OCTOBER 1983

Australia $1.80 New Zealand $2.10 Malaysia $5.50 I.R. £1.15 (inc. VAT)

90p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

VIDEOTAPE POSITION COUNTER-INDICATOR

SERVICING THE SONY KV1340UB

RECORDING 405-LINE VIDEO

VCR CLINIC · TV FAULT FINDING

SATELLITE TVRO SYSTEM

Interested in Television Servicing?

Try a ZED Pack. Effect Repairs at Minimum Cost.

Z1	300 mixed $\frac{1}{4}$ and $\frac{1}{2}$ watt and miniature resistors	£1.95
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Z3	300 mixed capacitors, most types amazing value	£3.95
Z4	100 mixed electrolytics	£2.20
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Z9	100 mixed Miniature Ceramic and Plate caps	£1.50
Z10	25 Assorted Potentiometers	£1.50
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Z12	20 Assorted VDR's and Thermistors	£1.20
Z13	1 lb Mixed Hardware, Nuts, Bolts, Selftappers, "P" clips etc.	£1.20
Z14	100 mixed New and marked transistors, all full spec. includes: PBC108, BC148, BC154, BF274, BC212L, BC238, BC184L and/or Lots of similar types	ONLY £4.95
(Z14A)	200 Transistors as above but including power types like BD131, 2N3055, AC128, BFY50 etc.	£9.95
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Z16	20 IN4148 Gen Purpose Diodes	£1.00
Z17	20 IN4003/10D2	£1.00
Z18	20 Assorted Zeners. 1 watt and 400 mw	£1.50
Z20	10 Assorted switches including: Pushbutton, Slide, Multipole, Miniature etc. Fantastic Value	£1.20
Z21	100 Assorted Silver Mica caps	£2.20
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Z23	20 Assorted TV Knobs including: Push Button, Aluminium and Control types	£1.20
Z24	10 Assorted Valve bases B9A, EHT, etc.	£1.00
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Z27	12 Assorted IC Sockets	£1.00
Z28	20 General Purpose Germanium Diodes	£1.00
Z29	20 Assorted Miniature Tantalum Capacitors. Superb Buy at	£1.20
Z30	40 Miniature Terry clips, ideal for small Tools etc.	£1.00
Z31	5 CTV Tube Bases	£1.00
Z32	10 EY87/DY87 EHT bases	£1.00
Z33	20×PP3 Battery Connectors	£1.00
Z34	6×Miniature "Press to Make" Switches, Red Knob	£1.00
Z35	12 Sub Min S.P.C.O. Slide Switches	£1.00
Z36	12 Min D.P.C.O. Slide Switches	£1.00
Z37	8 Standard 2 Pole 3 Pos Switches	£1.00
Z38	4×HP11 Batt Holders (2×2 Flat type)	4 for £1.00
Z39	3.5mm Jack Sockets, switched, enclosed Type	8 for £1.00
Z40	100 Miniature Reed Switches	£2.30
Z41	100 Subminiature Reed Switches	£4.20
Z42	20 Miniature Reed Switches	£1.00
Z43	12 Subminiature Reed Switches	£1.00
Z44	TO3 Mounting kits (BU208)	8 for 60p
Z45	TO220 Mounting kits (TIP33)	10 for 60p
Z46	TO126 Mounting kits (BD131)	12 for 60p
Z47	Pack of each Mounting kit. All include insulators and washers	£1.50
Z48	3a 1000v Diodes (IN5408 type)	8 for £1.00
Z49	Brushed Aluminium Push Button Knobs, 15mm long × 11mm Diam. Fit standard 3$\frac{1}{2}$mm square shafts	10 for £1.00
Z50	Chrome finish 10mm × 10mm Diam as above	10 for £1.00
Z51	Aluminium Finish. Standard Fitting Slider Knobs. (Decca)	10 for £1.00
Z52	Decca "Bradford" Control Knobs Black and Chrome. $\frac{1}{4}$" Shaft	8 for £1.00
Z53	Tuner P/B Knobs, Black and Chrome. Fit most small Diam Shafts, ITT, THORN, GEC etc.	8 for £1.00
Z54	Spun Aluminium Control Knobs (ITT) $\frac{1}{4}$" Shaft, suitable for most sets with recessed spindles	8 for £1.00
Z55	14 Pin DIL I.C. Sockets	12 for £1.00
Z56	16 Pin Quil I.C. Sockets	12 for £1.00
Z57	16 Pin DIL TO QUIL I.C. Sockets	10 for £1.00
Z58	22 Pin DIL I.C. Sockets	10 for £1.00
Z59	B9A Valve Bases P.C. Type	20 for £1.00
Z60	0.47Ω $\frac{1}{2}$ 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**

ELECTROLYTIC

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**

ZENER DIODES

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

10 of one value	80p
10 of each	£6.60

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

CA270AE £1.00	6 for £5.00
MC1327P £1.00	6 for £5.00
TBA120SB	50p each, 5 for £2.00
TBA820	£1 each, 6 for £5.00
TBA810P £1.00	6 for £5.00
555 Timer 30p	4 for £1.00
TAA661B £1.00	6 for £5.00
SN76660N 50p	5 for £2.00

V.C.R. BATTERY PACKS.

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.**

MISCELLANEOUS

BG100 tripler for CVC45 etc.	only £3.50
Line output transformer for RBM823A	£4.25 each, 3 for £10.00
ITT VC200 4P/B Transistor Tuner. Suitable for some Pye and Philips sets. 3 hole fixing	£2.75 each
Decca Bradford Tuner. 5 button type	£4.00 each, 4 for £12.00
UHF Modulator UHF out Video in. Ch. 36. 2$\frac{1}{2}$"×2"×$\frac{1}{2}$" 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 2$\frac{3}{4}$"×$\frac{1}{4}$". 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
EHT Lead with Anode cap (CTV) suitable for split Diodes sets 1m long	60p each, 3 for £1.50
EHT Cable	30p per metre, 10 metres £2.50
Anti Corona Caps	3 for £1.00
4.433 Mhz CTV Crystals	£1.00 each, 3 for £2.50
75Ω 2$\frac{1}{4}$ 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. 1$\frac{1}{2}$" 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.

THORN SPARES

"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
"950" Can. 100 + 300 + 100 + 16µf	£1.00

THYRISTOR CONVERGENCE POTS

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

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

GEMINI ELECTRONIC COMPONENTS

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

Please quote ZED code where shown. Send cheque* or Postal Order. Add 60p P&P and 15% VAT.
***Schools etc. SEND OFFICIAL ORDER. Allow up to 28 days for delivery. Most orders despatched same day.**
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

October 1983

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

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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").

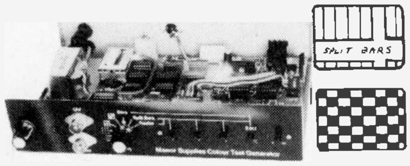
this month

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 19

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

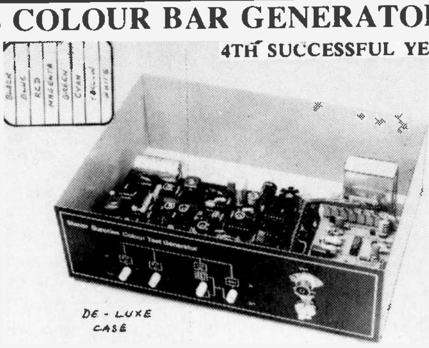
SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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.
MK 4 DE LUXE (MAINS) BUILT & TESTED £78.20 + £1.80 P & P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £6.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.
(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

MK 1 (Texas XMII) Cable remote control **£158.70** p.p. £2.80.
MK 2 (Philips/Mullard) Infra-red remote control **£198.40** p.p. £2.80.
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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BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

TELEVISION MAGAZINE PROJECT PARTS

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

MULLARD TELETEXT DECODER + INTERFACE suitable for use with TX10 **£69.00** p.p. £1.80.
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).
PAL DECODER KIT FOR RGB MONITORS **£31.00** p.p. £1.00.
SPECIAL OFFER TEXAS XMII TELETEXT DECODER NEW & TESTED, AT REDUCED PRICE **£46.00** p.p. £1.60.
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TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£7.80** p.p. £1.20. XMII STAB. POWER SUPPLY **£4.40** p.p. £1.20.
CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 60p. (ALUM CASE **£2.90** DE LUXE CASE **£5.50** p.p. £1.20.) ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
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BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
DECCA "Bradford" T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, SERIES, IF FRAME T.B. **£5.75 each** p.p. £1.40.
DECCA 80, 100 LINE SCAN UNIT salvaged **£11.50 each** p.p. £2.00.
GEC 2040 Convergence panels, Decoder panels **£2.88 each** p.p. £1.80.
GEC 2040 IF PANELS **£3.22** p.p. £1.60.
THORN TX9 PANELS ex factory for small spares. Includes I.C.s & Semiconductors etc. **£5.75** p.p. £2.00.
THORN TX9 PANELS salvaged ex factory for spares incl. LOPT & mains transformers **£11.50** p.p. £2.80.
THORN TX9 PANELS ex factory salvaged complete cond **£23.00** p.p. £2.80.
THORN TX10 T.B. PANELS salvaged ex factory **£17.25** p.p. £3.00.
THORN TX10 SIGNAL BOARDS salvaged ex factory **£17.25** p.p. £2.00.
TX10 type Remote & tuning control panel **£8.50** p.p. £1.50.
THORN 3000 LINE T.B., POWER PCB **£5.75 each** p.p. £1.30.
THORN 8000/8500 IF/DECODER PANELS salvaged **£3.70** p.p. £1.80.
THORN 8000/8500 FRAME T.B. PANELS salvaged/spares **£2.88** p.p. £1.40.
THORN 9000 SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
THORN 9000 IF/DECODER PANELS Salvaged **£5.75** p.p. £1.60.
PHILIPS G8/G9 IF/DECODER Panels for small spares **£1.75** p.p. £1.40.
G8 Decoder panels salvaged £4.25. Panels for spares **£2.00** p.p. £1.40.
G9 Scan Panel. Basic PCB in fibreglass **£16.68** p.p. £1.80.
PYE 713 TIME BASE & POWER PANEL incl. LOPT etc. **£9.20** p.p. £2.80.
VARICAP, U321, U322, ELC 1043/06 ELC 1043/05 **£7.82** p.p. 80p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. MAKERS VARICAP CONTROLS Pye CT200 4PSN **£8.60,** A823 4PSN **£5.50,** Decca 6PSN **£6.70** p.p. 80p.
ITT CVC5 7 position **£7.82** p.p. £1.00.
SPECIAL OFFER ELEVEN POSITION VARICAP CONTROL UNIT UHF/VHF **£2.10** p.p. £1.00.
BUSH "Touch Tune" Varicap Control Z179, Z718 types **£4.40** p.p. 95p.
VARICAP UHF-VHF ELC 2000S **£9.80.** BUSH TYPE **£7.82** p.p. 85p.
VARICAP VHF MULLARD ELC 1042 **£7.95** p.p. 80p.
UHF/625 Tuners, many different types in stock. **DECCA** Bradford 5 position **£2.88** p.p. £1.80 etc.
LOPT TESTER Serivice Dept approved **£17.82** p.p. £1.20.
LOPTS NEW & GUAR. P/P Mono **£1.35p,** Colour **£1.45p,** Bobbins **80p.**

BUSH 161 to 186 (twin panel)	£6.80	**R.B.M.** A823	£5.60
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
FERG., HMV, MARCONI, ULTRA		**R.B.M.** T20, T22 Bobbin	£6.44
950, 1400, 1500, 1580,1590, 1591	£6.80	**DECCA** Bradford (state Mod No)	£10.15
THORN 1600, 1615, 1690, 1691	£10.50	**DECCA** 80, 100	£10.15
GEC 2000 to 2038 series	£7.80	**GEC** 2040	£6.70
GEC series 1 & 2	£9.20	**GEC** 2110 Series	£12.20
INDESIT 20/24EGB	£8.80	**ITT** CVC 5 to 9	£11.30
ITT/KB VC 200, 300	£8.80	**ITT** CVC 20	£11.30
MURPHY 1910 to 2414 series	£6.80	**ITT** CVC25, CVC30 series	£10.15
PHILIPS 170, 210, 300 SERIES	£8.80	**PYE** 691-697	£11.50
PYE, INVICTA, EKCO, FERR.		**PYE** 713, 715, 731 to 741	£7.85
368, 169, 569, 769 series	£8.80	**PYE** 725 (90°)	£10.60
SPECIAL OFFER		**PHILIPS** G8, G9	£10.15
DECCA 20/24, 1700, 2000, 2401	£4.40	**PHILIPS** 570	£7.85
GEC 2114J/Junior Fineline	£3.25	**THORN** 3000/3500 SCAN, EHT	£7.85
PYE 40, 67	£2.00	**THORN** 8000/8500/8800	£14.80
KB VC ELEVEN (003)	£2.00	**THORN** 9000 to 9600	£10.15
KB VC1	£3.25	**THORN** 9800	£21.90

OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.
TRIPLERS Full range available. Mono & Colour.
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TRANSDUCTORS suitable for G8, A823, Bradford etc. **£1.72** p.p. 60p.
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LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS

MANOR SUPPLIES

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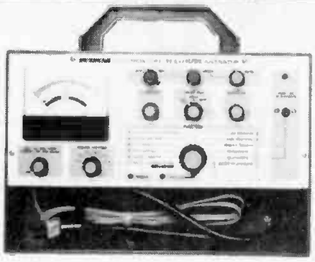

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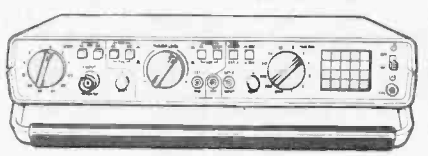

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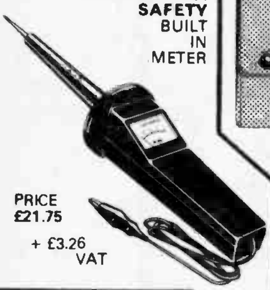

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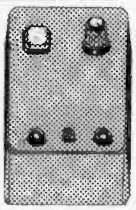

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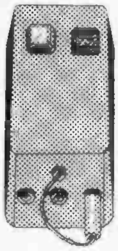

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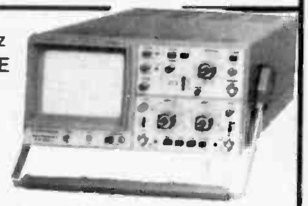

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Green	14
Yellow	14
Amber	22

T1 TYPE 3mm

Red	12
Green	14
Yellow	14

FLASHING

COX21	62
COX22 Red Only	66

3 COLOUR

Red/Green/Yellow V518P 76

PANEL CLIPS

3mm	4
5mm	4

CRYSTALS & FILTERS

6Mhz	74
5.5Mhz	74
4.3Mhz	1.30
8.8Mhz	1.30
10.692Mhz	6.00

NEW VALVES

30FL2	1.70	EF183	99	PCF200	1.35	PL95	1.00
DY802	98	EF184	1.09	PCF800	1.38	PL504	1.65
DY86/7	66	EH90	1.02	PCF801	1.13	PL508	2.90
ECC81	1.08	EL34	3.50	PCF802	1.12	PL509/19	5.30
ECC82	98	EL84	1.05	PCF805	1.80	PY88	81
ECC83	1.07	EL90	82	PCF806	1.30	PY500A	2.30
ECC84	80	EY86/7	68	PCF808	1.63	PY800/1	69
ECC85	98	EY500A	1.50	PCH200	1.45	UCH81	2.25
ECC88	1.35	EZ80/1	56	PCL82	1.20	UCL83	1.82
ECF80	80	GY501	1.45	PCL84	1.20	UY85	1.35
ECF82	88	GZ34	3.50	PCL86	92	PL802T	4.00
ECH81	1.60	KT66	8.50	PCL805	1.09	40KD6	5.30
ECH84	1.66	KT88	12.00	PD500	2.93	21LU8	3.00
ECL80	84	PC92	3.00	PFL200	1.86	17DW4A	1.60
ECL82	1.30	PC97	1.65	PL36	1.87	3AT2B	5.00
ECL86	1.99	PCC85	85	PL81	94	12BY7A	3.75
EF80	95	PCC805	1.40	PL83	1.43		
EF86	1.96	PCF80	1.00	PL84	84		

LINE OUTPUT TRANS.

R.B.M. T20A	13.95
R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	17.50
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 697 (Printed)	14.50
PYE 713/731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80/100	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	9.45
GEC 2040	9.50
GEC 2200	6.65
ITT CVC 1-9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
THORN 3000 EHT	9.95
THORN 3000 SCAN	7.95
THORN 8000	11.33
THORN 8500	11.33
THDRN 9000	10.65
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN 9800	19.90
THORN TX10	12.50
THORN 1615	9.75
PHILIPS KT3	8.15
RANK BUSHRANGER	10.00

WIREWOUND RESISTORS*

4W 1R-10K	22p
7W 1R-22K	23p
11W 1R-22K	25p
17W 1R-22K	28p

(Preferred values)*

CARBON RESISTORS*

¼W 3R3-8M2	20
½W 3R3-8M2	20
1W 10R-10M	36
2W 10R-10M	62

Sold in packs of 10 per type

SOLDERING EQUIPMENT

WELLER Iron 15W	4.31
WELLER Iron 25W	4.31
WELLER Gun	12.00
Pair Tips Gun	42
3/16" Tips iron	51
ANTEX 15W Iron	5.20
ANTEX 25W Iron	5.20
Iron Stands	2.20
ANTEX bits	65
ANTEX elements	2.20
Solder Sucker	6.50
Solda Mop	72
DIY Solder	50
500G Solder	7.00

REBUILT COLOUR TUBES

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

17" A44/271X	30.00
18" A47/342X (Stnd Focus)	30.00
18" A47/343X (Low Focus)	30.00
20" A51/110X	30.00
19" A49/120X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
25" A63/200X	34.00
26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (410X) 110°	36.00
26" A66/140X (410X) 110°	36.00
20" A51/161X	55.00
22" A56/510X	50.00
A56 540X	89.00
A66 540X	75.00
A66 500X	54.00

P.I.L. TUBES — we can rebuild your own glass — please ring for quotes.

NEW MONO TUBES

MULL. A31/510 110° 12"	18.50
MULL. A34/510 110° 14"	20.00
A50/120WR 110° 20"	15.00
A61/120WR 110° 24"	17.50
VEGA 12" 90° (Jap Types)	15.00
CME1520 (15" Mono)	15.00

MULLARD COLOUREX

18" A47/343X	59.00
19" A49/120X	53.00
20" A51/110X	53.00
22" A56/120X	43.00
25" A63/200X	55.00
26" A66/120X	57.00
26" A67/120X	58.00
22" A56/500X	58.00
A51 570X	63.00
A56 510	58.00
A66 510	92.00

1 year warranty Option on 4 years Quotes on delivery and glass charges

SPECIFIC COMPONENTS

PHILIPS

G8 Knobs Sm/Lg	50
G11 Final Anode Lead	1.50
E.W. Correction Coil	1.95
Transductor 90°	2.60
RGB 10G Diodes	50
Switch K30	2.60
Focus Unit G11	5.80
or 39 3W resist.	60

THORN

1591 Speakers Sm	4.10
Lg	4.50
1500 Controls	
Frame 390K/line 470K Contrast 1K5 each	32
Focus Control Unit	1.83
Thorn/GEC	
8500 Mains Filter Choke	6.50
8500 Focus Unit	4.75
TX10 Focus Controls	9.00
Video Lamps	1.30
Video Lamps with holder	3.30

DECCA

Bridge Trans.	97
Width Control(30)	50
3R9 Modulohm	60
2M2 Height Control	25

RR1

T.20 Focus Control	2.20

PYE

731 Mains Filter Choke	6.50

NEW PRODUCTS

Ayr Teletext Adaptor	127.00
AVO meters MkV	109.00
Mod. 8 (Factory recon.)	97.00
Video Leads (Direct Recording)	4.25
Electrical Circuit Testers	1.50
Battery Chargers Universal	6.75
L5 7" × 3⅜" Speaker 15R	4.25
5 pin-5 pin Audio leads	95

NEW PRODUCTS

Fluorescent Torch	6.50
Travel Plugs	3.50
Philips Clock Radio	21.39

Please order from latest copy of Television magazine to avoid missing price increases.

P. V. TUBES

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	2.70
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
THORN 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 (Also Slim GEC)	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

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 Wlag)
39pF 200pF **each**
150pF 220pF **30p**
180pF 250pF

CERAMIC CAPACITORS

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

SLIDER POTENT

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

SKELETON PRE-SET POTS

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

CONVERGENCE POTS

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

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	29
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

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

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

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

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)	7.00
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

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 Book Type – Any Format	80
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

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

P.V. MICROCOMPUTER CENTRE

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

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Vic 20 · Commodore 64 · Atari 800 · Lynx
Sharp · Oric · Dragon
We are also authorised dealers for the BBC Micro and accessories

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
CM7018 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 DC W/B	15.52
CM6038 UHF/VHF 625 Pattern Gen.*	50.00
CM6052 UHF/VHF PAL Colour Bar Gen.*	190.00

* While stocks last

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
THORN 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
DECCA 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

RECTIFIER STICKS

TV11	74	TV18	90
TV13	79	TV20	1.20

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BB105G	30
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BY127	11
BY133	15
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TELEVISION

Reality breaking through

Once again we seem to have reached a point of decision, or rather several decisions, in the world of TV. First cable. Thirty seven bids were put in by individual firms and consortia to build and operate the twelve pilot multi-channel cable TV systems authorised by the government. The approved schemes are to be given the go ahead next month. So the great cable bonanza has started, or has it? In fact it seems to most observers to be a very considerable gamble and certainly the pay off, if it comes, won't be for several years. The whole crazy notion of cabling half the UK in a matter of months, thereby creating jobs and massive investment in sunrise industries, as envisaged by the Cabinet Office's Information Technology Advisory Panel, seems to have fallen by the wayside long ago. Some of those who have applied for the twelve franchises were those to be expected – firms with experience already in this field, such as Rediffusion, Visionhire and Thorn EMI. They presumably feel obliged to see whether they can make a go of a wider range service than the present ones. Some other applicants look like local consortia with possibly more enthusiasm than experience of such operations.

It will be interesting to see how it all turns out. Meanwhile one must not overlook the existing realities. We already have four channels which, in comparison with services abroad, provide an excellent service for which we have to pay a licence fee anyway. In addition, the public has already invested heavily in VCRs, which provide freedom for programme time shifting and selection from a now very wide range of prerecorded material. Does the public, with the facilities already available, feel any sense of lack of choice? We all know the old joke about sets being permanently switched to one channel. Remote control may have encouraged people to change channel more often, but this seems to occur mainly during the commercials, much to the chagrin of the advertisers! The idea of people carefully selecting from a dozen or so channels and planning their evening's/week's TV choice seems altogether rather far fetched. If people are reluctant to switch between four channels, why should they suddenly want to switch between twenty? Increase the range of choice by all means, but this is something people are going to be asked to pay quite a bit for.

Something even more imminent is the appearance in the UK of the second video disc system, RCA's CED (capacitive electronic disc), despite the fact that Philips' technically excellent LaserVision system has hardly been a runaway commercial success to date. Hitachi CED player model numbers and suggested prices have already been announced. The top of the range VIP201P features stereo sound, pause and infra-red remote control at £259·95, some £40 less than the cheapest LaserVision player. The basic, mono sound only, Model VIP101P carries a suggested price of £199·95. There's also an in between model, the VIP202P, with stereo sound but not the other frills.

These are certainly competitive prices, and if the quality is as good as we have every reason to believe the package is attractive. The problem really is that the VCR has got itself well and truly established first, and in the present economic climate one can't see many households opting for both. The VCR will remain the first choice because it's more flexible and there's already a massive range of software. It also strikes this observer that the cassette is a lot more compact than the disc: if discs are hired rather than bought outright, as seems likely, it will be much easier to tote a cassette or two around. The failure of LaserVision to make significant headway casts a doubt over the prospects for CED, though given a massive promotion campaign and competitive pricing it could have a reasonable chance.

The fact is however that the fellows at JVC always seem to be one step ahead. The recently introduced two-speed machines, giving up to eight hours' playing time, not only trump one of the advantages of the V2000 system but also, in making more economic use of tape, counter the cost benefit that discs might claim. True there's some loss of quality, but viewers have never had a reputation for regarding the quality of the displayed image as being a matter of great importance.

As a background to all this we have the present rumblings in the BBC about the cost of providing a satellite TV service. This won't come cheaply, any more than cable, but the big problem is initial funding. The IBA can afford to sit back and look on wryly as the BBC has to confront this problem first. The fact is that the BBC would be most unwise to jeopardize its financial arrangements and independence in the attempt to get a satellite system going. The government should acknowledge this and, if it considers a satellite system to be important on industrial/technical grounds, as indeed it is, should be prepared to give the BBC such guarantees as it may require.

The one doubt is whether satellite TV could end up being some expensive white elephant like Concorde. In this case probably not. A satellite service is inherently more efficient than a terrestrial one and does genuinely seem to point the way forward. This is a development one feels worthy of encouragement.

HELD OVER

Due to shortage of space in this issue, Part 2 of our Quick Checks Q and A series, dealing with Pye colour chassis, has had to be held over till next month.

Recording 405-line Signals

Gareth Foster

With the close down of the 405-line service brought forward by two years, enthusiasts with vintage receivers may be wondering how they will be able to demonstrate them. Test card generators can easily be constructed these days using logic circuitry, but they are no substitute for moving pictures.

What's not so well known is that most VCRs will handle 405-line video easily. On record, the head drum is locked to the incoming field sync pulses, which are simultaneously recorded as a control track, while the capstan is driven at a constant speed. On playback either the drum or the capstan is controlled by the off-tape control pulses. Thus any TV standard with a 50Hz field frequency should enable the servos to lock (the US 60Hz standard confuses them however!).

Recording

We can't feed 405-line signals in via the aerial socket of course, even when the machine has a v.h.f. tuner, since the video modulation is positive-going instead of negative-going as used with the 625-line system I. One could convert the signals to a negative-going v.h.f. format, and I suggest that any reader wishing to pursue this course constructs a v.h.f. version of Roger Bunney's system L-I converter (see February 1983 issue).

The technique I use is to extract baseband video from a receiver and feed it into the VCR's video socket. Before attempting to do this, the 405-line receiver *must* be run off an isolating transformer if it is of the live chassis variety (as virtually all are). The method of extracting the video will vary from set to set, but generally a large-amplitude, inverted video signal is used to drive the c.r.t.'s cathode. This can be potted down and fed via an inverting buffer amplifier to obtain a 1V, 75Ω output.

I use my Murphy V849 DX receiver. In this, the c.r.t. cathode is driven from the cathode of the triode section of a PCF80 — see Fig. 1. I inserted a 120Ω resistor between the earthy end of the triode's load resistor 2R35 and chassis to obtain a 1V inverted video signal at normal contrast settings (note that in early versions of these sets 2R35 was 15kΩ, so the value of the added resistor will have to be adjusted accordingly). The 120Ω resistor is mounted on the same tagboard as 2R35. The buffer amplifier shown in Fig. 2 was built on a piece of Veroboard and fixed under the top chassis member. It should be earthed at one point only, namely at the earthy end of the 120Ω resistor, otherwise there will be hum problems on the output.

The 12V supply for the amplifier was obtained from the

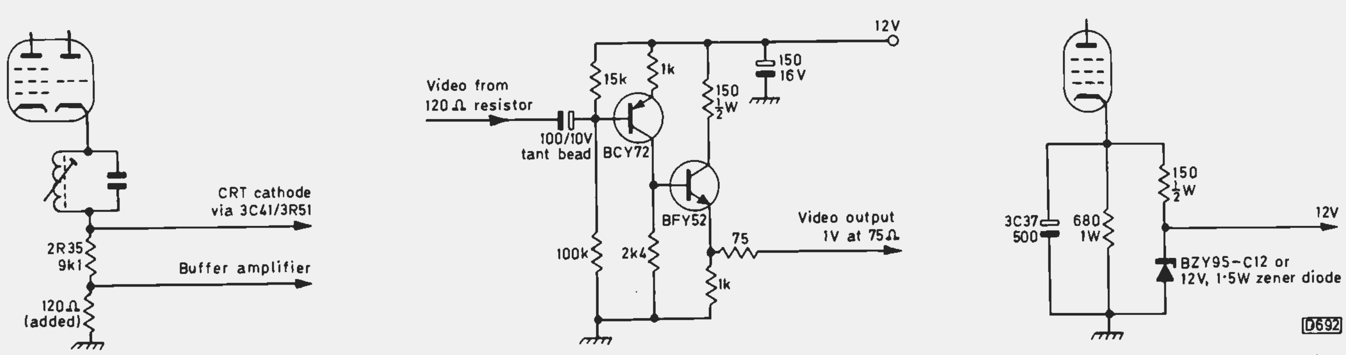
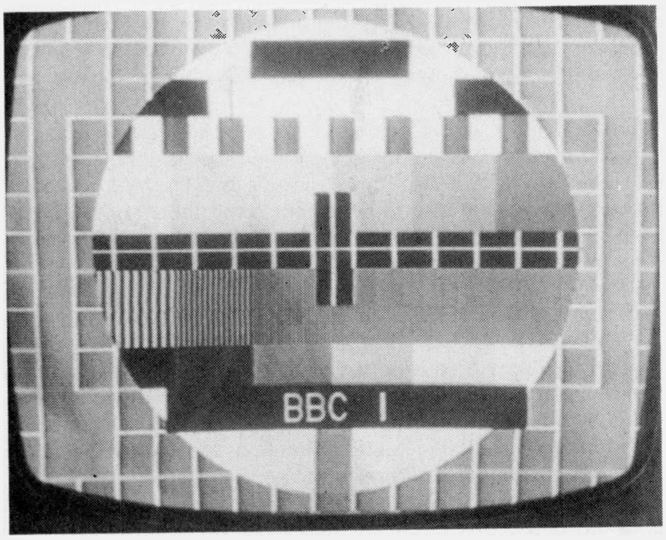
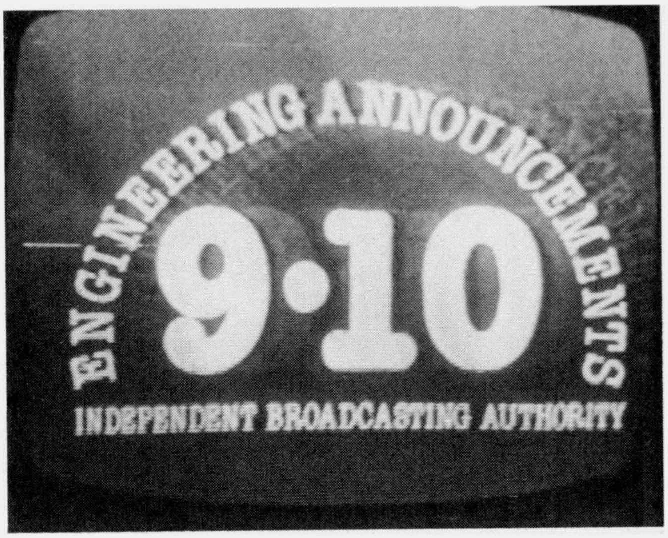


Fig. 1 (left): Extracting a suitable video signal from the Murphy V849. Fig. 2 (centre): Inverting buffer amplifier circuit. Fig. 3 (right): Obtaining a 12V supply from the cathode of the field output pentode.



Playback of a 405-line signal recorded on VHS tape. The subjective definition is better than with off-tape 625!



Still frame playback of a 405-line signal on VHS tape, showing the effect of drop-outs.

cathode of the field output valve by replacing its 270Ω, 2W bias resistor with the circuit shown in Fig. 3.

I haven't bothered to extract an audio signal, finding it easier to take this from the audio output socket of a 625-line portable receiver tuned to the same network. A suitable signal should be available across the set's volume control however.

Playback

Having recorded our 405-line video, we next have the problem of playing it back. Those wishing to demonstrate vintage TV receivers will need to use a modulator to the system A standard.

The u.h.f. output signal from the VCR will be to the system I standard but with 405-line scanning. Many dual-standard receivers have their timebase and i.f. switching on separate panels, and it's fairly easy to separate the switching so that only the timebase is switched to 405. I use this technique with the V849 and the photos show the excellent off-tape results. As a 405-line signal requires a bandwidth of only 3MHz, the VCR's reduced bandwidth is not so detrimental as with a 625-line signal — the subjective definition with off-tape 405 is actually better than with off-tape 625.

Drop-outs

There is one problem however. The drop-out compensator consists of a 64μsec (one line at 625) delay line arranged so that if a drop-out is detected the information from the previous line is switched in to replace it. Obviously if a line is 98μsec long, as with 405, the wrong information will replace drop-outs. This is clearly shown in the second picture, where a drop-out to the left and right of the I has been replaced with information from the 1 and 0 on the previous line. Apologies for the ghosting on the picture — Band III is like that in this area.

Tiny Tim's Long Hot Summer

Les Lawry-Johns

It was the month of July and Tim's magic thing said 30. He tried to work this out, at something like 90° in the shade, and felt even hotter. As he sat there behind his little counter, trying to avoid doing anything that might raise his temperature even higher, a young couple came in – carrying a GEC colour set.

The GEC C2233H

Tim noted the set (Model C2233H) and noted the young man. His eyes then became glued to the girl. A sort of Farah Fawcett lookalike, wearing high heeled sandles and the shortest of short skirts. Her eyes were sparkling and she smiled, showing her perfectly white teeth, as she became aware of Tim's rude scrutiny.

Tim smiled back and revealed his yellow tusks. The girl's smile froze and she shivered. So tim turned his mind to other things.

The set was one of those fitted with the 20AX tube. The ones in which the BU126 chopper transistor gets ruined when the 150kΩ chopper driver bias resistor goes high in value. "Is it dead?" he asked the young man. "Oh no" was the disappointing answer, "it's just that there's a blank white screen."

Tim whipped the back off and surveyed the unfamiliar RGB output section on the upper left side. "Complementary-symmetry output stages" he muttered, as though he knew what he was talking about. The tube's cathode voltages were very low, but there was full h.t. at the emitters of the top transistors, so Tim's tiny mind thought that these transistors were not being turned on. He looked at the circuit and noted that R281 (Mk.II decoder) is common to all three stages as part of the bias network. Snip, snip he went with his little cutters, and slapped the meter across the prostrate resistor. Infinity – bullseye! He looked and looked hard but couldn't seem to find a robust 82kΩ resistor, so he put in two 47kΩ ones in series.

The picture was a joy to behold, and he sneaked a glance at Miss Fawcett. Her previous look of disdain had been replaced by a look of admiration and the white teeth glistened at him once more. "How did you do that?" she gurgled. "It just comes natural to me" said Tim modestly.

"It's no good getting old if you don't get crafty" said the young man. "I suppose it's dead easy when you do the same thing day in and day out year after year."

"Why don't you try it if it's so easy?" growled Tim.

"I believe in working for a living" said the young man. "How much do we owe you for that little job?"

"Make it a tenner since you've been so nice to me" replied Tim.

"WHAT!" bawled the girl. "The last place that repaired the set worked on it for a week and charged us only twenty." She now looked ugly instead of alluring, and Tiny Tim felt sad. "Surely it's worth paying for the job to be done on the spot?" he protested.

The young man produced a wad of notes. "Shall I pay him or not?" he asked the girl. Clearly she was the boss, and Tim was glad she didn't belong to him after all. "Pay him and put the set in the car" she ordered. "Let's get out of here." She was still saying something as they carried the set out, and Tim was shocked by the language. Tinker Bell didn't swear. Only when it slipped out. She was lovely and kind to everyone, or nearly everyone, and was pretty with it. Tim was glad he had her to look after him and cuddle him on cold nights. These hot nights were a bit of a curse.

On Heat

"Funny thing heat", mused Tim. People go out in the sun with nothing on and get all burnt up. If they're white. He remembered when he was all brown, sailing his little boat in the bay of Alex, and the girls in No. 17 calling him blondy. Oh well, so much for people. What about sets?

CVC9s blowing their mains filter capacitors all over the place. What a clever boy he was keeping plenty in stock. Tim wondered about his. He always orders lots of bits and pieces so that he can do jobs quickly, and it costs him lots of money. He wished he was clever so that he could earn more, but that requires thought and energy. Thinking is difficult if it's to do any good. As to energy, that was something Tim only thought about. Doing things puffed him out.

The Thorn 9000

A nice lady then came in with the aid of a walking stick. Would Tim get the TV out of the car? She would call back later to see how he was getting on. So Tim puffed his way into the shop carrying the Thorn 9000 and put it on the bench. The lady went and Tim had to stop thinking his soppy thoughts and concentrate.

When the set was switched on the e.h.t. built up then collapsed, built up again them collapsed. Tim concentrated hard. "Something is making it do that" he thought. He noticed some smoke coming from the tuner panel. "Ah ha!" It was the 12kΩ h.t. feed resistor to the tuning voltage stabiliser. It looked cooked and read only 5kΩ. "Bloody carbon resistors" thought Tim crossly. He put in a 12kΩ wirewound that he kept for the Pye hybrids and switched on confidently. The e.h.t. built up and collapsed, built up and collapsed. A closer inspection was called for.

He checked the fuses and found F4 open-circuit. This is the 1·6A fuse in the 24V line, nothing to do with the cooked resistor. He measured the current across the fuseholder and found it was not excessive. So he checked all the diodes in the syclops circuit with the set turned up and the chassis withdrawn. None were shorted and none were open-circuit. There were no dry-joints. He put the set the right way up and disconnected the tripler, which was a new one he'd fitted a few months earlier. The set still huffed and puffed.

"Bloody thick-film unit" thought Tim. Then he caught sight of a diode he'd not checked. The SKE one in series with the syclops transistor VT701 – bolted to the side of the heatsink. Dead short. Tim was glad he kept lots of them in stock. He fitted a new one and a 1·6A fuse and the set now worked perfectly. Tim wondered about this but found it very trying, so he stopped thinking about it.

When the nice lady came back Tim was upstairs laying on the bed because he was puffed out. When he heard Tinker Bell talking to her however he came down and put the set back in the car. This puffed him out again. "I could have done that instead of you straining yourself" grumbled Tinker Bell. Tim thought this was ever so nice of her and gave her a hug before going upstairs for some more rest. He'd hardly laid his little body on the bed when someone else came in, so down he went again, now convinced that all this running up and down stairs was what was puffing him out rather than carrying the sets about.

Desaturation

"My husband and I put the set in the back of the car before he went to work. I can't possibly get it out. Perhaps you can do it?"

"Certainly madam." Tim went out to the car on the forecourt and looked at the set in the back. It was an ITT CVC2. You know, one of the heavy ones. Tim put one hand under the near end and stretched his little arm over to the far end and heaved. Nothing happened. So he heaved a big heave and managed to get the set out with the far end resting on the seat. He was now able to get at it from the front, which was far more comfortable, and soon had the beast on the bench. Tim took the lady's address so that he could deliver the set when it was done and save them lugging the thing in and out etc.

"If you don't get it done by the time you close, could you let us have a spare colour set so we won't miss Coronation Street tonight?"

"All right" said Tim. "What's wrong with this one?"

"The colour is there some of the time, but when it is there's a strip down the left side without the proper colour."

"Oh dear! I mean right ho," said Tim. "We'll get it back to you as soon as possible." Tim felt dubious. He'd repaired many of these fine sets but had never had to do battle with the decoder.

The lady departed and Tim started – to sweat. Just in case you don't know, the CVC1 and CVC2 were wired sets, with no pretty printed panels and numbers to identify everything, i.e. it ain't easy.

First of all Tim found a layout of the decoder with the items marked, then he turned to the circuit diagram which seemed a bit complicated to his little mind. With the set switched on the colour seemed to be in order except for a desaturated strip down the left-hand side, as the lady had said. He checked the burst signal, which was correct, and the tuning of the ident coils Ld24/5. Altering the position of the core brought a green band down the right side before the colour was lost, so Tim returned it to its original setting. He then tried setting up the reference oscillator, which was already correctly set up. Then he galloped around every adjustment there was, all to no avail. So he checked the transistors and found one that had a rather high base-emitter reading, higher that is than the base-collector, but not much. It was the first burst amplifier transistor TXd13, a BC118. Tim didn't have one of these, so he tried a BC108 which had equal readings.

There was now no colour at all. So he replaced the BC118 and there was still no colour. This made Tim angry, so he shorted out the colour killer and the colour appeared as bands. He set the oscillator and the colour was good, except for the strip down the left-hand side, and Tim started thinking funny things.

One funny thing was the absence of a degaussing buzz when the set was switched on. So he checked the VA8650 posistor and it came to pieces in his hand. He fitted a new one and switched on. The degaussing coils now hummed (the tune sounded like Bang Bang Lulu) and the picture slowly appeared as the valves warmed up. The desaturated band on the left-hand side was still there.

The combination of the July heat (still over 90) and the frustration made Tim somewhat delirious as he vainly tried to mop up the sweat. "Would you like a cold drink?" asked Tinker Bell. "A hot coffee" said Tim, hoping that the hot drink would finish him off and end the suffering.

"Don't forget you put that funny transistor back in" said Tinker Bell. But Tim wasn't listening (he rarely did) because he'd caught sight of some small electrolytics of a type he hated. He disconnected each in turn and tested them. All were in order so in the end he refitted the BC108 in place of the BC118 and the band disappeared.

"I've done it!" he croaked. He removed the short across the colour killer and the colour remained. Until he changed channels, when the colour was lost, even when he reverted to the initial channel. He cheated. He replaced the short across the killer and left it there. He delivered the set and told the lady to turn down the colour control when watching monochrome.

"We always have done" said the lady.

Tim didn't feel so guilty as he left the house, wiping the sweat from his little brow.

AC128	39p	BD244	85p	MJE340	50p
AC131	40p	BD386	68p	MJE520	65p
AC138	40p	BD592	1.20	MJE2955	1.40
AC141K	39p	BD589	1.20	MJE3055	1.50
AC142K	38p	BD677G	1.35	NKT241	8p
AC153	32p	BF137	20p	NKT276	20p
AD161	32p	BF153	20p	NKT453	1.65
AD162	32p	BF154	25p	PN107	7p
AD263	1.05	BF167	24p	R1038	80p
AF139	38p	BF173	29p	R1039	80p
AF239	41p	BF181	30p	R2008B	1.80
AU113	2.10	BF194	16p	R2010B	1.10
BC107	15p	BF197	15p	R2030	70p
BC108	15p	BF198	19p	R2265	1.30
BC109	15p	BF199	15p	R2305	80p
BC115	16p	BF223	18p	R2322	50p
BC117	21p	BF238	20p	R2322	50p
BC125	26p	BF240	9p	R2443	25p
BC142	30p	BF241	21p	RCA16446	30p
BC143	31p	BF255	10p	RCA16599	1.25
BC147	12p	BF256S	20p	RCA16600	1.40
BC148	12p	BF257	28p	RCA16799	1.13
BC153	16p	BF259	28p	RCA16800	1.42
BC154	16p	BF271	25p	RCA16802	1.38
BC157	12p	BF274	11p	S1299	2.25
BC158	12p	BF337	29p	S2800D	1.25
BC159	15p	BF362	50p	S6080A/B	3.50
BC171	9p	BF391	21p	T6050V	1.30
BC174B	23p	BF394	16p	T6052V	1.30
BC182LB	12p	BF422	47p	T6053V	1.30
BC184LC	12p	BF450	43p	T9003V	1.25
BC208	9p	BF459	40p	T9010V	1.45
BC213L	12p	BF461	59p	T9053V	1.30
BC237	12p	BF596	15p	T9054V	1.00
BC238	8p	BF694	16p	T9039V	1.10
BC250A	15p	BFR81	29p	TIP31	35p
BC251	8p	BFR87	25p	TIP41A	45p
BC307	10p	BFT42	30p	ZTX550	30p
BC308	8p	BFT43	30p	2N3703	10p
BC309	14p	BFX38	40p	2N3904	24p
BC337	17p	BFY51	34p	2SA329	15p
BC347	8p	BFY52	34p	2SA473	10p
BC394	8p	BRC116	1.50	2SA564	17p
BC454	8p	BRC1693	1.43	2SB187	48p
BC455	8p	BU105	1.00	2SC109A	19p
BC456	10p	BU126	1.10	2SC388A	20p
BC460-6	40p	BU207	1.05	2SC460	37p
BC463	22p	BU208A	1.15	2SC394A	18p
BC546	8p	BU326A	1.30	2SC495R	63p
BC549	8p	C1172B	9p	2SC734	48p
BC559	8p	C1129	9p	2SC784	51p
BC595	8p	E5386	14p	2SC785R	12p
BCX33	22p	E9005	25p	2SC1162	48p
BCX34	11p	ME0404	8p	2SC1957	79p
BD131	30p	ME0412	8p	2SC2570	27p
BD222	48p	ME6002	8p		
BD232	50p	MJE182	47p		

300 Mixed Resistors	1.50
300 Mixed Capacitors	1.50
150 Mixed Electrolytics	2.00
100 W/W Resistors	1.00
20 Mixed Conv Pots	1.00
40 Mixed Pots	1.50
20 Mixed Sliders	1.00
40 Mixed Presets	60p
20 Mixed VDR & Thermistors	1.00
20 Mixed Ferrite Cores	50p
100 Mixed Ceramic Discs	1.00
20 Mixed Valve Bases	1.00

10 Spark Gaps	1.00
10–16 pin Quil IC Socket	90p
20 Assorted TV Knobs	1.00
10–16 pin Quil to Dil IC Socket	90p
100 Mixed Diodes	1.00
50 Mixed Mica Washers	65p
300 Mixed Resistors & Capacitors	1.50
10–16 pin Dil to Dil IC Socket	1.00
50 Electrolytics & 50 Capacitors	1.00
50 Mixed Poly Capacitors	1.00
30 Mixed Neons & Bulbs	1.00

INTEGRATED CIRCUITS

BRC1330	1.40	TBA530	1.26
BRC3064	1.00	TBA540	1.00
BRC/M/200	1.00	TBA550Q	1.82
BRC/M/300	1.00	TBA560C	1.50
CA3060	1.58	TBA641	2.05
LM1303P	1.48	TBA651	2.50
ML237B	2.00	TBA720A	2.49
ML239B	2.86	TBA800	1.62
MC1327AP	1.25	TBA920	3.00
MC1358P	1.30	TBA950	1.95
MC1455P	18p	TBA1440	1.92
MC14516BCP	60p	TCA270SA	1.05
SAA1025	7.20	TCA270C	1.05
SAA1124	4.50	TCA270CQ	1.05
SAA5010	6.00	TDA1004A	2.97
SL432A	1.80	TDA1035T	3.50
SL1430	2.50	TDA1037	2.72
SN15846N	60p	TDA1170S	1.50
SN74123N	65p	TDA1200	2.42
SN74154N	1.40	TDA1270	2.76
SN76001N	1.40	TDA1327	2.53
SN76013ND	1.80	TDA2002	2.80
SN76023N	1.80	TDA2522	2.10
SN76033N	2.00	TDA2530	2.61
SN76115	2.00	TDA2540	3.50
SN76131N	1.58	TDA2560	3.50
SN76226N	1.25	TDA2581	3.00
SN76227N	1.00	TDA2591	1.96
SN76530P	1.30	TDA2571A	2.00
SN76545	1.40	TDA2640	2.90
SN76622N	1.00	TDA2690A	1.50
SN76660N	80p	TDA3560	6.00
SN76666N	75p	TDA9503	2.90
SN76744	1.92	TCEP100	3.48
TA7117P	1.00	TEA1009	1.95
TA7109AP	2.80	MC14426P	4.80
TAA611	1.40	MC14429P	4.50
TBA120B	1.20	MC14514	5.00
TBA120C	1.20	UA758PC	2.50
TBA120CQ	70p	UA1008A	2.66
TBA120S	70p	ULN2165	1.30
TBA120U	1.00	ULN2216A	1.25
TBA395	1.00	UPC1365C	5.75
TBA480Q	1.40	SC9488P	1.40
TBA500	2.65	SC9511P	1.40
TBA510	1.90	SW153	2.50

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

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

THICK FILM RESISTOR UNITS

3500 Thorn (5 Pin Connection) video	1.70
4000 Thorn (4 Pin Connection)	1.90

Thorn Mains TX 3000/3500	7.50
Thorn Mains TX 8000/8500	10.00
Thorn S.D.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
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 169	9.70
GEC LOPT 3113	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM–WM–21	6.75
Sanyo LOPT AM–WM–4	7.30
Philips LOPT G8	7.80
ITT LOPT 5-9	9.60
ITT LOPT CUC45	9.75
Baird 8750	10.25
Baird 8752	10.25
Korting AZ9100	10.25
Korting B92-170	10.25
Korting AZ2101	10.25
Korting AZ2103	10.25
Korting ZTR1001	10.25
Siemens V1155	11.75
Siemens V1823	11.75
Zanussi BS2222	10.25
Zanussi BS2223	10.25
Salora FR0057	10.25
Salora FR0029	10.25

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	8p	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

Thorn 10Ω 20W (3500) R751 Safety Resistor	75p
Pye 713 Speaker 5" × 3" 70Ω	1.00
Pye 713 Complete Tube Base Panel with Focus Slider & Leads	2.75
Pye 713 Control Knobs	4 for 50p
Tube Base Socket ITT CVC32	45p
Tube Base Socket Thorn 3000/8000 etc	50p
IC Inserter 16 Pin	50p
Large IC Extractor	50p
Crystal 4.43MHz	65p
EHT Lead & Cap for Split Diode Lopt	90p
Anode Cap	47p
Sanyo Anode Cap Assy + Lead 12TCD-CT-1G	65p
Degause Thermistors. PT37P. ITT/GEC	35p
Degause VDR E299D/HP230 3000/8000	25p
Casters Set of 4	1.90
Double Fuse Holder on Small Pax Board 20mm type	10p
Single Fuse Holder on Small Pax Board 20mm type	5p
Direct Panel Mounting 20mm Fuse Clips	(pair) 15p
Single Fuse Holder on Small Pax Board. As per early 3000 mains input	6p
EHT Cable	Metre 25p
13A Plugs	12 for 4.80
TX9 Tube Base and Panel	65p
3K PSU PL22 edge connector. + Lum to PSU (New)	40p
3K5 Complete Lum with all Plugs (New)	2.00
LM340 T12 on Heatsink	25p
T9051V on Heatsink	60p
BF259 with Heatsink	14p
TIP110 with Heatsink	40p
L129/130/131 Coil	10p
6MHz Ceramic Filter	25p
DL700 (Philips) Chroma Delay Line	1.00
DL50 Chroma Delay Line	1.00
T9006A Lum Delay Line	1.00
8K5/9K Lum. Delay Line	65p
Plastic Cover for 3K5 SP8385	5p
TX9 Back Ground Control 10K	15p
TX9 Gain Control 100R	15p
1500 Metal Chassis Supports Pair	40p
Thorn 8K5 Focus Pot	2.40
Thorn 4000 Focus Pot	2.75
Thorn 18Ω 9W (3K5) R752	30p

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 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

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

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	6.00
Thorn 9000	5.00
Thorn 9600	6.00
Thorn 900/950	1.50
Thorn 1500 3 stick	1.80
GEC 2100	3.60
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
ITT CUC5-9	4.00
Baird 8750	7.10
Korting AZ9100	7.10

THERMAL CUT OUT

Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

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

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	16+16	500V	45p
200+200+100+32	350V	70p	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
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Book Review

Domestic Videocassette Recorders — A Servicing Guide, by Steve Beeching, A.M.I.E.R.E., T.Eng. (C.E.I.), M.R.T.S., published by Newnes Technical Books.

The ever increasing amount of imported domestic equipment in use in the UK presents the servicing industry with a problem — where do you go for relevant information? You can get a service manual for a particular item of course, but while this will give you circuits, adjustments, exploded views and component lists, it probably won't tell you much about how the thing is supposed to work. The problem is particularly acute with VCRs, since most of them come from Japan and this introduces translation difficulties (to put it mildly). The situation was very different in the early days of television: a whole TV system, circuitry and all, had been developed in the UK and information was readily available. With VCRs one has to go to the Japanese or to Dutch/German speakers — well, could you 'phone Osaka and ask what C6 is supposed to do?!

There's a great need therefore for a practically orientated book that tells you what goes on in the various sections of a VCR. Some early manuals provided a fair amount of guidance in this respect, but the translation problems previously mentioned often made it hard going. More recent manuals assume that you know it all. Steve Beeching's book aims at filling this need and is pitched at exactly the right level. It covers much the same ground as Mike Phelan's series in this magazine, but if you missed out on early instalments or simply want the required information in a handy, single volume, then here it is.

Steve uses the Philips N1500/N1700 and the early VHS machines as his starting off points. If you think that the N1500 is going back a bit far, not so — it established the basic techniques that are still used, though with added refinements, in the latest generation of VCRs. The Betamax system is not overlooked, and where completely new techniques have come along these are discussed — examples include slow motion and still frame, and the assembly edit system used in the JVC HR7650. The basic principles of the V2000 system are also described.

There are some minor slips here and there — a diode round the wrong way in Fig. 3.10 for example — but most of these are obvious. The control mentioned at the foot of page 17 determines the amplitude of the signal fed to the f.m. modulator, not the record amplifier, a point that might be misleading. One could quibble with the statement that "by frequency modulating the signal on to a high band carrier and using a high frequency recording head the bandwidth can be greatly reduced". The problem solved by the use of f.m. is not the bandwidth but the signal's dynamic range in octaves.

Those who want a practical book on VCR techniques will find this work an essential guide and reference. Steve's experience of VCRs goes back to the earliest machines and ensures the practical nature of the book. It's not cheap at £14.50 for some 120 pages $7\frac{1}{2} \times 9\frac{1}{2}$in., but then VCR servicing literature does tend to be expensive. **J.A.R.**

VCR Servicing

Part 22 ***Mike Phelan***

When the 3V23 is in the standby condition, i.e. the mains input is switched on but the machine is in the "power off" state, the tuner/key scan microcomputer IC1 on the tuner/timer board is off. This is done by removing its 10V supply. There's a 10V rail in the machine, but this is present whenever the mains input is switched on. So a switched 10V supply is required. IC1 also requires a reset pulse at pin 7 (the microcomputer i.c.s are reset at "power on", except for IC1 on the display control panel — this one is reset at mains switch on).

The circuit used to provide a switched 10V supply for IC1 on the tuner/timer board is shown in Fig. 101, on the left-hand side. At power on pins 12 and 13 of IC10 go low. As a result pins 11 and 5 go high (we are using spare bits of the quad Schmitt trigger IC10 as inverters). Provided pin 6 is also high, pin 4 goes low, turning on X6 to provide the switched 10V supply. The reset pulse is generated elsewhere — more on this later.

The circuitry on the right-hand side in Fig. 101 generates the reset pulse for IC1 on the display control panel. When the unswitched 5V supply appears at pin 9 of IC11 at mains switch on, pin 14 goes high and C17 charges. As a result pin 10 of IC10 goes low, producing the reset pulse.

The connection between pins 9 and 6 or IC10 is there for a very good reason. If you recall, there's a delay circuit on the mechacon panel to prevent the machine being put into power on for five seconds after switching on the mains supply. The link between pins 9 and 6 of IC10 prevents the switched 10V supply being applied to IC1 until C17 has charged.

Similar circuits are used to reset IC1 and IC2 on the tuner/timer board and IC2 on the display control panel when we go to power on. This part of the circuit also switches on the supplies (10V, 3.5V, chassis and −23V) required by the EAROMS IC5 and IC8. This has to be done in the correct order, with the supplies removed in the

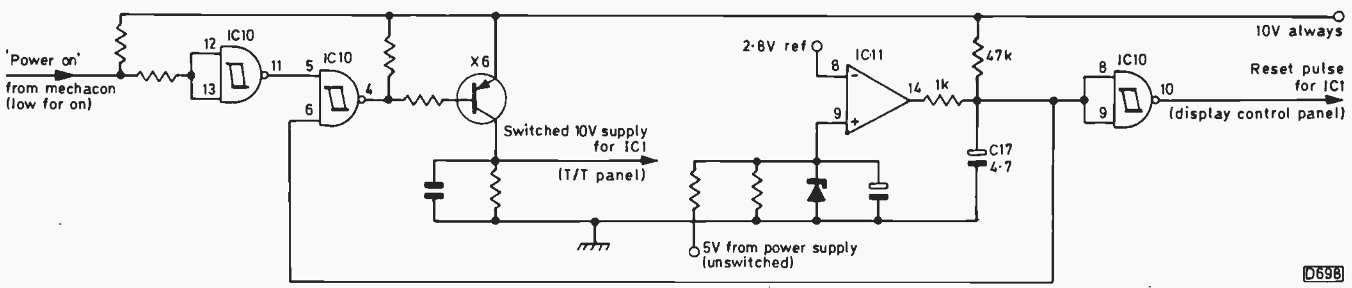


Fig. 101: Circuitry for the switched 10V supply and IC1 (display control panel) reset pulse generation.

reverse order at switch off. If this is not done, at best the stored information will be lost, at worst the two i.c.s will be destroyed. The circuitry consists of simple operational amplifier plus time-constant arrangements and doesn't warrant detailed description.

The only part of the machine we've not discussed so far is the display control board and the fluorescent display. Probably the best plan is to consider the display device first.

Early VCRs used seven-segment LED displays, usually red, as the only requirement was to display the time. These displays tended to be rather dim — some later machines got around this by using high-intensity LEDs, usually green. A few machines, for example the Toshiba V5470, used purpose-built LCD displays, but these are not easy to see at a distance.

Most of the current generation of VCRs use a fluorescent glass display, whose principle of operation is similar to that of a triode valve. The anodes are coated with a fluorescent material that glows bright bluish green when bombarded by electrons — remember the EM84 etc? Fig. 102 shows the construction.

It consists of an evacuated rectangular glass bulb, made from either two or three pieces of glass, the front sometines being shaped as shown. The anode segments, coated with the fluorescent material, are bonded to the opaque rear glass, the connecting print being on the outside. The mesh grids are in front of and slightly spaced from the anodes, the mesh being of open weave so that the light from the anodes is not obstructed. The filament, which is coated with an emissive cathode material, runs horizontally at the front. There are usually three or more parallel passes between the filament's mica end supports.

The 3V23's display has twelve seven-segment digits and 25 other legends — a total of 109 separate items. This would require a total of 112 connections if either a common anode or grid was used, which is clearly not very practical.

To illuminate any segment, the grid must be positive with respect to the filament and the anode more positive still. This solves the problem. The display is divided into two halves, each driven by a separate microcomputer i.c. (both type μPD552C-045) — see Fig. 103. IC1 receives data from IC2 on the tuner/timer board for the clock digits, and carries out the tape counter function internally. IC2 drives the tuner and tape remaining displays.

As can be seen from Fig. 103, each digit uses one grid, so there's a total of 14 grid connections. The anode segments for each digit are connected to the corresponding segments on the other digits, so there are 24 anode connections, 13 for the left-hand side of the display and 11 for the right-hand side.

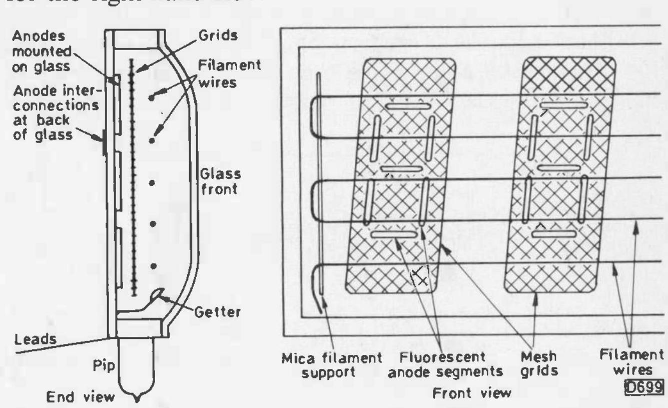


Fig. 102: Fluorescent display tube arrangement.

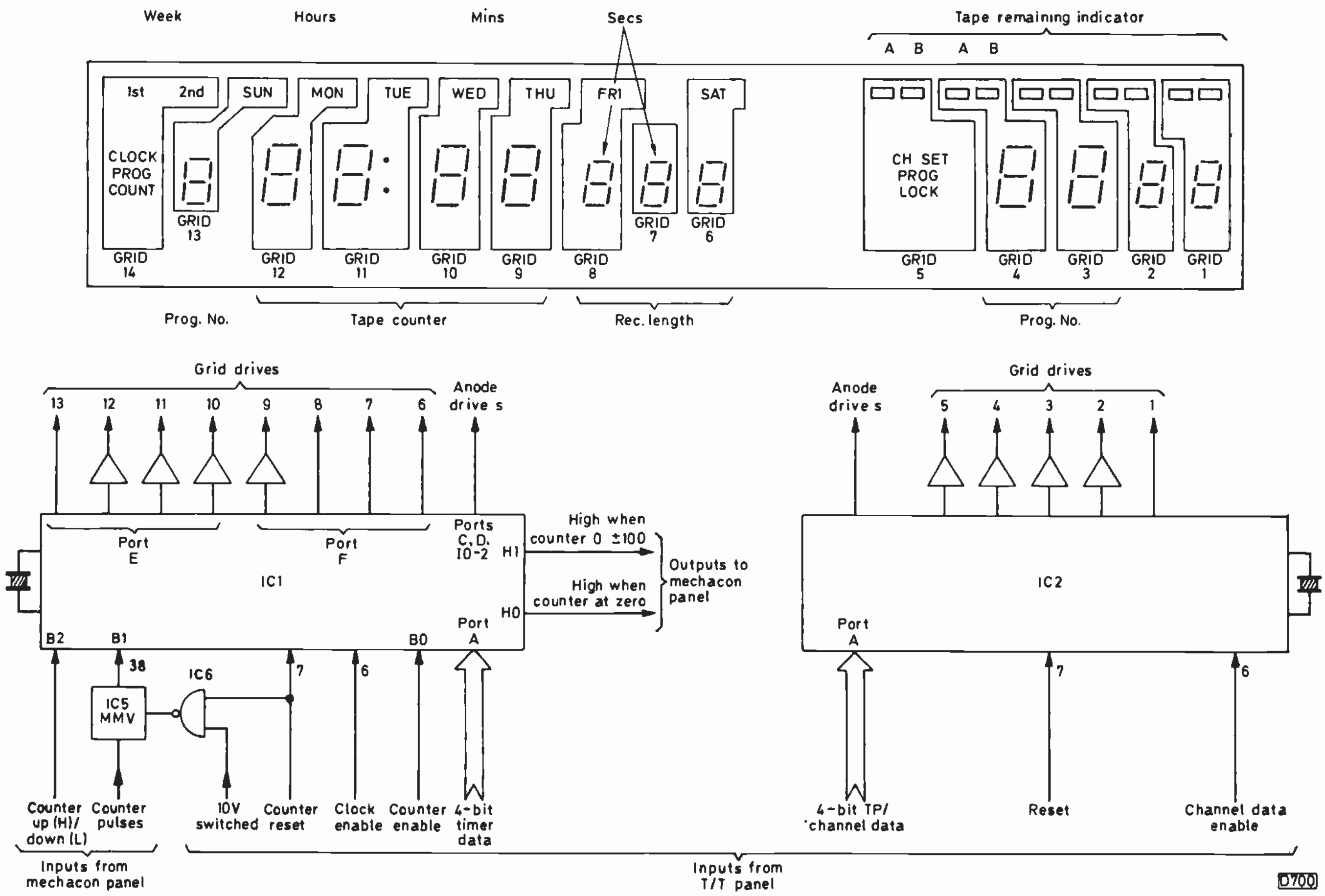


Fig. 103: Display drive system.

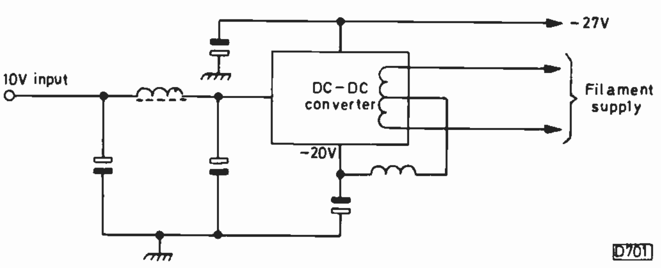


Fig. 104: Display power supply.

The display has its own switch-mode power supply — a small hybrid thick-film unit with a discrete transformer and also a transistor in earlier versions. The whole thing is enclosed in a small screened case and is known as a d.c.–d.c. converter. This approach was adopted for two reasons. First, a −27V supply is required to bias off the unused grids, and secondly the filament supply required is a.c. with a −20V bias added to it. This bias is necessary to give the same average voltage over the whole of the filament, otherwise different parts of the display would have different anode currents, and therefore brightness, because the filament is also the cathode. The −20V (remember that the filament must be less negative than the grids) is fed back into the centre tap of the converter's filament winding. See Fig 104.

As IC1 and IC2 are operated at 10V and the anode and grid resistors are returned to −27V, the anodes and grids swing between these two levels. For a segment to be illuminated, its anode and grid must be at some 10V — if either or both are at −27V, the segment is off. In practice only one segment is illuminated at a time, at a frequency of 75Hz to avoid flicker. The dimmer control operates via the tuner/timer board to reduce the duty cycle of the grid waveform from $\frac{1}{10}$ to $\frac{1}{30}$.

IC1 converts the four-bit timer data at its A port to anode and grid waveforms. IC2 does likewise with the tape remaining (TP) and channel data. Some of the outputs are buffered, using parts of IC3 and IC4. IC2 is enabled when pin 6 goes high and is reset when the machine is brought out of standby. IC1 must be reset only at mains switch on however as the clock function must be retained: the counter input is directly to pin 38, i.e. the counter data does not go via the tuner/timer board but directly from the mechacon panel to the display control board. As the width of the count pulses varies with reel speed, the monostable IC5 is used to produce constant width pulses. The NAND gate, part of IC6, briefly inhibits the count at switch on and when the counter is reset, in order to prevent spurious counts.

Resetting IC1 at switch on doesn't lose the real time clock as IC2 on the tuner/timer board retains the time: it simply zeros the counter. The clock stops at mains switch off only when the back-up battery is flat.

Input B0 of IC1 is the counter enable while pin 6 is the clock mode enable; pin 6 of IC2 is employed for enabling (these inputs all come from the tuner/timer panel). As the counter works in both directions, an up/down instruction is required: this is fed to input B2 from the mechacon panel. In return, IC1 supplies two bits of data to the mechacon panel: H0 goes high when the counter is at zero (this is for the counter search function); H1 goes high when the counter is within 100 of zero, to slow the tape down prior to stopping.

We've now covered all the electronic aspects of the 3V23. Next month we'll conclude our discussion of this machine with a few tips on fault-finding — especially on the mechacon and the tuner/timer boards.

Teletopics

WORLD VCR MARKET

As one market goes flat, another livens up. It's perhaps not surprising that the strong recovery in the USA's economy has been accompanied by increased VCR sales (added stimulus is expected from next year's Olympic games) whereas the flat European economies have not been taking such large quantities of Japanese VCRs (or V2000 machines for that matter). In the first seven months of the year Japanese VCR exports to the USA reached 2·58 million units – the total for the whole of 1982 was 2·50 million. During the same period, deliveries to the EEC declined by just over ten per cent. The decline has increased since the EEC/Japanese limitation agreement came into effect in mid-March, though the agreement undoubtedly led to inflated shipments in earlier months.

It's been a good year so far for most Japanese VCR manufacturers, with exports during the first seven months up a third at 7·56 million compared to the same period in the previous year. Japanese consumers have also been buying more of their own machines – sales in the first half of the year increased by 65 per cent. VCR production in Japan is expected to exceed 17 million this year, an increase of 34 per cent over last year, with exports of over 14 million.

VCR market penetration in the UK is now the highest in the world, at some 25 per cent – last year the UK took 47 per cent of Japanese VCR exports to the EEC.

Sony seem to be anxious to push the new 8mm video format. Founder and chairman Akio Morita recently commented "we shall be ready with 8mm in 1984 and, if we deem it necessary, will not hesitate to be the first to start volume production of the new video recorders." One problem could be the availability of prerecorded tapes.

CED LAUNCH PLANS

Launch of the RCA CED video disc system in the UK is imminent. Hitachi are expected to be first with players, at around £200 each, and a co-ordinated £2 million promotion campaign, including TV advertisements, is planned. Players are also expected to be marketed by GEC-McMichael and ITT. The initial RCA/Columbia disc catalogue will include 100 titles, selling at prices between £9·95 and £12·95.

VCR DEVELOPMENTS

There's more to the two-speed, eight-hour VHS machines than the capstan speed change and the use of an extra pair of narrow (32μm) heads. These heads are mounted at 70° to the standard (60/80μm) heads – all four heads have the same gap width (approximately 0·3μm). Problems arise because without added circuitry the signal-to-noise ratio would deteriorate when playing back an LP recording. This is due to the narrower tracks and the fact that the signals on adjacent lines are no longer aligned, i.e. the sync pulses on adjacent tracks no longer lie next to one another. This latter problem would invalidate the colour crosstalk cancellation system. To overcome this difficulty, the carriers on adjacent tracks are interleaved, i.e. the ch. 2 recorded frequency spectrum is offset by 0·5fh with respect to the ch. 1 frequency. In addition, a non-linear noise cancellation circuit is used, also a luminance comb filter system to remove asynchronous noise.

A further problem arises when playing back an LP recording and using fast forward or reverse search, still frame, etc. Because the heads then read information from more than one recorded track, the sync signal becomes discontinuous. The results would be skewing or total loss of line lock, also loss of colour. These problems are overcome by the use of jump pulse circuits: an 0·5fh jump is introduced to compensate for the 0·5fh offset, giving a precise 1hf offset. On its own this would upset the PAL colour signal, so for chroma 0·5fh and 1hf offsets are applied.

Mention was made last month of the Sony Betamovie VCR/camera combination which is due to go on sale in the USA next month (November). Further technical details have since been announced. The standard Beta tape loading and wrap arrangements have been dropped and instead an M wrap system is used (the cassette is played back on a standard Beta machine however, the Betamovie having no playback facility). The Betamovie drum diameter is reduced from 74·5mm to 44·7mm, the drum rotating at double speed (50 r.p.m. in Europe, 60 r.p.m. in the USA). Instead of having two heads mounted opposite each other on the drum there's a single head with two gaps. The tape wrap is over 300°. The result of these measures is that each revolution of the smaller drum is equivalent to a one half revolution of the standard Beta drum, i.e. the smaller drum records one field per revolution. There's a through the lens viewfinder and 6:1 zoom. The US Betamovie provides a recording time of three hours and twenty minutes on a standard L830 cassette.

Returning to the VHS system, mention was made of the stereo hi-fi sound technique in this column last July, i.e. recording the sound in helical tracks along with the vision. It seems that VCRs using this system are unlikely to become available in the UK until some time next year. The basic principles are as follows. Two extra heads are mounted on the drum to record the sound signals. Alternate tracks are recorded using 1·3MHz and 1·7MHz carriers, with f.m. (maximum deviation ±150kHz). Head azimuth offset is employed to suppress crosstalk and minimise interference between the audio and video signals. The audio signals are recorded at a greater depth in the tape than the video signals, which are impressed on the surface layer of the tape's magnetic coating. The term depth multiplex recording is used to describe this – get ready for the initials DMR! In addition, a new audio noise reduction system has been developed.

LATEST ITT CTV CHASSIS

The latest ITT colour TV chassis, the CVC1150, is designed to drive 20in., 29·1mm neck, 90° PIL tubes. It's similar to the CVC1100 with changes to meet the requirements of the different tube type. The main changes are the use of class AB RGB output stages and a TDA2653A field timebase chip.

PRINTS FROM THE TV SET

Mitsubishi have developed a domestic TV set that will produce a print-out of a field being received by the set. It's fitted with a 21in. tube and will go on sale in Japan shortly at a price of around £700. The company will also be marketing a printer that can be plugged into a conventional TV set, VCR, video camera or personal computer.

The image on the screen is converted into digital information, memorized in LSI chips controlled by a microcomputer, and then printed on thermosensitive paper as a monochrome image based on a 280 × 234 dot matrix. The print-out takes 15 seconds.

BBC'S SUPPLEMENTARY CHARTER

The Home Office has published the BBC Supplementary Charter which will enable the Corporation to borrow up to £150 million, with a possible increase to £225 million, on the private money market to finance its projected satellite TV services. The BBC board of governors has issued a statement confirming that a satellite service is "something the BBC should undertake", with the proviso "under proper conditions". In fact the board is continuing to review the situation and has warned the government that the costs could far exceed the amounts authorised by the supplementary charter.

SONY'S DIGITAL TV

Sony intend to market TV sets in which the video signals are processed digitally in about a year's time. A prototype was demonstrated recently and over sixty patents have been applied for. Initial sets would be up market models, and Sony comment that it would take some seven to nine years for the technology to be incorporated in the complete range.

DIY VIDEO HEAD REPLACEMENT

Monolith Electronics Co. Ltd. (5/7 Church Street, Crewkerne, Somerset – telephone 0460 74321) have introduced a head replacement kit to enable VCR owners to replace the head drum in their machines – kits are available for both VHS and Betamax types. There are three universal replacement drums, the main difference between the two VHS types being the size of the centre hole (5 or 15mm) which locates on the main shaft. One standard type will fit the majority of Betamax machines. The kits come with five cleaning tools, cleaning fluid, a can of air blast for dust removal, an inspection mirror, antistatic cloth, cross-head screwdriver and pair of surgical gloves. A motor speed check disc for VHS machines and an eccentricity gauge for Beta head alignment to an accuracy of about one fiftieth of a millimetre are supplied, also a maintenance manual and detailed step-by-step instructions for typical machines.

The kit with VHS head costs £53·25 and with Betamax head £65·25, including postage, packing and VAT. Further heads are available at £41·25 VHS and £53·25 Beta.

NEW VCRs

The ITT VR3905 has been introduced to replace the TR3913 as the standard machine in the ITT range. New features include full remote control, front loading, frame advance and "instant record" (recording at the touch of a single button). The suggested price is around £470.

The new Philips compact V2000 format model VR2334 is being introduced at £470 instead of the previously suggested price of £540. It comes complete with infra-red remote control. A bottom of the range version, Model VR2324, is also to be introduced.

Two new two-speed machines, offering stereo sound and up to eight hours' playing time, have been added to the Hitachi range. The VT19 is a full specification front loader with a suggested price of around £710. The interesting feature of the VT7 is that it has a detachable section so that it can be used as a portable. In this mode the battery offers one hour's recording time.

TAIWAN'S TV BOOM

During the first half of the year Taiwan's CTV exports increased by an astonishing 92 per cent, to just under 600,000. Most of the sets go to the USA, where a ruling on dumping charges is awaited from the US International Trade Commission. Don't expect to see sets from Taiwan in the high street just yet however – setmakers in Taiwan have PAL and Secam licences for sets in kit form only at present (they go mainly to S. America).

OLD NAMES AND NEW

Finlux colour TV sets are to be made available again in the UK. They will be handled by a new firm being set up by former Tandberg man John Farnell. The sets are made at Turku, Finland – remember the famous Finlux Peacock of the early seventies?

Cap Ten, which has been distributing NEC television sets and VCRs in the UK, has ceased trading. Nippon Electric Company is now selling direct to dealers and is setting up its own wholesale subsidiary. Tech-Semco of London has been appointed "UK service centre for goods previously distributed by Cap Ten."

SOUTH LONDON COLLEGE COURSES

The South London College's annual Colour Television Practical Servicing course starts on September 29th. It consists of 25 lecture/practical class meetings held between 6·15 and 9·15 on Thursday evenings – the course fee for London students is £20 and leads to an RTEEB Certificate of Competence in Colour Television Servicing award. There is also to be a course entitled "An Introduction to Microprocessor Systems", and the Telecommunications and Electronics Department has now started a TEC Higher Certificate in Audio and Television Engineering. For details phone 01-670 4488.

CASSETTE NTSC/PAL CONVERSION

Globe Video Services (192 Castelnau, Barnes, London SW13 9DH – 01-748 1453) have introduced a special rate for domestic users who wish to have video cassettes converted from 525-line NTSC to 625-line PAL (a digital standards converter is used). The rate is £20 for half an hour's recording and £35 for an hour, excluding tape and VAT. The special rate is strictly confined to recordings of a private nature, such as weddings and holidays: those in a hurry have to pay at the standard rate (£60 per hour plus tape and VAT).

MORE AND MORE TAPE

Fuji have added an L750 cassette, providing a recording/playback time of up to three hours, ten minutes, to their Beta Super HG range. The increased playing time has been achieved by making the tape 25 per cent thinner than that used in Super HG L500 cassettes. Fuji now have five Beta and four VHS cassettes in their Super HG range.

Polaroid brand videocassettes are about to be launched on the market, in both VHS and Betamax formats. Polaroid's Supercolour VHS cassettes will be made by JVC while the Betamax cassettes will come from Sony.

Agfa-Gevaert have opened a new videocassette factory in West Berln. A turnover of £20 million is planned for the first year, in VHS and V2000 formats.

Tape Position Indicator

Alan Willcox

The circuit used in this design operates on information received from a VCR's supply and take-up reels. It's use is therefore restricted to those machines that have tacho sensors (usually optocouplers) associated with these reels, including all those of Grundig manufacture, the JVC/ Ferguson HR7700/3V23, the Sony F1 and C9, Sharp VC7700 and in general any VCR with some kind of tape remaining indicator. It was originally developed for use with the Grundig SVR4004, into which it fits physically. Incidentally this model was years ahead of its time and is well worth buying on the second-hand market when the opportunity arises – it has arguably a better picture quality than any VCR produced since, and has an uninterrupted playing time of over five hours with an LVC180 cassette.

Principles

The most common type of tape counter is probably a mechanical device coupled to the take-up reel via a belt, though electronic counters with larger, digital displays have more recently come into use, especially where remote control is featured. A major drawback of both types is that they have to be zero referenced, i.e. for the counter to mean anything at all it has to be set to zero at some clearly identifiable point, say either at the beginning of a programme or at the start of the tape. In addition, any counter that's linked to the take-up reel's period of rotation will suffer from severe non-linearity. For example, in the play modc the take-up reel of an E180 cassette initially completes one rotation in approximately 3·5 seconds: as the tape winding radius increases, the reel's speed of rotation slows down to a final figure of about 11·4 seconds when the reel is full.

The fact that the count rate varies throughout the length of the tape makes it difficult to assess from the counter reading the time played or that remaining. This could be overcome by compiling a chart of time against counter readout for each type of tape used, but the disadvantage of having to zero the tape at a reference point remains. The circuit presented here is an attempt to produce a linear counter which automatically knows the tape position, giving a corresponding readout without having to be reset at any particular point.

The reel speed change characteristic can form the basis of such a tape counter, since each part of the tape has its own set reel rotation period during normal speed operation. The tape indicator can thus take the form of a frequency counter which is connected to the optocoupler associated with one of the reels. This technique of monitoring the reel rotation period is used as the basis of the coarse time remaining indicator in the HR7700. Unfortunately such a system breaks down at anything other than the normal playback speed, which is the reason why the time remaining display is blanked out on rewind etc. on the HR7700 and other machines. Clearly a tape counter is best if it gives a valid reading regardless of the VCR's mode of operation.

The system used in this unit gets around the problem by comparing the speed of one reel with that of the other, displaying the numerical value (× 1,000) of the ratio of their periods of rotation (this is the same as the ratio of their winding radii). The tape speed thus becomes irrelevant, since the effective winding radii of the reels is the only thing that determines the count. The basic idea is this: the unit operates as a frequency counter, monitoring the pulses from the supply reel, but instead of the gating period being fixed this is derived from divided down pulses from the take-up reel. Thus if the tape speed varies both pulse trains will vary in proportion and the count indicated will remain correct.

The linearity problem would remain however. To illustrate this, using the rotational speeds already given, the readout with an E180 cassette would be 3·5/11·4 × 1,000 = 307 at the start. Half way through it would rise to 8·4/ 8·4 × 1,000 = 1,000 and at the end the readout would be 11·4/3·5 × 1,000 = 3,257 – a difference of about 700 over the first half of the tape compared to more than 2,000 over the second half.

Fig. 1 shows how the tape winding radius of each reel varies with time for an E180 cassette – the winding radius for a full reel is 42·44mm while the relevant radius when the reel is empty is 13·02mm. The ratio of the take-up reel winding radius (RT) to the supply reel winding radius (RS) is also shown. It will be seen that this is virtually linear up to the half way point. To linearise the display, the counter monitors the ratio (× 1,000) of the winding diameters up to half way through the tape, when the count will be 1,000. At this point the tacho information is automatically changed over. The count then reverses, counting down from 1,000 so that at the end of the tape we get the starting figure. To identify the second half of the tape, all the decimal points are displayed. In the normal play/record modes the display is updated at typically one-two minute intervals – the updating is proportionally faster in the wind and rewind modes of course.

Circuit Description

The circuit of the unit is shown in Fig. 2. Tacho pulses from the sensors (generally optocouplers) are first fed to the buffer amplifers Tr1 and Tr2. The amplitude of the pulses should not be reduced as far as the VCR is concerned, so R1 and R2 provide the required isolation, which is also effective when the circuit is not powered. The pulses are then squared by the Schmitt trigger IC1 before

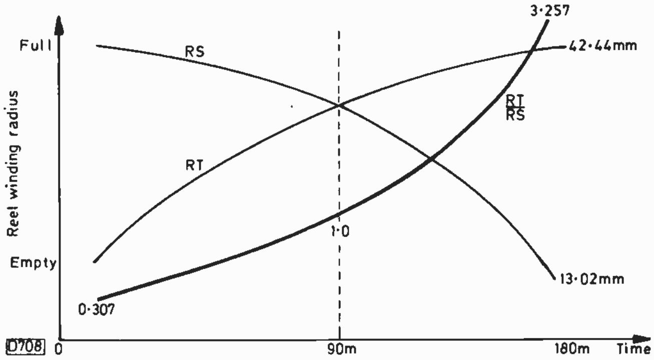


Fig. 1: Reel winding radius characteristics (E180 tape).

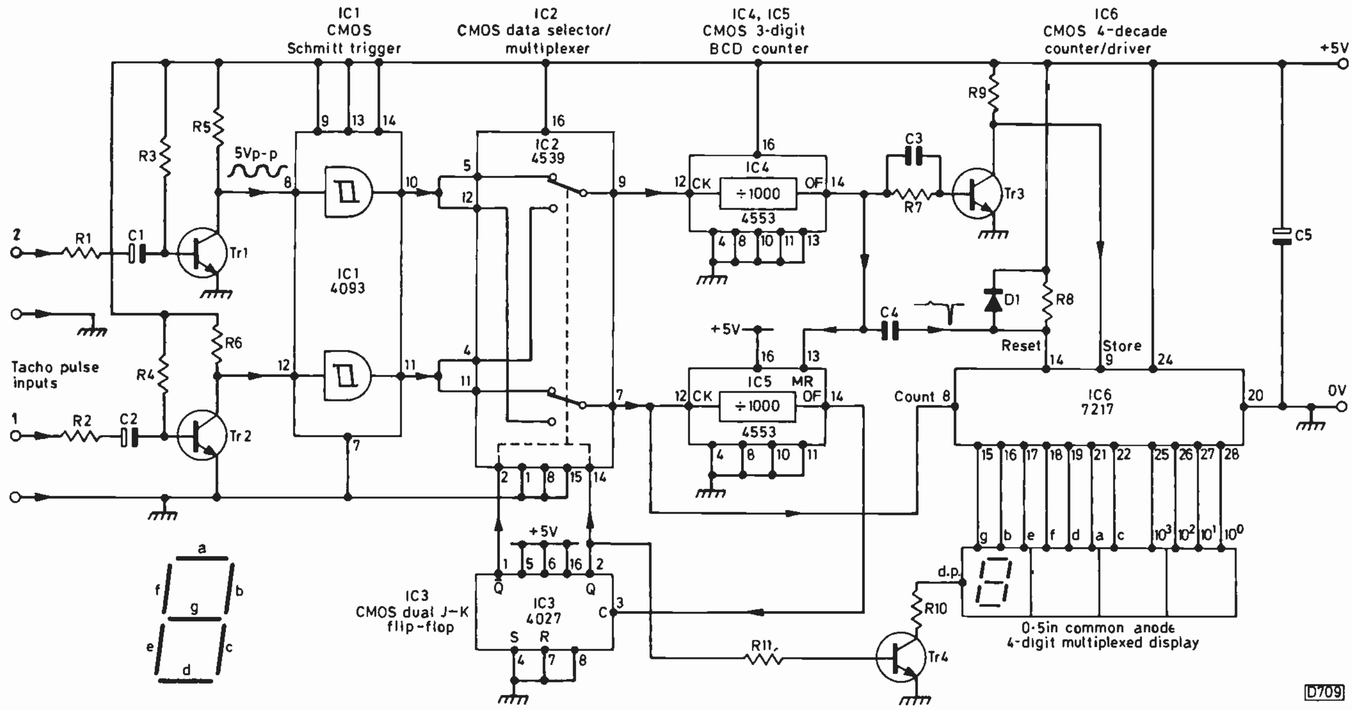


Fig. 2: Circuit of the tape position indicator.

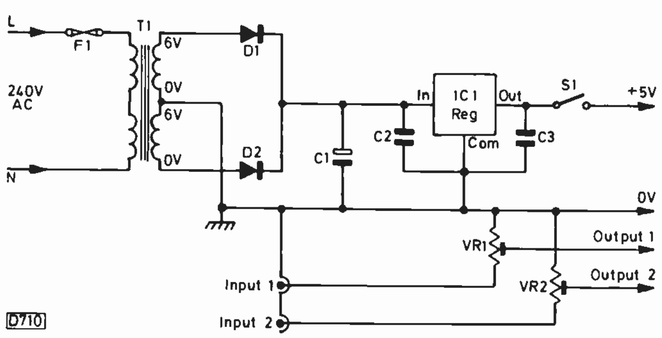


Fig. 3: Suitable power supply and input attenuator.

passing to the data selector IC2. This is connected as a double-pole, double-throw switch and is used to change over the two pulse trains at the half way point. IC4 and IC5 are BCD counters but only the carry-out pulses are used, making them effectively ÷ 1,000 circuits. IC2 is always in the state where the pulses from the faster reel (which has the least tape) appear at pin 9. The pulses from the other reel appear at pin 7 and in addition to going to pin 12 of IC5 go to pin 8 of IC6, the main counter/driver i.c.

At the start of the tape the pulses from the take-up reel are counted by IC4 while the pulses from the supply reel form the main count (IC6) and are also counted by IC5. IC4 will reach a count of 1,000 before IC5, and will reset IC5 at every thousandth pulse via the reset pin 13. This carry-out pulse also resets and updates the main counter IC6. The display will show the number of pulses from the supply reel obtained during this period of 1,000 pulses from the take-up reel. Taking the case of an E180 cassette again, the supply reel rotates at about a third of the speed of the take-up reel so the display starts at around 300.

Immediately after the tape half way point, IC5 will produce a carry-out pulse before being reset by IC4. The pulse is used to change the state of the flip-flop IC3, which in turn alters the state of the switches in IC2. The information from the reels thus changes over and IC4 continues to produce carry-out pulses ahead of IC5. The count reverses, finally ending up at the 300 or so starting figure.

Tr4 switches on the decimal points in the display to identify the second half of the tape. Note that IC2, IC5 and IC3 form a loop to ensure that IC5 doesn't "overflow", also ensuring that the main counter always counts the output from the slower reel.

The carry-out pulse from IC4 is inverted by Tr3 to provide the negative-going store pulse required by IC6, and is differentiated by C4 to produce a negative reset pulse at the end of the store period. D1 clips the positive excursion.

A suitable power supply with input attenuation (see later) is shown in Fig. 3.

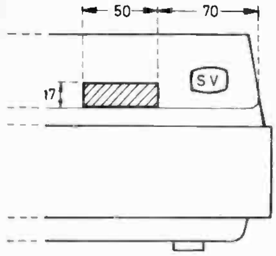
Construction

The circuit was originally developed for use with the Grundig SVR4004 and can be mounted on the panel facing the cassette compartment. All components must be small and mounted flat if the PCB is to clear the cassette when this is in position. The common-anode, multiplexed display is mounted ⅛in. off the board and protrudes through a cut out in the front panel (see Fig. 4). If the tops of the i.c.s come into contact with the front panel there will be good clearance with the tape.

The self-powered version can be used with suitable VCRs of other types – the only connections required in this case will be those to the optocouplers (see Fig. 5). The minimum internal case dimensions are 135 × 60 × 60mm. Although a suitable commercial case could no doubt be found, a custom built wooden box was used for the prototype.

Connections

In the case of the SVR4004, the inputs are taken directly from the optocouplers while the power supply is taken from the +5VD line. In later production models that have a two preselected recording option the 5V line was omitted: it can be restored by fitting the missing



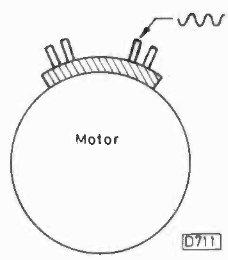


Fig. 4 (left): Position of the cut out required in the Grundig SVR4004.

Fig. 5 (right): The optocoupler output pin – applies to both the take-up and supply motors on the SVR4004. The common connection is to chassis.

With the Grundig 2 × 4 etc. the connections can be made as above, but the active pin on the supply reel motor is at the far right.

With the Sharp VC7750 the sensors are directly under the reels, accessible once the lower panel is unhinged.

For the Ferguson 3V23, use connection numbers 202 and 212 on the mechacon panel.

For the Sony F1, use pins 1 and 7 of IC201 on the reel servo board. With the C9 use pins 1 and 7 of IC001 on the reel servo board.

Common connection to chassis in each case.

components.

With other VCRs the inputs can generally be taken direct from the optocouplers – which reel information goes where simply determines in which half of the tape the decimal points come on. If 3·5mm jack sockets are used on the VCR the chassis connection provided by their mounting is the only screen connection required.

On the self-powered version, input attenuation is provided on the power supply PCB. Best noise immunity is obtained when these presets are adjusted to the minimum setting required. To set them without a scope, put the VCR into a wind mode for rapid display updating. With one preset at maximum, turn the other one up from minimum until the display updates. Leave this preset where it is and turn the other one to minimum, then increase its setting until the point is reached where the display continues to update. This is not a critical adjustment, and each preset can be turned up slightly to allow for tolerance changes. No input attenuation is required on the SVR4004.

If power is drawn from the VCR, the consumption can be reduced by 30 per cent by leaving open the break on the PCB to the units digit – this may be considered superflous anyway. No problem has been experienced however after several months' use with all the digits operational, drawing power from the 5V line on the SVR4004.

Use

Any point noted on the tape when playing back or recording can be located again accurately in the fast

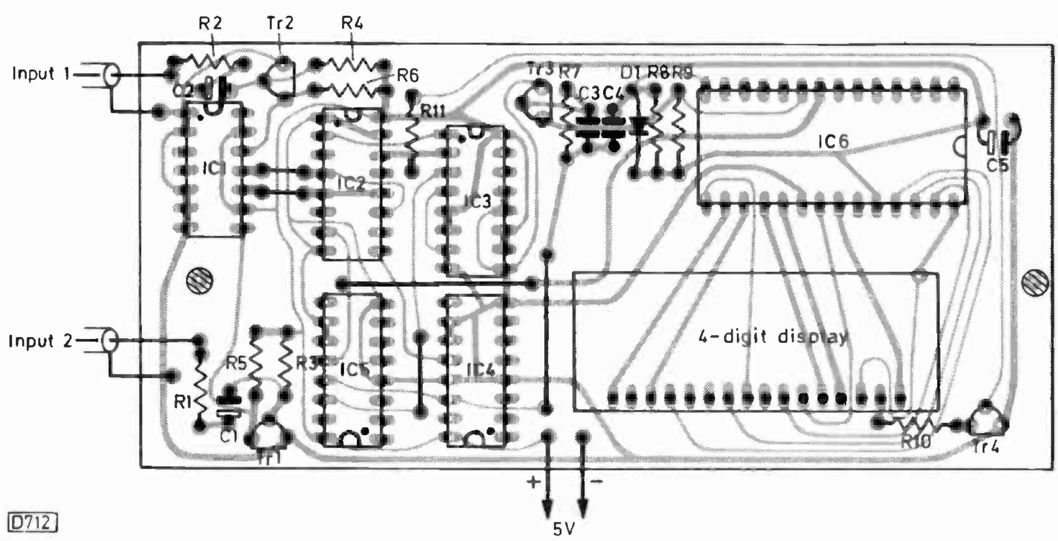


Fig. 6: Main board component layout.

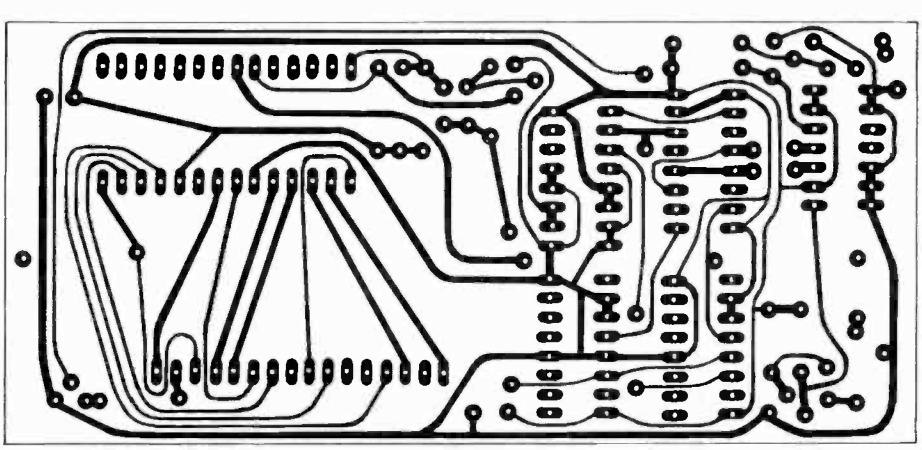


Fig. 7: Main board track pattern.

Components list

Resistors:

R1,2	47k
R3,4	1M
R5,6	4k7
R7	47k
R8,9	4k7
R10	82Ω
R11	12k
All ¼W	

Capacitors:

C1,2	1μF, 50V
C3,4	0·0022μF ceramic, RS 125-755
C5	47μF, 6·3V

Display:

0·5″ LED, RS 587-024

Semiconductor devices:

Tr1-4	BC237 etc.
D1	1N4148
IC1	4093
IC2	4539
IC3	4027
IC4,5	4553
IC6	7217, RS 307-749

Power supply:

T1	PCB mounting, 3VA, RS 207-829
D1,2	1N4001
IC1	7805, 5V, 1A
C1	2,200μF, 16V
C2,3	0·22μF, RS 114-418 miniature layer
VR1,2	100k miniature horizontal presets
S1	miniature toggle
F1	100mA, RS 413-147 20mm PCB mounting

Two 3·5mm jack sockets plus case (see text)

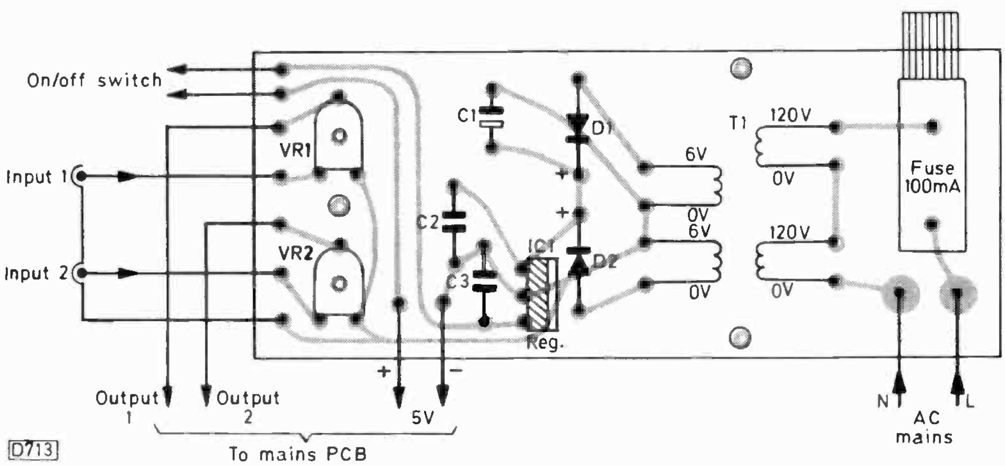


Fig. 8: Power supply board component layout.

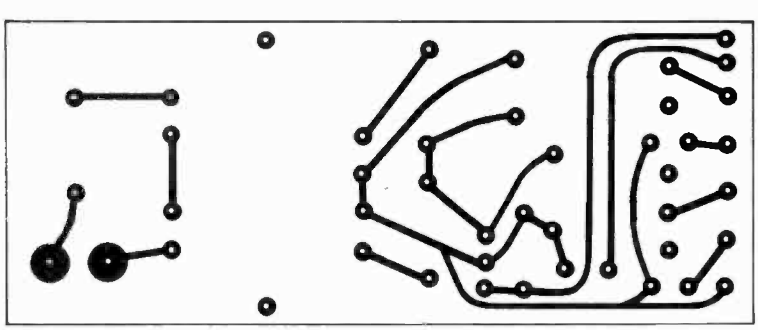


Fig. 9: Power supply board track pattern.

forward mode. If an attempt is made to locate a point in the rewind mode there's a small discrepancy. The practical consequences of this are that the tape is generally stopped a few minutes before the required section. This can then be located quickly by going in the fast forward mode to the required count. I can't account for this discrepancy – it's perhaps due to a change in tape tension affecting the radius of the winding.

When the counter is used as an indicator of time played/remaining, some reference is required until one gets used to interpreting the readout. Charts can be drawn up for this purpose. There may be some discrepancy if the playing time is longer than that shown on the tape – this is sometimes the case. If accuracy is important, play a particular tape through, noting the count at say five minute intervals up to half way when the decimal points come on. The time corresponding to a particular readout becomes the time remaining if the decimal points are on.

Letters

LIVE TV CHASSIS

The question of full-wave mains rectification came up again in Tony Thomson's excellent article "A Matter of Safety" (August issue). It's commonly said that when a TV set employs full-wave rectification of the incoming mains supply the chassis is at half mains potential. This half mains potential is an average figure however: the peak voltage remains unaltered and is 240 × √2, i.e. some 340V.

Consider the basic circuit shown in Fig. 1 – typical of a full-wave input bridge arrangement less switches, fuses etc. When the live mains supply line swings positive with respect to neutral, D1 conducts to charge the reservoir capacitor while D3 conducts and connects the chassis to neutral. That's the good news.

Now the bad. When the live mains line swings negative with respect to neutral, D4 conducts and connects the chassis to the live side of the supply while D2 links the h.t. supply to neutral. So the chassis is connected to the live mains on every negative half cycle via D4. The chassis is either at neutral (positive half cycles) or −340V peak (negative half cycles).

If you connect a meter between chassis and neutral it will measure half the normal r.m.s. mains voltage, because we have only the negative peaks and no positive ones (we're recording the negative peaks via D4). Half the a.c. waveform is missing and we read 120V r.m.s. The point however is that we've not diminished the peak voltage, only halved the number of peaks. These are still at 340V and capable of giving you a nasty shock – so don't be taken in by the expression "half mains voltage". The situation is very nasty and is the same whichever way round we connect the mains supply. The only safe way of coping with sets using this arrangement is to use a mains isolating transformer. But, as Tony Thompson says, these are not easily transportable for use in the field.

I'm pleased to see the current improvements in safety standards and thinking. Fifteen years ago I started a new job as a TV service manager and found that the workshop power was fed from the retail shop via a length of flex. TV sets, soldering irons and two electric fires were hung on the workshop end and there were no isolating transformers or fuses. The flex mentioned passed through the loo and was suspended about two feet from the ground by a piece of string tied to the cistern. When I asked why this was so, I was told that in cold weather you could hold on to the cable and warm your hands! Needless to say, my first priority was to rewire everything properly – including the addition of isolating transformers.

Lastly, my thanks to Les Lawry-Johns for his kind remarks in the same issue. There's a snag unfortunately.

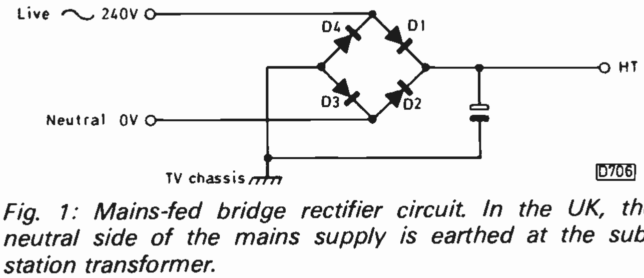


Fig. 1: Mains-fed bridge rectifier circuit. In the UK, the neutral side of the mains supply is earthed at the sub-station transformer.

I'm currently having to put up with my dear wife calling out "play 'Bless Your Beautiful Hide' again Sam" in a strong American accent!

Keith Cummins,
Southampton.

THE MAINS PLUG PROBLEM

Tony Thompson's article "A Matter of Safety" outlined the risks we all encounter daily and how they can be minimised. A point worth making however concerns the correct wiring of plugs. As a freelance engineer I service all manner of equipment from transistor radios through colour TVs to VCRs and video computer consoles, and seldom do I go through a day without encountering a number of dangerous plugs. The sort of thing I mean is brown leads wired to earth (brown suggests earth to people), sloppily wired plugs with loose leads, or cable clamps not used. It's rare indeed that I come across a plug wired with regard to polarity and lead dressing as Tony Thomson describes.

A recent example concerned an ageing colour set (Rank A823 chassis) with the complaint no results. As I plugged the set in I noticed to my horror bared leads protruding through the cable clamp. Opening the plug revealed that all three leads had been bared back two and a half inches or so and were welded together. The set burst into life once a new plug, correctly wired and fitted with a 5A fuse, had been fitted. Although an extreme case, this does illustrate the abuse to which the system is open at present.

It remains a constant source of amazement to me that year after year the standards of consumer product safety are increased yet the product is supplied to the customer minus plug so that he can fit one incorrectly and thus make it potentially lethal. My view for several years has been that all electrical equipment should, where applicable, be supplied with a moulded, correctly fused plug as an integral part of the unit. The busy engineer would then know that at least one aspect of safety had been dealt with.

Stephen Leatherbarrow,
Manchester.

DECCA 80/100 CHASSIS

In the May TV Fault Report feature the subject of dead Decca sets fitted with the 80/100 series chassis was mentioned. As a Decca agent and service engineer for twenty years, may I comment on this with a view to easing fault finding on these sets?

When you find the 3·15A mains fuse blown, the first step should be to remove the link TP600/601 on the power supply board to disable the crowbar trip. Connect an ordinary light bulb of 40/60W, 240V in place of the link (a bulb holder, lead and two crocodile clips are very useful). Replace the fuse, identify the 165V supply point (junction of dropper sections R802 and R803), and connect a meter on the 250V range between this point and chassis.

Switch on and if the bulb lights up check the voltage reading. If this is correct at some 165V the crowbar thyristor TY601 is probably faulty. If the voltage is low, there's probably a short in the line output stage. In this event, isolate the tripler by removing the input lead. If this doesn't clear the fault, remove the h.t. connector (PLB 80/88 series, PLC 100 series) on the line output board. If this clears the short, check the line output transistor and transformer. If the transformer has to be replaced, leave the tripler's input lead disconnected after doing so. Switch on, with the meter and bulb still in circuit. If there's 165V and the bulb doesn't light, switch off and reconnect the tripler. Then switch on and again monitor the voltage and bulb.

F.S.P. Turner,
Southampton.

DECCA 70/90 CHASSIS

The Decca 70-90 series chassis has been the subject of articles in recent issues. As stated, tripping can be due to C633 being short-circuit. It can be a problem tracing the cause of tripping however, and the following procedure may be of help to those confronted with this fault. The h.t. and l.t. feeds can all be disconnected by removing various test links around the chassis. The first thing to do is to disconnect the tripler. If the tripping persists, isolate the various feeds in the following order:

(1) Withdraw PL401 to disconnect the h.t. supply to the line output stage.

(2) Open TL203 to disconnect the 195V supply to the RGB output stages.

(3) Open TL102 to disconnect the 18V supply to the sound i.f./output circuits.

(4) Open TL204 to disconnect the 18V feed to the 12V regulator (decoder, i.f., sync and line oscillator supplies).

(5) Open TL401 to disconnect the 23V supply to the field timebase.

(6) Open TL101 to disconnect the 195V supply to the tuning voltage circuit.

Note that the 23V supply is the only one derived from the line output stage, the other supplies being derived from the secondary winding of the chopper transformer.

If the tripping persists, check the following items by substitution: C633, D602 (over-voltage sensor), R636 (excess current sensing), and IC601 (TDA2581 chopper control i.c.).

Other faults we've had on these sets are as follows:

No colour: Change both Tr201 (2N4123) and Tr204 (2N4125). These transistors produce the burst gate pulse.

Set won't start: Check that R630 is 1kΩ and not 470Ω. Change as necessary. This resistor is not identified in Fig. 1 (September 1983 issue). It's the one that biases the 3·9V zener diode D605 (top one).

Uncontrollable sound and lines on picture: IC202 (12V regulator) physically loose.

Finally I must say that most of the tripping we've experienced has been due to trouble in the power supply, mainly R636 going intermittently open-circuit. The value of this wire wound resistor seems to be critical.

Jim Rainey,
Bangor, N. Ireland.

VCR CIRCUIT OPERATION

I'd like to comment on some technical inaccuracies in the articles on VCRs in your July issue.

First, Fig. 3 in the article on A-D conversion is incorrect in assuming that port C of the counter is reset on initial detection of key operation. This is not so – the count remains at five for *15msec,* after which it's reset from within (see Fig. 2). On the second count of five, the microcomputer engages the play mode. This double check eliminates wrong function selection due to contact resistance at the instant of key operation. With such small voltage steps (0·625V), the system is totally dependent on the stability of the resistors in the ramp generator and switch potential divider networks.

The article also implies that remote operation is achieved by means of a changeover jack socket which exchanges the front panel keys for the remote hand unit. This is not the case with the HR7200/HR7300. Another comparator (part of IC3) is in this case fed with the same staircase and, via a front panel mounted jack socket, connects to the remote hand unit. This is a duplicate of the front panel keys with the addition of "channel up" which shorts directly to chassis.

There was a slip in Fig. 2 – the top step is 9·53125V not 9·63125V. Readers may be interested to know that the stereo HR7350 version and its equivalents have an identical circuit but a totally different programme within the microcomputer IC2. This model counts down instead of up, and since not all the sixteen possible commands are used certain binary counts are skipped, i.e. the staircase waveform is no longer regular. Further, the scan is generated only after a key is depressed.

In the article on the 3V23 (VCR Servicing) it's stated that the BA841 provides the required changeover switching for the double-speed mode (pin 32) as in the 3V16. In the 3V23 however the BA841 merely generates the synthetic field sync pulses during this mode, the servo switching being produced by an input from the mechacon panel. Fig. 85 suggests that the drum reference trapezoid is always derived from the 4·43MHz crystal oscillator: this is not so as in record the reference is always the incoming field sync pulses of course.

The top of the slow/still drive pulse is 15msec wide, not 20msec. Careful study of the circuit will show that R149 (slow pulse) adjusts the amplitude of the *whole* pulse. If the pulse is scoped while R149 is adjusted however, its width will also be seen to change for the reasons mentioned by Mike Phelan.

In double speed the control pulse frequency is 50Hz, so the spacing is 20msec, not 25msec. In Fig. 87, the resistor connected to pin 2 of IC12 should be shown connected to 12V, not chassis. D7/8 in this diagram do not form a noise trap – on record the output from IC8 is a clean, rectangular 12V p-p signal. Their purpose could be as follows: on playback, IC8's output pin is at earth potential from an a.c. point of view, thus providing a low impedance to the playback control pulses, but since D7/8 never conduct on playback a stand off is created.

There are several references to "the drum servo free

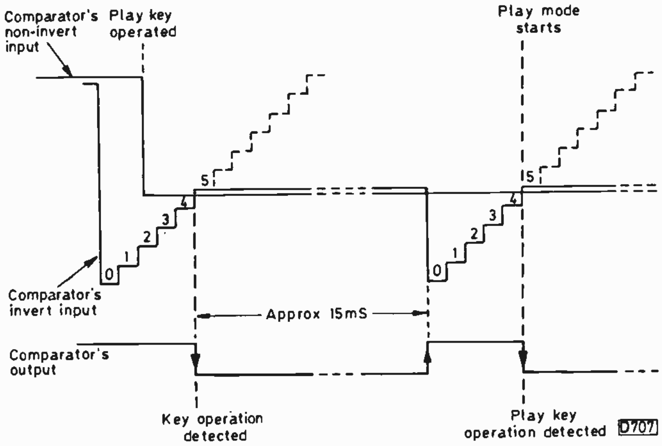


Fig. 2: Operation of the D-A converter control system-compare with Fig. 3, page 479, July.

running" and "stalling for time while the drum servo locks". During record, pause and edit however the drum remains locked to the incoming field sync pulses (local or camera pause only stops the tape transport, they don't remove the input signal).

The assemble edit system in this machine theoretically winds back 20 frames, plays forward for twelve and then overwrites the last eight. In practice a degree of overshoot occurs during backwinding due to inertia problems. This is of no practical consequence – the assemble always wipes out eight frames. The timing of the edit start is controlled from the mechacon microcomputer (using control pulses and the drum FF signal) in conjunction with the JK flip-flop IC9. This determines the point at which new f.m. tracks and control pulses are recorded and thus the success of the edit. At the point of changeover however the capstan sample signal is switched from off-tape control pulses to capstan FG pulses. While these two signals should both be at 25Hz, there is no guarantee of their respective phase. Since the sample signal gates the slope of the trapezoid, out-of-phase signals at the edit point could cause the phase detector to jump momentarily, with the possible loss of servo lock impairing the edit. It's for this reason that the FG counter is synchronised to the control pulse signal during the initial part of forward play (IC4a, IC4d).

During this initial part of forward play the capstan servo is in playback, and since the machine is playing back its own tape the customer tracking control should be in auto. This cannot be guaranteed, so during this time X13 is switched out and X10 in, introducing the "preset tracking 2" control which is set for a nominal delay of 25msec at pin 14 of IC12 (equivalent to the auto position of the customer tracking control). Budding video engineers should sharpen their reflexes if they want to adjust this – it's in circuit for just over half a second!

In the reel servo circuit (Fig. 88) D31 is shown connected the wrong way round. D31 is forward biased in search, removing the bias from the 6·2V switch. This allows C43 to stabilise to the nominal 4·8V during search.

IC16/X9 provide a "blank tape detector". IC15 will produce maximum d.c. output (limited at 11V by D28) in the absence of control pulses. The resultant tape speed, with the tape wrapped around the heads, is not considered to be a healthy condition however. IC16/X9 form a retriggerable monostable, i.e. IC16's output pin 6 does not have variable pulses but is high for as long as pulses are present. On a blank tape pin 6 goes low, opening the left-hand switch and closing the 8·2V switch (not closing it as the article suggests). The purpose of the 8·2V zener diode is to confine the motor speed to close limits.

The annotation shown at the input to X14 suggests that this is briefly high during rewind search. In fact it's permanently high in this mode. The coupling components differentiate the rising edge, causing brief conduction of X14. According to the manufacturers this obviates momentary colour drop-out as the tape changes direction and the drum speed is corrected. Due to drum inertia this cannot happen instantly, so the momentary "crowbar" action of X14 holds back the reverse tape speed to allow the drum to "catch up".

Tape snatch is prevented by the mechacon system. If the mechanical sequence at the moment of pressing reverse search is studied, it will be seen that the brakes are momentarily applied to bring the tape to a halt before the change of direction.

In record pause the cathodes of D32/33 go low. With D32 conducting, the right-hand switch (IC5) is opened, disconnecting the 8·2V clamp. D33 conducting opens the centre switch to disconnect the 6·2V clamp. This ensures maximum drive to the reel motor to provide sufficient torque for smooth rapid rewind of the frames in the assemble edit mode – for a given motor drive the speed, or amount of backwind in a given time, depends on the relative winding diameters on the spools.

For completeness, the purpose of X15, D29 and the associated components should be mentioned. They form a spool stall detector during search on a blank tape! In this most unlikely situation the motor is no longer servo driven but running on the 8·2V zener, and can thus suffer the effect mentioned above. As the tape shifts from one spool to the other, the tape speed slows down (older mechanical machines suffered from this effect in fast forward and rewind) so the motor could conceivably stall.

A couple of component reference numbers need to be added – C44 in X15's collector circuit and the following inverter, which is part of IC17. Take-up spool pulses (an infra-red interrupt detector is fitted underneath each segmented spool) keep C44 discharged. As the spool slows, C44 has time to charge to 6V. IC17 then toggles and D29 conducts, disconnecting the 8·2V clamp. The drive then rises to 11V, preventing the stall (otherwise the mechacon would unload the tape, thinking a fault was present).

I appreciate that it would be possible to fill the whole magazine with a description of the circuitry used in a particular machine and still not cover all the subtleties: one must draw the line and try to keep to basic operating principles. Readers could have been mislead however, especially those who are not backed by the training support of the larger video organistions. It's also a fact that most manuals leave a lot to be desired when it comes to describing exactly how the machine works. I hope therefore that you'll accept the above comments as being aimed at helping readers' understanding of these complex machines rather than as criticism of your contributors.

Eric L. Scann,
Bordesley Green, Birmingham.

HAMS AND 50MHz

In the August issue your correspondent Roger Bunney referred to amateur radio transmissions in the 50-54MHz band. Amateurs in the USA, Canada and many other countries outside Europe have had an allocation in this band for many years. During the last sunspot maximum the immense potential for DX working at these frequencies was demonstrated, with American and other amateur radio operators making contact with many European stations working crossband (i.e. with the European stations transmitting on the 28 or 70MHz bands). I myself had several contacts across the Atlantic in this manner, and the results were most rewarding.

At the 1979 World Administrative Radio Conference a proposal was made for an allocation to radio amateurs in the 50MHz region for Europe. Though supported by many European delegations, it was narrowly defeated at the vote. The Radio Regulations allow individual countries to allocate parts of the spectrum to other users than those internationally agreed however, provided there's no mutual interference to those in adjacent countries. This system has been used for many years for the UK's 70MHz amateur allocation.

As a result of RSGB negotiations with the Home Office (more recently the Department of Trade and Industry), a maximum of fifty special experimental licences have been made available for 50MHz amateur operation outside 405-line TV hours. These licenses are obtainable only by special application, and the amateur must show that he has a serious interest in the experimental use of these frequencies. Power is limited to around 50W input. With these operating times and the power limitation, the interference to broadcasting will be minimal. Amateur radio uses narrow-band modes of transmission, e.g. single-sideband which occupies about 3kHz, much less than the several MHz occupied by a TV signal. During 1979, signals from Canada were very strong by amateur standards: I know of no reported cases of interference to broadcast TV during this time. The interference caused by TV transmitters during SpE conditions is far more troublesome and has been endured for years. If one of your readers lives next door to a 50MHz permit holder he's obviously going to have problems receiving his DX-TV signals occasionally. But he's receiving signals beyond their normal service area and cannot expect a clear channel at all times.

When the 405-line service closes at the end of 1984 there's a strong possibility that the Department of Trade and Industry will consider a full allocation to UK amateurs in the 50MHz region. The problem of mutual interference with neighbouring European countries would then be carefully examined before any permission is granted. Until this time the experimental 50MHz permit holders will continue to use the band outside TV hours, gaining insight into the enormous potential these frequencies offer to those interested in DX.

David W. Sergeant, G3YMC,
Bracknell, Berks.

TV Fault Finding

Reports from Richard Roscoe, George R. Wilding and Mick Dutton

Pye 731 Series

The Dynatron 733 chassis is basically the Pye 731 with remote control and touch tuning, all dressed up in a fancy period cabinet that weighs a ton! In fact once installed these sets are so difficult to move that it's not unknown for us to make repeated trips back to the workshop rather than try. Anyway, the problem this time was field rolling. The field timebase circuit is generally reliable, so in view of this and the fact that most field faults are actually power supply faults we made sure we had all the likely bits on board before setting off.

When we saw the picture it looked awful. Not only was it rolling badly, the bottom was cramped and the convergence seemed to be badly out as well. In addition the top and bottom edges of the raster were strangely misshapen with what looked like bites taken out of them. As we'd suspected, the symptoms did not suggest a simple field timebase fault – they were too varied. Equally they were not the sort of symptoms caused by a fault in the 185V regulated power supply.

Had the symptoms been field rolling with lack of height we would have suspected the smoothing resistor R555 (6·8Ω) in the line output stage derived 25V supply. This resistor sometimes increases in value – it's not easy to get at, being right under the line output transformer screening can on the line scan panel. We checked it nevertheless, and found it to be o.k. Having got there we decided to check the associated electrolytics. Bridging the smoothing electrolytic C554 (4,700μF) provided an instant cure to all the symptoms. **R.R.**

Sony KV1800UB

Even today many engineers regard the scope as an expensive luxury and continue to put their faith in experience, the multimeter and persistence. Fair enough, but occasionally a fault which is very difficult to trace without a scope comes along. Even with a scope it may not be plain sailing, as was the case recently with a Sony KV1800UB. The symptom was random field jitter, with the whole picture jumping up and down.

When we took the back off we discovered that the problem had received previous attention. The line and field timebase board in the bottom of the set had clearly been extensively resoldered, while several transistors in the field timebase had apparently been replaced. We could understand this: by far the most common cause of trouble in the signal and other low-power stages of these Sony sets is noisy transistors, and the random jitter symptom could well be due to a similar cause. A meter is not much use in a situation like this, so out came the scope.

The first check we made was on the decoder board, where the 2SA677 sync separator transistor Q154 lives. We've had trouble with this transistor before – it often causes colour faults, due to the unique non-PAL decoder used in this chassis. Sure enough there was a lot of random noise in the sync output, so a BC214 was fitted – we've found it an adequate substitute in the past. Unfortunately this time it made no difference.

The output from the sync separator transistor goes via an integrating network and interlace diode to the field oscillator, also to the flywheel line sync phase-splitter transistor Q507 (2SC1364). All these items are on the timebase board, and the scope showed that noise was present everywhere in this part of the circuit, though it couldn't pinpoint the source. In order to do so we had to disconnect the various stages. To our surprise we found that the noise was coming from Q507, though the line sync was rock steady. A BC184 proved to be a suitable replacement. **R.R.**

Rank Z718 Chassis

A Bush Model BC6300 (Z718 chassis) led us a merry dance recently. The complaint was incorrect colours. When we arrived the BBC was being its usual helpful self with endless rolling teletext on both channels – it must be months since we last saw the little girl with her doll. Channel 4 is not yet available at this location, so we were left with ITV which was showing a black-and-white film!

The trusty colour bar generator revealed that the colour bar display was all wrong, but in a curious way we'd not seen before. The three decoder chips can all be plugged in, so as a start we replaced each in turn. There was no improvement, while the output stage voltages seemed to be o.k. as well. We next disconnected the blue and green cathode leads so that we could see what the red display was like on its own. The screen showed the correct red bar pattern – but in blue! Similarly blue ended up as green and green as red . . .

The only things that could do this were a displaced shadowmask or a purity fault. There was no sign of impurity – or was there? Yes, a *tiny* patch of impurity we'd not noticed before was present at the top left-hand corner. So out with the degaussing coil to give the set a good going over, after which we had a perfect display. The culprit was the degaussing thermistor 7TH1 which had broken down. These small, three-legged, positive temperature coefficient thermistors can cause other annoying symptoms, such as random fuse blowing and intermittent lack of purity. If you can't see anything wrong with one but want to check it, a good tip is to remove it from the circuit and give it a shake. If it rattles, change it. **R.R.**

Thorn 1590/1591 Chassis

After a series of monochrome portables with hum bar problems due to open-circuit bridge rectifier diodes, the arrival of a Thorn 1591 with the same problem naturally directed our attention to the rectifier diodes W7/8. These are fed from a centre-tapped secondary winding on the mains transformer, so to carry out a reliable check the lead from one of them has to be disconnected and the l.t. fuse F2 removed. Both diodes turned out to be o.k., so attention was turned to the series regulator circuit.

The regulator transistor was running at the normal temperature, confirming that it was not short-circuit, and as its emitter and collector voltages were correct the main reservoir capacitor was obviously in order. Although this is a rare occurrence, it now seemed that one of the l.t. smoothing electrolytics had lost capacitance. So we switched off and connected a 200μF test capacitor across the l.t. rail. This produced no real improvement.

The set had been brought to us from some distance, the four push buttons being tuned to what are in our area rather weak and ghosty signals. On retuning one of the buttons to a local transmission we obtained a clear, well contrasted picture and noticed two effects. First, the hum bar took a second or two to develop after the picture appeared following switch on, and secondly the hum bar faded away before it reached the bottom of the raster. As we've said before, unusual or peculiar symptoms are usually caused by a faulty semiconductor device of some sort. Despite the fact that it seemed to be working normally, we decided to replace the series regulator transistor. This cleared up the hum bar problem, our conclusion being that the transistor was developing excessive leakage when warm. **G.R.W.**

Decca 120 Chassis

The problem was that the set would go off after about thirty minutes' use. On soak test we noticed that just before it went off the line hold would drift. A scope was connected to the collector of the line driver transistor Q401, and as the fault appeared the line oscillator seemed to stop working. Replacing the TDA2576A sync/line oscillator chip failed to cure the fault, so we started to change the capacitors in this area one at a time whilst leaving the set on soak test. The culprit turned out to be C406 (22μF). **M.D.**

Philips K30 Chassis

A set fitted with the K30 chassis came in with the complaint of lines on the picture – this turned out to be loss of line hold. When we tried to adjust the line hold control R8371 we found that there was no line sync. As we had another set handy the sync/timebase oscillator panels were swapped over. This made no difference so the chopper control panels were next changed, clearing the fault. A check with the scope then revealed that there was no line drive pulse at pin 3 of the TDA2581Q chopper control i.c., due to C7341 (0·0012μF) being dead short to chassis. In these sets the chopper drives the line output stage. **M.D.**

VCR Clinic

Reports from Derek Snelling, Les Harris and Mick Dutton

Ferguson 3V29

The complaint with a Ferguson 3V29 was that it would not record in colour though it played back known good tapes in colour. A quick check on the colour/monochrome (mode select) switch at the back showed that it was in the correct position, though if it hadn't been this would have affected playback as well. A record colour fault is not one to be tackled in the field, so the machine was taken back to the workshop.

Checking with a scope during record suggested that the problem was around IC401 in the colour processing section, the waveforms at pins 7 and 8 both being wrong. Much time was then spent scoping waveforms through the various filters etc. before a meter was used to make some voltage checks. The voltage at the cathode of D401, whose anode goes to pin 8 of IC401, was found to be 2·9V. The manual says the voltage here should be "high" for colour, "low" for monochrome. Switching the mode select switch to monochrome set the voltage to zero, so it was assumed that 2·9V was "high". After more fruitless searching a comparison was made with another machine, which revealed that "high" means 9V – if I'd followed the wire to the switch I'd have seen that the switch is connected to a 9V rail. In fact the switch turned out to be faulty, though not faulty enough to have affected playback! **D.S.**

Hitachi VT9500

After dealing with the Hitachi Model VT9500 for twelve months, I've just read the service manual and discovered something that may be of interest to anyone owning one of these machines. The remote control unit has a button for frame advance, though there's no control for this on the front of the machine. You'll find however that if the front is removed the frame advance switch is located below the pause switch – it's just that there's no knob on the front to push it. Perhaps more interesting is the switch next to the frame advance one, as this is a slow switch. Pushing it puts the machine into slow play (stepped type, as with Ferguson machines). No additions or modifications are required to incorporate this feature, it's just that once again no knob is provided on the front to enable it to be used. Tracking is done via the still tracking control on the front. There are four adjustments, as follows, though the machine I tried was already set up:

(1) Brake pause, RT517. Set the still tracking control to the centre position, connect an oscilloscope to pin 2 of PG516, play back a tape recorded on the machine, set to slow and adjust RT517 for a pulse width of 25msec.

(2) Slow, RT901. Set up as before but with the scope to pin 1 of PG516. Adjust to set the centre of variation of the pulse width to 85msec.

(3) Slow tracking preset, RT516. Set up as before and adjust for minimum noise on the screen.

(4) Horizontal fluctuation, RT518. Set up as before and adjust for minimum horizontal fluctuation on the screen.

RT518, RT516 and RT517 are on the servo board while RT901 is on the system control board. **D.S.**

Ferguson 3V00

In the July VCR Clinic Steve Beeching dealt with the problem of key release and unthreading when play is selected on the Ferguson 3V00. One point of disagreement: our experience has been that the machine will not lace up if the cassette compartment bulb is faulty. **D.S.**

GEC V4100H

The customer had sprayed Rocket WD40 into the cassette compartment of a GEC V4100H (similar to the Hitachi VT11E). Why do they do it? – to keep me in a job of course! The reels and pulleys were cleaned, then the machine was tried. It worked in fast forward and rewind, but on playback it ran for seven seconds then unloaded. The reel rotation sensor was changed, the various pulses (drum tacho, capstan FG etc.) checked and found to be present, then the system control/servo board was changed – but the fault remained. It was finally traced to the mecha state switch not making contact in the play mode.

This switch is operated from a cam on a gear which is driven by the loading motor via two small belts. One of these had oil on it and was slipping as the mechanism approached the loaded position, so the mecha state switch contacts didn't close. Incidentally, plug PG902 from the mecha switch is wrongly marked on the diagram, i.e. pin 6 is shown as earthed instead of pin 1. **L.H.**

Ferguson 3V00

A Ferguson 3V00 I had in the workshop had a fault the customer didn't know about and would probably never have found. The machine had come in with tracking problems, and it was while testing the machine after carrying out the repair that I noticed the playback went streaky if the tuner/camera switch was moved to the camera position. Now this switch should have had no effect on playback. It merely connects the record 12V rail to the tuner/i.f. board. Checking with a meter showed that instead of 0V (playback) there was 2V on the rail, which dropped to 0·5V when the switch was set to tuner.

The 2V present was obviously coming from a high-impedance source which the loading of the tuner/i.f. board pulled down, hence the streaking only when the switch was in the camera position. By disconnecting components from the record 12V rail the voltage was eventually tracked down to IC206 on the Y/C board. Time was then wasted trying to find out why pin 7 of this i.c. was at 12V – according to the circuit this voltage should be present on record only. It turns out that the circuit has been modified and pin 7 is now permanently connected to 12V. The fault was in fact due to a leak in D212, as a result of which some of this 12V was getting on to the record 12V rail. Whilst the customer knew nothing of all this, it's possible that D212 would eventually have gone short-circuit, producing streaking whatever the position of the switch. Without the clue given by the switch, i.e. that the fault was on the record 12V rail, the problem would have been very difficult to sort out. **D.S.**

Grundig 2 × 4 Super

The complaint with this machine was failure to record. All other functions were o.k., but when the record sequence was initiated the display showed "CASS" and nothing happened. This display indicates that a tape with an anti-record lock has been inserted, but this was not the case. We checked the operation of the record lock microswitch to prove that it was o.k., then checked back through the wiring. The switch operation could not be measured across BM1-10 and BM1-6 on the keyboard panel, indicating an open-circuit interconnection. This turned out to be a crack in the print on the switch board at connection number two. **M.D.**

Fisher FVH-P350

This VCR produced a good picture but there was no sound on either playback or E-to-E. When we dismantled the machine the sound returned and we found that it could be made to come and go by applying pressure to the modulator. The problem was due to a defective i.c. leg within the modulator – it was breaking contact intermittently. Unfortunately the i.c. is not available and a new modulator had to be fitted. **M.D.**

Sharp VC2300

There were two problems with this machine. First lack of video to the modulator, due to dry-joints on Q409 (2SA1015Y). Secondly the picture was unstable, with a noise coming from the head drum assembly. This was due to the motor shaft being fitted too tightly, as a result of which the two halves of the rotary pick-up transformers were rubbing together. With some care we were able to tap the motor shaft to lift it slightly, giving a little clearance between the transformers. If the shaft is tapped too sharply the tape path alignment will be affected and it will be necessary to reset the head drum speed as there will be less friction. **M.D.**

Ferguson 3V31

The problem with one of these machines was that a channel could be tuned in but could not be stored in the memory. This was due to the MN1218A memory i.c. (IC205). I've since been told that it's quite a common fault. **M.D.**

Satellite TVRO System

Part 1

Nick Harrold

In view of the interest now being shown in 4GHz satellite TV signal reception I thought readers might be interested in details of my own home built TVRO (television receive only) system, which has been in use for the last two years and has given high-quality colour reception from the Russian Gorizont satellite and weaker reception of other 4GHz satellites, using only a 1·2m diameter dish aerial.

Head Unit

Fig. 1 shows a block diagram of the head unit. No constructional details will be given for the 4GHz to u.h.f. conversion section as this has already been covered in recent articles by Roger Bunney and Hugh Cocks (see the November 1982, May 1983 and September 1983 issues).

The 1·2m dish is quite small for this application and is very inefficient due to its short focal length – consequently it's difficult to illuminate it efficiently. In order to obtain the maximum possible signal a scalar horn feed was constructed out of two inch copper pipe. An adjustable back plate gives an extra 0·5-1dB over an open-ended waveguide feed when adjusted correctly for maximum signal/minimum sidelobes.

The majority of 4GHz satellites use right-hand polarisation. A 3dB signal loss will occur due to the quarter-wave signal pickup probe being linearly polarised. A polariser consisting of ten 2BA screws spaced quarter guide wavelength apart on an adjustable sleeve was added later. This should be rotated to maximise the signal and then finally set for right-hand polarisation.

The signals picked up by the quarter-wave probe are coupled to the low-noise amplifier via back-to-back SMA connectors. Three NE720s giving a total gain of 30dB are used in the LNA, which is wideband tuned to cover the 3 7-4·2GHz satellite band. An MC24T double balanced mixer follows the LNA, with a tuneable local oscillator to produce an i.f. at u.h.f. Further amplification at u.h.f. is provided by a 30dB wideband amplifier prior to feeding the signals into the house via 50ft of low-loss coaxial cable. This extra gain helps to avoid any possibility of u.h.f. TV breakthrough, the amplifier also providing the low-impedance output required to feed the long cable run. The range of the remotely tuned local oscillator is 2·5-3·5GHz – used in conjunction with the u.h.f. tuner's range of 450-850MHz, this gives coverage of the entire satellite band.

No form of image rejection is incorporated. Thus noise at the image frequency (local oscillator frequency minus the i.f.) will be added to the wanted signal. This degrades the picture quality slightly. A bandpass filter that allows only the wanted 3·7-4·2GHz signals through is currently being fitted, and when added between the LNA and the mixer will considerably improve the system's overall noise figure.

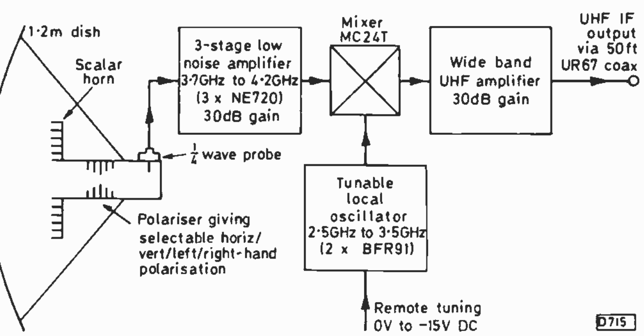


Fig. 1: Block diagram of the 4GHz head unit.

The IF Strip

A block diagram of the receiver less head unit is shown in Fig. 2. The rest of the present article describes the wideband tuneable i.f. circuitry – see Fig. 3. The down-converted, u.h.f. signals go first to an ELC1043/05 tuner modified for wideband operation. This produces a 35MHz output which is fed to a wideband amplifier built around the RS Components RS560C i.c. This section provides a gain of 27dB with a noise figure of less than 2dB. C5 and C7 tailor the response to give a flat output of ±1dB over 10-55MHz. The amplified 35MHz signal is then fed via a short length of coaxial cable to a wideband f.m. discriminator using a TAA661. The input tuned circuit L1/C14 is tuned to the centre frequency, 35MHz, while L2 and L3 are tuned low and high of the centre frequency respectively. All three tuned circuits are heavily damped by low-value resistors to reduce their *Q* and thus maintain the required bandwidth. The output is converted to low impedance by the emitter-follower Tr4, going via two short lengths of coaxial cable to the video clamp and the tuneable sound i.f. section.

An essential requirement to cope with the energy dispersal waveform used by the Gorizont satellite is the a.f.c. circuit associated with the tuner. This will be explained in detail in Part 2.

Construction

The bandwidth of a standard, unmodified u.h.f. tuner is about 10MHz. This has to be widened to at least 25MHz to allow the satellite signal through without limiting the h.f. chrominance information or the sound subcarrier. The modification required is quite simple. Remove the tuner's top cover and locate the i.f. output coil. This has to be removed and replaced with an 820Ω resistor. The best way to do this is to unsolder one end of the winding carefully then solder the resistor across the two pins. It may be beneficial to drill out the i.f. feedthrough capacitor (about 20pF), but this was not found necessary in my own case.

The RS560C has a response up to v.h.f., and due to the high gain certain precautions are required if instability is to be avoided. No problems should be encountered if normal v.h.f. techniques are used, i.e. keep all component leads as short as possible and decouple the supply pins adequately.

To give some idea of the construction, IC1, Tr2 and their associated components are all mounted above a 1 × 1·5in. piece of copper clad PCB used as a groundplane. Pin 1 of IC1 is soldered to the groundplane, the other pins being bent outwards. Components associated with IC1 are soldered directly to the pins. Tr2 is mounted off the

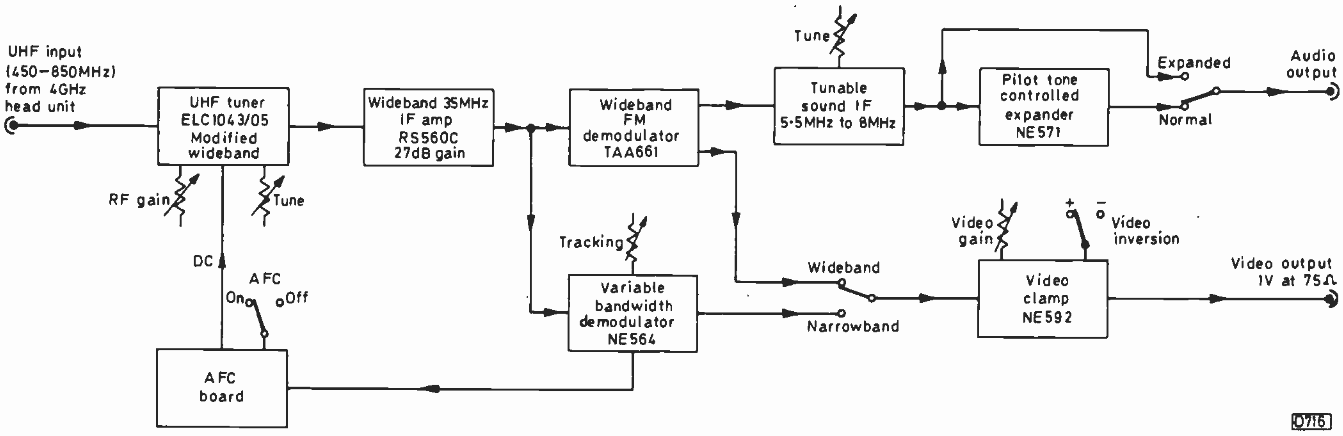


Fig. 2: Block diagram of the receiver less head unit.

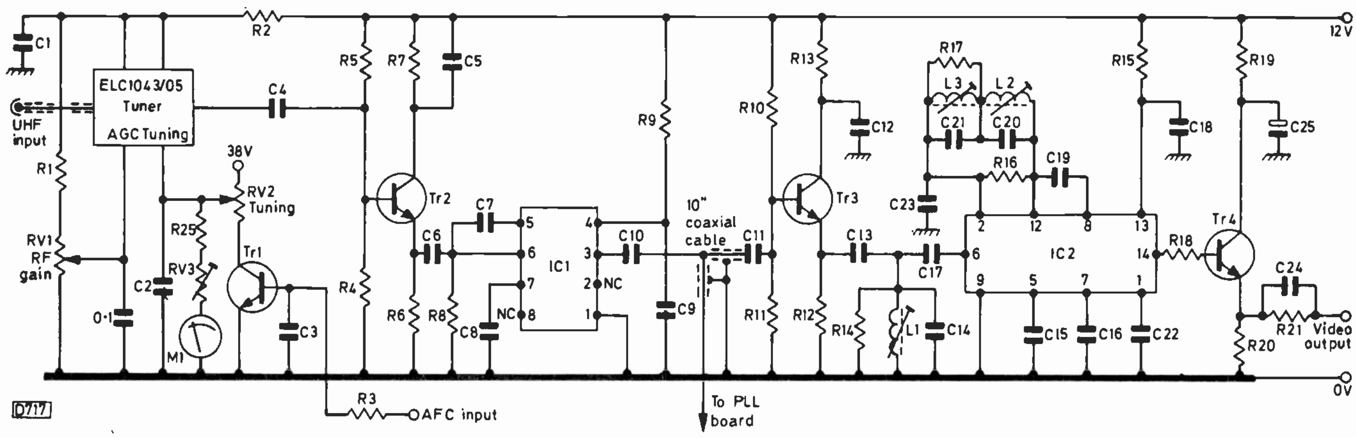


Fig. 3: Circuit of the i.f. section. Decouple the slider of RV1 if mounted more than 6in. from the tuner.

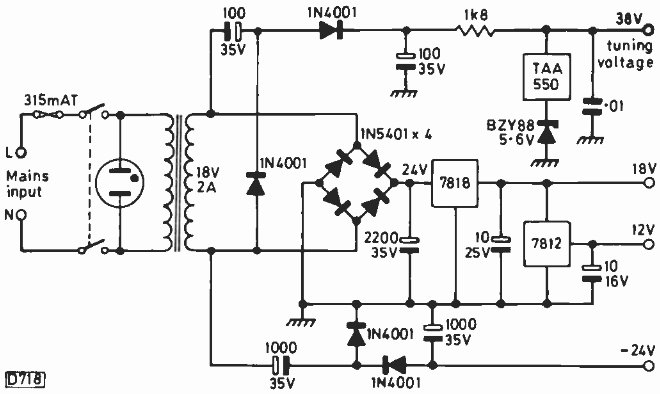


Fig. 4: Suitable power supply circuit.

groundplane, supported by R4 and R6. C5 and C7 should be 1% silver mica capacitors as they determine the i.f. amplifier's overall response.

Fit the i.f. amplifier board close to the tuner unit's i.f. output pin – don't use screened cable, just couple the two units together with C4. This connection should be no longer than 1in. The output from IC1 is less critical, being of low impedance, and can be fed via a short length of coaxial cable (say 10in.) to the demodulator board. A second output is also taken via a short length of coaxial cable, in this case to the NE564 PLL narrow-band demodulator board.

The wideband demodulator circuit is built on a small piece of Veroboard. No problems should be experienced here provided all leads are kept as short as possible.

The a.f.c. transistor Tr1 should be mounted close to RV2. Use screened leads from the base of Tr1 to the a.f.c. board and from the slider of RV2 to the tuner to reduce the possibility of hum pickup. RV1 and RV2 are front panel controls.

A suitable power supply is shown in Fig. 4. Mount the voltage regulators on small heatsinks.

Testing

Full testing cannot be carried out until completion of the items described in Part 2. A few simple checks can be done however. Set RV3 to maximum resistance. Check the various supplies, then check that the voltage at the emitter of Tr4 is 4·5V. Turn RV1 (r.f. gain) to maximum and ensure that the tuner's a.g.c. pin is at 3·1V. Tune L2 to maximum and L3 to minimum inductance.

For test purposes only, connect a 10kΩ resistor between the base and collector of Tr1. Set RV2 for the maximum tuning voltage, then adjust RV3 for f.s.d. on meter M1. Connect a u.h.f. aerial to the tuner's input and, with a scope connected to the emitter of Tr4, some sort of signal should be seen when RV2 is adjusted.

The discriminator cannot be set up till an f.m. signal is received. The adjustment of L1, L2 and L3 is then straightforward.

Next Month

In Part 2 a full explanation of the principles behind energy dispersal will be given along with details of the a.f.c. circuit, a narrow-bandwidth demodulator for digging out weak signals, and the video output clamp board. Discriminator setting up instructions will also be given.

A components list for Fig. 3 will appear next month.

Servicing the Sony KV1340UB

David Botto

The Sony model KV1340UB is a compact receiver fitted with a 13in., 90° Trinitron tube. There were several changes in sets with chassis numbered 100,001 on, so it's important to be sure which version you've got. The PCBs are accessible after removing the cabinet shell – to do this, pull off the side control knobs and remove the screws in the cabinet back. The boards are identified by letters which we'll use in this article.

The power supply is on board PR and is easy to test and repair. It consists of a capacitive voltage divider, a crowbar over-voltage protection circuit and a series regulator (see Fig. 1).

The a.c. mains input is applied via fuses F601 and F602 (both 2A) to the collector of transistor Q601 (2SC1454) and the junction of R602 (33kΩ, 2W metal-oxide non-flammable) and the cathode of D604 (type U05E). On the positive half-cycle of the mains input Q601 is biased off by R601/2 while D603 and D604 both conduct. The two capacitors in the divider circuit, C602 and C603A, thus charge via R603. On the negative-going half-cycle Q601 conducts and D604 is cut off. C602 and C603A are then effectively connected in parallel (D602 conducts to clamp the negative side of C602 to chassis). The net result is that a d.c. voltage of 144V is developed at the junction of C603A/R606 for presentation to the series regulator circuit.

Should the voltage across C603A rise due to an excessive increase in the a.c. input or Q601 going short-circuit, the voltage (usually about 8V) at the cathode of zener diode D605 will also rise. When it exceeds 11V D605 conducts and fires the crowbar thyristor Q602 (CV12E). This usually blows F601 and possibly F602, protecting the series regulator transistor Q604 and the rest of the set. The series regulator circuit is conventional, the output at terminal 6 of the PR board being 110V. This is set by VR601 and is best done with a digital multimeter.

Dealing with a Dead Set

So in comes a customer and deposits a dead KV1340 on your bench. What next? The first things to check are the mains fuses F601/2. If these are blown and a nice black colour, check the mains filter capacitor C601 (0·22 μF, 300V a.c.) and the switching transistor Q601 for being short-circuit. If Q601 has gone, test the thyristor Q602, the regulator transistor Q604 and its driver Q603, and diodes D601 (10D4) and D602/3 (both U05E).

When Q601 has been replaced the set will sometimes work but fail hours or maybe weeks later. In this event thoroughly test diodes D601/2/3 and transistors Q802 (line output, type 2SC1034) and Q801 (converter, type 2SC1316) for leakage. These latter two items are on the HC board. In case the term converter is not clear, it should perhaps be mentioned that the converter stage comes between the line driver and output stages. There are three transformers in all, the driver transformer T501, the flyback transformer T801 and the line output transformer T502. The converter transistor drives the flyback transformer, from which the e.h.t. and various other supplies are obtained. The line output transistor is driven by a secondary winding on the flyback transformer. Fig. 2 shows the arrangement.

To find out whether the fault is on the PR board or in some other part of the set, disconnect the wires from pin 6 of the PR board and connect a 60W, 240V bulb from pin 6 to chassis. Use a variac or tapped mains transformer to feed the mains input to the receiver, gradually increasing it from about 90V a.c. to 240V a.c. The bulb should light dimly, and you can measure the d.c. voltage between pin 6 and chassis.

If all is well with the power supply, disconnect the mains and reconnect the leads to pin 6. The VH board holds most of the line and field timebase circuitry. The next step is to power the line oscillator and driver stages by connecting an 18V d.c. supply between the junction of R505 (300Ω) and T501 on this board and chassis – two PP9 batteries in series work nicely, negative to chassis. With the mains supply still disconnected, connect the scope's probe (10:1 for all the tests we make) to the collector of Q503 (2SC633A) in the line oscillator circuit. The waveform shown in Fig. 3(a) should be obtained. Next see whether the waveform shown in Fig. 3(b) is present at the collector of the line driver transistor Q504 (2SC1475). If these waveforms are not present, check Q502 (2SC633A), Q503 and Q504, and make sure that the supply line decoupler C507 (10 μF, 25V electrolytic) has not dried up.

If everything is working correctly and the waveforms are present, leave the 18V supply from the batteries connected and apply the mains a.c. via the variac or tapped transformer, increasing the input gradually. If the set now works, back off the a.c. voltage till you get a smallish picture and disconnect the 18V battery supply. If the set then stops working, disconnect the mains and check the 18V rectifier diode D509 (type HF.SD-1Z), its surge limiting resistor R537 (12Ω, 1W), and make sure that the reservoir capacitor C532 (10 μF, 25V electrolytic) hasn't dried up. If the receiver continues to operate when the batteries are removed, but refuses to start when the mains supply is switched off and on again, suspect the start-up supply resistor R522 (10kΩ, 2W).

If line drive is present but there's still no sound or raster, check Q802, Q801 and the following diodes and capacitors on the HC board: D802 (SB-2C), D801 (SB-2B), C805 (7,500pF, 1·5kV), C806 (100pF, 2kV), C802 (16,000pF, 1kV) and C803 (680pF, 1kV). The flyback transformer T801 is very reliable but the tripler (DC801, HV rectifier block) can fail. When this unit is about to fail it sometimes makes the horizontal static convergence drift off. This effect can also be due to VR801 (1MΩ horizontal static convergence adjustment) being defective.

Fault Summary

A picture that varies in size can be caused by the thermistor Th601 (TH4700) in the regulator circuit on the PR board. This thermistor will often produce a clearly audible clicking sound at the same time.

Resistor R801 in Q801's base circuit can be any of four

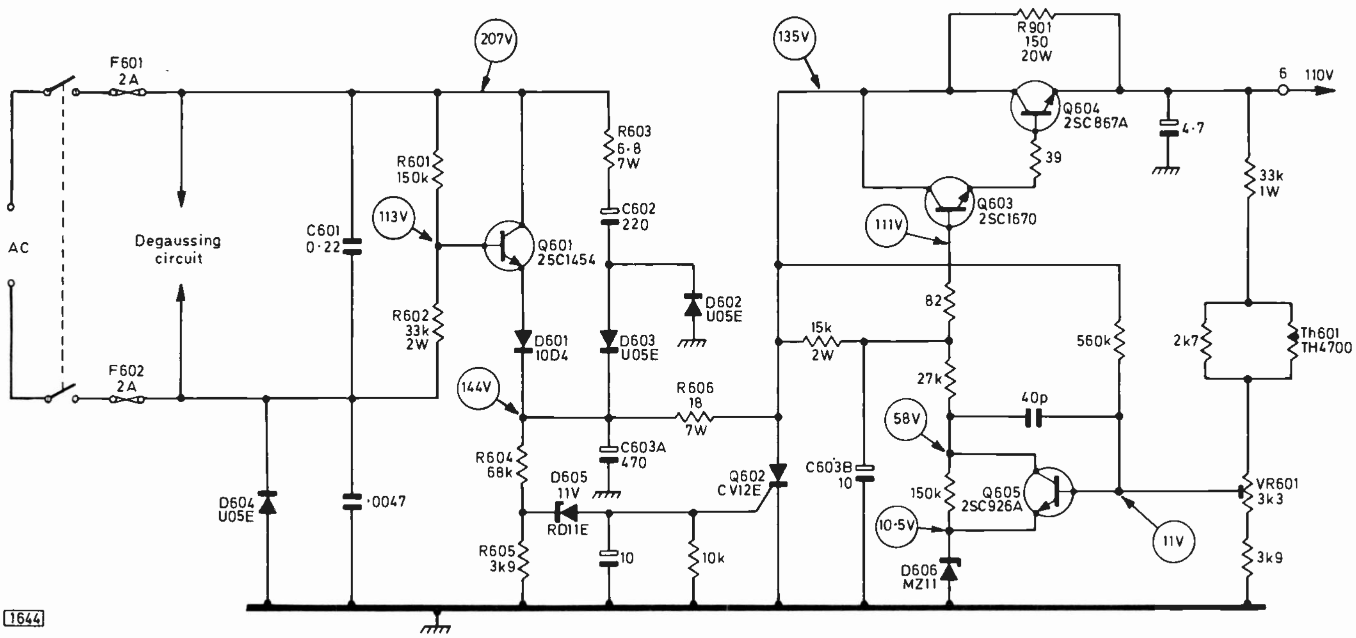


Fig. 1: Power supply circuit. In later production C601 is 0·1μF and D604 type U05G.

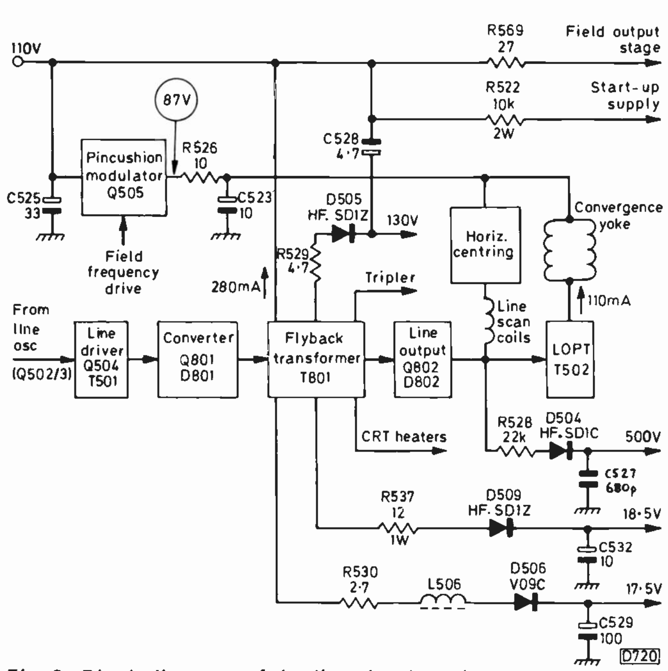


Fig. 2: Block diagram of the line timebase/converter system. In later production D509 is type HF1Z and R537 22Ω.

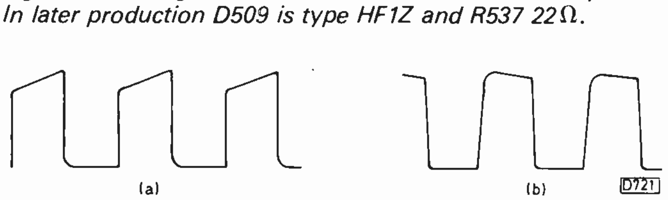


Fig. 3: Line drive waveforms.

values – 12/15/18/27Ω, 1W non-flammable. R802 in Q802's base circuit may also be any of four values, 1·8/2·7/4·7/5·6Ω, 3W non-flammable in this case. These resistors can cause line jitter, especially on changing channels. If you replace them, be sure to use the original value.

A too wide picture accompanied by nasty pincushion distortion calls for investigation of the pincushion modulator transistor Q505 (2SC1124) and resistor R526 (10Ω, ⅛W non-flammable) which is in series with its emitter. Beware of the decoupling electrolytic C528 (4·7 μF, 50V – how Sony love this value!): if it dries up or corrodes, a pair of white bars ½ to ¾in. wide will appear on either side of the picture. These three items are all on the VH board.

Still on the VH board, resistor R561 (220kΩ) in the field output stage bias network can increase in value or go open-circuit, causing lack of height and various interesting foldover effects. Measure the values of the associated resistors R562 (820Ω) and R563 (1·2kΩ) as well if this happens. Thermistor Th501 (TH1500) is connected across R563: change it if the complaint is intermittent field bounce.

In earlier versions of the chassis, the sync separator transistor Q307 (2SA677) and its feed choke L304 are suspect in the event of field or line sync trouble. These items are on decoder panel C. On both versions of the chassis, complete or intermittent sync failure can result from the sync separator's input coupling capacitor C235 (1 μF, 50V electrolytic) drying out and losing capacitance. Sometimes the end will fall off when you touch it! It's on signals panel S.

Board Compatibility

In earlier versions (up to serial no. 100,000) the decoder circuitry is on board C with the RGB output stages on c.r.t. base panel T. Later versions use decoder board B – and c.r.t. base panel C! The newer boards are not interchangeable with the earlier ones, though the VH, PR and S boards used in the two versions are interchangeable. The original decoder board C uses transistors throughout. The later board B uses transistors and a couple of i.c.s. Both panels are quite straightforward.

Signals Faults

We'll look at board C first. The passive subcarrier regenerator technique is used, i.e. the burst amplifier Q303 drives the 4·43MHz crystal X301 via its collector circuit tuned transformer T303. Adjustment of this transformer is critical. Connect the scope's probe to the junction of T303 and C316 (27pF). You should then see the burst waveform in Fig. 4(a). If adjustment is required, set the user picture and colour controls to half way then

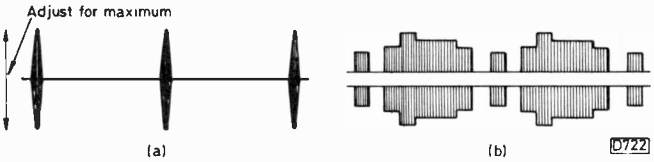


Fig. 4: Decoder waveforms.

adjust T303 for maximum signal. In general the decoder adjustments don't seem to change – unless someone's got at them!

The usual cause of colour loss or intermittent colour loss is dry-joints – not one but a multitude. If tapping the panel almost anywhere makes the colour go on and off, you've got no choice but to solder carefully over almost the entire panel. Apply a thin coat of circuit varnish afterwards. To override the colour-killer on the C panel, connect the base of the killer transistor Q308 (2SC633A) to chassis.

If brightness variations occur in sets fitted with the C panel, check the luminance amplifier and driver transistors Q151 and Q153 (both type 2SC633A) for leakage or corrosion and measure the value of R165 (470kΩ) which biases the emitter of the beam limiter transistor Q152.

For excessive brightness, check R805 (1kΩ, ½W) between the earthy end of the tripler and chassis for change of value.

The two i.c.s used in the later decoder board B are IC301 (CX108) and IC302 (CX109). An obscure fault consists of a vertical white line about an inch wide on the right-hand side of the picture. The cure is to change IC302. Apart from this both i.c.s are reliable. A couple of adjustments on this board call for extreme accuracy – if they are incorrect, the result is no colour. Don't touch them unless you are sure that they've been disturbed or have drifted off. The first of these adjustments is T301 in the chroma take-off circuit. With the scope connected between the junction of T301 (centre tap) and R315 (1kΩ) and a colour-bar input, the display shown in Fig. 4(b) should be seen. If the bars are clear with a peak-to-peak amplitude of about 0·8V all is well. If not, carefully adjust the core of T301. The other very sensitive adjustment that sometimes drifts off tune is the setting of the core of the a.p.c. coil T303. To check this, short together pins 9 and 10 of IC301 with a jumper wire and check whether the colour bars are in phase. If not, adjust T303 gently to correct this.

The RGB output transistors on the c.r.t. base panel are type 2SC1127 in both versions (Q701-3). Sometimes one fails, producing loss of the relevant colour. If you get a lovely bright green picture, make sure there's not a short- or open-circuit between the tube's final anode and convergence connectors before investigating the colour circuitry. The same effect is sometimes produced by a faulty tripler.

We've not had much trouble with the sound section on the S board. R617 (68Ω, ⅛W) on the PR board can fail, removing the d.c. supply to the 2SC867 sound output transistor (Q902). Should rectifier diode D506 (V09C) or the associated surge limiter resistor R530 (2·7Ω, 0·65A fusible) go open-circuit, the result will be no sound, no supply (B+) to the tuner and no field scan due to loss of the supply to the field oscillator.

A nasty, flashy, speckled picture is the result when the leads of transistors Q201 (2SC1129) or Q202/3 (both type 2SC1128), the first, second and third i.f. amplifier transistors, get corroded. These transistors are on board S. Examine and test them – if one is corroded, replace them all. The same symptoms will be present if transistors Q751/2, type 2SC1128, on the UIF board leak or corrode.

If you've a low-gain, dusty picture, suspect the tuner. Before condemning it however, take the lead off pin 10 of board S and bias the tuner from an external source. If this results in a good picture, check transistors Q210 (2SC633A) and Q209 (2SA677) in the a.g.c. circuit on board S. If the set drifts off tune, replace the tuning voltage stabiliser diode D101 (μPC574J).

In conclusion, it's best to use only parts supplied by Sony – if you fit substitutes, you'll just make lots of nasty problems for yourself.

The Betamax Video System

Part 3

Eugene Trundle

Before we get involved in the chrominance department of the Betamax system, we'll make a slight digression into the sometimes ill understood subject of vectors and phases – a basic working knowledge of this subject is essential if the chroma crosstalk cancellation process in a VCR is to be understood, regardless of the format in question.

Phase Relationships and Vectors

Phase is basically about relative timing, and in any situation where phase is relevant we're generally concerned with a master frequency, the reference, and the timing relationship between this and a second waveform, the sample. Thus in colour TV the chrominance subcarrier, in the guise of the burst signal or a regenerated carrier, forms the reference, the chroma signal itself being the sample. As the phase of the sample (chrominance signal) varies with respect to the reference, different colours are produced. The timing relationship is described not in seconds or nanoseconds but in degrees, with one complete cycle occupying 360°. See Fig. 15.

If the sample is delayed by half a cycle (180°) with respect to the reference, it's said to be in antiphase. Provided the waveform concerned is symmetrical about the zero line (as are sinewaves, square waves and triangular waves), the *effect* of this is apparent inversion of the waveform. This explains the confusion that's led to misnomers such as "phase splitter" for a stage which provides opposite-polarity outputs from a single input, and "phase inversion" in a common-emitter amplifying stage. True phase is the child of timing, not polarity!

The 180° phase relationship is an important one, because by adding two signals that are 180° apart in phase we can, provided their amplitudes are equal, achieve signal cancellation. If the phase relationship between the two signals is other than 180° full cancellation will not occur – the output from an adder circuit will depend on the exact phase relationship. When the two signals are in phase, i.e. coincident in time, signal reinforcement will occur, the output from an adder being the combined amplitudes of the two input signals. This effect is the key to the comb filter action of the delay line plus matrix arrangement so often used in TV equipment.

Another widely used phase relationship is the quadrature one, with two carriers spaced in time by a quarter of one cycle, i.e. 90°. This means that one carrier passes through zero when its companion is at its zenith – see Fig. 15(c). As a result, the information carried by each waveform can be extracted without crosstalk between the two signals by sampling one waveform when the other one is passing through zero. This is the principle of the synchronous demodulator, which can separate the information carried by two signals in quadrature even though they are carried in the same signal channel.

The phase conditions discussed so far are static ones, i.e. the reference and sample are at the same frequency. Where the reference and sample are at different frequencies, the phase relationship between them varies continuously. At one instant (see Fig. 16) they might both be at peak positive amplitude, and will then be in phase. As one waveform draws ahead of the other in time, the vector angle between them will change to the point when the waveforms are in antiphase. After a further period, during which another half cycle is "lost", the waveforms will once again be in phase. This steady cycling of the phase angle sets up the rotating vector effect shown in Fig. 16, where the lower waveform is at a frequency twenty per cent below that of the upper (reference) waveform. In this case the vector rotates clockwise, completing one full turn for each five cycles of the sample. This effect is used as the basis of the mixer or heterodyne circuit, where the output is at maximum each time the input signals are in phase and at zero when the signals are in antiphase. There's no shortage of mixers of various types in a VCR!

The Colour-under System

Spectrum space for VCR recording is restricted, and to accommodate the luminance and chrominance signals

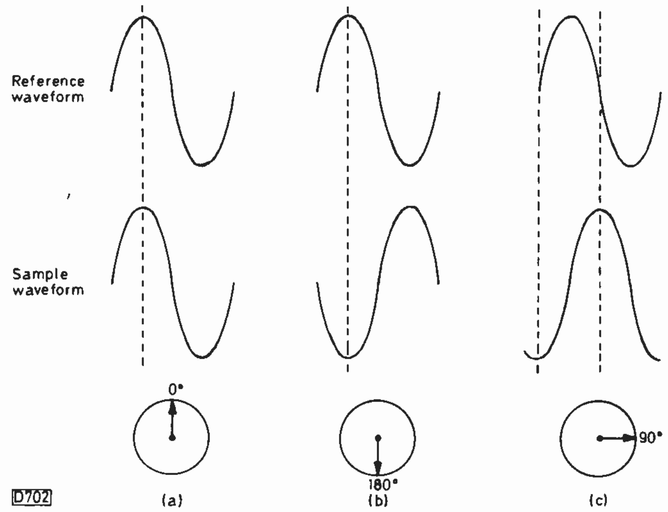


Fig. 15: Static phase relationships: (a) in-phase waveforms; (b) antiphase timings; (c) the quadrature condition.

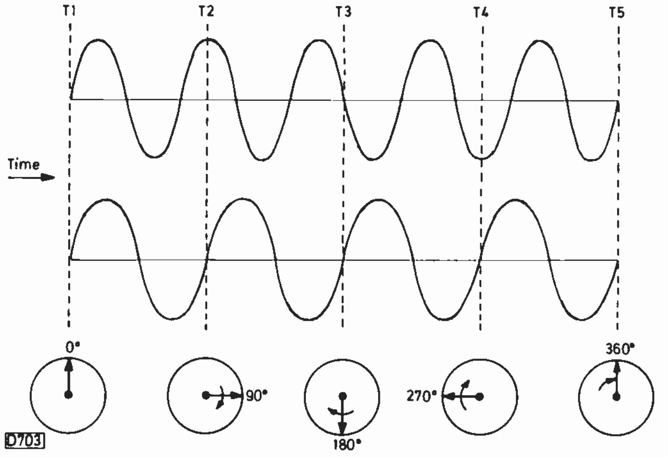


Fig. 16: Rotating vectors. The frequency of the lower waveform is lower than that of the reference waveform, its vector rotating clockwise.

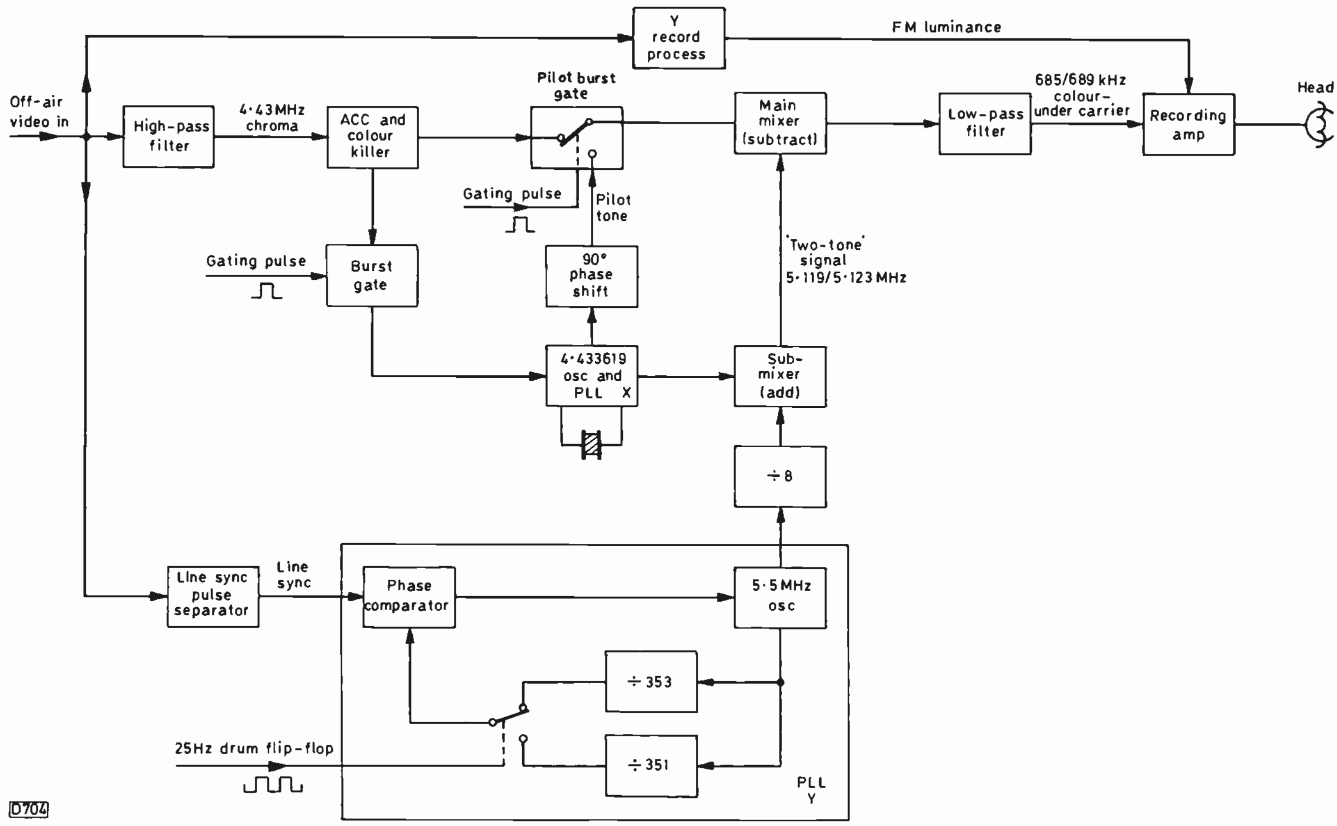


Fig. 17: Block diagram of the Betamax colour-under record system.

both have to be bandwidth limited. This is done by filtering within the machine. The luminance signal is restricted to 0-3MHz or thereabouts, so that the lower sideband of the luminance f.m. signal does not reach below about 1MHz. The colour signal, still PAL encoded and in double-sideband form, is limited to a total range of about 1MHz. After a process of frequency down-conversion, the colour signal is slotted into the gap left in the spectrum below the f.m. luminance signal.

The colour subcarrier frequency used in the Betamax system is 687·5kHz, but for reasons that will become clear later the signals fed to the two heads A and B are given a frequency offset from this figure: head A records a colour subcarrier 1·953kHz (one eighth line frequency) below the nominal figure while head B records a colour subcarrier 1·953kHz above the nominal frequency.

The colour-under frequencies are produced by mixing together the signal from a local oscillator and the incoming 4·433619MHz chroma signal. So to obtain the correct subcarrier frequencies for each head, the local oscillator has to run at two different frequencies on a sequential, field by field basis – we need a local oscillator signal at 5·119165MHz for the 20msec for head A's sweep, followed by a local oscillator signal at 5·123072MHz for head B's field. At the mixer's output we'll get 685·546kHz (5·119165MHz – 4·433619MHz) for head A and 689·453kHz for head B. Let's see how this "two-tone" signal is derived.

Betamax Colour Record System

The heart of the Beta colour-under system is the phase-locked loop marked Y in Fig. 17. The oscillator here runs at a nominal frequency of 5·5MHz, but depending on the position of the counter select switch it can be made to lock at 351 times the incoming line frequency (5·484375MHz) or 353 times the line frequency (5·515625MHz). Because the counter select switch is driven by the drum flip-flop waveform, these frequencies are produced for alternate 20msec periods that correspond with the active period of each head.

The output from this PLL is passed to a divide by eight counter, as a result of which the frequencies become 685·546kHz and 689·453kHz respectively, locked to the off-air line sync. Next comes the sub-mixer, where the output from the ÷8 counter is mixed with a stable 4·433619MHz reference sinewave locked to the off-air burst in phase-locked loop X. This mixer works in the additive mode, its filtered output containing the required alternating 5·119/5·123MHz "local oscillator" signal, now locked to both the off-air line sync pulses and the colour burst. This signal is then mixed with the incoming chroma signal in the main mixer, which acts in the subtractive mode. The filtered output is passed to the recording amplifier to be added to the f.m. luminance signal prior to application to the recording heads.

Chroma Crosstalk Cancellation

The one eighth line frequency offset given to the recorded subcarrier, negative for head A and positive for head B, is the key to eliminating chroma crosstalk during the playback process. In effect, the chroma vectors for each head are rotating in opposite directions, quite apart from the phase changes due to colour variations in the chroma signal itself.

The chart shown in Fig. 18 illustrates how the chroma signal is laid down on the tape. Row V shows the phase of the swinging burst as broadcast in the PAL system, at 225° on even numbered lines, (n, n + 2 etc.) and at 315° on odd numbered lines (n + 1 etc.). Now consider row W, which shows the burst phasors recorded by head A.

Because head A's signal is effectively retarded in phase by 45° per TV line, the vectors in row W twist clockwise 45° per line. As a result the broadcast and recorded vectors will agree only once every eight TV lines – see lines n and n + 8. Row X shows head B's recorded burst phasors, this time advanced 45° per line – for each TV line in row V, the vectors rotate by 45° anticlockwise. With eight 45° shifts in 360°, we return to normal on TV line n + 8, as with head A.

On playback head A replays row W of course. During the replay process the correct chroma signal phase must be restored, and as we shall see the same PLLs and switched divider system do this. Row Y shows head A's phase-corrected output during replay. The recorded vectors (row W) have been effectively rotated anti-clockwise by 45° per line, thus restoring the chroma signal's correct phase conditions. Now during this process any crosstalk signals picked up from adjacent tracks (recorded by head B) will be subjected to the same phase shift. This crosstalk is represented by the small arrows in row Y: each corresponds to the phasors in row X, but with an anti-clockwise twist advancing by 45° per line. Finally row Z shows the head B playback phasors. It reads out row X, which it recorded, but a compensatory phase retard effect (45° clockwise per line) is provided during playback to restore chroma signal normality (i.e. the large arrows in rows V and Z agree). Crosstalk vectors from adjacent tracks (row W) are similarly treated, appearing as shown by the small arrows in row Z.

A study of replay rows Y and Z will show that when any TV line for a given head is compared with its next but one neighbour, the wanted signals are in phase but the unwanted crosstalk signals are in antiphase. So if we add a signal from a TV line to that from its next-but-one neighbour, the wanted signals will be reinforced while the crosstalk signals will be cancelled. The addition is done using a delay line plus matrix arrangement like that described for luminance crosstalk cancellation last month, but in this case a 128μsec (two-line duration) delay line is required.

The system works well and all crosstalk is nulled out when the matrix is correctly set up. To those familiar with the VHS system, it will now be clear that the two systems are very similar. Both in fact use a 90° per line phase offset between the chroma subcarriers on adjacent tracks. In the VHS system this is achieved by recording "normal" phases with head A while rotating head B's phasors at a constant 90° per line: in the Betamax system a very similar track pattern is produced with the same 90° offset, this time as a result of two vectors rotating in opposite directions at 45° per line.

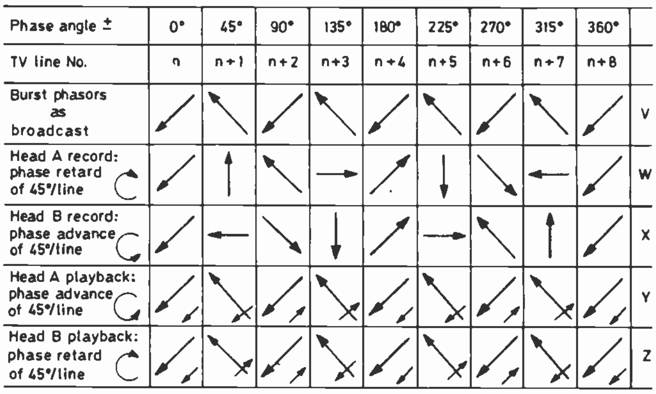


Fig. 18: Recorded chrominance vectors. The small arrows in rows Y and Z represent crosstalk vectors picked up from adjacent tracks.

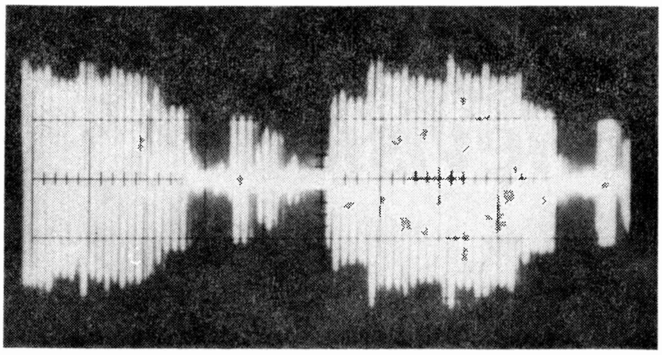


Fig. 19: The colour-under signal at about 687kHz. The photo was taken with a standard colour-bar signal and shows the pilot burst to the left of the PAL swinging burst.

Jitter

The business of getting a video signal on and off tape might almost be described as a mechanical rather than an electrical process! We are dependent on the tape transport system and the physical characteristics of the tape guides, friction, and tape-head contact. Perfection is not possible, and the result is a timing variation in the signal replayed from the tape – a tape deck in good condition may be expected to introduce a timing error of about $\pm 20\mu$sec over a 20msec field period. Now the phase of an encoded chroma signal defines the instantaneous colour, and for acceptable colour reproduction the phase of the recorded subcarrier needs to be held within about 5°. At 4·43MHz, 5° represents a period of about 3nsec, and the jitter imparted to the replay signal is way in excess of this.

To eliminate jitter from the chroma signal during replay we need a "jittering reference", i.e. one which contains the same timing errors as the chroma signal itself. This implies the use of a second off-tape signal at the down-converted subcarrier frequency. In Betamax machines an additional special burst signal, known as the pilot burst, is inserted on the tape during record for this purpose. It's very similar to the PAL colour burst, but is of about fifty per cent greater amplitude and of constant phase (90° to the reference subcarrier) for all lines. As shown in Fig. 19, it's included during a 3μsec section of the line blanking period. This is the reason for the pilot burst adder gate in the path to the main mixer (Fig. 17).

Summary

To summarise the Betamax chroma recording system, the PAL-encoded colour signal is converted to a new, lower subcarrier which is at 685·546kHz for head A and 689·453kHz for head B. The signal retains all the PAL characteristics of phase and amplitude, with the swinging burst, but contains in addition a pilot burst signal of constant phase in the position normally occupied by the line sync pulse in the video waveform. The "coarseness" of the colour-under signal's structure can be seen in Fig. 19. The colour subcarrier frequency for each head is locked to the incoming line sync and chroma subcarrier frequencies, the record subcarriers being arranged so that the recorded signal has a phase shift of 90° per line – 45° clockwise for head A, 45° anticlockwise for head B. The result is the chroma vector pattern shown in Fig. 18, which is carefully contrived to achieve crosstalk cancellation.

Long-distance Television

Roger Bunney

July and early August provided one of the most active periods of long-distance signal propagation in recent years. SpE propagation reduced in intensity and the number of openings however, though with an unexpected improvement in early August. The overall SpE log (i.e. mine and others' combined) for the UK is as follows. Some channels were present on more than one occasion on a particular date, but are mentioned only once.

8/7/83 TSS (USSR) ch. R1; TVP (Poland) R1; CST (Czechoslovakia) R1, 2; MTV (Hungary) R1-3; RTVE (Spain) E2-4; RTP (Portugal) E3; RAI (Italy) IA, IB; JRT (Yugoslavia) E4; ARD (W. Germany) E2; SR (Sweden) E2; TDF (France) F2, 4.
9/7/83 RTP E3; RTVE E2-4.
11/7/83 RTVE E2, 4; RAI IA; JRT E3.
12/7/83 TSS R1; RAI IA; RTVE E2.
13/7/83 NRK (Norway) E2-4; RTVE E2-4; RAI IA, IB; ARD E2; JRT E3, 4; TSS R1, 2.
14/7/83 TSS R1, 2; TVP (Poland) R1; JRT E3, 4; RAI IA, IB.
15/7/83 RAI IA; ORF (Austria) E2a; RTVE E2-4; TSS R1.
17/7/83 NRK E2-4; SR E2-4; TSS R1-3; CST R1, 2; MTV R1, 2; ORF E2a; ARD E2; JRT E3; SRG (Switzerland) E2; RAI IA, IB; RTVE E2-4; TDF F2, 4; Dubai E2.
18/7/83 RTVE E3, 4; RAI IA; ORF E2a.
19/7/83 TSS R1; MTV R1, 2; CST R1, 2; ORF E2a; SRG E2; ARD E2; RTVE E2-4; RTP E3; RAI IA, IB; RUV (Iceland) E4.
20/7/83 RAI IA, IB; JRT E3, 4; SRG E2, 3; ARD E2, 3; CST R1; MTV R1-3; TSS R1-3; TVR (Rumania) R4; SR E2.
21/7/83 RTVE E2-4; RTP E3; RAI IA; SRG E2, 3; TVR R2; TSS R1; TVP R1; MTV R1, 2; CST R1.
22/7/83 RTVE E2-4; RTP E3; RAI IA, IB; JRT E3.
23/7/83 RTVE E2-4; RAI IA, IB; JRT E3; TVP R1; MTV R1, 2; TSS R1-4.
24/7/83 RTVE E2-4; RTP E2, 3; RAI IA.
26/7/83 TSS R1-3; MTV R1; RAI IA; RTVE E2.
27/7/83 RTVE E2-4.
28/7/83 RAI IA, IB; RTVE E2-4.
29/7/83 RTVE E2-4; RTVE-Canary Is. (Ibiza) E3; RTP E2; RAI IA, IB; JRT E3 4; MTV R1, 2; CST R1, 2; ARD E2.
30/7/83 RAI IA, IB; RTVE E2, 3; JRT E3, CST R1.
1/8/83 TSS R1, 2.
2/8/83 TSS R1, 2; TVP R1.
3/8/83 TSS R1, 2; TVP R1; JTV (Jordan) E3 at 1030 BST.
4/8/83 RAI IA; RTVE E2-4.
5/8/83 TSS R1.

As mentioned in last month's news flash, dramatic double-hop SpE signals were received by Hugh Cocks (E. Sussex) on July 6th at 1800-1850 BST. Four system M channels with Spanish language sound were received (A2-4), from the south west. Two ch. A2 signals were seen, the stronger with an l.f. offset (Puerto Rico is h.f. offset) and commercials (hence Cuba can be ruled out). The Dominican Republic perhaps? Vision quality was "mainly ghosty", though a musical programme on ch. A2 was "quite good" at times. The m.u.f. reached ch. A4 sound (71·75MHz) occasionally. On the following day Hugh logged ch. A3 at 2030 BST, but here at Romsey I couldn't detect any 60Hz video buzz at scanner level. A remarkable logging.

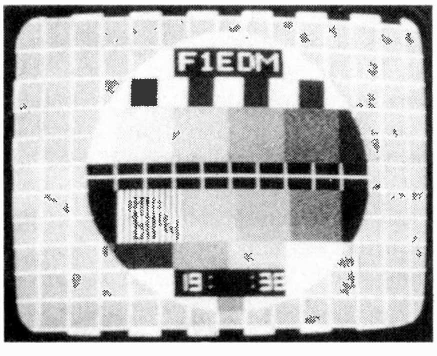
Tropospheric Reception

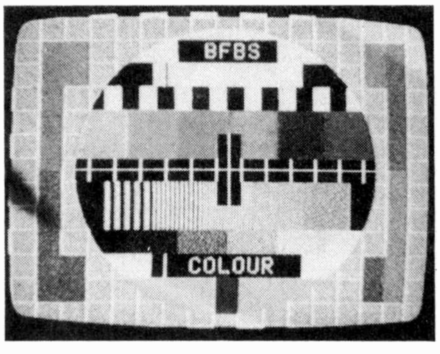
The prolonged heat wave and sustained high pressure system present in the UK during much of July provided a lengthy period of enhanced tropospheric reception from central Europe. A survey of correspondents' loggings along with my own shows that there were openings on July 8-16th, 22-23rd and 30th, with W/E German and Danish stations in Band III and at u.h.f. widely received along the south and east coasts, the French dominating along the south. Iain Menzies (Aberdeen) received signals from Scandinavia, Denmark and Germany – Band III was particularly rewarding, with all three DR (Denmark) Band III channels being seen and a good catch, Switzerland ch. E6, on the 13th. Loggings for this period would be too repetitive – Mark Baldwin's log resembles an EBU list! Unusual sightings however were ARD ch. E4 at Romsey and CST chs. R2, 7, 10, 38 in East Sussex on July 14th. On the same day there was reception in Kent of cross-channel radio links at 3·5GHz carrying TV material from various W. German networks and RAI-3. Sidelobe scatter presumably.

TDF was present on most u.h.f. channels along the south coast though Band III is looking a little bare as the 819-line stations are closed down (Paris ch. F8 closed on June 19th). There have been a few glimpses of the new TDF channel 4 system (625 lines, system L) – Paris ch. 6 for example.

Summary

A diamond shaped caption has been seen on Russian channels at close down. It has three words with the centre one flashing, and is usually followed by a test card. On





Left: Amateur TV test pattern from Le Havre received at Romsey, a distance of 120 miles. Centre: Amateur TV picture from Boix received at Romsey, a distance of 330 miles. Both signals at 435MHz. Right: The British Forces Broadcasting Service (BFBS) test pattern received in Lowestoft by Trevor Rose. Signal on ch. E48.

August 2nd I noted this at 0855, with a clock at 0857 BST – the clock also read 0857! I'm arranging for a translation of the three words.

Overall then a very active period, often with complete confusion and jamming of the broadcast TV channels. I recall that when the UK u.h.f. service was launched in the sixties the point was made that the move from Band I would end continental interference!

My thanks to the following for sending in their logs: Arthur Milliken (Wigan); Simon Hamer (Powys); Cyril Willis (Ely); Trevor Rose (Lowestoft); Iain Menzies (Aberdeen); Hugh Cocks (E. Sussex); David Moller (Eastbourne); Ian Mitchell (Biggin Hill); James Burton-Stewart (Milton Keynes); Brian Renforth (Torquay); Martin Reynolds (Nuneaton); Ian Johnson (Bromsgrove); Mark Baldwin (Rugby); Reg Roper (Torpoint).

I was pleased to meet Anthony Mann during his recent visit to the UK, after many years of corresponding. Anthony is now working on physics at Baton Rouge University, USA. For many years he sent reports to us from Perth, W. Australia.

News Items

UK: Close down of the 405-line service is being accelerated, with transmitters that were due to shut down in the second and fourth quarters ceasing operation in the first and third quarters instead. The final date for the close down is to be January 6th, 1985.

Cordless phones: The use of illegal units is still spreading. Dave Lauder (Barnet) reports that some units operating at 49·05/40·8MHz have the second frequency at 69/149MHz. A CB magazine recently reviewed a unit operating at 49 and 35MHz. Called a "handy phone", it's distributed by Thanet Electronics of Herne Bay. There's no indication as to its range, but the thought of it being operated near standard domestic TV sets with their i.f. of around 35MHz makes me shudder!

Spain: New EBU listing – RTVE-2 Santiago ch. E45, with 316kW e.r.p. and horizontal polarisation.

Turkey: Rather than start a second network, the decision has been taken to convert the present network to colour.

From our Correspondents . . .

The improved conditions have resulted in a very full post this month. Kevin Jackson (Leeds) has moved to the ninth floor in a block of flats, some 100ft above ground level and with a clear view to the NE and SW – he says it's "great for trop DXing"! A Band I dipole fits across the window: for Band III he uses a simple folded dipole and for u.h.f. a standard ten-element group B aerial which is to be replaced with a Triax 44-element wideband u.h.f. system. It all works very well. On July 3rd Kevin logged JTV ch. E3, showing the PM5544 pattern at 1100 BST, and on the 19th he had Sebastopol (USSR) at plus three hours BST. Tropspheric reception has given him NRK, DFF (GDR) and DR (Denmark) in Band III plus many W. German stations at u.h.f. – perhaps the best catch was Switzerland ch. E34 from Santis on the 21st.

Brian Renforth has now moved to Torquay and has modified an elderly KB VC52 for positive-going system L French reception. It's working well, used with a Plemi 103-element u.h.f. aerial and a Labgear CM7066 preamplifier. The KB set suffers from critical field hold however (see page 544, September 1970, for the items to check – *editor*).

Robin Crossley (St. Albans) reports that there's talk of

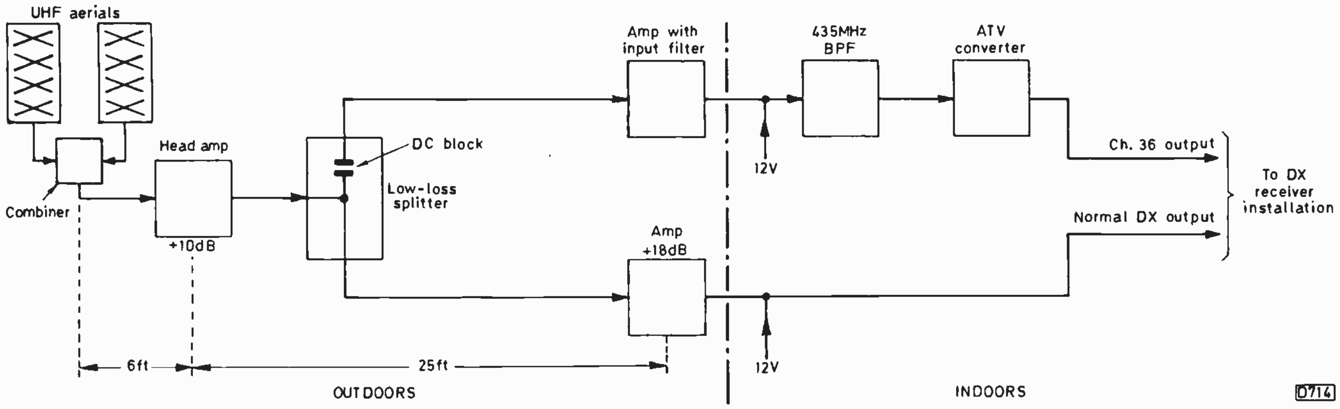


Fig. 1: U.H.F. aerial/amplifier system modified for the reception of ATV signals in the 435MHz band.

using parts of Band III for PMR use – various public undertakings seem confident that they can start installation of new transmitters during 1984. Sounds like more bad news. There are also rumours that the RSGB HQ at Potters Bar may be installing a 50MHz beacon with 24-hour operation at 100W!

Marios E. Colocassides (Nicosia, Cyprus) regularly receives ERT-2 (Greece) from Thera ch. 29 and Rhodos ch. 42, Beirut ch. E25 and Israel chs. E24/28/34/44/46 at u.h.f.; Beirut, Cairo and Turkey ch. E5, Turkey ch. E7, Israel and Cairo ch. E8, Syria, Jordan and Cairo ch. E9, Israel and Cairo ch. E10, Jordan and Israel ch. E11 plus signals on ch. E12 in Band III. A vertical Band III aerial provides ERT-1 from Rhodos.

Gosta van der Linden (Holland) reports that RT (Albania) now uses the PM5544 test pattern with the identification "RT SH" at the top and "TV Shquiptar" at the bottom. RTL (Luxembourg) ch. E7 is now relaying the RTL German service – the signals are beamed towards Germany and are on test between 0800-1500 GMT. He also mentions that NRK have commenced teletext services known as "Tekst-TV" and are consideraing the use of ECS-2 to provide a service for distribution by cable and local u.h.f. relay stations.

Finally Chandra de Silva (Colombo, Sri Lanka) reports that programmes from the Ekran satellite at 714MHz have been dropped recently on the first and last Monday of each month. Programmes start locally at 0530-1100, recommence until 1615 after a ten minute break, and then continue till 2100 after a further ten minute break. He and Nandra Kumar (Madras) have both noticed that the last Ekran transmission segment is at a much higher e.r.p.

ATV Reception

The system I've adopted for receiving ATV signals at 435MHz via the u.h.f. broadcast band aerials is shown in Fig. 1. Two standard, stacked Triax bowtie aerials are at present used. The outputs from these are combined by a wideband u.h.f. combiner (Triax 721U) and fed to a Labgear CM7060 amplifier which has a gain of 10dB and a noise figure of 1·8dB. The output from this is taken to a low-loss splitter (Triax 7200). The standard TV-DX feed then goes via a Wolsey Orbit amplifier (gain 18dB, noise figure 3·5dB), modified for through powering to the Labgear masthead amplifier at 12V, to the receiver installation. The other feed is taken to a further Labgear CM7060 amplifier which has been modified with 435MHz input filtering, then via a two-pole 435MHz bandpass filter to a Fortop 435/600MHz converter. This provides an output on ch. 36 for feeding to the receiver installation.

The split feed was found to be necessary because many ATV signals here originate from the south, as do the signals from the local 500kW Rowridge group A transmitter (48mV signals on each of the local channels with the aerial pointing south). As a result, the ATV converter with its bipolar transistors was subject to considerable overloading – hence the need for careful filtering and lower gain than in the DX feed.

The new arrangement makes it possible to receive signals of minimal strength – typical ATV transmission levels are a few watts, generally under 10W. The two-pole bandpass filter is a modified Teleng single-channel unit padded to reduce the frequency to 435MHz, the inscrtion loss being less than 1dB.

As an alternative to using a specialised converter, such as those available from Fortop and Microwave Modules, a tuner can be modified to reach down to the 435MHz spectrum – in view of the cost of tuners from Sendz etc. it's more practical to modify one to peak at 435MHz for ATV use only.

Conventional a.m. video transmission is used for ATV, with PAL colour by some operators, though the long-term aim is to move to the 1·3GHz band with f.m. video (the BATC now offer members an f.m. video i.f. board suitable for downlink satellite TV as well!).

Results

Results have been encouraging, with cross-channel signals received from F1EDM (Le Havre) and F6AGY (Boix), the latter at some 330 miles. Both signals were received during the improved tropospheric conditions in the early hours of July 16th. During "flat" conditions a poor caption (P1½ on the ATV/BATC scale) was received from G6MPE Brighton – the station runs at 3W, and the signal path along the South Downs is hardly clear! Cyril Willis receives Dutch and W. German ATV stations regularly during tropospheric lifts.

The BATC

If readers wish us to give details of ATV reception in addition to DX reception we'll include this from time to time. A descriptive leaflet on ATV can be obtained from the membership secretary of the British Amateur Television Club, B. Summers, 13 Church Street, Gainsborough, Lincs – write including a stamped (UK) s.a.e. The BATC also have available several detailed books on ATV station operation/equipment.

Service Bureau

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

ITT CVC20/3 CHASSIS

The problem was intermittent loss of sound and raster. Prior to this the set would occasionally flick briefly to excessive green. With the no sound and raster condition, LED1 was observed to be out. The set is now permanently off, with both LED1 and LED5 out, though there seems to be line whistle.

There would appear to be a dry-joint in the line output or driver stage. Whilst this could be almost anywhere in these stages, the following points give most trouble: the yellow lead connection going to the collector of the BU208 line output transistor; the line output transformer pin joints on the board; and the earthing of the line driver transistor's emitter (T13) to chassis – follow its long path, looking for bad joints.

TOSHIBA 5470B

There's intermittent slow running in both the record and playback modes. The sound drops out for about two lines, with the field slipping through but line lock retained. This slow but unvarying operation sometimes lasts for several minutes before returning to normal. Stopping and starting clears the fault.

The trouble is due to a defective capstan motor. To replace it and set up the capstan servo a test tape, a selection of capstan drive pulleys of various sizes and a frequency counter are required. If the servo is not set up correctly, symptoms similar to those already present will be experienced.

THORN 1590 CHASSIS

Neither the line nor the field can be locked on this portable, while the picture is negative. The voltages seem to be in order and a new sync separator transistor has been fitted.

The thing to concentrate on is the negative picture, since this effect is likely to be the cause of the loss of sync. Items to check, in order of likelihood, are the video driver transistor VT6, its base bias smoothing capacitor C36 (4·7μF), and the vision detector W2. If the emitter voltages of the first two i.f. amplifier transistors are incorrect, check the setting of the preset contrast control R2 and the a.g.c. circuit, i.e. VT1 and the associated components.

ITT CVC8 CHASSIS

There are two hum bars which move up the raster slowly, accompanied by intermittent rolling. One hum bar also pulls the right-hand edge of the raster. We suspected the l.t. supply: a scope check cleared this, but we've replaced the electrolytics, rectifiers and transistors nevertheless. We've also changed the h.t. electrolytics. All to no avail.

The earthing needs to be carefully checked around the electrolytics etc. On many occasions we've been led astray by poor contact between the print and the line output transformer cage – link all the earth lands on the line timebase/power supply board with a separate heavy wire. Another possibility is short-circuit turns in the mains transformer. This is usually betrayed by excessive c.r.t. heater voltage: if it's in excess of 7V r.m.s., the transformer could well be faulty.

PYE 725 CHASSIS

There's a light grey stripe approximately 1cm wide across the extreme top of the picture, though there's no distortion of the picture information. The stripe is visible only on darker scenes and is less pronounced at the top centre. It doesn't move at all. There's also caption buzz when small size white words appear, the words at the same time glittering with colour. A Ledco i.f. gain module has been fitted.

The light at the top of the screen is a tube condition due to secondary emission from Teletext etc. information out of sight over the top. Later tubes have an internal shield to prevent it. The second problem suggests mismatch between the Ledco unit and the tuner/i.f. board. Try retuning the i.f. core in the top of the tuner box.

FIDELITY CTV14R

The problem is that the h.t. smoothing resistor R828 goes open-circuit when the line output stage comes into operation. As a first step, the items fed from the transformer were disconnected in turn. The BU208 line output transistor and BY127 efficiency diode were then replaced. As the problem persisted, a new line output transformer and chopper transistor were fitted – the former in case of short-circuit turns, the latter because it went short-circuit. Now I have the correct 112V output from the chopper circuit, also h.t. at the collector of the BU208, but as soon as latter's base is reconnected R828 overheats.

We assume that in addition to disconnecting D34, D35 and R907 you tried the 180V rectifier D30 and its reservoir capacitor C903 – the latter has been known to cause trouble. If so, it would appear that the drive to the BU208 is incorrect. This comes from a secondary winding on the chopper transformer. A scope should show a 12V peak-to-peak line-frequency waveform at the base of TR14. If not, check C902, R904, R902, D26, L16 and if necessary the chopper transformer. Although the power supply is providing 112V off load, it's still possible that the waveform prior to smoothing is incorrect, so if necessary check for 325V peak-to-peak at the emitter of the chopper transistor and for 65V peak-to-peak at the collector of its driver TR11. If these are incorrect, suspect the TDA

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TELEVISION OCTOBER 1983

2581 chopper control i.c. and its associated components, particularly the oscillator timing components R816 (51kΩ) and C818 (0·0022μF) connected to pin 13 – incidentally don't connect a meter to this pin.

TEST CASE

250

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.

The Pye solid-state colour chassis (725, 731 etc.) was widely used in 20, 22 and 26in. models a few years ago. It's well known to service engineers as a fairly predictable (rather than reliable) animal. There were versions to drive 90° and 110° tubes.

One of these sets came into the workshop one fine morning with the complaint of a yellow picture. Our customer thought that the tube had perhaps failed – "blue pistol's gone" said he. Certainly there was no contribution from the blue gun. The picture was bright and sharp however, in red and green, suggesting that the lack of blue was probably due to a component fault rather than the c.r.t. This was quickly proved by interchanging the green and blue tube drive leads, which gave us a beautiful magenta picture. Much cheered, the owner departed and left us to sort out the problem.

The RGB channels are conventional, starting with a TBA530Q matrixing/preamplifier i.c. followed by single-transistor class A output stages, with a beam limiting diode in each feed to the c.r.t. base. A check at the blue drive point, i.e. the cathode of the blue beam limiter diode D289 (see Fig. 1), produced a voltage reading of 180V. D289 was quickly eliminated by checking the voltage at the collector of the blue output transistor VT463 (BF336) – the reading was the same. We then made the hasty assumption that the transistor was open-circuit and fitted a BF337 in its place. This did no more or less than the perfectly good transistor we'd removed! The 39kΩ preamplifier load resistor R474 looked discoloured (these resistors lead a hard life) but measured o.k. on a resistance check. After a careful inspection of the panel for dry-joints etc., we made some voltage measurements around VT463 and the i.c. (IC425).

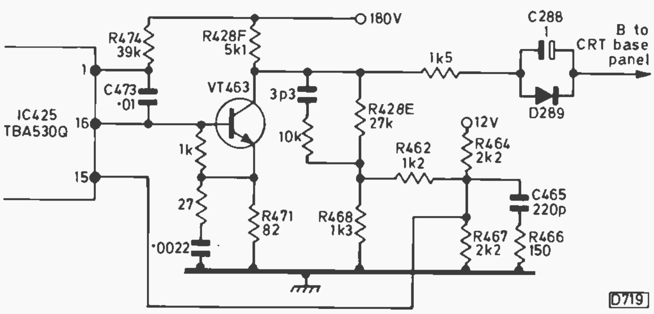

Fig. 1: Class A blue output stage circuit used in Pye solid-state colour chassis (725 etc.).

There was no measurable voltage at the emitter of VT463, and not surprisingly none at its base either. The i.c. is pluggable, so as a quick check another was fitted. Still no blue! The voltage at the chip's B − Y input (pin 2) was about right, but the voltages at pins 1 and 15 were both at 4·5V, way below normal. Pin 1 is the B preamplifier's load resistor connection while pin 15 is the feedback pin. The blue output is at pin 16, which is directly connected to the base of VT463 where we'd found no voltage reading. Pin 15 is decoupled by an *RC* network consisting of C465 (220pF) and R466 (150Ω), so C465 was checked for leakage. It proved to be o.k. To be sure that the i.c. holder was behaving itself (we've been cruelly misled by these in the past) we rechecked the i.c. voltages at the pins of the chip itself. This cleared the holder of suspicion. Where next?

When the cause of the trouble was located (it wasn't far away!) it dawned on us that if we'd really thought about the first voltage reading we took we would have gone straight to the faulty component.

ANSWER TO TEST CASE 249
– page 600 last month –

The specifications for Sony TV sets are full of automatic functions – ABL, ACC, ACK, AFT, APC to pick a few at random. Our KV2201UB had developed another, ABC (auto-brightness control), which was not required! We found that the set was somehow cancelling the effect of the user brightness control, to return the beam current to a constant low level. Rather like the effect of an a.c.-coupled video signal, though at a lower brightness level.

The problem was in the beam limiter circuit, which applies correction to pin 4 of the μPC1365C chip via Q304. This transistor is normally held cut off by the positive bias applied to its emitter via the potential divider R531/R822, coming into conduction only when the beam current flowing via R822/R832 is such that a significant negative potential is developed at the junction of these three resistors. R531 is on the timebase board D and had gone open-circuit (we found that it's a carbon composition type). As a result Q304 was reflecting every change in the beam current back to pin 4 of the chip, thus establishing a control loop that maintained a constant low beam current regardless of the setting of the brightness control.

The three lines across the picture? What the sharp-eyed lady was seeing were the shadows of the platinum tie-bars across the Trinitron tube's grille. The width of the tie wires is measured in microns, but critical examination of a uniformly bright highlight picture will show slight shadow effects. This applies to all but the smallest Trinitron tubes and is inherent in their design.

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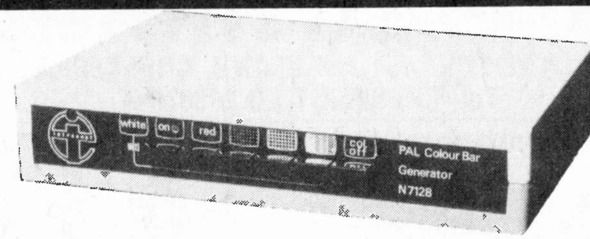

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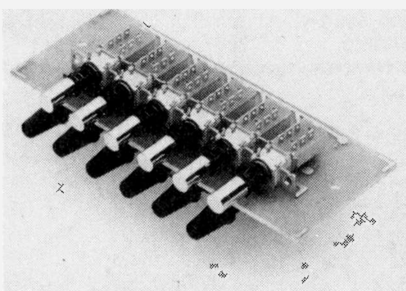

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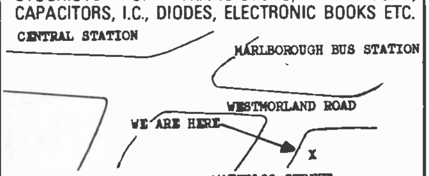

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TICV 106D (T092 case 2A/400V)	10p
TIP 29A	20p
TIP 30	30p
TIP 30A	35p
TIP 31	30p
TIP 31B	40p
TIP 32	25p
TIP 33	50p
TIP 34	50p
TIP 35	50p
TIP 36	50p
TIP 41B	40p
TIP 41c	40p
TIP 42	30p
TIP 42B	40p
TIP 47	40p
TIP 48	40p
TIP 49	30p
TIP 100	30p
TIP 112	30p
TIP 115	50p
TIP 117	50p
TIP 120	35p
TIP 125	35p
TIP 130	30p
TIP 131	30p
TIP 136	30p
TIP 640	75p
TIP 2955	35p
TIP 3055	35p
T 6032	30p
T 6036	40p
T 6040	40p
T 6047	40p
T 6049	40p
T 6051	40p
T 6052	40p
T 9004	40p
T 9005	40p

MJ 2253	60p
MJ 3040	60p
MV 2209	10p
SP 8385	25p

Voltage Regulators

5V/UA78PO5SC	30p
5V/LM79MO5CP	25p
8V/79M08c	30p
LM 342/12	30p
12V/MC 7912	20p
12V/LM 340T12	25p
15V/78M15	15p
18V/MC78M18	20p
24V/78M24	30p
TIS 90	15p
TIS 91	30p
TIS 92	30p

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16119 2A/40v.50Meg
5 for £1.

U 14727	15p
U 19885	40p
U 3832	15p
U 3845	15p
MR 508	10p
MR 501	10p
MR 502	10p
BYF 1202	10p
BYF 1204	10p
BYF 3123	40p
BYF 3126	40p
BYF 3214	40p
BYX 10	6p
BYX 36/600	35p
BYX 38/300	25p
BYX 38/600	50p
BYX 55/350	10p
BYX 55/600 (Bead)	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYV 95	8p
BYV 96D	10p
BYZ 106	10p
BPW 41	15p
BYW 56 2A/1000v	8p
BZY 93	50p
BZV 15/12	30p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
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Mono scan coil	£3
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AT 4041/41 transductor	£1
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A1 pots Thorn 3500	50p
2K5 Lin pot with 40mm spindle	20p

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KBL 02	30p
KBP 04	30p
W02	15p
W004	15p
W005	20p
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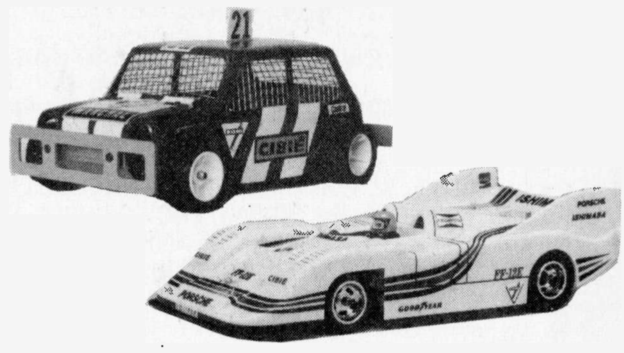

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BY 190 40p
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BY 198 10p
BY 204/4 8p
BY 206 8p
BY 210/400 5p
BY 210/600 8p
BY 210/800 10p
BY 223 80p
BY 224/600 50p
BY 226 15p
BY 227 15p
BY 228 20p
BY 229/400 30p
BY 237 5p
BY 254 10p
BY 255 10p
BY 298 10p
BY 299 10p
BY 527 20p
BY 407a 10p
BY 602 10p
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2200/25 10p
3300/25 20p
4700/25 25p
5000/25 25p
10000/25 50p
1500/30 20p
3300/30 30p
1500/35 10p
2200/35 25p
50/40 5p
220/40 5p
400/40 20p
680/40 5p
1250/40 20p
1500/40 20p
200/40 25p
2000/40 25p
2200/40 25p
2500/40 25p
3300/40 25p
6800/40 35p
750/50 10p
1000/50 20p
1250/50 25p
2000/50 20p
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0.1/1000 10p
.15/1000 20p
.47/250V A.C. 10p
.47/1000 50p
.001K/1250 10p
0.0047/1500 10p
.005/1500 10p
.0105/1500 10p
1n8/1500 15p
2n2/1500 15p
G11.11000/1500 15p
G11.8200/2KV 15p
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3n9/2KV 15p
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6n2/2KV 15p
7500pf/2KV 10p
4n7/2KV 15p
8n2/2KV 15p
0.0082/2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
270/8KV 10p
1000/10KV 10p
210/12KV 10p
1000/12KV 10p
1200/12KV 10p

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CMP 40 £2.00
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EL2060 ,,	£7.00
ELC2060 on panel NEW	£5.00
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U322 (UHF) ,,	£4.00
V314 (VHF) ,,	£5.00
U341 UHF	£7.00
ELC1043/05 Thorn	£5.90
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VHF ,,	£3.00
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Sylvania UHF F4720B	£6.00
Sylvania VHF 900	£6.00
Decca Bradford Tuner 5 Button	£4.00
Small Tuner DX 175-220MHz Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00
D.P.D.T. switch Black knob: Chassis or PCB mount	4p
each or 40 for £1.00	
THORN 1400 4P.B. Mech. Tuner	
THORN 1500 4P.B. Mech. Tuner	
THORN 1590 4P.B. Mech. Tuner	
THORN 3500 4P.B. Mech. Tuner	
THORN 8000 4P.B. Mech. Tuner	
THORN 8500 4P.B. Mech. Tuner	
All new & boxed	£4 each + £1 postage each

Diodes

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3 Amp 100v	7p
3 Amp 1200v	10p
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DL70	£1.00
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UDL11	30p
KT3 Luminence Luminance Delay Line	75p
MDL-CBL Min.	50p
3.15 Fuses	4p
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Co-Ax Belling Lee Plug	12p
UHF Modulator CCIR	£3.00
Infra Red Emitting Diode	20p
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Mullard 5 Watt Amps. LP1162 New	75p

T.V. Tubes

A31/510	£5
12" A31/300 Hitachi	£12
15" A38/170W Hitachi	£8
Add £2 P&P each	

Integrated Circuits

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AM25LS23PC	£1.00
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BTT6218	£1.50
CA270AE	50p
CA270CE	50p
CA270CW	50p
CA927	40p
CA3065	50p
CA3089Q	50p
CA3094AE	50p
CA3146	£1.00
CA920AE	£1.00
CA1310	50p
CD4510	30p
CBF16848	50p
DM7492	50p
HEF4001	10p
HBF4011AF	10p
HEF4016	15p
HEF4053B	30p
M913	£2.00
M1024	£2.00
M1025	£2.00
MC476p	£1.00
MC1307	75p
MC1330	75p
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MC1358	£1.00
MC14001	10p
MC14002	15p
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MC14066BCP	30p
MC14069	15p
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MC1748	80p
MCM2114	£1.00
NE511NE	£1.00
MEM4956PT	£1.00
MM5387	£1.00
MM5611	£1.00
MM5840	50p
N64100	£1.00
NE545B (Dolby)	75p
NE545N (Dolby)	75p
NE555	60p
IL-1	30p
OPT600	30p
OPT601	30p
PD2114	£1.00
SAA611	£1.00
SAA661	£1.75
SAA1020	£4.00
SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SAA1124	£2.00
SAA1130	£2.50
SAA1272	£3.00
SAA5000	£1.50
SAA5000A	£1.50
SAA5010	£3.50
SAA5012	£3.50
SAA5012A	£4.00
SAA5020	£3.50
SAA5040	£3.50
SAA5040A	£4.40
SAA5050	£3.50
SAF1039	£2.00
SAS560	£1.00
SAS570	£1.00
SA5660	£1.00
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TAA550	25p
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TAA621	£2.00
TAA641	£1.50
TA7117	50p
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TBA120C	40p
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TBA231	75p
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TBA396	75p
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TBA440C	£1.00
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TBA510Q	£1.00
TBA520	£1.00
TBA530	£1.00
TBA540	£1.00
TBA540Q	£1.00
TBA550Q	£1.00
TBA560CQ	£1.00
TBA560C	£1.00
TBA570	£1.00
TBA625	£50p
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TBA651	£1.00
TBA673	£1.00
TBA720A	£1.00
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TBA890	£1.00
TBA900	£1.20
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.00
TBA990Q	£1.00
TBA1440	£1.00
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TMS9980	£8.00
TMS9901	£3.00
TMS2716	£3.00
TMS3529	£3.00
TMS4014	£2.50
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SN76023N	£1.50
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SN76226	£1.00
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SN76228N	£1.00
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SN76532N	50p
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SN76545	£3.50
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76650	50p
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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
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TDA1190	£1.00
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TDA1327A	£1.00
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TDA2530	£1.00
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TDA2541	£1.00
TDA2575A	£1.00
TDA2590	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£4.60
TDA2653	£1.00
TDA2002	£1.00
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TDA2593	£1.00
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TDA3950	£1.50
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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
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BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
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BF161	20p
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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
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BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
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AC169	20p
AC176	20p
AC176K	20p
AC178K	20p
AC179	20p
AC186	20p
AC187K	20p
AC188	20p
AC188K	26p
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2N3703	10p
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2N4442	£1.00
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2SC458	50p
2SC515	10p
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2SC1419	20p
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FT3055	30p
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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
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BC238/338 pair	15p
BC239	10p
BC250	8p
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BC252	10p
BC262	10p
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BC298	10p
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BC308	7p
BC309	10p
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BC328	10p
BC328/338 pair	15p

BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
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BC394	10p
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BC414	10p
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BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
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BD204	60p
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BD222	30p
BD226	20p
BD233	30p
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