to lock properly can be caused by IC2008 (μPD4011C) which contains four NAND gates and is thus easily checked. Watch out for sneaky tricks caused by diode D2012 (MA165) which is connected between pin 2 of this i.c. and chassis.

Problems in IC2002 (AN6677) can result in failure of the drum to rotate. Check Q2019 (2SD389) first however.

If the capstan motor doesn't lock in correctly the suspects are IC2001, IC2004 (AN6341) and IC2007 (μPD4528C). The quickest way to find out which is the culprit is by replacement.

## Various Faults

When the tape loads and then immediately unloads after pressing the play button the loading belt is probably at fault. If you need to replace this belt it's best to fit a complete new set of belts to prevent future troubles.

Noise bands running up and down the recorded picture can be caused by a faulty tracking control – this is usually due to a heavy-handed user.

If the tape won't play make sure that the cassette lamp isn't open-circuit. I know that this is an obvious fault – but one can still get caught.

If the tape unloads when a cassette is played and the counter reads 0006 to 0007 it's possible that the Hall-effect i.c. (DN838) under the supply reel is at fault. It's best to replace this by cutting the legs off the old i.c., then soldering the new one to these – this is the official instruction we had from Panasonic. This is also a good place to say how helpful the engineers at Panasonic have been whenever we've phoned them for advice. It's appreciated, believe me!

A much more likely cause of trouble when the tape halts at 0006/7 is the capstan motor. These motors are expensive however. So carefully unplug the connector to the motor, unbolt and remove it from the machine. Take out the three screws that hold it together and separate the pieces. Don't lose any of the special parts that make up the motor. Lubricate the bearings with just the slightest trace of Castrol DWF lubricant. When reassembling lubricate the spindle – again the slightest trace – where it passes through the top plastic washer (this washer looks like an inverted top hat when removed from the motor). Don't push it down too far when reassembling. You'll nearly always find that the problem has been cured when the capstan motor is refitted.

## The Heads

Provided they are regularly cleaned the video heads enjoy quite a long life. Clean the whole video drum thoroughly before condemning them – also the audio/control and erase heads. Clean the entire tape path using only a proper video head cleaning kit and fluid. Good heads are easily ruined by incorrect cleaning materials.

A fair picture from a prerecorded cassette but a poor one from a recording made by the machine can be a sign of worn heads. You can check the heads by playing the Panasonic alignment tape (part no. VFM8100H3D) and observing the f.m. envelope at pin 10 of IC3002 (AN6320) on the luminance/chrominance board, using a scope with 10:1 probe. Make sure that the tracking control is in its fixed position. We find however that the best method, provided you've a spare drum to hand, is to try a new set of video heads. This is quick and reliable – it's done in minutes, just two screws and four soldered connections. The leads are colour coded, so it's difficult to wire them incorrectly. It's been done though! If you get a winding reversed you can end up with a nice monochrome picture, i.e. no colour.

It's always best to fit the correct heads supplied by Panasonic. You'll find it cheaper in the long run because with the correct heads fitted no or minimal adjustments should be necessary

## Tuner/Demodulator Panel

The tuner never seems to fail but it can drift off tune after an hour or so. If this occurs first check for 12V at pins 1 and 2 of connector P704 and 45V at pin 4. Then check D7011 (RD5·1EB) and D7013 (μPC574JK), also transistors Q7007 and Q7019 (both type 2SA684). Another suspect is D7026 (MA150). On rare occasions IC7001 (AN5701) gives trouble.

A dusty picture in the E-to-E mode only is caused by a faulty r.f. booster unit (part no. ENPE702). Replace the unit, don't waste time trying to repair it.

## General Advice

In conclusion I'll repeat my usual advice about applying a little circuit varnish to any joints you may have resoldered – but use a tiny brush to do so. The Panasonic alignment tape is well worth having as it will save you much time in servicing and any necessary adjustments. For voltage measurements I recommend using only an accurate digital multimeter.

# Service Bureau

***Requests for advice in dealing with servicing problems must be accompanied by a £1·50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon 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.***

### *TOSHIBA V9600*

**The picture is full of snow except for two inches or so at the bottom of the screen. This part is viewable but has no colour. The sound doesn't seem to be affected and the fault sometimes clears after a short run.**

It sounds as if most of the f.m. envelope is missing in the fault condition – the machine is probably not lacing up correctly. When the fault doesn't clear while the machine is running it's possible that the back-tension pole is outside the tape. The pole is adjustable. Otherwise observe the lacing action with the cover off: the back-tension arm could be sticking up or reaching its stop before contacting the tape.

### *THORN 1590 CHASSIS*

**The problem is bottom fold-up and bent verticals. Also the picture rolls when the video content changes – adjusting the field hold control restores field lock.**

Poor field sync can be caused by a number of things in this chassis: failure of the sync phase-spitter transistor VT8 or its base bias resistor R46 (100kΩ); C1, C2 (both 10μF) or C17 (4·7μF) in the a.g.c. circuit drying up; incorrect setting of the preset contrast control R2; or C36 (4·7μF) in the video driver transistor's base bias circuit drying up. Ideally you need a scope to check the vision detector's output (waveform B in the manual) – look at the quality of the field sync pulse. Careful examination of this will direct you back to the i.f. amplifiers or forwards to the video and sync departments. If the bottom foldover remains when the sync problem has been solved check the setting of the regulated l.t. supply then if necessary check the lower field output transistor VT20, the field scan coupling capacitor C78 (1,000μF), and C80 (change to 10μF if 25μF) in the field linearity feedback circuit.

### *SANYO VTC5300P*

**There are intermittent noise bars and field jitter. The noise bars usually start at the top of the picture: adjusting the tracking control removes them but they return soon after. The picture is otherwise o.k. I've gone through the setting up procedure in the manual several times and can't find anything wrong, though I did notice that the pinch roller is very sloppy on its spindle.**

The pinch roller is given some play to enable it to align with the capstan shaft. If you've cleaned the heads, guides and entire tape path, set up the guides using an oscilloscope to view the envelope pattern with an alignment tape, and in particular checked and adjusted the back-tension as specified, it's likely that the head disc itself is in need of replacement.

### *SONY KV1320B*

**The problem is foldover at the bottom of the picture. No adjustment of the controls removes this effect and I suspect a leaky capacitor in the field timebase. Any ideas?**

First check that the h.t. voltage is correct – there should be 115V at the emitter of the series regulator transistor Q903. If this is correct check the following electrolytics in the field timebase in this order: C511 (1,000μF, 16V), C506 (33μF, 16V), C507 (2·2μF, 10V). If the problem persists and adjustment of the vertical bias control VR503 doesn't clear it check the field output transistor Q901 (2SC867) and the driver transistor Q502 (2SC633A) for leakage.

### *ITT CVC20 CHASSIS*

**When this set is switched on with the correct h.t. setting there's no sound or picture, just a 1kHz whistle. If the h.t. is increased and pin 3 or 4 of the TBA920 line oscillator chip is touched the set will start with the e.h.t. high (28-30kV). Backing this down to 25kV will give normal operation.**

The whistle you describe indicates that the line output stage is drawing no current. This is almost certainly due to lack of drive to the base of the BU208 line output transistor. First check the earthing of the line driver transistor's emitter (T13). This is connected to the metal chassis frame via a lug at the top left of the chassis. If this is o.k. the driver transistor itself is suspect – its collector voltage should be 117V.

### *SONY SL5*

**When play is selected the machine shuts down, though the LED indicator remains lit. The fault can be cleared by turning the mains supply off and then on again – the machine will then operate normally for quite a time. The play solenoid has been adjusted and all belts and pulleys have been cleaned.**

This symptom is normally the result of the threading ring failing to rotate. The cause could be belt slippage, failure of the capstan motor or a fault in the capstan motor's drive circuit. If the tape does thread up before deck shutdown, check the operation of the slack sensor lever and reed switch.

### *PANASONIC U1 CHASSIS*

**There's sound only on this set. I'm told that the picture sometimes appears but I've yet to see it.**

The usual cause of this fault is failure of zener diodes D818/9. In this event the voltage at pin 9 of IC301 (TDA2530) will be in excess of 12·6V. Replace both diodes (type QA106SB) and change their feed resistor R819 to 560Ω, 0·5W.

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**TELEVISION JULY 1986**

### *SANYO VTC5000*

**This machine is slow on rewind and stops before the tape is completely rewound, sometimes leaving a tape loop protruding from the cassette. If the reel brakes are held off manually the tape will fully rewind, though a little slowly.**

The back end of the deck used in this machine is a fairly common source of problems. A complete cure will be obtained by replacing the reel motor and reel drive pulley unit and roughening the surfaces of the reel brakes. The parts required are not too expensive or difficult to fit.

# TEST CASE

# 283

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

As we said in test case 279 (March) the Hitachi NP8CQ chassis is very reliable. Even so, a dealer who looks after large numbers of these sets will inevitably see them in the workshop from time to time – and when they do come in they seem to have such interesting faults!

The set featured this month is an Hitachi Model CBP220. The fault seemed straightforward enough: the complaint was of a smeary picture and a technician was despatched forthwith to the address given. When our man arrived he found a very messy display on the screen. The picture was dark at the left, bright at the right and ill defined. It seemed certain that the c.r.t.'s cathodes were being modulated by a line-frequency sawtooth waveform and the most likely source of this was the line output transformer derived 180V rail which powers the RGB output transistors. A 10$\mu$F, 250V electrolytic capacitor was dug out of the spares box and dabbed across points K2 (180V) and K3 (chassis) on the tube base panel. Hey presto!, our technician was rewarded with a clear, sharp and evenly illuminated picture. It was the work of minutes to remove the decaying 180V supply reservoir capacitor C719 (4·7$\mu$F) on the main PCB and fit a new one in its place. Replacing the volume control potentiometer, which was found to be "crackly", took somewhat longer!

Some money and a cup of tea changed hands and our technician went on to his next call. The next call after that was to the recently repaired Hitachi – "goes all bright with lines across the screen" was the telephoned complaint. When our technician returned the set was behaving itself and couldn't be provoked into the fault condition. After a careful check on the work just done and a look at the connections to the relevant pins (3 and 10) on the line output transformer he hoisted the set into the car and brought it back to the workshop.

The fault didn't show up till the set was switched on next morning. The screen then lit up brightly, with prominent flyback lines: the brightness next fluttered up and down at random before the set returned to normal operation. During these capers the brightness control had very little effect. The workshop worthies hooked a meter to one of the tube's cathode pins and another one to the common first anode pin. The readings obtained were around 110V and 500V respectively, but the picture was now normal.

The set was powered once more after lunch and sure enough the high brightness condition had returned. A check on the meters revealed that the cathode and first anode voltages were both marginally lower than before. Excessive first anode voltage was thus ruled out as a cause of the fault, while the very slight reduction in cathode voltage could not have been responsible for such a large brightness increase. The only other relevant tube electrode seemed to be the grid, and since this is connected to chassis there's no circuitry to check. In theory an internal leak in the tube can cause this type of fault, but grid-cathode leaks rarely appear from cold and disappear as the temperature rises – the opposite is usually the case.

As it turned out the tube was innocent though the root of the fault was not very far away from it. In fact the problem area is prominently shown in the June 1985 issue cover photo! See next month for the solution.

### *ANSWER TO TEST CASE 282*
### *– page 524 last month –*

The poor trainee struggling with the Pye 725 would probably not have found the answer to his problem in his college courses. The set had come in because of an intermittently snowy picture, but on the bench the dominant symptoms were low h.t., a small fluttering picture and a squealing noise from the power supply panel – in fact from the mains feed choke L909.

Many checks had been made and all Techno-Supersleuth's suggestions had been followed up. The trainee was in fact wasting his time because there was nothing wrong with the set's power supply department, as he would have seen had he looked at the waveform at the anode of the rectifier/regulator thyristor D888. The waveform would have had big "bites" missing from it at each firing point of the thyristor. So would the waveform at the mains input fuse F913, where there should be a perfect sinewave.

It's a characteristic of this type of half-wave rectifying thyristor circuit that large, short-term gulps of current are taken from the mains supply. Fine on "raw" mains, though the electricity supply authorities don't like it, but in this case the supply was via a 200W isolating transformer. Though this was theoretically adequate in terms of power rating it wasn't providing a "stiff" enough a.c. power source: the impedance of its secondary winding limited the charging current available for the h.t. reservoir capacitor C880.

The intermittently snowy picture? Bad joints at the front end of the vision i.f. strip, as usual.

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| | |
|---|---|
| AA117 | 9p |
| AA119 | 9p |
| AAY32 | 9p |
| AC107 | 28p |
| AC126 | 17p |
| AC127 | 15p |
| AC128 | 15p |
| AC128K | 23p |
| AC141K | 30p |
| AC142K | 30p |
| AC153K | 23p |
| AC176 | 18p |
| AC176K | 20p |
| AC187 | 15p |
| AC187K | 20p |
| AC188 | 17p |
| AC188K | 23p |
| ACY18 | 48p |
| ACY19 | 48p |
| AD142 | 60p |
| AD149 | 45p |
| AD161 | 22p |
| AD162 | 22p |
| AF124 | 25p |
| AF125 | 25p |
| AF126 | 25p |
| AF127 | 25p |
| AF139 | 22p |
| AF239 | 22p |
| AL112 | 70p |
| AL113 | 80p |
| ASZ15 | 100p |
| ASZ17 | 100p |
| AU110 | 110p |
| AY102 | 180p |
| AY106 | 180p |
| BA145 | 10p |
| BA148 | 10p |
| BA154 | 6p |
| BA157 | 12p |
| BB101 | 13p |
| BB103 | 16p |
| BB105B | 18p |
| BB205B | 24p |
| BC107 | 7p |
| BC108 | 7p |
| BC109 | 7p |
| BC115 | 10p |
| BC118 | 11p |
| BC140 | 19p |
| BC141 | 19p |
| BC142 | 19p |
| BC143 | 19p |
| BC147 | 6p |
| BC148 | 6p |
| BC149 | 6p |
| BC157 | 6p |
| BC159 | 6p |
| BC182 | 6p |
| BC182L | 6p |
| BC183 | 6p |
| BC183L | 6p |
| BC184 | 6p |
| BC184L | 6p |
| BC212 | 6p |
| BC212L | 6p |
| BC213 | 6p |
| BC213L | 6p |
| BC214 | 6p |
| BC214L | 6p |
| BC237 | 7p |
| BC238 | 7p |
| BC300 | 16p |
| BC301 | 18p |
| BC302 | 18p |
| BC303 | 18p |
| BC327 | 6p |
| BC328 | 6p |

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|---|---|
| BC337 | 6p |
| BC338 | 6p |
| BC557 | 6p |
| BCY32 | 150p |
| BCY33 | 150p |
| BCY34 | 150p |
| BCY42 | 20p |
| BCY56 | 16p |
| BCY70 | 16p |
| BCY71 | 16p |
| BCY72 | 16p |
| BD115 | 26p |
| BD124P | 60p |
| BD124 | 110p |
| BD128 | 35p |
| BD131 | 25p |
| BD132 | 26p |
| BD135 | 20p |
| BD136 | 20p |
| BD137 | 20p |
| BD138 | 20p |
| BD139 | 20p |
| BD140 | 20p |
| BD144 | 90p |
| BD150 | 30p |
| BD157 | 38p |
| BD158 | 38p |
| BD166 | 30p |
| BD175 | 30p |
| BD177 | 30p |
| BD179 | 32p |
| BD181 | 45p |
| BD182 | 60p |
| BD183 | 60p |
| BD187 | 30p |
| BD201 | 33p |
| BD202 | 38p |
| BD203 | 42p |
| BD204 | 42p |
| BD222 | 31p |
| BD225 | 31p |
| BD232 | 31p |
| BD234 | 32p |
| BD235 | 28p |
| BD236 | 30p |
| BD237 | 21p |
| BD238 | 24p |
| BD244 | 50p |
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| BD434 | 30p |
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| BD538 | 40p |
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| BD676 | 40p |
| BD677 | 38p |
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| BD679 | 40p |
| BD680 | 40p |
| BD681 | 45p |
| BD682 | 45p |
| BDX32 | 100p |
| BDX65 | 80p |
| BDY92 | 100p |
| BF180 | 16p |
| BF181 | 18p |
| BF183 | 20p |

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|---|---|
| BF184 | 20p |
| BF185 | 20p |
| BF194 | 5p |
| BF195 | 6p |
| BF196 | 6p |
| BF197 | 7p |
| BF198 | 7p |
| BF199 | 6p |
| BF200 | 16p |
| BF240 | 16p |
| BF241 | 10p |
| BF255 | 12p |
| BF256 | 16p |
| BF257 | 16p |
| BF258 | 18p |
| BF259 | 18p |
| BF262 | 26p |
| BF263 | 25p |
| BF270 | 18p |
| BF273 | 15p |
| BF311 | 21p |
| BF324 | 26p |
| BF336 | 20p |
| BF337 | 20p |
| BF338 | 20p |
| BF355 | 28p |
| BF362 | 30p |
| BF367 | 13p |
| BF371 | 17p |
| BF414 | 18p |
| BF420 | 16p |
| BF421 | 18p |
| BF422 | 21p |
| BF423 | 15p |
| BF440 | 16p |
| BF451 | 17p |
| BF455 | 14p |
| BF458 | 19p |
| BF459 | 19p |
| BF461 | 60p |
| BF462 | 62p |
| BF469 | 30p |
| BF470 | 28p |
| BF471 | 28p |
| BF479 | 30p |
| BF493 | 18p |
| BF494 | 16p |
| BF595 | 16p |
| BF596 | 16p |
| BF597 | 10p |
| BF615 | 30p |
| BF758 | 41p |
| BF869 | 22p |
| BF870 | 22p |
| BF872 | 23p |
| BF960 | 38p |
| BF963 | 40p |
| BF964 | 38p |
| BF966 | 40p |
| BFR40 | 26p |
| BFR51 | 21p |
| BFR62 | 21p |
| BFR79 | 26p |
| BFR90 | 52p |
| BFR91 | 99p |
| BFX29 | 20p |
| BFX84 | 20p |
| BFX85 | 20p |
| BFX87 | 15p |
| BFX88 | 15p |
| BFX89 | 60p |
| BFY17 | 30p |
| BFY18 | 40p |
| BFY41 | 28p |
| BFY50 | 14p |
| BFY51 | 14p |
| BFY52 | 14p |
| BFY56 | 26p |

| | |
|---|---|
| BFY57 | 26p |
| BFY64 | 25p |
| BFY90 | 45p |
| BLY48 | 85p |
| BLY49 | 85p |
| BR100 | 14p |
| BR101 | 43p |
| BR103 | 37p |
| BSX20 | 16p |
| BSX26 | 18p |
| BSX29 | 19p |
| BT106 | 90p |
| BT109 | 90p |
| BT116 | 80p |
| BT119 | 100p |
| BT120 | 100p |
| BU100A | 110p |
| BU104 | 100p |
| BU105 | 80p |
| BU108 | 100p |
| BU110 | 110p |
| BU111 | 140p |
| BU124 | 60p |
| BU126 | 70p |
| BU204 | 75p |
| BU205 | 70p |
| BU208 | 76p |
| BU208A | 80p |
| BU208D | 100p |
| BU325 | 56p |
| BU326 | 85p |
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| BU406D | 95p |
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| BU408D | 95p |
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| BU426 | 120p |
| BU500 | 110p |
| BU526 | 80p |
| BU801 | 95p |
| BU806 | 120p |
| BU807 | 95p |
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| MJ2501 | 110p |
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| MJE29A | 30p |
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| MJE340 | 25p |
| MJE350 | 80p |
| MJE520 | 30p |
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| OC29 | 80p |
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| OC71 | 30p |
| OC72 | 50p |
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| TAG4443 | 76p |
| TAG4444 | 76p |
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| TIP29A | 22p |
| TIP29C | 26p |
| TIP30 | 26p |
| TIP30C | 30p |
| TIP31A | 24p |
| TIP31C | 30p |
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|---|---|
| TIP32A | 24p |
| TIP32C | 26p |
| TIP33 | 50p |
| TIP34 | 50p |
| TIP41A | 22p |
| TIP41C | 25p |
| TIP42A | 22p |
| TIP42C | 26p |
| TIP47 | 40p |
| TIP48 | 40p |
| TIP50 | 60p |
| TIP51 | 120p |
| TIP52 | 120p |
| TIP53 | 120p |
| TIP54 | 140p |
| TIP105 | 65p |
| TIP106 | 65p |
| TIP107 | 65p |
| TIP110 | 47p |
| TIP111 | 50p |
| TIP112 | 40p |
| TIP115 | 45p |
| TIP116 | 45p |
| TIP117 | 50p |
| TIP120 | 43p |
| TIP121 | 46p |
| TIP122 | 47p |
| TIP125 | 47p |
| TIP126 | 56p |
| TIP127 | 56p |
| TIP141 | 90p |
| TIP142 | 90p |
| TIP145 | 65p |
| TIP146 | 90p |
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| TIP2955 | 42p |
| TIP3054 | 45p |
| TIP3055 | 42p |
| TIS43 | 45p |
| TIS44 | 40p |
| TIS61 | 15p |
| TIS88A | 45p |
| TIS90 | 15p |
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| ZTX107 | 11p |
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| ZTX502 | 18p |
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| ZTX504 | 26p |
| ZTX550 | 24p |
| 2N.696 | 26p |
| 2N.697 | 22p |
| 2N.698 | 40p |
| 2N.699 | 45p |
| 2N.706A | 22p |
| 2N.708 | 22p |
| 2N.914 | 28p |
| 2N.918 | 36p |
| 2N.930 | 18p |

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| 2N.1132 | 28p |
| 2N.1613 | 24p |
| 2N.1711 | 24p |
| 2N.2102 | 50p |
| 2N.2160 | 300p |
| 2N.2218A | 24p |
| 2N.2219 | 24p |
| 2N.2221 | 23p |
| 2N.2222 | 23p |
| 2N.2369 | 16p |
| 2N.2484 | 20p |
| 2N.2646 | 40p |
| 2N.2904 | 20p |
| 2N.2905 | 20p |
| 2N.2906 | 18p |
| 2N.2907 | 16p |
| 2N.2926 | 6p |
| 2N.3019 | 28p |
| 2N.3053 | 18p |
| 2N.3054 | 35p |
| 2N.3055 | 35p |
| 2N.3055H | 50p |
| 2N.3440 | 58p |
| 2N.3442 | 85p |
| 2N.3702 | 9p |
| 2N.3703 | 9p |
| 2N.3704 | 9p |
| 2N.3705 | 9p |
| 2N.3706 | 9p |
| 2N.3707 | 9p |
| 2N.3708 | 9p |
| 2N.3771 | 85p |
| 2N.3772 | 90p |
| 2N.3773 | 100p |
| 2N.3819 | 29p |
| 2N.3866 | 68p |
| 2N.3903 | 11p |
| 2N.3904 | 11p |
| 2N.3905 | 11p |
| 2N.3906 | 11p |
| 2N.4031 | 25p |
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| 7815 | 35p |

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| 7905 | 35p |
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| 7915 | 40p |
| 7918 | 40p |
| 7924 | 40p |
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| 78L12 | 28p |
| 78L15 | 28p |
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| 74LS136 | 35p |
| 74LS138 | 38p |
| 74LS139 | 40p |
| 74LS145 | 83p |
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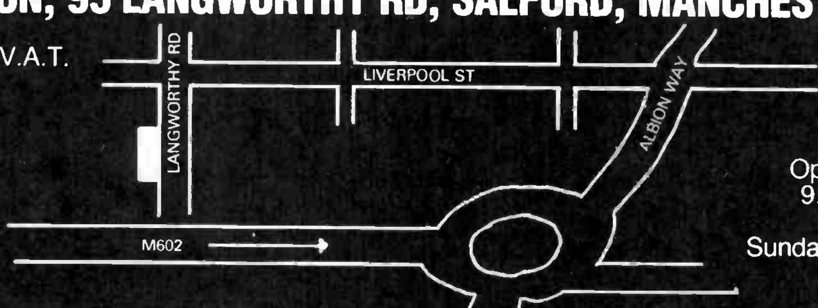


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Philips 12 Volt car aerial 15.00
Philips 2 off 30 watt car speakers. £15.00

10 Mixed TV & radio speakers £4
Philips car radio speaker door pair £7
2× Hi-Fi Philips car tune up tweeter EN8320 £10
ITT CVC45 8 way resistor unit for v/cap £3
4700/10v × 10 50p
68/16 × 10 50p
150/16 × 10 50p
47/25 × 10 50p
220/25 × 10 50p
1/250 × 10 50p
8000/30v 50p
470/40v × 10 £1
22/100v × 10 £1
100/350v 70p
400/350v 70p
.47/500v 25p
1/600v 25p
.022/1kv 10p
**VIEW DATA PANELS**
NEW £3
Tel-Tex Decoder VM6101/01 **£10.00**

12 Volt Aerial Changer over Relays 144 Mc/s 45 watts 50p

**GEC Hitachi**
V/Cap tuner, after 1979 Series £8
6 Push Button Unit for GEC 2100 Series
Replacement for Touch Button Unit £8

8 SEG LED Display with driver I.C. LM1017 50p

20AX GEC Split Diode lead £1.00

ITT Tel-Tex Decoder Panel £6.00

**MODEM**
Line Terminal Unit
**VM6501 £6**
Designed to work at 1200/75 or 1200/1200. Diagram and Connection Data Supplies
ITT Display Tube 58705 50p
8 Seg Display FND500 20p
Mullarad 12.5V/170 Mc/s 45 watts BLW60C £4.00
Mullard Broadband R.F. power modules UHF. BGY22E £10.00
PT4236C, PT8706C, PT9783 £3
ITT Micro Phone M5 50p with switch
1½ Volt Sub Min Relays 25p
12 Volt Relays Double changer over 10A contacts 35p
Sub-min Relay low voltage 50p
Mains relay coil 230v 30p
Philip PP3 batterys 10 for £3
12v battery holders A.A. 50p 1.5 battery
T/V 12v 2 pin battery lead 30p

25pcs Precision Screwdriver & Tool Set £6.00
25 Watt Solder Iron £4.00

**Various Tools and Accessories**
T/V V/Aerial 300Ω or 75Ω £1.50
L.C.D. clock display with alarm 75p
* D/P push mains switch 20p each
Mains lead & two pin socket for radio cassette 35p
3 Video Leads £1.00
Xcelitr cutter £3.90
T/V loop aerial 75p
Radio Telescopic Aerial £1.00
Philips Neon Lamps for TV sets 5p
Freeze £1.20
Foam Cleaner £1.20
Contact Cleaner £1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona All at £1.40
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt £1.00
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket £3.00
Screen locking agent, large can £1.50
20 GEC Service Manuals £5.00
Red E.H.T. LAED and Anode Cap £1.00
10 × G11 Cap 470/250 £15.00
Weller solder iron 15 watt/25 watt £5.00
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 60p
70ML Silicone Sealer (clear) £1
100 Coax Plugs £12.00
De-solder pump + 2 nozzels Philips £4.00
Plastic box for i.c.s 6"×3"×½" 50p
Flat Red LED and Green 5p
500gm 60/40 solder reel £6
Solder 1 kilo reel £5.50
Clearweld glue pack 30p
Dual v/u meter -20 – +10db £1
K30 thermistor 232266298009 75p
GEC Mains Power Supply R.E.G. £3.00
De-solder Pump £2.50

18R/11 Watt 25p

SONY 1400KV Chroma Panel £6
SONY 1400KV Touch button unit £3.50

12 Volt Mains Trans 500M/A £1.00
18V or 12 Volt Mains Trans 500M/A 75p

**Quantity Reductions**
BY204/4 25 for £1.00
BY206 25 for £1.00
W005 bridge 20 for £2
KT3 touch button black 6 for £1
G11 touch button red 6 for £1
K30 full remote Dawer Ass with 3 I.C. £7.00
K30 VHF. UHF Dawer Ass £6.00
BY298 3 amp/fast/R 20 for £1.50
BU126 10 for £6.00
BU205 10 for £8.00
BU105 10 for £6.00
2SC2122A 10 for £8.00
BF458 10 for £1.00
BF224 20 for £1.40
OA90 40 for £1.00
KT3 multicaps 10 for £7.50
50 Ceramic Condensers £1.50
Mixed Mounting Kit for Power Transistors 50p
300 Condensers £1.50
300 Resistors £1.50
150 Electrolytics £2.00
15 Bulbs 40p
Antistatic Discloth 5 for £1
100 Diodes £1.50

Plastic Boxes 4¼ × 4 × 1 × ¾ 50p
100 Fuses £2.00
100 W/W Res. £1.50
BF 199 20 for £1
10 × 20 Turn 100k pots. Rank £2
BF 470 20 for £2
20 Slider Knobs 70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

**Mixed Packs**
TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits £1.00
50 Mixed AC series Transistor £4.50
25 Panel Mount Bulbs & Neons £1.50
10A £1.50
25 LED red/yellow/green £1.50
20I/C Holders £1.20
20 Large LED Red £1.00
20 Small LED Red £1.00
10×20 Turn 100K Pots £1.00
100 Transistor £2.50
20 Convergence Pots 80p
10 Thermistors 50p
20 Slider Pots £1.00
30 Presets 50p
15 VDR + thermistors, degaussing, etc. £1.00
40 glass reed switch £1
10 press to make switch 70p
40 Pots £1.50
5 Tube Bases £1.00
1,000 Diodes, Condensers, Resistors on Bandolier £2.00
Lucky Dip 600 gram £1.00
Jungle Bag 5Kg £5.00
20 Knobs £1.00
20mm Fuse Holders
Chassis Mount 20 for £1
IN4001/6 100 mixed £2.50
EHT Diodes, small 20 for £1

200 Mixed Diodes £1

100 500M/A Fuse £1
100 1.225 Amp Fuse £1

**SENDZ COMPONENTS**
**TO ORDER SEE BACK PAGE**

# SENDZ COMPONENTS
## TO ORDER SEE BACK PAGE

**Thorn Spares**

New 9000 Decoder £8.50
9000 Frame panel £8
9000 Cyclops panel £1.50
8000/8500 timebase panel £8
8800 convergence panel £6
8500 convergence panel £6
4000 Power supply £3
1600 Mains lead, switch
3500 6 push button + cable form £1.50
T605 1vNPN T066 80v/6A 10p
9000 Sound output panel £1
3500 Focus unit £1.50
3500 Mains Trans £4
3500 cut outs 10 for £4
3500 IF panel £2
3500 Frame panel £3
3500 Line panel £3
3500 A1 Diode 20p
Export 3500 IF panel £2
IC board with set of SN74LS £1
4000 Tube base £4
3500 A1 pots 50p
Beam limiter panel £1.50
3500 Power panel with Y969 £1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA £3.50
Rank/Toshiba preh unit 0354 £9.50
2 banks of 3 PB unit. Pye 731 £2
4 Push button unit preh £1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
G8 Push Button Unit £10.00
KT3 12 Push button unit £2.00
KT3 (Export) 12 P.B.u £2
6 Push button Unit Thorn £1.00
6 Push button Unit fits GEC & Decca etc. £6.00
Hearing aid unit £3
Rank Z718 4 P/B/Unit MECH £4
7 Button Unit GEC with Lamps £7
Bush T515A 6 button unit with Pos & mains lead. 6 bush buttons. Bush £6.00
697 Push Button Unit £6.00

**Mains Droppers**

G8 2R2+68R £1.25
G8 47R 15 watt 75p
Pye 731 3+56+27R 50p
Thorn 50/17/1K5 £1.00
120/20/20/48/117 £1.00
270/10/6 for Thorn 4000 50p
18/320/70/39 £1.10
Thorn 50-40R-1K5 50p
Ae Socket & Lead
GEC, ITT, Philips, Pye 25p
7×3¾ Thorn £1
Thorn 1600-1700 £1.50
Rank Toshiba Tube Bases 30p

**Speakers**

| | | | |
|---|---|---|---|
| 6×4 G11 | | 25 ohm | £1.00 |
| 5½×2½ | | 3 ohm | £1.00 |
| 5×3 | | 80 ohm | 70p |
| 5×3 | | 50 ohm | 50p |
| 5×3 | | 35 ohm | 70p |
| 6×4 | | 15 ohm | £1.00 |
| 7×3 | | 70 ohm | £1.00 |
| 8×5 | 8 ohm | 15 watt | £2 |
| 8×5 | | 8 ohm | £1 |
| 5×3 | | 8 ohm | 70p |
| 7×3 | | 16 ohm | £1.00 |
| 5" dia | | 16 ohm | £1.00 |
| 5" dia | | 8 ohm | £1.50 |
| 6½" dia | | 4 ohm | £1.50 |
| 6½" dia | | 3 ohm | £1.50 |
| 2¾" dia | | 8 ohm | 75p |
| 3" dia | | 8 ohm | 75p |
| 4½" sq. | | 15 ohm | 75p |
| KT3 speaker | | K30 | 75p |
| 3" dia | | 15 ohm | 60p |
| 1690 5×3 | | 12 ohm | £1 |
| K45 Philip | | 15 ohm | 75p |
| K30 15 watt | | | £1 |

**KT3-K30**

OF-550 E.W. 10p
OF-513 correction 10p
OF-557 50p

**DIODES**

| | |
|---|---|
| BY 126 | 10p |
| BY 127 | 10p |
| BY 133 | 10p |
| BY 134 | 10p |
| BY 164 | 50p |
| BY 176 | 25p |
| BY 179 | 40p |
| BY 184 | 25p |
| BY 187 | 10p |
| BY 190 | 40p |
| BY 196 | 30p |
| BY 198 | 10p |
| BY 204/4 | 8p |
| BY 206 | 8p |
| BY 208/800 | 8p |
| BY 210/400 | 5p |
| BY 210/800 | 10p |
| BY 223 | 60p |
| BY 224/600: 4.8A/600v bridge | 50p |
| BY 226 | 15p |
| BY 227 | 15p |
| BY 228 | 10p |
| BY 229/400 | 30p |
| BY 237 | 5p |
| BY 254 | 10p |
| BY 255 | 30p |
| BY 298 | 10p |
| BY 299 | 10p |
| BY 406 | 8p |
| BY 527 | 20p |
| BY 407a | 10p |
| BY 527 | 10p |
| BY 602 | 10p |
| F 247 | 10p |
| GP20G | 5p |
| XK 3102 | 50p |
| BYV 28/200 | 20p |
| 800v/2.75 amps | 10p |

International Rectifier EHT Diodes G770/HV34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p

K35 Decoder £8
K35 Sound OP £4
K35 Split Diode 3122-138-35930 £10.00

Fidelity Tube Base with transitor & focus pot £1.50

Bush Tube Base on panel £1.00

**Line Transformers**

Hitachi Split Diode and GEC 1981 to 1984 £13
2 I/Pots 3,500 1 off each type £3.00
G8 Trans. Philips £7.00
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W AD5308F + Stik + Lead £1.50
1690 Thorn EHT over-wind with diode lead & anode cap £2.50
GEC 2040 £3.00
GEC 2110 £7.00
Mullard AT 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono T704A £3.50
Split Diode Trans £7.00
GEC 20 AX Rank Z522 £3
Rank L.O.P.T. Z970 £3
CVC 5-8-9 £3.00
CVC20 ITT £3.50
AT2080/15 £5.00
CVC30 ITT £5.00
CVC32 Line Tran £6.00
CVC800 Line Trans £6.00
CVC40 Slip/Diode £12.00
CVC 45 £5.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
EHT Split Diode Leads ITT £1.00
3500 L.O.P.T. & HT Trans each £2
LOPT Rank Z763 £5
K35 Split Diode 3122/13835930 £7

**Triplers**

KT3-30 BG 200/43 £6.00
ITT CVC 5-8-9 £3.50
Rank T25LE Tripler £2.00
Rank 11TCP A823 £3.50
TU 25 30K Rank £3.00
11 TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
9000 Thorn £6
9500 Thorn £4.50
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £5.00
TVK 76/9 £3.00
G8 £4.00
CVC 825 ITT CVC 20/25/30/32 £3.50
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBQ Pye 731 £3.00
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
ERO Tripler print type with foacs PO7 BG2087 £5
T/text ultrasonic rec'r panel £14.00
Video cassette lamps on lead. 12-14V. 50p or 3 for £1.00
20 for £5.00 200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E.W. Transformer 50p
G11 E/W. coils £1.00
G11 Transient Suppressors 245V 10 for £1.00
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver head £1
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 50p
KT3 receiver panel £8
KT3 line driver transformer 50p
Pye, K30, GEC, etc. Pre-mains stand-by switch £1
Decca 80/100 IF panel £5
NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P.B.U. £24
Tube base + base unit for 820 Euro chassis £4.00
GEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel (untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
G11 Line Driver Transformer 35p
KT3 Front Panel Control Assy. £2.50
BTW 30/50 50p

**TELETEX DECODER**

I.C. SAA 5051 K30
I.C. SAA 5042
I.C. SAA 5030
I.C. SAA 5020 etc. £8.00
BTW 92/800R £3
25A473 PNP C/P 10p

Rank T20 Z136 Panel £6
NEW Pack THORN 17 off Manual £5.00
NEW 1617 THORN Chassis with ICs & AU113 £5.00
30V Power Supply 500M/A 4×2¼ £2.50
Pye 731 Power Panel £13
6 Diode Universal Triplers £4.00
NEW PYE 725 line O/P panel with L.O.P.T. & Tripler £10.00
NEW GEC 20AX Power Supply Switch Mode £12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI £10
Field + Jungle panel for GEC 3133/3135 £1.50
GEC 2110 line panel with transformer £7.00
GEC 2110 tuner unit + IF Panel £12.00
Pye/Chelsea Line op panel £12.00
Pye 205 T/unit £3.90
Pye 205 Line op panel £7.50
Pye 713 IF panel and tuner £7.00
Pye 713 Chroma £10.00
Pye/Chelsea Timebase panel with LOPTI £10.00
Pye 731 Frame Panel £5.00
Pye 731 Convergence Panel £5.00
Pye 731 Chroma £10.00
Pye 731 IF panel + tuner £10.00
Pye CDA/205 panel £6.00
GEC portable chassis + LOPTI 2114 New £4.00
Thorn 1613/1713 chassis 9.75
G9 Power Panel £6.00
Mono RANK Chassis 127A NEW £10.00
NEW G9 Frame Panel £10.00
NEW G11 IF Panel £7.00

G8 Tuner Unit + Panel £4.00
G8 Power Supply £5.00
G8 6 Sloping PBU £8.00
G8 IF & Chroma £6.00
G8 Chroma £3.00

G11 IF Detector £3.00
G11 Selector gain module £3
Complete CVC 825 Chassis (both panels) £40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F £3.00
Z909B RANK IF Panels
Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q £2.50
K35 IF £6.00
Z743 RANK IF Panel
Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P £1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
Pye 6 button switch portable £1.00
GEC V/cap VHF/UHF tuner and IF+sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £6.00
2110 GEC Power Panel £8.00
GEC Power Supply (Export) £10.00
G11 dynamic correction panel £6
CVC 20 Front panel with sliders + mains input panel £4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £9.00
CVC9 slider pots panel 50p
CVC 5 Mains on/off + 5 pots £2
Universal Focus. Fits Pye, Thorn and Decca Units.
T147 Rank tube base on panel £1.00
Z718 Focus Unit £1.50
T20 Focus Unit £1.00
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
K30 Tube base on panel £1.00
TX10 Focus Units £7.00
CVC 32 Focus Unit 75p
Fedility Focus Unit 14R-14S 30p
3500 Thorn Focus Unit £1.00
ITT Small for use with Split
Z718 Bush Focus £2.00
Diode 50p
TV11 50p
Remo TV12SP 50p
1600 Thorn EHT Rec and Lead 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 rec stick 5p

G11 drawer ASS 3 pots Mains switch and lead £2.00

K30 Drawer Ass with pots cable forme £1.00

Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228 £10

**DISPLAYS**

4040 Clock £1.00
7seg Red LED 50p
2 digit LED 8.8 50p
2 digit LED ÷1.8 with panel + MC14511 £1.00
4700/63 £1.50
250/64 10p

| | |
|---|---|
| .1/250AC | 20p |
| .1/100 | 5p |
| 1/100 × 10 | 30p |
| 22/100 | 10p |
| 4.7M/100 | 5p |
| 470/100 | 20p |
| 2000/100 | 70p |
| 4700/100 | 75p |
| 47/160 | 10p |
| 300 300/300V | 80p |
| 800/160 | 50p |
| .1/250 Pulse | 5p |
| 2.2 250v | 10p |
| 3n3/250 A.C. | 10p |
| .33/250V | 20p |
| .39/250V | 15p |
| 4n7/250 tested 5KV | 25p |
| 22/250 | 15p |
| 47/250 | 10p |
| 100/250 | 20p |
| G11 470/250V | £1.75 |
| GEC600/250 | 60p |
| 700/250 | £1 |
| 300+300 MFD 350v | £1.00 |
| 800/250 | 40p |
| 32/300 | 20p |
| 4/350 | 5p |
| 8/350 | 8p |
| 4.7M/350v | 10p |
| 33/350 | 20p |
| 220/350 | 30p |
| 300/350 | 40p |
| 400/350 | 50p |
| 10/375 | 10p |
| 22/375 | 15p |
| 220/385 (ITT) | 75p |
| 330/385 CVC 820HT | 60p |
| 0.1/400 | 15p |
| KT3 E/W .39/400 | 20p |
| .56K/400v | 20p |
| 4700pf/400 | 10p |
| .22/400 | 10p |
| 8/400 | 15p |
| 33/400 | 20p |
| 400/400 | 40p |
| 394K/400V | 20p |
| 220/450 | 40p |
| .47/500 | 25p |
| 0.1/600 | 15p |
| 0.1/1200V wire end | 20p |
| 0.1/450 A/C wire end | 20p |
| .047/600 | 15p |
| 0.047/1000 | 10p |
| 0.01/1000 | 10p |
| 0.1/1000 | 10p |
| .47/1000v | 65p |
| .47/250V A.C. | 10p |
| .001K/1250 | 10p |
| 0.0047/1500 | 10p |
| .005/1500 | 10p |
| .0105/1500 | 10p |
| 1n8/1500 | 15p |
| 2n0/1500 | 10p |
| 2n2/1500 | 15p |
| .01/1600 | 15p |
| G11.8200/2KV | 15p |
| 0.1/2KV | 20p |
| 10n/2KV | 15p |
| 3n9/2KV | 15p |
| 0.0015/2KV | 10p |
| 5n2/2KV | 10p |
| 6n2/2KV | 15p |
| 2n0/2KV | 15p |
| 2n2/2KV | 15p |
| 470pf 4KV | 10p |
| 7500pf/2KV | 10p |
| 3000PF/3000V | 10p |
| 4n7/2KV | 15p |
| 8n2/2KV | 15p |
| 0.0082/2500 | 15p |
| 150/3500 | 10p |
| 1800/4KV | 5p |
| 4.7nf/5KV | 10p |
| 170/8KV | 10p |
| 180/8KV | 10p |
| 210/8KV | 10p |
| 1000/10KV | 10p |
| .47/100V | 80p |

CVC 20-25-30 Mains Switches 75p
Infra Red and Ultrasonic G11 Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Mains Remote Switch 2865 ohm £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
G11 Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
THORN Rotary Mains Switch 50p
G8 Mains Switch 75p
Thyristor 600/4 amp C106/2 24p
G11 Preh Red LED P/Button for C.H. Change 20p
RANK TOSHIBA Transductors TPC-2011 50p
Mains Switch ITT Long Type Print 75p
Mains Switch Philip Long Type TAG 75p
Mains Switch GEC Long Type TAG 75p
Thorn 12 or 24 volt battery convertor for portable colour T/V £6.00

Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF T115A £13.00

**Multi-Caps**

220 MFD Sprague 385V 50p
4,700/75 6 amp Rip £2.00
350V 300M + 300M £1.00
400V 400M 60p
350V 400M 60p
Thorn 3500
175/100/100/350v £1.00
KT3/200/25/25/385v £1.00
300+300+150+100+50MFD 350V £2
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
150/200/200/300v 70p
400/400/200v £1.70
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
200/200/75/25M 325V £1
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
Jelly pot Thorn 00D4/013 £3
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
225+25/380 GEC 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT 8 and 6 Push Button £1.00
Pye 725 LOPTs £6.00
Pye 731 LOPTs £6.00
Thorn 8500-8800 LOPTs £5.00

CMD 800 Chassis. No tuner £20.00

TAG 226/600 50p
BD 650 50p
UPC 574 30p
BSS 38 30p

G11 £1.50
1 I.C. Receiver Panel

3 I.C. Power Supply G11 Full Remote Receiver Panel £3

Teletext Receiver Model T1 £95
Fits on top of TV with handset.

FET Power VN88AF 50p

PHILIPS SBC 469 Stereo Microphone £23.00
Meters Hills 520 £17.00
Meters Hills 420 £15.00
Infra-red Tester Handset £12.00

**Infra Red**
**Hanset Tester**

Works at 24 feet – Sound repeater.
Works off 9 volt battery £8.00
Fits in top pocket.

**Repaired Handsets**

Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £9.00

GEC Full Remote Infra red. 1983 models £15.00

Timers, 60 mins, small £1.00

G11 Touch Unit Full Remote £13
G11 Ultrasonic Teletext Handset £24.00
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