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TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

SERVICING THE DECCA 70 SERIES CHASSIS

4 GHz LOW NOISE AMPLIFIER

THE ULTIMATE PATTERN GENERATOR?

QUICK CHECKS Q&A

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Z48	3a 1000v Diodes (IN5408 type)	8 for £1.00
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Z52	Decca "Bradford" Control Knobs Black and Chrome. ¼" Shaft	8 for £1.00
Z53	Tuner P/B Knobs, Black and Chrome. Fit most small Diam Shafts, ITT, THORN, GEC etc.	8 for £1.00
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Z60	0.47Ω ¼ Watt Emitter Resistors	40 for £1.00

High quality **COAX PLUGS**, silver plated pin, grub screw fixing. 5 for £1
COAX COUPLERS 5 for £1
COAX FLYING SOCKET 3 for £1

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1µf 63v	20 for £1.00
1µf 350v	10 for £1.00
2.2µf 63v	20 for £1.00
4µf 350v*	10 for £1.00
10µf 25v	20 for £1.00
22µf 16v	20 for £1.00
100µf 25v	20 for £1.20
160µf 25v*	20 for £1.50
330µf 25v	10 for £1.00
400µf 40v*	8 for £1.00
470µf 25v	10 for £1.00
470µf 35v	8 for £1.00
1000µf 35v	6 for £1.00
1000µf 40v*	5 for £1

*Axial. All others are Radial.

CAN TYPES

22µf 375v (3 pin)	50p
50µf 250v (3 pin)	50p
100+200 350v	£1.00
100µf 350v	80p
2000µf 100v	£1.00
1000µf 100v	60p
2,200µf 40v	60p
2,200µf 63v	70p
3,500µf 35v	50p
220µf 400v ITT/RBM	£1.00
6,700µf 70v	£1.00
10,000µf 40v	£1.00

EHT DIODES

Very small. 20kV 2.5ma. 30ma peak 50p ea. 3 for £1.00

R.B.M. USERS LOOK!

No more messy soldering. 24 pin I.C. sockets for SL901 etc.
SPECIAL OFFER: 5 for £1.00
100 for £12.50.

SPECIAL OFFERS

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

12V BULBS on leads. Suitable for most **VIDEO RECORDERS.**
70p each 4 for £2

"RIFA"

0·1µ 1000v Flameproof 5 for £1.00

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

10 of one value	80p
10 of each	£6.60

1.3 watt, 12v, 13v, 18v, 47v

10 of one value	£1.00
10 of each	£3.00

DIODES

25 × IN4002	£1.00
	100 for £2.50
20 × IN4003	£1.00
	100 for £3.00
20 × IN4005	£1.50
	100 for £5.00
20 × IN4148	£1.00
	100 for £2.50
10 × SKE4F2/06 (600v 2a fast switching)	£1.00
12 × BY127	£1.00
8 × BY255 (3A 1,300V)	£1.00
10 × BA158 (600v 400ma)	£1.00
IN5402 3a 200v	8 for £1.00
6A. 100V. Bridge Rectifier. Very small.	80p ea. 3 for £2.00

I.C.'s

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MC1327P £1.00	6 for £5.00
TBA120SB	50p each, 5 for £2.00
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TBA810P £1.00	6 for £5.00
555 Timer 30p	4 for £1.00
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SN76660N 50p	5 for £2.00

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HITACHI PORTABLE V.C.R. Nicad pack. Type VTBP60E **£20 each.**
Brand New and Boxed 3 for £50

THORN "VIDEOSTAR" 3V25/26 Nicad pack. Type VA214. Also suitable for J.V.C. etc. Brand new and boxed. **£20 each, 3 for £50.**

THORN "VIDEOSTAR" Nicad packs. Same as above but secondhand, untested. Contain **10 "C" size Nicads (HP11)** which can be replaced if necessary. **£10 each, 3 for £25.**

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BG100 tripler for CVC45 etc.	only £3.50
Line output transformer for RBM823A	£4.25 each, 3 for £10.00
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Decca Bradford Tuner. 5 button type	£4.00 each, 4 for £12.00
UHF Modulator UHF out Video in. Ch. 36. 2¼"×2"×¾" complete with 9 foot coaxial lead and plug. With connection data	£3.00 each, 2 for £5.00
GEC Hybrid 2040 series Focus Assembly with lead and VDR rod	£2.00 each, 3 for £5.00
Convergence Panel for above. Brand new leads and plug.	£3.00 each
GEC 2010 Transistor Rotary Tuner with AE. SKT. and leads	£1.95 each, 3 for £5.00
Bush CTV 25 Quadrupler type Q25B equivalent to ITT TU25 3QK	£3.00 each, 2 for £5.00
Focus VDR Rods 2¾"×¼". Suitable for GEC, Decca etc.	75p each, 3 for £2.00
Grundig UHF/VHF Varicap Tuner for 1500GB, 3010GB.	£12.50 each, 3 for £30.00
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EHT Cable	30p per metre, 10 metres £2.50
Anti Corona Caps	3 for £1.00
4.433 Mhz CTV Crystals	£1.00 each, 3 for £2.50
75Ω 2¼ Loudspeaker	60p each, 4 for £2
6 MHZ sound filters, ceramic 3 pin "TAIYO" type	50p each, 3 for £1.00
PYE CT200 Control Knobs	8 for £1.00
Degaus VDRs. 1¾" diam. for RBM etc.	5 for £1.00
Mains Neons	10 for £1.00
2k2 Screenfeed Resistors. White ceramic, 9 watt, with fusible link.	8 for £1.00
Philips G8 Transductor.	£1.20 each, 3 for £3.00
E.H.T. Discharge probe, with heavily insulated handle, with lead and chassis connector.	60p each, 3 for £1.50

SPECIAL OFFER

PHONO PLUGS, metal with plastic tops. Red, grey or black.

20 of ONE colour	£1
20 of EACH colour	£2.50
100 of ONE colour	£4
100 of EACH colour	£10

SPECIAL OFFER

LIGHTWEIGHT STEREO HEADPHONES. Good quality with 3.5mm stereo jack plug. **£2.95 each, £25 for 10.** Further discount available on large quantities.

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"3500" Transductor	£1.20, 3 for £3.00
"3500" Focus Assembly with VDR	£1.50
"8500" Focus Assembly. Rotary type	£1.50, 3 for £4.00
"8500" .0022 2000v Line Capacitor	10 for £1.00
"1590/91" Portable metal boost Diode (W11)	5 for £1.00
"1500" Bias Caps 160µf 25v	20 for £1.50
"1500" Jellypot. L.O.P.T. Pinkspot	£3.50
"900/950" 3 stick triplers	£1.00, 3 for £2.50
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THYRISTOR

SS106 (BT106) 75p each
3 for £2.00, 10 for £5.50

CONVERGENCE POTS

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

UNIVERSAL TEST LEAD KIT

Comprises: Red and black meter leads with 14 interchangeable probes, clips, points, plugs etc with screw threads.
ONLY £2.50

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Please quote ZED code where shown. Send cheque* or Postal Order. Add 60p P&P and 15% VAT.
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ZED PACKS now available for CALLERS at 50 Deptford Broadway, London, S.E.8.
Send large S.A.E. for list of Quantity, Prices and Clearance Lines etc.

TELEVISION

September 1983

Vol. 33, No. 11
Issue 395

this month

OUR NEXT ISSUE DATED OCTOBER WILL BE PUBLISHED ON SEPTEMBER 21

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

SUBSCRIPTIONS
An annual subscription costs £11 in the UK, £12 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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Binders (£4.50) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders, add 60p.

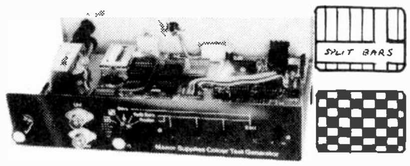
BACK NUMBERS
Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at £1·10p inclusive of postage and packing.

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

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"×2½")	£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	£120.75

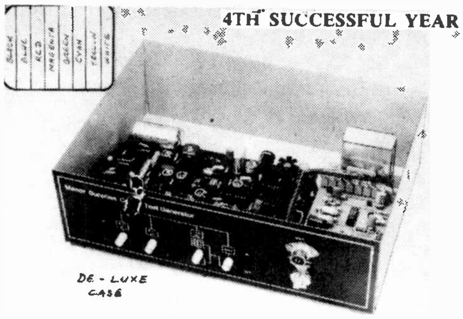
SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.50

All above prices include VAT 15%

PAL COLOUR BAR GENERATOR (Mk4)

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 MK 4 COLOUR BAR GENERATOR KIT £34.50. DELUXE CASE £8.50. BATT HOLDERS £3.20 OR MAINS SUPPLY KIT £4.80 (Combined P&P £1.80).

MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.
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VHF MODULATOR (CHI to 4) FOR OVERSEAS £6.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.
(ALL PRICES INCLUDE 15% VAT)

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MK 1 (Texas XMII) Cable remote control **£170.20** p.p. £2.80.
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Further details on request.

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

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NEW COLOUR PORTABLE TV
MONO PORTABLE TV, SMALL SCREEN MONITOR
LISTS AVAILABLE, PANEL TEST SERVICE

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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).
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GEC 2040 DECODER PANEL **£2.88** p.p. £1.60.
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THORN 8000/8500 FRAME T.B. PANELS salvaged/spares **£2.88** p.p. £1.40.
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UHF/625 Tuners, many different types in stock. **DECCA** Bradford 5 position **£2.88** p.p. £1.80 etc.
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BUSH, MURPHY 774 series	**£9.80**	**R.B.M.** Z179	**£11.30**
BUSH, MURPHY A816 series	**£9.80**	**R.B.M.** T20, T22	**£11.30**
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THORN 1600, 1615, 1690, 1691	**£10.50**	**DECCA** Bradford (state Mod No)	**£10.15**
GEC 2000 to 2038 series	**£7.80**	**DECCA** 80, 100	**£10.15**
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INDESIT 20/24EGB	**£8.80**	**GEC** 2110 Series	**£12.20**
ITT/KB VC 200, 300	**£8.80**	**ITT** CVC 5 to 9	**£11.30**
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PHILIPS 170, 210, 300 SERIES	**£8.80**	**ITT** CVC25, CVC30 series	**£10.15**
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	**£8.80**	**PYE** 691-697	**£11.50**
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KB VC ELEVEN (003)	**£2.00**	**THORN** 3000/3500 SCAN, EHT	**£7.85**
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TRANSDUCTORS suitable for G8, A823, Bradford etc. **£1.72** p.p. 60p.
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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)	3.40
DECCA 80 (400/350V)	3.00
DECCA 100 (800/250V)	3.97
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.30
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.70
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.66
RBM A823 (600/300V)	2.83
RBM Z146 (300/300/350V)	3.55
RR1 T20A (220/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.98
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)	2.20
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.78
THORN 3500 (1000/63V)	86
THORN 3500 (1000/70V)	86
THORN 8000/8500 (2500/2500/63V)	3.38
THORN 8000/8500 (700/250V)	2.31
THDRN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.28
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25
THORN 4700 P/C 25V	1.20
PHILIPS 320 400/400/200V	2.74
THORN 1591/1691 4700/25V	1.20

ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	8.40
Mullard ELC1043/06	8.40
4 P/B DECCA/GEC/ITT	6.88
6 P/B DECCA/GEC/ITT	7.50
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	7.98
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)	10.75
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
ITT CVC8 (5 wheel modified)	£12
ITT 6 way with VCR	8.90
PHILIPS KT3	14.50
PHILIPS KT30	10.30
PYE 697 Repair Kits	6.97
ELC 2003	£16.50

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/Push	75
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/Off	66
A1 Beam Switch (THORN 3500)	70
A1 Controls 5m (THORN 3500)	89
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		60
1.5A-2A-2.5A-3A-5A		60
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A		
1.5A, 2A		1.70
2.5A, 3A, 5A		2.70
20mm ANTISURGE		
80ma		4.80
100ma		2.50
160ma, 200ma		2.20
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A		1.30
2.5A, 3.15A		1.90
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A		60
1" MAINS		
2A, 3A, 5A, 10A, 13A		1.00

LABGEAR

CM7061 Power Unit 12V	10.70
CM7062 Reg. Power Unit 12V	11.67
CM7060 MHA 10db 12V W/B	8.94
CM7065 VHF/UHF MHA W/B 12V	13.01
CM7067 UHF 12V MHA (Specify A-B or C/D)	9.72
CM7068 UHF 12V MHA High Gain (Specify A-B or C/D)	14.47
CM7053 Behind Set UHF Amp. (Mains)	11.80
CM7054 Behind Set UHF Amp. (Battery e.g. Caravans)	9.45
CM7043 Second Set Amp. UHF	10.99
CM7093 Behind Set UHF Amp. 3 Sets	13.85
CM7063 Dist. Amp. VHF/UHF 17db/output 12V	20.10
CM7073 VHF/UHF 8+1 Dist. Amp.	39.24
CM9700 27mhz CB Suppress.	3.68
CM6011 Outdoor Splitter (2 way) W/B	7.10
CM9003 Flush Single Outlet	1.33
CM9010 Flush Twin Outlet	1.69
CM9034 UHF Group Filters with DC Through Pass (state A/B/CD)	6.97
CM6006 6 Way Passive Splitter	10.97
CM7042 TV Games Combin.	2.55
CM9009 Flush TV/FM Outlet	2.76
CM7069 Tri Star Amplified Set Top Aerial W/B	17.50
CM7090 Amplified Caravan Aerial 12V OC W/B	15.52
CM6038 UHF/VHF 625 Pattern Gen.*	50.00
CM6052 UHF/VHF PAL Colour Bar Gen.*	190.00

* While stocks last

AERIAL ACCESS.

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	1.80
Olympic II Set Top Aerial	2.30
M.H.A/P.U. the pair	18.00
Aerial Isolator Kit	2.08
4m Fly Lead	1.20
2m Fly Lead	90

ANTIFERENCE

SB11 Indoor Splitter	1.91
COB11 Single Outlet	80
TRR/VSP Transformer	2.83
CS200/SP Comb/Splitter	3.03
CS1000 Comb/Splitter	6.15
PU1240 Power Unit	11.10
UP1300 M.H.A. UHF/VHF	8.25
XTRABOOST XS2U	11.63
4 Way Amp UHF/VHF	33.75
6 Way Amp UHF/VHF	42.00
Super Set Top	5.50
XG8 High Gain Aerial A,B,CD or W/B	17.90

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	4.55
THORN 1500 5 Stick	5.29
THORN 1600	3.90
THORN 3000/3500	7.98
THORN 8000	5.28
THDRN 8500/8800	6.15
THORN 9000	7.93
DECCA 1730/1830	4.48
DECCA 1910/2213 Bradford	5.92
DECCA 30	6.76
DECCA 80	6.60
OECCA 100	6.14
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	6.75
PHILIPS G8 Long Focus 550	6.75
PHILIPS G9	6.37
Pye/Philips K3 Tripler	6.65
PYE 691/3	6.58
PYE 713/4 Lead	7.00
PYE 713 Doubler 5 Lead	7.50
Philips/Pye KT3	6.67
PYE 731/725	7.60
R.B.M. A823 (plug in) AV	7.60
R.B.M. A823	7.60
KORTING (similar to Siemens TVK1)	7.32
ITT KB CVC5/9	6.90
ITT KB CVC20/25/30 (Mullard)	5.95
RRI T20	6.80

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA317	26
BAX13	4
BAX16	8
BB105B	30
BB105G	30
BY126	12
BY127	11
BY133	15
BY164	45
BY176	85
BY179	63
BY182	87
BY184	55
BY199	28
BY206	14
BY210/600	28
BY210/800	33
BY223	90
BY227	28
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX36/600	35
BYX55/600	30
BYX71/600	90
OA47	9
OA90	10
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	5
IN4007	6
IN4148	2
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	16
ITT44	4
ITT2002	11
Y969 (30V Thorn 3500)	89
BZY15-24R	1.18
BZY15-12R	1.18

CAPACITORS AXIAL

Volts	Mfd	Price
6V3	33	9
10V	22	10
	47	10
	100	10
	220	15
	470	20
16V	33	11
	68	11
	220	16
	1000	27
	3300	53
25V	10	11
	22	13
	47	15
	100	15
	220	29
	470	30
	1000	55
	2200	51
	4700	98
40V	10	10
	22	10
	400	48
63V	1	12
	2.2	12
	4.7	12
	10	11
	15	12
	22	13
	47	19
	100	23
	220	37
	470	49
	1000	58
	2200	94
100V	10	13
	22	15
	47	20
	100	36
	220	70
450	1	33
	4.7	30
	10	30
	22	65
	33	75
500	1	32
	10	32
600	1	41

DISC CERAMIC CAPACITORS

8kV (12kV Mag)
39pF 200pF each
150pF 220pF 30p
180pF 250pF

SLIDER POTENT

Lin or Log
470R-1K-2K2-44-10K-47K-470K 65

CONVERGENCE POTS

3W/5R-6RB-10R-15R-20R
50R-100R-200R-500R 60

CERAMIC CAPACITORS

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

SKELETON PRE-SET POTS

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

METRIC CONVERGENCE POTS

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

PANELS + UNITS

AFC UNIT PHILIPS G8	8.82
IF GAIN MODULE (Pye/Philips)	9.00
CDA PANEL (Pye/Invicta/Ecko/Dynatron)	20.00
REAR CONVERGENCE PANEL (Philips G8)	23.00

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
Dual gang Controls 1.25
16mm Rotary Controls 10K, 22K, 100K, 1M, 10K 39p

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

EAGLE PRODUCTS

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

DF615 Full Range Speaker 6½"		8.95
Multimetres		
KEW 7N	2,000	5.25
KEW 20		14.50
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
MMT20		16.95
Case for MM100		15.95
T1206 2 Station Intercom		6.95

SPECIAL DIODES

SKE 49	£1.09
SKE 5F	£1.19
Y723	£1.30
Y827	£1.42

MIXED DIELECTRIC CAPS

Volts D.C.		
250V	0.91mF	84
400V	0.22mF	20
600V	0.1mF	38
1000V	0.01mF	24
	0.047mF	46
	0.033mF	33
	0.1mF	35
	0.22mF	66
	0.47mF	98
1250V	0.1mF	59
	0.91mF	1.15
1500V	0.0022mF	28
	0.0047mF	32
	0.022mF	30
	0.033mF	62
	0.005mF	65
2000V	0.0052mF	1.20

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
CH3/RX6 For SP2/HP2/NN1300/SP11/HP11/NN1400/HP7/NN1500 2-4-6 batteries in pairs. (RX6-RX14-RX20)	14.00
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 E30	3.06
VHS E60	3.66
Scotch E120 Video Tape	5.00
Scotch E180 Video Tape	5.13
BETA L500	4.90
BETA L750	5.80
PHILIPS VCC 240	5.93
PHILIPS VCC 360	8.30
PHILIPS VCC 480	10.21

VIDEO CASSETTE CASES

Red/Blue/Green/Brown	80
Book Type – Any Format	
Scotch Audio Tape	
C90 Ferric	65
C90 Super Ferric	96
Video Recorder Heads	
VHS (Universal)	38.00
Philips V2000	52.00

ELECTROLUBE PRODUCTS

Electrolube Adhesive	62
Electro-Mech lubricant	1.49
Elect. cleaning solvent	1.62
Freezer	1.49
Foam cleanser	1.12
Heat transfer compound	1.14
Silicone compound	1.94
Special contact fluid (Snorkel)	3.20
Permagard	1.52
Elec. mech. lubricant pen	74

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

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Why not pay us a visit and see our range of Micros, Software Books and Peripherals. Please ring for prices.

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We are also authorised dealers for the BBC Micro and accessories

SUNDRY TUNER ACCESS.

RANK Tuner P.B. 1½" × ½"-2" × ½"-2" × ⅜"	35
RANK Drive Cams	10
GEC 2110 Tuner Neons	14

SUNDRIES

Delay Lines DL60, DL700, DL50	2.20
CRT Tube Base	70
EHT Final Anode Cap	53
EHT Cable	25p mtr.
6.3V CRT Boost Trans.	4.35
13A Plug Top box 10	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)	6.50
Cassette Drive Belts price each	
35mm	35
46mm	37
57mm	37
66mm	39
71mm	41
76mm	43
90mm	43
110mm	59
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	3.25
Mains Connector 4 way 13A	5.00

RECTIFIER STICKS

TV11	74	TV18	90
TV13	79	TV20	1.20

MAINS DROPPERS

DECCA 20	2.48
DECCA 2R5	85
DECCA 27R/47R	1.40
DECCA 56R/6R8	1.40
R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 713/15 3R5/15/45R	1.80
PYE 725/31 3RO/56R/27R	1.84
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2k85	1.75
PHILIPS 210/5051 -/118R/148R	93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	95
THORN 1400	1.20
THORN 1500	1.38
THORN 1600	1.77
THORN 3500	94
THORN 8000	1.24
THORN 8500	1.36

TEST EQUIPMENT

Portable Oscilloscope	150.00
Probes x10	10.90
CRT Tester/Rejuvenator	172.00
KHP30 Measuring Probe (3 okv) EHT	29.95
T120 RF Signal Injector	4.00
Test Lead Set	4.20
Degaussing Coil (stick type)	17.00
Degaussing Coil (disc type)	24.00

SERVICE AIDS

SERVISOL Freeze-It	96
SUPER SERVISOL	88
SERVISOL Foam Cleanser	84
SERVISOL Plastics Seal	88
SERVISOL Silicone Grease	1.00
SERVISOL Tubes Silicone Grease	1.60
SERVISOL Aero Klene	78
SERVISOL Aero Duster	94
SERVISOL Excel Polish	76
SERVISOL Video Head Cleaner	80
Super 40	1.50
Fire Extinguisher 640G	2.80
Heat Sink Compound 25G	1.08
Silicone Rubber Tube 110G	2.98
Solda Mop standard reel	72

ZENER DIODES

BZX61/85 (1.3W) 20
6V2-7V5-8V2-9V1-10V-11V-12V-13V-15V etc up to 75V.
BZY9390, 18V 1.18
BZY88 (400MW) 10
2V7-3V-3V3-3V6-3V9-4V3-4V7-5V etc. up to 24V.

HOW TO ORDER

ADD 65p per order for Post and Packing (UK).
(Export orders will be charged at cost.)
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.

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.
Prices are subject to change without notice.

TRANSISTORS, ETC.

Type	Price (£)
AC107	0.48
AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.46
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.42
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	1.32
AF115	1.26
AF116	1.28
AF117	1.32
AF118	0.98
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.36
AF180	1.35
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	2.55

Type	Price (£)
AU103	2.40
AU107	2.75
AU110	2.40
AU113	2.60
BC107*	0.16
BC108*	0.15
BC109*	0.16
BC113	0.22
BC114	0.22
BC115	0.24
BC116*	0.25
BC117	0.30
BC118	0.24
BC119	0.34
BC125*	0.30
BC126	0.30
BC132	0.20
BC134	0.22
BC135	0.21
BC136	0.22
BC137	0.30
BC138	0.352
BC140	0.36
BC141	0.44
BC142	0.35
BC143	0.38
BC147*	0.12
BC148*	0.12
BC149*	0.13
BC152	0.42
BC153	0.38
BC154	0.41
BC157*	0.13
BC158*	0.12
BC159*	0.14
BC160	0.52
BC161	0.58
BC167B	0.15
BC168B	0.14
BC169C	0.15
BC170*	0.15
BC171*	0.15
BC172*	0.14
BC173*	0.22
BC174A & B	0.26
BC176	0.22
BC177*	0.20
BC178*	0.22
BC179*	0.28
BC182*	0.15
BC182L*	0.15
BC183*	0.14
BC183L*	0.14
BC184*	0.15
BC184L*	0.15
BC185	0.36
BC186	0.25
BC187	0.27

Type	Price (£)
BC192	0.56
BC204*	0.39
BC205*	0.39
BC206*	0.37
BC207*	0.
BC208*	0.37
BC209*	0.39
BC211*	0.36
BC212*	0.17
BC212L*	0.17
BC213*	0.16
BC213L*	0.16
BC214*	0.18
BC214L*	0.18
BC225	0.42
BC237*	0.16
BC238*	0.15
BC239*	0.22
BC251*	0.25
BC252*	0.26
BC253*	0.38
BC261A*	0.28
BC262A*	0.28
BC263*	0.26
BC267*	0.20
BC268*	0.28
BC286	0.40
BC287	0.49
BC291	0.27
BC294	0.37
BC297	0.36
BC300	0.62
BC301	0.38
BC302	0.86
BC303	0.64
BC304	0.44
BC307*	0.17
BC308*	0.14
BC309*	0.18
BC317*	0.15
BC318*	0.15
BC319*	0.19
BC320	
BC321A&B	0.18
BC322	0.28
BC323	1.15
BC327	0.16
BC328	0.18
BC337	0.17
BC338	0.17
BC340	0.19
BC347*	0.17
BC348A & B	0.17
BC349B	0.17
BC350*	0.24
BC351*	0.22
BC352A*	0.24
BC360	0.59

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	0.13
BC548*	0.13
BC549*	0.15
BC550	0.24
BC556	0.23
BC557*	0.16
BC558*	0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.05
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	0.37
BD136	0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	0.51
BD155	0.90
BD157	0.51
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.88
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
BD222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

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

Type	Price (£)
BF222	0.51
BF224 & J	0.22
BF240	0.32
BF241	0.31
BF244*	0.51
BF245*	0.43
BF254	0.48
BF255	0.58
BF256L*	0.49
BF257	0.47
BF258	0.52
BF259	0.54
BF262	0.73
BF263	0.88
BF270	0.47
BF271	0.42
BF273	0.33
BF274	0.34
BF336	0.63
BF337	0.65
BF338	0.68
BF355	0.72
BF362	0.49
BF363	0.49
BF367	0.29
BF451	0.43
BF457	0.46
BF458	0.49
BF459	0.52
BF594	0.16
BF596	0.17
BF597	0.27
BFR39	0.30
BFR40	0.29
BFR41	0.30
BFR50	0.29
BFR52	0.33
BFR61	0.29
BFR62	0.28
BFR79	0.30
BFR80	0.29
BFR81	0.30
BFR88	0.42
BFT41	0.48
BFT43	0.55
BFW11	1.02
BFW30	2.58
BFW59	0.19
BFW60	0.20
BFW90	1.65
BFX29	0.38
BFX84	0.42
BFY50	0.38
BFY51	0.37
BFY52	0.36
BFY53	0.36
BFY90	1.98
BPX25	1.62

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

Type	Price (£)
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
MPSU60	0.82
MPU131	0.59
OC26	1.90
OC28	1.49
OC29	1.60
OC35	1.25
OC36	1.25
OC42	0.90
OC44	0.68
OC45	0.63
OC70	0.65
OC71	0.73
OC72	0.73
OC81	0.83
OC81D	0.95
OC139	1.30
OC140	1.35
OC170	0.80
OC171	0.82
OC200	3.90
OC201	3.95
OC202	2.40
OC205	3.95
OCP71	1.98
ON236A	0.94
R2008B	2.72
R2010B	2.79
R2322	0.75
R2323	0.85
ST2110	0.49
ST6120	0.48
TIC44	0.25
TIC46	0.35
TIC47	0.45
TIP29A	0.47
TIP30A	0.50
TIP31A	0.51
TIP31C	0.67
TIP32A	0.56
TIP32C	0.72
TIP33A	0.77
TIP34A	0.84
TIP41A	0.72
TIP42A	0.80
TIP2955	0.77
TIP3055	0.58
TIS43	0.44
TIS73	1.36
TIS90	0.23
TIS91	0.28
ZTX108	0.14
ZTX109	0.16
ZTX213	0.2
ZTX300	0.16
ZTX304	0.26

Type	Price (£)
ZTX500	0.18
ZTX502	0.22
ZTX504	0.28
2N404	1.30
2N696	0.46
2N697	0.46
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.46
2N918	0.54
2N930	0.29
2N1164	10.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.45
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	0.15
2N2926O	0.14
2N2926Y	0.14
2N2955	1.12
2N3053	0.48
2N3054	0.86
2N3055	0.72
2N3250	0.52
2N3254	0.58
2N3391A	0.38
2N3633	0.60
2N3703	0.17
2N3704	0.19
2N3705	0.17
2N3706	0.16
2N3707	0.18
2N3708	0.17
2N3715	1.70
2N3771	2.09
2N3772	2.08
2N3773	2.90
2N3794	0.40

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

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)
CA810QM	2.50
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC400B	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SL432A	2.52
SL450	5.10
SL901B	6.50
SL917B	7.75
SL918A	5.95
SN72440N	2.21
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32

Type	Price (£)
SN76023ND	2.52
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.8F
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	2.85
TAA621AXI	4.75
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.32
TBA240A	3.98
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20

Type	Price (£)
TBA480Q	1.84
TBA500*	2.21
TBA510*	3.20
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	4.55
TBA641BX1	4.60
TBA651	2.42
TBA673	2.31
TBA700*	2.50
TBA750*	2.18
TBA800	2.05
TBA810AS	2.00
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	3.85
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	1.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

7400 to 74393 series available. Full range of C Mos in stock.

* Indicates Q version is also available.

SPECIAL OFFER
25 · AU110 for **£40.00**

DIODES

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

Type	Price (£)
BY114	0.60
BY118	1.10
BY126	0.20
BY127	0.21
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY182	1.14
BY184	0.44
BY189	5.30
BY190	4.90
BY206	0.26
BY238	0.25
BYX10	0.30
BYX38/600	0.70
BYX70/500	0.53
ITT44	0.08
ITT210	0.63
ITT827	0.80
MCR101	0.48
MR854	1.10
OA5	0.88
OA10	0.58
OA47	0.20
OA81	0.19
OA90	0.13
OA91	0.15
OA95	0.20
OA200	0.13
OA202	0.13
OA210	0.89
TIL209	0.14
TIL211	0.18
TV20	2.25
IN914	0.06
IN916	0.06
IN4001	0.06
IN4002	0.07
IN4003	0.08
IN4004	0.08
IN4005	0.09
IN4006	0.10
IN4007	0.12
IN5400	0.15
IN5401	0.17
IN5402	0.20
IS920	0.09
IS921	0.11

ZENER DIODES

400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	£1.26 each
2 5W plastic	7.5-75V	67p each
15W plastic PAB limited		87p each
20W stud	7.5-75V	£1.31 each

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	3.80
PCL82	0.93
PCL83	5.25
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL519	6.20
PL802	7.50
PY81/P810	0.60

BRIDGES

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

10A and 25A ranges also stocked.

RESISTORS

Carbon Film (5%)

Mixes of a minimum of 10pcs of any value:

	Ea	10 of one value	50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.49	£5.40
½W 10Ω-10MΩ (E24)	3p	25p	95p	£1.49	£5.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.80	£6.40	£26.90

Wirewound (5%)

2½W 0.22Ω-270Ω	18p
4W 1.0Ω-10kΩ	22p
7W 0.68Ω-22kΩ	24p
11W 1.0Ω-22kΩ	28p
17W 1.0Ω-22kΩ	33p
Vertical mounting pillars	3p

Presets (†)
0·1W (Vertical and Horizontal)
100, 220, 470Ω, 1, 2 2, 4·7, 10, 22, 47, 100, 220, 470kΩ, 1, 2·5, 5MΩ **all 14p each**
0 2W (Vertical and Horizontal)
Values as 0·1W **all 14p each**

FUSES (all packs of 10)

20mm Time Delay (BEAB)

40mA	5.50
50, 63mA	5.50
100mA	3.50
160, 200, 250mA	3.20
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 3.25

20mm quick-blow (BEAB)

100mA	£1.50
200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 70p
2A circuit breakers metal	£1.52
plastic	£1.48

ANTEX SOLDERING EQUIPMENT

Soldering Irons

XS	– 25W	£5.20
CS	– 17W	£5.00
C	–15W	£5.00
Soldering Station (inc. 30W or 40W iron – state which)		£49.95
MLXS	– 25W 12V	£5.50
Sk1-Kit		£7.80
Replacement Bits (Chrome plated)		90p
Stands		£1.90
Elements		£2.40

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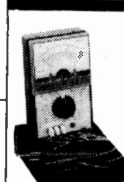

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TELEVISION

COVER PHOTO

Our cover photograph this month is by courtesy of Sogitec of France. It shows a computer-generated image which is part of an animated film the company has produced for the petrochemical industry. In this particular photograph, ethylene molecules are displayed in a tridimensional universe.

CHANGE OF ADDRESS

The editorial office location has changed. Please note the new address which is: King's Reach Tower, Stamford Street, London SE1 9LS.

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Research and Development

Apparently the Japanese Ministry of International Trade and Industry (MITI) has under its wing an Agency of Industrial Science and Technology which is trying to pinpoint the basic industrial technologies that will come to the fore in "the generation after next", i.e. in the twenty first century. The Agency started to consider the technologies that will be of practical importance in the nineties back in 1981. One can't help but admire such a forward looking approach to ensuring that Japanese industry will be able to move in the right direction when the time comes. It's perhaps worth noting that the Agency is backed by substantial government funds – there's possibly a moral here for our own government, in view of its rather niggardly approach to public expenditure. It seems that MITI has been doing this sort of thing for quite a few years. The idea has been to identify products that will result in industrial growth, to ensure that adequate effort and funds are devoted to the relevant technology, and to follow this up by applying enough pressure on industry to ensure that at least two major firms are active in any field considered to be of strategic importance.

The process seems to have worked well enough so far. The era of advanced modern technology is probably too new however to be able to draw any very firm conclusions on the effectiveness of this approach. One hopes, for the Agency's sake, that it won't overlook the extraordinary importance of sheer accident (luck?) when it comes to technological advance. As a very simple illustration, blotting paper was discovered when someone forgot to put the size in a run of printing paper. Penicillin is another example of an important development discovered largely by accident. Perhaps more relevant to our own field is the fact that the transistor was also discovered by chance. No one was actually looking for a method of solid-state amplification. It just happened that in the course of research into solid-state matters the effect was discovered. We all know the outcome of that: probably no little device has had such a profound effect on human affairs. There were similar strokes of luck/genius with earlier technologies. The invention of the steam engine for example was rather stumbled upon – the power of steam was first noted, then an application was found.

This highlights the basic difference between research and development. The Japanese are supposed to be good at the latter but not so good at the former, though I wouldn't like to bet too much on it. If there is any truth in this, it's possibly because of the rather literal attitude induced by Japanese culture, as a result of which the element of chance is played down. Be that as it may, the fact that does stand out is the need for continuous research effort that's not necessarily devoted to specific objectives. Which brings us to the problem of funding it. Who's going to pay for work that's not concerned with the development of specific products or processes? There can be no ducking this question: it's the government's responsibility in a developed country to ensure that the funds are available to maintain an adequate level of basic research. This presents awkward problems of course. How do you assess the value of such work paid for by public money for example?

Despite the limited funds available, the UK is generally regarded as having a good record for research work – and a rather poor one for development. Several recent reports have underlined this view. Research work is carried out effectively, but exploitation of the results is all too often left to others – examples in recent times have included the liquid crystal effect and various other discoveries in materials technology. Perhaps something like that Japanese Agency is required to ensure a smooth transition from basic discovery to practical application. There's quite clearly a need for closer collaboration between industry and the educational system in this respect, and for the government to guarantee the provision of appropriate funds. The concentration of higher education expenditure cuts on centres with a technological bias has not been a very hopeful sign.

Development as opposed to basic research is where industry is supposed to come in, but there's a government role here as well in view of the amount of money required and the lengthy time scales often involved. It seems unfortunate in this respect that so much government development expenditure – something like two thirds – goes on defence projects. This is a far higher proportion than in any other comparable country. Commenting on the subject recently Sir Henry Chilver, chairman of the Advisory Council for Applied Research and Development, said that he "did not fully understand why there was not a greater spin-off to benefit the civil sector." Well, perhaps one reason could be that work carried out for defence purposes is classified, making it difficult to apply elsewhere. Whatever the reason, it's a fact that the more successful countries economically spend relatively little on military research – we are talking about W. Germany and Japan of course.

There's been a tendency amongst some commentators to criticize British industry and the City for failure to invest sufficiently in research and development work. It's said for example that a profit is expected too soon. This hardly seems fair, since the overall economic climate has to be taken into account. In Japan inflation and interest rates have been low: so it's made sense to invest funds on a long term basis. Where profitability is low and inflation and interest rates are high, who can afford to invest money in research work that may lead nowhere? Getting these things right could make a big difference. Let's hope it will: continuous industrial regeneration is vital in a developed country, and this in turn depends on research and the funds to enable it to be undertaken.

Long-distance Television

Roger Bunney

After the rather belated start of the 1983 Sporadic E season there were plenty of signals on most days during June, though with perhaps some tailing off at the start of July. Tropospheric reception has also been good at times – details later. In many cases SpE signals seen earlier in the day would subsequently reappear, but to save space only one sighting is given in the following log.

7/6/83 RAI (Italy) ch. IA, B; RTP (Portugal) E2, 3; RTVE (Spain) E2-4; MTV (Hungary) R1, 2; TSS (USSR) R1; NRK (Norway) E2.

8/6/83 RTVE E2-4; RAI IA, B; MTV R1; NRK E2.

9/6/83 RAI IA, B; RTVE E2, 3; RTP E2; TVR (Rumania) R2.

10/6/83 RTVE E2-4; RAI IA; TSS R1, 2; SR (Sweden) E2; NRK E2, 3; RTP E2; RUV (Iceland) E4.

11/6/83 RAI IA, B; RTVE E2-4; MTV R1, 2; SR E2; ORF (Austria) E2a; TVR R2; RTP E2, 3.

12/6/83 RAI IA, B, C; JRT (Yugoslavia) E3, 4; RTVE E2-4; MTV R1, 2; TSS R1-3; NRK E2; TVR R2.

13/6/83 RAI IA; RTVE E3.

15/6/83 RAI IA, B; RTVE E2-4; JRT E3, 4; ARD (W. Germany) E2; RTP E2, 3.

16/6/83 ARD E2; ORF E2a, 4; CST (Czechoslovakia) R1; TSS R1, 2; TVR R2; MTV R1, 2; RTVE E2-4 plus RTVE-2 Santiago E2 and RTVE Canary Isles E3; RUV E4; TDF (France) F2 (819 lines); JTV (Jordan) E3 at 1340 BST.

17/6/83 RAI IA, B; RTVE E2-4; TDF F2, 4; PTT (Switzerland) E2, 3; ORF E2a, 4; ARD E2; TVR R2; MTV R1, 2; JRT E3, 4; DFF (E. Germany) E4; RTP E2, 3; SR E2; TVP (Poland) R1-3; RUV E4.

18/6/83 RAI IA, B; ORF E4; MTV R1, 2; TSS R1, 2; ARD E2, 4; PTT E2, 3; CST R1; TVP R1, 2; TSS R1, 2; SR E2, 3; DFF E4; JRT E4; RUV E3, 4; unidentified signals on chs R1-4.

19/6/83 TSS R1, 2; RAI IA; JRT E3, 4; PTT E2, 4; MTV R1, 2; CST R2; ARD E3; ORF E2a; TVP R1, 2; RTP E2, 3; RTVE E2-4.

20/6/83 RTVE E2-4 all carrying Teletexto information; RTP E2, 3; RUV E3, 4; RAI IA, B; ARD E2, 3; CST R2; TVP R1, 2 (with NTD identification on the PM5544 pattern); TSS R1, 2; SR E2-4; ORF E4; PTT E2; MTV R1, 2; NRK E2-4; DR (Denmark) E3, 4; a really chaotic day!

21/6/83 ORF E2a, 4; ARD E2; PTT E2, 3; RAI IA, B; RTVE E2-4; RTP E3; JRT E3, TSS R1, 2.

22/6/83 TSS R1, 2; TVR R2, 3; MTV R1, 2; RTS (Albania) IC; PTT E2, 4; RAI IA, B; RTVE E2-4; JRT E3, 4; RUV E4.

23/6/83 NCT (Italian free station) E3; RAI IA, B; RTVE E2-4; JRT E3, 4; RTP E3; PTT E2, 3; MTV R1, 2; SR E2.

24/6/83 RAI IA; JRT E3, 4; MTV R1, 2; TVR R2; RTS IC.

25/6/83 RAI IA, B; RTVE E2-4.

26/6/83 ARD E2; ORF E2a; PTT E2; TSS R1.

28/6/83 JRT E3, 4; RAI IA, B; ORF E2a; RTVE E2-4; TVR R2, 3; JTV E3 at 1755 BST; RTP E3; TSS R1, 2; NRK E3.

29/6/83 RAI IA; MTV R1.

30/6/83 RTVE E2-4; RTP E3; RAI IA, B; MTV R1; TSS R1; plus Spanish cordless phones!

1/7/83 RTVE E2-4; RTP E2-4; MTV R1, 2; RAI IA; JRT E3, 4; TSS R1, 2; SR E2; RUV E3, 4.

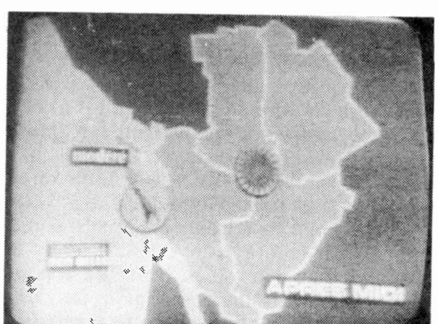
2/7/83 RTVE E2-4; RAI IA, B; MTV R1; CST R1; TSS R1-3; JRT E3, 4; NRK E2, 3; RUV E3, 4; JTV E3 at 1210 BST.

3/7/83 TSS R1; CST R1; NRK E2-4; JRT E3, 4; MTV R1; RAI IA, B; ORF E2a; JTV E3 at 1100 BST.

June/early July was thus an eventful month for SpE reception. Apart from the Jordanian reception on several days the only exotic signal of note was Hugh Cocks' reception of Sokoto ch. E3 at 1600-1730 BST on June 7th, with typical Nigerian dancing. An unidentified ch. E2 Arabic signal, possibly Dubai, was noted by Hugh on the 28th at 1800, from the south east. Cyril Willis noted Band II SpE on June 7th at up to 106MHz, with AFRTS programmes: the 144MHz band was similarly affected during the late afternoon.

Tropospheric Reception

There was excellent tropospheric reception on June 6/7th, with v.h.f./u.h.f. signals from W./E. Germany reaching the midlands, and even better reception on many Band III/u.h.f. channels on the 18/19th, with reports of BFBS u.h.f. TV signals amongst many W. German ones reaching the midlands and the east and north east coasts.



Left: Veronica, a Dutch TV pirate active in Amsterdam. Centre: Clermont Ferrand ch. F6V received by Ryn Muntjewerff in Holland via tropospheric propagation in December 1982. Right: Vilnius USSR ch. R8, another tropospheric reception by Ryn Muntjewerff, this time in September 1982.

BFBS was noted as far west as New Radnor, at v.h.f./f.m. During this period Cyril Willis noted many Belgian, Dutch and W. German ATV stations in the 435MHz band, with powers down to a few watts (PE1DWQ Holland was in colour). There was yet another tropospheric lift on June 23/24th, with many u.h.f. signals and extensive loggings of Band I signals, including DR E3 and ARD E4.

It seems that the French are at present carrying out tests of the new system L standard during the daytime, using existing E channel carriers, converting at night to 819 lines.

My thanks to the following for supplementing my own log during one of the most active months for some years: Cyril Willis (Ely); Iain Menzies (Aberdeen); Reg Roper (Torpoint); Ian Johnson (Bromsgrove); Simon Harmer (New Radnor); Mark Baldwin (Rugby); Arthur Milliken (Wigan); Graeme Wilson (Middlesbrough); Hugh Cocks (E. Sussex); Tim Anderson (Stroud); James Burton-Stewart (Milton Keynes).

News Flash!

Finally a news flash. Hugh Cocks reports reception of system M signals on chs. A2, 3 and 4 via SpE on July 6th, with Spanish language sound. This is thought likely to be Puerto Rica, or possibly a central American country. Further details next month.

News Items

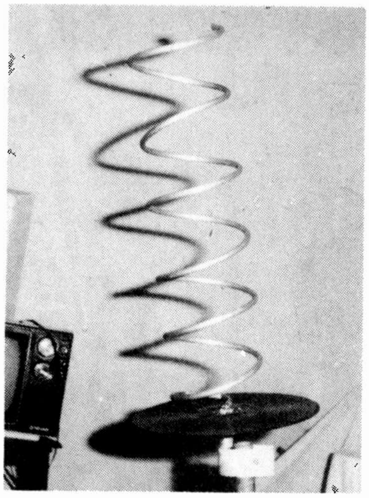
Luxembourg: RTL has been testing on ch. E7 at higher power, using system B, in preparation for the new German service due to start next January 2nd.
Denmark: Approval for a second TV network has been given, to start in 1985.
Norway: There's a proposal to use the Norwegian ECS capacity for a pay-TV service to be run by NRK from January 1985.
Holland: There's every intention to start a Pay-TV service via the ECS craft next year.
ECS: The ECS-1 satellite has been successfully launched. It carries twelve 20W transponders with outputs in the 11GHz band. There are three spot beams and a wide-angle Eurobeam with two TV programme capacity.
India: The Indian Apple satellite is now providing eight-hour daily TV linking. The Soviet Stat-3 craft is also being used: a translator takes uplink signals from Delhi for distribution to the remoter parts of the country.

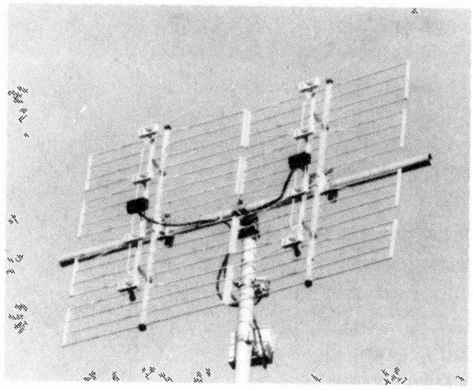
UK 4GHz DBS?

Reports have appeared suggesting that a consortium proposes to provide a satellite TV channel, featuring recently released films, early next year. The Home Office at present has official limitations on 4GHz TV reception. How the arrival of an American down-link craft will be viewed remains to be seen. A well known UK aerial manufacturer is developing 4GHz equipment for release by the end of the year. All very intriguing.

Amateur 50-52MHz Allocation

I can only assume that the idea of allocating 50-52MHz to amateur radio is for compatibility with the USA, where there's a 50-54MHz allocation. The US TV spectrum starts with ch. A2 (55·25MHz vision) however, unlike Europe where the TV allocations start with ch. E2 at 48·25MHz and ch. R1 at 49·75MHz – the new French





Left: Six-turn helical aerial used by Chandra de Silva in Sri Lanka. Centre: John Abbott's stacked Colour King/Super Prince aerials for Ekran reception. Right: Typical Ekran reception at 714MHz by John Abbott in South Africa.

channel B covers 49-56MHz. Having seen the patterning that a low-level 50MHz experimental amateur transmission can cause on a relatively strong (0·5mV) ch. R1 SpE signal, I must conclude that giving this band to the amateurs will present the European broadcasters with quite unnecessary problems during the summer months (see this month's log!). The segment 56-58MHz would provide less interference on a shared basis with the Europeans, though losing the possibility of transatlantic communication. I've written to the Home Office to make these points and have been promised a "substantive" reply. In the meantime, I'd be interested to hear the views of other readers on this subject.

ATV Activity

I've been carrying out modifications to the main u.h.f. aerial to receive 435MHz signals without an aerial dedicated to this band. These have proved very successful, with 1W signals being received over a severely obstructed path. Further details will be given next month.

From our Correspondents . . .

Lots of letters this month! Nanda Kumar (Madras) reports receiving Dubai ch. E2 using a newly developed aerial and amplifier system – it's proved to be a difficult signal in the past. Conditions at the end of June were apparently quiet, with the Ekran (Orbita III) satellite providing the usual programmes from 1145-2130 Indian time.

Jim Maden (S. Africa) reports that Zambia has shuffled transmitters around. Kitwe has moved to ch. E9 (from E4), the Kasama ch. E3 transmitter has moved to Mongu, Kabwe ch. E2 has been reduced to 75W e.r.p., while Bulawayo is now on ch. E6 as well as E3.

Anthony Mann (Baton Rouge, Louisiana) reports that the US SpE season wasn't too good up to June 15th. He received Mexico ch. A3 on May 23rd, NY State and the Great Lakes at up to 92MHz on May 26th, Cuba ch. A3 plus NY and the Great Lakes and Canadian f.m. transmitters as far as Northern Ontario on June 8th, and Dakota at up to 95MHz on June 15th. That's all there was to June 19th. There's been confirmation that the ch. A7 spurious emissions have been measured at 26·29 and 26·39MHz. Since they've been received in NZ/Australia, there's no reason why they shouldn't be received in Europe given suitable conditions.

Robin Crossley (St. Albans) experienced problems in attempting to use an ET021 tuner with his Thorn 1691 chassis and has now fitted a more conventional tuner with bipolar transistors instead. This has proved to be very successful, and the addition of a G8 selectivity module has sharpened the i.f. response. Further modifications include a tunable i.f. and the recent idea from Ian Moody for use with positive-going video modulation. Robin has heard that there are proposals for a PMR allocation in sub-bands within a future re-engineered Band III. We hear that the 47MHz cordless phone allocation will be moved out of Band I. PMR in Band I is less than attractive due to the longer whip aerials and the problems of SpE during the summer.

Ekran Statsionar-T

The Ekran satellite at 99°E (invisible from the UK) provides a u.h.f. downlink to the northern parts of the USSR with a very wide beam, 9MHz peak video deviation centred on 714MHz, and a 6·5MHz sound subcarrier. It's perhaps the most powerful satellite transmitter, using two 200W klystrons and 96 helical arrays – the equivalent in TV terms to the BBC's World Service! The footprint (shown in Steve Birkill's satellite book) covers almost a third of the world's surface.

Although aimed towards the north, it's evident that good reception can be obtained elsewhere, as two letters received this month confirm. Chandra de Silva (Sri Lanka) has constructed a six-turn helix and is using this system indoors with a Visi head amplifier feeding an unmodified Tatung portable TV set. This is giving him fair quality programmes (approximately P3½ on the ATV scale). The amplifier uses three BFR91 transistors to provide a u.h.f. gain of 36dB.

John Abbott (Vereeniging, S. Africa) is using two Wolsey Colour Kings which with a domestic type low-noise head amplifier gives him P4 quality pictures. The Colour Kings are locally manufactured by Carlton Engineering incidentally, and are known there as Super Princes! A photograph he's sent shows the remarkable results with a standard monochrome set realigned for the 6·5MHz intercarrier sound of system D – both sound and vision are received with good quality. The aerial system provides a gain of some 15·5dB. Elevation is at 10° above the horizon, and well "behind" the Ekran.

It's interesting that some years ago a report suggested that the Ekran on ch. 51 could just be seen at Lahti, Finland, with the characteristic f.m. video, during good tropospheric conditions.

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AC141K	39p	BF197	15p	R2008B	1.80
AF139	38p	BF199	15p	R2010B	1.10
AF239	41p	BF238	20p	R2030	70p
BC107B	15p	BF240	9p	R2265	1.30
BC108A	15p	BF255	10p	R2443	25p
BC109B	15p	BF256S	20p	RCA16446	30p
BC109C	15p	BF257	28p	RCA16599	1.25
BC117	21p	BF259	28p	RCA16600	1.40
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BC154	16p	BF435	41p	2SC346	8p
BC159	15p	BF450	43p	2SC1162	48p
BC171	9p	BF459	40p	2SC1167	1.00
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BC174B	23p	BFR87	25p	2SC3020	15p
BC182LB	12p	BFT42	30p	2SC388A	20p
BC184LC	12p	BFT43	30p	R2322	50p
BC208	9p	BFY51	34p	R2323	50p
BC237	12p	BFY52	34p	TIP31	35p
BC238	8p	BU105	1.00	TIP32	35p
BC251	8p	BU126	1.10	TIP110	80p
BC307	10p	BU207	1.05	T9010V	1.45
BC308	8p	BU208A	1.15	T9016V	1.20
BC347	8p	BU326A	1.30	T9017V	1.20
BC394	8p	C1172B	9p	T9050V	1.50
BC454	8p	C1129	9p	T9051V	1.00
BC455	8p	E9005	14p	T9052V	1.30
BC460-6	40p	E5386	14p	T9053V	1.30
BC546	8p	ME0404	8p	T9054V	98p
BC549	8p	ME0412	8p	T6059V	1.00
BC556	8p	ME6002	8p	S2800B	90p
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100 Mixed Ceramic Discs	1.00	50 Mixed Poly Capacitors	1.00
20 Mixed Valve Bases	1.00	30 Mixed Neons & Bulbs	1.00

AERIAL SOCKETS

AE. Socket & Lead. Pye, ITT, Thorn	25p
AE. Socket & Lead. GEC	25p
AE. Socket & Lead. (long) GEC	25p
AE. Socket & Lead. Pye 691/693	25p
AE. Socket & Lead. Philips KT3	25p
AE. Socket & Lead. Thorn col. portable	25p
AE. Socket & Lead. (long) Pye 725/731	25p
AE. Socket & Lead. ITT CVC32, etc	25p
UHF TV Aerial for portable	50p
Indoor Aerial Parabolic Type Reflector to Help Combat Ghosting Problems	2.50
Line Connectors	38p
Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Flush Mounting TV/FM Diplexer	1.00
Switched Flush Fitting Aerial Outlet	1.00

Thorn Mains TX 3000/3500	7.50
Thorn Mains TX 8000/8500	10.00
Thorn S.O.P.T 8000/8500	3.50
Thorn Scan TX 3000/3500	6.00
Thorn EHT TX 3000/3500	6.00
Thorn LOPT 9600	12.00
Thorn LOPT 1615	7.25
Thorn LOPT 1590/91	7.25
Thorn LOPT 1690/91	7.25
Thorn LOPT 8500	9.80
Thorn LOPT TX9	9.85
Thorn LOPT 9800	17.00
ITT LOPT CVC1–9	9.60
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 169	9.70
GEC LOPT 3133	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM–WM–21	6.75
Sanyo LOPT AM–WM–4	7.30
Philips LOPT G8	7.80

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 70V Thorn 3K	1.00
50MF 275V	50p		
100MF 150V	65p	1500MF 100V	1.05
100MF 250V	70p	2000MF 30V	50p
100MF 450V	75p	2200MF 40V Thorn 4K	95p
220MF 400V Thorn 9K	1.30	2500MF 35V	65p
220MF 450V Thorn 4K	1.30	2500MF 40V	65p
		3000MF 30V	65p
400MF 350V Thorn 8K	1.00	3300MF 16V	50p
		3300MF 25V	60p
800MF 250V Print type	80p	4700MF 16V	72p
800MF 250V	70p	4700MF 40V	75p

CAPACITORS

3.3PF	350V	3000PF	2KV
6.8PF	63V	3300PF	250V
8.2PF	350V	4700PF	400V
10PF	350V	.0047MF	500V
12PF	1000V	.0075MF	2KV
22PF	63V	.01MF	250V
30PF	63V	.01MF	600V
47PF	350V	.015MF	400V
182PF	63V	.02MF	200V
250PF	2000V	.02MF	250V
330PF	63V	.022MF	250V
330PF	160V	.047MF	400V
330PF	8KV	.1MF	250V
470PF	250V	.1MF	600V
560PF	63V	.22MF	400V
1000PF	250V	.33MF	250V
1500PF	250V	.39MF	250V
1800PF	160V	.47MF	250V
2700PF	63V		

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MULTISECTION CAPACITORS

100+150+150	350V	50p	16+16	450V	45p
220+47	350V	65p	200+100+100+50	350V	60p
200+150+50	350V	60p	200+200+100	350V	55p
200+200+100	325V	54p	200+200+75+25	350V	60p
32+32+16	275V	52p			
200+200+100+32	350V	70p	16+16	500V	45p
			50+50+8	300V	55p
100+50+150	350V	58p	100+50+100	350V	55p
400+400	200V	72p	16+16	350V	45p
32+32+16	350V	52p	100+150+50	350V	55p
200+32+300+100	350V	70p	2500+2500 (Thorn 8K)	63V	1.20
225+25	350V	50p	150+150+100	300V	1.80
200+200+100	350V	70p	200+47	250V	65p
200+100	325V	65p	500+500 175V Thorn TX9		1.00

ELECTROLYTICS

1MF	63V	20/£1	100MF	25V	10/£1
1.5MF	63V	20/£1	100MF	160V	10/£1
2MF	350V	10/£1	150MF	25V	20/£1
2.2MF	25V	20/£1	160MF	25V	20/£1
4MF	64V	20/£1	160MF	40V	10/£1
4MF	350V	10/£1	250MF	16V	10/£1
6.8MF	40V	20/£1	250MF	25V	10/£1
10MF	40V	20/£1	330MF	10V	20/£1
10MF	160V	10/£1	330MF	35V	10/£1
15MF	16V	20/£1	330MF	63V	10/£1
15MF	63V	20/£1	470MF	6.3V	20/£1
22MF	10V	20/£1	470MF	10V	10/£1
22MF	63V	20/£1	470MF	25V	10/£1
22MF	160V	10/£1	470MF	40V	10/£1
32MF	275V	10/£1	680MF	40V	10/£1
33MF	40V	20/£1	1000MF	10V	10/£1
33MF	50V	20/£1	1000MF	18V	10/£1
33MF	250V	10/£1	1500MF	16V	10/£1
33MF	350V	10/£1	1500MF	35V	10/£1
50MF	25V	20/£1	2200MF	25V	6/£1
100MF	18V	10/£1	2200MF	40V	6/£1

WIRE WOUNOS

2R 5W Thorn 3K	30p	36R 17W	23p	330R 7W	16p	4K7 7W Fus.	25p
2.2R 4W	16p	235R 9W Fus.	25p	370R 17W	23p	5K1 7W	16p
3.3R 9W	30p	220Ω 7W Fus. (Korting)	30p	1K2 10W Fus.	25p	8K2 7W	15p
10R 9W	18p			2K2 5W Fus.	25p	8K2 9W 8K Thorn	20p
10R 9W TX9	20p	270R 5W	15p	2K2 7W Fus.	25p	10K 7W	15p
15R 17W	23p	270R 7W	16p	2K7 9W Fus.	25p	10K 9W	16p
22R 9W Fus.	25p	280R 17W	23p	3K9 4.5W Fus.	25p	12K 9W TX9	20p
27R 7W Fus.	25p	330R 5W	15p			39K 4W	15p

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn TX9 main panel

Complete (no tuner) ex-factory 11.00

Thorn 3/3K5 ex equip panels untested

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75

Autovox Decoder FG/01 new boxed	5.00
Autovox IF & tuner panel A/01 new boxed	7.50
Thorn 4000 Convergence panel ex-factory	3.75

Thorn 4000 PSU panel ex-factory	2.50
Thorn 4000 FTB panel new boxed	4.75
Thorn 3K5 beam limiter board new	1.75
Thorn 3K5 PSU bottom board PC206 new	2.75
Thorn 3K5 IF panel new	3.00
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

INTEGRATED CIRCUITS

BRC/M/200	1.00	TBA395	1.00
BRC/M/300	1.00	TBA480Q	1.40
ML237B	2.00	TBA510	1.90
ML239B	2.86	TBA641	2.05
MC1327AP	1.25	TBA800	1.62
MC1358P	1.30	TBA950	1.95
MC1455P	18p	TBA1440	1.92
SAA1025	7.20	TCA270SA	1.05
SAA1124	4.50	TCA270C	1.05
SAA5010	6.00	TCA270CQ	1.05
SL432A	1.80	TDA1035T	3.50
SL1430	2.50	TDA1037	2.72
SAS590	2.60	TDA1170S	1.50
SN15846N	60p	TDA1200	2.42
SN74123N	65p	TDA1270	2.76
SN74154N	1.40	TDA2422	1.96
SN76013ND	1.80	TDA2540	3.50
SN76023N	1.80	TDA2591	1.96
SN76033N	2.00	TDA2571A	2.00
SN76115	2.00	TDA2640	2.90
SN76131N	1.58	TDA2690A	1.50
SN76226N	1.25	TDA3560	6.00
SN76227N	1.00	TDA9503	2.90
SN76544N	1.20	TCEP100	3.48
SN76660N	80p	TEA1009	1.95
SN76666N	75p	MC14426P	4.80
TA7117P	1.00	MC14429P	4.50
TA7109AP	2.80	MC14514	5.00
TAA611	1.40	UA758PC	2.50
TBA120CQ	70p	UA1008A	2.66
TBA120S	70p	UPC1365C	5.75
		SW153	2.50

DIODES

AA112	8p	IN4007	6p
AA119	8p	IN4742A	8p
AA143	8p	IN5254B	8p
BA115	8p	IN5349	14p
BA154	8p	IS025	8p
BB103	8p	IS131	8p
BR303	46p	IS1658	8p
BT106	1.50	MR854	35p
BT116	1.00	SKE1/02	20p
BY127	12p	MCR406	35p
BY204	26p	TIC106C	40p
BY298	22p	TIC45X	50p
BYX22/400	30p	2N4444	1.50
IN60	3p	Y827	80p
IN2070	8p	ZX150	12p
IN4001	4p	OA91	5p
IN4002	4p	MCR106/7	1.00
IN4003	4p	MCR106/8	1.50
IN4004	5p	TD3F800H	2.80
IN4005	5p	TD3F800R	3.00
IN4006	5p	BY255	30p

MAINS DROPPERS

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.00
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p

THERMAL CUT OUT

Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	5.00
Thorn 9000	5.00
Thorn 9600	6.00
Thorn 900/950	3.00
Thorn 1500 3 stick	3.40
GEC 2100	5.39
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35

FUSES

20mm		1¼"	
50MA	10 for 70p	250MA	10 for 65p
315MA A/S	10 for 50p	750MA	10 for 65p
500MA	10 for 50p	7A	10 for 50p
1A	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

AM–LS–200 Mono Scancoils Sanyo	1.00
M–LS 145 Mono Scancoils Sanyo	1.00
4–2761–44570 Scancoils Sanyo	1.00
Thorn 4000 Coil L401	40p
Thorn 4000 Coil L701/2/3	12p
Pye 713 Coil L831/832	65p
Philips G8 Coil L482 Late Type	65p
Philips G9 Luma Delay Line	90p
Pye 713 Luma Delay Line	90p
Convergence Yoke Assy AT1023/05	5.90

SWITCHES ETC

Rank A823 4 P/B Assy	5.80
ITT CVC8 On/Off Switch	65p
Thorn 3500 6 P/B Assy + Leads	1.75
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	65p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2·5A Push to make on/off switch	15p

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Teletopics

UK SATELLITE TV SERVICES

Growing concern is being expressed in BBC quarters over the financial aspects of the satellite TV service it's due to launch in 1986. Getting the satellite into operation is likely to involve capital costs approaching £250 million, and there is then the added cost of providing the programmes. It seems that subscription revenue and any extra licence fees could still leave the corporation saddled with considerable debt. The BBC is known to be keen to exploit the technology of satellite broadcasting, something the government has encouraged in view of the need to ensure that the UK's electronics industry is involved in this from the start, but may require rather firmer guarantees from the government on the future financial implications.

The News International Group (*The Times, Sun* etc.) has taken a controlling interest in Satellite TV Ltd. with a view to starting the first commercial satellite TV service to the UK. Satellite TV Ltd. at present provides programmes to cable TV operators in Scandinavia and Switzerland via the OTS-2 satellite, and has been allocated a channel on the European Space Agency satellite ECS-1. The initial aim is to increase the transmissions from two-three hours a night to seven hours daily by the end of the year. Cable distribution will be required in view of the low-power transponders on ECS-1, and SATV is engaged in talks with potential cable network operators. At present SATV's copyright agreements with UK and US programme suppliers cover only non-English speaking countries, but renegotiating such agreements should not present major problems.

ANTI NASTIES BILL

The problem of video nasties is being tackled by a bill which is to be introduced by Graham Bright, MP. Mr. Bright came first in the ballot for private members bills and his proposals have been warmly welcomed by the Home Secretary. The bill will be given government help in drafting and is expected to come into operation some time next year. Under the proposals, those dealing in horror video cassettes that have not been approved by a central censoring authority will face fines of up to £10,000 and possible imprisonment on summary conviction. Police will probably be given powers to search shops and seize unapproved cassettes. The penalties for distributors and importers could be even stiffer than those for dealers.

TELETEXT – A MILLION UP

Deliveries of teletext equipped TV sets in the UK have now passed the million mark. To acknowledge the achievement, a ceremony attended by the Prime Minister was held at the Guildhall, London. Eighteen teletext sets were presented to organisations for disabled people.

Deliveries of teletext sets rose from 20,000 in 1979 to half a million last year, and now represent a market penetration of five per cent of UK households. Most sets are going out under rental agreements – the ratio is at present 70 to 30 per cent rentals to sales. Since many rental organisations are now offering only teletext equipped sets in the larger screen sizes, it's felt that there is still much to be done to promote sales interest. There will be another National Teletext Month (the third) in October.

AND MORE LINES

The BBC is to carry out tests on a six-line teletext service to reduce the average waiting time for a page to between five-six seconds and enable the number of pages to be increased. The extra teletext lines would be 13 and 14. If the tests – to ensure that there will be no impairment to normal television pictures – are successful, the BBC will seek Home Office authority to start an extended service next spring.

SATELLITE TV EQUIPMENT

A 4GHz TVRO comprising 90cm dish aerial, down-converter and demodulator has been introduced by Magnetic Shields, Headcorn Road, Staplehurst, Kent TN12 0DS at a VAT-inclusive price of £1,000. The DR90 aerial is fully adjustable and can be wall, roof or ground mounted.

Premier Industries (Cheltenham) Ltd., 343-5 High Street, Cheltenham, Gloucestershire GL50 3HS is handling the Vorta range of satellite aerials and down-converters and is running training courses for dealers on the installation of this equipment.

STEREO TV SOUND

TV sets with stereo sound have been on the market for some time – a detailed account of the techniques used by Thorn appeared in our July issue last year. In addition to the basic stereo signal processing, such sets usually feature synthetic stereo and stereo wide. The former is a technique whereby a stereo effect is obtained with a monophonic signal by introducing a phase shift in one channel. The latter feature makes use of a controlled amount of phase-reversed signal cross-coupling between the channels to compensate for the close spacing of the speakers in a stereo TV set. Mullard have now introduced an i.c., type TDA3810, to provide all these features and simplify stereo TV set circuitry. For the synthetic stereo effect, frequencies between 300Hz and 2kHz in one channel are delayed by an amount depending on frequency, e.g. 500μsec at 800Hz. The low-pass filtering required has been kept off the chip to allow setmakers to use the circuit to their own specifications. Channel separation in the stereo mode is 60dB, the signal-to-noise ratio 70dB and the harmonic distortion less than −80dB.

Another stereo TV sound system has been suggested, this time by Grumman Aerospace in the USA. The basic idea is to transmit L + R in the existing sound channel and L − R in digital form as a sound-in-sync signal. The receiver would need circuitry to separate, decode and expand the L − R signal.

LATEST VCRs

A couple of replacement models have been introduced this month. First, the budget Ferguson machine, Model 3V29, has been replaced by the 3V35. The new model was originally intended as a same-price replacement but as a result of the EEC/Japanese agreement the price will be some £90 more at around £489. The specification has been improved however, with infra-red remote control as standard, front loading, a time elapsed indicator, frame advance, a picture sharpness control and an instant-record button.

Secondly the Grundig 2 × 4 Super has been superseded

next month in

TELEVISION

● **VIDEO TAPE POSITION INDICATOR/ COUNTER**
The types of tape counter commonly used in VCRs have certain disadvantages – whether mechanical or electronic. First they have to be zeroed, secondly they tend to be inaccurate. Alan Willcox has come up with a simple but very effective unit which can be used with any VCR using a tachometer sensor – for example all Grundig machines, the JVC/Ferguson HR7700/3V23, the Sony F1 and C9, Sharp VC7700 and generally any machine that incorporates some kind of tape remaining indicator.

The unit is built on a small PCB and incorporates its own LED display. It's inexpensive to build, simple to construct and connect, and is considerably more linear than the usual counters found in most VCRs.

● **SERVICING THE SONY KV1340UB**
This was one of the most popular of Sony's small-screen colour portables. As with so many Sony sets, there's some unusual circuitry – this time a switched capacitance system in the power supply. Our Sony expert David Botto reports on the set and the procedures to adopt to ensure reliable repairs.

● **SATELLITE TVRO SYSTEM**
Nick Harrold's satellite TV receiver system has been very successful, giving good results at 4GHz even with a 1·2 metre dish. A new series describes the system and provides circuit details for the indoor signal processing part of the installation.

● **RECORDING 405-LINE SIGNALS**
With the 405-line network being rapidly closed down, vintage TV enthusiasts will soon find they've no signals to feed to their sets. Unless that is they record some, which as Gareth Foster points out is perfectly feasible.

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by the 2 × 4 Slimline, a front-loading machine with a competitive suggested price of around £480 and new features such as simplified record operation, an enhanced go-to facility, clean editing and an eight-event timer.

Sanyo's latest machine is the front-loading Model VTC6500 which features infra-red remote control and a 14-day, eight-event timer at a suggested price of around £480. Sanyo intend to start production of VCRs in W. Germany during the course of 1984. Whilst Sanyo's Lowestoft machines will be to the Betamax format, it's understood that W. German production will consist of VHS machines. Production at the two plants will be at the same rate.

Akai's Model VS4EK uses the TV set as a monitor to display the timed programme instructions given to the machine in order to make setting up simple and foolproof. The programming can be done via the infra-red remote control system. Suggested price is around £550.

The Sony Betamovie VCR/camera combination is to be launched in the USA, aimed at the 8mm film user market. The machine uses a full-sized Betamax cassette and gives up to three hours, twenty minutes recording time though the battery has to be changed after an hour. The Betamovie weighs only 5½lb but does not have playback capability.

The JVC Video Centre in Piccadilly, London, is holding courses for those wishing to know more about video programme techniques and production. There are two course levels, basic and advanced – special courses to suit particular needs can also be arranged. The basic course lasts for three days and is designed for beginners; the advanced course is intended as a follow on and lasts for two days. The courses are being held twice monthly.

8mm VIDEO

Agreement has been reached between Japanese, US and European companies on the specification for the new 8mm video system. This was originally intended as a simple, low-cost system for use in combined camera/ recorder units, giving a restricted recording time on a small cassette. There is now speculation however that if development of the system is successful it could become a new basic VCR standard: with new heads and new tape formulations, the system could turn out to be the next big step in increased video recording information density. Longer playing versions would probably take some three years to develop.

IN-CAR ENTERTAINMENT

US drivers are certainly being pampered by the consumer electronics industry. An experimental compact disc player with four-speaker system has been shown by Mitsubishi, and now there's a dashboard stereo radio/cassette player/ quartz clock/monochrome TV set. What, drive 'n watch? Not so: the unit is designed so that the screen is blacked out, though TV sound continues, when the ignition switch is on. The unit can also be installed at the rear of the car to provide viewing whilst the car is moving.

THAT VIDEO AGREEMENT

The EEC/Japanese VCR import restriction agreement has come in for severe criticism from the EEC consumer interest group BEUC, which calls it a "dangerous precedent" that takes into account the interests of European industry but not that of consumers. It argues that the net result will be to give Japanese producers extra profit by aligning their prices with high-cost European factory prices, that if dumping was suspected it should have been proved or otherwise and sanctions applied as necessary, and asks the commission to consider the compatibility of the agreement with the Community's competition rules.

Thorn-EMI have increased the pressure on the EEC to get the J2T joint VCR production venture excluded from the kit quota part of the agreement. A Thorn-EMI spokesman has commented that the EEC has little or no understanding of the J2T operation, whose Newhaven and Berlin factories are being forced to work at an uneconomic level as a result of the agreement.

RECORD DELIVERIES

The first quarter of the year saw record trade deliveries of TV sets and VCRs. The increase in CTV deliveries compared to the first quarter last year was some 25 per cent, with imports up by over 50 per cent at some 313,000. VCR deliveries increased by a startling 75 per cent, though a rush to beat the EEC/Japanese restriction agreement is thought to be partly responsible for this. In both cases however the figures emphasize the fact that any substantial increase in demand cannot at present be met by domestic production. The view of many of those on the sales side of the industry is that demand for CTVs and VCRs has now reached some sort of plateau following the upswing in consumer spending late last year and early this year.

Here's an interesting aside from tube rebuilders TSR Vacuonics Ltd., whose managing director John Collins points out that of at least 138 different types of tubes used in the UK only some 32 could until recently be replaced by regunned tubes. TSR have invested over a quarter of a million pounds in machinery and training to tackle the problem. As John Collins says, one regunned tube bought means one less tube imported.

CABLE TIMETABLE

The cable TV bill is expected to be on the statute books early next year. Meanwhile the twelve pilot cable TV networks sanctioned by the government should receive their licences by November. Each network will serve some 100,000 households, the aim of the interim licence being to encourage the development of the technology during the period before the full legislation comes into force. Well, that's what they say: it's more likely to encourage the use of whatever happens to be to hand, since a delay of a couple of months will make hardly any difference at all.

VCR Clinic

Fault reports from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling, Mick Dutton, Mike Sarre, Peter H. Dolman and Les Harris

Toshiba V8600

The problem with a Toshiba V8600 was that it was stuck on channel 1. After considering the relevant circuit we decided to check transistor QA03, which selects channel 1 when the power is applied at switch on. It was found to be leaky from collector to emitter. **S.B.**

Hitachi VT8000 Series

Two Hitachi machines came along with sound faults. On the first the fault was in playback. The note attached to the second machine gave no further details. Testing the first machine revealed whistling and hissing with the odd buzz or two thrown in just to confuse the issue. The audio output waveform was covered with instability of an h.f. kind, but after a few moments it settled down to normal. Perhaps the second machine had the same fault? Not very likely. Wrong again! Time to have a word with Hitachi to find whether there's an easy way out.

The nice man at the other end of the phone chatted about a fault with some VT8000/VT8300 machines, along with some VT8700s, that have an audio head problem. But not on the VT8500 which has a modified head. So I asked what was the problem and the modification? The problem audio/control heads have metal spacing between the upper audio and the lower control track sections: as this metal wears, vibrations are set up when the tape passes over the head. Rather like the finger round a wine glass rim trick, sympathetic resonance, I suppose. Modified heads have a glass based spacing section. Of course the only two VT8500s in the world with metal spacing were the two I'd got.

The nice man also mentioned a relay problem. RL401 connects one side of the audio head to chassis during replay, the signal to the preamplifier being taken from the other end of the winding. On record the output from the record amplifier is fed to the other end of the winding. If one end of the winding is not properly earthed during replay, the result is oscillation. Change RL401 or in dire emergency remove the cover and clean the contacts. **S.B.**

Panasonic NV333

Two Panasonic NV333s had the same complaint but different faults. In both cases the complaint was squeaking, very similar to that experienced with certain Hitachi machines fitted with a particular type of audio/control head. In one case this was in fact the cause – the symptom could be made to come and go by touching the head with a screwdriver. In the other case touching the head had no effect and the only way in which the squeaking could be affected was to move the pinch wheel. This didn't really help as it stopped the tape moving! After eliminating the take-up spool and ordering and fitting a new pinch wheel, we eventually traced the fault to a nylon roller on one of the loading arms – a squirt of Servisol cured it. We took care to remove any trace of Servisol from the surface of the loading arm before trying a tape of course. **D.S.**

Sanyo VTC9300P

We had an unusual fault with a Sanyo VTC9300P – it would work all right until rewind was selected, whereupon the stop solenoid would operate and stay on until the machine was switched off and then back on again. Attention was directed to the end sensor circuit, where we found that the rewind oscillator was not working – the operation of the forward oscillator was also incorrect. Replacing the CX141 control chip made no difference, and as there is very little else in the circuit the fault was soon traced to the rewind end sensor PCB. This is a flexible board and one of the tracks was open-circuit. **D.S.**

Panasonic NV333

No reverse search was the problem with a Panasonic NV333: playback, forward search and pause were fine, but in reverse search the picture broke up with the top half of the picture disappearing in noise. I've had this problem twice before on Hitachi VT8000 series machines, and in both cases slight adjustment of the leading loading arm was required. This is done with the machine in visual search, then checking playback and pause to ensure that too much adjustment has not been made (about an eighth of a turn is all that's necessary). Unfortunately adjustment made no difference with this Panasonic machine and the video heads had to be replaced. Checking them with the Panasonic head tester showed that one of the heads was badly worn. **D.S.**

Ferguson 3V00/3V22

A problem that's becoming common with Ferguson 3V00s and 3V22s as they get older is failure to erase the sound and vision. So far this has always in our experience been caused by the smaller record/playback switch on the audio-servo board – cleaning with Servisol usually clears the problem. On two or three occasions recently however we've had to replace the switch to achieve a lasting cure. **D.S.**

Hitachi VT9500

There appeared to be an alignment fault with an Hitachi VT9500 – the problem was that the picture jumped on its own recordings, rather as if the head switching points were off, while the tracking control had to be at one end with recordings made on other machines. This suggested misalignment of the audio/control head, but as the machine was only three months old and had not been previously touched we were loath to alter the alignment without checking a bit further.

A check on the head switching points with the alignment tape showed that they were correct, but when a check was made on one of the machine's own recordings one head switching point was found to be lost in noise. More in hope than anything else (and because it was easier than thinking), I tried a new video head. This provided a complete cure: the tracking was now in the centre on the alignment tape and the jumping had disappeared. The old head showed no signs of wear or damage, was perfectly clean and tested o.k. on the head tester. I can only assume that the alignment of one of the heads had altered slightly.

Whilst on the subject of Hitachi machines, readers might like to know that the VT9500 has a small switch inside, located next to the display, for switching from 12 to 24 hour operation of the clock/timer. **D.S.**

Ferguson 3V29

The complaint with a Ferguson 3V29 was that it wouldn't rewind automatically at the end of a tape, and when rewound it left a tape loop. This was because the tape end sensors weren't working, so that the machine didn't know it had reached the end of the tape and should rewind, whilst on rewind it didn't know when the other end had been reached and didn't apply the brakes, the result being that the tape "bounced", leaving a loop.

The cause of the problem was simple but unusual. In this machine the cassette bulb is a push fit into a plastic holder, and is sealed in place by a small blob of rubbery compound. We found that the wires to the bulb had been pulled tight during assembly. The compound had subsequently stretched and the bulb had slipped down in the holder until it finally no longer lined up with the holes in the cassette and the end sensors failed to operate. This fault could have taken some time to trace if a colleague hadn't had the same trouble a few weeks previously, when he'd changed a bulb and failed to push it fully home in the holder (a point to note perhaps). **D.S.**

NEC 740E

We've had two of these machines in for repair recently. The first suffered from an intermittent clock display. This turned out to be the filament in the fluorescent display device going open-circuit from time to time. The second machine produced very grainy pictures in the E-to-E mode and on its own recordings: the problem here was the r.f. booster unit. **M.D.**

Sanyo VTC9300P

The problem with a Sanyo VTC9300 was that the tape would intermittently stop during play or record. When the fault eventually showed up for us, we noted that the pause solenoid was deactivated, causing the pause mode to apply although the button hadn't been pressed. As the reel motion stopped after three seconds, auto-stop was actuated. The supply to the pause solenoid was found to be low at 0.5V, and on checking back to the 12V line we found that D814 was high-resistance. Replacing this diode cured the fault — an easy one for a change! **M.S.**

Hitachi VT11E

Sometimes the most involved problems turn out to be due to practical down-to-earth causes... The fault we had with an Hitachi VT11E was no deck functions (clock display normal). The tape was laced up, but there was no sign of any mechanism activity. Checks on the various power supply lines revealed that the stabilised 16V line was missing. This is derived from a Darlington transistor, Q101 (see Fig. 1), the circuit incorporating an inhibit transistor, Q104, which is in turn controlled by the main microcomputer i.c. on the system control panel.

A check back to the microcomputer revealed that the clock pulse output was not present at pin 42. Since these pulses are vital to the i.c.'s operation, nothing was happen-

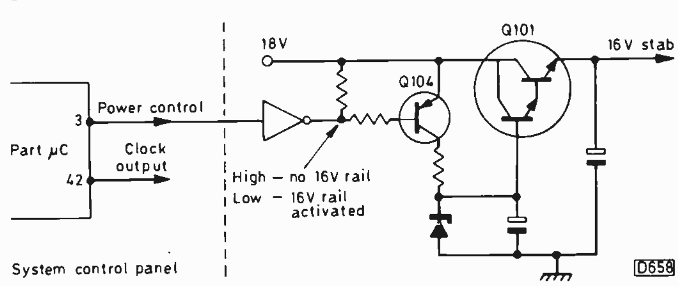


Fig. 1: 16V regulator circuit, Hitachi Model VT11E.

ing. Was the chip faulty, or could that spot of what looked like rust on a nearby component lead be a clue?! On swinging the board open we found that the print side appeared to be suffering from a nasty attack of "wet rot" in an area that included pin 42 of the microcomputer. It turned out that part of the contents of a flower vase had been spilt over the machine whilst it was in operation. Cleaning the contaminated area with copious amounts of RS solvent cleaner and replacing a few "rusting" resistors restored normal operation. **P.H.D.**

Conversion for UK Use

A customer brought us a Metz 9918 he'd bought in W. Germany and enquired about converting it for use in the UK. It's similar to the Philips VR2021, and the main problem seemed to be the 5·5MHz intercarrier sound. Philips were consulted but suggested it would be uneconomical.

We decided to have a go without Philips's help. First we removed the r.f. modulator and hooked up one of the type used in the Hitachi VT9300. The machine would now replay prerecorded tapes. We found that it was impossible to retune the intercarrier circuit with the i.f. panel in situ, so we removed it and wired it under the main panel, then tuned the two cores for best sound.

Changing the mains transformer connections from 220 to 240V and soldering the r.f. modulator on to the rear of the aerial amplifier completed the conversion. Test recordings were made and good results obtained. **L.H.**

GEC V4001

A GEC V4001 was o.k. when playing back a prerecorded tape, but when a recording was made the capstan speed drifted. A check was made to see whether the control signal was reaching the head, but this was o.k. The capstan FG signal was next checked at pin 6 of IC504, where it's amplified before emerging at pin 8. It then passes to the base of Q522 via R542 and C529. The FG signal disappeared at the base of Q522, due to C529 being open-circuit — it had a hole in its side! **L.H.**

Vintage TV: Fernsehsender Paris

Alexander Wiese

Just forty years ago a unique TV station went on air – in mid-1943, when the Germans established in occupied Paris the only TV station to operate in Europe during the war. Broadcasting continued until August 1944.

The former chief of staff of the Fernsehsender Paris (Paris TV station), Kurt Hinzmann, today lives in a small town in southern Germany. It was he who had the energy to get a German TV station going in a foreign country under wartime conditions. It all began when the Germans unexpectedly found a TV transmitter in the Eiffel tower. The French had been intending to start a service and had installed a 30kW transmitter there.

The occupying authorities decided to dismantle the transmitter. Some German civilians thought it rather pointless to dismantle a transmitter that had been properly installed however, and instead persuaded the military to allow the station to go ahead. They succeeded by arguing that the h.f. signals would disturb the equipment in enemy planes!

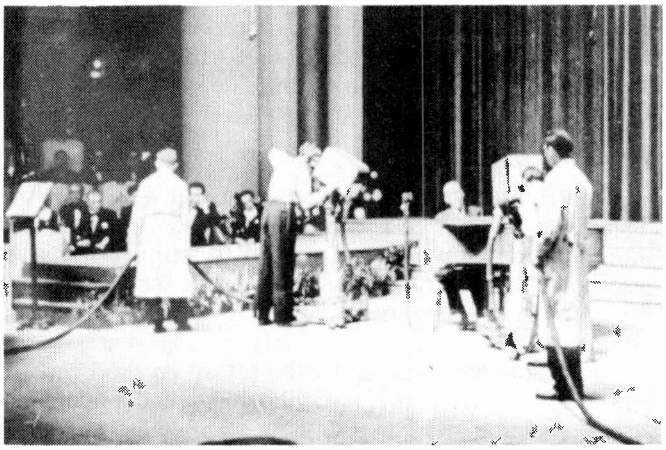
Kurt Hinzmann had been working on television in Berlin. He was sent to Paris to get the new station into operation and had high hopes – he expected the Paris station to be the first in a network that would cover all Europe in the post-war period. The Italians had already adopted the German 441-line system, with negative vision modulation, and the first step was to convert the Paris transmitter from the French 180-line system to the German system. The sound-vision spacing was to be 2·8MHz, with a.m. sound.

Only the transmitter was available initially, but after some asking around Kurt Hinzmann got the German post office to send cameras and the other equipment required for the station. It was all available in Germany, since a TV service covering the whole country had been planned before the war. In conjunction with the French authorities an old, unused theatre was found and was soon converted into a TV studio. Some months later the station went on air with regular programmes.

Some of the programmes were in sound only, full TV being transmitted only during the peak hours. The service was intended to serve wounded and recuperating German troops in the Paris hospitals to start with, but some programmes were subsequently transmitted with French language sound for the "host" population. The material consisted of German films and live performances from the studio. The latter mainly consisted of musical shows with German actors, plus a few French plays (in French) adapted for television.

The service operated outside the control of the Nazi regime and played little part in propaganda exercises. The French industry produced some TV sets which were sold in the Paris area. The service was monitored in the UK and provided some useful information on conditions in Paris.

In August 1944 the Americans reached Paris and Fernsehsender Paris transmitted its final programme. A unique service had come to an end. Issue No. 14 of *TELE-audiovision* contains a complete history of the station, written in German and with several contemporary photos. It can be obtained from the author by application to Postfach 801965, D-8000 Munich 80, W. Germany.



Broadcasting from the Fernsehsender studio, Paris.

The Passing Over of Tiny Tim

Les Lawry-Johns

Tim lay awake in his little bed, wide awake, while his wife Tinker Bell slept soundly beside him. He couldn't sleep and had no idea what time it was. Then he did. The first blackbird started up the dawn chorus and chirped away, calling all the others to wake up and stop Tim from sleeping. It wasn't even dawn.

"That blackbird's got his clock wrong again" thought Tim angrily. He now knew what time it was. It was 3.40 a.m. What a time to start singing and soon to start work. Those birds must be daft. It always seems to be the same in June. Birds awake half way through the night.

Tinker Bell stirred, murmured sleepily, and promptly dropped back to sleep. Tim couldn't sleep though. It was June and the television had said last night that Clive Sinclair had been awarded a knighthood in the Queen's Birthday Honours list. What would Tim get? An OBE at least. Perhaps a peerage. You never know what the Queen might decide. After all, Tim had been a good boy for a long time, a very long time. Tim drifted into a troubled sleep, thinking about the times he'd been bad, very bad.

He woke to find his wife standing by the bed with his breakfast and the morning paper. Tim grabbed this eagerly. Pausing only to shovel some scrambled egg and toast into his mouth, he scanned the columns of names of those who were to receive honours. Lots of familiar names, some perhaps who deserved honours, but nowhere did he find mention of Tiny Tim.

Overlooked

At last he had to admit that he'd been overlooked for another half year. What could the Queen have been thinking about to overlook him yet again? As her father had thirty years earlier.

Tim sulked. He'd waged a thirty year war single-handed against inflation and this was his reward. Thirty years ago he had charged three pounds to repair the average telly. Then it was half the peasant's weekly wage. Now what did he get? He still charged them much the same, perhaps a little more here and there, but not a lot more. What if he charged them half their weekly wage now? He wouldn't get any work, that was for sure.

He lay in his bed fretting, while the rest of the working world went about its business. He heard the shop door open, and the sounds of a TV set being brought in. He panicked out of bed, pulled on his clothes, combed his little locks and strolled downstairs, trying to look as though he'd been about for hours.

Mr. Pedalcar's Bush

Mr. Pedalcar stood there patting his Bush T20. Before Tim could bid him good morning, Mr. Pedalcar launched into a tirade. "You put what you called a tripler in this set last month and ever since we've had white streaks coming from anything that's at all light. I'm going to take you before the race relations board. Ha, ha, ha."

Tim smiled weakly and put the set up on the bench. It was as Mr. Pedalcar said. Everything light had a thin white streak shooting over to the right. Something stirred in Tim's little mind, but it wouldn't come through.

"Only since you put that thing in" Mr. Pedalcar repeated.

So Tiny Tim fitted another tripler just to show him that it didn't make any difference. He then checked the 330Ω resistor connected to the tripler to ensure that it was the right value. It was.

"Call back later, Sir. I'll get at it as soon as I've taken the dog for a walk and had a think."

Left alone Tim thought awfully hard, but nothing happened. He tried this, that and the other, but the streaks remained. He then called his friend Geoff, who knows all about T20s and other funny things. "Buggered if I know" said Geoff helpfully. "Whenever I get trouble on a T20 signals board it always turns out to be a chip."

Tim was ever so grateful, and something stirred again in his wonky memory. He stared at the signals board and especially at the TCA800 demodulator/matrixing chip. He removed the suspect and found a replacement lurking in the i.c. cabinet. This was fitted in a trice, and Tim switched on confidently. "If the Queen could see me now" he thought.

On came the picture, completely free of nasty streaks as Tim knew (hoped) it would be. Then he remembered. He'd read in *Television* (Tim reads most of the articles in *Television,* apart from those that are too complicated for him) just this fault described, along with the advice to change several items including the chip. Funny how he can never remember before the agony, only afterwards. Tim swore an oath to read it more carefully in future, if he could.

Another Bush

The next one wasn't a confusing T20, merely an older A823. As everyone knows, these are no trouble at all to anyone with a grain of common sense. The owner described the symptoms and asked for an immediate diagnosis, which he got. Apparently at odd times the width would decrease, with curved edges and a bright kink (undulating) down the centre.

"It's going into overdrive" explained Tim. "With a possible loss of smoothing."

"Ah" said the owner, impressed with this display of expertise.

"Call back later" said Tim. "It'll be ready by five o'clock."

Left alone Tim fretted and sulked a bit, because he'd no idea what could cause the trouble so intermittently. He switched on and watched the picture appear with a foldover down the centre, just as he'd been told. Then the picture corrected itself and remained good until Tim changed channels. The fault then returned for a few seconds.

He clipped smoothers across smoothers, then decouplers across decouplers. Still the same. He remembered his first diagnosis (going into overdrive) and his eyes narrowed. If the damping components across the primary winding of the line driver transformer were to become open-circuit intermittently, the drive to the line output transistors would be distorted. This was it. The resistor seemed o.k. on test, but Tim noticed that the capacitor in series with it leaned against the resistor, which normally runs hot. Ah, ha. He replaced the capacitor with a flourish and beamed at his expertise. There was no change. He crept into the corner and cried. Tinker Bell found him there and gave him a cuddle.

Feeling better, he had another try. What rules had he forgotten to follow? Ah yes, the colour prejudice rule. If capacitors are red or green and big, suspect them. If they are smaller and black, replace them. Tim looked and found a small, black 10μF electrolytic that decouples the emitter of the line oscillator transistor 5VT6. He whipped it out and checked it. As it didn't seem to feel well he fitted a replacement which was also black. He applies the rule only when it's convenient you see. The picture stayed steady for an hour. So the job was deemed done and the set was collected and carried away.

It was carted back the next morning. Lacking moral courage, Tim changed the complete panel. This cured the problem and he resolved to have another go at the faulty one another time when he felt better. So far he's felt groggy every day, so he still doesn't know what caused it to go into overdrive.

Ups and Downs

Tim had been reading his *Reader's Digest*. He'd come across a snippet reprinted from the *Daily Telegraph* — sent in by a Mr. J. W. Reid. It made Tim think, which is something he's not used to doing. So he thought he'd have a go at Tinker Bell.

"After you've washed down the breakfast things, you can go out and wash up the car." T.B. gazed at Tim for a long time.

"You've got that wrong dear. After you've washed up the breakfast things, you can go out and wash down the car."

Tim sulked a bit after this, then had another go.

"The cat hasn't eaten down her food." Tinker Bell joined in the confusion. "I think you're getting a little mixed down love." Tim saw that it was game down and gave . . . "And don't forget to fill down the form that came yesterday."

The World's End

If you take your dog for a walk to the top of Windmill Hill and look across the river to Tilbury, you can see The World's End just to the right. Tiny Tim was talking to his dog. "In that pub over there, there's a dog even more queer looking than you."

Ben wagged his tail and Tim continued. "It's a cross between a Jack Russell and a Labrador. Since his father was the Jack Russell, the queerness doesn't stop at the dog's appearance. How could a little . . . ? Ben wagged on. He clearly knew the answer but wasn't saying anything. Tim rebuked his dog sternly.

"How can you look so knowing? When we tried to mate you with a very pretty Collie at the very height of her hotness, all you did was run around cocking your leg up everywhere until a dirty old mongrel jumped over the fence. We got a right old rollicking from the owner when the puppies were born."

Ben lowered his head and walked home on his own. Tim followed, saying how sorry he was, afraid that Ben would tell Tinker Bell who would no doubt put her hands on her hips and comment "he's a fine one to talk . . ."

4GHz Low Noise Amplifier

Hugh Cocks

Since my article describing a 4GHz converter with image-frequency rejection (May issue), there have been a number of requests for details of a relatively low-cost, low-noise amplifier for use with it. Commercial LNAs from the USA still cost upwards of £230 to import into the UK.

The amplifier described in the present article is based on the NEC/California Eastern Labs two-stage design which has been very popular with manufacturers and home constructors in the USA. The previously described converter calls for a minimum of three stages of amplification however, preferably four stages, to achieve a low system noise temperature. The cost of gallium arsenide field-effect transistors has fallen dramatically during the past two years. As a result, this four-stage LNA requires about £70 worth of parts. Add to this a few hours' work and you get a gain of around 43dB with a noise figure of below 2dB.

Circuit

The circuit is shown in Fig. 1. The input matching circuit in the first stage consists of a quarter-wave transformer with a series inductor. This matches the input impedance to the optimum source impedance, which is 50Ω. The transformer is of 33Ω stripline to transform the 50Ω source to 21Ω, the f.e.t.'s gate lead being used to series resonate its input impedance.

The interstage matching filter is less complex because the optimum source impedance and the load reflection coefficients are similar. A quarter-wave transmission line of 50Ω impedance is used to match the output impedance of the first stage to the input of the second stage. The second stage's output impedance is series resonated using the f.e.t.'s output (drain) lead as the inductor. This is followed by a quarter-wave 40Ω stripline which transforms the output resonated load impedance of 30Ω to 50Ω. Open-circuited 50Ω stripline stubs are also present – two in the input circuit and one between each stage – to compensate for the source lead inductance of the f.e.t.s and chip capacitor parasitics. The third and fourth stages are identical to the second. The circuit board material must be similar to that of the 4GHz converter – Teflon with a dielectric constant of 2·5. It's unlikely that any other type of PCB material will give good results. 10pF interstage coupling chip capacitors are used, and the gate bias and drain supply inputs are brought on to pads (see Fig. 2) that connect to the stripline via small etched chokes. Each pad is decoupled to an outer pad, which is soldered to the case, by an 0·001μF chip capacitor.

Power Supply

Now to the supply and biasing arrangements. Gallium arsenide f.e.t.s are similar to valves in that the gate must be negative with respect to the source, otherwise excessive current will flow. Unfortunately we can't use source bias resistors as our hard-won gain would be reduced (to say nothing of the noise added).

With both the Mitsubishi MGF and the NEC NE series of gallium arsenide f.e.t.s the optimum noise figure is obtained with about 3V at the drain and a current of 10mA. Maximum gain (about another 5dB) occurs with a current of 20-30mA however. So the first two stages, where low noise is vital, are biased for minimum noise whilst the last two stages, which contribute most of the gain, are biased at the higher current level.

The power supply circuit is shown in Fig. 3. The positive side is simple, consisting of a 5V regulator with a 5·6V zener diode at the output to provide cheap insurance should the regulator go short-circuit. The drains of the first two f.e.t.s are fed via 200Ω resistors which drop 2V at 10mA, giving the required voltage and current. The final two stages are fed via 100Ω or 82Ω resistors for higher gain (the f.e.t.s will take 100mA safely).

The negative supply is a high impedance one to provide the required gate bias. The supply is derived from an NE555 timer i.c. which runs at about 20-30kHz. Its output, taken from pin 3, is fed to a voltage doubling rectifier (D2/3) whose output is smoothed by the electrolytics and regulated by zener diode D4. A 3·3V zener diode is quite sufficient as the negative bias required will not exceed 1·5V. The output then goes to four 100kΩ presets which set the bias applied to each gate. In each case a 10kΩ resistor is used to link the voltage to the feedthrough capacitor in the LNA's case.

It's advisable to use a decoupling resistor of about 22Ω (1W minimum) to feed the power unit from the 12V source. If this isn't done, the oscillator in the converter circuit can pick up signals from the NE555, producing an effect like radar interference on the picture.

The power unit has been in use for several months and no problems have been encountered with mains transients killing the f.e.t.s. If your local supply is dirty however it might be advisable to run the LNA from a 12V battery. The unit has been tested with repeated on-off switching of electric drills and on one occasion the mains transformer arced to the case, blowing the winding open-circuit and also the supply fuse, though the f.e.t.s survived happily. In the unlikely event of the negative supply failing, the devices will survive as a result of the current limiting action of the drain resistors.

Mechanical Construction

The LNA board should be mounted in the middle of a tinplate box (see Fig. 4) open at the top and bottom. If the LNA is used in conjunction with the previously described converter (see Fig. 5) the tinplate may carry on to surround both of them. Ensure that a small strip of tin links the ground plane side of both boards. The input may be connected to a feedhorn via an SMA connector or to a helical pick-up (see later).

Solder the ground plane side of the board and the decoupling capacitor pads on the top of the board to the case. If excessive heat is used the whole assembly may warp. It's a good idea to arrange for everything to be kept rigid whilst doing this.

Feedthrough capacitors bring the d.c. through the wall

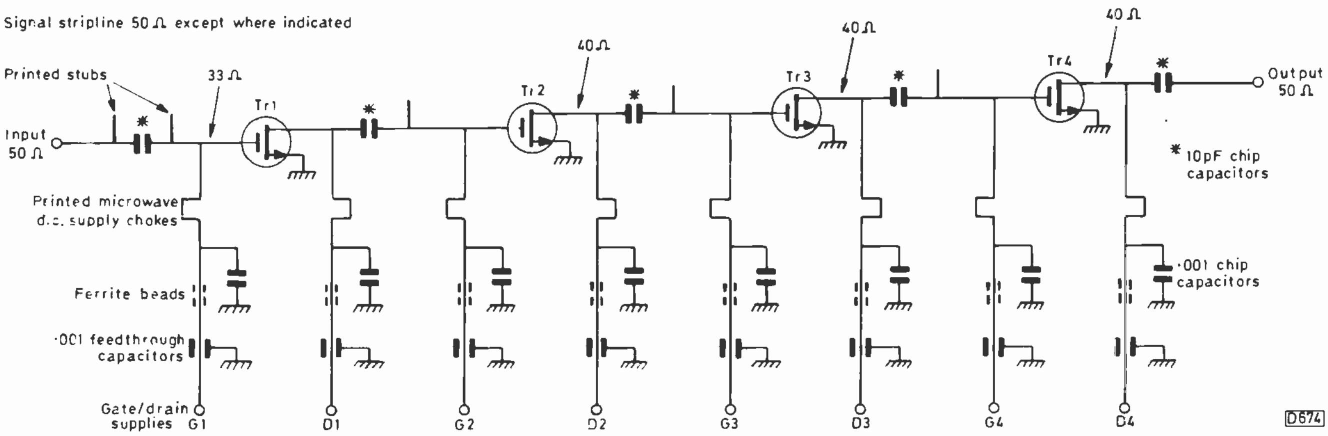
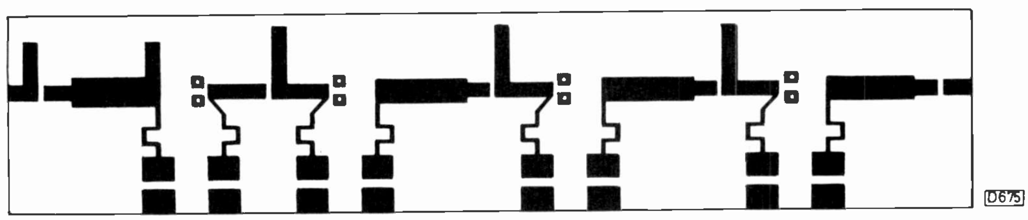


Fig. 1 (above): Circuit of the 4GHz low noise amplifier.
Fig. 2 (right): Amplifier PCB. Note different track widths.



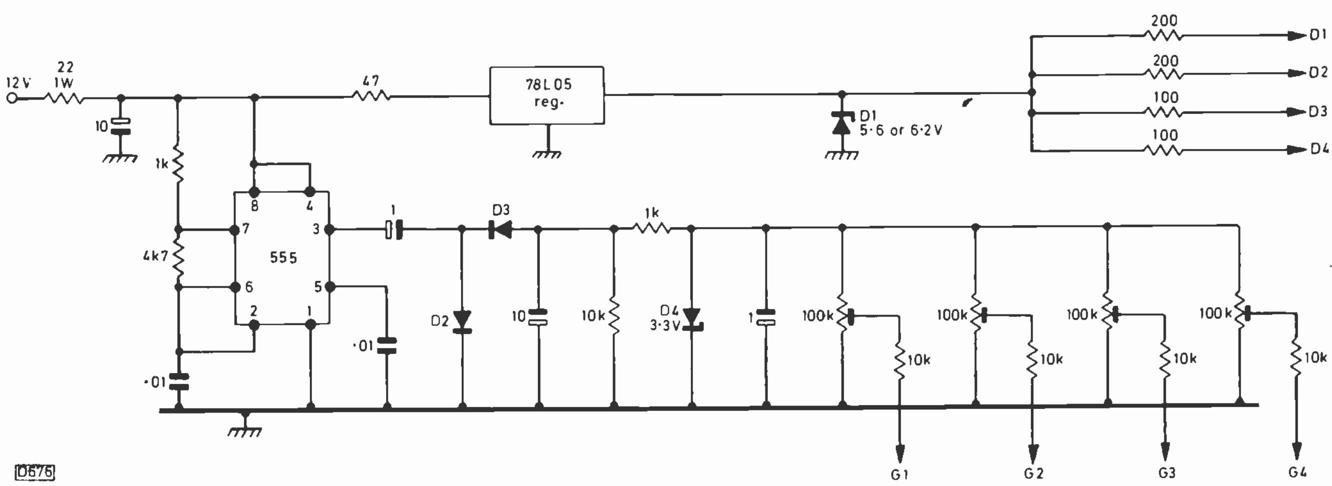


Fig. 3: Power supply for the low noise amplifier.

of the box and are linked to the pads via thin pieces of wire with a ferrite bead sleeved over each to reduce the likelihood of any stray microwave signal leaving via this route. At this stage it's a good idea to link the feedthrough capacitors on the outside of the case whilst awaiting the arrival of the f.e.t.s. The LNA power board has been designed to run along the outside of the LNA in the "well" formed by the converter board and the front reflector of the helix feed (if used). It can be spot soldered to the tinplate walls. The feed resistors are connected between the board and the feedthrough capacitors.

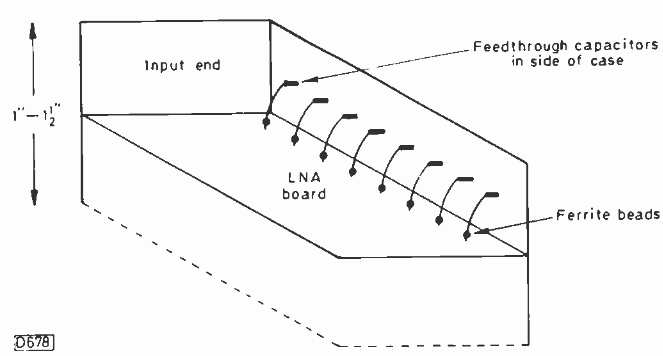


Fig. 4: Amplifier board in its case – "cut-away" view.

Electrical Construction

Once the mechancial construction of the LNA is complete, the electrical construction can be started by soldering in the chip capacitors. These require a delicate soldering technique! If possible clean the ends in a weak solution of ferric chloride, and attempt to tin them. Hold the capacitor on the board with a small screwdriver blade and lightly solder one end. Solder the other end properly, finally returning to the first joint to tidy it up. If excessive heat is applied the capacitor can crack. Mechanical stress can have the same effect. This is especially the case with the input chip. The signal may decrease by only a small

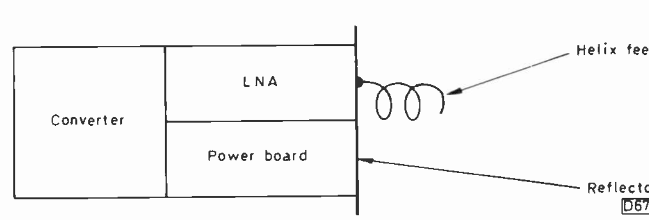


Fig. 5: Board layout of the complete down-converter.

amount when this happens, and one can spend a lot of time attempting to find the cause of the trouble as the crack is often invisible without a magnifying glass. The

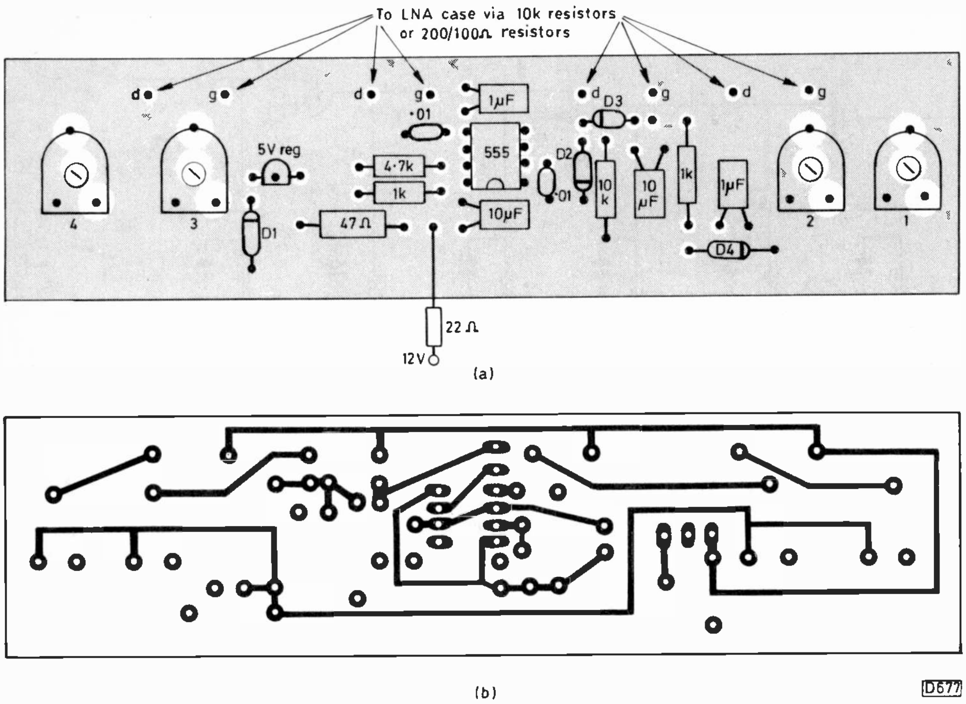


Fig. 6: Power supply PCB track pattern and component locations.

feedthrough capacitors are best mounted at this stage, prior to installing the f.e.t.s.

A few precautions are required when handling/soldering gallium arsenide f.e.t.s. Earth the iron bit to the LNA case, then earth the entire system to a known good earthed source. It's not really necessary to earth yourself, provided a nylon carpet or a very dry atmosphere is not involved. If the air is very dry, it's advisable to increase the humidity by boiling a kettle in the room.

When the device is removed from its envelope you'll find that there are two thick source leads. These are taken through the board and soldered on the ground plane side. On the NEC devices the lead with the dot adjacent is the drain: with the Mitsubishi devices the lead with the diagonal cut is the gate. Solder the source leads first, then trim the other two leads to link on to the board. Solder these two with as little solder as possible. Repeat this with the other three f.e.t.s and the LNA is complete.

Alignment and Testing

It's advisable to power each individual stage on its own initially to check that all's well. The drain voltage should be measured only with an accurate meter. Don't connect the meter to the gate feedthrough capacitor, though the device isn't likely to die if you do. Make sure that the drain voltage varies smoothly when the negative bias is varied. The sign of a dead device is about 0·5V all the time on the drain feedthrough capacitor with no negative bias on the gate feedthrough capacitor (yes, I have blown one!).

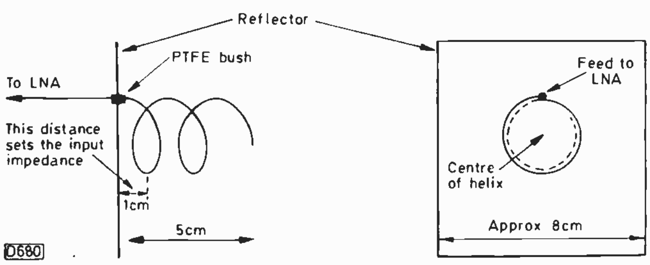


Fig. 7: Simple helical feed system.

When all the stages are powered a lot of extra 4GHz noise should be seen on the screen. An instability effect may be noted, not unlike intermittent carriers when tuning through the band. This can usually be cured by fitting a snug lid over the final two stages of the LNA, where the level of r.f. is at its highest. There should be a good cover on the microstrip side of the converter: this may need to be extended to cover the final stages of the LNA. A front cover may be fitted to the first two stages, but these may initially need tuning up (see below). Stubborn instability can usually be eradicated by placing a ferrite bead or two on the three-sided rectangular bias choke in the first or second stage.

If the LNA/converter is now connected to the horn and a suitable dish, signals should be seen. With a 1·8m/6ft dish Gorizont ch. 1 (3·675GHz) will be very strong. The weak transponder signals are ideal for tuning the LNA. Whilst watching the picture, turn the first stage's bias potentiometer. A peak in the signal should be clearly seen. Repeat with the second stage. The setting for the final two stages won't be too critical, especially the last one.

To fine tune the unit, place a small patch of copper (2-3mm square) on the end of a plastic rod. Slowly move this around the edges of the stripline in the first two stages, taking care not to short anything out. Note the effect on the signals. If they increase at a certain point, a small amount of copper needs to be added (paint it on). If they fall, a small piece needs to be removed. Make sure that all signals behave similarly, i.e. don't just peak the response on one channel. I've found that the most common thing is that the end 2mm of the first stage stubs needs to be removed. This can be done with a sharp knife, so that the dead section can be linked back with solder if required.

Having done this, you should have an LNA that provides a gain of about 42-44dB with a noise figure of around 1·1dB at best (possibly a little below) to 1·9dB at worst. Various grades of gallium arsenide f.e.t.s are available. Finances permitting, a low-noise type should be used in the first stage. This will dictate the overall performance, making a noticeable difference on weak signals.

My thanks to Dave Lewis for all his help with this project.

Simple Helical Feed System

It's a very simple matter to connect a helix feed to the LNA (see Fig. 7). This does away with the need for a copper pipe and PTFE polariser. An increase in signal has in practice been seen, probably due to the truly circular polarisation of the helix. All that's required for a prime focus feed is two and a half turns of 16 s.w.g. copper wire, with a diameter of one inch spaced over about 5cm.

A rear ground plane/reflector is required. This should be of 8cm or so diameter and can be part of the LNA case. The feed to the LNA may be via a PTFE bush or similar. The 50Ω impedance is set by taking the input from the circumference of the helix, with the distance from the first turn to the reflector about 1cm. The number of turns can easily be adjusted and some experimentation here may prove beneficial. For right-hand polarisation the coil should be wound anticlockwise looking from the dish into the head.

Component Sources

The NEC NE72089 (typical noise figure 1·3dB) and NE21889 (typical noise figure 0·9dB) are available from Microwave Modules, Brookfield Drive, Aintree, Liverpool L9 7AN (telephone 051-523-4011).

The Mitsubishi MGF1402 (typical noise figure 1·1-1·3dB) and MGF1412 (typical noise figure 0·8-0·9dB) are available from either Harrison Brothers, 22 Milton Road, Westcliffe-on-Sea, Essex SS0 7JD (0702-332-338) or Aspen Electronics Ltd., 2 Kildare Close, Eastcote, Middx HA4 9UR (01-868-1188).

Teflon board is available from Walmore Electronics, 11-15 Betterton Street, Drury Lane, London WC2 (01-836-1228) – 0·8mm thick Teflon or PTFE/woven glass laminate.

Ready etched boards and chip capacitors are available from Hugh Cocks TV Services, Cripps Corner, Robertsbridge, Sussex TN32 5RY (058-083-317).

The Ultimate Pattern Generator?

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

I was very pleased when my local Grundig technical liaison engineeer Peter asked me if I was interested in having a look at their VG1000 pattern generator. From the information given in the catalogue it seemed to provide every signal required for VCR servicing, and as I was looking around for a replacement for my Philips PM5509 it was an opportunity not to be missed.

Controls

The front has more knobs and pushbuttons than a Concorde's cockpit, and there's such a variety of functions that it's difficult deciding where to start.

At the extreme left there's an on/off switch, BNC connector and video level knob. The latter enables the video output level to be varied between 0-2V peak-to-peak when terminated at 75Ω, and by pulling the knob out the signal is inverted.

To the right of this there's an array of no less than 15 pushbuttons to select all manner of signals which we'll describe later. Next, almost central, come four more pushbuttons and another knob – these are the chroma controls, with variable chroma level control, again a push-pull switch. When the knob is pushed in the chroma is set at a specified fixed level: when pulled out, the chroma can be varied from 0 to 100 per cent (the fixed level). The pushbuttons provide chroma off, PAL switch off, R – Y off and B – Y off.

Farther along to the right comes the genlock section – if the relevant optional PCB is fitted (it wasn't in mine). This enables the VG1000 to genlock to an external composite signal such as one from a camera, for checking a mixer system for example. On the extreme right-hand side there's the r.f. output section, with sound carrier and modulation on/off switching.

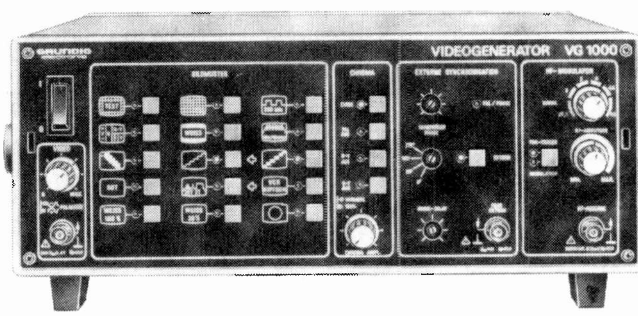
At the rear there are more BNC sockets, arranged in a column. These provide 1·5V peak-to-peak of chroma carrier, 4V p-p of mixed sync, 4V p-p of mixed blanking, and 1V p-p of composite video, when terminated at 75Ω. So there are two video outputs, one fixed and one variable, which is useful. The variable output can be used to check VCR a.g.c. circuits, and with two outputs one can be used to lock the scope while the other one feeds the VCR. A further optional panel provides RGB test pattern outputs.

Patterns

We'll now take a look at some of the waveforms and patterns the VG1000 can produce. Some will be familiar to you. Others may not seem too obviously useful until you know how to make the best of them.

Grid pattern: This has 19 squares horizontally and 15 vertically and can be used for CTV convergence, checking line jumping of the field syncs, picture bounce, linearity, focusing, pincushion distortion, etc. None of this has much to do with VCRs you may think. However there's ringing to check as well as the Q network response and limiter balance, which will respond to peak whites.

250kHz bars: About twelve vertical black and white bars which can be used for white clip adjustments as the



The Grundig VG1000 pattern generator.

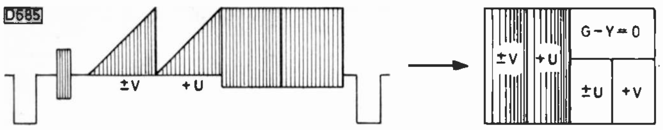


Fig. 1: Vector test pattern.

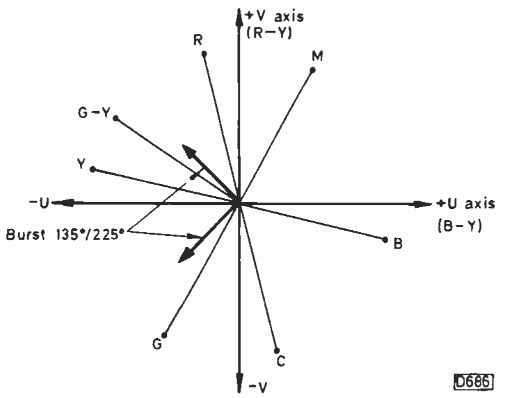


Fig. 2: Colour phase axes.

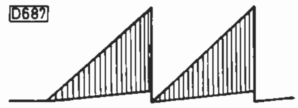


Fig. 3: Video amplifier response check.

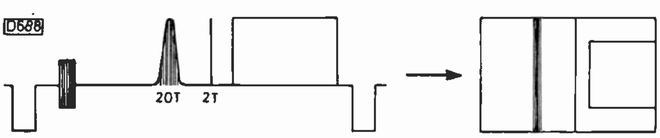


Fig. 4: Sine squared pulse and bar signal.

Fig. 5: Chroma amplitude and phase checks.

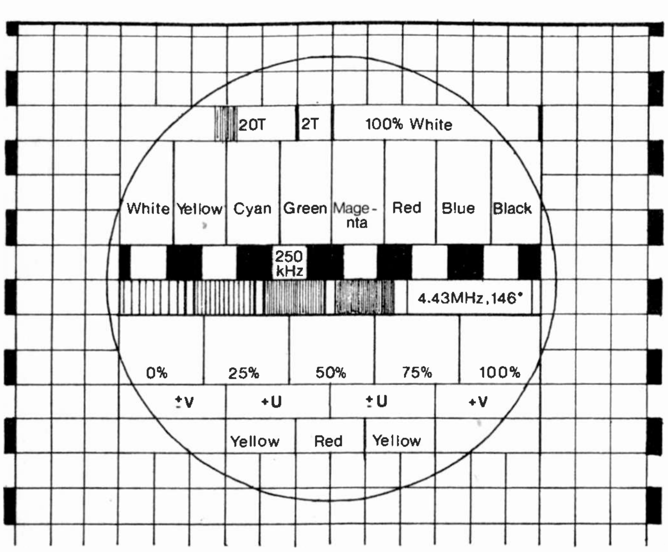


Fig. 6: The composite test pattern.

waveform is a very nice video squarewave. Can also be used to set replay crispening circuits, aperture or video equaliser networks and limiters.

Cinamascope 100 per cent white block: This is called a 50Hz black to white jump. It consists of a wide field blanking period followed by 100 per cent white level. Useful for checking l.f. response, and difficult faults in Sony C7s that play up when recording cinemascope films.

Multiburst: Six sets of sinewaves across the screen in vertical columns. Frequencies are 1MHz, 2MHz, 3·5MHz, 4·8MHz, 5·8MHz and 10MHz. What's so special? They start and stop at zero crossing, are locked at line rate so that they stay still and don't drift through, and you can set them yourself to whatever you want up to 10MHz. I chose 1MHz, 2MHz, 2·8MHz, 3MHz, 3·8MHz and 4·8MHz in order to check VCR response and luminance carrier modulation.

Colour bars: EBU bars with white at 100 per cent, colour saturation 100 per cent and colour amplitude 75 per cent.

White raster: A full level white raster for f.m. deviation.

White 30 per cent: Mid-grey raster for signal-to-noise checks.

Red raster: About 30 per cent white with red chroma. For purity and VCR chroma noise checks.

Grey scale: Eight linear steps from black to 100 per cent white. A second pushbutton allows chroma to be superimposed for differential chroma gain checks. The chroma is 215mV at 180°, a sort of yellowy green colour.

Circle: This is digital and stored in a PROM, so it's not subject to drift or change and is a true circle. As it's digital it seems a bit raggy edged in parts on close inspection, but it's a good circle nevertheless. It can be superimposed on all the other test patterns with the exception of the multiburst. An intersting point is that superimposition is achieved by means of OR gating, so that the white level never exceeds 100 per cent, i.e. the white circle is not added to but gated with the other patterns.

Vector test pattern: This has five sections (see Fig. 1). The first section of each line consists of two sawtooth waveforms, which contain PAL-switched V and +U respectively. The V signal is slightly bluish red and the U signal bluish with a hint of red. Fig. 2 shows the basic colour phase axes. If the video amplifier system's response in the 4·43MHz area is low the chroma-filled sawteeth will be as in Fig. 3, where the bottom edge is not level due to the reduced chroma amplitude. The top of the second half of the screen has zero G − Y, i.e. orange, and can be used to check the G − Y matrixing. Below this are two sections called achromatic vectors: a correctly set up PAL decoder should produce no output. The switched U signal will cancel, similarly the +V signal. Such things as delay line phase and subcarrier phase can be adjusted easily.

Sine squared pulse and bar: This is a standard broadcast specification signal. There are two pulses followed by a bar. One pulse has a duration of 20T and the other 2T, where T=100nsec. T is defined as 0·5fg, where fg is the upper frequency limit of the TV system – taken to be 5MHz. The line (see Fig. 4) contains a 20T pulse (2μsec) which is filled with chroma followed by a 2T pulse (200nsec). Sine squared is simply a complicated way of saying that video pulses are not by nature a.c., starting from black and rising towards peak white. The 2T pulse is followed by a step of T rise time to a 100 per cent white bar. Since it appears line by line its frequency is 15kHz. As Peter so aptly put it, "try finding a VCR that can replay that!"

The TV screen shows a vertical, soft-looking greenish column followed by a sharp white line and then a white bar which is 200 lines in height and is referred to as a jump signal.

An extra button gives you the 2T pulse on one field followed by a broken line on the next field, enabling video heads to be identified.

A further use of the 20T pulse is illustrated in Fig. 5. The thing to examine is the base of the pulse, since this reveals chroma phase and amplitude problems. If the base has a single curve as shown at (a), there's a slight amplitude discrepancy: a baseline with a tendency to ripple, as shown at (b), indicates that there's a phase problem. It's a very sensitive signal that will show up the slightest errors.

Test pattern: This is shown in Fig. 6 and includes samples of all the full-screen test patterns in a single composite pattern.

Lines 16/17 and 329/330 at the beginning of each field carry a peak white 100 per cent level signal as a reference. Alternate black and white rectangles at the sides define the edges of the picture. The basic grid consists of 19 horizontal and 15 vertical squares, but the centre 12 × 10 section contains other singals, surrounded or not by the optional circle which can be switched in or out. The top of the insert section contains the sine squared pulse and bar. This is followed by colour bars then 250kHz black/white squarewaves. Next comes the multiburst, with 4·43MHz at 146° (flesh coloured) at the right. The grey scale beneath has five steps from 0 to 100 per cent. This is followed by switched and unswitched U and V and finally, at the bottom, yellow/red/yellow for phase position and amplitude ratios of the colours.

Test Cassettes

Now for an advert. I am producing test cassettes of thirty minute duration with this test signal on them, using a specially aligned centre tolerance recorder, at some £30 (check with the Newark Video Centre Ltd.). These can be used for general setting up prior to final alignment if necessary using a manufacturer's alignment cassette.

Table 1 provides further specification details. The output is to broadcast standard, with the correct four-field PAL burst sequence.

Conclusions

It's certainly the best pattern generator I've come across. The syncs have full half line equalising pulses and there's the correct burst sequence. It's as good as a Channel 4 test pattern in my opinion. The square wave signals have no discernible overshoots, the corners being nice and neat, far better than a received signal. I've never seen such a nice little 10 cycle burst: its overall shape is rectangular.

After I'd used the generator for several weeks I began to get concerned about the production alignment of some VCRs, something I've not noticed before. Colour record levels and crispening circuits for example. Visiting engineers have positively drooled over the waveforms displayed on my 50MHz scope – the input to the scope has to be terminated of course or the signal will show the effects of an unterminated line – even with a cable only one metre long.

The VG1000 is almost too good for setting up TV sets and, here's the snag I've not mentioned before, the r.f. output is at v.h.f., though you can get an output at i.f. With Grundig TV sets the v.h.f. output is no problem as they can all receive v.h.f., while with VCRs it's immaterial as you can go in at video frequency. If you want a u.h.f. output, a suitable v.h.f.–u.h.f. converter is available from Philips. I found that this was fine for feeding individual sets but couldn't be linked to the workshop signal distribution system because the output is full of harmonics.

No one is ever completely satisfied and, having acquired the VG1000, I propose to make some modifications. First I intend to arrange for an audio output, which I miss. Secondly I don't think that the 30 per cent white is as useful as black. By changing this I'll be able to get a white circle on a black background. Switching from white to black and vica versa has helped me to solve many l.f. sync problems with VCRs. Another change I propose to make is the addition of RGB outputs, which will be useful for testing computer monitors.

VCRs are getting more and more sophisticated and there's a trend towards better picture quality. As a result, much more accurate alignment will be required. Already we have the Sony C9 which calls for a spectrum analyser, without which the result will be noisy pictures. Then there's the JVC HR7655 long-play machine that requires eccentricity setting up after changing heads. To be effective, a VCR service department will need substantial investment in specialised equipment. The VG1000 is not cheap at around £1,200, but it will last a long time and will not date. What's more, it *is* effective for VCR repairs when off-air transmissions will not suffice.

Availability

Any company wishing to purchase the VG1000 should contact their local Grundig technical liaison officer or myself at the Newark Video Centre, 108 London Road, Balderton, Newark, Notts.

Table 1: VG1000 specification.

Chroma carrier: 4·433619MHz. df/f less than ±5 × 10^{-6} between 5-40°C.
Burst phase: ±135° ±2° on the −U axis.
Burst amplitude: 300 mV p-p.
Burst position: 5·6μsec after the front slope of the line sync pulse.
Burst width: 2·25μsec.
Burst blanking: PAL quad sequence.
Line frequency: 15·625kHz ±1 × 10^{-5}.
Sync width: 4·7μsec.
Sync pulse amplitude: 300mV.
Line blanking: 12μsec.
Front porch: 1·5μsec.
Field frequency: 50Hz ±1 × 10^{-5}.
Equalising pulses: 5 half line pulses, 5 half line broad (field) pulses, 5 half line.
Patterns: 15 basic patterns including the circle which can be added if required to 13 of the other patterns.

All grid lines are passed through a sine squared Thompson filter and are thus 2T pulses. The multiburst and circle are added after the sine squared filter: all other luminance signals, including the syncs, are shaped to a 2T rise time.

TV Fault Finding

Reports on TV faults from Peter H. Dolman, T.J. Hawken, Tech. (C.E.I.), George R. Wilding and R.J. Fox

Thorn TX90

The owner of a set fitted with the TX90 chassis was delighted with its performance – but rather concerned when it broke down after two evenings' use. We found that the mains transformer's secondary side fuse FS2 was lightly blown, and on replacing this were presented with a picture of slightly reduced height, with slightly bent verticals, and no sound. Checks revealed that the 12V supply was low at some 10·8V, though there was plentiful input to the 12V regulator i.c. At this point a fine wisp of smoke floated skywards to assist our search. The smoke was coming from R144 which provides the supply to pins 7/22 of the all-singing, all-dancing TDA4500 i.c.

Replacing this resistor and the i.c. restored normal height and sound but the verticals were still bent. This bending was dependent on beam current – the brighter the display the less the bending. The cause was found to be the presence of a 5V, 50Hz ripple on the 95V boost line, which was slightly high at 95·9V, though the "set h.t." control was at minimum. Increasing the boost voltage slightly removed the hum but brought the set close to tripping. This high boost voltage gave us the clue: a check on the mains transformer revealed that it was wired for 220V operation instead of 240V. After rewiring the transformer the hum problem was solved and we were able to adjust the "set h.t." control for 95V at the cathode of D109, with the slider near the centre of the track. **P.H.D.**

Hitachi CTP202

The problem with this set (PAL-4 chassis) was top foldover, covering approximately one and a half inches – diagnosis was complicated by the fact that the fault would appear ten minutes after switching on. The best approach seemed to be to check waveforms.

The waveform at the input to the vertical module (field preamplifier, driver and output stages) remained correct, but the output waveform was seen to change slightly, the lower part tending to become flattened. The d.c. voltages and the peak voltage of the output waveform remained correct however.

The module is not an easy item to check, since the four transistors and associated components are glued to an aluminium heatsink which is soldered at right angles to the main panel. The supply comes from the 128V stabilised h.t. rail, via a filter consisting of R613 (330Ω, 3W) and the smoothing electrolytic C613 (100μF), entering the module at pin 3. I decided to take a look here and discovered a large sawtooth signal at field frequency. C613 turned out to be open-circuit. **T.J.H.**

ITT CVC8 Chassis

Slight smoke plus a burning smell had come from the back of this set. Fortunately this was found to be due to C306 (330pF, 6kV) being leaky, as a result of which excess current was flowing through R422 (1·8kΩ) – these two series-connected components form a damping network in the line output valve's anode circuit. Since R422 is mounted on one of the line output transformer's plastic cheeks, part of this cheek had scorched and carbonised. Removing the carbonised sections and resoldering the appropriate connections restored normal results, but whilst balancing the first anode presets the raster suddenly disappeared and the PL509 line output valve began to overheat visibly.

This is often due to lack of drive as a result of one of the capacitors in the line oscillator circuit going open circuit, but the possibility of a dry-joint in the PL509's control grid circuit couldn't be overlooked, especially in view of the initial fault. When making meter checks at the valve's control grid pin the negative bias suddenly appeared and the e.h.t. developed, but vanished just as quickly when the test prod was removed. The prod was then placed on the inch long strip of printed wiring leading to the grid stopper resistor R420. This failed to get the line output valve going, though returning the prod to the original test point started up the line output stage. There seemed to be a dry-joint between these two points therefore, but further tests showed that touching the control grid pin itself produced line output stage operation since the pressure was causing a break under the panel to make. This was soon cured by resoldering. Had the break been a fraction larger and failed to make on test prod pressure, finding the cause of the trouble would have taken a lot longer. **G.R.W.**

Telpro CTV

The Telpro hybrid colour chassis was electrically almost identical to the Decca 30 series chassis. The board layouts, sizes and mounting arrangements differ however, so they are not interchangeable. Anyway, the fault we had with one of these sets was no colour. As a first step we checked the voltage at the collector of the colour-killer transistor (TP206). This point is normally at nearly the rail voltage. With the test prod applied, sweeping through the tuning position failed to produce any voltage reading.

The fault could have been in many sections of the decoder – burst channel, ident amplifier, colour-killer rectifier and so on. But as a second step we decided to check the first, controlled chroma amplifier stage, since the burst signal is tapped from the collector of the transistor concerned (TR205). The transistor itself was the main suspect, but due to its position near the bottom of the panel, virtually inaccessible to a test prod, we removed the panel to make resistance checks. This revealed that the transistor itself was o.k. We also found that there was a convenient test point (TP204) at which the base voltage could be checked. The reading was only about 3V instead of the correct 10·3V, so there was clearly a biasing problem.

A look at the circuit revealed a suspect for this loss of voltage, a miniature 5μF smoothing electrolytic (C216) which actually forms the a.c.c. reservoir capacitance. The circuit diagram shows the value as 10μF incidentally. An ohmmeter test in both directions, to eliminate the effect of the transistor's base-emitter junction, showed that it probably was leaky, and unsoldering one end confirmed this suspicion. On unsoldering the other end however the electrolytic tested o.k. Nevertheless a replacement restored normal conditions – almost certainly the heat from the solder gun had affected the capacitor's innards. **G.R.W.**

National Panasonic Colour Portables

Those who, like us, operate in a holiday area – sunny Colwyn Bay! – get lots of colour portables brought in at this time of the year. The following fault reports may be of help to those not familiar with these National Panasonic sets.

Model TC492G (PIX-M11 chassis): The fault is an over bright, flat picture, with the customer brightness control at its minimum position and the contrast control having little effect. The preset brightness control will reduce the brightness to the normal level, but with a very poorly contrasted picture. You'll find that the collector voltages of the RGB output transistors are low due to the h.t. line being low. This is derived from the line output transformer, by rectifier diode D555 which charges the $10\mu F$ reservoir capacitor C555. The problem is that C555 goes open-circuit. Replacing this and adjusting the brightness preset restores the excellent pictures these sets give.

Model TC371GM (PBX-M7A2 chassis): There was a peculiar "half moon" blanked off section of the raster over the bottom one third of the screen, with the curved edge very jagged (on a monochrome set it would have looked as though the phosphor coating had dropped off the bottom part of the c.r.t.). An examination of the flyback blanking pulses fed to pin 5 of the video processing i.c. (IC301) revealed that these were not clearly defined. The pulses come from TR471, which receives field and line flyback pulses at its base. The field pulses were o.k., but the line pulses were a bit messy. These come from the line output transformer via a non-polarised $0{\cdot}47\mu F$ tantalum capacitor (C857). Replacing this item solved the problem. **R.J.F.**

VCR Servicing

Part 21 ***Mike Phelan***

TIME for us to look at the 3V23's tuner/timer board. This contains mainly logic circuitry, so if you managed to get to grips with the mechacon board the tuner/timer board should not present many problems. A block diagram is shown in Fig. 97. At first glance it may seem a bit fearsome, but it's not too bad once we break it down.

We'll look at the sweep tuning system first. To operate this, you press "ch set" and then "sweep". The tuning voltage increases from zero until a signal is reached, when the sweep stops. You then press "store" and "ch set" again if no more channels need to be tuned.

IC1 processes the sweep tuning information in conjunction with the DAC (digital to analogue converter) IC9, type MN1204A, and IC5/8, which are both type MN1208 EAROMs (electrically erasable read only memories). These two i.c.s store the tuning information so that channels can be selected without retuning, and retain their memory at switch off provided the power supplies to them are removed and reapplied in the right order. Each EAROM

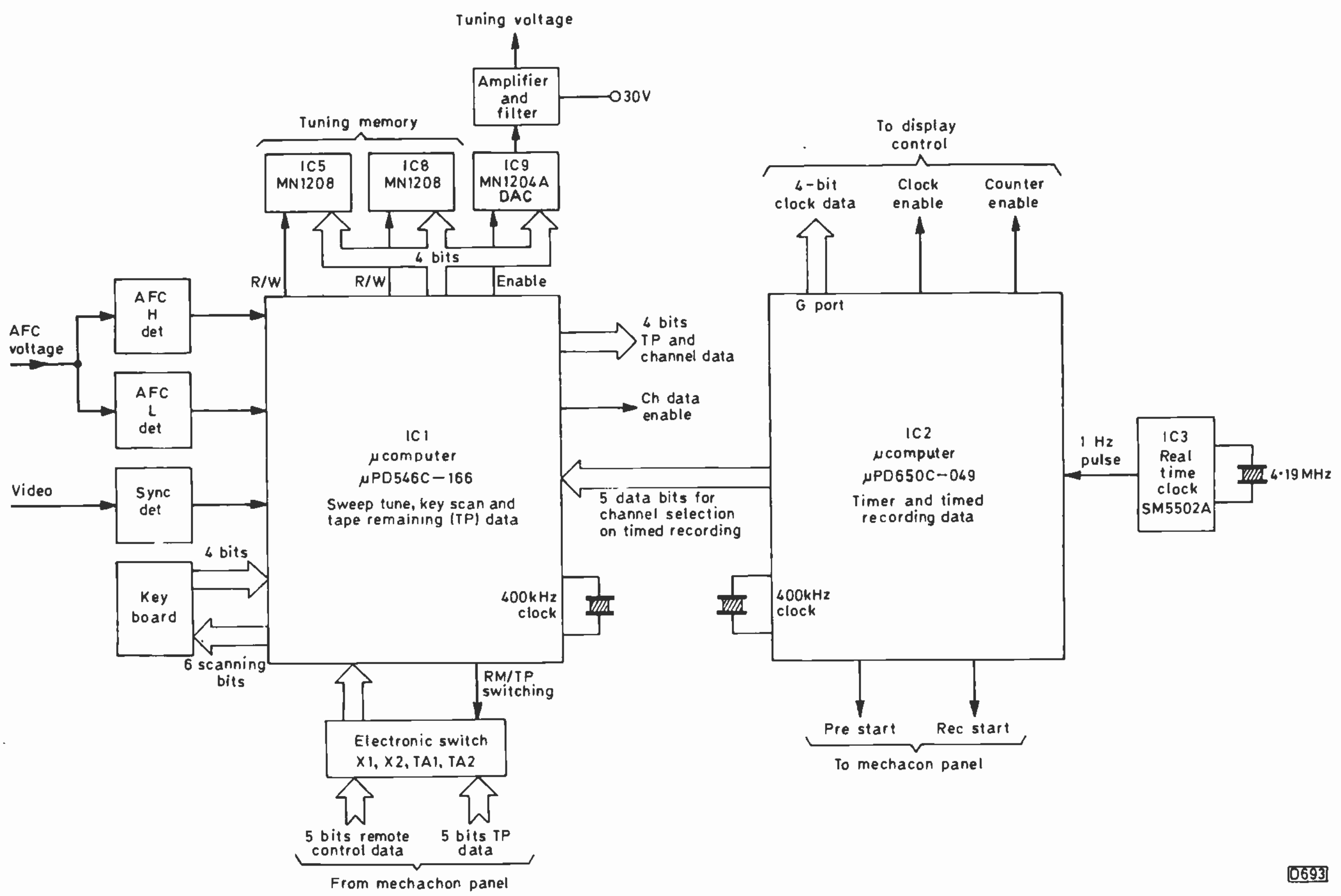


Fig. 97: Tuner/timer board block diagram.

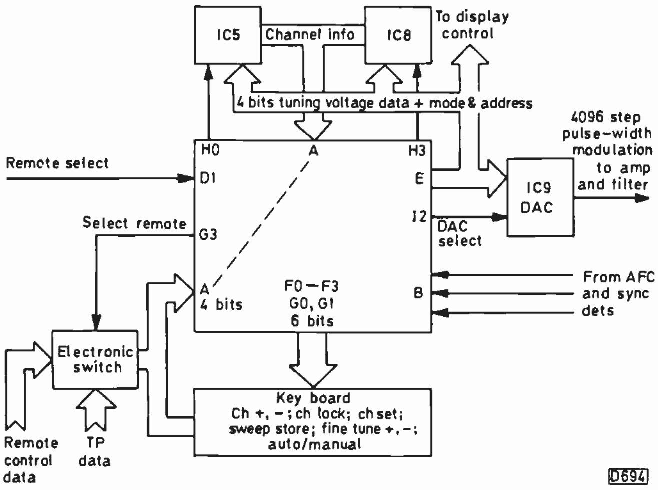


Fig. 98: Tuning system block diagram.

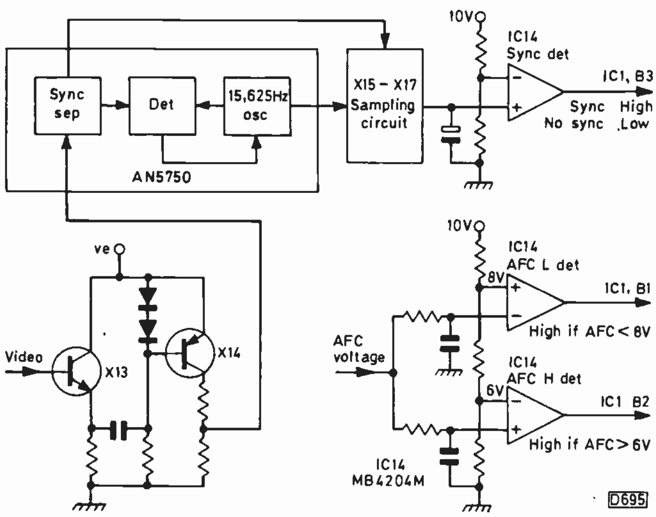


Fig. 99: Sweep tuning system.

has a read/write input to tell it whether to give or receive information.

The arrangement is shown in greater detail in Fig. 98. Port E of the microcomputer IC1 feeds four-bit parallel data to the DAC IC9 which produces a 6V peak-to-peak pulse waveform with a basic 3·15msec period. The mark-space ratio of this waveform varies over 4096 steps (2^{12}) depending on the data from the E port. This waveform drives a transistor (X10) which is operated from the stabilized 30V rail, amplifying the pulses to this voltage level. A low-pass filter (integrator) smooths out the bumps so that we end up with a smooth voltage which can be varied between 0 and 30V depending on the data from port E of IC1, i.e. the more mark there is to space in the output from IC9, the higher the tuning voltage.

The four-bit code is also fed to IC5 and IC8, which will store this information if told to do so by taking pins 12 (read/write) low. This occurs when we press "store" and pins H0 and H3 of IC1 go low. When we wish to select a channel, port E gives an address to IC5 and IC8 where the relevant data is located. Pin I2 turns off the DAC so that the address information is not converted into a tuning voltage. IC5 and IC8 then read out the appropriate four-bit voltage code which goes to port A of the microcomputer, and internally to port E. The output at I2 then enables IC9 once more and the required tuning voltage is produced.

Although we've made this appear as a two-stage operation, in fact pin I2 gives out a digital code which switches from "address" to "tuning data" at a high frequency. Also the input to IC5 and IC8 contains information on which of these two things is being fed in and whether or not to give an output to port A. This is necessary because the E port bus (nothing to do with public transport on the Wirral!) also contains data for the display – channel number, tuning indication (a bar-graph display, also used for TP, i.e. tape remaining, information during record/play), and the legends for channel lock and set. Obviously these latter signals must be ignored by IC5/8/9.

The key board scans six output bits from IC1 which receives four bits back – these represent the commands shown in Fig. 98. The remote data for these commands comes from the mechacon panel – remember the D0 to D4 bits from the serial to parallel converter IC38? The block marked "electronic switch" consists of two TA57 transistor arrays, which can be thought of as five-pole changeover switches. Each array contains five pnp transistors with a common emitter connection. When this goes high, signals can pass from the base to the collector. Normally they are switched on alternately by pins G2 and G3. When the remote handset is operated, D1 goes high, G3 goes high and the remote data is switched so that it goes to port A (which is also used for the stored tuning voltage data). When G3 is low, TP data from the mechacon panel is fed to port A – again these functions are time multiplexed so that the data arriving at port A is a mixture of several things.

Sweep Tuning

So far so good, but how do we find stations by sweep tuning? See Fig. 99. Three detectors provide inputs to port B. Each gives a high when certain conditions are met. As we sweep the tuning voltage upwards we will come to the lower sideband of a signal. The a.f.c. S curve will go positive, fall to zero, go negative and then return to zero. It's then too late – we've gone past the station. Clearly it's necessary to modify the sweep rate depending on the outputs from the three detectors.

When we press sweep, the DAC is enabled and the code from port E starts to go through its 4096 steps, the tuning voltage rising. When we come to a station the output from the sync detector goes high. The microcomputer then slows the sweep rate to a third. The a.f.c. L detector next gives an output, as a result of which the sweep rate falls to an eighth. The correct tuning point is then passed and the a.f.c. H detector gives an output, slowing the sweep rate down to a thirtieth and reversing its direction. When the a.f.c. H detector's output once again changes, the sweep stops and the a.f.c. detectors apply any slight correction needed. "Store" is then pressed and the EAROMs store the voltage code present at the address input. This is time multiplexed on the same bus as the channel voltage code, and determines the channel number (1-16) which will give this voltage code.

The a.f.c. H and L detectors should be self-explanatory. The sync detector uses a standard TV sync/line oscillator chip along with transistors X15/16/17 as a coincidence detector.

Digital to Analogue Conversion

Before we leave IC1 and its operations, let's take a closer look at the DAC (Fig. 100) which is actually three DACs. Which DACs are in operation depends on the

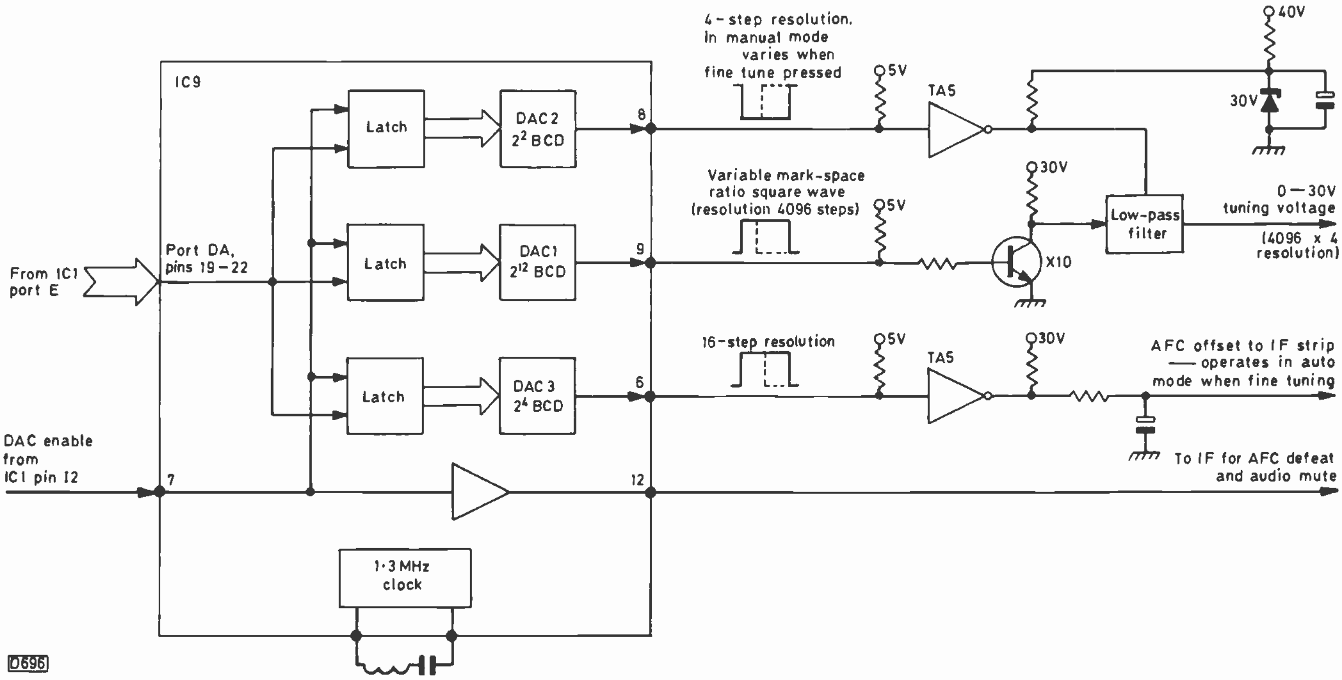


Fig. 100: Digital to analogue converters and tuning voltage integrator.

address code from port E. DAC1 provides the 4096 step output when the band is being swept: when a channel is selected the output remains constant, as instructed by the code from port E. X10 amplifies the pulse output to 30V peak-to-peak and the low-pass filter smooths the pulses to provide a d.c. output. The output from pin 12 goes high whilst band sweeping, muting the a.f.c. and audio between channels.

There are actually two sweep modes, manual and auto, operated by a switch (on the key board). On auto the sweep is automatic, ignoring weak stations: on manual, the sweep stops when the button is released, the countdown being operated if a station has been located. The fine tuning plus and minus buttons give a very precise control over the tuning point. DAC2 gives an output of four increments to every one from DAC1 – in auto only. This output is level shifted to 30V and added to the DAC1 output from X10, giving 4 × 4096 steps of tuning voltage. On manual it varies only when fine tune plus or minus is pressed, remaining at a midpoint (50:50) mark-space ratio otherwise.

As we can't use this for fine tuning in the auto mode, this is where DAC3 comes in – the output is again level shifted and filtered and goes to offset the a.f.c. to the tuner. There are 16 steps and the output is 50:50 in the manual mode.

Round Up

The other microcomputer i.c., IC2, is much simpler. It's driven by a 1Hz pulse from IC3, the real time clock. This is not just another buzz work – it's essential to differentiate between the various other clocks used in these circuits. The 4·19MHz oscillator can be trimmed for regulation. Port G gives a four-bit output which goes to the clock display, together with the clock enable and counter enable lines. When in the counter mode, the counting is done on the display board, the tuner/timer board playing no part in this operation.

Next month we'll conclude our account of the tuner/timer board with a look at the switched power lines that prevent amnesia in IC5 and IC8, then look at fluorescent displays, display control boards and battery back-up.

Meanwhile a correction to Part 19 (July) – spotted by a reader whilst on the beach at Majorca (what dedicated readers we have!). The outputs from the 4017 i.c. (IC6) in the capstan servo go high (not low) for one clock cycle each. It's a CMOS device with totem-pole outputs.

Quick Checks Q and A

Part 1

S. Simon

Over the past few months we've discussed the common faults than happen on popular colour sets and the simple checks that can be made to enable a quick repair to be carried out in most cases. If you've been following the series or are familiar with the various chassis you should have no difficulty in dealing with the following questions. If you don't know the answers, you've not been paying attention!

Bush A823 Chassis

(1) The set is apparently dead apart from the glow of the tube's heaters. There is 200V at the top fuse on the power panel. What is the usual cause and why does this shut the whole thing down?

The l.t. fuse on the right side of the panel (rear) has probably failed due to a short in the bridge rectifier immediately above it. Check the bridge with an ohmmeter, whether it's a BY164 (dodgy) or four separate diodes. A short will almost certainly be found. The whole thing is shut down because one of the l.t. lines feeds the line oscillator and driver stages, hence the line output stage is inactive.

(2) There's no voltage at either end of the top 600mA fuse but the VA1104 thermistor at the bottom of the panel is intact and there's high d.c. at the cathode of the thyristor. What's happened?

The 68Ω wirewound h.t. filter resistor, left section under the tube, is open-circuit. The h.t. reservoir capacitor may remain charged after the set has been switched off if the 47kΩ shunt resistor has deteriorated or been removed.

(3) The colour disappeared suddenly. Which item should be checked first?

The BC148 11V supply emitter-follower transistor 3VT2, which could well be open-circuit. There should be 11V at this transistor's emitter. The chroma amplifier at the top left of the i.f. panel (three transistors in can) is also suspect and should be checked before making a more detailed investigation (if necessary) on the decoder panel.

(4) There is total field collapse, i.e. a white (or funny) line across the centre of the screen. The voltages on the field timebase transistors seem to be in order. Which item should receive attention first?

Open up the timebase board and check the soldering to the pincushion phase coil L20 at the top right of the scan control panel. Moving the coil will often restore the field scan to prove that a dry-joint is present. Also check the wirewound control immediately below the coil — it could have a dud spot on the track.

Bush T20 Chassis

(5) The complaint is a "dead set". What are the first steps to take?

You listen to how it "doesn't start" when switched on! If it tries to start but lapses into sudden silence, suspect the 910Ω resistor 4R16 on the upper left of the swing-down timebase panel. The circuit will make it read about 50Ω one way, through transistor VT7, but high the other way (through the resistor). To be sure, remove it and check it out of circuit. If a 910Ω resistor is not to hand, use 1kΩ, 2W.

If the start-up is completely dead, check the 200V supply to the line output panel. If correct, check the following two resistors. First 5R8 (1Ω) in the line output transistor's base circuit. This small wirewound resistor often goes open-circuit. Secondly 5R3 (1.8kΩ) in the supply to the line driver stage. This could well be found unsprung.

Other common failures are the two diodes D6 and D7 in the EW modulator circuit at the front centre of the same panel. Check them out of circuit — any reverse leakage cannot be tolerated (though this wouldn't stop the set working). Use type BYX71 for replacement.

If the h.t. supply is low, check the BU208A line output transistor for leakage with the collector disconnected.

Before the set is even tried it's well worthwhile checking 5R8 on the right side panel and 4R16 on the swing-down panel. They could well be in order, but all too often one will be found faulty and you'll have the satisfaction of repairing the set without making any other tests.

Decca Bradford Chassis

(6) The line output stage is inoperative due to the 500mA fuse being open-circuit. What's the first action?

Check the resistance reading from the top cap of the PY500 boost diode to chassis. If this reading is low, transfer attention to the lower panel, right side, and disconnect one end of the 0.22μF, 1kV boost reservoir capacitor. It will nearly always be found short-circuit. If not, check the PY500 itself and the 150pF high-voltage disc capacitor on the top of the line output transformer.

(7) The set is suffering from lack of width and you're inclined to suspect the PL509 line output valve. What do you check first?

The width control (bottom right slider) which often develops a poor contact and needs to be moved only slightly to restore normal working.

(8) The 500mA fuse has failed but there's no low reading from the top cap of the PY500 to chassis. What's the prudent course of action?

Replace the PL509 and PY500 valves, fit a new fuse, and watch closely how the new valves warm up (preferably with a meter on the PL509's control grid to record the line drive or lack of it). If there's no negative swing to denote the presence of line drive, the PL509 will overheat. Attention should then be directed to the PCF802 line oscillator valve and its associated components, in particular the 470pF polystyrene and 5μF electrolytic capacitors. If the PL509 doesn't overheat (line drive is not delayed), the right action was taken in replacing the valves. If the drive is proved to be absent or delayed, refit the old output stage valves.

(9) What are the weak links on the left side decoder panel?

The usual offenders are the small presets which set the operating levels of the top RGB output transistors. Check them thoroughly and also suspect the small electrolytics mounted close to the wirewound resistors. The heat from the wirewound resistors tends to make the capacitors not only dry up but also suffer from leakage, upsetting the working conditions of the output transistors (mainly the right side blue drive).

GEC Hybrid CTVs

(10) The 3A supply fuse (in-line fuse, plastic holder, left

side) has blown. Examination shows that it's not blackened. What's the first move to make?

As with the Decca hybrids, check from the boost line to chassis (top cap of the PL509 or PY500) to see whether there's a short or partial short. Again the boost reservoir capacitor is the primary suspect — this time it's the large 0.47μF, 1kV capacitor to the left of the line output transformer, immediately behind the width control. Disconnect one end to check. If it's not shorted, look on the left side of the transformer for the secondary suspect, a high-voltage disc capacitor.

(11) What other weak links are there on this chassis?

Undoubtedly certain resistors, which tend to change value, particularly those associated with the boost voltage feed to the height control (a bit messy this one) and the sync separator transistor's collector load resistor R500 (56kΩ) which is on the timebase panel, on the left edge about half way down.

GEC C2110 Series

(12) What's a snubber network?

These sets incorporate a snubber network consisting of an 0.22μF capacitor and 270Ω resistor in series, wired on the top left of the main frame, to protect the mains rectifier thyristor from spiky transients. Although its position doesn't suggest this, it's actually wired from the anode of the thyristor to chassis. The point about this is that a glance at the resistor's condition shows whether the capacitor has gone short-circuit, thus blowing the 3.15A mains fuse. Failure of the 0.22μF mains filter capacitor doesn't blow this fuse as it's connected elsewhere, in series with the 2A degaussing circuit fuse.

(13) What does this tell us?

If the resistor in the snubber network looks well and the 3.15A mains fuse has blown violently, the most likely cause is a short-circuit thyristor, with the 600μF h.t. reservoir capacitor C702 another possibility.

(14) If the 3.15A fuse has failed but isn't blackened, what's the most likely cause?

The line output transistor is the most likely suspect, and a meter check may well show a direct short-circuit between the body (the collector of the BU108/BU208) and chassis. The reason for this is that the zener diode connected between the transistor's emitter and chassis is also short-circuit. It's included to protect the circuits supplied from the emitter of the line output transistor, i.e. the set's l.t. lines. The replacement zener diode must be a small 400mW type in order to preserve this protection.

The thermal resistor on the top dropper may or may not be open if the BU108 has gone short-circuit. The flyback tuning capacitor C52 (in parallel with the line output transistor) is also suspect: it may appear blameless when checked with a meter, but can still be capable of ruining every BU108 fitted.

ITT Hybrid CTVs

(15) If the customer complains of lots of smoke issuing from the set although it continues to perform normally, what item would you suspect?

The receiver is probably a CVC9 with a yellow mains filter capacitor rated at 220V a.c. mounted on the front left mains input board. These capacitors tend to overheat and split without actually shorting (though they can do this as well).

(16) The h.t. supply fuse to the line output stage has failed. What's the first suspect?

The 0.47μF, 1kV boost capacitor C310 situated just below the line output transformer. If a 400mA fuse is fitted, uprate this to 630mA. Check the PY500 for damage. The 210pF harmonic tuning capacitor C308 is also suspect. Replace it with a disc type if it's short-circuit.

(17) The focus is very poor. Which resistor is most likely to be at fault and which should be checked first?

The 4.7MΩ resistor R429 feeding the top of the focus VDR is most likely to be at fault, but as access to this requires lowering the chassis and removing the screening cover check the 2.2MΩ resistor R276 on the tube base first (you may be lucky!).

(18) The valve heaters aren't glowing, neither are the tube's heaters. H.T. is present. Which feature explains this?

The valve heaters are fed from a tapping on the mains transformer's primary winding rather than via a dropper resistor. The tube's heaters are fed from a secondary winding. There's a 315mA fuse to feed the transformer, located on the mains input panel. This fuse is open-circuit.

Philips G8 Chassis

(19) The tube's heaters are glowing but there are otherwise no results. Where do you start?

Note the vertical black dropper resistor on the front left. Use a voltmeter to check the voltages here (not an ohmmeter with the set switched off). There should be mains a.c on the bottom section (surge limiter) and d.c. at both ends of the top section (h.t. filter). There may be plenty of d.c. at the lower tag but not at the top. This d.c. voltage will still be present when the set is switched off, which is why an ohmmeter check is unwise.

(20) If the dropper is intact and there is some 200V at the rear edge fuses, what do you look for on the stock shelf?

The right side 800mA fuse feeding the line output stage is probably open-circuit. If so, it's highly likely that the line output transformer is responsible. The look on the shelf was to make sure you have one, as you should. If the 800mA fuse is intact however, with 200V at both ends, check the 47Ω wirewound anti-breathing resistor R5535 on the front of the line output panel. There may be voltage at one end only.

(21) Apart from the line output transformer, what other items are likely to cause failure of the 800mA line timebase fuse?

Remove plug H (red plug to the lower right side, to the transductor) and check the current taken with this out. The set will function perfectly happily with this plug disconnected, the only effect being slight bowing of the raster, hardly noticeable on 20in. sets. If the current doesn't exceed 500mA with plug H removed, take a good look at the transductor and the 120Ω resistor (R4484) which is in series with it. If the current consumption is still excessive, disconnect the tripler. This is simply a matter of removing the plug from the nipple on top of the line output transformer. On rare occasions the tripler can be the cause of transformer failure. So after fitting a new transformer it's prudent to test with the tripler disconnected.

(22) If excess current flows with the tripler connected, does this necessarily mean that the tripler is faulty?

No. If there is no h.t. supply to the RGB output transistors, or if the RGB output transistors are taking excess current which lowers the voltages at the tube's cathodes, the tube will draw excess current which will put an overload on the tripler and line output transformer. Check the tube's cathode voltages and the upper left side 250mA fuse. This is often blown by a sparkover in the tube, something that's quite common when a rebuilt tube has been fitted.

The Betamax Video System

Part 2

Eugene Trundle

The techniques used on the electronics side in Betamax machines follow conventional practice for the most part. This is generally true of the luminance processing, system control and servo circuits, the receiver section and remote control arrangements. The colour department uses very similar principles to VHS and V2000 machines, though the crosstalk cancellation process is carried out in a somewhat different way, as we shall see. Betamax machines have used a number of purpose-designed chips in the past, many of them produced by the system's originator Sony.

The luminance frequency modulation characteristics for the Betamax system are black level 3·8MHz, peak white 5·2MHz. Thus the total deviation is 1·4MHz, representing a rather high modulation index (carrier frequency deviation ratio to the video frequency) of almost 0·5, compared to 0·33 for the VHS system. A non-linear emphasis system is standard on Betamax machines.

As Fig. 10 shows, the azimuth offset of the heads (total difference 14° for Beta) ensures that crosstalk problems between adjacent tracks are mainly confined to the relatively low-frequency section of the signal spectrum, where the colour signal is recorded (centre frequency 687kHz). Some form of crosstalk protection is obviously needed here. Whilst a degree of crosstalk takes place between the luminance signals on adjacent tracks, it becomes significant only at the lower end of the luminance sideband. First generation machines of all formats took no account of it. It's possible to provide compensation for luminance crosstalk however, and while high performance machines in other formats now incorporate the technique it first appeared in the Sony C7 Betamax machine. Let's see how it's done.

Track Correlation

All VCR manufacturers go to great lengths to ensure correlation of the video tracks on the tape. This is important for colour and luminance crosstalk cancellation, and is of significance during the trick-speed replay modes. The idea is to ensure not only that each recorded TV line lies on the tape physically adjacent to its companions on the preceding and succeeding fields, but that each picture element within each TV line is lined up alongside the corresponding picture elements in adjacent recorded lines. The idea is conveyed in Fig. 11.

This correlation depends on three factors – the transmitted half line offset between TV fields, the linear movement of the tape past the head drum (this has the effect of "stacking"tape tracks like a collapsed column of books, as shown in Fig. 5 last month) and, where applicable, an angular displacement of the position of one head on the drum. Only when the picture elements are lying adjacent to one another in this way will any form of electronic crosstalk cancellation work.

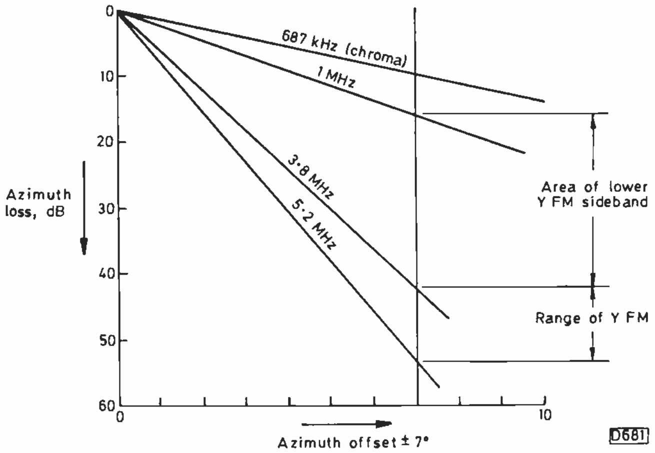


Fig. 10: Effect of azimuth offset at different frequencies.

Luminance Energy Packets

In most TV pictures the bulk of the luminance information is present in bunches, or "energy packets", which are centred on multiples of the line scan frequency – as a spectrum analyser will show. Between these bunches

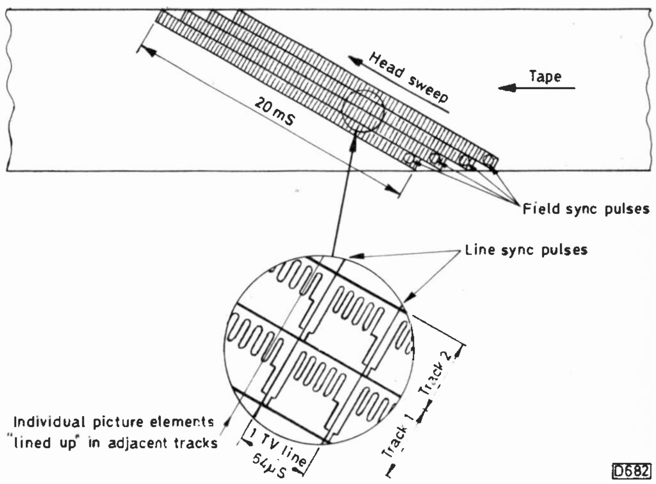


Fig. 11: Track correlation – the video signal shown is symbolic of course.

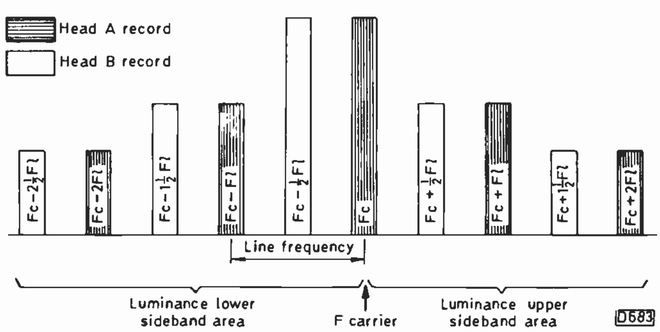
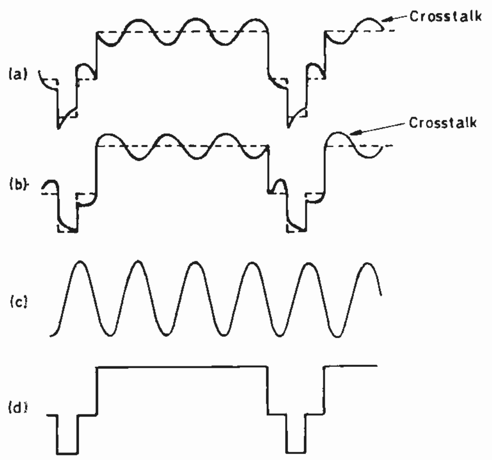


Fig. 12: How the positions of the luminance "energy packets" are interleaved on the tape. The f.m. carrier signal recorded by head A is at the nominal carrier Fc, the sideband components spacing themselves on each side at multiples of the line frequency. Head B records an f.m. signal at 7·8kHz below that of head A, so that the sidebands interleave with those recorded by head A. Thus the clear and shaded components in the diagram appear on alternate tape tracks.



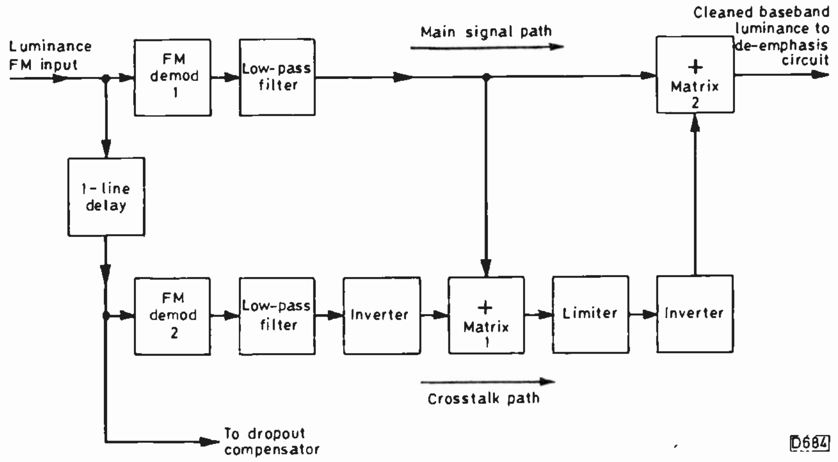


Fig. 13 (left): Luminance signals with crosstalk. (a) Direct signal. (b) One-line delayed signal. (c) Crosstalk signal obtained at the output from matrix 1 (see Fig. 14). (d) The effect of subtracting (a) and (c) in the correct proportions – the crosstalk ripple is cancelled.
Fig. 14 (right): Luminance comb filter technique. Two demodulators are required, but the delay line doubles as part of the dropout compensation circuit.

there's relatively little information (advantage of this is taken in broadcast colour encoding systems, where the luminance and chrominance energy packets are interleaved so that the latter sit in the quiet spaces between the former, hence the carefully selected colour subcarrier frequency). This energy bunching effect is still present when the luminance signal is in f.m. form, the bunches in this case taking the form of sideband groups around the luminance carrier frequency.

Let's now consider the effect of changing the basic f.m. modulator frequency. Because the f.m. sidebands space themselves on each side of the carrier at multiples of the line frequency, a shift in the carrier frequency will alter the positions of the bunches recorded during a line. If we have head A recording at the nominal carrier frequency, the bunch spacings may be drawn as shown by the shaded sidebands in Fig. 12. Head B records the adjacent tracks, and if we offset its carrier frequency by *half* the line frequency the bunch sequence along head B's tracks will interleave with the bunches along head A's tracks on a line by line basis, as shown by the non-shaded sidebands in Fig. 12.

Why this is done will be explained shortly: let's first see how it's done. Very simply, a squarewave at 25Hz (in fact the PG, or drum flip-flop, waveform) is added to the luminance signal before this is applied to the f.m. modulator on record. The squarewave is of course synchronised to the head sweeps, and its level is closely controlled so that it gives rise to a 7·8kHz (fl/2) difference in carrier frequency between the recording signals fed to heads A and B. Thus the signals are recorded on the tape in the manner depicted in Fig. 12, establishing the first part of the crosstalk cancellation scheme.

Crosstalk Cancellation on Replay

Assuming that the tracking is correct, the signal from the tape during replay will consist of a large wanted signal from the track being scanned and a small crosstalk component from adjacent tracks. Because of the half-line carrier offset introduced when recording, the crosstalk bundles from adjacent tracks become interleaved with the wanted signal over each line period, paving the way to the use of a comb filter cancellation system.

Fig. 13(a) shows the demodulated waveform for a plain grey TV line, with crosstalk (greatly exaggerated) shown as a superimposed ripple. If we provide a second demodulator and arrange for it to produce a delayed signal exactly one line "old", the crosstalk ripple will be in antiphase to that from the first demodulator, as shown in Fig. 13(b). This odd-phase effect is due to the half-line carrier offset. The wanted signal after demodulation will be the same on both lines however. Clearly, by adding the outputs from the two demodulators the result will be reinforcement of the wanted signal and cancellation of the crosstalk ripple component.

Practical Cancellation Circuit

To implement the scheme in the way outlined above would call for a one-line delay line capable of handling a luminance signal with a bandwidth of 3MHz. Such things do exist, but not in VCRs! By rearranging the crosstalk cancelling circuit however we can use the familiar narrow-band glass delay line – in fact the one that's already present in the machine's dropout compensation circuit.

Fig. 14 shows the way in which it's done. The normal luminance replay arrangement is shown at the top – f.m. demodulator and low-pass filter, feeding out to a de-emphasis network. The signal path at the bottom is concerned with the crosstalk signals. Demodulator two receives a replay signal one line "old", having passed through the 64μsec delay line. This ensures that the crosstalk component of its output is of opposite polarity to that of demodulator one. If we subtract (invert then add in matrix 1) the outputs from the two demodulators, the luminance signal will cancel out while the crosstalk components will be reinforced to produce a large output – as shown in Fig. 13(c) – consisting of spurious noise and crosstalk components, representing all that we don't want in the replay signal coming from demodulator one. All that's now required is to invert this unwanted signal and add it to the main replay signal so that we are left with the wanted signal only. This is done in matrix 2. The cleaned video waveform will then be as shown in Fig. 13(d).

We've made a dangerous assumption however in thinking that crosstalk components will always interleave exactly with the wanted signal. Where the correlation of TV lines is bad due to timing jitter, large changes in picture content between adjacent lines of alternate fields, or during the field sync pulse train, the system will break down. "False" crosstalk signals will give rise to large cancelling signals fed to matrix 2, deleting chunks of wanted signal so that the vertical definition is reduced and the field sync is impaired. To prevent this a limiter is included in the demodulated crosstalk signal path to restrain the amplitude of the cancelling signal.

This circuit is a useful addition to a VCR. It offers a degree of immunity to random noise and interference from the colour-under signals, as well as the considerable reduction in crosstalk. The net result is a precious 3-4dB improvement in the signal-to-noise ratio. The f.m. frequency offset between fields will lead to a brightness difference in the reproduced fields from heads A and B however – after all, the carrier frequency defines the instantaneous picture brightness. This, if uncorrected, could lead to a noticeable flicker at 25Hz on replayed pictures. Compensation for this during playback is effected by adding a correctly phased drum flip-flop signal to the video signal after demodulation.

Another aspect of the luminance signal processing in Betamax machines is the mute circuit, which shuts off the replay signals until the servos are locked to the off-tape control track signals. This is done to prevent reproduction of unlocked or unstable pictures during the servo lock-up time, but can be confusing if the servos run out of sync for any other reason such as a servo PLL fault or loss of the control track pulses. Thus a dirty or worn control track head will mute the picture, as will a blank (unrecorded) or faulty tape. This means that instead of a wildly out-of-lock picture or a screen full of snow, a plain blank raster will be seen under these fault conditions unless the mute circuit is overridden to aid diagnosis. Fortunately the mute circuit is automatically overridden in the still frame and trick-speed modes, and by selecting one of these it's often possible to see what is or isn't going on.

Servicing the Decca 70-90 Chassis

Neil Dobson

THE Decca 70 and 90 series chassis have been with us for several years, long enough for a few stock fault patterns to emerge. This is not to suggest that these sets are fault prone – in fact they are very good models indeed. It's just that because I deal with so many of them I'm able to report on various servicing aspects.

A feature of these sets is the mains-isolated switch-mode power supply, which uses a Darlington chopper transistor (type BUW81A) and TDA2581 control i.c. The 70 series chassis are designed to drive a 14in. tube, while the 90 series chassis are designed to drive 20 or 22in. tubes, with 90° deflection in each case. There's a similar chassis (110 series) for 110° tubes – a note on this appears at the end. Fig. 1 shows the power supply circuit.

In roughly seven out of ten cases when a set comes in for repair it's completely dead. After removing the back, the first thing to do is to check the two fuses on the small mains filter panel (F701/2, 2A anti-surge). You'll probably find that they look o.k., and indeed they usually are. Next look on the main panel. You'll see another fuse (provided you've swung the panel up) next to the mains bridge rectifier's reservoir capacitor C624. This fuse (F601, 1A anti-surge) is in the feed to the chopper transformer. You'll usually find it blown – really blown!

In this event the thing to check is the BUW81A chopper transistor. These seem to go short-circuit for the least little thing or for no reason at all. If it is short-circuit, spend a few moments checking Tr604 (BSR59) in the chopper driver circuit – do this with the transistor out of circuit. This transistor sometimes bites the dust (or the print) when the chopper transistor goes short-circuit. The only other things I've had go faulty when the BUW81A pops off are the two rectifiers D608 and D610 (1N4003GP) in its emitter circuit. These produce a bias voltage across C627. Being in series with the BUW81A, they tend to be dealt a fatal dose of h.t. So when you've had to replace the BUW81A, check Tr604 and the two diodes, just in case.

The line output stage is extremely reliable and will probably be all right. Which means that you can plug the set in and switch on. If all is well the set will start up. If all is not well the set will start up and quickly cut out again as the protection circuit comes into operation. This starting up and cutting off creates a rhythmic click-bonk. If the set does trip, switch it off and get out your Avo.

There's not a lot to check. Start with the three recifiers fed from secondary windings on the output side of the transformer. These are D614 which provides some 195V for the class AB RGB output stages, D615 which provides either 120V (70 series) or 150V (90 series) for the line output stage and, the most likely culprit, D616 which provides 18V for the LM340T-12 12V regulator i.c. (IC202) and the TDA1190Z intercarrier sound/audio output i.c. (IC102). Check D616 first if the set is tripping – it usually goes leaky. IC202 should also be checked if necessary – I've had to change it on several occasions because of tripping. Another possibility is C633.

Now to the less common faults. One I've had on a number of occasions is a very dark picture with no response from the brightness control. The cause is R910 (270kΩ, 1W) going open-circuit. It's connected in parallel with the first anode preset VR908.

As mentioned before, the line output stage gives very little trouble. In all the sets I've come across, I've had to change the e.h.t. tripler only once.

Lack of contrast has been traced to R706/7. These two series-connected resistors are 82kΩ in the 90 series, 120kΩ in the 70 series, and are rated at ¼W. They link the contrast control to the 195V rail and form part of the beam limiting arrangement. Unfortunately they can go open-circuit. The rating seems to be a bit low in view of the voltage across them, so I fit ½W types.

Distorted sound has always turned out to be due to the speaker itself. The varicap tuners are reliable – I've had to change only two.

Something that's not uncommon in earlier production sets is dry-joints in the switch-mode power supply, usually around the transformer T602 and the TDA2581 control chip (IC601). The usual symptom is intermittent tripping.

There's not a lot that goes wrong then. The 110 series chassis differ mainly in using a TDA1470 instead of a TDA1170 field timebase i.c., incorporating an EW diode modulator in the line output stage, and having separate first anode presets (VR909/10/11).

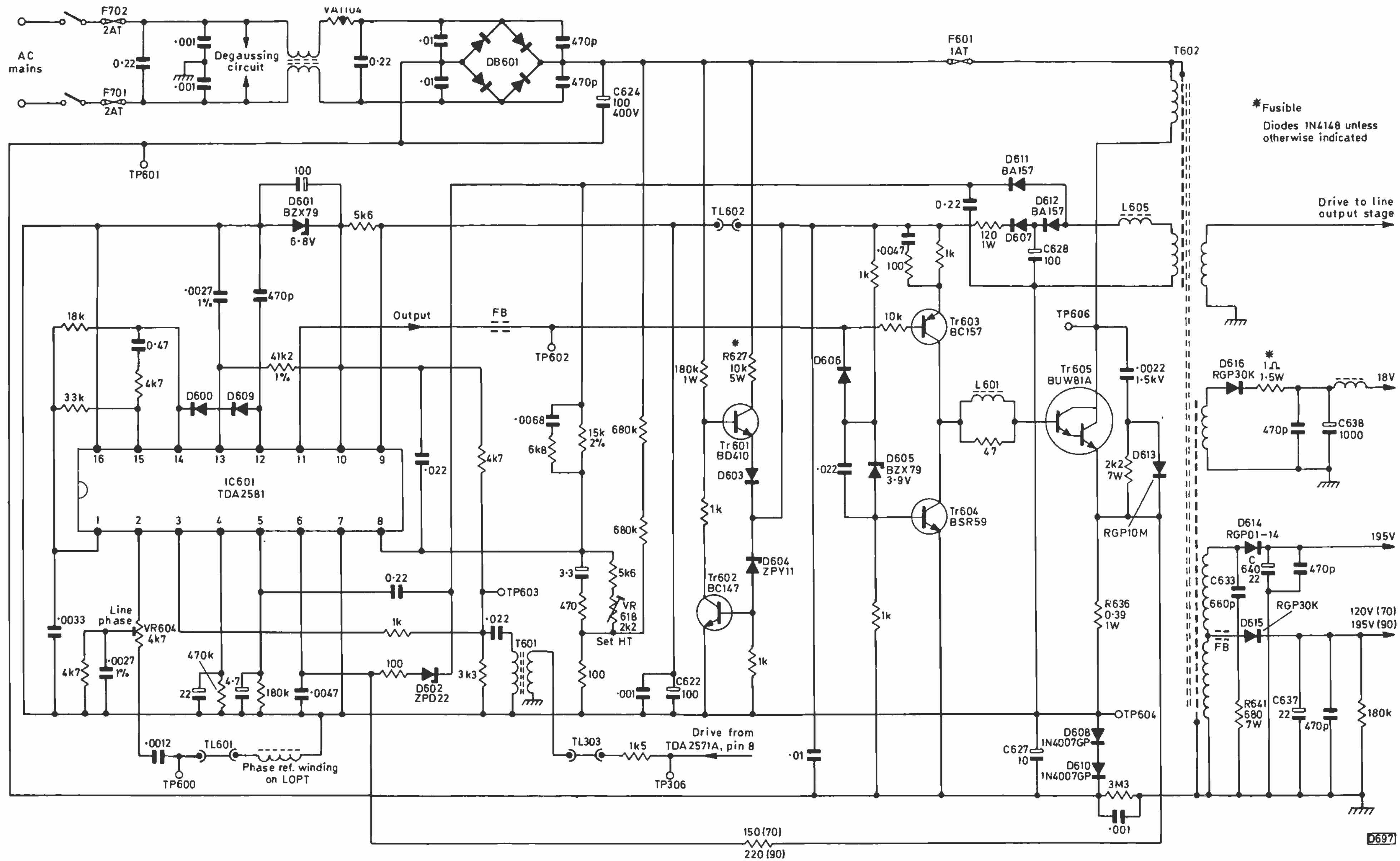


Fig. 1: Circuit of the switch-mode power supply used in the Decca 70, 90 and 110 series chassis. During normal operation IC601 is powered by the supply from D612/C628. At switch on a start-up supply is provided via R627 and Tr601. Once the circuit starts up, D604 and Tr602 switch on and Tr601 switches off. Tr603/4 form a complementary-symmetry driver stage. Tr603 conducts when pin 11 of IC601 goes low. The Darlington chopper transistor Tr605 then turns on while Tr604 turns off. When Tr603 is switched off (IC601 pin 11 high), Tr604 switches on, reverse biasing Tr605 via D608, D610, C627. Excess voltage is monitored by D602 and excess current by R636, in either case operating the trip via pin 6 of the i.c. In later production D613 is type BA159.

Ayr Teletext Adaptor Review

Vivian Capel

OWNERS of non-teletext TV sets can receive the teletext services by fitting one of the several teletext adaptors that have appeared on the market. Some of these have required wiring into the receiver's video circuits, and prices hitherto have been in the region of £200. In addition, a first-class aerial installation has been considered to be essential. All this tends to be rather off putting, and it seems that demand has not been as great as had at first been hoped. There is also the fact that the price differential of new teletext-equipped sets has fallen considerably – to something like £70-80.

Though not exactly tumbling, the prices of adaptors have been coming down. Fitting is easier, aerial installation is less critical, and useful bonuses are available on the latest models. One of these is the Ayr T11, which costs £147·50 including VAT. I had one of these for test over several weeks.

Description

The unit is housed in a $14\frac{1}{2} \times 9\frac{1}{2} \times 3$in. wooden case which is finished in walnut and has a black front panel. The latter has a press on/off switch, indicator lamp and infra-red receiving sensor. The remote control pad measures $5 \times 2\frac{5}{8} \times 1$in. Three leads come from the back of the main unit: a short coaxial lead with line socket to take the aerial feeder plug, a coaxial lead with plug to connect to the set's aerial socket, and a mains lead. Connecting up is simplicity itself therefore, the unit being left permanently between the set and the aerial. The mains lead can be fitted with a plug, but a better idea is to wire it to the receiver's on/off switch so that both are switched on and off together. Otherwise it's easy to forget to switch off the unit, as I did more than once.

There are six presets along the back of the main unit for tuning to individual stations. Setting up involves tuning the receiver to channel 36: when correctly tuned, the legend "P100" appears on the screen. The presets are then adjusted to the local stations, which are selected numerically from the keypad, using the same buttons that select the teletext page numbers. When a station is selected, an inset with the station identification appears in the top left-hand corner of the picture for about four seconds. This inset can be recalled by pressing the button labelled status.

Features

Another button, inscribed CLK/CT, produces the time in 24-hour format as an inset at the right-hand corner. It also clears the screen for newsflash and alarm clock functions. The latter is a rather complicated procedure in which the appropriate page number (160 or 260) is dialled, the time-on key pressed, the required time dialled and the CLK/CT button then pressed. If you've remembered to do all that correctly, the words Alarm Clock will come up superimposed on the picture at the appropriate time. If you become so engrossed with the programme that you need reminding of the time you'll consider this function useful. Cancelling the clock requires the operation of another button, labelled time off.

Some teletext pages are known as rollers, i.e. they make up a series of two or more, each one being displayed until the page number comes round again whereupon the next page appears. The next in the series may come along before you've had an opportunity to digest the previous one. This can be prevented by pressing the hold key, which stops the page rotation until cancelled by pressing the TXT key.

Other features include reveal and double height. Changeover from the TV picture to teletext and back is carried out by two keys at the top right-hand side of the pad. A reset key to clear most of the teletext functions is some way below them.

A useful facility is remote volume control, which is governed by three buttons – increase, reduce and mute. A second operation of the mute button restores the sound.

Regular users of calculators may find the numeric keys confusing, as they run the opposite way, from top to bottom. Much thought has obviously gone into the key layout however, the ones generally most used being the easiest to find. An exception is the hold key – I found myself searching for it on several occasions, and by the time I found it the page had rolled on. A better position would have been between the reset and text keys.

Single-handed operation of the pad is possible by holding it on the fingers and palm, using the thumb to select the keys, but it's a bit too chubby to do this comfortably. It must be pointed at the main unit – the range is in excess of 16ft, the farthest I could check.

Performance

So how well does it perform? I had some trouble initially on two counts. First poor colour and apparent loss of colour sync on teletext, and secondly vision buzz on sound. There's a note in the instruction manual on the first problem, though you could miss it (it consists of a few lines at the end, on an otherwise blank page). A small preset is accessible through a hole in the bottom (see Fig. 1). A fraction of a turn brought the teletext up in full colour. The second problem wasn't so quickly resolved as there's no reference to it in the manual. I tried the adaptor with three different sets, also at a different location, but the trouble persisted. Eventually, after removing the case, I found a slug-tuned coil in the output compartment. Gingerly tuning this whilst keeping a careful watch on the

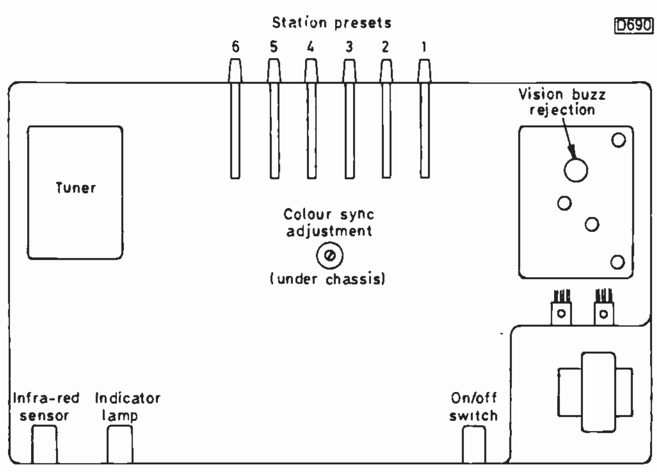


Fig. 1: Basic layout of the Ayr T11 teletext adaptor.

screen enabled me to eliminate the buzz completely.

Whilst the cover was off I took a look at the general construction. The PCB supports some nineteen i.c.s plus a number of transistors and other components. All, including the presets, are identified. In all it's soundly engineered and constructed.

After overcoming the initial problems the adaptor was found to work very well. The colour rendering is good, and the alphanumerical characters are fully rounded and very easy to read. The TV picture itself is to no extent impaired as a result of being passed through an additional tuner – in fact it seemed marginally cleaner.

I tried experimenting with variations in the aerial orientation and discovered that the TV picture would become noticeably degraded before the teletext was seriously corrupted. The effect first of all was of a letter here and there dropping out or being incorrect, the incidence of this increasing as the aerial was progressively moved from its correct alignment. The lesson seems to be that if you have a reasonably clean picture the unit will given intelligible teletext, so there's no reason to be over concerned as to whether the aerial will be adequate.

Remote control aiming is not too critical either. It worked at up to 35° to each side of the true axis, giving a 70° acceptance angle both horizontally and vertically. The only thing to watch is that there's nothing in the way.

The Teletext Service

Whilst giving full marks to the adaptor and its performance, I'm not quite so happy about the teletext services themselves. The potential is considerable but by no means fully utilised. Much information is duplicated and triplicated between the services, particularly news and TV programme information. Yet programme details are sparse. Channel 4 is exemplary in giving a full page synopsis of each programme over the next few days, but the others are lacking in this respect. All radio programmes are compressed on to a single rolling page on BBC-1, with very limited information. Local events appear on certain pages, but again with lack of detail. To know that a certain opera company is visiting a nearby town for example is of limited interest if the works they will perform are not listed. Yet many pages are unused and a considerable amount of trivia occupies others.

Weather, travel, financial and consumer information and the latest news items are generally well covered, though with duplication. There are also interesting features and scientific news. But the range of information could be expanded to embrace many more subjects and with more detail. If the potential was exploited the service would be valuable indeed. As it is, the novelty tends to wear thin after a while. Whether buying a teletext receiver or an adaptor, this is a factor to take into account.

Conclusions

Returning to the Ayr adaptor, I found the remote control facility a considerable asset. My trusty Thorn 2000 still gives needle-sharp, bright pictures with the original tube, but the reset accuracy of the mechanical tuner buttons is not as good as it could be, retuning generally being necessary on changing channels. It was a treat to be able to change channels accurately, without fuss and from the armchair too. The remote volume control was even more appreciated, enabling a major source of annoyance (excessive background music, loud pop tunes in variety programmes, etc.) to be removed. So if you've not already got remote control, this facility will prove a great benefit. In combination with the teletext reception the domestic TV installation will be truly enhanced.

Teletext adaptors are not cheap, though they cost less than they did. This is one of the lowest priced models, costing less than some kits. In view of its performance and construction I'd say it offers excellent value. The unit comes ready to fit and work, except for a mains plug and a PP3 battery for the remote control unit. The battery should last for up to two years with average use.

TEST CASE

249

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.

WHEN it comes to quality and reliability, there's no doubt that Sony sets are amongst the best. Most technicians are probably unfamiliar with the operation of current Sony TV circuits for the simple reason that they don't need to be! On the odd occasion when things do go wrong however, it's unlikely that it will be possible to repair the set in the field: even back at the bench, the service manual will have to be studied closely by way of a quick training course before you delve into the back of the set.

On the last occasion we were called to a Sony TV set under guarantee we found a KV2201UB and a rather distraught lady. She described two faults. First, three narrow shadows were occasionally visible across the picture. Secondly, the brightness had diminished over a few days to the point where she was unable to see any detail in the highlights. The fact that after four months she knew neither the function nor the whereabouts of the brightness and contrast controls is testimony to the picture stability of this Sony set.

We found that the brightness control had little effect on the picture, which seemed to remain at the same low *mean* brightness level regardless of the control's setting. This produced the "soot and whitewash" effect on a contrasty picture. For example, the pattern of the newsreader's dark jacket could not be discerned. Low contrast scenes were reproduced reasonably well however. We did not see any horizontal shadow bars.

Back in the workshop we dismantled the set and found the luminance department in one corner of the μPC1365C decoder chip (see Fig. 1). The voltage at pin 4 sets the operating point of the luminance pedestal clamp, whose reservoir capacitor C311 is connected to pin 3. The luminance signal is clamped to the voltage developed here, and we found that this voltage varied little when the brightness control was adjusted. The sub-brightness potentiometer RV301 didn't do much either, the voltage at pin 4 remaining at around 8V.

Several things determine the voltage at pin 4 – the user and sub-brightness controls, the ABL (auto beam limiter), and the video mute line. Resistance checks revealed that RV301 was operating correctly, while voltage checks showed that the voltage at the slider of the main brightness control varied between 0 and 12V as it should. R451 was checked for value and found to be correct, but there was precious little voltage change at the end that links to R329 (via pin 4 of plug A2). We tried replacing the two electrolytics C311 and C320 before directing our suspicions to the chip. Careful observation however showed that a sudden change in the setting of the brightness control had the desired effect, though for only a fraction of a second before the display reverted to its previous self-set level: this led us away from the chip.

It was almost as though some form of unwanted stabilizing loop was in action, cancelling the effect of the user brightness control. We found the cause of the trouble soon afterwards, and we can let on that the cost of the replacement component amounted to pence rather than pounds. We've since had another failure of the same component in a larger Sony colour set, a KV2207 viewdata model. So what's the offending device? See next month's issue.

ANSWER TO TEST CASE 248
— page 545 last month —

Last month's conundrum concerned a Thorn 1600 chassis with a small broken-up raster, a very hot line output transistor and a cold line driver transistor whose collector feed resistor R142 was also cold. An oscilloscope check at the collector of the line output transistor revealed that it was working under something very close to class A conditions, indicating that the base drive current was inadequate to switch it properly from off to on. This was in turn due to the line driver transistor not saturating on the positive-going half cycles of the output from the line oscillator. This output is a.c. coupled by C117 (0·1μF), and without any other influence the base-emitter junction of the line driver transistor would simply act as a clamp, charging C117 to the peak of the incoming waveform from the line oscillator. The other influence consists of R138 (470kΩ), which provides forward base bias from the h.t. line and should ensure that the driver transistor is driven into saturation. This wasn't happening in our set, because R138 had gone virtually open-circuit.

The ITT CVC20 colour chassis has a similar resistor (R80, 150kΩ) which does the same sort of job in the chopper driver stage. It often goes high in just the same

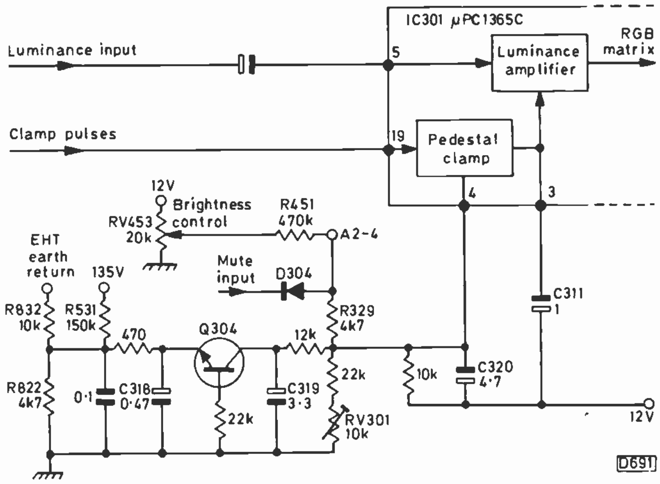


Fig. 1: Luminance signal processing arrangement used in the Sony Model KV2201UB.

way, this time resulting in the destruction of the BU126 chopper transistor. You'll find the same situation in GEC sets that use this type of chopper circuit (with TDA2640 chopper control i.c.).

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PYE 725 CHASSIS

At switch on there's a perfect monochrome picture, but it takes some ten minutes before the colour appears – sometimes gradually and sometimes suddenly. The set then works normally for some six hours, after which the colour gradually fades out. Most of the i.c.s on the decoder panel, also the crystal, have been changed without success. Colour can be made to come and go by heating the crystal, but a replacement gave monochrome only.

The reference oscillator (in IC376) is probably off tune. Disable the colour killer to produce colour (lift one end of R349), then adjust C372 for colour lock.

NATIONAL PANASONIC TC2203

Some hanky-panky seems to be going on in the decoder: sometimes there's normal operation but at other times there's no picture, with incorrect voltage readings around the TDA2522 and TDA2530 i.c.s. The two i.c.s have been replaced, but the problem persists.

This is usually due to intermittent zener diode failure. We suggest you replace D818 and D819 (both type TVSQA106SBV) in the 12V regulator circuit and also change R819 which biases them from 220Ω to 560Ω.

PHILIPS K80 CHASSIS

When a monochrome transmission is being received there's just a green raster present. The only way in which a monochrome picture can be obtained is to override the colour killer, i.e. short the junction of R1066/TS444 to chassis.

This symptom is caused by either slider C on R2256 (white setting) on the c.r.t. base — it's the long metal assembly with four knobs – or, more likely, contacts 2 and 3 on relay RE1496 (also on the tube base) not making. Check by shorting the three connections at the bottom left of the relay base together. To clean, remove the relay (the can slides off) and then apply methylated spirit (don't use anything else). The tension can be adjusted by means of the small screw on the armature. Adjust sliders A and D of R2256 for a slightly "warm" white on a colour transmission with the colour control turned to minimum, then turn off the colour with switch SK3 and adjust sliders B and C for a bluish white (like the picture on a monochrome tube).

TELEFUNKEN 709 CHASSIS

The sound failed, followed shortly after by loss of picture, leaving an unsynchronised raster. There's a low hum from the speaker but the user controls have no effect.

The 24V line is probably missing due to failure of the bridge rectifier GR521 – it often breaks down, blowing the 1·25A fuse Si521. The reservoir capacitor C521 (500μF) has been known to fail on occasion, causing fuse and possibly rectifier failure. The 24V rail can be monitored at test point M521 at the centre rear of the main PCB.

GEC C2110 SERIES

The picture would pulsate then eventually settle – it did this several times during an evening. Now there's no picture or sound, with R601 open.

R601 feeds the 12V zener diode D602, so you've no 12V supply. The first suspect must be D602, for leakage. Replace this, also R601, and check the value of the associated resistor R602. If necessary check the 12V supply reservoir capacitor C401 for leakage – it's on the line oscillator panel. Finally make sure that the h.t. voltage is set correctly – for 190V at the junction of R58/9 or R66/7, depending on set – by means of P701.

SONY KV1320UB

The problem with this set is chronic EW pincushion distortion. I've tried to correct it by adjusting the value of C808, as suggested in the manual, but without success.

This sort of thing in older Sony sets is usually due to dried up electrolytics. In this receiver the voltage developed across the field output stage feed resistor R806 is integrated by C807/8 and then fed to the line output stage via C809/R807. We suggest you check C809 (220μF), also C806 (47μF) which helps to shape the waveform.

THORN TX10 CHASSIS

The colour decoder chip lasts for only a few weeks. When it fails it leaves a bright green raster with flyback lines, then a pulsating raster. The picture and colour are perfect once a new chip has been fitted.

Two possibilities occur to us. The early demise of the TDA3560 i.c. could be due to excessive supply voltage – try replacing the LM340T12 12V regulator IC621. Alternatively flashovers could be responsible: ensure that R668 (3·3MΩ) and C657 (0·068μF) on the tube base panel are present and correct.

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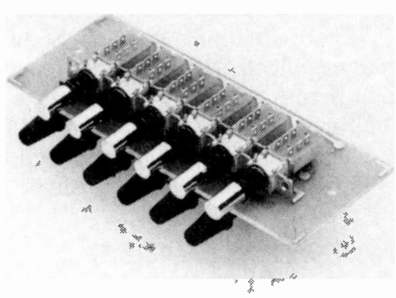

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TBA396	.85	TDA2590	2.25		

DIODES

BA102	.15
BA115	.14
BA154	.07
BB105B	.25
BB105G	.25
BY127	.10
BY133	.15
BY164	.40
BY179	.60
BY210/800	.30
BY223	.86
BY227M	.23
BYX10	.20
BYX55/600	.26
BYX71/600	.78
OA90	.07
1N4001-7	.07
1N5401-8	.12
Y969	.85
BZX61-range	.18
BZY88-range	.11

TRANSISTORS

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
AC127	.22	BC184L	.11	BF115	.30	BU205	1.42
AC128	.22	BC208	.12	BF167	.26	BU206	1.35
AC128K	.30	BC212L	.10	BF184	.28	BU208A	1.40
AC141K	.30	BC213L	.10	BF185	.29	BU208/02	1.70
AC142K	.30	BC214L	.10	BF194/394	.12	BU326A	1.48
AC176	.28	BC237B	.11	BF195	.13	BU407	1.12
AC176K	.30	BC300	.25	BF196	.11	BU500	1.80
AC187K	.30	BC303	.26	BF197	.11	BU526	2.00
AC188K	.33	BC337	.11	BF198	.14	BUW81A	3.20
AD149	.70	BC338	.10	BF241	.15	MJE340	.40
AD161	.42	BC547	.10	BF256LC	.25	MJE3000	1.50
AD162	.42	BC548	.10	BF258	.25	R2008B	1.78
AF126	.38	BC557	.10	BF259	.26	R2010B	1.78
AF127	.36	BC558	.10	BF337	.28	R2540	2.35
AU110	2.10	BD124P	.55	BF338	.30	TIP29C	.45
AU113	1.85	BD131	.33	BF355	.32	TIP30C	.45
BC107B	.14	BD132	.33	BF362	.38	TIP31C	.46
BC108B	.14	BD201	.80	BF458	.30	TIP32C	.47
BC109B	.14	BD202	.70	BF459	.36	TIP33B	.80
BC139	.24	BD203	.70	BFR90	1.60	TIP41C	.48
BC140	.26	BD204	.83	BFT42	.30	TIP42C	.48
BC141	.26	BD222	.50	BFT43	.30	TIP2955	.70
BC142	.23	BD232	.50	BFX85	.30	TIP3055	.55
BC143	.25	BD233	.37	BFY51	.22	TV106/02	1.60
BC147	.09	BD234	.40	BR100	.18	2N3054	.55
BC148	.09	BD235	.32	BR101	.32	2N3055	.50
BC157	.10	BD236	.43	BR103	.55	2N3703	.12
BC158	.11	BD237	.40	BT106	1.15	2N5496	.50
BC159	.11	BD238	.39	BT116	1.30	2SC1172Y	1.85
BC160	.22	BD410	.50	BT106/2	1.58	2SC2029	2.00
BC172	.10	BD434	.50	BT119	2.30	2SC2078	2.00
BC177	.22	BD437	.70	BT120	2.30	2SC2091	1.10
BC182	.10	BD438	.78	BU105/02	1.44	2SC2078	2.20
BC182LB	.11	BD707	1.05	BU126	1.78	2SC1969	2.45
BC183LB	.11	BDX32	1.65	BU204	1.50		

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RBM Z718 18/20/22	22.95
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PHILIPS G9	8.75
PHILIPS G11	13.50
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THORN 1690/1	9.68
THORN 1615	9.75
THORN TX10	12.50
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PYE 725(90)	10.20
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DECCA 2230	8.30
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DECCA 100	8.58
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RBM A823	7.20
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THORN1500-3S	4.25
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DECCA 80	6.30
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PCL84	.81
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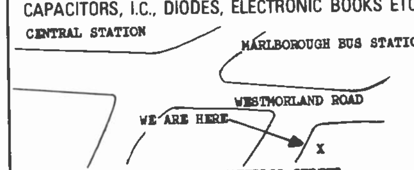

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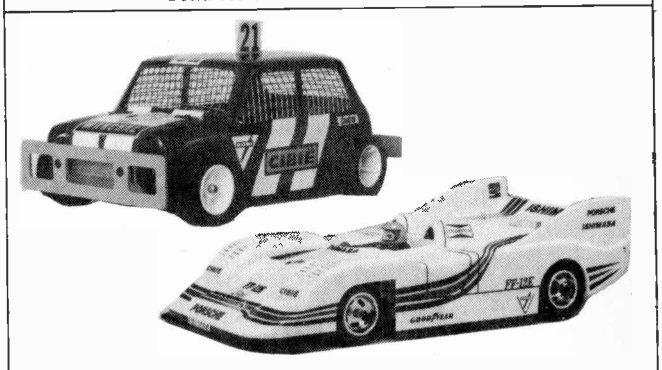

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TBA641BX1	£2.00
TBA651	£1.00
TBA673	£1.00
TBA720A	£1.00
TBA750Q	£1.00
TBA780	£1.50
TBA800	40p
TBA810S	70p
TBA820	70p
TBA890	£1.00
TBA900	£1.20
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.00
TBA990Q	£1.00
TBA1440	£1.00
TMS1000NL	£4.00
TMS1943NL	£2.00
TMS9980	£8.00
TMS9901	£3.00
TMS2716	£3.00
TMS3529	£3.00
TMS4014	£2.50
TX012	£5.00
TMS9902	£3.00
UPD2114C 4K RAM	75p
ULN2216	75p
SN29848	50p
SN74107	£1.00
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50
SN76033	£1.50
SN76115	50p
SN76131	50p
SN76226	£1.00
SN76227	60p
SN76228N	£1.00
SN76530P	60p
SN76532N	50p
SN76544N	£2.00
SN76545	£3.50
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76650	50p
SN76660	40p
SN76620AN	50p
SN76666	£1.00
SN76707N	75p
SN76708N	75p
SN76720	£1.00
ML231	£2.50
ML232R	£1.20
BJT6016	£1.20
ML236E	£1.50
ML237B	£1.50
ML238B	£3.50
BTT822	£1.00
BTT6018- ML237B	£1.50
BTT8124	£1.00
BTT8224	£1.00
UA783P3C	40p
UPC1365C	£1.50

Semiconductors

BT100A/02	30p
BT106	£1.20
BT106 Plastic	50p
BT119	£1.00
BT120	£1.00
BT109	£1.00
BT138/10A	70p
BT146	30p
TCA270	£1.00
TCA270Q	£1.00
TCA940	£1.00
TCA4500A	£1.00
TCA640	£1.00
TCA650	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£1.00
TCA830	£1.00
TCA940	£1.00
TCA4500A	£1.00
TCEP100	£2.25
TDA440Q	£1.00
TDA1003A	£1.00
TDA1010	£1.00
TDA1170	£1.00
TDA1190	£1.00
TDA1327A	£1.00
TDA1412	30p
TDA2010	£1.00
TDA2140	£3.50
TDA2522	£1.00
TDA2530	£1.00
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2575A	£1.00
TDA2590	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£4.60
TDA2653	£1.00
TDA2002	£1.00
TDA2640	80p
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3500	£2.00
TDA3560	£3.50
TDA3571Q	£1.50
TDA3950	£1.50
SN74LS 125AN	30p
SN74LS32	15p
SIL4516	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764	£1.00
SN297728N	50p
RGP30G	10p
MPSA43	10p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	30p
Sanikron Diode SKE262/04	30p

Transistors

A1222	20p
A1223	20p
AC121	20p
AC128	20p
AC151	20p
AC131	20p
AC138	20p
AC152	30p
AC153K	20p
AC142K	20p
AC169	20p
AC176	20p
AC176K	20p
AC178K	20p
AC179	20p
AC186	20p
AC187K	20p
AC188	20p
AC188K	26p
ACY18	20p
ACY21	25p
AD143	50p
AD149	50p
AD161/162	pair 40p
AF139	25p
AF181	£1.00
AF239	25p
AF367	25p
AL102	£1.75
AU113	£2.50
BC161	30p
BD138	30p
BD229	20p
BD437/438 on heat sink	60p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD595	35p
BD596	35p
BD610	40p
BD646	50p
BD676A	30p
BD678	50p
BD681	25p
BD807	20p
BD948	30p
BDX32	£1.25
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF167	20p
BF173	10p
BF178	25p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	20p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	20p
BF244	40p
BF245b	20p
BF256	10p
BF257	20p
BF258	25p
BF259	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF336	30p
BF337	20p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF423	15p
BF448	30p
BF450	20p
BF457	10p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	30p
BF480	50p
BF594	10p
BF597	10p
BF694	10p
BF757	30p
BF758	30p
BF760	30p
BF761	30p
BF858	30p
BF871	30p
BFR79	15p
BFR39	15p
BFR52	7p
BFR61	25p
BFR79	15p
BFR81	15p
BFR87	10p
BFS60	10p
BFT34	15p

BFT43	10p
BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BRC116	40p
BRX43	15p
BRX48X	10p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
FT3055	30p
TCE82	30p
2N930	5p
2N2221	8p
2N2222	8p
2N3055	40p
2N3702	10p
2N3703	10p
2N3705	10p
2N3711	10p
2N3583	50p
2N3904	15p
2N3906	15p
2N4355	10p
2N4442	£1.00
2N4444	£1.00
2N5296	40p
2N5496	75p
2N5983	30p
2N6099	40p
2N6109	40p
2N6130	50p
2N6133	20p
2N6348	20p
2N6399A	20p
2X 2N6099 on heat sink	50p
2SB407 Sanyo TO3	10p
2SB474	30p
2SB566	10p
2SC381	10p
2SC458	50p
2SC515	10p
2SC732	10p
2SC733	10p
2SC828	10p
2SC1030	£1.00
2SC1172	£1.00
2SC1173	10p
2SC1311	20p
2SC1419	20p
2SC1546	20p
2SC1617	£1.00
2SC1684	20p
2SC1725	20p
2SC2068	20p
2SC2073	8p
2SC2122A	£1.00
2SC2229	15p
2SC7350	15p
2SD180 TO3 80v/6A	15p
2SD200	£2.00
2SK30A	10p
2SN30A	8p
FT3055	30p
BC107	10p
BC108	10p
BC109/2N930	5p
BC113	10p
BC114	10p
BC115	10p
BC116	10p
BC117	20p
BC125	10p
BC139	10p
BC141	25p
BC142	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC182L	10p
BC183	10p
BC184	10p
BC187	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC238/338 pair	15p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300 BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC447	10p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
BCX31	25p
BCX34/36 pair	50p
BD116	25p
BD124	50p
BD124 (metal)	£1.20
BD130Y	25p
BD131	30p
BD132	30p
BD135	25p
BD136	30p
BD140	30p
BD176	25p
BD182	£1.00
BD202	60p
BD203/204 pair	£1.25
BD204	60p
BD207	30p
BD221	20p
BD222	30p
BD226	20p
BD233	30p
BD235	30p
BD238	30p
BD239	15p
BD243a	30p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD332	20p
BD416	25p
BD433	25p
BD437	25p

Filters

5-5MHz	15p
6MHz	35p
BFU455K	5p

Thyristors

BT119	£1.00
BT120	£1.00
BRC4443	75p
G11 Thyristor	60p
Decca 80-100	60p
G11 Teletext Decoder Panel Philips	£30.00

Thermistors

VA1104	35p
ITTP7266312	15p
PTH451 AOR	15p
PT37P Fits Pye & Bush	25p
PT34	20p
Degausing Thermistor (fits most sets)	20p
GEC Double Thermistor	75p

3 Pin Blue Thermistor (fits most sets)	20p
BLY49	50p
I.C. Heat Sink	10p
20×TO5 Heat Sink	£1.00
T4040 Clock Display	£1.00
CVC 9 power supply board	£1.50
CVC 20/2 mains panel	£2.00
FED4/1220/4 3 pin ITT 1.	
MFD 4 Amp Mains Filters	50p
ITT Mains Filter .1/250v/	
CVC 20 to 45 chassis	50p
Pots 10 k with Switch	25p
Pots 47 k with Switch	25p
Mullard Surface Wave Filter RW 153P Colour TV Filter	40p
Mullard Surface Wave Filter RW 154 Colour TV Filter	40p
G11 Line Scan P.C.B.	£1.00
ELC 1042 P.C.B.	30p

Crystal T/V

1/V 4.443-619KHz	50p
6 MHX Crystal	50p
8.8867-238KHz Min	50p
Miniature ITT 6meg	75p

I.C. Holders

DIL – DIL

42 Pin × 5	£1.00
28 Pin × 5	80p
16 Pin × 10	70p
24 Pin × 5	75p
14 Pin × 10	70p
18 Pin × 10	80p

DIL – QIL

16 Pin × 10	£1.00

QUIL – QUIL

16 Pin × 10	£1.00

Hepworth Transformers.