JULY 1982

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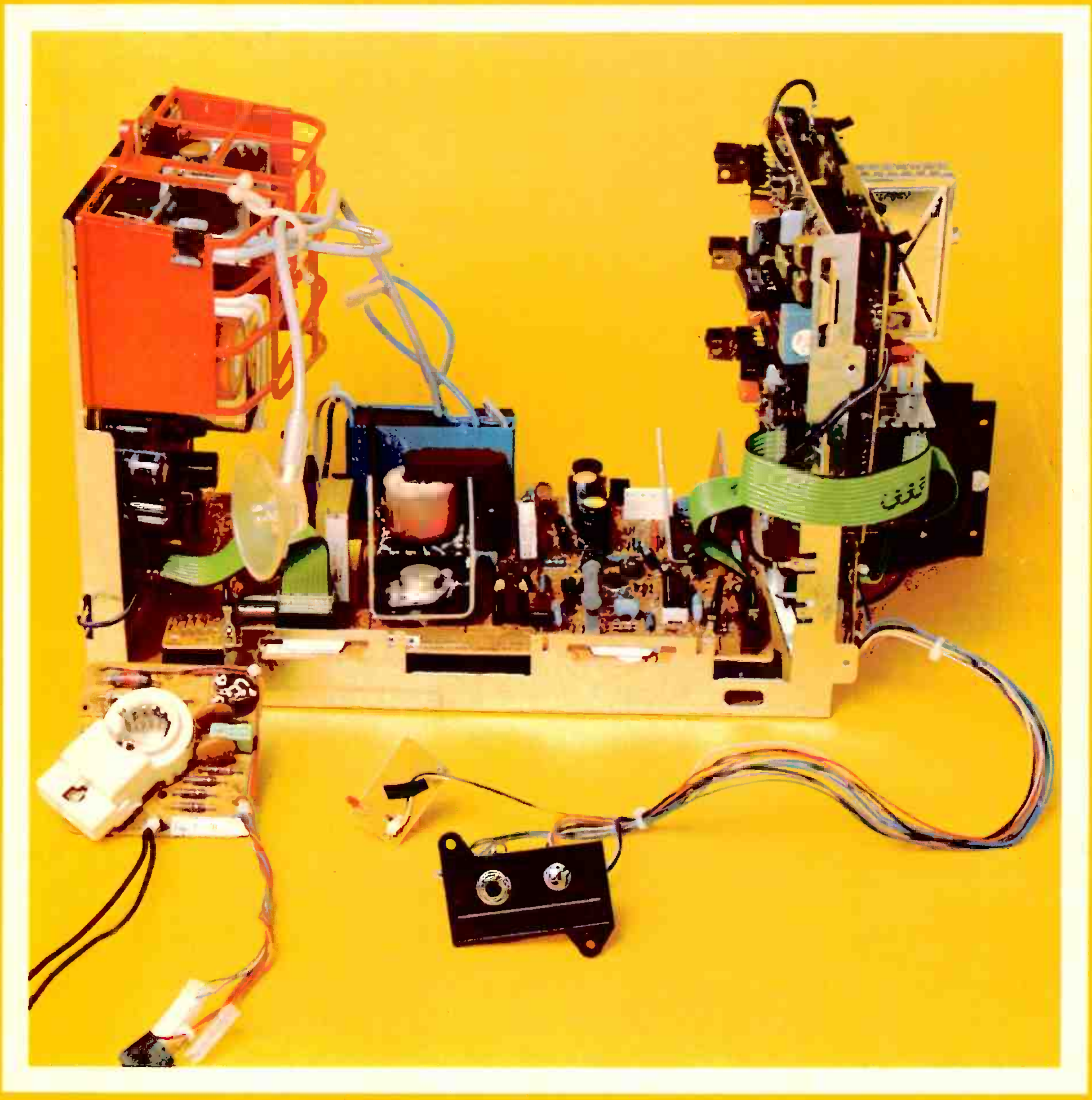
80p

# TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



## REDIFFUSION Mk 4 CHASSIS

## VIDEO SYNTHESIZER REVIEW

### Servicing Features:

## GEC C2110 SERIES

## LUXOR 90° HYBRID CTVs

# TELEVISION

July 1982

Vol. 32, No. 9
Issue 381



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

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

## this month

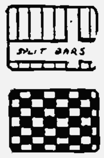


**OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 21**

# MANOR SUPPLIES

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

**TEST DEMONSTRATIONS AT 172 WEST END LANE**



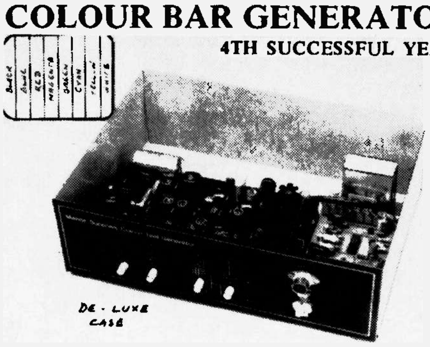

- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ 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. 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 | **£80.50** |
| Standard Case (10½″×6½″×2¼″) | **£5.50** |
| De Luxe Case (10″×6″×2¼″) | **£8.50** |
| Optional Sound Module (6MHz or 5.5MHz) | **£4.50** |
| Built & Tested in De Luxe Case including Sound Module | **£115.00** |

Post/Packing £2.00.
All above prices include VAT 15%

## PAL COLOUR BAR GENERATOR (Mk 4)

**4TH SUCCESSFUL YEAR**




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

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

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

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

**MANOR SUPPLIES TELETEXT ADAPTOR KITS**

**MK 1** (Texas XMII) Cable remote control **£170.20** p.p. £2.80
**MK 2** (Philips/Mullard) Infra-red remote control **£227.70** p.p. £2.80.
Further details on request.

Goods available if in stock immediately over shop counter (Mail order between 3 days and 2 weeks

## TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

Large selection tested colour panels for popular models.

**SPECIAL OFFER** Leading makers Tuner-Timer in De Luxe Case. 12 station touch tune UHF-VHF + IF amp. Video Audio Outputs, Digital Clock etc. Less than half original trade price **£74.75** p-p £3.50.

**TELEVISION MAGAZINE PROJECT PARTS**

NEW COLOUR PORTABLE TV
TV PATTERN GENERATOR — SMALL SCREEN MONITOR
MONO PORTABLE TV — LARGE SCREEN COLOUR TV
PHONE, CALL, OR SEND FOR LISTS
WORKING MODELS & PANEL TEST SERVICE AT
172 WEST END LANE.

TV SOUND IF TRANSISTOR, FULLY TESTED **£7.82** p.p. £1.00.
**SAW FILTER IF AMPLIFIER PLUS TUNER** COMPLETE AND tested for T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
**SPECIAL OFFER** TEXAS XMII TELETEXT MODULE NEW & TESTED, AT REDUCED PRICE **£57.50** p.p. £1.60.
**TELETEXT** 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£7.80** p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
**CROSS HATCH UNIT KIT**, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 60p. (ALUM CASE **£2.60** DE LUXE CASE **£5.50** p.p. £1.20.)
ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
**UHF SIGNAL STRENGTH METER KIT £21.60** (VHF version also available). ALUM CASE **£2.00** DE LUXE CASE **£8.50** p.p. £1.80.
**CRT TESTER & REACTIVATOR PROJECT KIT** FOR COLOUR & MONO **£29.40** p.p. £2.00.
**BUSH Z718 BC6100 SERIES** IF PANEL **£5.75** p.p. 90p.
**BUSH A816** IF PANEL (SURPLUS) **£1.90** p.p. 90p.
**DECCA "Bradford"** IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
**DECCA 80**, SERIES, IF FRAME TB **£5.75 each** p.p. £1.40.
**GEC SERIES I** MONO PANELS **£2.10** p.p. £1.30.
**GEC 2110** Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
**GEC 2040** DECODER PANEL **£2.88** p.p. £1.60.
**GEC 2040** IF PANEL **£3.22** p.p. £1.40.
**GEC 2040** (SERIES) CDA PANEL **£2.88** p.p. £1.40.
**PYE 713/715** Convergence **£5.75 each** p.p. £1.40.
**THORN 3000** LINE T.B. PCB **£5.75** p.p. £1.00.
**THORN 3000** BEAM LIMITER PANEL **£1.72** p.p. 80p.
**THORN 3000** VID, IF, DEC, Ex Rental **£5.75 each** p.p. £1.30.
**THORN 8800** Varicap channel selector & front control unit **£4.37** p.p. £1.80
**THORN 8000/8500** IF/DECODER PANELS salvaged **£5.52** p.p. £1.80.
**THORN 8000/8500** FRAME T.B. PANELS salvaged **£5.52** p.p. £1.40.
**THORN 9000** LINE T.B. (incl. Lopt etc.), Salv., spares **£8.62** p.p. £2.00.
**THORN 9000** SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
**THORN 9000** IF/DECODER PANELS Salvaged **£8.90** p.p. £1.60.
**PHILIPS 210, 300** Series Frame T.B. Panels **£1.15** p.p. 80p.
**PHILIPS G8/G9** IF/DECODER Panels for small spares **£4.80** p.p. £1.40.
**G8** IF Panels for small spares **£1.75** p.p. 95p.
**G8** Decoder panels salvaged **£4.25**. Decoder panels for spares **£2.00** p.p. £1.40.
**VARICAP, U321, U322, ELC 1043/06 ELC 1043/05 £7.82** p.p. 80p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. Control units, 3PSN **£1.40**, 4PSN **£1.75**, 5PSN **£2.00**, 6PSN **£4.00** p.p. 60p. Makers special types available.
**SPECIAL OFFER** ELEVEN POSITION VARICAP CONTROL UNIT UHF/VHF **£2.10** p.p. £1.00.
**BUSH** "Touch Tune" Varicap Control Unit **£4.40** p.p. 95p.
**VARICAP UHF-VHF** ELC 2000S **£9.80**. BUSH TYPE **£7.82** p.p. 85p.
**VARICAP VHF** MULLARD ELC 1042 **£7.95** p.p. 80p.
**UHF/625** Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, Mullard 4 position push button **£4.80** p.p. £1.50.
**MULLARD EP9000** Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
**LINE OUTPUT TRANSFORMERS.** New guar. p.p. £1.35.

| | | | |
|---|---|---|---|
| BUSH 145 to 186SS series | £9.20 | R.B.M. A823 | £5.60 |
| BUSH, MURPHY A816 series | £9.80 | R.B.M. Z179 | £6.70 |
| DECCA 20/24, 1700, 2000, 2401... | £8.80 | R.B.M. Z718 | £16.60 |
| FERG., HMV, MARCONI, ULTRA 850 to 1580 | £6.80 | R.B.M. T20, T22 | £11.30 |
| THORN 1690, 1691 | £10.50 | R.B.M. T20, T22 Bobbin | £6.44 |
| GEC 2000 to 2038 series | £7.80 | DECCA Bradford (state Mod No.) | £10.15 |
| GEC series 1 & 2 | £9.20 | DECCA 80, 100 | £10.15 |
| INDESIT 20/24EGB | £8.80 | GEC 2028 | £5.60 |
| ITT/KB VC1 200, 300 | £8.80 | GEC 2040 | £6.70 |
| MURPHY 1910 to 2417 series | £8.80 | GEC 2110 Series | £12.20 |
| PHILIPS 19TG 170, 210, 300 | £8.80 | ITT CVC 5 to 9 | £11.30 |
| PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series | £8.80 | ITT CVC 30 Series | £10.15 |
| SPECIAL OFFER | | PYE 691-697 | £14.80 |
| GEC 2114J/FINELINE | £5.50 | PYE 713-715 | £7.85 |
| PYE 40, 67 | £2.00 | PYE 731 to 741 | £7.85 |
| THORN 1590/1591 | £5.50 | PHILIPS G8, G9 | £10.15 |
| KB VC ELEVEN (003) | £2.00 | PHILIPS 570 | £7.85 |
| | | THORN 3000/3500 SCAN, EHT | £7.85 |
| | | THORN 8000/8500/8800 | £14.80 |
| COLOUR LOPTS p.p. £1.40 Bobbins 80p | | THORN 9000 to 9600 | £10.15 |

**OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.**
**TRIPLERS** Full range available.
**Special Offer:** Thorn 1400 5 stick EHT Tray **£1.72** p.p. 65p.
**THORN** 3000/3500, 8000, 8500, MAINS TRANSF. **£10.15** p.p. £1.80
6·3V CRT Boost Transformers **£5.80**, Auto Type **£3.20**, p.p. £1.20.

**CALLERS WELCOME AT SHOP PREMISES Telephone 01-794 8751/7346**
**THOUSANDS OF ADDITIONAL ITEMS AVAILABLE, ENQUIRIES INVITED**
**LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS**

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

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

**Mail Order: 64 GOLDERS MANOR DRIVE, LONDON N.W.11.**
ALL PRICES INCLUDE VAT AT 15%
**CLOSED FOR HOLIDAYS JUNE 21 TO JULY 3 INCLUSIVE.**

# P. V. TUBES

## REPLACEMENT ELECTROLYTICS

| | |
|---|---|
| PYE 169 (200/200/100/32) | 2.12 |
| PHILIPS 320 (400/400/200V) | 2.07 |
| DECCA 30 (400/400/350V) | 2.96 |
| DECCA 80 (400/350V) | 3.15 |
| DECCA 100 (800/250V) | 3.15 |
| DECCA 1700 (200/200/400/350V) | 4.83 |
| PHILIPS G8 (600/300V) | 2.21 |
| PHILIPS G9 (600/300V) | 2.21 |
| PHILIPS G11 (470/250V) | 2.90 |
| PYE 691/7 (200/300/350V) | 2.39 |
| PYE 731 (600/300V) | 2.31 |
| RBM A823 (2500/2500/30V) | 1.26 |
| RBM A823 (600/300V) | 2.30 |
| RBM Z146 (300/300/350V) | 3.15 |
| RR1 T20A (200/400V) | 2.00 |
| ITT CVC5/9 (200/200/75/25) | 2.47 |
| ITT CVC 20 (220/400V) | 2.00 |
| GEC 2110 (600/250V) | 1.94 |
| GEC 2040 (1000/2000/35V) | 1.19 |
| GEC 2040 (300/300/150/100/50) | 4.10 |
| THORN 3500 (400/40V) | 30 |
| THORN 950 (100/300/100/16/275V) | 1.83 |
| THORN 1400 (150/100/100/100/150/320V) | 2.79 |
| THORN 1500 (150/150/100/300V) | 2.01 |
| THORN 1500 (12/300V) | 31 |
| THORN 3500 (175/100/100/400/350V) | 2.46 |
| THORN 3500 (1000/63V) | 65 |
| THORN 3500 (1000/70V) | 84 |
| THORN 8000/8500 (2500/2500/63V) | 1.54 |
| THORN 8000/8500 (700/250V) | 2.31 |
| THORN 8000/8500 (400/350V) | 2.56 |
| THORN 9000 (400/400V) | 3.05 |
| GEC (200/200/150/50) | 2.64 |

## ELECTRONIC TUNERS AND ASSEMBLIES

| | |
|---|---|
| Mullard ELC1043/05 | 7.60 |
| Mullard ELC1043/06 | 7.60 |
| 4 P/B DECCA/GEC/ITT | 5.80 |
| 6 P/B DECCA/GEC/ITT | 7.00 |
| 4 P/B PYE | 9.00 |
| 6 P/B PYE | 16.00 |
| PHILIPS G8 Tuner | 10.50 |
| PHILIPS G8 Ass. (Square/Early) | 13.50 |
| PHILIPS G8 Ass (Sloping/Late) | 13.90 |
| PHILIPS G9 Tuner | 10.50 |
| PHILIPS G11 Tuner | 9.00 |
| ITT/PYE/GEC 7 Button P/B | 13.95 |
| GEC 2110 6 way P/B | 7.75 |
| U321 UHF Tuner | 7.50 |
| THORN 8800 SELECTOR (HMV Model 2725/6 way round button) | 7.50 |
| THORN 9000 SELECTOR | 11.40 |
| U322 | 7.20 |
| HITACHI 4 way Chan Selector (Also Rank A823) | 8.00 |
| RR1 T20A 6 way Chan Selector | 9.75 |
| RR1 T20/22/26 | 11.00 |
| PHILIPS 8 way TIP Switch Unit (suitable for all G11) | 23.00 |

## SWITCHES

| | |
|---|---|
| 4A Double Pole On/Off Switch | 66 |
| General Purpose Push/Push | 84 |
| Philips G8 Push On/Off Switch | 1.38 |
| 4A Double Pole Rotary On/Off | 66 |
| A1 Beam Switch (THORN 3500) | 50 |
| A1 Controls 5m (THORN 3500) | 69 |
| GEC 2110 A1 Control IM5 (Red, Blue, Green) | 58 |
| GEC 2040 On/Off Switch | 88 |
| On/Off Switch G11/G12 | 1.58 |
| On/Off Switch GEC/TCE TX9/10 | 1.06 |

## FUSES

| | Per type | Pack of 10 |
|---|---|---|
| **1¼" QUICK BLOW** | | |
| 100ma | | 73 |
| 250ma-500ma-750ma 1A | | 54 |
| 1.5A-2A-2.5A-3A-5A | | 45 |
| **1¼" ANTISURGE** | | |
| 250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A | | |
| 1.5A, 2A | | 1.60 |
| 2.5A, 3A, 5A | | 2.49 |
| **20m ANTISURGE** | | |
| 80ma | | 3.43 |
| 100ma | | 2.30 |
| 160ma, 200ma | | 2.09 |
| 315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A | | 1.18 |
| 2.5A, 3.15A | | 1.59 |
| **20mm QUICK BLOW** | | |
| 100ma, 250ma, 500ma, 630ma, 800ma | | 81 |
| 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A | | 40 |
| **1" MAINS** | | |
| 2A, 3A, 5A, 10A, 13A | | 91 |

## AERIAL ACCESS.

| | |
|---|---|
| Aerial Jump Lead 2m | 90 |
| Triang Splitter | 1.20 |
| Surface Mount Splitter | 1.70 |
| Surface Mount Outlets | 80 |
| Cable Clips per 100 | 1.18 |
| Coax Plugs per 10 | 1.80 |
| P.V.C Tape | 35 |
| F.M. Plugs | 25 |
| PL259 Plugs | 40 |
| Line Connectors | 35 |
| Reducers for PL259 | 16 |
| T.V. Filter 50db Rejection 27mhz | 2.10 |
| Attenuators 6db, 12db, 18db | 1.60 |
| Olympic II Set Top | 2.20 |
| Aerial Isolator Kit | 2.08 |

## ANTIFERENCE

| | |
|---|---|
| CS200/SP Comb/Splitter | 2.96 |
| SB11 Indoor Splitter | 1.91 |
| COB11 Single Outlet | 78 |
| TRR/VSP Transformer 75-300R | 2.25 |
| Super Set Top Aerial | 6.80 |
| Caratenna | 7.80 |
| XG8 High Gain Aerial A-B-CD or W/B | 17.50 |

**NB** A full range of aerials and accessories available from trade counter

## LABGEAR

| | |
|---|---|
| CM7025 UHF High Gain MHA 24V (Specify A-B or C/D) | 15.66 |
| CM7061 Power Unit 12V | 10.19 |
| CM7062 Reg Power Unit 12V | 11.11 |
| CM7060 MHA 10db 12V W/B | 8.51 |
| CM7065 VHF/UHF MHA W/B 12V | 12.39 |
| CM7067 UHF 12V MHA (Specify A-B or C/D) | 9.26 |
| CM7063 UHF 12V MHA High Gain (Specify A-B or C/D) | 13.78 |
| CM7053 Behind Set UHF Amp. (Mains) | 11.24 |
| CM7054 Behind Set UHF Amp. (Battery e.g Caravans) | 9.00 |
| CM7043 Second Set Amp. UHF | 10.47 |
| CM7093 Behind Set UHF Amp. 3 Sets | 13.20 |
| CM7063 Dist. Amp VHF/UHF 17db/output 12V | 19.14 |
| CM7073 VHF/UHF 8+1 Dist Amp | 37.37 |
| CM9700 27mhz CB Suppress | 3.50 |
| CM6011 Outdoor Splitter (2 way) W/B | 6.76 |
| CM9003 Flush Single Outlet | 1.27 |
| CM9010 Flush Twin Outlet | 1.69 |
| CM6006 6 Way Passive Splitter | 10.97 |
| CM7042 TV Games Combin. | 2.43 |
| CM9009 Flush TV/FM Outlet | 2.63 |
| CM7069 Tri Star Amplified Set Top Aerial W/B | 16.75 |
| CM7090 Amplified Caravan Aerial 12V DC W/B | 14.78 |
| CM6038 UHF/VHF 625 Pattern Gen | 91.47 |
| CM6052 UHF/VHF PAL Colour Bar Gen | 223.86 |
| CM7056 Teletext Adaptor | 210.00 |

## NEW VALVES

| | | | | | |
|---|---|---|---|---|---|
| 30FL2 | 1.60 | EZ80/1 | 56 | PD500 | 2.93 |
| DY802 | 72 | GY501 | 1.45 | PFL200 | 1.35 |
| DY86/7 | 66 | GZ34 | 1.56 | PL36 | 1.15 |
| ECC81 | 60 | KT66 | 7.00 | PL81 | 94 |
| ECC82 | 68 | KT88 | 8.00 | PL82 | 46 |
| ECC83 | 60 | PC86 | 81 | PL83 | 1.43 |
| ECC84 | 80 | PC88 | 81 | PL84 | 84 |
| ECC85 | 98 | PC92 | 90 | PL95 | 1.00 |
| ECC88 | 1.35 | PC97 | 1.14 | PL504 | 1.50 |
| ECF80 | 80 | PC900 | 80 | PL508 | 2.30 |
| ECF82 | 88 | PCC84 | 70 | PL509/19 | 4.50 |
| ECF86 | 1.50 | PCC85 | 85 | PL802 | 3.00 |
| ECH81 | 1.04 | PCC88 | 82 | PY33 | 61 |
| ECH84 | 1.13 | PCC89 | 79 | PY88 | 81 |
| ECL80 | 84 | PCC189 | 1.02 | PY500A | 1.90 |
| ECL82 | 77 | PCC805 | 1.40 | PY800/1 | 69 |
| ECL86 | 84 | PCF80 | 75 | UCF80 | 67 |
| EF80 | 68 | PCF86 | 1.13 | UCH81 | 1.43 |
| EF85 | 68 | PCF200 | 1.35 | UCL82 | 84 |
| EF86 | 1.19 | PCF800 | 1.38 | UCL83 | 94 |
| EF89 | 1.43 | PCF801 | 1.13 | UL84 | 1.02 |
| EF183 | 68 | PCF802 | 86 | U26 | 1.30 |
| EF184 | 68 | PCF805 | 1.80 | U191 | 95 |
| EH90 | 1.02 | PCF806 | 1.30 | 6F23 | 85 |
| EL34 | 3.50 | PCF808 | 1.63 | UY85 | 80 |
| EL81 | 2.05 | PCH200 | 1.45 | PL802T | 3.00 |
| EL84 | 68 | PCL82 | 78 | 40KD6 | 4.50 |
| EL90 | 82 | PCL83 | 2.00 | 21LU8 | 3.00 |
| EL509 | 4.50 | PCL84 | 81 | 17DW4A | 1.60 |
| EY86/7 | 68 | PCL85/805 | 90 | 3AT2B | 2.25 |
| EY500A | 1.50 | PCL86 | 81 | 12BY7A | 3.75 |

## CAPACITORS AXIAL

| Volts | Mfd | Price |
|---|---|---|
| 6V3 | 33 | 9 |
| 10V | 22 | 8 |
| | 47 | 8 |
| | 100 | 10 |
| | 220 | 12 |
| | 470 | 20 |
| 16V | 33 | 11 |
| | 68 | 11 |
| | 220 | 14 |
| | 1000 | 20 |
| | 3300 | 53 |
| 25V | 10 | 8 |
| | 22 | 8 |
| | 47 | 10 |
| | 100 | 12 |
| | 220 | 19 |
| | 470 | 24 |
| | 1000 | 38 |
| | 2200 | 48 |
| | 4700 | 80 |
| 40V | 10 | 10 |
| | 22 | 10 |
| | 400 | 30 |
| 63V | 1 | 8 |
| | 2.2 | 8 |
| | 4.7 | 8 |
| | 10 | 10 |
| | 15 | 12 |
| | 22 | 10 |
| | 47 | 18 |
| | 100 | 20 |
| | 220 | 32 |
| | 470 | 40 |
| | 1000 | 56 |
| | 2200 | 85 |
| 100V | 10 | 13 |
| | 22 | 15 |
| | 47 | 20 |
| | 100 | 29 |
| | 220 | 35 |
| 450 | 1 | 25 |
| | 4.7 | 30 |
| | 10 | 30 |
| | 22 | 58 |
| | 33 | 64 |
| 500 | 1 | 32 |
| | 10 | 32 |
| 600 | 1 | 35 |

## MIXED DIELECTRIC CAPS

| Volts D.C. | | |
|---|---|---|
| 250V | 0.91mF | 84 |
| 400V | 0.22mF | 20 |
| 600V | 0.1mF | 38 |
| 1000V | 0.01mF | 20 |
| | 0.047mF | 29 |
| | 0.033mF | 31 |
| | 0.1mF | 32 |
| | 0.22mF | 48 |
| | 0.47mF | 75 |
| 1250V | 0.1mF | 45 |
| | 0.91mF | 85 |
| 1500V | 0.0022mF | 19 |
| | 0.0047mF | 20 |
| | 0.022mF | 24 |
| | 0.033mF | 59 |
| | 0.005mF | 60 |
| 2000V | 0.0052mF | 70 |

## CERAMIC CAPACITORS

**63V** A range of pref values **each**
22pF-4700pF 6p

## MINIATURE SKELETON PRESET POTS

**Horizontal or Vertical**
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K-100K-220K-470K-1M0 — **15p each**

## STANDARD SKELETON PRESET POTS

**Horizontal or Vertical**
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K-100K-220K-470K-1M0-2M2-4M7 — **15p each**

## SLIDER POTENTIOMETERS

**Lin or Log**

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

## MIDGET CONTROLS

**Insulated Spindle Length 44mm**

**Log or Lin Without Switch**
5K-10K-25K-50K-100K-250K-500K-1M — 39p

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

## THERMAL CUT OUT

| | | |
|---|---|---|
| THORN 3000 2A Metal | | 1.60 |
| THORN 8500 2.5 Plastic | | 1.60 |
| GEC 2040 Metal | | 2.50 |

## MULTITURN POTS

| | |
|---|---|
| 100K | 55 |
| GEC TCE | 55 |
| PHILIPS G8 DECCA, RANK | 55 |

## THICK FILM RESISTOR NETWORK

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

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

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|---|---|---|
| DF615 Full Range Speaker 6½" | | 8.95 |
| SE500 Headphones | | 3.75 |
| SE540 Headphones with Volume Control | | 5.50 |
| SE600 Lightweight Headphones | | 7.95 |
| **Multimeters** | | |
| KEW 7N | 2,000 opv | 5.25 |
| EM5 | 5,000 opv | 9.95 |
| EM10 | 10,000 opv | 11.50 |
| EM50 | 50,000 opv | 19.95 |
| EMC321 Carrying Case for above | | 2.25 |
| Digital Meter TS1000 | | 44.50 |
| MM20 | 20,000 O.P.V. | 21.95 |
| MM50 | 50,000 O.P.V | 25.95 |
| MM100 | 100,000 O.P.V | 36.50 |
| Case for MM100 | | 15.95 |
| T1206 2 Station Intercom | | 6.95 |

## DATA BOOKS (No VAT)

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

## ELECTROLUBE PRODUCTS

| | |
|---|---|
| Electrolube Adhesive | 59 |
| Electro-Mech lubricant | 1.39 |
| Elect. cleaning solvent | 1.50 |
| Freezer | 1.39 |
| Foam cleanser | 1.00 |
| Heat transfer compound | 1.07 |
| Silicone compound | 1.81 |
| Special contact fluid (Snorkel) | 2.07 |
| Permagard | 1.43 |
| Elec. mech lubricant pen | 69 |

## CONVERGENCE PRE-SETS

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

## METRIC CONVERGENCE POTS

PHILIPS G8
5R-10R-20R-50R — 35

## EVER READY

| | |
|---|---|
| 13A Compact Plug | 43 |
| 13A Super Plug | 64 |
| 13A Rubber Plug | 69 |
| 13A 2 way Adaptor | 1.79 |
| 13A 3 way Adaptor | 2.15 |
| Batten Lamp Holder | 88 |
| Cordgrip Lamp Holder | 62 |
| 13A Trailing Socket | 1.00 |
| Flex Connector | 60 |
| Ceiling Rose | 65 |
| 13A Shaver Adaptor | 1.10 |
| Single Socket Mount Box (13A) | 47 |
| Double Socket Mount. Box (13A) | 84 |
| Plateswitch Mount Box | 45 |
| 5A Extension Lead | 5.86 |
| 13A Switched Socket | 1.40 |
| 13A Double Switched Socket | 2.71 |
| 5A 2 way Switch | 78 |

## EVER READY RECHARGEABLE BATTERIES

| | |
|---|---|
| **CHARGERS** | |
| **CH1/22** For PP3/NN1604 1 battery (RX22) | 6.40 |
| **CH4/50** For HP7/NN1500 1-4 batteries (RX6) | 5.55 |
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| **CH3/RX4** For SP2/HP2/NN1300 SP11/HP11/NN1400 HP7/NN1500 2-4 batteries in pairs (RX6-RX14-RX20) | 9.55 |
| **BATTERIES** | |
| RX6 – HP7/NN1500 | 1.39 |
| RX14 – SP11/HP11/NN1400 | 2.17 |
| RX20 – SP2/HP2/NN1300 | 2.34 |
| RX22 – PP3/NN1604 | 4.69 |

## VIDEO/AUDIO

| | |
|---|---|
| VHS E180 Video Tape | 7.00 |
| PHILIPS VCC 240 (2x2) | 8.06 |
| PHILIPS VCC 360 (2x3) | 12.08 |
| PHILIPS VCC 480 (2x4) | 16.11 |
| Video Cassette Cases (any format) | 80 |
| Video Record Heads VHS | 30.00 |
| Video Record. Heads Philips V2000 | 49.00 |
| Scotch Audio Tape | |
| C90 Ferric | 65 |
| C90 Super Ferric | 96 |

## SERVICE AIDS

| | |
|---|---|
| SERVISOL Freeze-It | 92 |
| SUPER SERVISOL | 84 |
| SERVISOL Foam Cleanser | 82 |
| SERVISOL Plastics Seal | 85 |
| SERVISOL Silicone Grease | 98 |
| SERVISOL Tubes Silicone Grease | 1.56 |
| SERVISOL Aero Klene | 72 |

## SUNDRY TUNER ACCESS.

| | |
|---|---|
| RANK Tuner P B | |
| 1½" × ¼" | 35 |
| 2" × ¼" (yes we have some!) | 35 |
| 2" × ⅜" | 35 |
| RANK Drive Cams | 10 |
| GEC 2110 Tuner Neons | 14 |

## SUNDRIES

| | |
|---|---|
| Delay Lines DL60 | 2.20 |
| DL700 | 2.20 |
| DL50 | 2.20 |
| EHT Final Anode Cap | 53 |
| EHT Cable | 25p mtr. |
| 6.3V CRT Boost Trans | 4.35 |
| 13A Plug Top box 12 | 4.80 |
| Quick Set Adhesive | 78 |
| Moulded Plastic Hex 6mm Trim Tools | 10 |
| Double End 4mm/8mm Trim Tools | 20 |
| Focus Rod | 1.25 |
| Focus Holder | 2.00 |
| Keynector Safe Block (mains) | 5.50 |
| Cassette Drive Belts per pack of 5 | |
| 44.5mm | 1.65 |
| 64mm | 1.71 |
| 74mm | 1.80 |
| 57mm | 1.65 |
| 89mm | 1.90 |
| Torch (handy for tool box) | 42 |
| I.C. Inserter | 1.18 |
| SM Neon Screwdriver | 40 |
| DIN Plugs 3 pin | 22 |
| 4 pin | 22 |
| 180° 5 pin | 20 |
| Stnd 5 pin | 20 |
| Phono Plugs | 12 |
| Car Aerial Plug | 18 |
| 2.5mm Jack Plug | 14 |
| 3.5mm Jack Plug | 14 |
| Stnd Jack Plug | 20 |
| Stereo Jack Plug | 36 |
| 5A Connector Block (12) | 40 |
| Fuse Wire 5A-15A-30A | 5 |
| Battery Plug Thorn TV's | 28 |
| Gen Purpose Power Supply 9V 200ma 12V 200ma | 3.25 |
| Mains Connector 4 way 13A | 5.00 |

## TEST EQUIPMENT

| | |
|---|---|
| Portable Oscilloscope | 150.00 |
| Probes x10 | 10.90 |
| TF200 Frequency Meter | 155.00 |
| CRT Tester/Rejuvenator | 172.00 |
| KHP30 Measuring Probe (3 okv) EHT | 29.95 |
| T19 Transistor Tester | 9.80 |
| T120 RF Signal Injector | 4.00 |
| Avo 8 Test Lead Set | 4.20 |
| Degaussing Coil (stick type) | 15.50 |

## SERVICE AIDS

| | |
|---|---|
| SERVISOL Aero Duster | 90 |
| SERVISOL Excel Polish | 74 |
| Penetrating Fluid | 70 |
| Fire Extinguisher 640G | 2.60 |
| Heat Sink Compound 25G | 1.05 |
| Silicone Rubber Tube 110G | 2.98 |
| Solda Mop standard reel | 72 |

## NEW MONO TUBES

| | |
|---|---|
| MULLARD A31/510 110° 12" | 17.00 |
| MULLARD A34/510 110° 14" | 18.50 |
| VEGA A50/120WR 20" | 14.50 |
| VEGA A61/120WR 24" | 16.90 |
| VEGA 12" 90° (Japanese Types) | 15.00 |
| CME1520 (15" Mono) | 15.00 |

## SPECIFIC COMPONENTS

| | |
|---|---|
| **PHILIPS** | |
| G8 Knobs Sm | |
| Lg | 50 |
| E.W. Correction Coil G11 | 95 |
| Transductor 90° | 2.60 |
| **THORN** | |
| 1591 Speakers Sm | 3.45 |
| Lg | 3.95 |
| 1500 Frame Hold 390K | 32 |
| 1500 Line Hole 470K | 32 |
| 1500 Contrast 1K5 | 32 |
| Focus Control Thorn/GEC | 1.83 |
| **DECCA 100** | |
| Bridge Transformer | 97 |
| 30 Series Width Control | 50 |
| BR9 Nodulohm | 60 |
| Height Control 2M2 | 25 |
| **RR1** T 20 Focus Control | 2.20 |

## L.E.D.'s

| | |
|---|---|
| 5mm | |
| **T1 ¾ PACKAGE** | |
| Red | 12 |
| Green | 14 |
| Yellow | 14 |
| Amber | 22 |
| **T1 PACKAGE** | |
| 3mm | |
| Red | 12 |
| Green | 14 |
| Yellow | 14 |

**FLASHING L.E.D.**

| | |
|---|---|
| CQX21 | 62 |
| CQX22 | 66 |

RED ONLY

**THREE COLOUR L.E.D.**
3 Colour options Red/Green/Yellow
V518P — 76

**PANEL CLIPS**
For stnd range L.E.D. as above

| | |
|---|---|
| 3mm | 4 |
| 5mm | 4 |

## SOLDERING EQUIPMENT

| | |
|---|---|
| Solder Iron Stands | 2.50 |
| WELLER Iron 15W | 4.31 |
| WELLER Iron 25W | 4.31 |
| WELLER 3/16" Single Flat Tip | 51 |
| MIN Soldering Iron | 5.00 |
| WELLER Heat Gun | 11.75 |
| (Pair) Tips for Gun | 42 |
| WELLER Cordless Iron | 24.78 |
| ANTEX Soldering Iron 25W | 4.89 |
| Solder Remover Sucker | 6.50 |
| Solda Mop | 72 |
| 500G Reel Solder | 7.00 |
| DIY Type Solder | 43 |
| 250G Solder | 3.50 |

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**THEN ADD 15% VAT TO TOTAL COST.**
Orders which contain aerosols or degaussing coils are very heavy – please add extra 30p per can/coil
**First Class Mail is used whenever possible.**
**All enquiries S.A.E. please.**
**VAT invoice on request.**
**SEE SPECIAL NOTE RE MAIL ORDER TUBE COSTS.**
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. As our regular customers know, orders telephoned in before 4 p.m. will be despatched the same day.
Give us a ring – we'll give you service.
Please ask if what you need is not listed – we will try to help.

# TELEVISION



## Changing Scene

In the past, the TV servicing industry has tended to be recession proof. After all, whatever else might happen the nation is not going to stop watching its TV sets, and someone will be required to attend to them when they go on the blink. The trouble is that they don't very often nowadays. Not those produced during the past three-four years anyway. There are still vast quantities of older sets around of course, cooking away and giving troubles of one sort or another from time to time, so there's still plenty of work to be done. But not enough.

We have been hearing reports of redundancies from numerous sources recently. Rental companies that have up-to-date stock for example no longer have the work load to be able to keep a fair sized service department going – it's been said that as a rough guide a service engineer must turn over work worth at least three times his salary for it to be economic to employ him. That implies a substantial work throughput. It's not that salaries themselves are or ever have been all that good in this business. The ungrateful public gets the benefit of course – in the form of low-priced goods that seldom require any servicing. For those in the trade the prospects have for many years been poor: they are caught between the low profits that price-cutting high street and discount operators have between them brought about and the technical improvements that have led to the TV receiver reliability of today.

At this year's RETRA conference John O'Neill, Philips Video's divisional director, declared "I think we're bloody nuts". This was after his succinct summary of the current situation: "We all agree that margins in all areas are insufficient. We all agree that the cost per service call has escalated because of inflation, though the cost per set in use has dramatically fallen because of quality and reliability. So what do we do about it? We give even more away to the consumer in the form of extended guarantees!" Competition may be the life blood of a business economy, but it can have disastrous consequences. One has only to think of recent events in the air travel business – of Laker and Braniff. The cost of air travel is now rising again. It had to.

In the TV field, the rental concerns have in the past been able to buck economic trends. Shoppers may stop buying, but the TV hire bill still gets paid. As a result, the TV rental companies have seldom suffered from cash-flow problems. The situation is no longer so favourable – for the immediate future anyway. To be able to compete with the reliable, low-cost sets available from retailers, the renters have had to up-date their stock. The video explosion has increased rental business considerably, but has involved a massive investment in VCRs. That investment is going to take some time to pay off. It's interesting that one of the largest rental businesses, the Electronics Rentals Group (Visionhire), has recently raised fresh capital in a rather unusual way – by taking over an investment trust and selling the trust's shares for cash! The aim was to reduce ERG's bank borrowings from £73m to under £40m. ERG is thinking both of its current affairs and future needs. By the end of the '80s it considers that the traditional rental outlet will have become a sort of local video-computer centre, providing video and domestic computer software and hardware. That could well be, but the point is that it will involve a great deal of capital expenditure.

Shouldn't all this video equipment mean a steady supply of work for the TV technician? We've suggested this much before, and certainly TV work is not about to come to an end. VCRs do not match the reliability of TV sets and require a certain amount of regular maintenance, while looking farther ahead there will be plenty of installation work once satellite TV transmissions start. But as a correspondent recently put it, "the engineers required can be obtained by transferring 'spare' ones from the TV side without having to employ extra staff". And trends on the TV side have led to all too many 'spares'.

The outlook is uncertain, though the employment prospects for those technicians who can keep up with the advancing technology and handle the growing amount of TV/video equipment are not too bleak. There are also the smaller operators who manage to make a living by keeping older sets bought at rock-bottom prices going for as long as possible – the problem here is the increasing cost of replacement parts for such sets. But the financial rewards of working in the TV/video servicing industry, never particularly generous, are unlikely to improve: unfortunately the money just isn't there.

Regarding the state of the trade generally, while 1981 was a very good year in terms of turnover a dramatic reversal has occurred in more recent months, with stocks rising to dangerous levels. "Trade", declared RETRA president Michael Peters at the recent conference, "is bloody awful".

### COVER PHOTO

Our thanks to Rediffusion Consumer Manufacturing Ltd. for the loan of the Mk. 4 chassis shown on the front cover. The chassis was photographed from the front, i.e. you see it from the other side when looking in the back of a set fitted with the chassis.

### APOLOGIES

A couple of sillies occurred last month. "Part 1" fell off page 420 and mysteriously appeared on page 402 after passing for press. Not too serious that. Our sincere apologies are due to Sendz Components however, part of whose advertisement appeared on both page 448 and the cover page iii.

# Servicing Luxor 90° Hybrid CTVs

**Part 1**

**Tony Thompson**

THIS article is based on the ex-rental Rediffusion RT531/22 series, which is fitted with the Luxor 90° hybrid colour chassis, though much of the information can be used for other similar models such as the Luxor 2237. Note however that Luxor/Skantic also produced a 110° hybrid colour chassis (see articles in the November/December 1980 issues of *Television*) which though superficially similar differs in major respects. The decoder and luminance/colour-difference output panels used in the two chassis are almost identical, but the i.f. strips and timebases are totally different. The PC92 valve in the 110° chassis is the field oscillator, while in this 90° chassis it's used in the width/e.h.t. stabilisation circuit – something that can be a bit misleading to say the least!

Large quantities of these well engineered ex-rental sets have come on to the second-hand set market and represent excellent value for money. They look reasonably up to date, and are by and large very reliable. Like all sets however there are problems and pitfalls for the unwary.

## Pre-purchase Examination

Pre-purchase examination is worthwhile of course. If you can get the back off, do so. It's held by two quick-release coin-slot turnbuttons – a good idea, marred somewhat by the brittle plastic used in manufacture. As the back is difficult to secure in any more conventional way, this is worth checking. Inside, look for completeness – some sets get robbed. Look for a tiny label bearing the note "RGB rejuve" or similar attached to the tube's degaussing shield. This tells you two things. First that the tube's been boosted and is probably clapped out: secondly that it's probably the original tube anyway, so if it's not clapped out it very soon will be. This doesn't mean that the set's a write off, but since a rebuilt tube represents a considerable investment careful thought is called for. If no little label is found the tube is probably a replacement and the chances are that it will be o.k.

Now look at the tuner – from the front of the set. Are the buttons in good order, with all the spun aluminium caps in place? These are not of the same size as used on other makes, so you'll not find caps to fit. The buttons are part of an integral and horribly complex band-switching/tuning head which is a definite weak spot. Tiny red indicators showing in the long window beside the buttons indicate the choice of bands: they should all be in the eleven o'clock position for Bands IV and V or you'll get no local stations! They are easy to adjust: simply turn the button in the appropriate direction – any button that is other than the one depressed. They should all be at u.h.f. anyway, but anonymous fiddlers lurk behind the piles of tube cartons and scrap chassis . . .

## Cabinet Repairs

Look for feet on the cabinet. If they are missing, check that the cabinet base isn't broken beyond reasonable repair. Chipboard is not strong, especially when it has wide cooling slots cut in it. Also inspect the condition of the veneer, because severe damage will be impossible to correct (and don't fall for the old tale about covering with Fablon: it's just not on, especially with these sets). Marks that have dented but not penetrated the teak may be removed by steaming with the wife's domestic iron and a damp cloth (don't have the iron too hot), but you'll have to be prepared to wire-wool the polyurethane and refinish with teak oil. Don't apply more polyurethane: teak is too greasy to allow proper adhesion of varnish under domestic conditions, and due to the wood's open grain the effect will be grotty. Small marks are best filled with plastic wood and disguised by painting over with modelling paint, using a small watercolour brush.

## Access

Access is a strong point of these sets. Two latches can be released to allow the chassis to slide out on metal/plastic runners. At the farthest out position the chassis can be pivoted to two preset positions, held by a spring-loaded plunger located near the large mains transformer at the bottom left. This gives access to the complete chassis, which consists of a long horizontal panel carrying the decoder and the sync/line oscillator/field timebase panels. The valved luminance/colour-difference panel is hinged to this, and at each end vertical panels carry at the left the i.f. and sound circuits and at the right the line output stage. These last two panels can be hinged outwards after removing self-tapping screws. The complete front panel, carrying all the controls and the tuner, can be removed after pulling off the control knobs and unscrewing two long securing bolts with knurled ends.

Unlike UK manufactured sets of the same era the panels are not easily removable, being permanently wired into the loom. This is only a minor problem in practice. The convergence panel is removable, but it's unlikely that you'll need to do this. Note that static convergence is set by means of three potentiometers in the centre of the convergence panel instead of the usual magnets on the convergence yoke. Convergence is usually good though never perfect, the board giving little trouble. Watch for the R/G horizontal differential coil however: it's mounted on the scan coils and tends to get knocked.

## Power Supply Circuits

The h.t. supplies are obtained from a bridge rectifier. This of course means that the chassis is at half mains potential regardless of the wiring polarity (if it's still the original Luxor mains lead, black is live). So ensure that your test equipment isn't earthed – it shouldn't be anyway.

The power supply circuits are commendably straightforward (see Fig. 1), with the discrete diode bridge being mounted on a small plug-in subpanel for ease of repair. The bridge is directly across the set side of the mains switch, protected by a fuse in each arm. Like the other

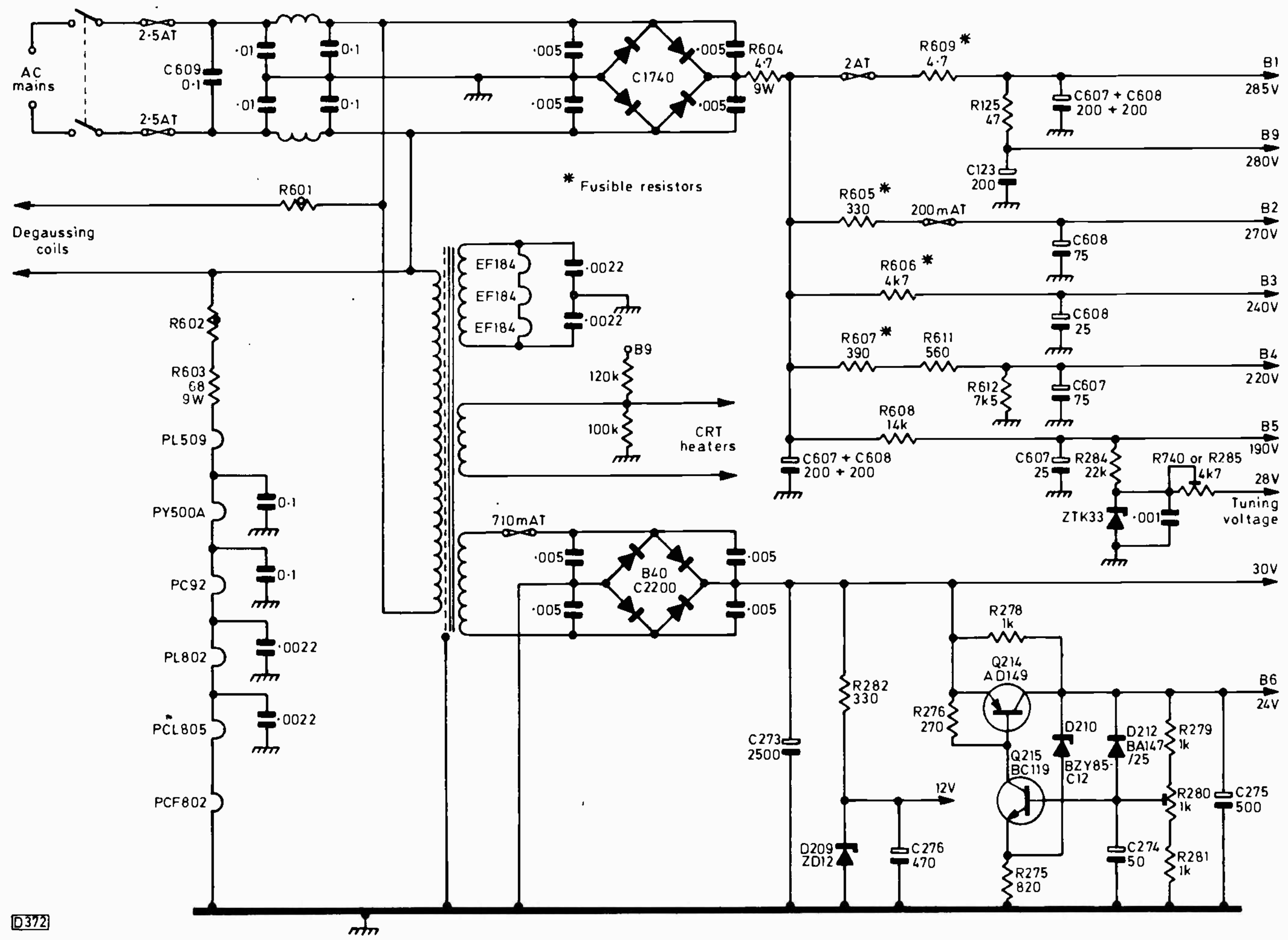



*Fig. 1: Power supply circuitry used in the Luxor 90° hybrid colour chassis. The 30V bridge rectifier, 24V stabiliser and associated components are mounted on the audio panel.*

fuses in the power supply, these are delay types. After rectification a series of wirewound resistors with attendant smoothing electrolytic sections provide outputs between 285V and 190V.

Fault-finding in this area is straightforward: dry-joints are common, but component failure is quite rare apart from the electrolytics which are naturally feeling their age and give rise to a variety of symptoms such as picture ripple or wide, slow hum bars. Don't try connecting parallel capacitors: replacement is the only cure. A faulty bridge rectifier diode can be replaced using the ubiquitous BY127, though you may consider it prudent to change the lot. Use the physically large diodes, and stand them slightly off the panel when soldering.

The heater arrangements are a little unusual. The PL802 luminance output valve and the field and line timebase valves are supplied from the mains via the bridge rectifier which thus acts as a wattless dropper, reducing the value of the dropper resistor required (R603). The c.r.t. heaters are fed from a secondary winding on the mains transformer, the three EF184 colour-difference output valves being series fed by another secondary winding.

A common problem is sound but no raster – a transistor audio circuit which in my experience is totally reliable is used. You'll find the three EF184s lit but the PL802 dead. Don't assume that the PL802 is to blame – most likely you'll find that the PY500A boost diode's heater is open-circuit.

When checking for shorts across the mains input, remember that the mains transformer's primary winding will read practically short-circuit – disconnecting it is the only sure way to check. The mains filter capacitor C609 is mounted on the panel and not across the switch itself. In the event of no results the switch is not above suspicion: it's a little difficult to replace unless you resort to subterfuge and fit a rotary type with a suitable knob (those used on GEC hybrids look reasonable – but only if you change *all* the knobs to match!).

## The IF Panel

You'll find no i.c.s in the i.f. and decoder departments. Transistors are used throughout. I.F. troubles seem to be confined to the two canned coils L222/L223 which form a bandpass circuit between the second and final i.f. stages. The cans are mounted on a small metal bracket along the lower inside of the vertical i.f. panel, connecting with the print lands via small slots cut in the Paxolin. This is another unit that's prone to physical damage, giving rise to the symptoms of weak luminance and noisy or no chroma. If you suspect this, waggle the cans whilst watching the screen: if the colour or gain flash up, you've got the culprit.

The only successful repair method is to unsolder the wires, noting the colours and connections carefully, then remove the self-tappers holding the bracket. You'll then be able to resolder the broken joints you'll find. Don't be tempted to increase the length of the wires materially to ease reassembly. Oddly, for no good reason that I can

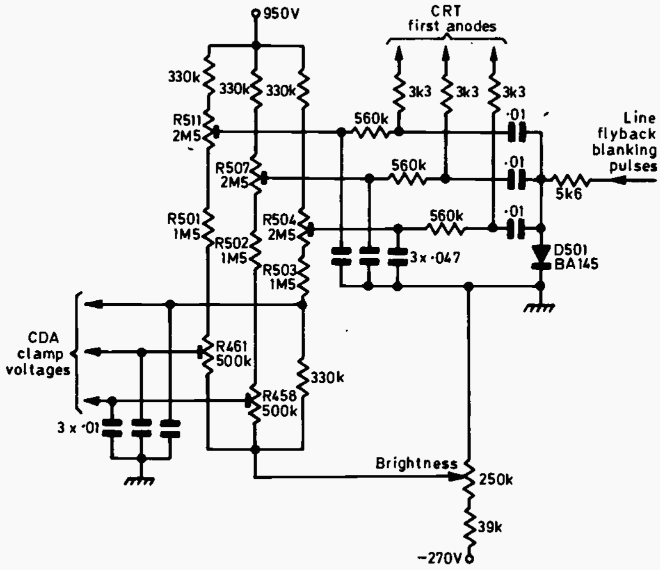



*Fig. 2: The c.r.t. biasing network. Note that there are no c.r.t. cathode drive presets. The 950V and −270V supplies come from the line output stage.*

think of, one of these units was responsible for a low hum on the sound.

Note that there is always some residual caption buzz which can be minimized with patience.

## The Decoder

The decoder circuits are also reliable, though all the presets can give trouble, especially the miniature types. It's best to replace them if in any doubt. The transistors used in the decoder are as follows:

| | |
|---|---|
| Q301/2 | Chroma amplifiers (BF195 and BF194 respectively) |
| Q303 | Delay line driver (BC147A) |
| Q304 | Gated burst amplifier (BC147B) |
| Q305 | Reference oscillator (BC147A) |
| Q306 | PAL switch driver. Feedback to the burst detector is taken from the collector of this transistor, which also provides the reference feed to the B −Y demodulator (BC107A) |
| Q307 | R −Y detector driver (BF194) |
| Q308 | Colour-killer (BC148C) |
| Q309 | Emitter-follower driving ident stage (BC147A) |
| Q310 | Ident stage (BC147A) |
| Q311/2 | Bistable (BC147B) |
| Q313 | B −Y detector driver (BF194) |

Q304 drives a single diode detector (D303) for a.c.c. and two synchronous detectors for the reference oscillator control loop and colour-killing.

The three EF184 pentodes drive the tube's grids – they are capacitively coupled with double-diode driven clamps. The PL802 drives the tube's cathodes via a simple diode beam limiter (no presets here).

As always, colour fault-finding is simplified if you've a good scope, though most faults can be dealt with by thoughtful test meter analysis. In the case of good monochrome but no colour, override the colour-killer by connecting test point M309 to chassis. This will probably produce running colour blinds, and adjustment of the oscillator coil L311 will then probably restore the colour. If the colour fails to lock, check the 4·43MHz crystal by substitution.

A distinct lack of one colour should lead to checks on the appropriate chroma demodulators and drivers (after checking the output stages of course), though the cause of such trouble in the decoder is more likely to be a stopped bistable, especially if the symptom is of one colour only being reduced rather than missing. This is a strange effect: when I've seen it, faces have had green shadows though the colours in brightly lit areas were correct. Scope or voltage checks will sort this out.

No chroma whatsoever means a check on the voltages around the reference oscillator and the chroma channel generally. Any of the transistors can fail, but don't overlook those presets!

## Video Output Stages

Partial or complete loss of one colour with good monochrome pictures is more likely to be due to a fault in the EF184 colour-difference output stages of course. A quick test here is to touch the upright 10kΩ anode load resistors R406, R422 and R441 – these run warm, the cool one giving the game away. Swap the valves around to confirm (it's unlikely to be the resistor itself). Other faults you may encounter on the valved output panel include clamping troubles due to diodes D406/7/8/9/11/12, giving at times an effect like a curtain of light down one side of the picture, or the appearance of severe impurity. Very odd colour effects, looking sometimes like a low-emission tube, can be caused by the 1·5MΩ resistors R501/2/3 going high in value – they are in series with the tube's first anode presets (see Fig. 2). The best test is to replace them. The large first anode presets themselves are not above suspicion.

As always the PL802 runs very warm indeed. Poor contrast could well be improved by fitting a replacement valve, but don't throw the old one away: the chassis doesn't have a lot of gain to spare, and the old valve might be fine in another set. This valve can also run into grid current, producing a smeary picture.

We'll deal with the timebases next month.

## *NEW IBA PUBLICATIONS*

Three new titles – "Digital Coding Standards", "Developments in Radio-frequency Techniques" and "Standards for Satellite Broadcasting" – have been added to the IBA's Technical Review series. The books are intended for those directly involved in broadcasting and are also available, free of charge, to libraries and educational centres in the UK and overseas. "Digital Coding Standards" contains six engineering papers covering the development and future applications of the latest component-coded digital video systems. Subjects covered in the r.f. techniques book include the Sabre adaptive aerial system, the use of comb filtering to reduce co-channel interference, a three-channel stereo/surround sound decoder design, and the effects of synthesizer phase noise plus the development of spectrally improved frequency synthesizers.

"Standards for Satellite Broadcasting" contains a detailed account of the experimental studies carried out in connection with the OTS satellite over the period 1978-81, including the use of digital transmission techniques. It shows how this work led to the IBA's proposed MAC system for direct satellite broadcasting. S.H.F. propagation studies are also described.

# Letters

## CLOCK-TIMER PROJECT

A couple of points gave me trouble with the microcomputer clock-timer project (December 1981 and subsequent issues). When first switched on the clock functioned satisfactorily, but when reading switching data from the memories to find out why this was erratic I found that they contained rubbish. Whilst investigating with a scope I noticed that proper operation was obtained with the probe on the data clock line (pin 11 of IC104). On the basis that the probe's capacitance is about 30pF, I soldered a 33pF ceramic capacitor between pin 11 and pin 39 (chassis). This appears to give reliable operation.

My second problem was that the Sunday, Monday and Tuesday LEDs were much dimmer than the rest, while the respective decimal points came on. I then realised that this was inevitable, as they are all returned to 0V via Tr110 and the decimal points are multiplexed. The latter have a forward voltage of only 1·7V, the figure for the yellow LEDs being 2·2V. A simple cure is to cut the track to pin 15 of the numerical display device and insert a 47Ω resistor. This still leaves the "illegal" decimal points, but they are somewhat dimmed: the correct decimal point, having nothing in parallel with it, is then more obvious, with the day LEDs at full brilliance. If individual displays (as recommended in the TMS1601 data sheet) had been used this problem would not have arisen, but I appreciate that this would have meant a more complex arrangement.
*T. C. Churchill,*
*Lancaster.*

## EW DIODE MODULATOR

I feel I should point out an error in your April issue: in the simplified circuit showing the power supply and line output stage arrangements used in the Rank T20 chassis (Fig. 2, page 305) the two diodes 5D6/7 are the wrong way round. These are the EW modulator diodes of course, and must be the other way round for the circuit to work.
*Jim Rainey,*
*Bangor, N. Ireland.*

*Editorial comment.* Jim Rainey is quite right. In our haste we got the diodes round the wrong way and failed to spot this when checking the drawing. Simple accounts of the mode of operation of this type of EW diode modulator circuit are not easy to find, so in penance we offer the following – the main bits are shown in Fig. 1. There are two aspects to EW correction. The line scan obviously has to be modulated at field frequency, but the circuit has to be arranged so that the e.h.t. remains constant – we don't want the e.h.t. to vary at 50Hz as well.

Let's consider the forward scan first. The EW drive consists of a field frequency parabola which is fed to the junction of the two diodes 5D6/7. 5D7 acts as a clamp, conducting on the peaks of the negative-going sections of the parabola (at the centre of the screen). The parabola is applied to 5L5 via 5C15, varying the impedance in series with the line scan coils in order to modulate the line scan as required. The width control (in the EW drive circuit) sets the mean d.c. level of the parabola.

As an incidental bonus with this type of circuit, when 5D7 conducts 5D6 also conducts, generating a 36V supply (in this case) across 5C8 – this action also generates the supply for the EW driver transistor. Note that when 5D7 conducts 5C15 is connected in series with the main scan-correction capacitor 5C11. This linearizes the scan at the centre of the screen, a requirement with the 20AX tube.

Now to the flyback bit. During the flyback, 5D6 and 5D7 are both cut off. This means that 5C12 is connected between the secondary winding on the line output transformer and (via 5C15) 5L5. The effect it has on the tuning of the line output stage and thus the e.h.t. depends on the pulse voltages developed – if the amplitudes of the pulses developed across the line output transformer's secondary winding and 5L5 are the same, 5C12 has no effect (it's virtually open-circuit). The net result is that the circuit's *LC* product and thus the flyback tuning and the e.h.t. are kept constant. This is a little more complicated than it might at first seem, since what 5C12 actually does is to adjust the fifth harmonic tuning of the line output stage. For those new to line output stage operation, the amplitude of the flyback pulse fed to the tripler can be – and is – controlled by adding to it an oscillatory waveform at the fifth harmonic of the oscillatory frequency of the line flyback pulse.

Other chassis that use the 20AX tube generally employ a high-level diode modulator circuit – the diodes are connected between the collector of the line output transistor and chassis. There are differences in the circuit operation, the main one being that the diodes provide most of the shunt efficiency diode action, i.e. their conduction contributes to the initial half of the forward scan, before the line output transistor is driven on to complete the scan.

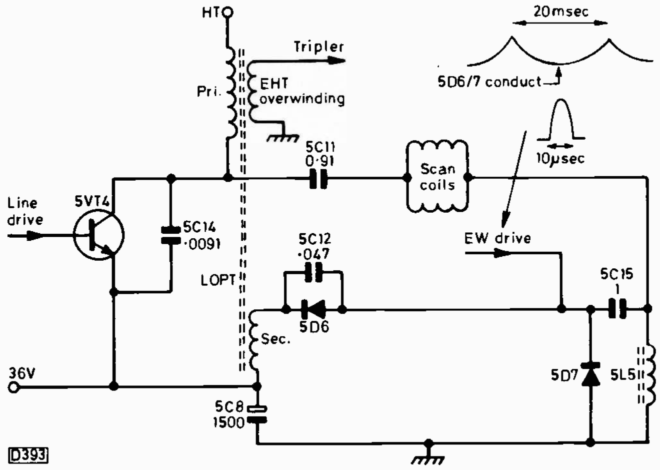



*Fig. 1: The Rank T20 chassis' EW diode modulator circuit.*

## CORE ADJUSTMENTS

Twiddling transformer cores is generally to be condemned – the work of bodgers. A judicious half turn this way or that can be a different matter however, and may work wonders where no amount of component changing will. This can be especially so where there's reason to suppose that vibration may have shifted a core – or that an "expert" may have got at it. Unless one's lucky enough to hit the nail first time, more than one core might have to be tried. A core that's hard to move should be left alone or tried last – if you can't move it, vibrations are unlikely to have done so. In addition the core could break, making matters worse.

Where no improvement is obtained the core should be returned to its initial position. It's all too easy to forget what that was however, especially if one is likely to get

distracted for some reason or other. The following procedure helps. Twist a short length of copper wire around the trimmer to form a pointer about 1cm long. Insert the tool and when it engages with the core adjust the pointer so that it just clears the can, marking the position with a fine-pointed lead pencil. Where there's no can, a piece of cardboard with a hole in the middle can be fitted to the former to enable a pointer marking to be made. If more than one turn has to be tried, write down the direction and number of turns made.
*Victor Rizzo,*
*Msida, Malta.*

### JOB SCENE

I sympathize with Mr. Todd (*Letters,* June) and his back injury, but would suggest that a more common type of "back injury" is that caused by the knife a fellow TV engineer or manager wields. All too many TV types seem to take glee in outsmarting the next man – they are their own worst enemies, hence also the reason why trades unions have never had any success in this field. There are great tensions of course, what with all the driving, customer aggro and overwork, often in poor lighting conditions. The average telly man tends to look ten years older than he is, and many snuff it in their early fifties.

Can anyone answer this one? Where have all the video geniuses suddenly come from? Types who could never repair anything properly are suddenly cast as clever video men. Could it be that a VCR is easier to fit into the van than say a 26in. B and O CTV?!

Except in tin-pot firms, TV jobs are certainly scarce here in the N.W. Contractor and video are good buzzwords just now!
*K. Wells, R.T.E.B.,*
*Liverpool.*

# Video Synthesizer Review

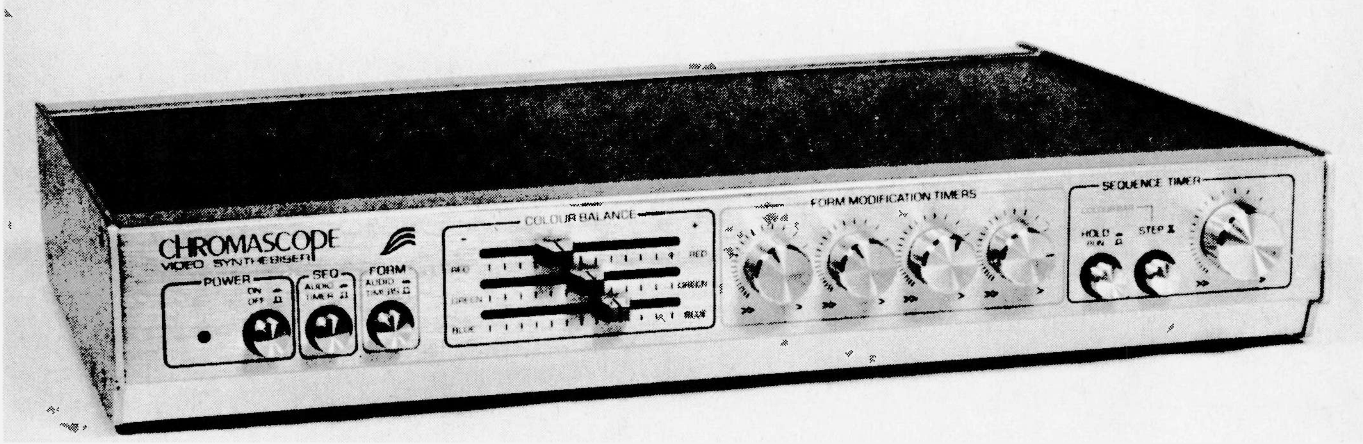
**Eugene Trundle**

THE synthesizer under review this month represents a slight departure from the usual sorts of things that are featured in our test reports. For a start, I've been trying to decide whether it's hardware or software. One oft-quoted definition says that it's hardware if you can kick it. Well, you could certainly kick this box of tricks, but what you're actually buying is electronically generated patterns. The Chromascope C101 video synthesizer is basically an electronic pattern generator which when connected to a TV receiver provides random colour patterns. It uses no tapes or moving parts, a combination of analogue and digital circuitry being used to produce a PAL-encoded signal which is modulated on to a u.h.f. carrier at around channel 38. It's powered from the mains via the 15V a.c. power unit supplied. The synthesizer will invent and display its own patterns, or synchronize them with an audio input via a rear-mounted standard DIN socket. The audio and r.f. connectors have a loop-through facility so that the unit can be integrated with other equipment in a domestic installation without any need to disturb plugs and sockets. Switching the synthesizer on cuts out the normal TV signal, injecting the pattern into the aerial socket instead.

There are five rotary controls on the front panel. Four of these set the "form modification timing" – the rate at which individual components of the pattern move and change shape and colour. The fifth, called the sequence timer, sets the rate at which new basic patterns are selected. Two press buttons are provided for use in connection with sequence timing: one allows you to freeze or hold the current pattern, while the second enables you to step through patterns manually. The patterns generated contain all combinations of colour, but the display can be biased towards any colour or combination of colours by means of three front-panel slider controls – one for each primary colour. Two further push buttons provide control over audio synchronization. The unit will accept a wide range of audio signal amplitudes at its input socket, and the sound source can be made to modify the pattern form or select a new pattern on each waveform peak, typically a drum beat. A colour-bar generator is also incorporated, mainly for tuning adjustment in the receiver.

### The Constituents

The unit is housed in an attractive case with a brushed aluminium front panel and silver controls. The top and bottom are made of heavy-gauge aluminium sheet with a leather-effect finish. All the electrical sockets and con-




*The Chromascope C101 video synthesizer.*

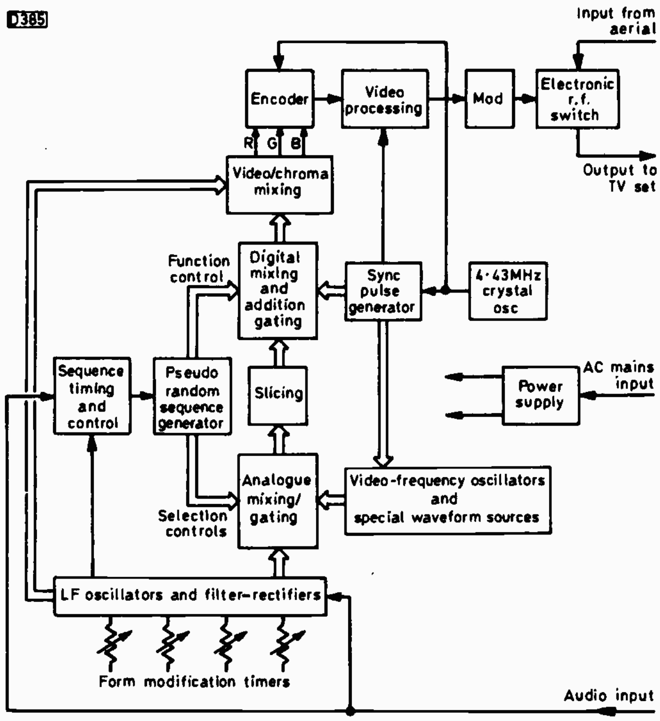



*Fig. 1: Block diagram of the Chromascope video synthesizer.*

nections are rear mounted.

Inside I found a huge (40 × 27cm) glass-fibre printed circuit board on which 51 chips and a dozen or so transistors are mounted. This is the pattern generator proper: its outputs feed a smaller panel at the rear. This second panel contains four chips and a further twelve transistors, and looks after the functions of PAL encoding, 4·43MHz subcarrier generation, r.f. modulation and u.h.f. switching. Fig. 1 shows a simplified block diagram of the synthesizer.

Although the unit has no audio output, I suspect that the patterns themselves would make music of sorts if one were to filter out the line and field sync pulses and perhaps beat the result with the output of a supersonic oscillator. I never got around to trying this however.

## Patterns Generated

It's not easy to describe the range of patterns the synthesizer generates. There are geometrical shapes like hour-glasses, cones, ellipses and cogwheels; flickering flames, bars, stripes and a sort of map of Australia; tartan and gingham effects and red herringbones on a blue ground; pulsating Christmas crackers that swell then shrink to nothing; half a dozen eggs changing to a row of distended carrots; and so on! It's not all geometrical shapes and figures however. Sometimes the effect is like a disco oil-wheel projector, or the display may consist of diffused colours that swirl and change.

All the patterns change in colour, size and position at a rate determined by the settings of the front panel controls or by the audio waveform. I've not seen the same pattern combination twice in many hours watching, and I'm told that the possible combinations run to many millions. Sometimes odd basic components of previous patterns repeat themselves, but in different combinations and colours, so that the pattern range is quite random. In fact it's a sort of electronic kaleidoscope – and can be quite hypnotic (I've had to turn it off whilst writing this, as I kept on getting sidetracked!).

The synthesizer certainly generated a lot of interest: at home, at work and at the local technical college. The children were fascinated by it, though the budgerigar seemed totally indifferent. I hooked it up to the audio system to see the effect of Rossini's William Tell and Tchaikovsky's 1812 overtures. The results were sometimes dramatic, sometimes bizarre, especially towards the ends of these pieces, with everyone in the orchestra going full bore, blowing and pounding fit to burst, the pattern throbbing, flashing and gyrating. Although the colours don't specifically relate to the mood of the music or even the audio frequencies, the slider controls enable you to get a "mood" setting, so that modern jazz can be made to appear in suitably smokey blue and so on.

Off I went to see a friend who is an electronic organ enthusiast. We hooked it up and Michael went through his repertoire. The Chromascope responded to every nuance – and with the synthesizer under the organist's control, and the ability to hold a pattern appropriate to the mood, a sort of second dimension was added to the music.

Back in the workshop I hooked the instrument up to a soak testing TV set. This was one that was under the control of my good friend Terry. His face was a picture when he noticed the strange patterns on the screen! "Is it us or them" he muttered, thrashing the tuning buttons on that and several other nearby sets. It took him a few anxious minutes to suss out what was going on!

## Conclusions

The Chromascope is without doubt an electronic conversation piece. One can only wonder at the electronics in this box of tricks, and admire the design. Who will buy it? It's intended for home use, as an adjunct to the domestic audio and video installation, but it's true to say that a synthesizer would come farther down most people's priority list than say a VCR, a disc player or in due course a satellite receiving dish. In conjunction with one or more large monitors or a projection receiver however it would be ideal in a disco, where it could mirror the music, or in other places of public entertainment. It would also make an interesting eye-catcher in a TV dealer's window, as a change from off-air/tape programmes, and one feels that the burgeoning tape/video outlets might find it a useful source of non-copyright video.

Another version of the synthesizer, Model P135, can be used with cameras and other video sources. This facilitates mixing and cutting between the patterns and other video signals. The audio synchronization facility is retained. Small video studios and production units might find this a useful addition to their effects facilities.

Is the C101 worth some £300? That's a difficult question to answer. Certainly a glance inside convinces one that it's money's worth all right, but it would be difficult to assess the Chromascope's likely amount of use under normal domestic conditions once the novelty had worn off.

Finally some technical details. The audio input specification is 0·5-1V into 100kΩ. The aerial input is the standard 75Ω coaxial socket, the loss being less than 2dB when "off" and greater than 30dB when "on". The u.h.f. output is 1·5mV at about channel E38 – a v.h.f. option is available. The Chromascope weighs approximately 2kg, measures 417 × 68 × 300mm, and is available from CEL Electronics (Harlow) Ltd., River Way, Harlow, Essex CM20 2DA (telephone 0279 418611).

# Teletopics

### STEREO TV SOUND

Suddenly, stereo sound seems to be all the rage in the TV industry, with Grundig, Philips, Salora, Tandberg and Thorn showing stereo sets at this year's CETEX exhibition, the introduction of stereo VCRs by Grundig, JVC and Panasonic, and the stereo capability of the Philips LaserVision disc system. Because of the absence of off-air stereo signals in the UK the TV sets incorporate "synthesized stereo". Contrary to what we said a couple of months ago, this does not mean simply splitting the audio signal into its h.f. and l.f. components and using these as the left and right channel signals – a technique that's been used in the past in the USA. Instead, a second channel for stereo is created by passing the signal through a frequency-dependent phase-delay circuit – and very effective it is. Further details are given in the article on Thorn's stereo TV sets on a later page.

The JVC stereo VHS machine is the HR7650EK, which comes in at the top end of the JVC range and includes other new features such as insert and assemble editing, high-speed shuttle search, and slow-speed search down to between a fifth and a twenty-fifth of normal speed. The machine features front loading, with a five motor mechanism to give a high standard of stability. Grundig's machine is a version of the 2 + 4 Super, while the Panasonic is the NV7800 – a VHS machine of course.

### VHD LAUNCH POSTPONED

A joint statement from Thorn-EMI and JVC announces the postponement of the UK launch of the VHD disc system until next year – it was previously scheduled for introduction this September. Postponements in the USA and Japan had been announced previously, due to economic and market conditions: the UK postponement has been decided upon so that the eventual launch can go ahead on a world wide basis. Presumably the investment required is more than a single market could support.

### EXHIBITION NEWS

It's back to Radiolypia next year – for the first time in over twenty years! Only this time the event will be known as "The Great Home Entertainment Spectacular" – from September 17-25, 1983. The proposed scheme is to have public and trade-only shows on alternate years, the next CETEX coming in May 1984.

The UK's first cable and satellite TV exhibition and conference – CAST 83 – is due to be held in Birmingham from September 13-15, 1983. The exhibition is being organised by Cable and Satellite TV Exhibitions Ltd., 5 Barratt Way, Tudor Road, Harrow HA3 5QG while the conference is being organised by *The Economist.*

### VCRs GALORE

Competition in the VCR market seems to be hotting up at all levels. Toshiba have introduced a low-cost Betamax machine featuring front-loading – Model V9600B. Panasonic's new "basic" machine is the NV333 – a slightly more complex machine, the NV366, features frame-by-frame advance and a one-hour battery back-up. Another budget-price Betamax machine is the Sanyo VTC5400P, a slightly more sophisticated version of the VTC5300P. Sony's contender at this end of the market is the C6, which like the Toshiba machine features front loading.

At the top end of the market Sony have introduced the ingenious F1 – a portable machine that's understood to have more features than the C7. It's in two sections of course, the VCR itself and the tuner/timer/mains adaptor. Sony claims that the VCR section is the world's smallest portable.

ITT have added three VHS machines to their previously V2000 only range. The new VCRs are the budget TR3913, top of the range TR3943 and portable TRP3833.

### VIDEO PIRACY

Several successful prosecutions have recently been brought against people involved in the pirate copying of video cassettes. A motion on the subject, calling on the government to stamp out the practice as a matter of urgency, has been introduced in parliament. It's estimated that 65 per cent of the prerecorded cassettes now sold in the UK come from pirate sources. Anyone greedy enough to get involved in large-scale pirating is quite likely to get caught – they have to get a lot of blanks from somewhere – but it's difficult to see how small-scale operators can be detected.

### TRADE SCENE

According to the latest figures from BREMA, 1981 was a record year for the UK's video/TV trade, with deliveries of VCRs exceeding one million for the first time and deliveries of colour TV sets exceeding two and a quarter million – the only time CTV deliveries previously reached this level was in the boom year of 1973. Whether or not this has meant success for home TV manufacturers is another matter however. CTV imports in the final quarter of 1981 increased to more than twice the equivalent figure for 1980 (up from 208,000 to 417,000). Since then there seems to have been something of a reaction, with demand for large-screen TV sets in particular falling – GEC for example have blamed the present high level of stocks for the decision to work a three-day week at the joint GEC-Hitachi plant at Hirwaun.

### TRANSMITTER NEWS

The following relay stations are now in operation:
**Crockerton** (Wilts) HTV-West ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51. Vertical polarisation.
**Patcham** (Sussex) BBC-2 ch. 40, TV South ch. 43, BBC-1 ch. 46, TV4 (future) ch. 50. Horizontal polarisation.
**Portslade** (Sussex) TV South ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51. Vertical polarisation.

The BBC have issued a pocket booklet entitled "BBC Television and Radio Stations". This guide to all transmitters that carry the BBC's domestic services is available from the BBC Engineering Information Department, Broadcasting House, London W1A 1AA free of charge on receipt of a 110 × 220mm stamped addressed envelope. The booklet also contains some general information, including a note on satellite broadcasting.

The IBA have issued the following list of planned channel 4 transmitter openings during 1983/4 – high-power stations first.
**First quarter 1983:** Bluebell Hill.
**Second quarter 1983:** Craigkelly, Rosemarkie.
**Third quarter 1983:** Heathfield, Limavady, The Wrekin.
**Fourth quarter 1983:** Beacon Hill, Broughter Mountain,

Darvel, Midhurst, Redruth, Ridge Hill.
**First quarter 1984:** Rumster Forest.
**Second quarter 1984:** Keelylang Hill, Knock More.
**Third quarter 1984:** Chatton, Eitshal, Huntshaw Cross.
**Fourth quarter 1984:** Bressay, Torosay.

The following relay stations will carry channel 4 programmes by the end of 1983: Bath, Brierley Hill, Brighton, Bristol (Ilchester Crescent), Bromsgrove, Carnmoney Hill, Chesterfield, St. Thomas (Exeter), Fenham, Fenton, Guisborough, Hastings, Hemel Hempstead, Keighley, Lancaster, Luton, Malvern, Milburn Muir, Morpeth, Oliver's Mount, Pendle Forest, Poole, Salisbury, Sheffield, Storeton, Strabane, Stroud, Tay Bridge, Tunbridge Wells, West Kilbride.

Sianel 4 Cymru relays that will come into operation during the same period are: Almwch, Carno, Cemaes, Cerrigydrudion, Cilfrew, Clydach, Dolwyddelan, Fishguard, Llanarmon-Yn-lal, Llanbrynmair, Llandysul, Pencader, Waunfawr.

## *REPLACEMENT CHANNEL SELECTOR FOR DECCAs*

Alderson-James Ltd. (160 King's Road, Harrogate, N. Yorks) have introduced a channel selector unit specifically designed to replace the seven piano-key unit fitted to certain Decca sets in the 30 and 80 series and other derived models, e.g. Telefunken. The unit (type UPB-30-80) gives six-channel selection, with each position tuned by a multi-turn potentiometer – double-pole switching is used for improved reliability. Individual switches can be replaced if necessary without having to remove the complete switchbank. The original seven-position units are very difficult to obtain, though most of the sets still have plenty of life in them. The price per unit, with fitted fascia and mounting brackets, is £16 plus VAT – quantity discounts are available.

## *LCD SCOPE*

There's been much talk of flat-screen TV sets in recent years. Now, from Scopex, comes a flat-screen oscilloscope using a 128 × 256 matrix liquid-crystal display manufactured by an English Electric Valve Co. subsidiary. The Scopex Voyager is a battery portable, all solid-state scope using a 1·25MHz sampling rate. It's intended for use in environments where high voltages would be hazardous.

## *3-D TV*

Following the recent demonstration of 3-D TV – in monochrome via colour sets – during a programme transmitted by TV South, Philips took a group of journalists to see their work on 3-D TV at the company's Eindhoven headquarters. Of particular interest was the demonstration of full-colour 3-D TV. Separate TV channels are required to provide two displays which are optically combined in the manner shown in Fig. 1, using a clear image-mixing "mirror" mounted at 45° to the two colour c.r.t.s. Those present report that the results, viewed through special polarised spectacles, were excellent – without the spectacles a "fuzzy" picture is seen. The camera uses similar principles, with two lens systems separated by a 45° glass mirror/screen, the lenses being separated by a distance equal to that between the average pair of human eyes. Philips emphasize that their work in this field is not regarded as having any practical application in the immediate future, since any form of 3-D TV would be incompatible with present TV transmission standards.

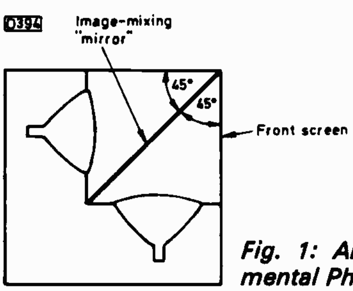



*Fig. 1: Arrangement of the experimental Philips 3-D colour TV set.*

## *MAC AND EXTENDED PAL*

The IBA MAC and BBC Extended-PAL systems, proposed for satellite broadcasting use, have now been publicly demonstrated. Both systems are capable of providing much enhanced pictures on sets incorporating the extra circuitry required to handle the signals. Contrary to an earlier comment of ours, the MAC system would be suitable for direct broadcasting to individual receivers – the set's decoder would have to be able to store and process a complete line however since each MAC line consists of a sync word followed by 20μsec of time-compressed chroma signal and then 40μsec of luminance signal. The IBA system is proposed as a European standard to overcome the problems created by differently coded signals. A major difficulty at present being considered by the EBU is how to get up to six sound channels into each satellite TV channel – the IBA make the point that the presence of several sound subcarriers is likely to cause interference with PAL and SECAM video signals.

The BBC feel that European agreement on anything other than variants of PAL and SECAM is unlikely in the time available before the start of regular European satellite transmissions.

## *ITT SERVICE DEPARTMENT MOVES*

ITT's UK TV activities are being reorganised. With setmaking for the European market being increasingly concentrated at the Bochum, W. German plant, assembly and manufacturing operations at Basildon are being cut back. The extra space is to be used for the Service Department, which will be moved from Paddock Wood, Kent – the reorganisation is due to be completed by November.

A new chassis, the Pico, for small-screen portable colour sets is now in production at Bochum. Models using the chassis are due for release in the UK this autumn.

## *IN BRIEF*

Some snippets from Sony. The Bridgend plant has been producing NTSC colour sets for export to the USA – the first time UK produced colour sets have been exported to the US. Production of Betamax machines for the European market is due to start shortly at Sony's W. German plant . . . Grundig report that rising sales of V2000 VCRs are helping to restore the company's fortunes. The loss for the year to March 1982 was £9·5m, substantially down from the £45m loss recorded in the previous financial year. Grundig produced a quarter of a million VCRs last year and expect to produce half a million this year. The V2000 system now has some 30 per cent of the W. German market . . . Panasonic expect to produce some three million VCRs this year, while Hitachi are increasing production capacity to one and a half million. It seems that an awful lot of VCRs are now being produced, which could mean trouble for someone sooner or later.

# The Rediffusion Mk. 4 Chassis

**Part 1**

**Stephen Clay**

TECHNICALLY the Rediffusion Mk. 4 chassis is probably one of the most advanced to have gone into production in Europe so far. Sets using the chassis are marketed in Rediffusion shops as TVRMs – Television Receiver-Monitors – since all versions being produced at present are fitted with video and audio input sockets for direct video connection to VCRs, video games, computers, etc. This of course means that a fully isolated power supply is used. There is also a new generation decoder i.c. which features automatic c.r.t. black-current control, eliminating the need for separate background (black-level) grey-scale controls. This, together with the self-converging picture tube, minimizes the number of preset adjustments. Careful design has resulted in a low power consumption.

The remote control and teletext versions of the chassis use a frequency synthesis tuning system. This allows up to sixteen programmes to be preset directly – the number is displayed on the screen when a channel is selected. One advantage of this system is that the receiver can be tuned in the absence of a transmission – particularly helpful for example with the present need for tuning to local Channel 4 transmitters. The system is also very helpful for DX reception.

The chassis is British designed and is manufactured at factories in the North of England. Readers will come across it in receivers marketed under the Rediffusion, Doric and other well known brand names.

The accompanying photograph shows a rear view of the chassis fitted into a receiver. A small U-shaped chassis made from a single sheet of metal is employed (see also the front cover), the four main printed circuit boards (signals, decoder/RGB drive, timebase and power supply) being clipped into this. The signals panel, which contains the tuner, i.f. strip and sound channel, is mounted on the outside of the "U" to give short connections to the controls, loudspeaker and input circuitry as well as screening from the RGB, timebase and power supply circuits. The decoder/RGB panel is placed on the inside of the chassis to give short connections to the tube's base panel. The timebase panel is at the bottom, ensuring that the tripler and the output devices run cool. The power supply panel is on the right-hand side, giving short connections to the timebase panel. Fig. 2 shows a simplified block diagram of the chassis.

It will be clear from the above description that the designers did not follow the currently fashionable single-board chassis concept. The modular approach adopted provides easier servicing and allows the receiver to be easily updated or changed to meet different market requirements. Although the majority of receivers are supplied for normal off-air domestic use, a considerable number are manufactured for export (v.h.f./u.h.f., PAL/SECAM, different sound-vision carrier spacing, etc.) and there are cable (including hotel and industrial types) and video monitor versions.

Careful layout, the use of ribbon cable with in-line connectors fitted in a single crimping operation (the IDS – insulation displacement system), clip-fit printed circuit boards and control panel are some of the features which ensure that the receiver is competitive in terms of manufacturing cost. Automatic component insertion and microprocessor controlled factory test equipment are used in production.

The 22 and 26in. models are fitted with the Videocolor S4 tube. This is an in-line gun, narrow neck (29mm), slotted-mask 110° tube with saddle-wound line and toroidal field scan coils. The tubes are delivered to the factory fully preset for convergence, purity and north-south pincushion correction, requiring only east-west pincushion correction from the chassis. The 20in. models are fitted with the pincushion-distortion free Videocolor 90° S4 tube. The different scan coil impedances and absence of the need for EW correction in the 90° version mean that there are a few circuit changes.

The signals panel is of conventional design, with a Mullard U321 u.h.f. tuner followed by a Plessey SL1430 i.f. preamplifier i.c., a Plessey SW153A surface acoustic wave filter and a TDA2540 i.f. amplifier chip. The ITT TDA1035T 6MHz intercarrier sound/audio amplifier i.c. is also mounted on this panel.

Since the power supply is mains isolated, an aerial isolator is not used. The latest version of the chassis is fitted with a Mullard U341 u.h.f. tuner. This has a MOSFET r.f. amplifier stage, and as a positive a.g.c. feed is required the i.f. amplifier chip is changed to a TDA2541.

Various combinations of v.h.f. and u.h.f. tuners can be accommodated on the panel for export models and sets intended for use with v.h.f. cable distribution systems. Export models also require a different SAW filter, sound bandpass ceramic filter, plus changed alignment of a few coils for 38·9MHz i.f. and 5·5MHz intercarrier sound as appropriate.

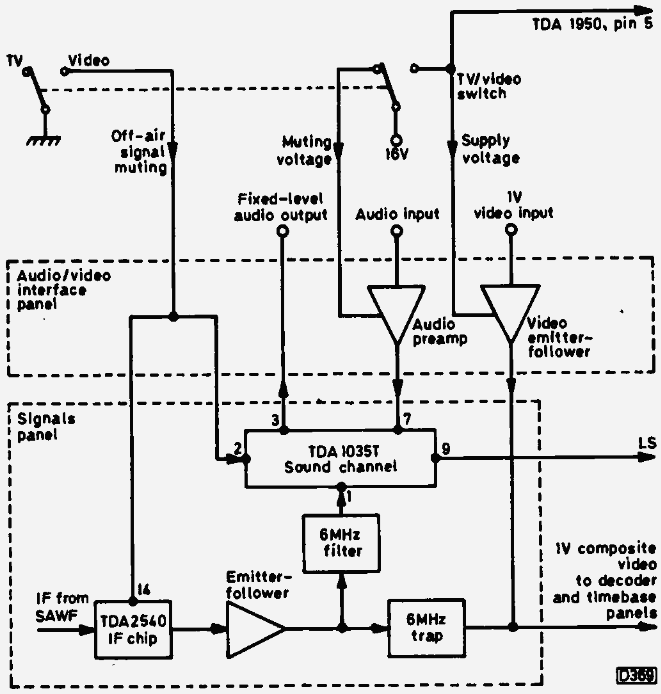



*Fig. 1: The video and audio interfacing system.*

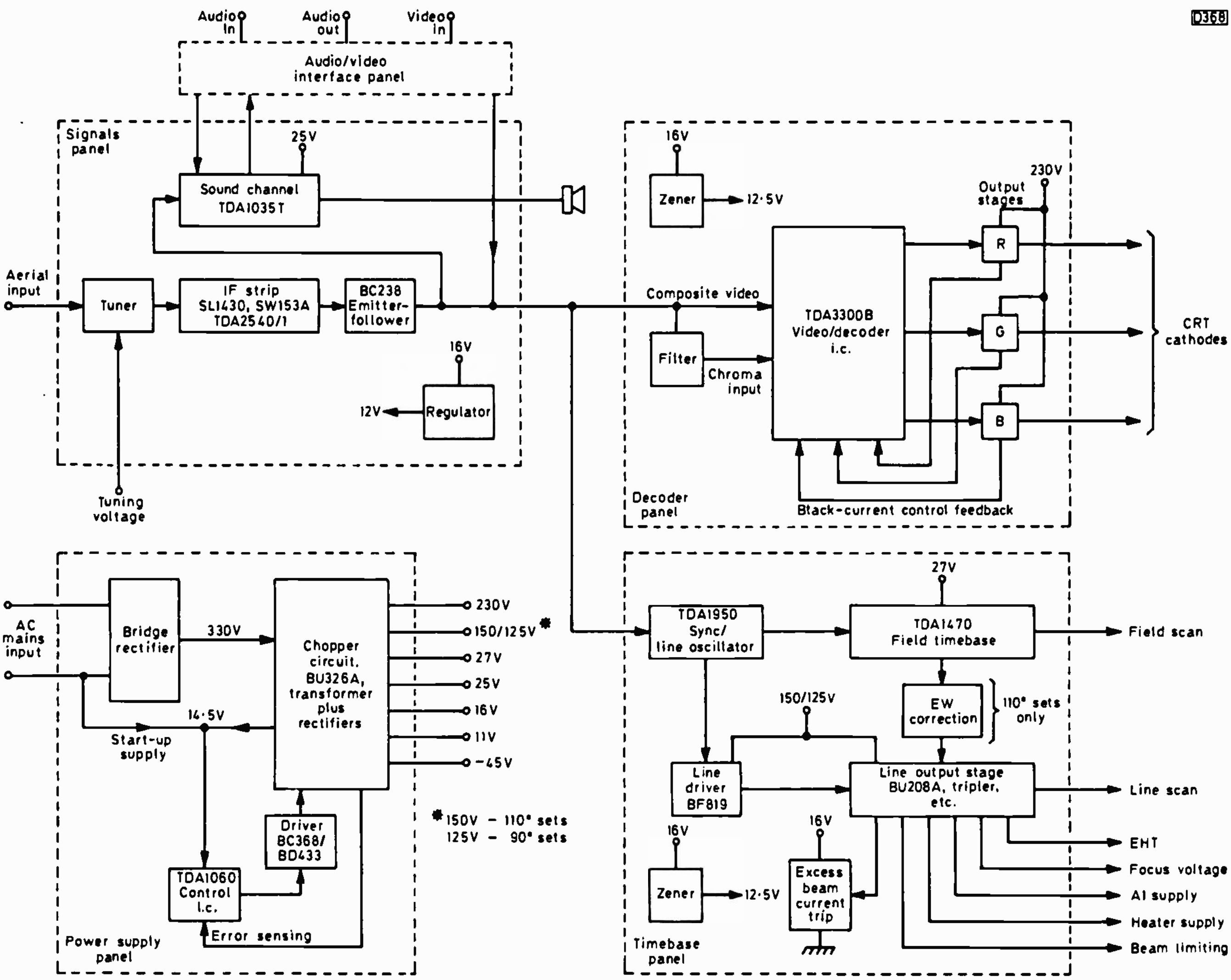



*Fig. 2: Block diagram of the Rediffusion Mk. 4 chassis.*

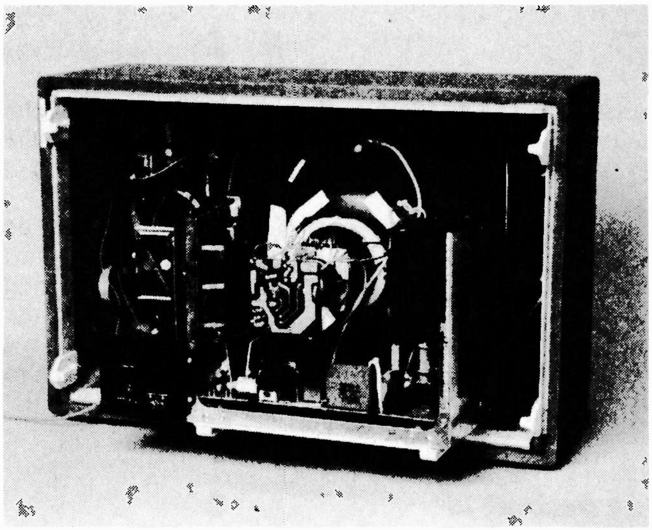
Rediffusion have traditionally been associated with cable television, and a special tuner can be fitted (together with the u.h.f. tuner for off-air reception) for use by cable subscribers connected to 8·9MHz h.f. distribution systems. The special tuner converts the 8·9MHz input up to the i.f.

## *Audio/video Interfacing*

The small, additional audio/video interface panel is fitted to all retail/rental versions of the chassis – i.e. not to hotel or specialist monitor versions that use different circuitry. The video and audio input sockets enable a VCR to be connected without the difficulty of tuning the receiver to the VCR, and also improve the picture quality since signal modulation and demodulation are avoided. Throwing a TV/video switch at the front of the receiver mutes the i.f. and 6MHz signals and allows the external video and audio signals to be fed in – the video is at 1V into 75Ω and the audio 1V r.m.s. into 47kΩ (nominal).

In addition a five-pin DIN socket (giving 500mV r.m.s.) at the rear enables the user to feed his TV sound, independently of the set's volume control setting, to his hi-fi equipment while a jack socket at the front allows headphones to be connected (the use of this socket also disables the internal loudspeaker).

Fig. 1 shows the video and audio switching arrangements. When the TV/video switch is moved to the video position several actions occur. (1) 16V is supplied to the video emitter-follower to enable the video to be fed in and to pin 5 of the TDA1950 sync/line oscillator i.c. to adjust the flywheel line sync time-constant for VCR use. (2) Pins 14 and 2 of the TDA2540 i.f. and the TDA1035T sound i.c. respectively are earthed to prevent off-air signals or noise being mixed with the video and audio input



*Rear view of a receiver fitted with the Rediffusion Mk. 4 receiver-monitor chassis.*

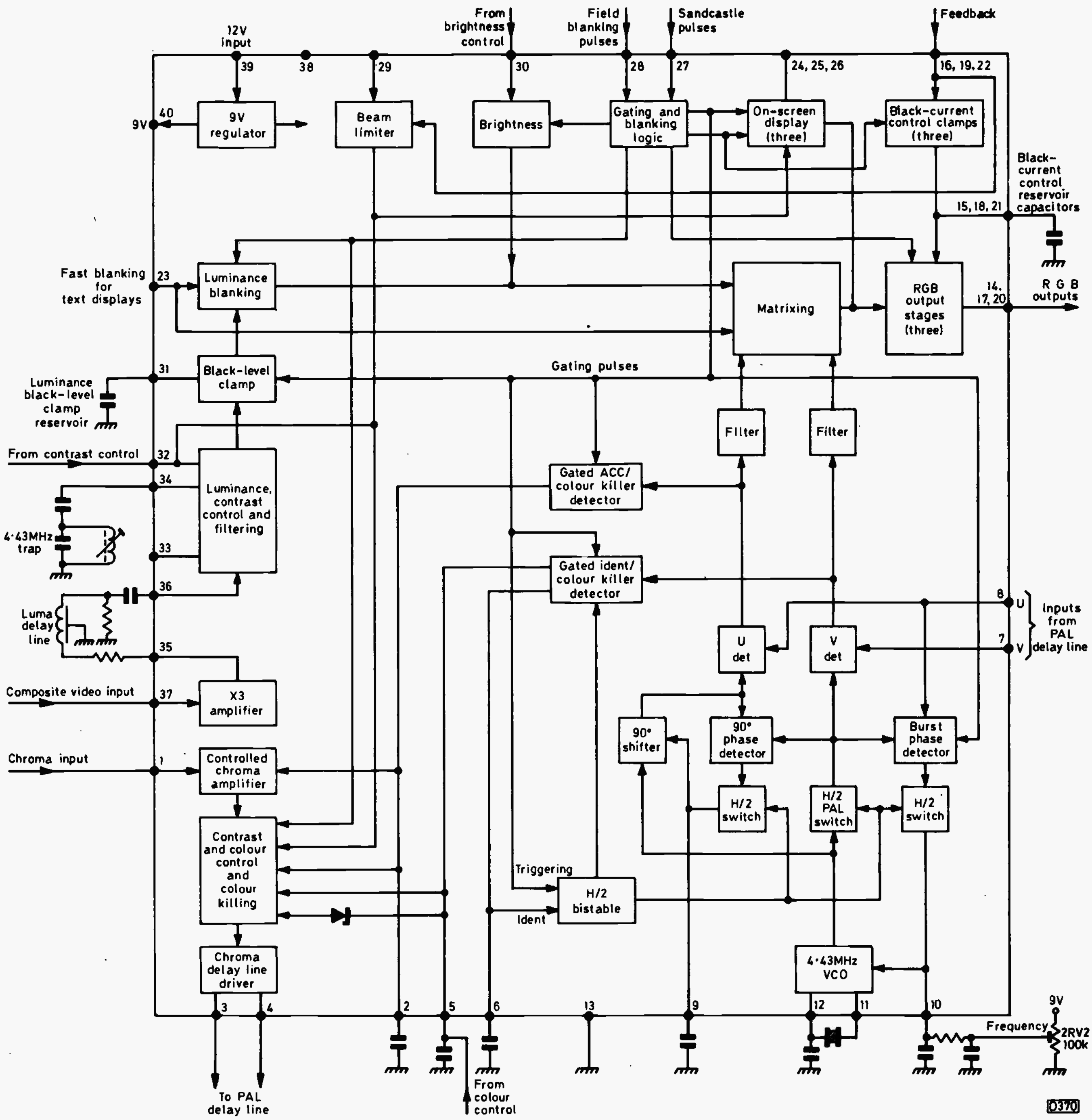



*Fig. 3: Simplified block diagram of the TDA3300B decoder i.c.*

signals. (3) The 16V feed applied to the emitter of the audio preamplifier on the board to reverse bias it in the TV mode is removed, allowing the audio input to be fed to pin 7 of the TDA1035T i.c.

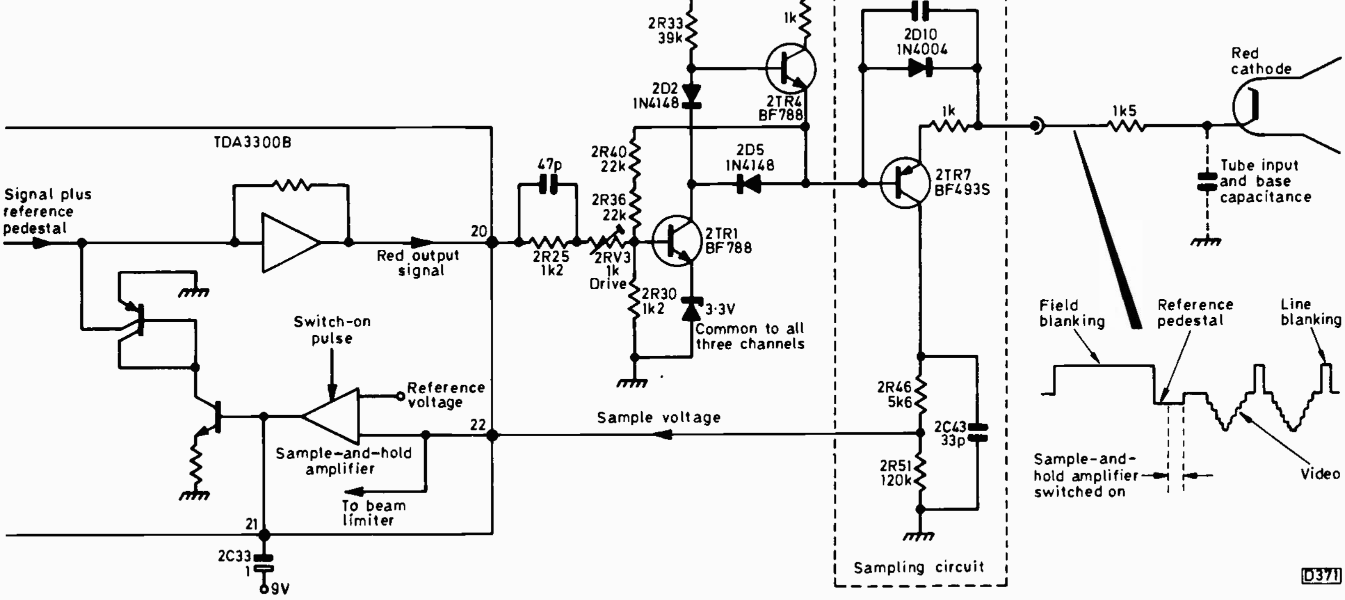
The short flywheel line sync time-constant can also be selected by using button 8 on the tuner control unit. This enables u.h.f. output only VCRs to be used. An odd "quirk" of the design is that in this case pin 5 of the TDA1950 is connected to earth instead of to the 16V supply – it doesn't matter however, as switching this pin to take it to either earth or the supply rail switches the time-constant.

### The Decoder IC

The centre-piece of the decoder is the Motorola TDA3300B i.c. which carries out all the luminance and chroma signal processing required. Features of this 40-pin chip include:

(1) Automatic black-current control via feedback from the RGB output circuits.
(2) Peak beam current limiting to prevent blooming on highlights – in addition to the normal beam current limiting action.
(3) Separate R, G and B input pins for the injection of teletext/data signals (or on-screen display of the channel number with frequency synthesis tuning). These signals can be varied by means of the user brightness and contrast controls.
(4) Low dissipation – about 600mW.
(5) By adding a small adaptor panel with a TDA3030A SECAM-to-PAL converter i.c. during production the receiver is given multistandard (PAL, SECAM and NTSC-4·43) capability.

*Fig. 4: The red output stage and black-current control circuit.*




A block diagram of the TDA3300B i.c. is shown in Fig. 3. As with the better known TDA3560 single-chip decoder, both the chroma and the burst pass through the chroma delay line. The U output from this enters the TDA3300B at pin 8, passing to the U detector and to the burst detector. The latter is part of a phase-locked loop, the detector's output being applied via an H/2 (half-line frequency) switch to the 4·43MHz voltage-controlled crystal oscillator.

The 4·43MHz reference oscillator's output is applied to the V detector via an H/2 switch for PAL switching, and to the U detector via a voltage-controlled 90° phase shifter. This shifter is under the control of the 90° detector which compares its output with the oscillator's output coming via the PAL switch: when the phase shift is correct, the output from the 90° phase detector is zero.

The combined effect of the two H/2 switches in the reference oscillator control loop – the two shown on the right-hand side – cancels phase detector offsets. The outputs from the U and V detectors include burst "flag" pulses which are used for a.c.c., ident and colour-killing – there are two colour-killing actions.

## RGB Output Stages

The RGB output stages are of the class AB type and incorporate extra circuitry for c.r.t. black-current sampling and beam limiting. Fig. 4 shows the red output stage.

Under most conditions transistor 2TR1 acts as a class A amplifier, driving the tube's cathode via 2D5 and 2TR7. A high-value collector load resistor (2R33) is used to reduce the dissipation in 2TR1. The stage gain is set by the ratio of 2R40 and 2R36 to 2R25 and 2RV3, the latter setting the drive level.

For good transient response it's necessary for the tube/base capacitance to be rapidly charged/discharged in accordance with the signal swings. There is no problem when 2TR1 is being driven from off to on, since the capacitance is discharged rapidly via 2D5 and 2TR1. When 2TR1 is driven from on to off however 2D5 will become reverse biased. Under these conditions 2TR4 acts as an emitter-follower so that the capacitance charges rapidly.

Black-level stability is critical for good results. As we've seen, the TDA3300B chip incorporates circuitry for automatic black-current correction. Making use of this reduces service calls and ensures constant performance despite tube ageing or circuit misadjustment. Feedback is required, and this is provided by the sampling circuit shown in the box with the broken outline.

Transistor 2TR7 acts as an emitter-follower between the video output stage and the c.r.t.'s cathode. It's a low leakage type, the components 2C40, 2D10 and 2C43 ensuring that the circuit has negligible effect on the video signal. Since the beam current flows via 2R51, a voltage proportional to the beam current is produced across this resistor. It's fed into the TDA3300B at pin 22.

## Black-current Control

For automatic black-current control the important thing is the small beam current that flows when the tube is biased just above cut off. To enable this current to be sampled, the TDA3300B replaces the video signal with a fixed reference pedestal voltage for a couple of lines at the end of each field blanking period (this pedestal can be seen as a grey line at the top of the picture if the height control's setting is reduced). The sample voltage at pin 22 of the i.c. is fed to one input of a sample-and-hold amplifier which is switched on to sample the input for one line only of the reference pedestal period. 2C33 acts as the black-current control reservoir capacitor, holding the charge acquired during the sampling time for the whole field period. This charge is added to the video signal within the i.c., thus maintaining the correct red gun black current.

It's interesting to notice that when a set is switched on from cold there's a momentary screen bright-up with flyback lines as the beam current begins to flow. This is because it takes several fields for 2C33 (and the corresponding capacitors in the green and blue channels) to charge fully.

Since the voltage continuously available across 2R51 is proportional to beam current, it's used within the i.c. for peak beam current limiting during the active line periods. This is in addition to beam current limiting via the contrast control – and a crowbar trip that operates should the beam current exceed 3mA.

# Ah For Yesterday!

## *Les-Lawry Johns*

WE seem to be losing our touch. Sets keep coming in that I haven't the parts for or the problem is one that can't be dealt with in the time available. Like the Bush T20 which wouldn't start until I disconnected the left-side signals panel. I thought that would be easy. Just connect each plug in turn until the one with the short is identified, then check the relevant circuitry through. I subsequently found that the set shut down whenever the signals panel earth connection was made. This was so even with all the other connections except those to the tube base removed. The fault remained when the tube base was disconnected, so what was causing the overload? At this point the owner returned. I tried to explain to him what was happening, but he looked as blank as I did.

"If it's going to be trouble, I'll take it back where I got it. It's still under guarantee you know."

It's a fact that a lot of people think that the four year tube insurance is a four year guarantee on the set, but I kept quiet.

"Oh well, if that's the case I'll put it back together so that you can take it" said this coward. Which I did, and he took it. If the person who finally did the job and located the fault reads this, perhaps he'd let us know what it was all about.

Like the Garrard hi-fi music centre with both loudspeakers faulty and the fuses blown. One output pair of transistors was shorted, and I thought they'd be of the ordinary BD203/204 variety. When I looked up the BDX53/54 devices fitted I found that they were Darlingtons. So I did a quick phone around. Not in stock. Sorry don't keep them. I eventually got the npn half, but nowhere could I find the pnp half (TIP135 etc.).

In the meantime I thought I'd check up on the good side with a new speaker fitted. Someone had been there before me, and although the circuit was working from the output stage back to the audio input there were no signals from the radio or gramophone sections due to a mix up of the many interconnecting leads. I surveyed the whole thing and decided to remove the new loudspeaker, replace the old one and call it a day (to be fair, after a few hours of torment and making up a pnp Darlington pair, then finding that this side wasn't working either). I decided to spend the rest of the day sulking, and immediately got into trouble with Honey Bunch. She put her hands on her hips and launched into a bitter tirade.

### Onslaught

"I don't know what's got into you lately. You don't do anything properly. Most people wash their hands after they've been to the loo. Not you. Oh! no. You have to wash your hands before. How vain can you get? And do you have to put the lead round your own neck when you take the dog for a walk? If you don't pull up those socks you keep mentioning there'll be a change here all right and you'll be sorry."

Well. What an outburst. And so unjustified. Of course I wash my hands before going to the loo. You can't be too careful. What with all this infection about. And as for the dog's lead, he doesn't want it on and the chain makes it heavy so I put it around my neck to leave both hands free to waive to everyone – and to carry the bottles from the off-licence.

But it was the first bit of the onslaught that gave me pause for thought. Was it a fact that I wasn't doing things properly? I thought it was just a coincidental run of useless jobs that would not have been profitable anyway – and one can hardly be expected to tackle everything that comes along, can one? A tiny voice at the back of my mind said "you used to".

Yes, that's true. I used to work all hours, doing the jobs that didn't pay as well as those that did. Vanity, that was it. I'm not so vain any more, and I'd rather put my feet up for a couple of hours in the evening – and watch television! When I think of all the running around we did in the fifties, working round the clock and actually enjoying it (though we never let on)! We were younger of course, full of vitality and virility. Things were also a lot more straightforward: there was nothing like the almost evil complexity that seems to permeate everything these days. I feel I'm not alone in this weariness of never ending complication, but if anyone feels inclined to disagree I ask one question first – what age are you old chap?

### Mr. Frisby's Murphy

Anyway, that's quite enough of this depressing claptrap. Let's get on with some work done properly – this time. Mr. Frisby sailed in carrying, with some difficulty, his 26in. Murphy (Rank A823 chassis). He put it down, again with difficulty, and his trousers split at the rear.

"I thought that only happened to me" I consoled him.

"Bloody heavy set that" moaned Mr. Frisby. Ben, our collie, came round to see what was going on and Mr. Frisby went to pat his head. Ben snapped at his hand and Mr. Frisby jumped back in alarm.

"He only bites men" I explained, having ordered Ben out of the shop in disgrace.

"Do you get many customers in here?" asked Mr. Frisby.

"Not many."

"I'm not surprised if you keep a vicious dog that bites everybody."

"He's getting old and grumpy, and it's taken me a long time to teach him to bite men and not women. Now I've got to teach him not to bite anyone during the day, but it's taking a long time."

Mr. Frisby gave up on that one and explained about his set. Apparently the sound was o.k. but there was no picture (raster). With it up on the bench we found that there was h.t. at the top fuse so we moved across to check the c.r.t. base voltages. Plenty of voltage at the first anodes, cathode voltages slightly high, grids slightly negative. Shorting the common grid point to chassis produced a pale raster with no modulation.

"How much are you going to charge me?" asked the anxious Mr. Frisby.

"You'll get about fifty pence change out of fifteen quid, counting the VAT" I estimated, bearing in mind the cost of the SL901B decoder i.c.

"You charged me only a fiver last year."

"This time it looks like a rather expensive chip, but you can hang around if you like while I make sure."

So he hung around whilst I checked the other possibilities, but as I was getting nowhere I started to unsolder the SL901B. He watched this operation, fascinated. "Those pins are close, aren't they? You'll have to be careful when you put another one in. Have you got another one?"

I stopped operations. "If you say another word I'll call the dog in." He started to say something, then shut up.

The new chip was fitted and the decoder panel replaced. I was fully prepared to be proved wrong by a blank screen, but the picture appeared, albeit with the green missing. Fortunately the green output stage is the first one in on the top of the panel, so it was no great task to take voltage readings with the panel in place and wedged open with half a reel of used tape. Collector voltage high, base voltage higher than normal, nothing on the emitter. So in went a new BF337 and the picture looked more normal. As I was putting on the back cover, Mr. Frisby started to get his money out.

"Change out of fifteen quid you said."

"That was for supplying and fitting the chip. Not for the extra transistor, and fitting it."

"Just thought I'd try it on" he smiled. "I called in one of those chaps who advertise in the paper. You know, no call out charge and free estimate. He wanted thirty five quid for a new decoder panel and said that was cheap." So Mr. Frisby parted with half of that and went away quite happily.

### *The Vet's G9*

Although we've sold more G8s and G11s, plus KT3s and K30s, than I can remember, we've sold only one G9 so far as I can recall. That was to our local vet, and of course we have to keep on the right side of him and his partners. So when he arrived with the set in the back of his car we assured him that he'd be kept waiting no time at all. His description of the fault (sides coming in and going out, then no picture at all) suggested that it was the trouble common to all G9s – the 2,200µF electrolytic on the line scan panel. It did look a bit sick, so we changed it. The no picture condition remained however, and there was a familiar acrid smell . . . Surely not. But it was. The line output transformer was hot to touch, and remained dead with the tripler disconnected.

We had lots of G8 transformers, but not a G9. None of our local friends had one, so all we could do was to order one by phone and wait. The best laid schemes . . . I've since learnt that a new wholesaler has opened up not far away, and that I could have obtained one within the hour, but I didn't think. Isn't that where we came in?

### *Mistaken Identity*

I was in this queue of traffic waiting to leave a car park and we didn't seem to be getting very far. I noticed the woman in the car in front looking in her mirror – and not at herself. She seemed to be looking at me.

I saw the driving door open, and a pair of shapely legs swung out. An equally shapely lady followed and came straight back towards me – smiling, I was glad to note.

"Hallo darling. How lovely to see you. Just as pretty as ever" she gushed.

"Evergreen" I admitted. The cars ahead then started to move and off she dashed, calling out something about phoning.

I'd never seen her before and can only think I must have a double. Handsome perhaps, on a very dark night, but pretty?!

# Colour Portable Follow Up

**Luke Theodossiou**

THE colour portable project which we started in May 1981 has to all accounts proved most successful. Many of the sets have been built, no major difficulties have been experienced by constructors, and the picture and sound quality are comparable with those provided by commercially produced receivers.

## Line Output Device

The project used up to the moment technology, in particular an interesting line output device – the Mullard BTW58-1500R gate-controlled switch. Whilst this has proved to work well enough in our project, and is certainly reliable, it now seems unlikely that it will be adopted by setmakers. The reasons for this are as follows:
(1) The voltage across the device when it is conductive varies with temperature, from about 2V to around 5V. This causes an effective change in the h.t. rail voltage, which in turn results in width and e.h.t. changes. Compensation could be provided in our design by means of feedback to the power supply, but since this is of the mains isolated type a transformer would be required. The extra complexity hardly seems worthwhile, the variations being quite tolerable – though one can see that they would be a bit of a nuisance on a setmaker's production line.
(2) The total power dissipation is greater than with a bipolar transistor. The main factors contributing to this are the higher voltage across the device when "on" and the slower switch-off time. This necessitates the use of a more substantial heatsink, with consequent increase in the board area and cost.
(3) The price of a gate-controlled switch is substantially higher than that of say a BU208A transistor.

The next step in commercial designs is likely to be the use of high-voltage Darlington line output devices. This will eliminate the necessity for a driver transformer.

## Alternative Line Driver Circuit

The line driver stage in our design can be improved upon. Fig. 1 shows an alternative circuit which has the advantages of lower power consumption and better switching conditions for the GCS. One drawback is that it requires a drive pulse of the opposite polarity to the original circuit. The simplest way of providing this is to use a TDA9513 sync/line oscillator i.c. instead of a TDA9503. These two devices are identical apart from the line pulse output stage. Alternatively a simple single-transistor inverter stage can be used with the TDA9503 – a suitable circuit is shown in Fig. 2.

Now let's consider the circuit shown in Fig. 1. When the output at pin 3 of IC1 is in the high state, the base of the BD675 Darlington transistor is forward biased by R10. The transistor saturates, so that the cathode of the gate-controlled switch SCR1 is at a voltage just above chassis potential. At this point it's gate is at 12V, and gate current flows via the 0·1μF capacitor so that SCR1 switches on very fast, minimising losses. Gate current is subsequently maintained via the 56Ω resistor. When the output at pin 3 of IC1 goes low, the BD675 switches off. SCR1's cathode is now virtually open-circuit, and the stored charge is diverted via the gate, recharging the 0·1μF capacitor. When this has charged to 12·6V, the BA157 diode switches on, any remaining gate current charging C12. The circuit is now ready for the next drive pulse from IC1, with the 0·1μF capacitor charged to ensure rapid switch on.

This mode of GCS drive is referred to as cathode drive. Another advantage is that it uses fewer components than the circuit we originally adopted.

The 12V supply can be obtained from the signals board, i.e. from the 7812 regulator i.c. The value of R9 must be changed from 100Ω to 10Ω.

## Modifications

Now for some simple modifications. First, we suggest increasing the value of R4 on the timebase board to 1kΩ. This improves the loop filter response. Secondly, some constructors have had trouble with field flyback lines on the screen. This is due to the fact that the field flyback blanking pulses, which are superimposed on the sandcastle pulse, are swamped by the low output impedance at pin 5 of IC1. A scope will reveal this. The solution is to isolate pin 5 of IC1 from the field flyback blanking pulse as shown in Fig. 3.

We have heard of instances of the power supply "cogging". This has been traced to the BR103 thyristor. If the device is obtained from a reputable source no problems should be experienced. If an alternative device is used it must have a switch-off time of 6μsec or less. The only suitable substitute we've found is the BRY55S – make sure it's the "S" version, since the ordinary BRY55 *will not do.* The voltage rating for this device is relatively

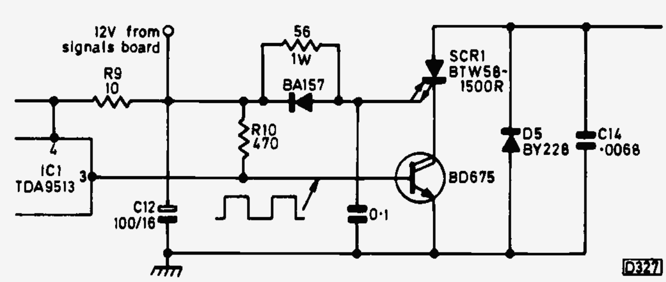
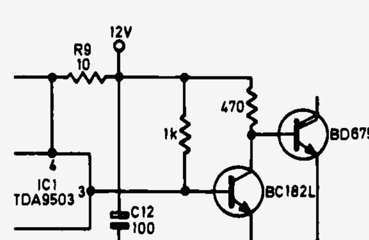



*Fig. 1: Alternative drive circuit for the BTW58-1500R line output device.*



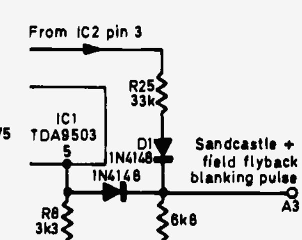




*Fig. 2 (left): Inverter stage for use with the TDA9503 line oscillator i.c.*

*Fig. 3 (right): Field blanking circuit modification.*

unimportant: the lowest in the BRY55S series is 30V, which is adequate.

To reduce dissipation in the chopper transistor, a BUX80 can be used in place of the BU326S. To reduce r.f. radiation from the power supply, isolate the transistor from the heatsink using a mica washer and plastic bushes – make sure that a generous amount of heatsink compound is used for optimum thermal efficiency.

Damping the tuner's i.f. output coil provides the broad bandwidth required for the SAWF to perform the necessary bandpass shaping. Unfortunately it also reduces the overall system gain. We now suggest leaving the coil undamped, adjusting the core until the colour burst on the composite video signal is seen just to increase in amplitude. This should provide a good overall response with higher gain.

Some patterning which varies with the brightness and/or contrast control settings has been observed. It can be eliminated (or at least substantially suppressed) by adding a wire link between the chassis pin of the 7812 i.c. and pin 27 of the TDA3560 i.c. If the problem persists, solder a 1,000μF 16V electrolytic between pins 1 and 27 of IC3, on the copper side of the board (do this in addition to fitting the wire link just mentioned).

### *Improved Decoder Chip*

Since the start of our project Mullard have announced the availability of the TDA3561 colour decoder i.c. This is pin compatible with the TDA3560 but offers the following improvements:

(1) The internal peak white limiter is active only when the output exceeds 9·3V. The start of the limiting action is delayed by one line period. This is done to avoid some interference type patterning on the screen during colour to monochrome transitions.
(2) The brightness control circuit has been modified to provide improved performance.
(3) The demodulated video signals have been further suppressed when data inputs are selected (this facility is not used on the colour portable).
(4) There is improved suppression of residual 4·43MHz signal components in the RGB output stages within the i.c.
(5) Circuit changes have been made in the colour demodulator and burst detector stages to minimise interference.
(6) High current chrominance output and RGB output stages are used.

We recommend using a TDA3561 in place of a TDA3560 therefore. No circuit modifications are required.

### *Tubes*

We understand that JLC Electronics (110 First Avenue, Bush Hill Park, Enfield EN1 1EP) have available supplies of 14, 16 and 20in. pincushion-distortion free tubes.

Finally, we would be interested in any comments from constructors who have either completed the receiver or experienced any problems other than those mentioned above.

# *Service Notebook*

*George Wilding*

### EHT Lead

The output lead of an e.h.t. tripler quite often gets damaged by coming into contact with a hot component or cutting edge. A repair is sometimes possible by cutting the lead to expose the minimum of wire, then soldering it up and covering with small sections of large diameter e.h.t. sleeving, but the end result rarely looks professional. The other day we found the ideal answer to the problem – use of the two-piece plastic fitting from a discarded Grundig-type tripler. This fitting covers the small current-limiting resistor just before the cap connector. These two-piece fittings are used on some other types of tripler, and are worth putting aside when the tripler itself has to be discarded.

### Thorn 1590 Chassis

After about ten minutes the picture on this monochrome portable (Thorn 1590 chassis) would start to roll. The setting of the field hold control was already well past the central position, so it wasn't possible to lock the picture by turning the control further. It seemed that some slight thermal change was affecting the field oscillator's time-constant, and as the two transistors were suspect these were replaced. The symptoms remained the same, so we decided to replace the only reasonably high-value resistor (R79, 120kΩ, in series with the field hold control) in the time-constant circuit – it's high-value carbon resistors that most often increase in value. This brought the locking point to about the centre of the control's track, and it was then possible to roll the picture in either direction. The picture would remain locked whilst left on any one channel, but on changing channel the picture would again start rolling – again lockable by means of the hold control. It seemed that although the sync pulse train was reaching the oscillator it was not able to lock the oscillator after a signal interruption. Attention was turned to the sync separator circuit therefore. The first suspect here was the high-value base bias resistor R41 (3·3MΩ) – the specified 0·25V was not present at the base of the transistor. The resistor was within tolerance however, so the transistor itself was replaced. This restored normal sync stability.

### Philips G11 Chassis

After a few intermittent crackles and breaks in the sound there was complete silence from the speaker of a Pye colour set fitted with the G11 chassis. The first thing we noticed was a thin wisp of smoke coming from C43, the 470μF electrolytic which provides the base drive for the "upper" transistor in the output stage. This electrolytic links the collector of the lower BD131 transistor to the base of the upper one, and as the voltage across it is normally only about 1V the lower transistor was the prime suspect. A meter check revealed that it was short-circuit collector-to-emitter. To be on the safe side we decided to replace both transistors, but on switching on again there was still no output from the speaker. This was simply due to the two 1Ω resistors R49/51 between the two transistors having burnt out when the lower one went short-circuit.

# VCR Servicing

## Part 10

**Mike Phelan**

OUR subject this month is chrominance circuit faults. Let's first recap briefly on how the system works. Fig. 46 shows in simplified block diagram form the chroma circuits in the record and playback modes. Remember that we are not dealing with a PAL decoder, and that although you'll find stages with similar names, e.g. a 4·43MHz crystal oscillator and burst gates, they are present for quite different reasons. The main purpose of the circuit is to carry out frequency conversion of the chroma signal – from 4·43MHz to 626·9kHz on record, and the reverse on playback. The box labelled 5·06MHz carrier generator contains the bulk of the circuitry. Note that although we show one frequency leaving the converter, the signal at this point consists of a mixture of four carriers (at least!), the following filter selecting the wanted signal.

### No Colour

To get back to fault finding, the most common symptom is no colour – on playback, record or both. Usually on both, as most of the circuitry is common to both modes. It's useful to have a prerecorded tape of colour bars to give a recognisable signal on the scope – chroma from a moving picture can look very much like noise. Don't bother to look for colour faults without a scope – it's an absolute waste of time.

We can split the faults into two categories, those occurring in the chroma signal handling stages and those that cause the 5·06MHz carrier to be either absent, unlocked or of incorrect frequency. The latter type of fault will result in the colour-killer operating on playback, as will any interruption in the signal path up to the point where the 4·43MHz burst is gated out.

The first thing to do is to operate the switch (see Fig. 47) at the back of the machine – note that this switch is present only on earlier VHS machines. Switch from auto to colour and then to black-and-white while watching the picture closely. Switching to colour overrides the colour-killer, and may produce some sort of colour – if it gives perfect chroma, the fault is almost certainly in the killer circuit itself. Usually however there'll be either no chroma or unlocked colour – as if the TV set's decoder is faulty. Unlocked colour will mean a fault in the carrier generator circuitry. No chroma at all could mean the same thing – it depends on the receiver's tolerance to variations in the frequency of the colour signal. If you repair enough machines to have a permanent monitor in use, fit a switch on it to override the colour-killer: doing this as well as overriding the VCR's killer will produce a colour display even if the carrier is at the wrong frequency or unlocked.

If you cannot get any colour by operating the switch at the rear of the machine, watch for the change in definition as the luminance filter is switched by the killer, and note between which two switch positions this occurs. This shows whether the killer is in operation when the switch is in the auto position. Fig. 47 makes the point.

If you find that the killer is not operating (i.e. not killing) in the auto position, this proves that the 5·06MHz carrier is present and locked and that 4·43MHz chroma is reaching the burst gate. The fault lies between transistor X206 in the chroma channel (see Fig. 31) and the luminance-chroma mixer in IC5, the cause often being that the AN608 amplifier i.c. (IC203) is defective.

If the killer is operating and there's no chroma in any of the switch positions, the fault could be in any part of the circuit preceding X206 – including the carrier circuitry of course.

### Checking the Converter

A good place at which to start testing is the converter stage – refer to Fig. 46(b). In the machine under discussion, this is in IC202 (AN305) on the Y–C (bottom) board. IC202 contains various things, but the chroma signal input to the converter, the 5·06MHz carrier input and the output should be present at pins 3, 5 and 7 respectively (see Fig. 31 in Part 6). You'll probably find that there's either something present on all three pins, something present on pin 5 only or something on pin 3 only. There is a fourth possibility, namely a distorted and obviously clipped output at pin 7. Before reaching for a soldering iron and a spare AN305, check the amplitude of the signal at pin 3 (or TP203). If this is much more than 300mV peak-to-peak, the a.c.c. circuit in the i.c. is not working. The converter will work normally only with correct amplitude signal and carrier inputs – too much of either and the output becomes severely distorted.

So why might there be no a.c.c. action? The next check to make is at pin 15 of the i.c. – the input to the burst gate in the i.c. There should be a chroma signal of about 0·7V peak-to-peak at this point. Note that this burst gate is used solely to operate the a.c.c. system – there's another burst gate to feed the burst to the a.p.c. detector on playback, and a third one to operate the record colour-killer (the latter two use discrete circuitry). All three burst gates receive a delayed line sync pulse from X219/X220 for switching. This pulse can be seen at TP216, and of course if there's no line sync pulse input from the servo board (check at TP213) there'll be no burst gating.

### The AFC and APC Loops

This problem will show up as an unlocked carrier however, due to the 2·5MHz voltage-controlled oscillator in IC208 (a.f.c. loop) having no control input. Any other 5·06MHz subcarrier frequency problems that prevent the converted signal containing a 4·43MHz component and thus passing through the following bandpass filter will produce the same effect.

Lack of signal input to the converter at pin 3 should not give headaches, nor should lack of carrier input at pin 5. Remember how the 5·06MHz carrier is produced? To recap briefly, on record a 2·5MHz voltage-controlled oscillator is locked to the line sync pulses, its output, after division by four, giving a 625kHz signal which is mixed with the output from a 4·435MHz crystal oscillator (see

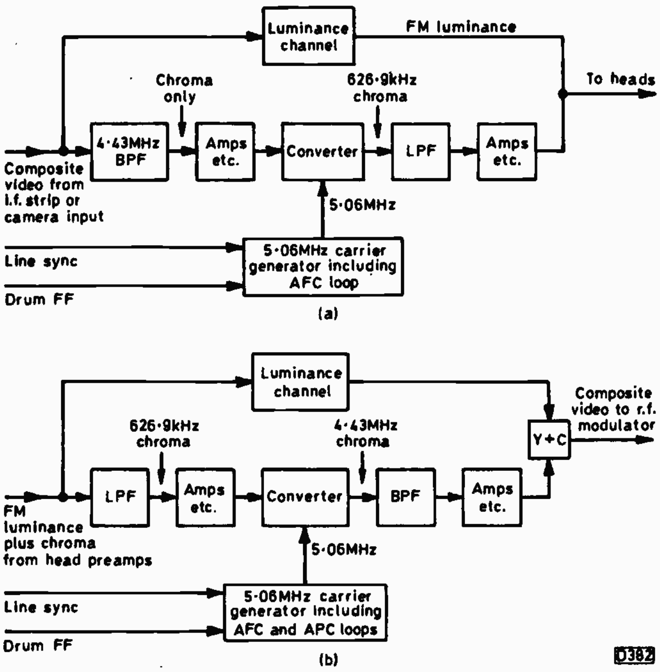



*Fig. 46: Block diagrams showing the chroma channel in the record (a) and playback (b) modes. In the record mode, the 5·06MHz carrier is produced by mixing the outputs from a 4·435MHz crystal oscillator and a 2·5MHz oscillator in an a.f.c. loop. Additional circuitry is used in the playback mode – the 4·435MHz oscillator is then contained within an a.p.c. loop, which compares the phase of the off-tape burst signal with the output from a second crystal oscillator working at 4·433619MHz.*

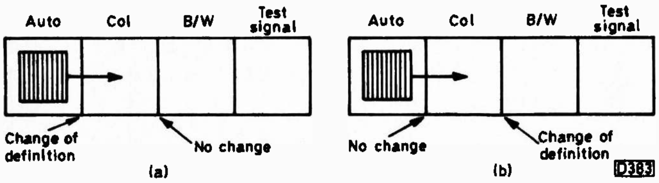



*Fig. 47: (a) Killer in operation. (b) Killer not in operation – chroma reaching burst gate.*

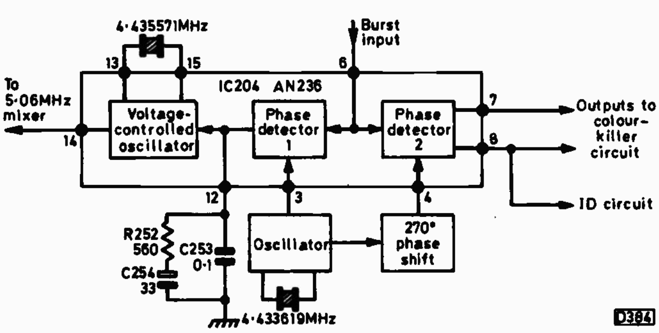



*Fig. 48: Block diagram of the a.p.c. loop used on playback. The ID output corrects phase errors greater than 90°.*

Fig. 29) – this crystal oscillator is free-running on record. The sum of these two signals is the 5·06MHz carrier. On playback all this happens – and more too (Fig. 31). This time the crystal oscillator is voltage-controlled by means of a phase-locked loop which compares the phase of the up-converted off-tape burst with the output from a free-running 4·433619MHz crystal oscillator (see Fig. 48). The phase detector used in this loop will not work if the phase error is greater than 90°, so a second phase detector, fed with a phase-shifted (270°) reference signal, is used to produce an output (the ID pulse) when the error exceeds 90°. This output momentarily inverts the 625kHz signal to put things right.

The extra bit that operates on playback only is referred to as the a.p.c. loop, the 2·5MHz oscillator and its control system being called the a.f.c. loop. So a fault in the a.p.c. loop will affect playback only. Such a fault will probably produce running colour when the killer is overridden, because the 5·06MHz carrier will be present but not phase locked. In this event the first thing to do is to ensure that the 4·433619MHz oscillator is actually running. If not, the prime suspect is the crystal. If this oscillator is o.k. and its output is reaching pins 3 and 4 of IC204 (AN236), check for the presence of the burst at pin 6 of this i.c. If this is missing, look around the burst gate transistor X205, ensuring that both the chroma signal and a delayed line sync gating pulse are arriving at its base. Maybe all these things will prove to be in order but IC204 will be running hot (it gets fairly warm in normal operation). Replacing IC204 will then solve things.

There's another little problem that sometimes occurs here. The machine records o.k., but on playback the chroma appears to change phase every ten lines or so (best seen on colour bars). If you look at Fig. 48, the purpose of the three components connected to pin 12 of IC204 should be apparent – this is the sort of network that appears in most TV receiver flywheel line sync circuits and also in decoder reference oscillator control loops. It is of course a time-constant network, and if the electrolytic C254 goes open-circuit we get the fault symptom just described – because there's a ripple on the voltage that controls the 4·435571MHz crystal oscillator on playback.

Faults that affect the 5·06MHz carrier on both record and playback fall into two main categories – failure of the 4·435571MHz crystal oscillator or faults in the a.f.c. loop (not to be confused with the tuning a.f.c., which is a different kettle of fish altogether). Most of this circuitry is in IC207 and IC208. The crystal oscillator itself is in IC204, which as mentioned before can run hot and fail, as can the 4·435571MHz crystal. Note the frequency: we have on occasion found that someone has put a standard crystal in this position. Adjustments to either of the crystal oscillators call for a frequency counter for best results. The MN6061A i.c. (IC207) rarely fails, but the mixer in IC208 can pack up – check the inputs at pins 14 and 15 and the output at pin 12, and don't forget that if either the 2·5MHz oscillator (producing the 625kHz signal) or the 4·433571MHz oscillator is far off frequency there'll be an output at pin 12 but it won't get any further than the following 5·06MHz bandpass filter (BPF203) if there's no 5·06MHz component. BPF203 has been known to go open-circuit, but remember that filters have an insertion loss: there will be only about 0·15V of carrier at the output (TP219) therefore.

Another fairly common fault is unlocked colour caused by lack of line sync pulses (TP213). This leads us to the sync separator on the servo board, and you'll probably find that this would work if it had any video going into it. As it probably hasn't, go back to the Y–C board where the emitter-follower transistor X7 is likely to be open-circuit.

### Crosstalk Cancelling System

Finally, faults affecting the crosstalk cancelling system. If the machine replays its own recordings with noisy chroma and won't play a prerecorded tape in colour, check for the drum flip-flop signal at the collector of

X216. If this is absent there'll be nothing to tell the MN6061A i.c. to phase shift the carrier on alternate fields. As a result the machine will replay only its own recordings, and these will be replayed without any crosstalk compensation. A similar effect occurs when the video head connections are reversed, i.e. the channel A leads are connected to the channel B head – yes, it happens!

### *Other Machines and Systems*

That more or less sums up the approach required for colour fault finding. The colour system used on other VHS machines is similar – in later machines there are fewer i.c.s. As the V2000 system is being covered in these pages by Brian Dempster, all there is left to do is to mention the Betamax system briefly. This differs in a few respects, mainly in the frequencies used. The down-converted chroma is at 688kHz, so the carrier is at 5·12MHz instead of 5·06MHz. Instead of line-by-line phase shifts on alternate tracks, crosstalk elimination is carried out by using slightly different carrier frequencies on each track. There are still two crystal oscillators, but the output from the a.f.c. loop is at 44 instead of 40 times the line frequency while the other input to the 5·12MHz mixer is at 4·433619MHz. A pilot burst derived from this signal is added during record and used instead of the original, swinging PAL burst: it's removed at the end of the playback process.

# Thorn's Stereo TVs

THE latest stage in the development of the Thorn TX chassis is a range of models featuring stereo sound. As Thorn put it, the sound side has long been the Cinderella of TV receiver performance, whilst stereo has become the accepted way of listening to audio signal sources. You might wonder why stereo sound should be included in a TV set when there are no UK TV transmissions with stereo sound – nor any plans at present to start stereo transmissions. There are several answers to this. The need to be able to offer sets for sale in export markets for a start, then the fact that the average life of a modern set is now assumed to be 9-12 years – and we shall almost certainly have stereo sound with our TV transmissions within the next decade. Of more immediate relevance is the introduction of VCRs featuring stereo sound and the fact that stereo sound will be available with the various video disc systems.

Much of the prerecorded material on tape and discs – feature films and so on – is without stereo sound of course. For the present, that is: it seems that much of the material is being reprocessed with stereo sound tracks, something that's not as difficult to do as it might initially appear. You can achieve a great deal with switching and mixing, using sophisticated audio processing equipment.

So Thorn's view is that with domestic audio equipment now all of the stereo variety it won't be long before viewers come to expect the sound from their TV sets to be in stereo as well: now is the time, Thorn feel, to take the plunge and offer stereo TV sets to the public.

They've certainly put a lot of effort into ensuring that the product will be acceptable to the viewing public. Consumer research has been undertaken of course, and on the technical side the aim has been to provide an appropriate "audio package" – appropriate output power and performance, the sort of tone/balance control arrangements users of audio equipment have become used to, and in particular simplified operation (there is no need for mechanical switching or plugging/unplugging to get things right). Thorn refer to this as the "consumer friendly approach": it's felt that there's no point in confusing the public with a bewildering array of switches, knobs and sockets. The sets in fact detect the type of input being applied, and by means of electronic switching adjust themselves to suit. A synthetic stereo system which Thorn call Supersound is also incorporated – more about this later.

The new range is based on the existing TX9 and TX10 chassis, and there are both manual and remote control versions – the latter include teletext. There are two DIN sockets at the rear to take stereo inputs, at a.f., from a VCR and a disc player – appropriate leads will be supplied with Thorn video products. The channel seven and eight selector positions are dedicated to disc and VCR use respectively.

Let's now see what's used for stereo and Supersound in the new Thorn sets. Stereo versions of the TX10 chassis use the 1550 series board which includes a stereo output stage: stereo versions of the TX9 chassis use the 1044 series board. In both cases the audio output is provided by a single Toshiba TA7227 i.c., which can be driven in either the stereo or mono mode depending on the position of the input plug/socket. In the TX10 chassis the i.c. delivers some 5W per channel, operating from a 22V line: in the TX9 it delivers some 4W per channel, operating from an 18V rail. The performance achieved with the TX10 chassis is as follows: power output 5·2W r.m.s. per channel for one per cent total harmonic distortion at 1kHz; 20W r.m.s. total music power at ten per cent THD; frequency response at 1W 50Hz-20kHz ± 1dB. The TA7227 features both current and short-circuit protection. It's a robust device, whose reliability has been proved by its use in car audio equipment.

An additional stereo audio processing panel, type PC1072, is used in both chassis and provides the follow-

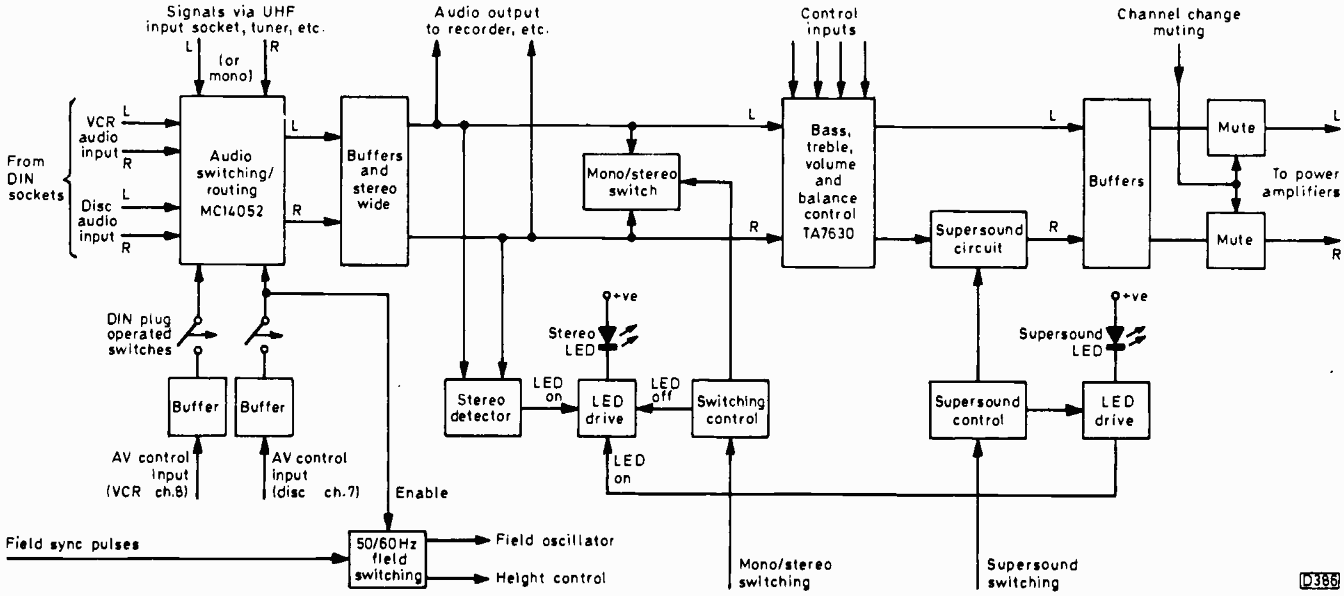



*Fig. 1: Block diagram of the circuitry on the stereo audio processing panel.*

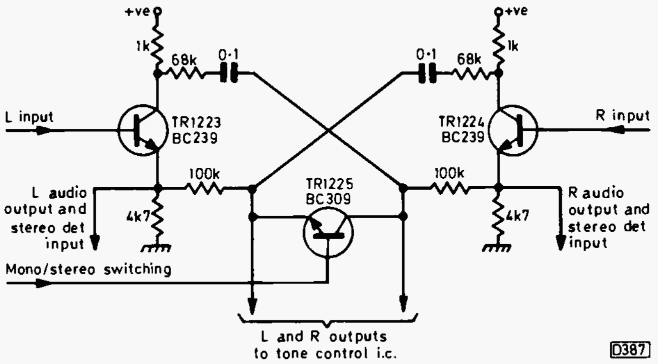



Fig. 2: Stereo wide cross-coupling.

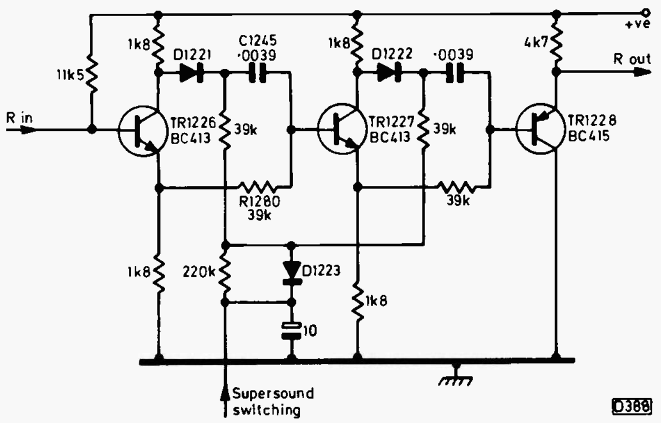



Fig. 3: Method of obtaining synthetic stereo.

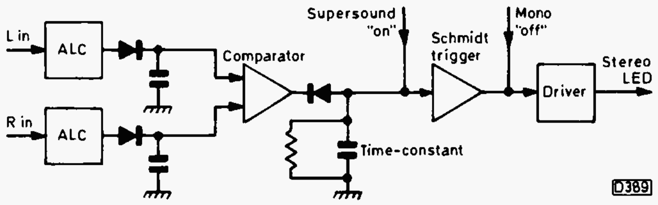



Fig. 4: Stereo sensing system.

ing features: bass, treble, volume and balance control; the audio signal routing and switching; "stereo wide"; mono/stereo switching; synthesized stereo, which is selectable with all input sources; automatic stereo indication; and 50Hz/60Hz field rate switching on the disc channel for playing NTSC discs. Fig. 1 shows a block diagram of the circuitry on the panel.

D.C. bass, treble, balance and volume controls are used to enable remote control to be applied, all these actions being carried out within a single Toshiba TA7630 i.c. The volume control range is 70dB, treble −18dB to +12dB, bass −15dB to +11dB, balance +3dB to −70dB.

Plugging a stereo audio input into one of the two DIN sockets at the rear closes a switch that gives the signal priority, on the appropriate channel, over any sound signal coming in via the aerial socket. Timebase AV switching is carried out simultaneously. The logic system ensures that when a VCR is connected to the receiver conventionally monophonic sound will be obtained; when the same VCR is linked via the DIN socket then this source, with the appropriate channel selected, will be reproduced in stereo. This switching/routing is carried out by an MC14052 i.c. There's a dual input from the i.f. strip to cater for future off-air stereo signals.

There have been suggestions that the impact of stereo TV would be reduced because of the inevitable close spacing of the loudspeakers at each side of the screen. Subjective tests have shown that some benefit is obtained by incorporating a modest amount of phase-reversed interchannel cross-coupling – the "stereo wide" feature. The relevant circuitry is shown in Fig. 2, where it will be seen that a couple of emitter-followers (TR1223/4) also provide cross-coupled, phase-reversed outputs from their collectors. A switching transistor (TR1225) is connected across the outputs to give monophonic operation.

The synthesized stereo "Supersound" is more effective than we expected it would be. The principle used is to derive two separate outputs from a monophonic source, a frequency-dependent time delay being applied to one output. As Thorn say, this is certainly capable of providing an extra dimension to the sound, particularly when a significant complex or reverberent element is present. The Supersound circuit is under the control of a user switch.

The Supersound circuit is shown in Fig. 3 – it's in the right-hand channel, the signal being subject to two frequency-dependent phase delays when the circuit is in operation. The combination of these delays produces a 180° phase shift at about 1kHz, rising to a 360° phase shift as the frequency increases. This is equivalent to introducing a time delay in the right-hand channel, with the delay varying over the audio bandwidth. Since the delay varies continuously with frequency, the audio image moves.

Transistors TR1226/7 control the phase shifting. The equal amplitude but opposite phase outputs at the emitter and collector of each stage are summed via *RC* networks – R1280/C1245 in the first stage. The capacitor has a high impedance at l.f., so the output is taken from the emitter with no phase change. At h.f. the capacitor has a low impedance and the anti-phase output is taken from the collector. The Supersound effect is cancelled by biasing diodes D1221/2/3 off.

What you listen to of course is the loudspeakers, and care is required with these. With a fair amount of audio power being delivered at each side of the tube, purity problems could arise at the resonant frequency of the shadowmask. Thorn use a pair of 7W elliptical speakers which have been specially developed by Goodmans for use in these sets. Care is obviously also required with the mounting and acoustics.

Thorn felt that a LED stereo indicator was a desirable feature. The problem here is that with no off-air signals there's no pilot tone – a convenient indication of the presence of a stereo signal. A stereo signal sensing circuit was therefore devised (see Fig. 4), using a TL084 quad operational amplifier i.c. Two of the operational amplifiers are used as automatic level control (ALC) amplifiers to equalize the amplitudes of the left- and right-hand signals. The outputs are rectified and fed to an operational amplifier comparator which detects phase differences between the equalised signals and thus the presence of a stereo source. The comparator's output is detected by a circuit having a fast attack and slow decay, so that temporary centre-stage activity etc. does not cause the indicator to flash on and off. The fourth operational amplifier is used as a Schmidt trigger to provide a degree of system hysteresis. Selection of Supersound automatically biases the Schmidt trigger to force the stereo indicator on – there is a Supersound indicator as well to show that this sytem is in use.

The JVC VHD disc system has been arranged so that the players can accept and replay either PAL or NTSC discs. The problem remains that an NTSC disc will deliver signals with a 60Hz field frequency (the line frequency difference is small enough to be catered for by the flywheel line sync system). Since manual adjustment of the field hold and height controls would be tiresome, circuitry is incorporated to enable the sets to adjust automatically.

The circuit used is based on an NE555 timer i.c. which operates as a retriggerable monostable when fed with field sync pulses (see Fig. 5). The monostable's time-constant is such that with an input pulse train at a frequency of above about 55Hz the monostable remains permanently latched. Sync pulses at a lower repetition frequency allow the monostable to reset itself before the next edge arrives to trigger it. As a result the monostable's output is either permanently latched high (60Hz) or consists of a rectangular waveform with a 50Hz repetition frequency. The difference is detected by a diode/capacitor combination whose output drives transistors that in turn adjust the field oscillator's free-running frequency and the height.

The remote control system has to be able to provide all the audio controls in addition to the picture controls and teletext selection. This is beyond the capability of the existing sets of remote control chips, so an 8048 microcomputer i.c. with in-house programming has been brought into use. The processing power of the 8048 is also used to operate "bar-graph" indicators that show the state of the treble, bass and balance controls. In order that these indicators should not distract from the picture, they are illuminated only when the control system is in

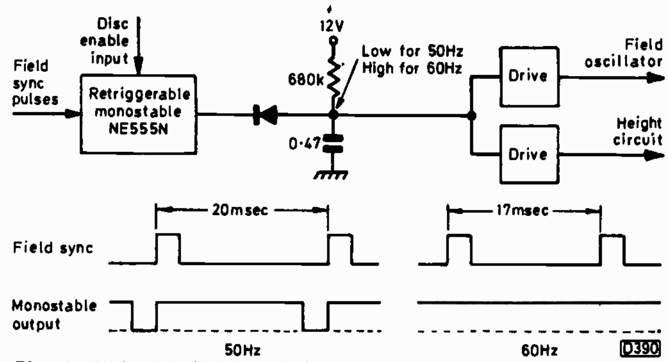


*Fig. 5: 50/60Hz field switching.*

the audio mode. This arrangement provides a ready indication therefore of the mode engaged, preventing user confusion with the buttons and their operation. The volume and balance controls operate in all modes.

The 8048 chip is used with two simple interfacing i.c.s to extend the capability of the existing Mullard remote control chips. The i.c.s, bar-graph LEDs and associated components are mounted on two back-to-back boards (PC1073/4) at the rear of the left-hand side facia moulding, allowing the LEDs to show through. The whole assembly can be loaded into the cabinet moulding from the front. Thorn comment that the use of the microcomputer i.c. allowed this compact module to be developed in a short time and with a minimum component count. The programme masked into the 8048 is entitled ERIC – Extended Remote I-bus Converter.

# Routine TV Receiver Tests: GEC C2110 Series CTVs

*S. Simon*

The GEC C2110 series presents us with quite a contrast to the hybrids, being the first solid-state colour chassis from GEC. The circuitry is reasonably straightforward, with a BU108/BU208 transistor line output stage, thyristor regulated h.t. supply and considerable use of i.c.s in the small-signal stages. These sets have their own characteristics however, some endearing and some not. Since the purpose of this series of articles is essentially the initial handling of sets as they come in for repair, we cannot go into the more obscure of the occasional horrid problems that arise. We will however touch upon the more common faults, within the confines of our own experience that is. Note that the tube's heaters are this time supplied from a winding on the line output transformer.

## Fuses

After removing the rear cover the first thing to observe is the position of the mains fuse – on the top left of the main frame. It's a 3·15A anti-surge type. If you find it open-circuit with no apparent cause, its contact with the clip is suspect: a poor contact is sufficient to produce enough heat to melt the fuse internally. When a fuse is replaced, clean and retension the clips to avoid further trouble.

Another thing to note is that there may be a "snubber" network behind the fuse – an 0·22$\mu$F 350V a.c. capacitor (C58) in series with a 270$\Omega$ resistor (R69) to chassis. This network is not shown on all circuit diagrams: it was added to protect the thyristor.

The degaussing circuit has its own fuse FS2 (5A, later changed to 2A) on its own little board, on which the 0·22$\mu$F mains filter capacitor C751 is also mounted. So if C751 goes short-circuit, FS2 will be found blown.

Returning to the 3·15A fuse FS1, if this has blown its appearance will (as usual) give a clue to the cause. If it's severely blackened, the cause is not far away – either the snubber capacitor or the BT106 thyristor, which is on the bottom centre power unit. Check with an ohmmeter to see whether there is a short between the body (anode) and the legs (the long one is the cathode). If it doesn't appear to be short-circuit, take a look at the condition of the two large electrolytics towards the front of the panel. These can cause all sorts of trouble, and it's not a nice job getting rid of all traces of electrolyte from under the components and the multi-pin sockets.

If the fuse is not blackened to any extent, it's more likely that the short-circuit is in the line output stage.

## Over to the Line Output Stage

This is on the right side (lower) and some caution is

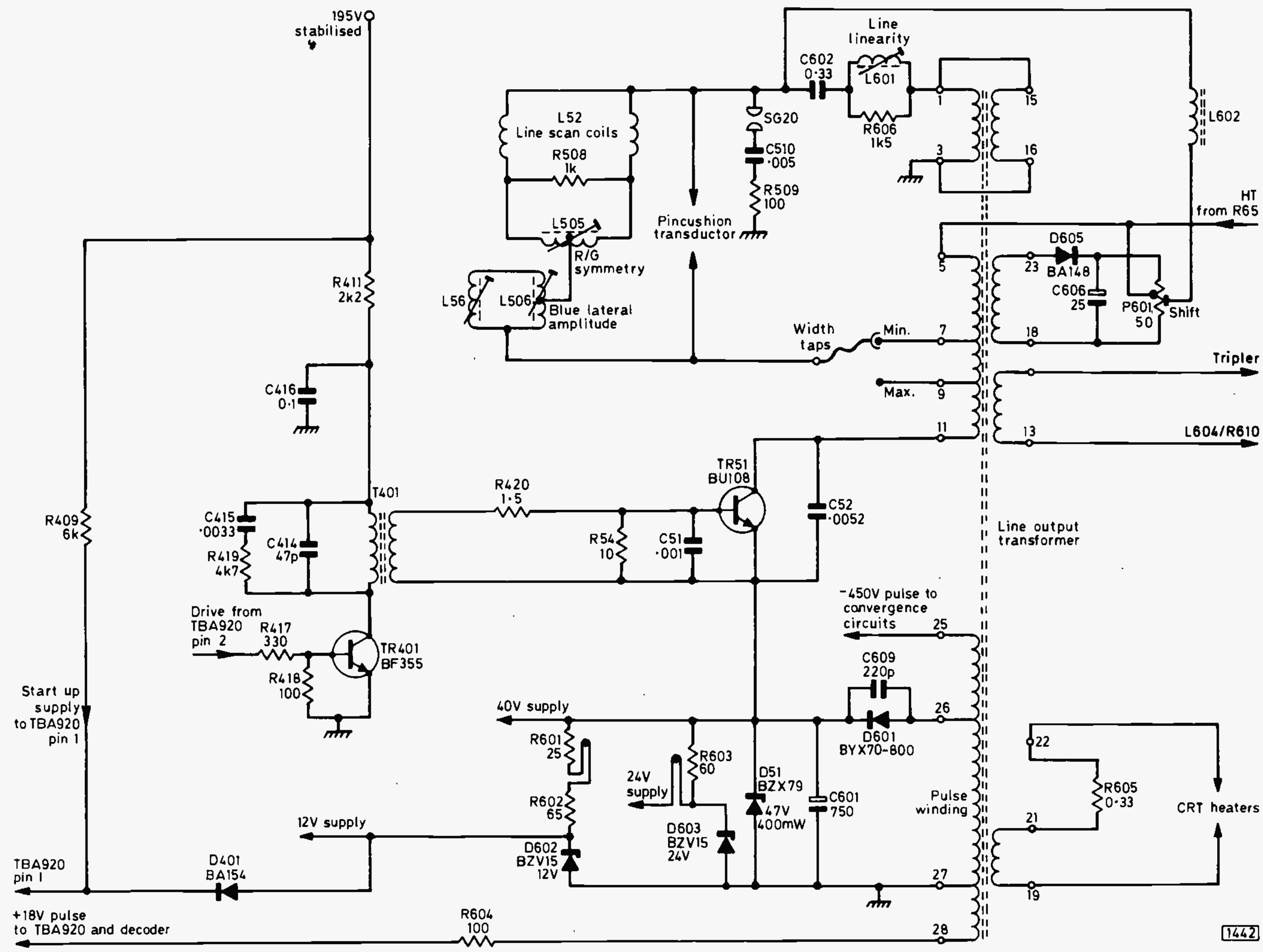



*Fig. 1: Line driver and output stage circuits. D601 was later changed to type BY210-800.*

required in order to save a lot of time. The BU208 (originally BU108) line output transistor is liable to go short-circuit and if it does this is not the end of the story. It's a fairly simple matter to expose the transistor by removing the cover plate. The transistor can then be isolated by removing its collector lead. Test it for leaks with the black probe to its collector – there should be no reading. If there is a reading, the transistor should be replaced together with the small 47V zener diode D51 which is wired between its emitter and chassis. Any short through the transistor will spell doom for the zener diode, which is what it's there for (to stop the transistor's emitter voltage rising above 47V). A point to note is that the original cause of the trouble could be that the flyback tuning capacitor C52 (0·0052μF) has gone open-circuit. This will certainly kill the diode, and probably the transistor as well. The transistor could just as well have gone short-circuit on its own account however.

If the transistor is not at fault, check between its emitter and chassis, disconnecting the zener diode to prove whether this is responsible or not, since it's quite likely that the 40V rectifier diode D601 (BYX70) on the board near the line output transformer is short-circuit. Its reservoir capacitor C601 (750μF), the fairly large electrolytic on the rear edge, is also suspect.

It's common in these sets to have a minor burn up on the top of the line output transformer housing where there are two small 1MΩ resistors (R607/8). These change value and in doing so hasten their own demise without causing too much trouble. As they fall in value, so the tube's first anode supply falls. Sometimes they stay intact long enough to cause a bit of a burn up (and maybe a blown fuse), but this is not common.

Talking about tube supplies, we should mention the habit of R701 (180kΩ) going high in value. This results in a dark picture since the voltage at the tube's grids is reduced. R701 is situated on the front left of the bottom centre power supply board. Brightness problems are not uncommon on these sets, and the cause of reduced brightness could be in the first anode supply network: check R506 (560kΩ) on the convergence panel in earlier models, or R616 (same value as it replaced R506) on the same panel as R506/7 in later models. In the event of excessive brightness, check R507 (300kΩ) on the convergence panel.

## The Field Timebase

A major trouble spot is the field timebase, which is on the upper right panel. There are two npn output transistors on separate heatsinks inverted at the front end, and it's here that the causes of inadequate field scan, bottom cramping etc. will probably be found. Power transistors such as the BD203 or TIP31 are suitable replacements for the ON447. The resistors in the emitter circuits of the output transistors (R466, R467, R469 and in later versions R474) should also be checked, while the mid-point voltage preset (P454) requires careful setting (for 23·5V

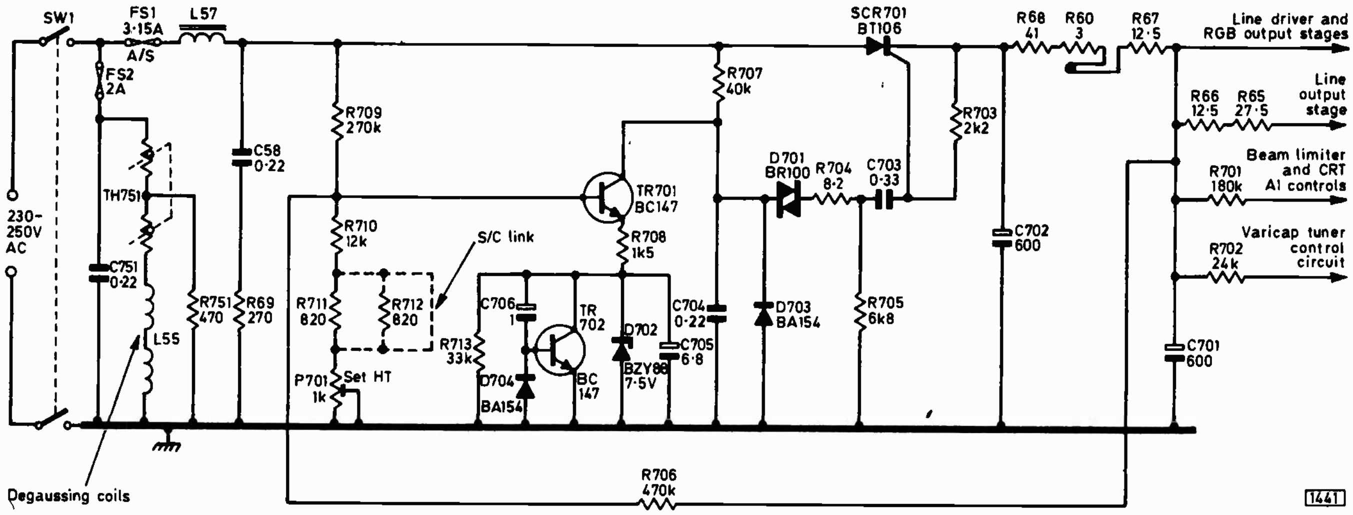


*Fig. 2: Power supply circuit. In later versions R714 (270kΩ) is added in parallel with R710.*

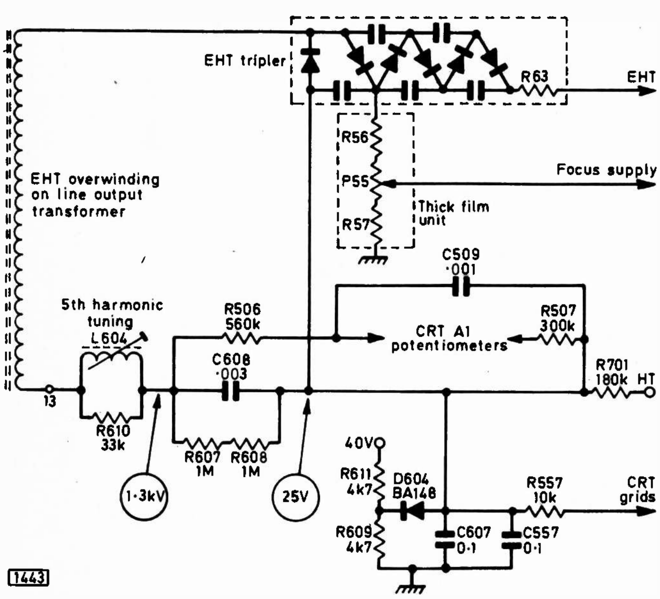


*Fig. 3: Tripler, focus, c.r.t. first anode supply and beam limiter circuits.*

at the emitter of TR454).

Excessive scan should direct attention to the field charging capacitors C457 (47μF) and C458 (22μF) which can lose capacitance. In the event of field hold problems check C452 (4·7μF).

## Around the Line Timebase

There are two fusible (sprung) resistors on the line output transformer housing. One (R601) is for the 12V supply and the other (R603) for the 24V supply. Either can spring open for no apparent reason, but if they do overheat check the associated zener diode (D602 and D603 respectively) before looking elsewhere. Whilst the 24V line feeds the audio output chip only, the 12V supply feeds the small-signal stages and the TBA920 sync separator/line oscillator chip. The latter obviously requires a start-up supply, which comes from the h.t. line via R409 (6kΩ). These two items are on the centre right side panel, along with the line driver stage. The BF355 transistor used in this stage is a possible trouble spot, and attention should be paid to it and its h.t. feed resistor R411 (2·2kΩ) in the event of the no results symptom where the h.t. supply is present. Whilst we're in this neck of the woods, line sync problems should be dealt with by replacing the TBA920, whilst striations on the left-hand side could well cause head-scratching if you don't know that C414 (47pF) across the primary winding of the line driver transformer can be responsible.

A quick idea of the state of things can be gauged from the condition of the thermal resistor R60 on the top of the frame with the other droppers. If it has sprung open, it's a pretty safe bet that some sort of short is present on the h.t. line and that it's something to do with the line output stage. Don't quote us on this however, since when it happens to you it'll probably be for some other reason . . .

## Fault Round Up

The SN76013ND-07 audio chip is fairly reliable. The reason why these chips give a lot of trouble in some audio units but not here is because of the supply voltage. In these sets the voltage is 24V and the chip runs fairly cool: in an audio unit the voltage is more towards 30V and the audio is generally run at a higher level. The usual cause of distortion is the 24V zener diode D603.

The colour decoder is pretty reliable apart from very occasional chip failure. The real villains here are the small preset controls which tend to become intermittent, either at the wiper or at one end of the track. Before delving too deeply, check their operation with a meter, ensuring that they are returned to their original settings (mark them) once passed o.k. Most colour defects originate around the RGB output transistors and are easy to trace by checking and comparing the voltages in the three stages – these are identical apart from the drive controls incorporated in the red and green stages only.

The tuner unit is of the varicap type, the tuning voltage being derived from the h.t. line via R702 (24kΩ) on the power supply unit. If you can't tune in, check this resistor first.

We're back where we started then, at the power supply. The h.t. should be set (P701) for 186V at the junction of R58/59 or R66/67 (earlier or later power supplies respectively). In the event of low/high h.t., check the values of R706 and R709. Low h.t. can also be caused by D702 or C705 being leaky. Picture jitter is sometimes a problem. Try replacing the trigger diac D701 first (ITT V413M or RCA 17000 are recommended types). If this fails to improve matters, replace the thyristor.

# Long-distance Television

### *Roger Bunney*

THERE was a wide selection of long-distance TV reception of all types during April. With the approach of the Sporadic E season, there's been an increase in the number of short-duration receptions, European signals being noted on most Band I channels. Tropospheric conditions have been similarly active, following on from the good openings in March. F2 and TE signals have also been received at times. It's been interesting here at Romsey (Hants) to monitor the early evening period from 1700-1900BST: TE video information has been present most evenings on ch. E2, arriving from the south, generally weak but at times rising to give recognisable pictures. The signals are certainly height conscious, and I suspect restricted to along the south coast: a signal present at 52ft cannot be resolved with an aerial at 30ft.

The log for April is as follows. First SpE reception.

| | |
|---|---|
| 30/3/82 | TSS (USSR) ch. R1, 2; TVP (Poland) R1, 2. |
| 31/3/82 | TSS R1, 2; CST (Czechoslovakia) R1. |
| 4/4/82 | SR (Sweden) E2, 3, 4. |
| 10/4/82 | SR E2, 3, 4; NRK (Norway) E2, 3, 4. |
| 11/4/82 | TSS R1, 2; RAI (Italy) IA. |
| 23/4/82 | SR and NRK E2 and 3. |
| 1/5/82 | TVP R1. |

TE/F2 loggings were as follows:

| | |
|---|---|
| 31/3/82 | ZTV (Zimbabwe) E2; GBC (Ghana) E2. Both TE. |
| 1/4/82 | ZTV E2 (F2 with PM5544 pattern); GBC E2 (TE); Dubai E2 (F2). |
| 5/4/82 | ZTV E2 – very strong PM5544 pattern via F2. |
| 6/4/82 | Similar to 5/4/82. |
| 9/4/82 | GBC E2 (TE). |
| 10/4/82 | Dubai E2 (programme material, very strong, via F2); TE signals from ZTV and GBC on ch. E2. |
| 12/4/82 | ZTV and GBC E2 (TE). |
| 13/4/82 | GBC E2 (TE). |
| 16/4/82 | GBC and ZTV E2 (TE). |
| 18/4/82 | As 16/4/82. |
| 23/4/82 | ZTV E2 (TE). |

A sustained high-pressure system gave tropospheric reception during much of the month. Conditions were not as good as they can be, but were nevertheless good enough to enable W. German u.h.f. stations to be received in the Midlands on some days. The first period of tropospheric reception extended from the openings of late March, the best days perhaps being the 5/6th and the 17/18/19th of April. DR (Denmark) was received on the 18th, in Band III.

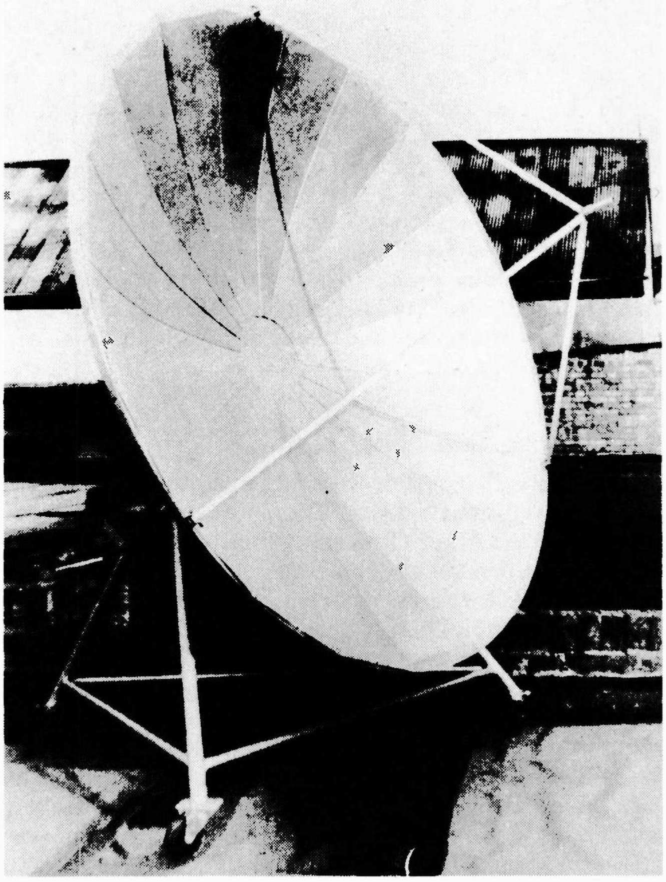
There was particularly marked MS (meteor shower) activity on the 7th. Cyril Willis noted RTVE (Spain) using a new identification – "TVE" rotating on a "roundabout".

My thanks to the following who contributed to the log and sent comments this month: Cyril Willis (Cambridge), Arthur Milliken (Wigan), Mark Baldwin (Canterbury), Garry Smith (Derby), Hugh Cocks (Sussex), Reg Roper (Torpoint), D. Moller (Eastbourne), Roger Hazelden (Bishops Stortford) and Ryn Muntjewerff (Holland).

Good F2 conditions have continued in Australia. Anthony Mann reports signals as high as 55·42MHz – a Japanese f.m. link – on some days in late March, also ch. R2 vision. April 4th was particularly good, with TDF (France) ch. F2 audio (41·25MHz). Robert Copeman (Melbourne) received strong signals from Lanchow (China) and Vladivostok (USSR) on ch. R1 on the same date. A reader in Dhahran (Saudi Arabia) reports reception of an unlisted Iranian ch. E21 transmitter, using the Fubk test pattern and a colour pattern with a broad horizontal band of colours (four) at the bottom.

### *4GHz Satellite Terminal*

Work is continuing on the development of a home constructed satellite TV receiver for the 3·7-4·2GHz spectrum, in which signals can be received on three Russian channels – one relatively strong. The terminal illustrated last month works, but with insufficient gain in the aerial system to resolve signals. I'm now awaiting the arrival of a larger dish. A fellow enthusiast has got the basic system shown working with a 6ft dish, and reports excellent results – using a Chapparel horn feeding directly into the mixer/i.f. amplifier arrangement described. The low i.f. (70MHz) with single conversion from 4GHz has resulted in a selectivity/image problem however. As a result, a design with an initial i.f. at u.h.f. and a second conversion to a lower i.f. is being tested. As soon as a basic design giving reliable results is achieved, information will be given – including sources of supply. A two metre dish with supporting structure is available from Harrison Brothers of 22 Milton Road, Westcliffe-on-Sea, Essex – send s.a.e.



*Six foot/two metre dish aerial of petal construction – available from Harrison Brothers (see text).*

with enquiries, and note that they do not have electronics items available at present.

During April I visited the CAI Exhibition at the IBA's Brompton Road headquarters. One of the most striking features was a bank of SECAM monitors displaying noise-free colour signals from the Russian Gorizont satellite, the 3·8GHz signals being picked up by a 6ft dish atop the building. Tuning to other channels revealed two weaker Russian TV signals. The equipment is understood to be available from Megasat Ltd. of 8 Poland Street, London W1 – send s.a.e. with enquiries and note that the prices for complete terminals run to several thousand pounds.

### *New EBU Listings*

**Portugal:** Valencia do Douro RTP-1 ch. E4, 35W horizontal – a possible via SpE.

**Syria:** Nabi-Saleh SRT-1 ch. E3, 180kW e.r.p. horizontal – this one has already been received in W. Europe.

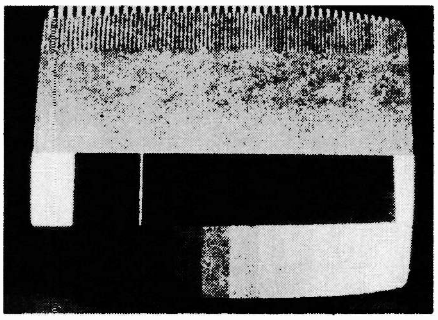
### *Channel E1*

At the end of my account of the history and demise of the American ch. A1 last month I raised the question as to whatever happened to the European ch. E1? Mr. R. Gressmann of the EBU, Brussels, has kindly provided the answer. The spectrum that had been allocated for TV broadcasting at the Atlantic City ITU Conference in 1947 was 41-68MHz. The first European TV channel plan was agreed at the Stockholm ITU Conference in 1952. At that time there were only twelve W. European transmitters in operation – one French transmitter was using a 441-line standard. Only three 7MHz bandwidth channels could be accommodated in the 41-68MHz spectrum, and these were defined as 47-54, 54-61 and 61-68MHz. This left the spectrum 41-47MHz unoccupied, though assignments were made for three Yugoslavian stations in this spectrum. As far as is known no system B transmitter has ever operated in this part of the spectrum, and the plan following the 1961 Stockholm Conference deleted any mention of it. It's assumed that setmakers had regarded this unused part of the spectrum as channel 1, hence to this day we start at ch. E2 in W. Europe. Not quite such a lengthy saga as the story of ch. A1, but our thanks nevertheless to Mr. Gressmann for clearing up the mystery.

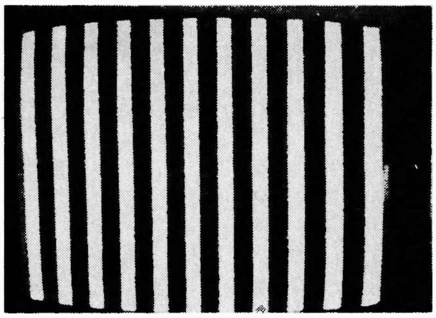
### *From our Correspondents . . .*

Roger Hazeldon (Bishops Stortford, Herts) was very successful in both Band III and at u.h.f. during the recent good tropospheric conditions. He had noise-free colour from Holland and Belgium, and good quality Band III signals from Denmark. April 1st was a red letter day, when he received Dubai ch. E2 via F2. Roger is using a Telerection wideband short-backfire u.h.f. array, a Jaybeam ABM11 Band III aerial and an Antiference MH308 covering both Bands I and III. The short-backfire gives high gain, especially when the optional director extension is fitted. Unfortunately few were produced, since Telerection ceased aerial manufacture shortly after introducing their version. The receivers Roger uses are an "ageing" and heavily modified (for variable bandwidth switching and varicap tuning) Cossor dual-standard set, a Pye hybrid colour receiver and a Thorn 1690 monochrome portable.

Paul Barton (Harrogate) has built a DX system similar



*EBU bar test pattern used by Madras ch. E4 – photo courtesy T. S. Nanda Kumar.*



*Vertical bar test pattern used by Madras ch. E4 – photo courtesy T. S. Nanda Kumar.*

*Gorizont satellite reception showing a Moscow/Berlin link via the hemispherical beam. Photo courtesy S. Birkill.*

to that described in these pages recently (i.f. processor etc.) but making use of G8 panels. He reports that the gain and selectivity are both good. Paul is also considering a 4GHz satellite receiver system . . .

Nanda Kumar (Madras) has sent in two shots of local ch. E4 test patterns. He's made a high-gain 16-director ch. E5/8 Yagi array which, with an Indian made 45dB v.h.f. only preamplifier, enables the new Sri Lanka TV to be received. Nanda mentions that Stat-T is still operating on ch. 51 (714MHz), not 754MHz as previously reported.

# The LaserVision Disc System

***Part 2***

***Vivian Capel***

THERE are two types of LaserVision record, the CAV (Constant Angular Velocity) and CLV (Constant Linear Velocity) types. Philips also use the terms active and long play respectively. With the CAV disc the speed of rotation is constant, at 1,500 r.p.m. (25 r.p.s.). As this is the same as the frame frequency, it follows that one complete frame is recorded per revolution. Thus all the field sync pulses and flyback periods are lined up in the same positions across the disc.

Track jumping can thus be easily performed without affecting picture quality by arranging for it to occur during the field flyback period, of which there are two per revolution. This is accomplished by open-circuiting the loop that controls the radial mirror, kicking it in the required direction by means of a large pulse, braking it rapidly with another pulse of the opposite polarity, then closing the control loop so that the servo picks up the centre of the newly selected portion of the track.

## *Special Effects*

A number of effects can be obtained according to the direction and frequency of the jump (see Fig. 9). For example, a jump backwards once per revolution gives a still picture by repetition of the frame. A jump backwards every half revolution gives reverse motion at normal speed, while a jump forward every every two revolutions gives half speed forwards. To get reverse at half speed the spot must jump two tracks every one and a half revolutions. For fast forward one forward jump per revolution gives three times normal speed.

Hence by changing the polarity and varying the frequency of the pulses a range of playing modes is possible. The controls provided and their effects are as follows:

**Freeze frame:** There are two buttons. Pressing one gives the next frame while pressing the other gives the previous frame.

**Slow motion:** Either forward or reverse can be selected by two buttons, while a linear potentiometer varies the speed from normal to four seconds per frame.

**Normal speed:** Two buttons give forward or reverse.

**Fast forward:** Three times normal speed as long as the button is depressed.

**Search:** Two buttons for forward or reverse search. In this mode the disc rotates at a very high speed, about 75 times normal, which means that a complete side is scanned in 24 seconds. This continues as long as the relevant button is pressed or until the end of one section (called a chapter) of a programme is reached and the next is ready to start.

So how does the machine know where the chapters end? For this purpose codes are included on lines 16-20 and 329-333 during the field blanking period. These identify not only chapter divisions (if included) but also the numbering of every frame. Either of these numbers

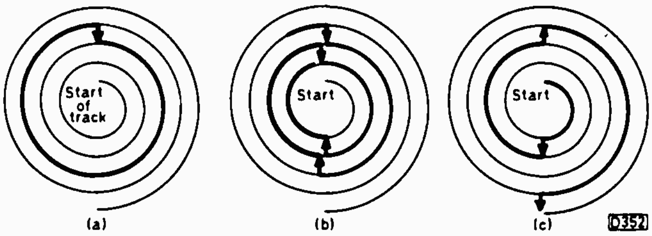



*Fig. 9: Examples of the effects possible with the CAV type of disc. (a) One jump back per revolution gives a still picture. (b) One jump back per half revolution gives reverse motion at normal speed. (c) One jump forward per half revolution gives three times normal speed.*

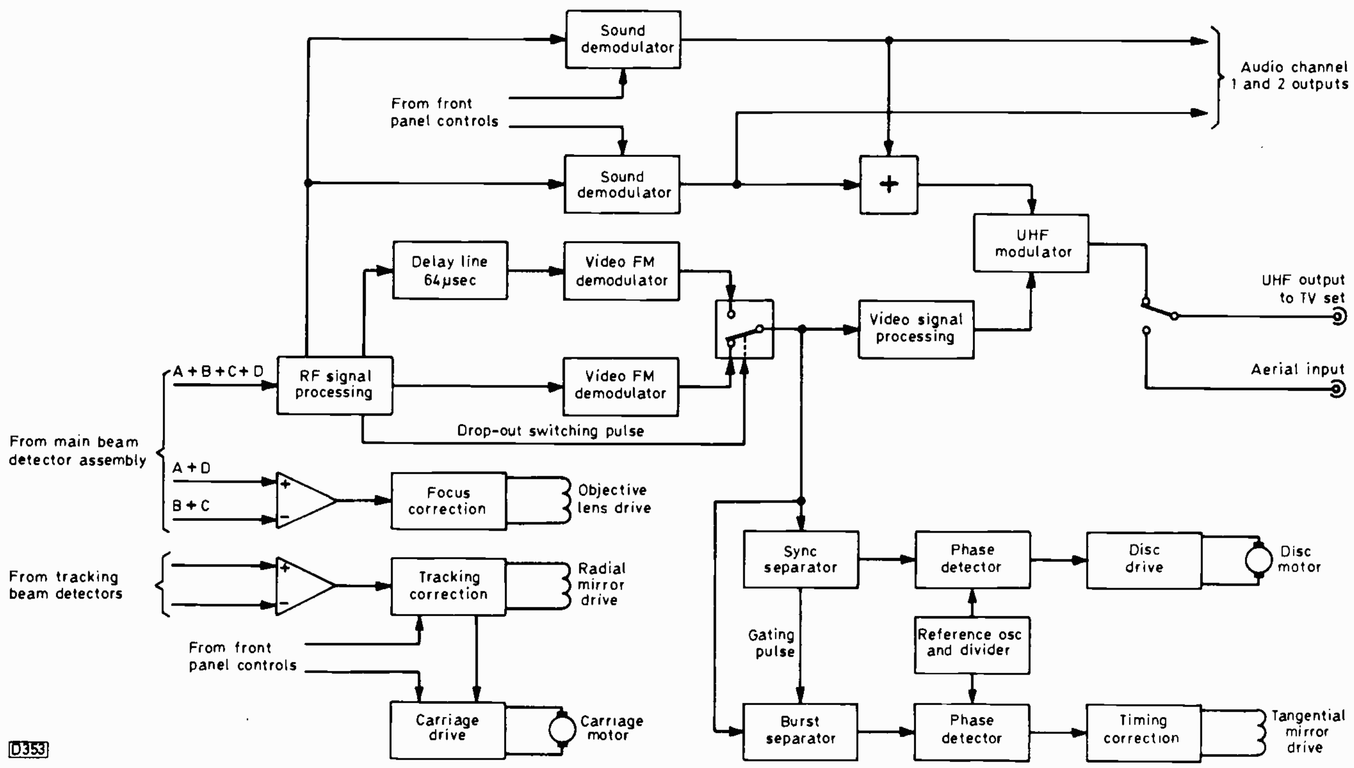



*Fig. 10: Block diagram of the player.*

can be displayed on the screen by pressing the index button. A stop code may be included with some instructional material to freeze the frame automatically when the code is reached – this can be overridden if not required.

These features are all available with the CAV disc. There's a drawback however. As with an audio gramophone record, maximum use is not made of the space available on the disc. While the information packing density approaches the theoretical maximum for the system at the inner parts of the track, it becomes less as the track diameter increases: at the outside, where the track length per rotation is two and a half times greater than at the centre, there is much wasted space. This means that the playing time is only half an hour per side.

Hence the CLV disc. With this, the linear scanning velocity and hence the information density remain the same from the inside to the outside of the disc, which in turn means that the playing speed is not constant. It starts at 1,500 r.p.m. and gradually slows, to 750 r.p.m. half way across and 500 r.p.m. at the finish. This enables the playing time to be doubled to an hour per side.

This gradual slowing down is not difficult to arrange. Since the motor speed is controlled by the off-disc line sync pulses, it will adjust to give the normal 64µsec per line. This method of recording means that the field blanking periods do not line up across the disc in the same direction, so track jumping is not possible. A special code is included on the lines previously mentioned to disable the various speed controls. Instead of the chapter and frame number codes, a time code is recorded. This gives the elapsed time on the screen in hours and minutes when the index button is pressed.

The type of record depends on the type of programme material. Instructional and documentary features would normally be recorded on CAV, but with feature films, where the playing time is more important than the provision of still picture and slow-motion facilities, CLV discs will be used. No switching is required by the user to select the appropriate mode.

## Block Diagram: Outputs Provided

Since (unlike a VCR) little signal processing apart from demodulation/remodulation is required, the circuitry used in the player is fairly straightforward (see block diagram, Fig. 10). As we've already seen, loss of signal due to surface blemishes is unlikely. It may occur however as a result of other factors such as imperfect metalising or tiny bubbles in the plastic coating material. These are taken care of by including drop-out compensation. A 64µsec delay line stores the signal from the previous line and, if a drop-out is detected, a switch selects the output from the delay line (via a separate f.m. demodulator), thus filling in with the corresponding portion of the previous line until the signal is restored.

Two buttons are provided for the sound channels, so that either or both can be switched in. There are two output sockets so that the audio signals can be taken out directly and fed to a stereo amplifier (output is 1V at 1·5kΩ). There's also a 2V video output. The normal output is provided via a u.h.f. modulator on channels 31-43, at 2·5mV.

## In Conclusion

So there it is, the latest addition to the world of video/TV. The performance, as far as we've been able to judge from demonstrations of prototypes, is excellent, the technology neat and sophisticated. As to whether the system will be successful commercially, the problems include the launch of the rival VHD System next year and the dominant position already achieved by VCRs – in addition to selling the whole idea of discs of course. Discs and tapes have coexisted for many years in the audio field – but in that case the discs came first.

# VCR Clinic

### Ferguson 3V23

A Ferguson 3V23 came in with the complaint that it wouldn't accept a cassette. When the machine was set up and a cassette was inserted the threading motor was energised, but no sooner was the tape threaded than it was ejected again. A different tape, which was not fully rewound, was then inserted. The machine went into the rewind mode, stopped, rewound etc. until the tape was fully rewound. The cassette was then ejected.

This gave us the required clue. On the 3V23, JVC HR7700 etc., an end sensor (cassette lamp shining through to a phototransistor) is activated when the tape has come to the end of play. The tape is then automatically rewound. The end sensor phototransistor (X4) has a collector voltage of 9·9V for no light input, the end sensed reading being 2V. The faulty machine gave the end sensed reading regardless of the light conditions. As a result, the tape was rewound: when a rewound tape was inserted both the start and end sensors were activated, producing a mechacon eject command. Replacing the phototransistor (mounted on the servo-2 board) completely cured the fault. **M.J.C.**

### Ferguson 3V16

Intermittent play key tripping was the problem. As the drum and tape transport system seemed to be working normally we monitored the inputs to the MSM5830 i.c. on the mechacon (mechanism control) board. The input to pin 20 from the take-up spool sensing Hall effect i.c. was found to be low when the machine stopped, a new Hall effect i.c. completely curing the trouble. **M.J.C.**

### Ferguson 3V23

There were two problems with a Ferguson 3V23. The first was a squeaking noise during rewind and was overcome by replacing the take-up tension brake assembly – with the modified version. The second problem was more complicated – no colour on playback, and no servo lock on record. What was common to these symptoms? We found that IC4 (HA11703) contains a sync separator stage which is used to supply the servo-2 panel and the sync gate in IC202 (HA11717). There was video information at pin 2 of IC4 but no sync output at pin 1: replacing the i.c. cured the fault. **M.D.**

### Hitachi VT5000

Customers sometimes do stupid things. In this case a cassette had been put in a Hitachi VT5000 and the play button pushed. The tape had threaded, and then almost immediately unthreaded again. The customer had convinced himself that the only problem was failure of the play key to latch, so he'd tried to get the machine to play by holding the key down. When I called I was told that he'd tried this for nearly an hour, after which the machine had given up and gone dead.

We decided to take the machine back to the workshop. On removing the top cover we found that F952 (3·15A, anti-surge) had failed and that the bridge rectifier D951 was short-circuit. After replacing these items the machine came to life, so we inserted a cassette and pressed play. The machine threaded up and the head drum started to rotate but the tape failed to move. This was because the capstan motor had seized up – the cause of the tripping play key.

After fitting a replacement motor the machine threaded up and the tape moved along nicely in play. We then connected the output to a TV set, but all we got on the screen was noise. The machine worked normally in the E-to-E mode and we knew that the tape had a recording on it, so we checked the f.m. waveform at TP215. It was almost non-existent, indicating the need for a new drum – which restored normal operation. The customer must have ruined the heads by keeping the tape threaded around the original rotating drum for such a long time. **M.D.**

### Grundig 4000

The customer brought in a Grundig 4000 VCR and explained that the tape had got jammed inside. He'd managed to remove the tape, but the machine now refused to go into the play mode. We lifted the top cover off and inserted a tape: the machine threaded up, but when play was selected the head drum failed to rotate. Checking the voltages around the commutator module revealed that the 26V supply was missing, and tracing this back to the power supply brought us to R471 which was open-circuit. **M.D.**

### Ferguson 3V23

The fault label attached to a Ferguson 3V23 machine read "intermittent record". An initial check revealed that everything was in order, so the machine was left for a few hours in the E-to-E mode to see whether the fault would develop. At the same time the waveform at TP1, the f.m. output from the Y–C board to the pre-rec board, was monitored. After about three hours the amplitude and symmetry of this waveform were seen to vary. We checked back to TP2 (see Fig. 1), where the pre-emphasized video is present, and found that the waveform was constant. The output at pin 9 of IC1 was seen to vary, so it seemed a clear case of a defective HA11701 i.c. We didn't have one in stock however, so the remaining possible components were checked. Cold resistance tests revealed that C4 was leaky, shorting down the f.m. waveform. **M.J.C.**

### Ferguson 3V30

No colour on playback was the fault on a Ferguson 3V30. As a start, a prerecorded tape was tried, establishing that the fault was indeed present on playback. We decided to

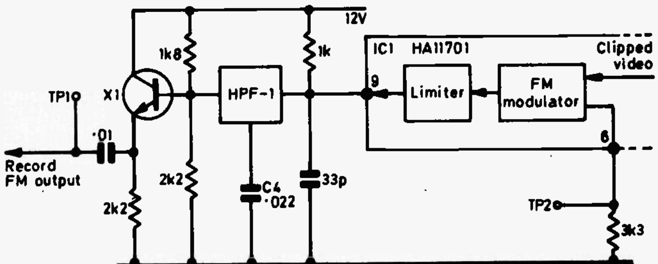



*Fig. 1: Record f.m. output circuit, Ferguson Model 3V23.*

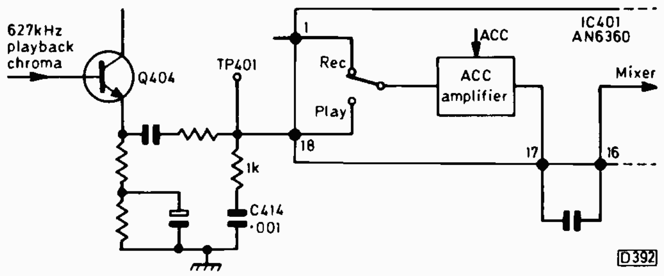


*Fig. 2: Part of the chroma playback circuit, Ferguson 3V30.*

start checking around IC401 (AN6360) which carries out conversion of the chroma signal from 627kHz to 4·43MHz (on playback), automatic chrominance control, record/playback switching etc. (see Fig. 2). The 627kHz chroma signal was present at TP401 (pin 18), the playback chroma input to the i.c., but was absent at pin 17 – after passing through the record/playback switch and the a.c.c. amplifier. The record/playback switching voltage was correct, so the i.c. came under suspicion. Further checks revealed that the voltage at pin 18 was only 2·6V however instead of the specified 3·4V. The culprit turned out to be C414 (0·001$\mu$F) which was leaky, a replacement returning the voltage and the colour to normal. **M.J.C.**

## Toshiba V8600B

The problem with a Toshiba V8600B was intermittent colour when recording – playback was not affected. The machine would run for several hours at a time without the fault occurring. Heating with a hairdryer and cooling with freezer helped us to find the culprit – IC202 (CX130). This i.c. is used for switching the pilot burst into the horizontal sync section of the waveform when recording. We proved the point by interchanging IC202 and IC203 (both type CX130), when the colour remained stable. **M.D.**

## Panasonic NV2000

A stock/demonstration Panasonic NV2000 came into the workshop from one of our branches, the problem being that the cassette was jammed in the machine – it wasn't possible to push the eject button down to release the cassette carrier. Removing the two screws from the cassette carrier cover didn't help since it couldn't be removed in the carrier down position. Removing the bottom cover and swinging open the servo panel gave us access to the cassette lock lever unit, and after removing this with a few twists and turns the cassette carrier was released. The tape was still threaded however, and had to be removed and wound back into the cassette.

This left the machine in the play position, so it was going to be necessary for us to carry out the adjustment of cam gear and mode select switch procedure given in the manual. This procedure and the description in the manual are exactly the same for the NV7000 and NV7200, but there's a difference between the diagram of the cam gear hole (A) shown and the machine – in the manual it's shown close to another hole in the cam gear, with a single hole at 90° clockwise to it, but the cam in our machine had a single hole (A) with a double hole at 90° clockwise from it. Anyway, the full alignment was carried out, but when we switched on and inserted a cassette the machine threaded up just like a Beta machine! We went through the mechanism alignment again, and this time removed the belt from the threading motor before switching on: pushing the carrier down immediately switched on the threading motor.

We decided to investigate the threading motor circuit. Pin 25 of the microprocessor i.c. was telling the motor to start, but there were wide variations in the voltages on many of the other pins of the i.c. compared to those given in the manual. Changing the i.c. (IC6001) failed to cure the trouble, so Panasonic were consulted. They suggested that the gating i.c. (IC6002) might be fault, but changing this also failed to cure the problem.

We next started to investigate the incorrect voltages around IC6001. The voltage on the reset pin 27 was only 0·12V instead of 5·1V. This pin is connected to the collector of transistor Q6002, so this was removed to see whether the voltage would rise. It didn't, so pin 27 was isolated, giving us a reading of 5V. What else was there? Pin 27 is connected to the microprocessor's stop output pin 33 via the 0·01$\mu$F capacitor C6002 which, when checked out of circuit, read 68Ω. The machine worked perfectly when this capacitor was replaced – but I guess it'll be some time before I come across another low-resistance C6002! **R.J.F.**

## Panasonic NV7200

A Panasonic NV7200 we had in was stuck on channel "18". As with all machines that have microprocessor control, the first test is to make sure that all voltages, including back-up circuits, have been discharged, since when spurious mains pulses are received by the microprocessor it can produce erroneous instructions. To remove the back-up voltage on this machine, unplug P7053. After getting the no voltage condition and then switching the machine on again the fault was still present however.

Since the machine was displaying 18 and not a correct number (it goes up to channel 12), it seemed more than likely that the microprocessor itself was defective. I first checked the clock oscillator, which was o.k., then for the switch pulse at pins 14 and 15 – this pulse is derived within the microprocessor i.c. from the clock pulses, and is used to check the state of the pins sequentially. As it was not present the microprocessor i.c. was changed, clearing the fault. **M.S.**

## Panasonic NV2000

We've had four Panasonic NV2000 machines in recently with low gain due to the aerial amplifier. **M.S.**

## Hitachi VT8700

A small point concerning the Hitachi VT8700. A couple of customers have complained that the battery back-up for the clock has not worked. The system maintains the correct time and programme memory for up to fifteen minutes in the event of a power cut – but only when the machine is switched to the timer mode. It differs in this respect to the previous VT8500, and in fact to most other machines with a battery back-up facility. **D.S.**

***Reports from Michael J. Cousins, T.Eng. (C.E.I.), Mick Dutton, R. J. Fox, Mike Sarre and Derek Snelling***

# Service Bureau

***Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 491 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.***

### *THORN 9600 CHASSIS*

**The problem with this set is lack of width – the picture is about two and a half inches in at each side of the screen. On investigation I found that W810 in the diode modulator circuit had burnt out, but I can't read its type.**

The trouble is almost certainly confined to the diode you mention – it's type BY298. An improvised heatsink could be fitted to increase its reliability.

### *SONY KV1320UB*

**There's a green raster when the set is first switched on. A white raster without noise then appears while the sound, low when you switch on, fades away. The final i.f. transistor seems to be defective with 5·7V at its emitter and 4·4V at its base. Any suggestions for a replacement?**

The 2SC1128 transistor you mention definitely seems to be defective. Replacing it with a BF199 or BF224 should restore normal results. The preceding 2SC1129 transistors could be replaced with a BF198, BF225, BF310 or BF367 should the need arise.

### *PHILIPS G11 CHASSIS*

**The problem we have with this set is repeated failure of the h.t. fuse due to the line output transistor going short-circuit. Replace both items and the set works perfectly – for a time. The line scan panel has been investigated thoroughly for dry-joints, leaks etc. but no fault can be found. The h.t. is correct.**

The h.t. reservoir capacitor C4029 on the power supply panel can be the cause of this sort of thing, due to defective riveting. The recommended Philips replacement type is part no. 124 47056. Other things worth checking are the screening of the line drive cable between the timebase panel and the line output stage panel (it should be earthed at both ends) and the foil on the line output transistor's heatsink (could be punctured). If necessary, try replacing the 0·91$\mu$F scan-correction capacitor C3135 on the line output stage panel.

### *TELETON TVC20*

**The sound and picture suddenly disappeared. The set was switched off and the back removed, and on switching on there was good, clear sound. The e.h.t. then came up and the sound went. A raster appeared but no picture. Retuning gives very distorted sound but no picture.**

Since the sound comes through clear when the set is first switched on it would appear that the tuning voltage (approximately 30V) applied to the channel selectors is correct. Confirm that it does not vary as the line timebase warms up – the voltage is obtained from the main h.t. line, with a shunt stabiliser on panel CP083 for regulation. If the tuning voltage does not vary, check whether the a.g.c. system is working properly – there should be 3·7V at the a.g.c. input to the i.f. preamplifier subpanel. From there you will have to check through the main i.f. strip if necessary – the voltage at the base of the first transistor (TR1), which is also gain controlled, should be 2·2V.

### *KUBA FLORENCE*

**There's no colour and the bottom corners of the raster have gone like a triangle. Before this the colour would flash on and off, with slight pulling on the left-hand side of the screen – not all the time. The line output valve fitted is a PL509, though the details suggest that it should be a PL519.**

The line output valve in this chassis should indeed be a PL519, and one of reputable make at that. It sounds as if the valve has developed a heater-cathode leak. Fit a new PL519 and replace the 100Ω and the 10kΩ resistors above the valve – you will probably find them burnt (they are in the screen and suppressor grid circuits respectively). Lack of chroma with this chassis occurs when a fault reduces the line output.

### *THORN 3500 CHASSIS*

**There's a peculiar focus fault on this set. Originally the focus would become incorrect momentarily, then revert to normal, but after a time the situation was reversed, the focus being poor most of the time, reverting to correct only occasionally. The focus control can be adjusted for good focus during the fault condition however. The tripler has been checked by substitution, the focus spark gap cleaned and the focus control itself checked. What next?**

This fault can be caused by leakage across the c.r.t. base panel. Increasing the focus spark gap with a file sometimes provides a cure, but on occasion it's necessary to fit a complete new panel. Before going to this length however check for corrosion and poor contact at the c.r.t.'s focus pin (9). It's also possible for the c.r.t. to be the cause of the fault, in which case a microammeter connected in series with the focus pin will show a current flow.

### *RANK T22 CHASSIS*

**The line output stage ceased to work and on checking the h.t. feed at 5Z2 this was found to be low at 90V. Disconnecting 5Z2 restored the h.t. to 200V, so the power supply is o.k. The line output transistor's base feed resistor 5R8 reads o.k. but has obviously been running hot. With it disconnected at one end and 5Z2 reconnected the h.t. remains at 200V. As the line output transistor seemed to be all right a new output transformer was fitted. This has restored the picture, but there's horizontal waving of the picture from the sides. A steady picture can be obtained by turning the contrast down, but the picture breaks up when the contrast or brilliance control setting is advanced.**

The most likely cause of your problems is a defective e.h.t. tripler. Other things worth checking if necessary are the EW modulator diodes 5D6/7 and the 1·2MΩ sync separator bias resistor 4R50 associated with pin 5 of the TBA950 line oscillator/sync separator i.c.

### *PHILIPS G9 CHASSIS*

**There's a fault in the NS correction circuit. The NS amplitude control R7114 has to be left turned completely anticlockwise otherwise R7118 overheats. As a result, there are downward and upwards curves at the top and bottom of the screen respectively.**

This fault will arise if there's an open-circuit somewhere between pin 6 of socket Q and the junction of L7111 and R7113. Check the print, L7115 for being open-circuit or dry-jointed, and C7112 (0·15$\mu$F) for being open-circuit.

### *ITT CVC5 CHASSIS*

**The problem with this set is that the channels change. The tuner, tuner head and tuning voltage stabilizer have been replaced but the trouble persists.**

You've dealt with most of the usual causes of drift in this chassis. Further possibilities are the a.f.c. amplifier transistor T6d, the tuning source preset R41d, the a.f.c. discriminator assembly, and R47P which feeds the stabilizer. First however check the goodness of the plug and socket connections between the tuner and the station selector potentiometer bank and ensure that the anode of the stabilizer D11 is properly earthed.

### *PYE 169 CHASSIS*

**The field sync is o.k. but the line sync is weak – and when locked in it's false, with a 2-3in. displacement at the right-hand side. The TBA550 sync i.c. and the PCF802 line oscillator valve have been changed and various components in the line sync department checked, but the displacement remains.**

The trouble is usually in the line oscillator stage itself. The coil could have short-circuit turns, but the offending component is usually one of the polystyrene capacitors. These are C64 (0·001$\mu$F), C65 (0·0033$\mu$F) and C67 (820pF).

### *PHILIPS G8 CHASSIS*

**The transductor and its associated 120Ω resistor R4484 on the field timebase panel caught fire. These have been replaced, restoring the picture and sound, but after about ten minutes the resistor smokes and burns out.**

After replacing the transductor in a G8 it's advisable to soak test the set while watching to ensure that the h.t. voltage does not rise above 205V. It's not unknown for the thyristor in the power supply to have developed a gate-cathode short-circuit, as a result of which some 300V appears across the h.t. line, damaging R4484 again. For test purposes the line drive to the transductor can be removed by disconnecting plug H. An OT112 is the recommended thyristor replacement: R4484 must be replaced with an identical type to the original.

### *THORN 8000A CHASSIS*

**There was a bang and the overload cutout came into operation. Upon investigation I found that the line output transistor was short-circuit. This was replaced, but the new one burnt out within a minute.**

Replace the line output transistor using a BDX32 if this is the type originally fitted or a BU206 if the original was a BU105/02 (note that the BDX32 and BU206 are not equivalents). Then check the h.t. rectifier thyristor W703 and the resistors in the line output transistor's base circuit (R406, R407, R466 and, if the transistor is a BDX32, R478/9). Replace the flyback tuning capacitor C406, using the correct Thorn approved type, and before switching on disconnect the tripler. If failure again occurs, the line output transformer could be faulty. If not, reconnect the tripler.

### *ITT CVC8 CHASSIS*

**The raster collapsed to a very narrow vertical line consisting of red, green and blue parts. This then disappeared. There is no voltage at the c.r.t. first anode pins, and only 1kV instead of 4·5kV at the focus pin. The fusible resistor R380 in the h.t. supply to the line output stage keeps opening.**

First check the PL509, PY500A and PCF802 line timebase valves. If these are in order, remove and check R403h (180kΩ) which supplies the line oscillator from the boost rail once the timebase has started up. This resistor may be open-circuit or high in value. If these measures fail, disconnect the scan coil plug and check for −76V drive at pin 1 (control grid) of the PL509. If this voltage is low concentrate on the line oscillator stage. If the voltage is present however the tripler and line output transformer are suspect – in that order.

### *GEC 2040 SERIES*

**The fault on this single-standard hybrid colour set is a vertical strip of red about three quarters of an inch in from the left-hand side of the raster – the strip is not present with the colour control turned down. Someone had turned up the set e.h.t. control to mask the effect, but as a new tripler has had to be fitted and the focus spark gap had been disconnected to prevent sparkovers I think the fault should be dealt with instead! The strip is about a quarter of an inch wide and varies in intensity with the colour control setting. It appears to pulse from the top of the screen to the bottom, looking like a colour version of the rope effect you get with a Thorn 950 when the line output valve's screen grid decoupling capacitor has gone open-circuit. If the red gun is turned off the strip is seen to have green and blue components, but red is by far the predominant colour.**

First make sure that C74 is fitted – it was omitted in early production. This is an 0·001$\mu$F, 400V capacitor connected from the anode of the boost diode to chassis. Then if necessary investigate the decoder panel and particularly the colour-difference/luminance output panel. Check the lead dressing, especially to PC9 and PC11 on the output panel. Ensure that the print is properly earthed, and check C353 (8$\mu$F) which decouples the supply to the ident stage and the colour-killer reservoir capacitor C352 (12·5$\mu$F).

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***TELEVISION JULY 1982***

## *LUXOR 90° HYBRID CHASSIS*

**The 2·5A anti-surge mains fuses keep blowing on this set (Model RT531/22). I suspect the h.t. bridge rectifier – can you suggest suitable replacement diodes? Also what is the voltage rating of the associated protection capacitors? There's an unusual valve, type PC92, in the chassis. What function does it perform?**

The fuse blowing is almost certainly due to one of the bridge rectifier diodes going short-circuit as you've guessed. The BY127 is a suitable replacement. The protection capacitors C603-6 are 0·005$\mu$F ceramic types rated at 750V and do sometimes fail. The mains filter capacitors used in these sets on the other hand are very reliable. If two of the bridge diodes fail when the valves in the line output stage warm up, check the PY500A for heater-cathode leakage. The PC92 valve is used in the e.h.t./width stabilizer circuit and works in conjunction with the 16V zener diode D901. This is a noted trouble spot in these sets – failure of either or both of these items results in a small picture.

# TEST CASE

# 235

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

It's not often that a set fitted with the Thorn TX10 chassis comes our way: there are a lot of them about, but they are very reliable. No colour faults are also rare nowadays, especially in modern receivers. So we were surprised to find a new, stock Ferguson set on the bench with a note to say that it had no colour. We've learnt to be a bit sceptical about most of what comes along from our sales and delivery departments, but that's another story . . . Anyway, with the set on the operating table and tuned to a transmission there was indeed a beautiful monochrome picture – complete with subcarrier dot pattern to show that chroma was getting through the i.f. strip.

We next tuned the set to a locally generated colour-bar signal, and soon found the colour-killer test points on the readily accessible decoder panel. The chassis uses a TDA3560 jumbo chip for colour decoding – it undertakes all the operations required without the need for any external active devices. With the colour-killer overridden we were greeted with rainbow colours, indicating that the reference oscillator was not synchronised to the burst. The circuit uses an 8·86MHz crystal, with a trimmer (CV601) for setting up. But no way would the trimmer bring the crystal on to the correct frequency, i.e. the colours running through, either with or without a link across the reference oscillator test points. So the crystal was suspect number one and a replacement, held in stock by our far-sighted stores department, was fitted. No change. The trimmer maybe? Another one was hooked in, but again without any effect. After some deliberation we decided to order a new TDA3560, and the set was put on one side to await its arrival.

A week or two later the device came in and there seemed little doubt that our problems would be over. No such luck. When it was fitted we had the familiar rainbow pattern when the colour-killer was overridden, and as before adjusting CV601 failed to produce the correct frequency.

At this point we noticed that the monochrome picture was a little on the blue side, with moving horizontal lines corresponding to the bars of unlocked colour when these were present. We checked the sandcastle pulse input at pin 8 of the i.c. and found the pulse to be present and correct. The chroma input at pin 3 was also correct. The 11V supply was present at pin 1 and fully decoupled. What next?

The internal workings of the i.c. are not shown in any great detail, and there are few voltage readings to go by. We couldn't find anything obviously amiss and had no luck with replacing the electrolytics C609, C620 and C624. All relevant resistors were then checked and found to be o.k. The decoder was finally tamed after we'd made oscilloscope checks on the i.c.'s pins and then carried out a simple repair job. Any ideas? Watch this space!

## *ANSWER TO TEST CASE 234*

*– page 437 last month –*

Our somewhat demoralised field technician got through to us on the workshop phone. You'll remember that he'd called to attend to an Ekco set fitted with the Pye 725 solid-state colour chassis, and that the h.t. fuse blew each time the set was switched on. But not with the e.h.t. tripler disconnected. A new tripler had been fitted therefore, and as this failed to provide a cure the conversation ran along the lines that the so-and-so stores had supplied duff goods. Not so however!

The workshop man had come across several cases of this sort, and suggested replacing the c.r.t.'s first anode supply reservoir capacitor C563. This turned out to be the culprit, measuring dead short when checked with the ohmmeter. The overload occurs because C563 is normally charged to over 1kV by the clipper diode in the e.h.t. tray. Thus when the capacitor goes short-circuit there's a heavy load on the line output transformer, with the result that the h.t. fuse blows. The replacement capacitor should be rated at 1·25kV, or better 1·5kV.

Whilst in this part of the circuit it's worth checking the resistors in the c.r.t.'s first anode supply network – they often fall in value. This applies to the potentiometers (RV564/6/8) as well as the fixed resistors (R565/7/9 and R642/3).

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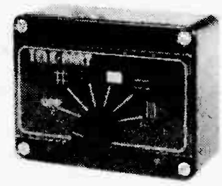

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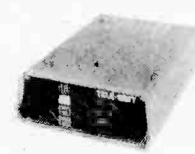

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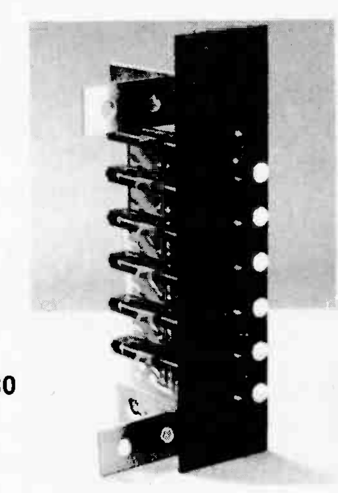

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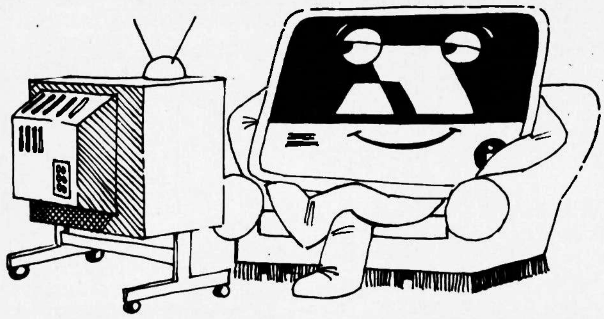

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Hundreds in Stock.
**From £20. Guaranteed Complete.**
Mono's and non-complete sets from £3.
Most makes available.
**QUALITY COLOUR TUBES**
Reconditioned and used tubes.
**From £10 Guaranteed.**
*Don't delay, ring today.*

**ALPHA TUBES (DUNSTABLE)**
**53 Lowther Road, Dunstable.**
**Tel. (0582) 68934**
**TRADE**

## MAIL ORDER ADVERTISING

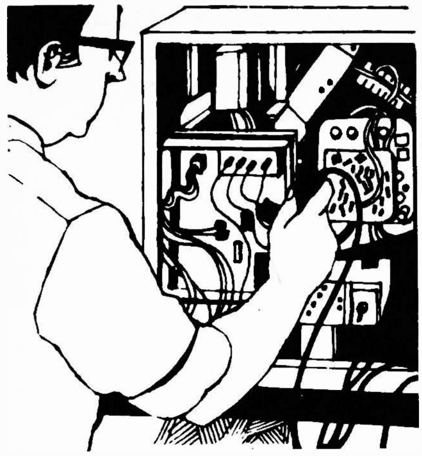
**British Code of Advertising Practice**
Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfill orders within 28 days, unless a longer delivery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

**Mail Order Protection Scheme**
If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:
(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

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

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

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



## SETS & COMPONENTS

**CAMPBELL ELECTRONICS LTD.**
**COLOUR T.V. PANEL EXCHANGE/ REPAIR SERVICE**
THORN, RANK, PHILIPS, GEC, DECCA, TELPRO, GRUNDIG etc.
90 Day Guarantee on all repairs – same day postal service.
**Telephone Telford (0952) 502422**
*for catalogue and price list.*
**CAMPBELL ELECTRONICS LTD.,**
**Unit 5, Heath Hill Estate, Dawley, Telford, Shropshire.**

**T/V ENTHUSIASTS** here is your opportunity 20″, 22″ GEC C/TVs fully serviced and working. Buy as seen £33. B/W £9. Unlimited spares. Circuits available for same £1.50. Query service letter only. P.O. £1. If you've got the TV bug visit VOLTOHM ELECTRONICS, 71-73 Barlow Road, Levenshulme, Manchester M19. Tel. 061 248 6590.

12″ NEW MONO 14″
**PORTABLE TV TUBES £19 inclusive**
1 year guarantee – £3 delivery including Ireland. State number on tube to:
**U-VIEW (TUBES)**
**29 Warmsworth Rd, DONCASTER, Yorkshire DN4 ORP.**
**Tel (0302) 855017** CALLERS RING FIRST

**TELEVISION TUNER REPAIRS ALL TYPES**
BRITISH, EUROPEAN JAPANESE ETC.
**MEN-TU ELECTRONICS LTD.**
**SALTERNS LANE, FAREHAM, HANTS.**
**TEL: 0329-235116**

# SMALL ADS

The prepaid rate for classified advertisements is 29p per word (minimum 12 words), box number 60p extra. Semi-display setting £5.64 per single column centimetre (minimum 2·5 cms) All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television, Room 2612, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

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

**TRADE ONLY**
**N. W. ELECTRONICS**
**CLEARANCE SALE**
LARGE QUANTITY OF GOOD CLASS
**COLOUR TELEVISIONS**
BUSH, PYE, GEC, THORN, PHILIPS ETC.
Excellent Cabinet Condition. Genuine Change Over TV's and Repossessions.
**FROM ONLY £15!!! DELIVERY ARRANGED**
We export large quantities of TV's weekly. Can we help you?
**Discount on Quantity Orders.**
**OVER 1,000 MONO TV's IN STOCK FROM £5**
100's colour tubes suitable for reconditioning. Working colour TV's to order, i.e. Bush 20″/22″ 2 I.C. excellent picture, ready to sell. **Only £39.**
CALL AND SEE OUR SELECTION
**WHITE GOODS**
All types of Washing machines, Vacs, Fridges, Cookers, etc. Hoover Autos, Servis, Hotpoint, Hoover Uprights, Vacs. 500 always in stock.
Fully reconditioned Hoover Twin Tubs and Upright Vacs, all models. Phone for details.
PAY US A VISIT YOU WILL NOT BE DISAPPOINTED
**N. W. ELECTRONICS**
**BOLINGBROKE BUILDINGS, BOLINGBROKE STREET, BRADFORD 5.**
**3 minutes from Motorways. Telephone 0274 390121**

**SOLID STATE SETS.** Complete Grundig, Nordmende (UHF/VHF) also panels (Tested). 0785 814643.

**COLOUR AND MONO TV's**

| | Comp with tested CRT | Comp untested |
|---|---|---|
| Thorn 8/8½K, G8, Grundig etc. | **£30** | **£25** |
| Bush, Telpro, Decca | **£25** | **£20** |
| Pye & GEC Hybrid | **£14** | **£9** |
| Korting, A' Bush | **£15** | **£10** |

Good working Decca Bradford **£30** each. Good working single standard mono **£9** each. Untested 10p, slots **£2** each. Thousands of panels @ **50p** each. Fully tested tubes – any standard size **£10.** Tested colour valves – Output valves **50p** each; Small valves **20p** each
**LAVITE LTD.**
**Viaduct Mills, Market Street, Milnsbridge, Huddersfield.**
**Tel. 0484 643273.**
*(Callers by prior appointment).*

**SECOND HAND COLOUR TV** spares and tubes, most makes. Telephone Southport (0704) 74411. Anytime.

**EUROLEC U.K.**
**Telephone 01-669 2611. Telex 893819**
*Address for correspondence:*
**35 Sandy Lane South, Wallington, Surrey SM6 9RF.**
(Callers to office by appointment only)
We are pleased to advise delivery of further supplies of Philips VCRs and cassettes.

| | |
|---|---|
| 1502s, sound working order | **£90.00** |
| 1502s, requiring attention | **£65.00** |
| 1500s, sound | **£75.00** |
| 1500s, requiring attention | **£50.00** |

*(Collection preferred on these)*
1700s – please phone for details

**Note**: Two VC30 supplied gratis with each machine.

| | | |
|---|---|---|
| New VC60/LVC120 | **£11.00** | (Limited supply) |
| New VC45 | **£8.50** | |
| New VC30 | **£6.00** | (Limited supply) |
| Used VC45 | **£6.00** | |
| Used VC30 | **£4.00** | |
| Used VC15/20 | **£3.00** | |

[Minimum order 6 cassettes of which 3 must be used VC30]
**CCTV equipment, colour cameras**: Please write with specific enquiries.
**Lenses**: 16mm 'C' mount (no iris) **£10.00.** Wide angle 'C' mount **£30.00.** (Regret we have no zoom lenses at present but customers can be advised upon receipt of SAE).
**VHS-BETA Cassettes** (quantity orders only at present). Please telephone or telex.
We will be pleased to quote for equipment for schools, hospitals and other authorities on both new and second user equipment.
**Note:** Prices include VAT, packing and postage, except where stated.
[Existing clients on VCR tapes may deduct 5% from cassette prices shown]
VAT Reg. No. 335 7096 45

**IRELANDS LARGEST TV DISTRIBUTOR**
THOUSANDS IN STOCK INCLUDING BUSH 2 IC, PHILIPS G8, ITT, DECCA BRADFORD, GEC AND PYE SOLID STATE, GRUNDIG, JAPANESE etc.
COLOUR FROM **£10** MONO FROM **£1.**
*Delivery can be arranged.*
ALSO DISTRIBUTORS OF NEW TELEVISIONS, VIDEOS, MUSIC CENTERS, (GRUNDIG, HITACHI, GEC etc.)
C.Bs, TELEPHONE EQUIPMENT, AERIALS, + AMPS, TUBES, SPARES etc.
**TELETRONICS, IRELAND, SESKINORE, OMAGH, CO. TYRONE.**
**TEL: Fintona 841389**
(STD0662)

## SETS & COMPONENTS CONTINUED

### RANK BUSH MURPHY
**TV Panels Repair,**

By ex RRI expert engineers. Same day return with 100 days guarantee. 823, Z718, 179, T20, T26 chassis covered. Contact for price list & economise.

**T.K. Panels Service,**
**31 Leaves Spring, Stevenage, Herts.**
**Tel: 0438 61567.**

**TRIPLERS – PRICES REDUCED**

Thorn 3000/3500
Thorn 9000
**UNIVERSAL**
**£3.65** inc. p.p. Add 55p VAT. 1 year guarantee

The UNIVERSAL TRIPLERcan be used in most G.E.C., I.T.T., Pye, Rank, Decca & Continental sets.

**WING ELECTRONICS**
**15 Waylands, off Tudor Rd, Hayes End, Middlesex**

### BARGAIN PACKS!

New, branded components, incl. res; w.w. res; var. caps; cer. caps; electrolytic can caps; i.c.s; diodes; rectifiers; pre-set pots; slider pots; etc. etc.
1 PACK for **£2.50** plus £1 p&p
3 PACKS for **£7.50** p&p free.
PACK VALUE £10.00 TRADE

Allow 28 days.
Trade enquiries welcome.
**JAYSOUND (HALLIWELL)**
**16 Hazeldene Close,**
**Bury, Lancs. BL9 9SA.**

**Tel: Northwood 27019** **01-845 2036**
**RETACH LTD.** Rear 78 High St, Northwood, Middx.
**COLOUR SET RANK & THORN**..............from £20
**COLOUR TUBES REBUILT 2yr guar.**......from £28
**RANK PANEL** (TESTED OK)
DECODER 1 IC ONLY......£11 POWER SUPPLY..............£6
TIME BASE....................£11 CONVERGENCE..............£6
IF.................................£9 TUNERS......................£5
ALL PRICE + VAT £2 POST & PACKING

### TELFURB TV LTD

FOR THE BEST IN REFURBISHED COLOUR TV. OUR PRICES START FROM £35 + VAT AND ARE READY FOR IMMEDIATE INSTALLATION. IDEAL FOR RENTAL COMPANIES WISHING TO EXPAND ON LOW CAPITAL OUTLAY. MOST POPULAR MAKES AVAILABLE.
**TEL: 08677 3849**
**51-53 HIGH ST.**
**WHEATLEY OXFORD**

**PROFESSIONAL STICK**
### DE-GAUSSING-COILS
**£18 EACH INCLUSIVE & DELIVERED**
*1 Year Guarantee.*
**U.View (Tubes)**
**29 Warmsworth Road, DONCASTER, Yorkshire DN4 0RP. Tel: (0302) 855017.**

## PERSONAL

**TELEVISION ENGINEER REQUIRED,** part-time evening/weekend work, Bristol area. Tel. Almondsbury 614136.

**NEWLY ESTABLISHED VIDEO SHOWROOM** requires part-time or freelance colour video Service Engineer, with own workshop or equipment. Phone Mr. Shaw, Windsor 67774.

## VETERAN & VINTAGE

### "SOUNDS VINTAGE"

The only magazine for all vintage sound enthusiasts packed with articles by top writers, covering gramophones, phonographs, 78s, wireless, news, history reviews etc.
All back-numbers to No. 1 available. Send 75p for sample copy.
28 Chestwood Close, Billericay, Essex

## FOR SALE

**THORN 3500** 22" working, £55. Grundig 3010 26" U/S £30. – Tel. 01-749 6978.

**DX TVs SONY TV112UM,** Sinclair, both multi standard and first class condition. Best offer. Highcliffe (04252) 3027.

**CUSTOM BUILT** Teak louvre fronted floor standing cabinet containing "Television" 22" colour TV fully assembled but unaligned and all relevant magazines. £300. QTH Cambridge Box. TV171.

**COLOUR TV's** – good working, £25 each, any quantity. Most makes, sizes available. Tel. Coventry (0203) 714213.

**RADIO AND TELEVISION** Servicing, 1959-1968, good condition, £24 o.n.o. Bournemouth 36482.

**PHILIPS N1502** V.G.C. Tapes £55. Tel. Leicester 738136 between 6p.m. to 8p.m.

## WANTED

**WANTED RADIO & TELEVISION** Servicing Books 1970-71, 1972-73, 1973-74. High price offered. 051-677-6668.

## SERVICE SHEETS

**Thousands of different full size service sheets** **Thousands of different manuals of all kinds in stock.**
(Many of above are unique to us and obtainable nowhere else.) Any published single service sheet still only £1 + s.a.e.
**British CTV circuit/layouts from dual to latest from Decca, G.E.C., ITT, Philips, Pye, Rank, Thorn, etc.**
Continually updated – 3 giant binders only **£39.50** – latest update includes Thorn 9200 to 9800.
**Revised foreign C.T.V. Repair System in 2 huge binders plus 3 Repair Manuals for £39.50.**
Contains chassis from Grundig, Hitachi, Korting, Kuba, Luxor, Mitsubishi, National P., Nordmende, Sharp, Skantic, Toshiba, Zanussi.
**Any Repair Manual only £6.50 for the first – £6 each thereafter.**
**Save £6.50 on complete set of 11 unique TV repair manuals – only £60.** Mono +colour from dual standards to recent sets, McCourt & Tunbridge.
***NEW* Tunbridge Portable Mono TV Repair Manual – Pre Publishing Offer at £5.50 each (save £1).**
***NEW* Full details HOW TO BUILD YOUR OWN TRANSISTOR/DIODE TESTER – price £1.50 post free.**
*S.A.E. any quotation, also price lists, newsletter, bargain offers, details of our unique TV repair systems. Service sheets and all stock manuals by return of post.*
**Phone: 0698 883334, anytime. Callers 4–6 pm. weekdays, Saturdays 11 am.–1pm only.**

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

### 30,000 SERVICE SHEETS IN STOCK. COLOUR MANUALS ALSO AVAILABLE

TV Monos, Radios, **£2.00.** Tuners **£2.00.** Tape Recorders, Record Players **£2.00.** Transistors, Stereograms & Music Centres **£2.00** + SAE. Also Colour Available. Car Radios **£3.00** + SAE. All Radiograms **£2.00.** State if Circuit will do if sheets are not in stock. All TV Sheets are full-length 24×12, not in Bits & Pieces. All other Data full-lengths.
TV Catalogue with order. All Sheets **£2.00** except Colour. Old Valve Radios
**MAIL ORDER S.A.E.**
**C. CARANNA, 71 BEAUFORT PARK, LONDON NW11 6BX. 01-458 4882**

### SANDHURST PUBLICATIONS
**Television Service Sheet Specialists**

Workshop Manuals, large selection of Japanese and European TV Sheets. Callers 5.30-7.00 pm. Send S.A.E. for Catalogue and Enquiries:
**49C Yorktown Road,**
**Sandhurst, Camberley, Surrey GU17 7AG.**

## ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

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

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NAME..........................................................................................
ADDRESS....................................................................................
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*Send to:* Classified Advertisement Dept.
**TELEVISION**
**Classified Advertisement Dept., Room 2612, King's Reach Tower, Stamford Street, London SE1 9LS.** **Telephone 01-261 5846.**
Rate
**29p** per word, minimum 12 words. Box No. **60p** extra.
**JUL 82**

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

## BOOKS & PUBLICATIONS

**ANY PUBLISHED SERVICE SHEET £1 + S.A.E.** Thousands different repair/service manuals/sheets in stock. Repair data your named TV £6.50 (with circuits £8.50). S.A.E. Newsletter, price lists, quotations. AUST. 76 Church Street, Larkhall, Lanarkshire. (0698 883334).

**DX-TV**

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

**HS PUBLICATIONS**

**Dept. T(F), 7 Epping Close, Derby DE3 4HR.**

## EDUCATIONAL

**TELEVISION COMPUTER RADIOCOMMUNICATIONS & RADAR SERVICING**

**2⅓ YEAR full-time Modular Diploma course to include a high percentage of practical work.**

- ELECTRONIC PRINCIPLES (1st)
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- MONOCHROME TV
- COLOUR TV, CCTV & VCR
- MICROELECTRONICS & DIGITAL TECHNIQUES
- MICROPROCESSORS & COMPUTERS
- RADIOCOMMUNICATIONS & RADAR

**Each of the above Modules are 13 weeks in duration. Individual Modules can be arranged for applicants with suitable electronics background.**

**Subject to approval, students will be awarded a TEC Diploma in Electronics & Communication Engineering on completion of the full course.**

*Next session starts September 13th.*

Prospectus from:

**LONDON ELECTRONICS COLLEGE**

**Dept: PP, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.**

## COURSES

**VIDEO RECORDER TRAINING COURSES.** Due to overwhelming demand, Mrs. Beeching has had to quickly organise yet another two more courses. On 24th and 25th July, and 18th and 19th Sept. 1982. Those people who did not get on the April course, please book immediately. All others please contact her at: Newark Video Centre, 108 London Road, Balderton, Newark, Notts. Tel. (0636) 71475.

## MISCELLANEOUS

**8mm FILM TRANSFER** to any video format. Eurolec – Tel. 01-669 2611. Telex 893819.

**BURGLAR ALARM EQUIPMENT.** Latest Discount catalogue out now. Phone C.W.A.S. Alarm. 0274 682674.

# "TUBE REPLACEMENTS" OFFER

## SPECIAL TRIAL PRICES

### "WELLVIEW" EXCHANGE COLOUR

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|---|---|
| A44-271X | **£24** |
| A47-342X | **£24** |
| A47-343X | **£26** |
| A49-120X | **£24** |
| A51-110X | **£24** |
| A51-110LF | **£26** |
| A55-14X | **£28** |
| A56-120X | **£28** |
| A63-120X | **£33** |
| A66-120X | **£33** |
| A66-140X | **£33** |
| A67-120X | **£33** |
| A67-150X | **£33** |

**If no exchange glass £4 extra**

### "WELLVIEW" EXCHANGE MONO

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| A44-120 WR | **£11** |
| A47-26 WR | **£12** |
| A50-120 WR | **£11** |
| A59-120 WR | **£12.50** |
| A61-120 WR | **£13.50** |
| A31-300 NEW | **£15** |
| A34-100-510 NEW | **£16** |

**If no exchange glass £1 extra**

**All above plus VAT @ 15%.**

**Carriage £5.00 inc. VAT.**

**ALL TUBES 18 MONTHS GUARANTEE**

**ALSO YOUR VALVE SUPPLIER NEW AND BOXED**

(inclusive of VAT)

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| DY802=**74p** | ECC81=**64p** | EF183=**78p** |
| EF184=**64p** | ECC82=**64p** | PCF802=**98p** |
| PCL82=**78p** | PCL84=**92p** | PCL805=**97p** |
| PFL200=**£1.15** | PCL86=**97p** | PL504=**£1.38** |
| PY800=**70p** | PL508=**£1.30** | PY88=**70p** |
| | | PY500A=**£1.52** |

### NEWSFLASH

Mullard PL509-19 **£5 inc. VAT**

**Postage and Packing 10p per valve. All orders over £10 Free of charge.**

**Camping – Self sufficiency – Emergencies Be prepared!**

Fantastic 200 watt square wave inverter 12v input 200-240v AC output tested but no guarantee **£20** + £3 VAT, p&p £3.

24v transistor fluorescent ballast units will run 2×4ft tubes and draw under 2 amps (Philips) **£5 each** + 75p VAT, p&p 70.

Dynamo torches complete with spare bulb. You need never buy torch batteries again. **2 for £5** inc. VAT, p&p 50p.

Ex rental colour TVs from **£10** + VAT.

Allow up to 14 days for delivery.

**TUBE REPLACEMENTS**
**Unit No. 1, Monmouth St., Bridgwater, Somerset.**
**Tel. 0278 425690-722816**

# DISPLAY ELECTRONICS

## LEADERS IN TUBE TECHNOLOGY SINCE THE 60's.

### REGUNNED COLOUR TUBES

**2 YEAR GUARANTEE**

Up to 19"........**£33.00**
22"........**£36.00**
26"........**£39.00**

The above prices are for standard 38mm Delta Gun Types. Add £3 Gun surcharge for 20AX Types. Other in-line & P.I.L. Types, prices on application.

### MONO TUBES

**2 YEAR GUARANTEE**

20"........**£12.00**
24"........**£14.00**

### BUDGET CORNER

Buy any 5 mixed types Cash 'n Collect – Take 20% discount.

**PRICES EXCLUDE VAT**

### CALLERS WELCOME

Late night Thursdays until 8pm Saturdays until midday.

N.B. Customers intending to collect orders are requested to telephone in advance:— even popular types may be out of stock for short periods.

**WATERLOO ROAD, UXBRIDGE, MIDDLESEX**

**Telephone: Uxbridge 55800**

| | |
|---|---|
| **NEW PHILIPS** Infra-red Transmitter, 9 c.h. & Vol & brightness change | **£7.00** |
| **THORN** Front Panels. 6 slider pots & knobs & touch button. Ultrasonic transducter & I.C. & components & Mains Switch | **£3.75** |
| **GEC C2110** Line OP Transformer | **£7.00** |
| ZTX 109K | **3p** |
| BC548 | **4p** |
| BC307 | **3p** |
| TIP29 | **10p** |
| BC147 | **4p** |
| SN76550/3R | **10p** |
| BC148 | **4p** |
| BC338 | **4p** |
| BFT34 | **10p** |
| BC237 | **3p** |
| IR106A | **20p** |
| **DECCA** 80-100 Thyristors | **35p** |
| TDA1003 | **15p** |
| TBA540 | **40p** |
| TDA2540 | **40p** |
| TDA2560 | **50p** |
| TBA540Q | **40p** |
| SN76660 | **30p** |
| TBA800 | **30p** |
| SN76707 | **50p** |
| TBA810 | **30p** |
| CVC 45 Line O.P. Trans | **£4** |
| CVC 45 Triplers | **£3.50** |
| 3500 Triplers | **£3.50** |
| KT3 AE Sockets | **25p** |
| G11 Tuner Units | **£6.00** |
| G11 6 Button Key Switch | **£2.00** |
| G11 E/W Coil | **50p** |
| G11 E/W Transformer | **50p** |
| G11 Line OSE Tran. | **50p** |
| G11 .47/250 | **10p** |
| G11 8200pF/2000V | **15p** |
| G11 11000/1500V | **15p** |
| G11 Transient Suppressors 245V | **25p** |
| G11 Scan Coils | **£5.00** |
| KT3 AE Sockets | **25p** |
| G11 Mains On/Off Switch | **40p** |
| ELC1043/05 NEW on Panel | **£4.00** |
| 20 BY298 3 Amp fast recovery diodes | **£1.50** |
| 4000 Thorn Frame Panel | **£5.00** |
| 4000 Thorn Power Supply | **£3.00** |
| 4000 Thorn Line OP Panel | **£20.00** |
| Post **£4.** 15" T.V. Tube Hitachi; New | **£6.00** |
| NPN PNP 80V 6 Amp TO66 O.P. Trans Piar | **25p** |
| **GEC IC** CBF16848, SN16861, SN1682 | **50p each** |
| Mixed Packs, Mounting Kits and Washers for Power Transistor | **50p** |
| **DECCA** I.F. 80-100 | **£3.50** |
| **BRIDGE REC** Wire leads KBP04 | **15p** |
| G11 Time Base Panel | **£12.00** |
| A.E.C. V/cap Resistor Unit U.H.F. with I.C. SAS 660 SAS 670 | **£3.00** |
| KT3 200×25×25 385v | **£1** |
| BF458 | **10 for £1** |
| Thorn 3500 Frame Panel | **£1.50** |
| Thorn 900 Sound O.P. Panel. NEW | **£1.00** |
| U321 T/Unit on Panel Cum 40 ITT | **£6.00** |
| Thorn 3500 I.F. Panel. NEW | **£3.00** |

| | |
|---|---|
| Thorn Tuner Panel. 6·100K Pots & Components. NEW. NO Tuner ELC1043/05 | **£2.00** |
| **GEC** Line O/P Trans & Rec Stick for Portable | **£3.00** |
| **RANK TOSHIBA** Tube Base | **25p** |
| LP1162 O/P STAGE | **£1.00** |
| Y933 | **5p** |
| IN914 | **5p** |
| BA248 | **5p** |
| G11 Power Supplies | **£12** |
| **REC & TRANS** 40K Transducer | **EACH 50p** |
| TIC 126 12A 800V | **30p** |
| BPW41 | **15p** |
| BD437 | **25p** |
| **PHILIPS** NE511N | **£1.20** |
| **GEC 2040** Line OP Transformer | **£5.00** |
| LD57 CA Infrared L.E.D. | **15p** |
| SAA5010 | **£2** |
| BD226 | **20p** |
| BUX84 | **50p** |
| LM337M Reg. | **30p** |
| **PYE** Line O.P. Trans Mono | **£3.00** |
| BY229/400 | **30p** |
| Co. Ax. Plugs | **10p** |
| BYX72/300 | **20p** |
| 2SD180 TO3 80V .6A | **15p** |
| 2 SB407 Sanyo TO3 | **10p** |
| Thorn T605 1V NPN TO66 80V 6A | **10p** |
| 50 Mixed High Voltage Ceramic Condenser | **£1.00** |
| 20 GEC Black Spark Gaps | **£1.00** |
| Mono Rank Line Trans T704 A | **£3.50** |
| 4000 Thorn Mains Dropper | **35p** |
| 20 I.C. Socket Mixed | **£1** |
| G11 Line Driver Transformer | **35p each** |
| 2 SD350A BU208A | **£1** |
| G11 IF Detector | **£3.00** |
| G11 Teletext Transmitter | **£19.00** |
| G11 Chrome/Lumin Can | **£3.00** |
| KT3 LOPT | **£3** |
| BG200/43 Tripler | **£3** |
| BU208A | **£1** |
| RCA CA270 | **40p** |
| KT3 2SD 200 Line Transistor | **£2** |
| **V.H.F.** 3 Transistor Rotary Tuner Units D.X. T/V | **£1 NEW** |
| ITT CVC 32 Line O.P. Trans | **£6.50** |

| | |
|---|---|
| G11 6 Push Button | **50p** |
| 8 Core Screen Cable R.S. | **35p per metre** |
| Line O/P Transformer | |
| ITT CVC9 | **£7.00** |
| AT2076/38 ITT CVC40 Split Diode | **£10.00** |
| Philips G8 Line O/P | |
| Philips G11 Split Diode | **£12.00** |
| ITT CVC32 Chassis | **£30.00** |
| **ITT PANELS** | |
| CMA10 | **£2.00** |
| CMU40 | **£7.00** |
| CMN40 | **£1.00** |
| CMC67 | **£3.75** |
| CMH31 | **£1.50** |
| CMS30 | **£1.50** |
| CMF40 | **£2.00** |
| CMU30 | **£7.00** |
| CMU45 | **£1.50** |
| CMA40 | **£1.50** |
| CMA11 | **£2.00** |
| **DIODE** MR856 | 20 of **£1.50** |
| BF470 | **30p** |
| BF757 | **30p** |
| ZTX213 | **4p** |
| MC78M18 | **20p** |
| SL432 A/T | **75p** |
| CA3094AE | **50p** |
| Infra Red Hand Set KT3 | **£18.00** |
| BD437 and BD438 on Heat Sink | **50p** |
| International Rectifier EHT Diodes G770/HV34 6KV | 3 for **8p** |
| 6A/600V Stud Diodes | **20p** |
| 6A/1000V Stud Diodes | **20p** |
| Bridge Rec KBL02 4 Amp | **28p** |
| 10 BU126 | **£6.00** |
| 10 BU208A | **£8.00** |
| 20 BU204 | **£8.00** |
| 10 BU205 | **£8.00** |
| 10 BU105 | **£8.00** |
| DECCA 100 Tripler | **£4.00** |
| BSX 19-20 | **15p** |
| 20 Large Red LED | **£1.00** |
| 20 Small Red LED | **£1.00** |
| RANK & ITT Mains Remote On-Off Switch (720R) | **£1.50** |
| Mains-dropper PYE 3R5+15R+45R | **50p** |
| Thyristor 600V/4 amp C106M/2 | **24p** |
| 9500 THORN Tripler | **£4.50** |
| G11 Preh Red LED Push Button for C.H. Change | **20p** |
| THORN 3500 175+100+100 350V | **£2.00** |
| 2SC2073 on Heat Sink 150 NPN 1.5 Amps | **7p** |
| RANK TOSHIBA Transductors TPC-2011 | **50p** |
| Ultrasonic G11 Hand Set | **£12.00** |

# SENDZ COMPONENTS

**D. Whitworth,**
**63 Bishopsteignton, Shoeburyness,**
**Essex SS3 8AF.**
**Telephone: 0702 32992**

**VAT 15%, 50p Post.**
**Goods despatched on receipt of order.**

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### TUNERS

| | |
|---|---|
| MITSUMI small v/cap tuner units UHF | £4.00 |
| MITSUMI small v/cap tuner units VHF | £3.70 |
| THORN 1043 | £5.00 |
| New. ELC 1043/05 Mullard on Panel | £4.00 |
| GEC 2040 6 Push Button Units and ELC 1043/05. New. | £6.50 |
| ELC 1042 | £5.00 |
| ELC 2000 | £7.00 |
| ELC 2004 | £7.00 |
| ELC 2060 | £7.00 |
| NSF AEG UHF/VHF | £4.50 |
| NSF 1043 on Panel | £5.00 |
| MULLARD U314 | £5.00 |
| MULLARD U321 | £6.00 |
| MULLARD U322 | £6.00 |
| GEC Rotary Tuner | £2.50 |
| MOSS FIT UHF/VHF DXT Tuner Unit | £9.00 |
| Small DX Tuner V/capp 175-220MHz auto changeover | £5.00 |
| V/capp Tuner 50-300MHz auto changeover | £2.50 |
| V/capp Sylvania T/units VHF/ UHF F6003 | £4.00 |
| V/capp Sylvania T/units VHF | £3.00 |
| F6013 Rank Set | |
| DECCA Bradford Tuner 5 button | £4.00 |
| SONY KV 1400 Tuner Unit | £4.00 |
| VHF Modulator CCIR | £3.00 |
| THORN 9000 Tuner on Panel | £7.00 |
| 9000 Frame Panel | £7.00 |
| SANYO Rotary Tuner | £4.00 |

### MODULES

| | |
|---|---|
| LP1173 10 watt Seconds | £1.00 |
| LP1173 10 watt New | £2.00 |
| LP1170 Seconds | 50p |
| LP1179 Seconds | 50p |
| LP1162 New PYE OUTPUT STAGE | £1.50 |

### TRIPLES

| | |
|---|---|
| GEC 2028 Tripler | £2.50 |
| GEC 2040 Tripler | £2.50 |
| DECCA 80 Tripler | £2.50 |
| PYE TBQ | £1.50 |
| DECCA 80 | £4.00 |
| TBZ fits GEC 1028, 2028, 1040, 1060, CS108 | £4.00 |
| G9 | £4.00 |
| CVC 20/25/30 | £3.50 |
| THORN 9000 | £4.50 |
| THORN 9500 | £3.50 |
| GEC 2110 | £3.50 |
| LP1194 | £3.50 |
| GEC 2100 | £3.00 |
| LP1174/NC | £3.50 |
| GRUNDIG TVK52 | £3.50 |

| | |
|---|---|
| ITT BG 100/41 | £3.00 |
| BG 100/61 | £3.00 |
| TBW fits Autovox, Saba, Grundig, Tanberg | £4.00 |
| TCZ | £2.50 |
| TAU | £1.25 |

### FOCUS UNITS

| | |
|---|---|
| THORN 8500 | £1.00 |
| THORN 3500 | £1.00 |
| DECCA Large | £1.00 |
| DECCA Small | £1.00 |
| ITT CVC 40 | 60p |

### MAINS DROPPERS

| | |
|---|---|
| PYE 69-161 | 40p |
| PYE 731 3+56+27R | 50p |
| THORN 50R-40R-1K5 | 50p |
| Mains Dropper 50R-17R-1K5 | 50p |
| Coax Plugs | 12p |
| De-solder Pumps | £4.00 |
| Aerial Socket and Lead | 35p |
| Pye, Thorn, ITT, Thyristor, Philips G11 G122 | 60p |
| 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 |
| 5×3 | 15 ohm | 80p |
| 6×4 | 15 ohm | £1.00 |
| 7×3 | 70 ohm | £1.00 |
| 5×3 | 8 ohm | 70p |
| 7×3 | 16 ohm | £1.00 |
| 8×5 | 16 ohm | £1.50 |

### MULTI-CAPS

| | |
|---|---|
| 2500/2500/63V | 50p |
| 470/470/250V | 50p |
| 385V/330M | 60p |
| 150/200/200/300V | 70p |
| 100/200/325V | 40p |
| 400/200/200/350V | £1.50 |
| 800/250V | 40p |
| 700/350V | 50p |
| 600/300V Pye, Bush, GEC | £1.00 |
| 200/200/100/300V | 60p |
| 200/200/100/32 325V | £1.00 |
| 100M+300M+200+100M+16M 350V | £2.00 |
| 220M+47M. 350V | 60p |
| 400/400V | 40p |
| 220/450V | 40p |
| 4700/25V | 25p |

### CONDENSERS

| | |
|---|---|
| 15M/63 | 5p |
| 750/50V | 10p |
| 470/25V | 5p |
| 220/40V | 5p |
| 4/350V | 5p |

| | |
|---|---|
| 8/350V | 5p |
| 8/300V | 8p |
| 680/40V and 25V | 5p |
| 47/250V | 10p |
| 33/450V | 15p |
| 2200/25V | 10p |
| ·1/600V | 15p |
| ·1/800 | 10p |
| ·1/1000V | 10p |
| ·1/2000V | 15p |
| ·47/1000 | 30p |
| ·01/1000V | 10p |
| 22/375V | 15p |
| ·047/1000V | 8p |
| ·0047/1500V | 10p |
| 1N8-1500V | 10p |
| 1500M 35V | 7p |
| 32 MFD 300V | 10p |
| 2N2-1500V | 10p |
| 8N2-1500V | 10p |
| 6N2-2000V | 10p |
| ITT CV5 7 Push Button Unit | £7.00 |
| 2040 GEC 6 Push Button Unit for v/cap | £3.50 |
| PYE 6 P/B Unit for v/cap | £6.00 |
| PYE 731 6 P/B Unit for v/cap | £2.00 |
| 4 Push Button Unit for v/cap | 50p |
| THORN 1400/1500 4 P/B Unit Mech | £7.00 |
| GEC 8 Channel Touch Tune Unit | £4.50 |
| XK3123 4000 THORN Diode | 50p |
| FT3055 | 20p |
| BD116 | 25p |
| A1 Dioder 3500 | 10p |
| BU137T | £1.00 |
| BUY69 (RCA 1693) | 80p |
| THORN Transductor | £1.00 |
| Transductor AT404/41 | 50p |
| Front End Music Centre VHF/MW/LW Size 13×3½ | £5.00 |
| Output stage for music centre | £5.00 |
| Sony 1400kV Chroma Panel | £6.00 |
| Tuner Unit Sony | £3.50 |
| Touch Button Sony | £3.50 |
| ORP 12 | 40p |
| AD 161/162 | 60p pair |
| BY212 | 10p |
| NPN PNP 660/661 | 20p |
| 5·5MHz Filters | 15p |
| 6MHz Filters | 25p |
| TV 11 EHT REC | 25p |
| TV 12 EHT REC | 30p |
| TV 13 EHT REC | 25p |

| | |
|---|---|
| TV 14 EHT REC | 40p |
| TV 18 EHT REC | 40p |
| 100K 40 Turn Pots G9-G11. And Thorn | 20p |
| 3500 6 Push Button | £1.00 |
| NE 2B6H Small Neon Lamps, GEC | 5p |
| 20 small LEDs | £1.00 |
| TV XTALs 4·433-619KHz | 50p |
| TV XTALs 8867-238KHz | 40p |
| 6MHz Crystal | 50p |
| Infra Red Emitting Diodes TIL 30P | 20p |

### THERMISTORS

| | |
|---|---|
| VA 1104 | 35p |
| ITT PT266 3W12 | 15p |
| PTH 451A or B | 10p |
| PT37P fits Pye, Bush etc. | 20p |
| MR 501 3 amp 100V | 7p |
| MR 508 3 amp 800V | 12p |
| Philips Snips | £1.50 |
| B9A Print V/Holder | 5p |
| PYE 697 Long V/Holder | 15p |
| 12"TV Tube Hitachi A31/300 | £12.00 |
| Line OP Lopt CVC20 | £4.00 |
| V/U Meter | 45p |
| Convergence Panel GEC | £1.00 |
| Lead Split Diode LOPT | £1.00 |
| ITT Push Button | 25p |
| THORN Push Button | 20p |
| MR 856 | 15p |
| Mains On/Off Rotary | 13p |
| DP Push Button | 12p |
| PHILIPS Tuner/Unit UHF | £2.00 |
| UHF TV Aerial Portable | 50p |
| TV Sound Tuner Kit ideal for Hi Fi TV sound | £9.50 |
| AD 149 | 80p |
| KBL005 4 amp 40V | 25p |
| LT340T 12V Reg | 20p |
| RANK TOSHIBA Prey front control Units Type 0354 | £9.50 |
| TCE520 | 25p |
| FUA 78M24UC | 20p |
| MC 7724CP | 20p |
| MTO 309 THORNE | 20p |
| TIP 640 | £1.00 |
| 2SC 2122A | £1.00 |
| BRC 1693 | £1.00 |
| Touch Buttons RANK TOSHIBA | 10p |
| 2SB566 | 10p |
| THORN Hearing Aids | £3.00 |

| | |
|---|---|
| 600. THORN Portable TV Chassis, Mono | £10.00 |

Mains in 110-120-220-240V A.C. 50Hz Adaptor. For black and white camera. Power consumption: 12V A. Output voltate: 14V D.C. Dimensions 150mm (w) × 80mm (h) × 120mm (d). Accessories: Mains lead and video/audio remote cable (2 metres) **£4.60** (post £1.00)

## INTEGRATED CIRCUITS

| | |
|---|---|
| CA270CE | 50p |
| CA270CW | 50p |
| CA3089Q | 50p |
| MC1327 | £1.00 |
| MC1349 | 50p |
| MC1352 | £1.00 |
| MC1358 | £1.00 |
| MC14066BCP | £1.00 |
| MC14069 | £1.00 |
| MEM4956PT | £1.00 |
| M102485 | £1.00 |
| MCM2114 | £1.00 |
| SAA1020 | £4.00 |
| SAA1021 | £4.00 |
| SAA1024 | £2.50 |
| SAA1025 | £2.50 |
| SA1130 | £2.50 |
| SAA5000 | £1.50 |
| SAA5040 | £2.50 |
| SAS560 | £1.00 |
| SAS570 | £1.00 |
| SL901 | £3.50 |
| SL918-SL917 MOD | £2.50 |
| TAA320A | 50p |
| TAA470 | £1.50 |
| TAA550 | 25p |
| SAA570 | £1.00 |
| TAA700 | £1.00 |
| TBA120A | 40p |
| TBA120AS | 40p |
| TBA120SA | 40p |
| TBA120B | 40p |
| TBA120SB | 40p |
| TBA120U | 40p |
| TBA120C | 40p |
| TBA1441-TBA440 | £1.00 |
| TBA231 | 75p |
| TBA395 | 50p |
| TBA396 | 75p |
| TBA440 | £1.00 |
| TBA440G | £1.00 |
| TBA510 | £1.00 |
| TBA520 | £1.00 |
| TBA530 | £1.00 |
| TBA540 | £1.00 |
| TBA550Q | £1.00 |
| TBA560CQ | £1.00 |
| TBA560C | £1.00 |
| TBA570 | £1.00 |
| TBA673 | £1.00 |
| TBA720A | £1.00 |
| TBA750 | £1.00 |
| TBA800 | 40p |
| TBA810S | 70p |
| TBA820 | £1.00 |
| TBA890 | £1.00 |
| TBA920 | £1.00 |
| TBA920Q | £1.00 |
| TDA2541 | £1.00 |
| TBA950 | £1.00 |
| TBA990Q | £1.00 |
| TCA270 | £1.00 |
| TCA270Q | £1.00 |
| TCA4500A | £1.00 |
| TCA640 | £1.00 |
| TCA650 | £1.00 |
| TCA660 | £1.00 |
| TCA740 | £1.00 |
| TCA800 | £1.00 |
| TCA830S | £1.00 |
| TCEP100 | £2.25 |
| TDA1003 | £1.00 |
| TDA1170 | £1.00 |
| TDA1190 | £1.00 |
| TDA1327A | £1.00 |
| TDA1412 | 30p |
| TDA2010 | £1.00 |
| TDA2530 | £1.00 |
| TDA2540 | 80p |
| TDA2541 | £1.00 |
| TDA2590 | £1.00 |
| TDA2560 | 50p |
| TDA2600 | £2.75 |
| TDA2653 | £1.00 |
| TDA2002 | £1.00 |
| TDA2640 | 80p |
| TDA2680 | £1.00 |
| TDA2690 | £1.00 |
| TDA2593 | £1.00 |
| TDA3190 | £1.00 |
| TDA3500 | £2.00 |
| TDA3560 | £1.50 |
| SN168ZAN | £1.00 |
| SN16964AN | 50p |
| SN29764 | £1.00 |
| SN297728N | 50p |
| SN29848 | 50p |
| SN7472N | 20p |
| SN75108AN | £1.00 |
| SN76001 | £1.00 |
| SN76003* | £1.00 |
| SN76013* | £1.50 |
| SN76023* | £1.50 |
| SN76115 | 50p |
| SN76131 | 50p |
| SN76226 | £1.00 |
| SN76227 | 60p |
| SN76530P | 50p |
| SN76532 | 50p |
| SN76533 | £1.00 |
| SN76544N | £1.00 |
| SN76546 | £1.00 |
| TBA480Q | £1.00 |
| SN76650 | 50p |
| SN76660 | 50p |
| SN76620AN | 50p |
| SN76666 | 50p |
| SN76707N | 75p |
| SN76708N | 75p |
| TBA820 | £1.00 |
| ML236E | £1.50 |
| ML237B | £1.50 |
| ML238 | £3.50 |
| BTT822 | £1.00 |
| BTT6018–ML237B | £1.50 |
| BTT8124 | £1.00 |
| BTT8224 | £1.00 |
| SAS660 | £1.00 |
| SAS670 | £1.00 |
| TDA2522 | £1.00 |
| UA783P3C | 40p |
| UPC1365C | 50p |
| EQV TBA810 | 40p |

## SEMICONDUCTORS

| | |
|---|---|
| AC128 | 25p |
| AC153K | 25p |
| AC176K | 25p |
| AF139 | 25p |
| AF239 | 25p |
| AU113 | £1.20 |
| BA159 | 7p |
| BA182 | 7p |
| BA248 | 7p |
| BB103 | 7p |
| BB105 | 7p |
| BC107 | 7p |
| BC108 | 7p |
| BC109 | 7p |
| BC139 | 7p |
| BC147 | 7p |
| BC148 | 7p |
| BC149 | 7p |
| BC154 | 7p |
| BC157 | 7p |
| BC158 | 7p |
| BC171 | 7p |
| BC173 | 7p |
| BC174 | 7p |
| BC182L | 7p |
| BC183 | 7p |
| BC207 | 7p |
| BC212 | 7p |
| BC213 | 7p |
| BC237 | 7p |
| BC238 | 7p |
| BC245 | 7p |
| BC250 | 7p |
| BC251 | 7p |
| BC252 | 7p |
| BC257 | 30p |
| BC300 | 30p |
| BC303 | 30p |
| BC307 | 7p |
| BC308 | 7p |
| BC327 | 7p |
| BC337 | 7p |
| BC338 | 7p |
| BC350 | 20p |
| BC365 | 10p |
| BC413 | 7p |
| BC454 | 7p |
| BC460 | 25p |
| BC462 | 7p |
| BC463 | 7p |
| BC546 | 7p |
| BC547 | 7p |
| BC548 | 7p |
| BC559 | 7p |
| BD130Y | 25p |
| BD131 | 30p |
| BD132 | 30p |
| BD135 | 30p |
| BD136 | 30p |
| BD207 | 30p |
| BC221 | 20p |
| BD228 | 25p |
| BD238 | 20p |
| BD239 | 12p |
| BD331 | 20p |
| BD332 | 20p |
| BD253B | 35p |
| BD416 | 25p |
| BD595 | 35p |
| BD596 | 35p |
| BD681 | 25p |
| BD807 | 20p |
| BD534 | 20p |
| BF127 | 20p |
| BF137 | 20p |
| BF157 | 20p |
| BF180 | 20p |
| BF181 | 20p |
| BF182 | 20p |
| BF185 | 20p |
| BF195 | 7p |
| BF198 | 7p |
| BF199 | 7p |
| BF200 | 20p |
| BF240 | 7p |
| BF245 | 7p |
| BF263P | 15p |
| BF264 | 15p |
| BF273 | 7p |
| BF274 | 7p |
| BF337 | 24p |
| BF338 | 24p |
| BF458 | 12p |
| BFR79 | 15p |
| BFT43 | 25p |
| BFY50 | 15p |
| BFY90 | 20p |
| BR100 | 25p |
| BSX20 | 7p |
| BT100A | 30p |
| BT106 | £1.00 |
| BT109 | £1.00 |
| BT138/10A | 70p |
| BT151/800R | 70p |
| BTY80 | 20p |
| BU105/104 | 80p |
| BU108 | £1.00 |
| BU124 | 50p |
| BU126 | 80p |
| BU137 | 50p |
| BU204 | 50p |
| BU205 | £1.00 |
| BU208 | 60p |
| BU208A | £1.00 |
| BU407 | 50p |
| BU426V | 50p |
| BU526 | £1.00 |
| CA3089 | 50p |
| R2008B | £1.00 |
| R2010B | £1.00 |
| E1222 | 20p |
| BDX32 | £1.00 |
| OA90 | 7p |
| MJE51T | 25p |
| MJE2801 | 30p |
| BY127 | 10p |
| BY133 1600V/1 Amp | 10p |
| BY134 | 10p |
| BY176 Type | 25p |
| BY179 | 35p |
| BY184 | 25p |
| BY187 | 10p |
| BY190 | 40p |
| BY206 | 10p |
| Fast Recovery | 8p |
| 600 Volt 3A | 10p |

## DIODE 2AM 600/800v

| | |
|---|---|
| BY164 | 30p |
| RGP30G | 10p |
| BY210/400 | 5p |
| BY210/800 | 10p |
| BY223 | 25p |
| BY226 | 15p |
| BY254 | 10p |
| BY255 | 10p |
| BY296 | 10p |
| BY298 | 10p |
| BY299 | 10p |
| BYF3123 | 40p |
| BYF3126 | 40p |
| BYX55/350 | 10p |
| BYX38/600 | 50p |
| BYX38/300 | 25p |
| BYX71/350 | 20p |
| BYX71/600 | 30p |
| BYX72/300 | 20p |
| 2N2222 | 7p |
| 2N3055 | 40p |
| 2N4444 | £1.00 |
| 2SN30A | 7p |
| TIP29C/A | 20p |
| TIP31A/B | 25p |
| TIP32 | 20p |
| TIP33B | 50p |
| TIP34 | 50p |
| TIP35 | 50p |
| TIP36 | 50p |
| TIP41 | 30p |
| TIP42 | 30p |
| TIP100 | 30p |
| TIP130 | 30p |
| TIP2955S | 40p |
| IN60 | 3p |
| Y716 | 20p |
| Y827 | 30p |
| BYW56 2A/1000v | 8p |
| BYV95 | 8p |
| BYV96D | 10p |

## MIXED PACKS

| | |
|---|---|
| 20 Convergence Pots | 80p |
| 100 Mixed Sticks | £1.00 |
| 10 Thermisters | 50p |
| 20 Slider Pots | £1.00 |
| 30 Presets | 50p |
| 40 Pots | £1.50 |
| 300 Condensors | £1.50 |
| 300 Resistors | £1.50 |
| 150 Electrolytics | £2.00 |
| 15 Bulbs | 40p |
| 100 Diodes | £1.00 |
| 100 Fuses | £2.00 |
| 100 W/W Res | £1.50 |
| 300 Carbon Film Res | £1.50 |
| 20 Slider Knobs | 70p |
| 8 Mixed Gun Switches | 50p |
| 20 I/C Holders | £1.20 |
| Red Green L.E.D. | £1.00 |

## DIODES

| | |
|---|---|
| 1 Amp 1600v | 7p |
| 3 Amp 100v | 7p |
| 3 Amp 1200v | 10p |
| MR856 3 amp diodes | 10p |
| W004 Bridge | 15p |
| W005 Bridge | 20p |

| | |
|---|---|
| 9000 Thorn O/P Transistors with Heatsink T903 8v | £1.00 |
| SW150 Surface Wave Colour TV Filter | £1.00 |
| TiC 126N Thyristor 800v/12A | 50p |
| Mullard Surface Wave Filter RW154 Colour T/V Filter | 60p |
| 7 Seg Display, Led, Red | 50p |
| LM340T12 Reg | 25p |
| 1800/4KV | 5p |
| 4.7NF/5KV | 10p |
| 180/8KV | 10p |
| 210PF/8KV | 10p |
| 270PF/8KV | 10p |
| 330PF/8KV | 10p |
| 1000PF/10KV | 10p |
| 1200PF/12KV | 10p |

## ITT SPARE PANELS

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|---|---|
| CVC9 Power Supply Board | £1.50 |

## DECODER PANEL

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|---|---|
| ITT CVC20-25 30-32-40 | £7.50 |
| Audio Amp Driver Mod | £1.50 |
| ITT Control Panel 5 Sliders and Mains Lead | £1.50 |
| ITT 3 Sliders Control Panel | £3.50 |
| 2SC1030 | £1.00 |
| BF858 | 50p |
| TDA1010 | £1.00 |
| TA7607 | £1.00 |
| TA7609 | £1.00 |
| TA7315 | £1.00 |
| TDA2653 | £1.00 |
| TDA2560 | £1.00 |
| TDA7315 | £1.00 |
| Delay Lines TAU80 | £1.00 |
| TAU80 | £1.00 |
| DL50 | £1.00 |
| DL70 | £1.00 |
| DL600 | £1.00 |
| DL700 | £1.00 |
| 3.15 AS Fuses | 5p |
| G11 Teletex Panel No. 3113-267-1597 | £30.00 |
| THORN R1039 | 50p |
| THORN R1038 | 50p |
| FE04/1/220/4 3 pin ITT 1 MFD 4 Amp Mains Filters | 25p |
| G11 Philips 0.91M/210v Scan Coil Correction | 25p |
| Pots 10KΩ with switch | 25p |
| Pots 47KΩ with switch | 25p |

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