AUGUST 1983

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

90p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

THE BETAMAX VIDEO SYSTEM

SERVICING THE PHILIPS TX CHASSIS

SAFETY IN SERVICING

VINTAGE TV • VCR CLINIC

CTV BATTERY OPERATION

Interested in Television Servicing?

Try a ZED Pack. Effect Repairs at Minimum Cost.

Z1	300 mixed ½ and ¼ watt and miniature resistors	£1.95
Z2	150 mixed 1 and 2 watt resistors	£1.95
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Z16	20 IN4148 Gen Purpose Diodes	£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
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Z33	20×PP3 Battery Connectors	£1.00
Z34	6×Miniature "Press to Make" Switches, Red Knob	£1.00
Z35	12 Sub Min S.P.C.O. Slide Switches	£1.00
Z36	12 Min D.P.C.O. Slide Switches	£1.00
Z37	8 Standard 2 Pole 3 Pos Switches	£1.00
Z38	4×HP11 Batt Holders (2×2 Flat type)	4 for £1.00
Z39	3.5mm Jack Sockets, switched, enclosed Type	8 for £1.00
Z40	100 Miniature Reed Switches	£2.30
Z41	100 Subminiature Reed Switches	£4.20
Z42	20 Miniature Reed Switches	£1.00
Z43	12 Subminiature Reed Switches	£1.00
Z44	TO3 Mounting kits (BU208)	8 for 60p
Z45	TO220 Mounting kits (TIP33)	10 for 60p
Z46	TO126 Mounting kits (BD131)	12 for 60p
Z47	Pack of each Mounting kit. All include insulators and washers	£1.50
Z48	3a 1000v Diodes (IN5408 type)	8 for £1.00
Z49	Brushed Aluminium Push Button Knobs, 15mm long × 11mm Diam. Fit standard 3½mm square shafts	10 for £1.00
Z50	Chrome finish 10mm × 10mm Diam as above	10 for £1.00
Z51	Aluminium Finish. Standard Fitting Slider Knobs. (Decca)	10 for £1.00
Z52	Decca "Bradford" Control Knobs Black and Chrome. ¼" Shaft	8 for £1.00
Z53	Tuner P/B Knobs, Black and Chrome. Fit most small Diam Shafts, ITT, THORN, GEC etc.	8 for £1.00
Z54	Spun Aluminium Control Knobs (ITT) ¼" Shaft, suitable for most sets with recessed spindles	8 for £1.00
Z55	14 Pin DIL I.C. Sockets	12 for £1.00
Z56	16 Pin Quil I.C. Sockets	12 for £1.00
Z57	16 Pin DIL TO QUIL I.C. Sockets	10 for £1.00
Z58	22 Pin DIL I.C. Sockets	10 for £1.00
Z59	B9A Valve Bases P.C. Type	20 for £1.00
Z60	0.47Ω ½ Watt Emitter Resistors	40 for £1.00

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.**

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

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. 2¼"×2"×¼" complete with 9 foot coaxial lead and plug. With connection data	£3.00 each, 2 for £5.00
GEC Hybrid 2040 series Focus Assembly with lead and VDR rod	£2.00 each, 3 for £5.00
Convergence Panel for above. Brand new leads and plug.	£3.00 each
GEC 2010 Transistor Rotary Tuner with AE, SKT, and leads	£1.95 each, 3 for £5.00
Bush CTV 25 Quadrupler type Q25B equivalent to ITT TU25 3QK	£3.00 each, 2 for £5.00
Focus VDR Rods 2¾"×¼". Suitable for GEC, Decca etc.	75p each, 3 for £2.00
Grundig UHF/VHF Varicap Tuner for 1500GB, 3010GB.	£12.50 each, 3 for £30.00
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 2¼ Loudspeaker	60p each, 4 for £2
6 MHZ sound filters, ceramic 3 pin "TAIYO" type	50p each, 3 for £1.00
PYE CT200 Control Knobs	8 for £1.00
Degaus VDRs. 1¼" 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

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

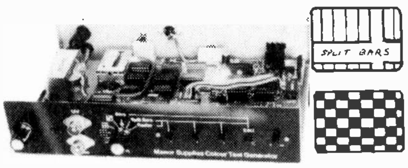
this month

OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 17

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

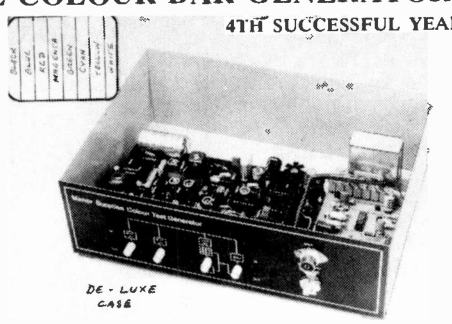
SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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 £80.50 + £1.80 P & P.
VHF MODULATOR (CHI 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 **£170.20** p.p. £2.80.
MK 2 (Philips/Mullard) Infra-red remote control **£227.70** p.p. £2.80.
Further details on request.

Goods available if in stock immediately over shop counter (Mail order between 3 days and 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.
THORN TX9, TX10 SAW FILTER IF PANELS **£5.75** p.p. 85p.
SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND tested for T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
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PHILIPS-PYE G11 TYPE TELETEXT DECODERS **£34.50** p.p. £1.60.
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 **£2.60** DE LUXE CASE **£5.50** p.p. £1.20.)
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UHF SIGNAL STRENGTH METER KIT £21.60 (VHF version also available). ALUM CASE **£2.60** DE LUXE CASE **£8.50** p.p. £1.80.
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BUSH A823 POWER BASIC PCB. IN FIBREGLASS **£6.40** p.p. £1.00.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
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 **£2.88** p.p. £1.80.
GEC 2040 DECODER PANEL **£2.88** 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.
TX10 type Remote Receiver & 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 210, 300 Series Frame T.B. Panels **£1.15** p.p. 80p.
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.
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 Service 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 950, 1400, 1500, 1580,1590, 1591	**£6.80**	**R.B.M.** T20, T22 Bobbin	**£6.44**
THORN 1600, 1615, 1690, 1691	**£10.50**	**DECCA** Bradford (state Mod No).	**£10.15**
GEC 2000 to 2038 series	**£7.80**	**DECCA** 80, 100	**£10.15**
GEC series 1 & 2	**£9.20**	**GEC** 2040	**£6.70**
INDESIT 20/24EGB	**£8.80**	**GEC** 2110 Series	**£12.20**
ITT/KB VC 200, 300	**£8.80**	**ITT** CVC 5 to 9	**£11.30**
MURPHY 1910 to 2414 series	**£6.80**	**ITT** CVC 20	**£11.30**
PHILIPS 170, 210, 300 SERIES	**£8.80**	**ITT** CVC25, CVC30 series	**£10.15**
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	**£8.80**	**PYE** 691-697	**£11.50**
		PYE 713, 715, 731 to 741	**£7.85**
SPECIAL OFFER		**PYE** 725 (90°)	**£10.60**
DECCA 20/24, 1700, 2000, 2401	**£4.40**	**PHILIPS** G8, G9	**£10.15**
GEC 2114J/Junior Fineline	**£3.25**	**PHILIPS** 570	**£7.85**
PYE 40, 67	**£2.00**	**THORN** 3000/3500 SCAN, EHT	**£7.85**
KB VC ELEVEN (003)	**£2.00**	**THORN** 8000/8500/8800	**£14.80**
KB VC1	**£3.25**	**THORN** 9000 to 9600	**£10.15**
		THORN 9800	**£21.90**

OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.
TRIPLERS Full range available. Mono & Colour.
Special Offer: Thorn 1400 5 stick EHT Tray **£1.72** p.p. 65p.
TRANSDUCTORS suitable for G8, A823, Bradford etc. **£1.72** p.p. 60p.
6·3V CRT Boost Transformers **£5.80,** Auto Type **£3.20,** p.p. £1.20.
THORN 3000 Mains TX **£5.75** p.p. £2.00. **8000** Mains choke **£6.78** p.p. £1.22.

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MANOR SUPPLIES

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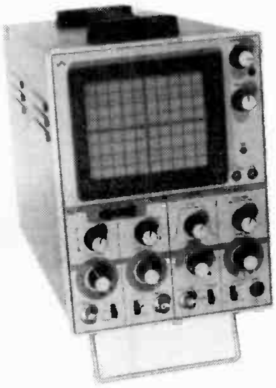

SAFGAN DT-520 DUAL TRACE SCOPE 20MHz–5″ C.R.T.

SPECIFICATION
- ★ CH1, CH2: 5mV/div-20V/div
- ★ Time Base: 1 sec/div-100ns/div
- ★ XY Facility: Matched XY inputs
- ★ Trigger: Level control, ± slope selection
- ★ Auto, normal, TV Triggering
- ★ Z-Modulation
- ★ CAL output 1V 1KHz
- ★ Sweep output
- ★ Graticule blue ruled 10×8 cm (5″ C.R.T.) Very sharp trace.
- ★ Size: H235mm, W177mm, D360mm.
- ★ Weight: 6.5Kgs.
- ★ Supply: 200-240V. 40-60Hz.

Price: £210.00 + £31.50 V.A.T.
Optional Probes as Thandar below.

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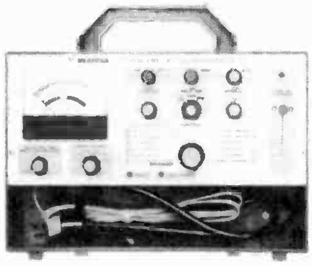
Size: H 230mm W 330mm D 120mm.



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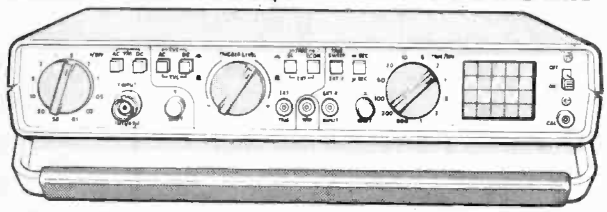

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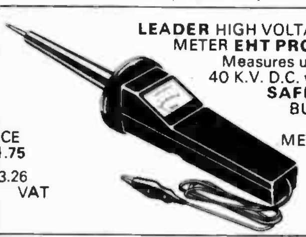

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AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.46
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70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

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

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

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

Type	Price (£)
BD234	0.68
BD235	0.63
BD236	0.63
BD237	0.68
BD238	0.68
BD253	1.58
BD410	1.65
BD433	0.65
BD435	0.70
BD436	0.71
BD437	0.74
BD438	0.75
BD519	0.88
BD520	0.88
BD599	0.87
BD600	1.23
BD663BR	0.86
BDX18	1.55
BDX32	2.95
BDY16A	0.63
BDY18	1.55
BDY20	2.29
BDY38	1.38
BF115	0.48
BF117	0.45
BF120	0.55
BF121	0.85
BF123	0.48
BF125	0.55
BF127	0.51
BF137F	0.78
BF152	0.19
BF158	0.25
BF159	0.27
BF160	0.20
BF161	0.84
BF163	0.65
BF164	0.95
BF166	0.50
BF167	0.38
BF173	0.35
BF177	0.36
BF178	0.46
BF179	0.58
BF180	0.53
BF181	0.53
BF182	0.44
BF183	0.52
BF184	0.44
BF185	0.42
BF186	0.42
BF194*	0.14
BF195*	0.12
BF196	0.14
BF197	0.15
BF198	0.29
BF199	0.29
BF200	0.25
BF218	0.42

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

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

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

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

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

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)
CA810QM	2.50
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC4008	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SL432A	2.52
SL450	5.10
SL901B	4.75
SL917B	6.50
SL918A	5.95
SN72440N	2.21
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32

Type	Price (£)
SN76023ND	2.52
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.8
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	2.85
TAA621AX1	4.75
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA6618	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.32
TBA240A	3.98
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20

Type	Price (£)
TBA480Q	1.84
TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	4.55
TBA641BX1	4.60
TBA651	2.42
TBA673	2.31
TBA700*	2.50
TBA750*	2.18
TBA800	2.05
TBA810AS	2.00
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA280A	1.43
TCA290A	3.46
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA820	3.29
TDA440	4.16
TDA1003	1.88
TDA1004	3.85
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	1.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

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* Indicates Q version is also available.

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DIODES

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

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

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400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	£1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each

VDR's, etc.

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

VALVES

Type	Price (£)
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DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.60
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	3.80
PCL82	0.93
PCL83	5.25
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL519	6.20
PL802	5.60
PY81/PB10	0.60

BRIDGES

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

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	Ea	10 of one value	50pc	100pc	500pc
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¼W 10Ω-10MΩ (E24)	3p	25p	95p	£1.48	£5.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.80	£6.40	£26.90

Wirewound (5%)

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

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

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20mm quick-blow (BEAB)
100mA £1.50
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plastic £1.48

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4n7F	1500V DC	60p	100nF	1000V DC	46p
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3kV	1.5nF	20p
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A Loss of Confidence

At one time it was fashionable for editors of technical magazines or their contributors to write occasional pieces that gave a glowing view of the prospects ahead. In the early thirties it was easy enough to write that in ten years' time high-definition TV would be established, maybe with colour, that cars would be better and faster and so on. Twenty years later, in the early fifties, there were still grounds for optimism. Nuclear power could provide cheap and plentiful energy, the jet engine was revolutionising travel, and the transistor had begun to revolutionise electronics. Automation was a buzz word and people were becoming design conscious, which would in turn revolutionise our homes, products and the environment.

The boom of the sixties seemed to confirm that all was on course for a better standard of living with more options and facilities at everyone's disposal. Since then, everything seems to have gone sour. Nuclear power has turned out to be expensive and of questionable need, for the time being at any rate. All that flowering of design ended up in a mass of shoddy goods and a shoddy environment, with buildings twenty or less years old being demolished because they simply didn't work. In this sort of situation it's not so easy to be confident about the prospects that lie ahead.

Another factor that makes prophecy less enlightening is that we nowadays very often know years ahead what to expect. Developing something may take ten or twenty years. We've known that satellite TV is coming for several years already, and by the time it does come we may well greet it with a great big yawn. The problems seem increasingly to be not so much what can be achieved and how to go about it, but how to fund development work and what to do with its results when they eventually turn up. Cable TV is a classic example, It'll be expensive, especially if it's to be of the all singing, all dancing interactive variety, and the great question is whether people will actually want it. Channel 4 does not seem to have unleashed a flood of innovative programme material, and there's little reason to feel that cable or satellite TV will. More can mean worse! It's not an exactly confidence building prospect.

When one looks at the wider scene one detects a general loss of confidence in future prospects. The sort of article I keep coming across runs along the following lines – I've not made it up either. "Large sections of industry are facing a painful process of readjustment with substantial job losses. The aim must be to support future orientated industry. Major surgery is expected in the iron and steel industry and shipbuilding, the plans being to promote the creation of more jobs in modern industries such as electronics, industrial design and (yes, here it comes!) information technology." That sort of thing can be written about almost any industrial country today. This time it was Spain of all places.

There's a small problem here that seems to go largely unnoticed. If everyone stops building ships and goes in for information technology instead, it won't be all that long before it's the information technology industry that will be facing a painful process of readjustment. Assuming, that is, that such industries really do get going. Information technology is the current buzz phrase but is inherently vague. One could perhaps define it as the use of computer technology to increase the availability of information generally. But this brings us to the same problems that cable/satellite TV pose. Will there be a need for all this extra information? And who will be willing to pay for it?

I'm not suggesting that there are no worthwhile developments being introduced or in prospect. The compact disc for example seems to be genuinely worthwhile. It stores more, better quality wanted information than its predecessor and in the long run should be as cheap. That *is* progress, and should surely be cause for its inventor Philips to feel full of confidence. It's strange therefore to find Philips pressing for an increased (19 per cent) EEC tariff on the players, as mentioned in the May Teletopics. Philips have since gone to some trouble to explain their view of the matter The hope is that the compact disc will lead to "the complete regeneration of the European audio industry", though "a breathing space" is required while volume production is being built up. This is puzzling. Surely the last people who should need a "breathing space" are those who developed the system and got there first. The problem seems to be that Japanese firms can move to the mass production stage at a much faster rate.

This doesn't say much for European production technology or for European methods of funding industry, a point that was emphasized by speakers at the recent *Financial Times* Electronics Conference. During his introduction Peter Benson, formerly deputy chairman of British Telecom, put the question "are our existing (European) institutions able to cope with the growth of the industry?". The consensus seeemd to be definitely not, and that the European electronics industry was not in good shape at all in comparision with the USA and Japan. Meanwhile there are mutterings in Japan that the boom years have come to an end and that life is going to be more difficult from now on.

Returning to Philips' views on the compact disc, the suggestion is that if it's unsuccessful there could be "a domino effect, hitting first the audio industry, then TV manufacturing, component suppliers and so on". It would be nice to sit down and pen a piece on the good times ahead, but the general view now that we've arrived in the mid eighties seems to be one of a distinct lack of confidence.

FRONT COVER

This month's front cover photograph was taken at the factory of c.r.t. rebuilding specialists TSR Vacuonics Ltd. It shows an operator spot welding the cathodes on the stem supports of a colour c.r.t. gun.

CHANGE OF ADDRESS

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

PCB SERVICE

Send orders to Readers' PCB Services Ltd. (TV), Fleet House, Welbeck Street, Whitwell, Worksop, Notts – see note on page 457 last month. A revised list of boards available will be published next month.

Teletopics

MINI CTVs

Details of two mini colour sets have been released. Matsushita's set (National Panasonic) is called the Travelvision and uses a conventional though newly developed 30° deflection miniature colour tube that gives a 1·5in. picture (22 × 28mm). It measures 38mm high, 110mm wide and 180mm deep and weighs only 600g (1·34lb) excluding batteries. The set was on show at this summer's Chicago Consumer Electronics Show and is due for release in the USA in the near future. Plans for a PAL version for the UK market have not been finalised.

The Travelvision is equipped with video input terminals, making it convenient for use as a video monitor as well as a portable TV set. There's also an audio input socket and an earphone/headphone jack. The set can be operated from an a.c. mains supply, 12V d.c. car battery, nickel-cadmium rechargeable battery or eight AA dry batteries. Power consumption is 2·9W with a d.c. supply and 5W when fed from the mains. The audio output is 0.12W from a 32mm round speaker. There's continuous variable tuning with an illuminating bar that scans the screen.

The second set has been developed by the Epson Corporation and Suwa Seikosha Co. Ltd. (Seika) and is quite different. It measures 160 × 80 × 28mm and uses a liquid crystal colour display system. This flat display is certainly something of a breakthrough and one wonders what larger versions will look like – it's illuminated for maximum visibility under dark or light viewing conditions. John Patterson, national sales and marketing manager of Epson (UK) Ltd., commented that "there are no plans to make the new receiver available in the UK, but it does reflect the continuous research and development being undertaken in Japan".

LARGE LCD CTV

At the other extreme, Mitsubishi have developed a very large, flat, full-colour liquid crystal display system which was also on show at the Chicago exhibition and is already being marketed. The version shown at Chicago gave a display of 1·2 × 1·8m though there are five standard sizes ranging from 0·9 × 1·4m to 2·9 × 4·6m. The depth is only 40cm.

Mitsubishi hope to receive orders for 200 units in the first year, priced at ten to thirty million yen per square metre. The LCD system is said to give a full colour display of animation, patterns and characters and is designed for use with inputs from a VCR, camera or computer. It's intended for applications such as advertising, displaying information at stations, airports and conference halls, plant monitoring, etc.

The display uses specially developed light sources, featuring high and uniform brightness, behind liquid crystals with red, green and blue colour filters arranged in a grid. The light emitted from the sources is controlled by the action of the liquid crystals.

UNUSUAL TVs

Tektronic have developed a field-sequential colour display system consisting of a monochrome c.r.t. combined with a liquid crystal colour switch. The fast LCD switch provides alternate red/green/blue fields and since there's no shadowmask or phosphor matrix high resolution can be achieved. Intended uses are for instrument and control process displays and computer readouts where high resolution is important.

Philips have introduced a slow-rate TV system that enables single frame pictures to be transmitted via normal speech circuits. There are three units, a transmitter to convert the signal from the camera into slow-rate data that can be handled by a telephone circuit, a receiver to convert the slow-rate data into a video signal for monitor display, and a control unit to enable any of four pictures to be selected or alternatively displayed simultaneously. The system is intended for use in security and surveillance applications. The transmitter stores a single frame and uses a sampling system to release picture elements at a rate compatible with the bandwidth of the cable link: the slow-rate pictures can be recorded on an audio cassette for future use.

MULLARD SOLID-STATE IMAGE SENSOR

Mullard have introduced a solid-state image sensor, development type number RGS-4, which is intended to sell in the same price range as a monochrome TV camera tube. Suggested applications include measuring equipment, industrial robots, CCTV in hazardous environments, videophones, bar-code readers, military photographic and sensing devices, etc. The RGS-4 needs only simple peripheral electronics, gives a consistently good picture quality and has good sensitivity to both blue and infra-red light. It has an imaging diagonal of 7mm, which corresponds to the format of Super-8 film, a resolution of 200 horizontal by 300 vertical elements, and can be used with low-cost, commercially available lenses. The standard illumination is 15μW per square cm but the device can operate at down to less than 0·5μW per square cm, giving pictures under poor lighting conditions. A 30V supply is required and the total power consumption of a camera using the sensor can be less than 3W.

The RGS-4 is a resistive-gate sensor made up of photosensitive elements which are connected via charge-coupled device channels to a buffer and output register, i.e. the charge carriers generated by the incident light are periodically transferred to potential wells below the control electrodes and are then moved into and out of the shift register as a video signal.

RELIABILITY

The NEDO consumer electronics sector working party is due to publish a report on the considerable improvements that have been achieved in component and TV set reliability in the UK. The on-line component failure rate has been reduced from 200 parts per million to 40 p.p.m. since 1977/8, with receiver fault rates during the first year falling from 5 per cent to 0·6 per cent.

Though the reduced component count per set has contributed to this improvement, the main factor has been improved component quality – such that the difference between UK and Far Eastern component reject levels is now insignificant. The aim has been to achieve a "zero defect approach", with the reason for every failure found rather than simply sticking to a contractual quality specification. This has required close collaboration between setmakers and component manufacturers, with liaison at several levels. The long-term aim is to be able to eliminate goods inward testing by setmakers, also on-line fault finding and the amount of soak testing necessary.

Plastic mouldings now account for over a third of on-line rejects, and accordingly the working party has started a programme of co-operation with the Plastics Processing sector working party to improve the quality of the mouldings used in TV sets. Although full analysis of the problems has not yet been completed, close liaison between setmakers and suppliers has been established.

At the end of last year a joint union-management delegation from Thorn's Gosport and Enfield plants paid a return visit to six major Japanese CTV plants. The earlier visit took place in 1978, "when the UK consumer electronics industry was wilting under pressure from Japan." The conclusion this time was that Thorn have now caught up with and in some cases overtaken the use of advanced manufacturing processes by leading Japanese CTV manufacturers, though Matsushita would not permit a visit to the "almost completely automated" TV assembly line being developed at Ibaraki.

One thing we may come to see in TV sets is increasing use of surface mounted components, again a field in which Japan has established a lead. In mass production there seems to be a cost advantage in surface mounting as opposed to the automatic component insertion techniques now being used.

VCR NEWS

The new Mitsubishi VCR plant in the UK is to be at Livingston near Edinburgh. The plant involves an investment of some £2 million and is expected to be in full production by the end of next year.

Considerable efforts are being made to get VCR kits excluded from the EEC-Japanese quota agreement, which could have severe consequences for the operation of European VCR assembly lines unless amended. One of the points being made is that the local content of European manufactured VCRs is being steadily increased – the local component content of J2T machines is expected to reach 35 per cent by the end of this year for example. The quota agreement has also led to a shortage of c.r.t.s – Thorn for example expect to be short of some 20,000 90° 22in. tubes, which are not produced in Europe and are normally obtained from Hitachi and Toshiba.

Philips have added a front-loading V2000 format machine, Model VR2350, to their new range. Features include stereo sound, high-speed picture search and multiple slow-speed options. Further front-loading Betamax machines are due from Toshiba shortly – Models V31B and V33B. Features include high-speed picture search, slow motion and still picture, the V33B having a 14 day/ eight programme timer and remote control.

Research workers at NHK, Japan, have demonstrated that the use of recently developed (by Fuji) metal-powder coated tape and a domestic VCR modified for digital recording can give a much increased recording information density, with good picture quality, compared with the conventional analogue machine. Improved head sensitivity and tracking accuracy would be required for successful operation of the system.

LATEST FROM ITT

The latest version of the ITT CVC1200 chassis is the CVC1202, which is intended to drive 20in., 90° mini-neck (22·5) tubes. Since these tubes use a pincushion distortion free yoke, the EW diode modulator circuit is omitted. An associated change is the use of a BU208D line output transistor with integral efficiency diode.

A retrofit kit (VRFK02) has been introduced by ITT to enable various current ITT TV sets and VCRs to be connected at video/audio frequency. The direct video/ audio input unit is fitted as standard in the 26in. remote control Model CT2712/1, and VCRs TR3913 and TR3943 have the necessary output sockets.

NEW BOOKS

The 1983/4 Video Yearbook, now in its seventh edition, is available at £25/$44 from specialist bookshops or £27/$48 direct by mail order from Specialist Publications Group, Link House Magazines plc, Link House, Dingwall Avenue, Croydon CR9 2TA, UK. The 800-page reference book covers all aspects of the video industry in over 80 countries around the world and is a valuable source of information for all those involved in the industrial, professional or broadcast video fields.

The latest book in the "IBA Technical Review" series is entitled "Developments in Teletext". The 69-page book is profusely illustrated and includes seven papers by engineers working in the teletext field. It covers ten years of teletext development including the enhancements of additional levels, with the possibility of using alpha-geometric coding, networking, i.c. decoders and the NEWFOR system of teletext subtitling. The book is intended for engineers and students directly involved in this field of broadcasting and is also available to technical libraries and educational centres. Enquiries to IBA Engineering Information Service, Crawley Court, Winchester, Hants, SO21 2QA.

ADDRESSES

Please note that the magazine's editorial office has been moved to the firm's headquarters building. The new address is given on page 513.

South West Aerial Systems have moved to 11 Kent Road, Parkstone, Poole, Dorset BH12 2EH (telephone 0202-738232).

We omitted to give the address of Heron Electronics Ltd. last month. This is Heron House, 19 Marylebone Road, London NW1 5JL.

SERVICE EQUIPMENT

A new analogue multimeter, Model 1001, has been introduced by Avo. It's housed in a tough ABS plastic case and is priced at £28·50. The meter provides a.c. or d.c. voltage measurements up to 1kV, d.c. measurements up to 1A and resistance measurements up to 2MΩ. There's also a continuity buzzer for resistances up to 20Ω. The sensitivity is 10kΩ/V d.c. and 1kΩ/V a.c.

Alcon Instruments Ltd., 19 Mulberry Walk, London SW3 6DZ have introduced a small, pocket-sized signal injector in the form of a pen-shaped signal probe – the Chinaglia USIJET. The main signal generator is a 500kHz blocking oscillator whose output is modulated at 1kHz for identification and demodulation check purposes. Because of the waveform, the equipment produces detectable harmonics at up to 500MHz, which is useful in many servicing applications. The power consumption is 25mA from an internal 1·5V battery to give a 20V peak-to-peak output at the probe tip. A fly-lead connects the case to the earth line and the probe can cope with circuit voltages up to 500V d.c. The price, complete with earthing lead and instructions, is £11·55 including VAT.

VCR Clinic

Fault reports from Derek Snelling, Mike Sarre, T. L. Bingham, Les Harris and Michael J. Cousins, T.Eng. (C.E.I.)

New Machines

The Mitsubishi range of VCRs has recently been added to the list of machines we handle. There are three models at present, the HS700, HS320 and HS303. The latter is the standard machine with wired remote control, pause and visual search, while the HS700 is a portable — it's really a normal VCR made to work in the vertical position and given a handle. The power pack can be removed and replaced with an optional extra rechargeable battery, and a camera can be plugged in directly. Being based on a standard VCR, it's not particularly light. So I'd not recommend it for someone who wants to do a lot of outdoor camera work. For someone who wants a machine for occasional portable use or for moving around from room to room however it's ideal, and has the advantage over many portables that the tuner and power supply/charger are built in. It's also only about £50 more than the standard machine.

The HS320 is the up-market model, with infra-red remote control and Dolby sound. The handset tucks away into a compartment at the bottom right front corner. There are a couple of features that could confuse the user. First a switch called "panel lock", behind the front flap. When this is switched to on in the record mode all the machine's front controls are disabled. The idea is to stop the children messing up a recording. But you're bound to get a customer who switches it on, forgets it and then phones to say he can't get the machine out of record. The other point is that with the timer flap open to set the timer the channel change buttons are inoperative. This raises two potential problems — the customer who doesn't shut the flap properly and can't change channels, and the fact that with the front off for servicing the microswitch must be taped down if you want to change channels.

The HS320 has "stepped" slow motion, as used in Ferguson machines, and can be slowed down or speeded up using two buttons on the remote control unit. As well as an electronic counter it has an elapsed time indicator which tells you, in hours, minutes and seconds, how much tape has been used during the current recording or playback. This doesn't work in fast forward or rewind: if these are selected the display flashes to indicate that the elapsed time is no longer correct. In slow motion it goes to one tenth normal time irrespective of the slow speed selected, and in visual search it goes to seven times normal forwards or backwards as appropriate.

Whilst on the subject of displays, when the machine is first plugged in the clock display will flash if left, indicating that the clock has not been set to the correct time. This flashing should stop after two-three hours — the point when it stops flashing indicates that the timer back-up battery is fully charged. Finally the machine incorporates "fine edit", i.e. when record is selected the tape backs up for a few seconds then locks on to the control pulses of the previous recording before going into record, so that the transitions between "takes" are noise free.

Two other new models have recently come in, the Hitachi VT14 and VT17. The VT14 is a top loading stereo machine with Dolby, similar to the VT11. The features include I.R.T. (instant record timer), which enables the machine to be set to record for up to four hours in thirty minute steps without setting the timer. The VT17 is a front-loading two-speed machine with four heads — two extra ones for the long-play facility. On playback the machine automatically selects long or standard play as required. The slow motion is at half speed, not stepped as in the Mitsubishi machine, and the comprehensive range of features includes picture sharp/soft control. A small improvement is that the infra-red receiver has been moved up to near the top of the machine instead of being tucked away virtually underneath as in previous models. **D.S.**

Hitachi VT9300

A niggling fault with the Hitachi VT9300: I've had three of these machines now with dirty channel change switches as they approach one year old. It's simple enough to cure, just take the front off and spray with Servisol, but shouldn't really be necessary and is the first time I've had trouble with channel change switches. **D.S.**

Panasonic NV2000

The complaint we had with a Panasonic NV2000 was warble on the sound, and certainly the speed seemed to be fluctuating every half second or so. I tried the easy way first, but a new capstan motor did not provide a cure (incidentally this comes as a unit complete with a loading motor). On scoping the waveform at pin 12 of IC2005, part of the capstan set-up procedure, I found that instead of a regular trapezoid the waveform went from a small sawtooth to a large one over a period of four cycles, followed by two cycles of the correct waveform, then back again. This waveform is generated in IC2005, but an output goes to IC2001 and on spraying this with freezer the correct waveform would return. Changing IC2001 alone didn't completely cure the fault however: both i.c.s had eventually to be replaced. **D.S.**

Mitsubishi HS320

We've had a couple of faults on Mitsubishi HS320s. The first was clearly playing at the wrong speed, and the drum speed was also off. Waveform 25, which is derived from a crystal oscillator on the chroma panel, was found to be missing, due to the crystal (X6A0) being faulty. The second machine occasionally laced up only half way before going into play. This was soon traced to the microswitch that tells the machine when lace-up is complete — it's position needed altering slightly. The switch is located in the far left corner of the machine, by the end of travel of the left loading arm.

Apparently both these faults are to be expected. Mitsubishi mentioned another fault, though we've not had it yet. This is the tape-end phototransistor going short-circuit, giving the symptom that the tape will travel in one direction only as the machine thinks it's at one end of the tape. An unusual point is that one of the phototransistors is mounted directly on one of the panels. This means that care is required if this panel is removed during servicing as

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that end sensor will then be inoperative. Likewise care should be taken to ensure that the panel is refitted correctly so that the sensor lines up with the hole in the cassette housing. **D.S.**

Ferguson 3V29

Here's one that nearly had me swinging from the trees — every 10-60 seconds the tape speed appeared to slow for a fraction of a second, giving the symptom of intermittent sound slurring. All the pulses seemed to be rock solid except, after close scrutiny, the capstan trapezoid waveform which altered just slightly. After changing the main servo chip IC3 (HA11711) without success I decided to speed things up a bit by changing the servo panel complete. Again no joy. Neither did changing the motor drive amplifier panel make any difference. So it seemed that the capstan motor was suspect.

This is where things got really bad. A new motor was ordered and fitted, but the problem remained. There was another machine close by, so clutching at straws I changed the capstan. Again no difference. To cut a long story short, a motor from another machine was tried. A certain amount of swapping about was then done in order to check the motors, which were eventually cleared of suspicion. The only other item in the faulty machine was the electrolytic capacitor across the motor, C001. This final remaining item turned out to be the culprit. **M.S.**

Grundig 2 × 4 Super

No vision on playback, except for several diagonal lines, was traced to L723 (a 4·7μH choke) in the drop-out compensation circuit on the Y module being open-circuit. **T.L.B.**

Ferguson 3V29/3V30

In the event of erratic, unstable picture and sound, possibly intermittent, check the stability and accuracy of the 12·5V regulated line at TP1 on the power supply panel. If the voltage is high or unstable, suspect the preset R5 (1kΩ) which can go high in value or become erratic in operation. **T.L.B.**

Hitachi VT11E

The fault on this machine was no output from the r.f. modulator. Although it's not shown in the Hitachi service manual, the 9V rail to the modulator is fed via what appears to be a 6·8μH choke just inside the can, near the edge connector. It seems to go open-circuit for no apparent reason – it's one of those chokes that look like a capacitor that looks like a resistor! **T.L.B.**

Toshiba V8600

The fault with a Toshiba V8600 seemed to be slight tuner drift, as a result of which the colour would go off. I found that by pressing down on the tuner can any selected channel would go completely off tune. When the tuning pin voltage was measured whilst pressing the tuner can down it was found to rise to about 30V. Checks around the channel selector chip (μPC1363C) in the fault condition then showed that channel 1 (pin 11) was rising from 0V to 31V while supply pin 14 dropped to 0.5V. The trouble was due to a crack in the 12V supply line print close to the tuner's earthing lugs. I assume that the crack had been "resistive", lowering the voltage at pin 14 and causing pin 11 to rise off ground to give slight detuning. **L.H.**

ITT VHS VCR

This was a strange fault with an even stranger cause. The machine was an ITT one, similar to the Ferguson 3V29. The customer's complaint was that if the third channel button was selected and the machine set to make a timer recording the channel selector would reset to channel one. On trying the machine in the E-E mode we found that the channel reset to number one and in addition the clock display disappeared when the power supply panel was prodded. So we measured the 12·5V regulated supply and prodded the panel. The voltage dropped to 10V. On investigation we found that a diode had been dropped on to the panel during production. It had got trapped under the set 12·5V preset and was intermittently shorting the wiper to one end of the track! **L.H.**

JVC HR7700/Ferguson 3V23

Perhaps the most obscure and difficult faults to locate on these machines are those on the mechacon panel. The problems are aggravated by the use of double-sided print, and it's not uncommon for the panel to act as a catchment for liquid spilt into the machine.

A recent illustration of this was a machine fitted with the original mechacon panel. The initial fault was no tape loading (not no cassette loading). This turned out to be due to transistor X7 (2SA1020) in the loading motor control circuit being open-circuit. Further checks revealed that there was no fast forward control or rewind in the cue memory mode. The counter memory mode worked perfectly, so it appeared that in the cue mode the microcomputer control i.c. (ICI) was receiving a permanent cue signal. Tracing back, we found that pin 12 of IC26 (data selector cue signal input pin) was low, indicating that a cue signal was present. Investigation in this area brought us to R223 (10kΩ) which had gone open-circuit due to corrosion. It's the collector load resistor for the cue signal switch transistor X49, which is directly coupled to pin 12 of IC26. **M.J.C.**

Ferguson 3V23

The fault on a 3V23 fitted with the early mechacon board was no reel motor functions, and it was immediately evident that the reel motor switching transistors X24, X23 and X18 had all suffered badly. These were replaced and the other five transistors in the reel motor switching network checked and found to be in order. We next checked transistor X2, which controls the voltage applied to the reel motor and hence its speed, and X2's driver transistor X46. Both were o.k.

On applying power smoke came from X18 even though no reel motor function was selected. So X18 was replaced and X2 removed. On applying power once more we found that X46 was hard on. It's controlled by the microcomputer IC1, via various items including IC9 which is connected to pin 11 of IC1. The voltage at this pin was high, but in my experience of these machines I've never known the microcomputer i.c. to be faulty. Fortunately it turned out that IC9 was at fault with an internal short – it's a CMOS gate i.c., type TC4025. **M.J.C.**

The Betamax Video System

Part 1

Eugene Trundle

There are currently three competing formats on the domestic VCR market— Betamax, VHS and V2000, which were developed by Sony, Matsushita/JVC and Philips/ Grundig respectively. It's likely that all three will be with us for many years to come, if only because of the huge investments these systems represent for the manufacturers on the one hand and the purchasers/rental organisations on the other. It's true to say that there's very little difference in the performance of the three systems, and that it's very difficult to tell them apart simply by viewing a replayed picture, providing we are comparing like with like in terms of screen size, software quality, signal coupling to the TV set (video or u.h.f.) and so on.

Format Comparison

The main features of the three formats are shown in Table 1. It can be seen that the Betamax system uses the highest writing speed at 5.83m/sec — the head drum is relatively large and the peripheral speed is thus high. This offers the best conditions for a wide luminance frequency response. The linear tape speed is low: whilst this is a disadvantage in terms of audio quality with conventional longitudinal sound recording, it combines with the narrow video track width (approximately 33 microns) to give a high recording density figure, approaching that of the V2000 system. Hence the Betamax cassette is significantly smaller than those of the other systems and is the only one that fits easily into a jacket pocket. In other respects there's little to choose between the specifications of the three systems in terms of performance.

The early machines produced by all manufacturers in the Betamax camp tended to have a battleship air about them — they were large, heavy, and often finished in grey and black! They are rugged and robust however, and built to last. Second generation machines such as the Sony C5 and C7 are also bulky, but this image has finally been shaken off by current machines such as the Sanyo VTC5300 and the Sony F1 and C9.

Most Betamax machines (the Sanyo VTC5000 is an exception) perform fast transport operations with the tape fully laced up — there is little evidence that this leads to undue head wear, as was originally feared. Initially this feature saved frustrating seconds when searching for a particular point on the tape, but the advent of picture search and "counter go to" facilities on later machines of all formats have overcome this problem.

The Tape Deck

One reason for the ponderous look of early Betamax machines is the deck layout, with the large video drum and the characteristic long, U-shaped tape threading path. Betamax threading is a little reminiscent of the Philips N1500 and N1700 series machines, in that a loop of tape is drawn out of the cassette and wrapped around the drum by means of a single post on a loading ring. In Betamax machines the loading ring completely surrounds the drum and the stationary heads as shown in Fig. 1. In the rest position, the threading post protrudes into the cassette holder, insertion of a cassette initiating the threading process. The loading ring then moves anti-clockwise through almost 270° while the tension regulator arm simultaneously moves out to define the tape exit path from the supply reel. This U-wrap system was developed from Sony's very successful semi-professional U-matic system: Sony maintain that tape friction and strain are less than with the alternative M-wrap system. It also has the advantage that the critical head entry and exit guides are kept separate from the threading mechanism, offering better alignment and long-term stability. It's certainly been my experience that tape interchange problems seem to be less common with Betamax VCRs. The total angle of the tape around the drum and guides is less than the 540° of the M-wrap system: it's claimed that this results in more reliable operation and reduced tape stress, as well as facilitating very high-speed picture search and the latest feature, swing search — this allows forward and backward running of the tape at normal speed without noise bars.

Because of the helical scanning and the fact that the cassette is parallel to the machine's plane, a change in the tape path angle is required — so that the tape starts its path around the head at a higher level than the exit point. The long return path A-B accommodates this feature easily and means that the drum and loading ring can be mounted parallel to the deck surface. The latter is at the required angle to the machine and the cassette. All this is in great contrast to the VHS system, where the deck, the machine and the cassette are all parallel but the head drum is tilted.

Fig. 2 shows a "linear" diagram of the tape path across the deck, drawn from the point of view of the tape — in practice tape guides A and B are at a higher level than guides C and D. After emerging from the supply reel the tape first encounters the tension regulator, which is a simple mechanical negative feedback arrangement operating on a brake band wrapped around the supply reel turntable. Next comes the adjustable guide A, which aligns the tape with the full-width erase head. This is

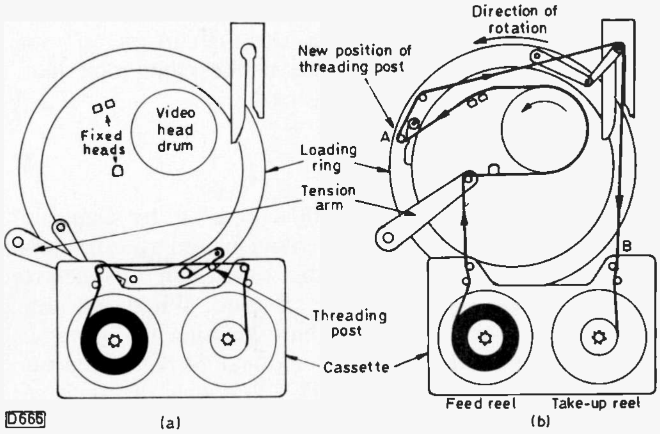


Fig. 1: The Betamax threading cycle, (a) at start, (b) at the completion of threading.

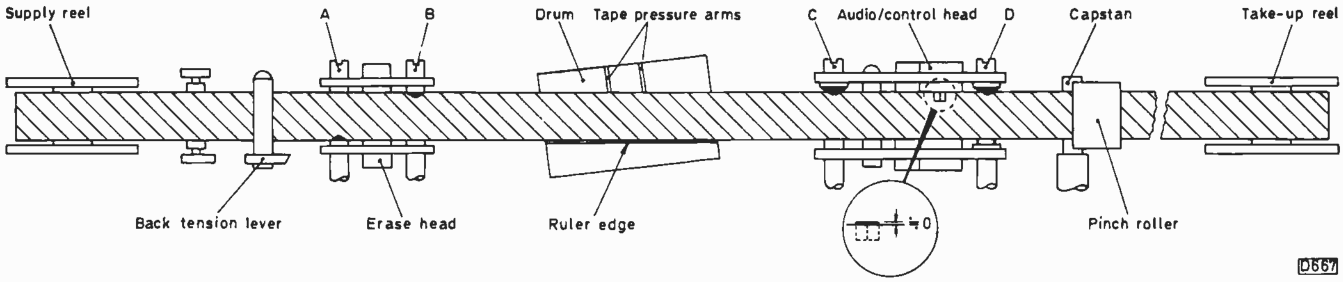


Fig. 2: "Linear" diagram of the tape path around the deck, drawn from the point of view of the tape. In practice tape guides A and B are at a higher level than guides C and D and their associated audio/control head. B is the head entry guide and C the head exit guide.

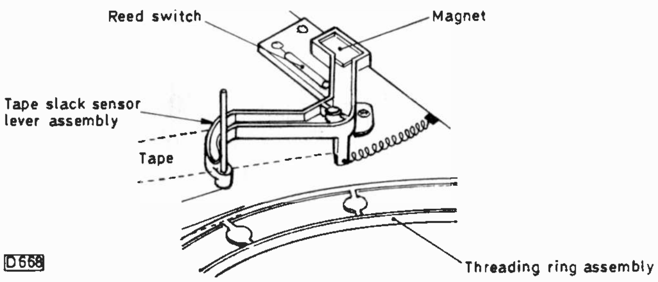


Fig. 3: Mechanical slack sensor used in Sony machines. When slack tape results in the sensing pole being deflected sufficiently, the magnet moves round to close the reed switch. This signals the syscon to enter the stop mode.

followed by the height adjustable guide B which also forms the head wrap entry guide. The tape now travels along a helical path around half the periphery of the head drum, guided by and sitting upon a ruler edge which is at exactly 5° to the plane of the path of the rotary heads. This sets the video tape track angle, which due to the linear movement of the tape during record and replay is slightly more than 5°.

The tape runs off the drum on to exit guide C, which is height adjustable, and then passes the audio/sync head and its associated, adjustable guide. The capstan comes next: it's deck mounted of course, but the pressure roller is fixed to the threading ring and is brought into engagement during record and play by a neighbouring solenoid. This completes the operational part of the tape path: from here the tape climbs up the gradient, around the spacing poles or rollers on the threading ring, and back into the take-up reel. In some machines it deflects a slack-detector arm on the way (see Fig. 3).

The different levels and sometimes slight inaccessibility of the stationary heads and guides can make thorough cleaning difficult in some models — I recommend the use of cotton buds on sticks (the sort intended for babies' ears) and a dental mirror for this. If the mirror is of the illuminated type, so much the better: it's also useful for examining the tape path when adjusting guides.

The method of driving the loading ring depends very much on the vintage of the machine. In later types a loading motor does the job, whereas early machines have an ingenious mechanical linkage from a single motor which is the prime mover of everything in the machine — capstan, drum and all.

Table 1: Characteristics of current formats.

Characteristic	*Betamax*	*VHS*	*V2000*
Video writing speed (m/sec)	5·83	4·85	5·08
Longitudinal tape speed (cm/sec)	1·87	2·34	2·44
Video track width (μm)	32·8	49	22·6
Slant azimuth offset	±7°	±6°	±15°
Information density (hrs/m²)	1·63	0·926	1·786
Cassette volume (cc)	368	489	523

Video Head Drum

The head drum brings us to another fundamental difference between the Betamax and other formats. The Betamax head assembly is in the form of a three-layer "sandwich" with only the centre portion rotating. This has given rise to the term head disc rather than drum. A typical head disc is shown in Fig. 4, which also shows the tacho magnets. This form of head construction usually means that head cleaning must be done by holding the cleaning pad stationary on the disc's periphery, then rotating the heads via the drive belt. Where appropriate, this can be done by hand rotation of the motor fan. As with any video head cleaning operation, this must be done with great care — the 33 micron heads are no less fragile than those of any other format!

With all Sony machines and some Toshiba ones, eccentricity adjustment of the head disc is necessary when this has been replaced. It requires the use of a sensitive dial gauge which must be rigidly mounted on the disc's surface. Although the same dial gauge can be used on all models, the mounting kit varies — it's essential to have the correct type. Eccentricity setting is necessary to establish the exact centring of the video head disc before tightening

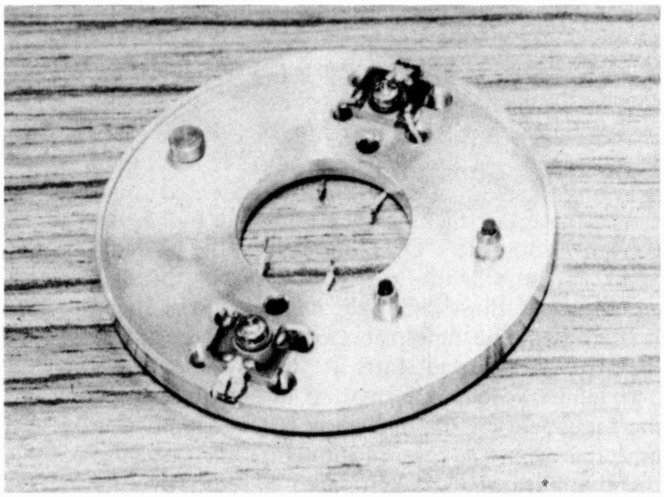


Fig. 4: Sony video head disc – the mounting screws, central to each head assembly, should be left severely alone!

its mounting screws, and is checked by rotating the head with the dial gauge sensing arm trailing on the disc's periphery. Great care is necessary here to ensure that the gauge sensor tip does not foul the video heads.

Sony mention dihedral adjustment in their manuals. This is a procedure whereby each video head can be "nudged" sideways via its mounting on the head disc by means of tapered screws on each side. The threaded holes for this can be seen at each side of the head mounting plate at the edge of the disc in Fig. 4. Although a setting-up procedure is given in the manual (using the monoscope portion of the alignment tape), I've never found it necessary to carry out this adjustment during many head replacements. The alignment of the heads on the drum is accurately set with a microscope at the factory, and there's no reason to doubt its accuracy — perhaps only if the machine was being precision adjusted as a master copier would dihedral adjustment be required.

As with all current formats, each head has an azimuth offset to avoid the need for guard bands between video tracks (slant-azimuth technique). For the Betamax system, head A is skewed 7° clockwise and head B 7° anticlockwise. In current machines the video head gap width is 0.4μm, which with a head writing speed of 5.8m/sec provides a minimum recording wavelength of 1.3μm.

Test Cassettes and Jigs

A range of special cassettes and jigs is available for use during the repair and alignment of Betamax machines. They devolve into two categories: expensive ones that will be useful with any make or model of Betamax VCR, and cheap ones, such as eccentric screwdrivers and metal gauge blocks, which are designed for one model. Into the first category come the alignment tape, eccentricity dial gauge, forward/rewind cassette torque meter and hand-held torque meter. They need careful handling, especially the dial gauge and hand-held torque meter, neither of which would survive a fall to the floor... Along with the necessary colour bars and r.f. sweep, the alignment cassette has a monochrome (monoscope) test pattern that seems to make even a half-dead machine perform beautifully! All these items are essential if serious work on Betamax machines is envisaged, and it would be folly to attempt major deck servicing or component replacement without them.

A word of advice here. The major jigs and test tapes are common to machines made by different manufacturers, and it pays to shop around. A few minutes spent getting quotes on the phone will be amply repayed, as prices seem to vary widely — and as far as I can see the products are exactly the same!

Tape Track Configuration

The Betamax track layout is shown in Fig. 5. As with all current domestic VCR formats, the heads rotate anticlockwise and the tape is pulled past the drum in an anticlockwise direction. The diagram shows the tracks as viewed from the head therefore, on to the oxide side of the tape. Each head starts at the lower edge and writes one field of video information during its journey across the tape, leaving the top edge 20msec later. During this time the drum has rotated through 180°. The tape wrap is slightly more than this to give a small overlap period during which head changeover switching is done. The control and audio tracks are recorded longitudinally in the conventional manner — the upper (audio) track is split into two for stereo sound etc.

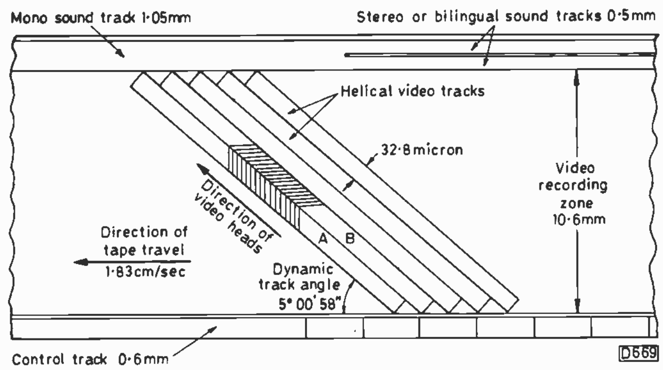


Fig. 5: Betamax tape track layout. The tape is 12·7mm (½ in.) wide. One control pulse is recorded for every two video tracks.

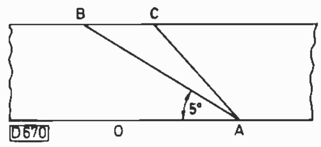


Fig. 6: The difference in track angle between moving and stationary tape.

The difference in the effective video track angle between tape which is moving and tape which is not has already been mentioned in passing. It arises from the fact that when the tape is moving the tape position advances during each head sweep — see Fig. 6. The static angle, OAB, is 5° as set by the drum ruler edge. If the tape advances by the distance BC during the 20msec field period however the head's path will be AC and the track angle OAC. In practice the difference is less than one degree, but with a 33 micron video track width it's quite sufficient to cause a grave tracking error, giving rise to the "torn" picture shown in Fig. 7 — this was taken during pause on a basic Betamax machine.

The position of the noise bar on the TV set's screen depends on the chance position of the tape track relative to the head path at the instant the tape stops, but in no position can it be eliminated. This problem, which is common to the VHS format, led to special arrangements being devised to get good still frame reproduction. These usually take the form of extra wide heads and shunting the bar out of the way at the top or bottom. Toshiba, in their

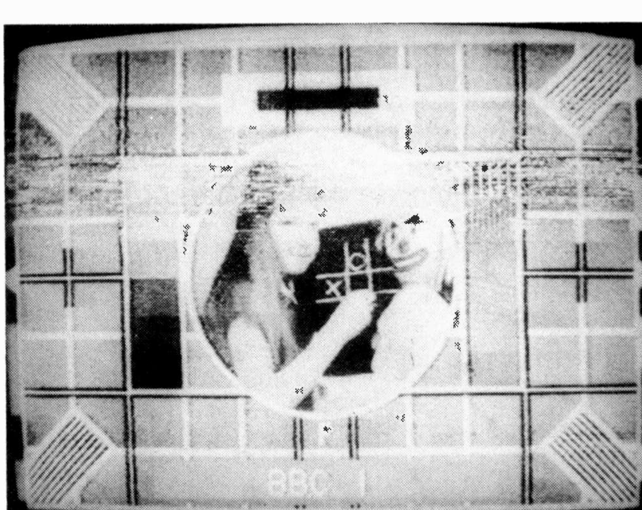


Fig. 7: Still frame noise bar produced by a "basic" VCR. The severe mistracking is due to the heads following path AB in Fig. 6 instead of path AC.

Model V8600, pioneered a more radical approach however.

Toshiba Four-head Drum

The four-head drum approach used in this Toshiba machine is depicted in Fig. 8. Heads A and B are conventional 33 micron Betamax heads and are used in the normal record and play modes. During still-frame reproduction, playback is via the special heads B1 and B2

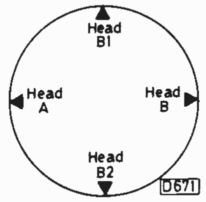


Fig. 8: Toshiba four-head arrangement. The two auxiliary heads B1 and B2 both read B tracks.

which are switched in for this mode of operation. Both have the correct azimuth slant for the B channel tracks, and they are extra wide to enable them to "see" enough of a B video track (provided the tape is stopped in a suitable position) to ensure noise-free reproduction along the whole length of the recorded TV field in spite of the difference in angle between the tape track and the head path.

The wide-head technique is now in common use – it's employed in many VHS machines to secure noise-free, still-frame pictures with two-head drums. For still frame in the V8600, the tape is inched along to a suitable position by the capstan servo: the resultant picture is in fact a repeated still field because both auxiliary heads are reading a channel B track. Subjectively, the results are very good. In conventional freeze-frame arrangements (with a two-head machine) an annoying judder effect is present when the televised subject is a fast moving one. This is because image movement takes place between field scans, so that the two-field still frame contains two different pictures! The Toshiba four-head machine is immune to this effect.

The Toshiba machine's auxiliary heads are used on trick-speeds too. Slow motion is in effect an advancing series of still-frame pictures with the capstan servo pulsing under the influence of individual control track pulses and a special slow-motion tracking control. The disturbance due to the effective angular displacement of the video tracks during double-speed replay is minimised by the extra width of the auxiliary B1 and B2 heads.

Deck Mechanics

The first generation machines in all formats were piano-key operated. Rather like an audio tape deck, much of the safety interlocking, and some of the function movements, were carried out mechanically by levers and slide bars operated directly by the keys. Great ingenuity went into the mechanics of these machines, and it's worth noting that Betamax machines were the only ones in common use with a single motor. Examples are the Sony SL8000UB and the Sanyo VTC9300, in which the single motor, necessarily a large a.c. type, drives all deck functions, the capstan, the drum, the take-up reel, fast forward and reverse, threading and all! The servo (there's only one) operates an eddy-current braking system, working on a disc mounted on the motor shaft. This latter arrangement will be familiar to many engineers as the basis of the servo systems used in the early Philips machines.

When piano keys went out of fashion their place was taken by soft-touch controls. This idea makes great demands on the system control (syscon) department. The syscon acts as a policing system as it were, to forestall user abuse and prevent damage to the tape under normal (and most abnormal) operating conditions. Early lever-operated machines lent themselves to mode interlocking by means of a slide bar, and such chores as reel braking were carried out directly from the operating keys. Such a machine required only a relatively simple syscon, and simple logic chips, either a purpose designed one or a handful of general purpose TTL devices, sufficed.

A much more comprehensive syscon is necessary in a touch-button operated machine, and its functions need to include: mode interlocking; operation of solenoids for the pinch roller, reel brakes and, in some machines, cassette ejection (Toshiba hit the heights with the V8600, which has seven solenoids); control of up to five motors; generation of switching signals for various other parts of the machine; and so on. Thus our policeman has now become a very busy housekeeper as well! This role is ideally suited to a microcomputer i.c., at least one of which will be found in all domestic VCRs offering soft-touch control of the deck functions. Such machines as the Sony C5 and C7 are of this type. All this costs money, and a low-cost alternative has been engineered by Sanyo, a machine designed to provide picture search, electronic deck control and slim, light design, but still retail at under £300 in the UK.

Look – No Solenoids!

By clever adaptation of the tape threading system, the Sanyo VTC5000 manages without any solenoids at all. To achieve this it breaks new ground in the Betamax deck system by unthreading during the stop and fast transport modes, just like VHS. There are three stages of operation as follows.

In the stop mode the tape remains unthreaded, with the reel brakes on and the cassette eject lever free to operate. In fast forward and rewind the loading ring rotates to an intermediate position, with but a small loop of tape drawn out of the cassette. This first phase locks the cassette cradle down mechanically to prevent ejection and also takes off the reel brakes, these operations being carried out by a boss and cam respectively on the loading ring. Fast transport in either direction can now take place safely, driven by a single central reel motor with a swinging idler wheel which snaps to the left or right automatically (under the influence of the motor shaft) to drive the appropriate reel.

During play, record, pause and picture search the loading ring completes the full 270° or so of the Betamax threading path, and at the completion of the threading cycle a "loading-end" roller slips into a cam on the periphery of the loading ring. This operates a lever to engage the pinch roller and start normal tape movement, which continues (provided the capstan motor continues to rotate) until the loading ring once again returns to the stop or fast transport positions.

The reel drive motor in this machine also turns the reels during normal forward motion and for picture search in either direction. In these modes the reel drive is via a slip mechanism of course, and the engagement of this is also invoked by a mechanical link from the loading ring, on the basis that slip drive is required when the tape is fully threaded, direct drive being required when the ring is in the intermediate position. The back tension arm is swung

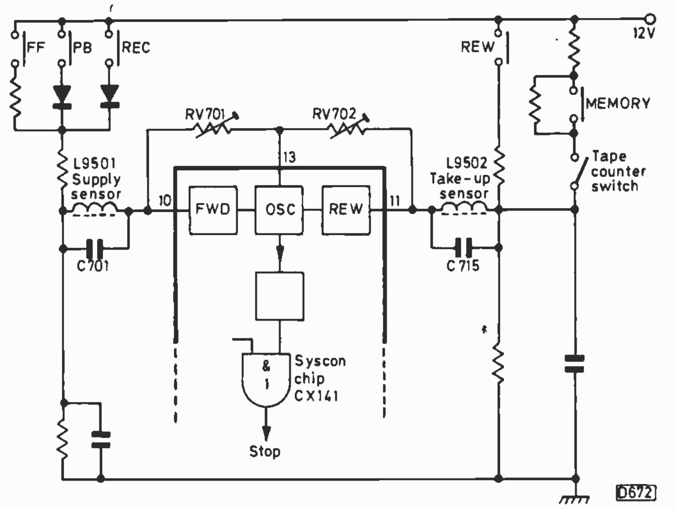


Fig. 9: Sony tape-end sensor circuit.

into position, during modes other than stop, by a further cam on the loading ring.

The new Toshiba V9600 uses a similar mechanism in a front-loading machine. This unusual deck system requires two extra syscon features. When the tape-end sensor is activated during rewind there may not be enough tape left on the take-up reel to provide the full threading loop, so the machine performs a short fast forward operation for tape safety's sake before entering stop. Secondly, to avoid the short wait for the machine to thread up each time the operator goes from stop to record or play (or vice versa) a so-called stop-pause mode is provided. In this condition the machine remains threaded ready for the next operation if required, thus maintaining the convenience of previous Betamax machines.

Automatic Programme Search

One interesting aspect of the syscon in current top of the range Betamax machines is the APS (automatic programme search) facility, which enables the user to find the beginning of each recorded sequence or programme on a tape without having to memorise the corresponding tape counter number. The idea is to "mark" the control track with a special signal that indicates each start point.

The basic format specification calls for control track pulses at 25Hz rate – a digital (on/off) signal with a 1:1 mark-space ratio. In APS machines the mark-space ratio of the control track signal is changed to almost 2:1 during the first nine seconds or so of each new recording. During rewind or forward APS the syscon examines the control track, recognizing the short-lived change in pulse width. Each time it happens, a one is clocked into a counter, and when the counted store equals the user's request the APS ends and play commences. This control track pulse width modification has no effect on the operation of the servos, since these are concerned only with the timing of the leading edges of the control track pulses.

Tape-end Sensors

The method of detecting tape end on Betamax machines is quite different to that employed with other formats. The idea is that a short piece of metallic leader tape is included at each end of the tape: this is magnetically detected by inductive end-sensor coils.

A typical circuit is shown in Fig. 9. The CX141 chip contains an oscillator that operates at 200kHz, the frequency being determined by the *LC* circuit L9502 and C715 – the coil forms the end-sensor. It's a small ferrite-cored coil mounted on the deck close to the take-up reel and held in contact with the tape. The oscillator runs normally during rewind, its output holding off the syscon's auto-stop circuit. When the leader tape appears, the end sensor coil L9502 becomes saturated magnetically as a result of which oscillation stops. The detector within the i.c. senses this and signals stop to the syscon. The same thing happens in the forward modes using the supply reel sensor L9501 which resonates with C701. The threshold of operation is set by RV702 and RV701 respectively. This seems as good a system as any for tape-end detection – there are no bulbs to burn out or contacts to keep clean, and the system is quite unaffected by the bench lamp during servicing!

CTV Battery Operation

George R. Wilding

Whilst mains-battery monochrome portables operate very successfully from a stabilised l.t. rail of around 11V, such a voltage is inadequate for use with a colour portable. Depending on requirements, quite a variety of design approaches are to be found in mains-battery colour portables.

Alternative Approaches

The Sony 9in. Model KV9000UB for example operates with a 22V rail obtained from a series regulator. For 12V battery operation a sort of miniature line timebase is used to produce the 23V required at the collector of the series regulator transistor. This "miniature line timebase" is driven from the collector of the line driver transistor and consists of an inverting amplifier, a driver stage and an output stage which produces a pulse output for rectification. Switching between 12V and 24V operation is automatic.

The National Panasonic 13in. Model TC333G (chassis M6A) operates with a 110V rail obtained from a chopper of the blocking oscillator type. This requires a 275V input which is provided by a simple rectifier when connected to the mains. For operation with a 12V battery, a conventional converter is used to produce the required 275V. It consists of an astable multivibrator which drives a push-pull power amplifier: the output transformer's secondary winding steps up the output which, after full-wave rectification by a bridge circuit, gives 275V d.c.

A rather different approach is used in the 11in. Sanyo Model CTP1101 and the 13in. Hitachi Model CWP130 (NP6C-3 chassis). These both use chopper circuits driven from the line timebase. In the case of the Sanyo set, 120V and 80V h.t. lines are produced from the secondary

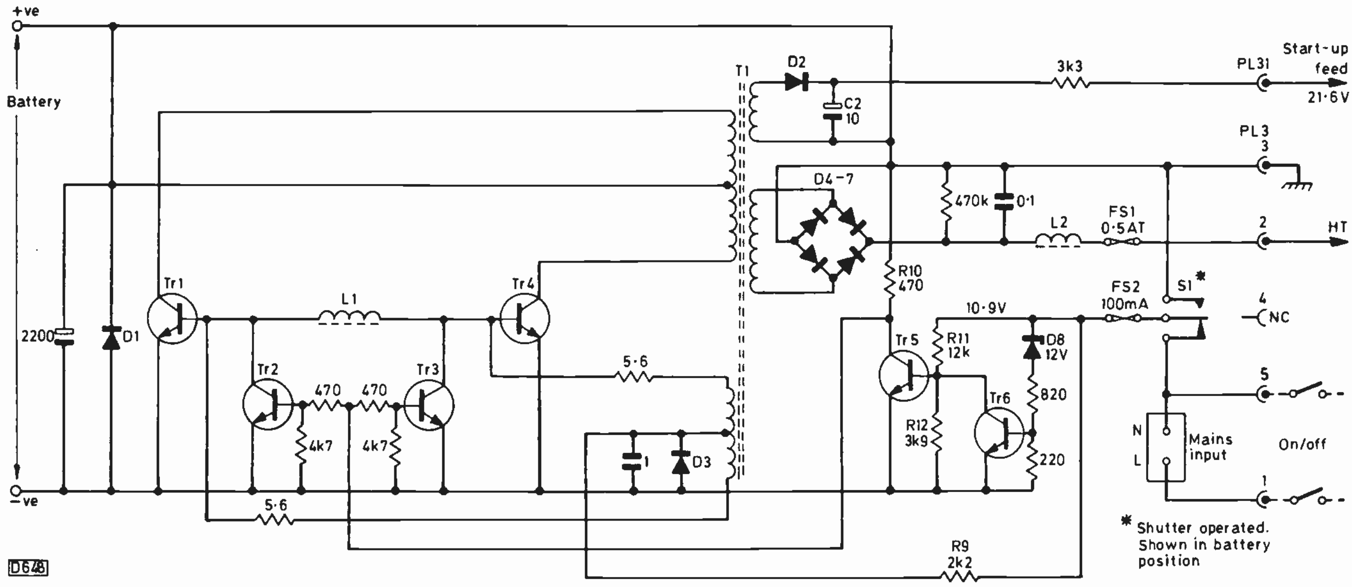


Fig. 1: Circuit diagram of the Thorn TA126 converter for use with later versions of the TX9 chassis, simplified by omitting the links for 12/24V operation. The converter will provide an average five hours' operation from a typical car battery.

winding on the chopper transformer. The main supply line produced across the transformer's secondary winding in the Hitachi set is 108V. In both chassis separate primary windings and chopper transistors are used for mains and 12V battery operation.

Thorn Colour Portables

Until the advent of the TX90, the only UK produced mains-battery colour portable was the 14in. version of the Thorn TX9 chassis. With both these chassis the converter is a separate, optional extra unit. There are two quite different converters for use with the TX9 chassis, due to the two very different power supply arrangements used in earlier and later versions of the chassis. In the earlier version the 115V stabilised h.t. line is produced by a regulating thyristor. Since a thyristor requires an a.c. input, on battery operation the converter (type TA92) has to produce a regulated output which is fed to the main chassis at the output of the thyristor circuit. The converter consists of a blocking oscillator arrangement with extra windings for 24V operation. An internal trip operates when the nominal 12V battery input falls to about 11V or alternatively if the current demand rises above 500mA.

In the later version of the TX9 chassis a self-oscillating chopper power supply is used – a Siemens type circuit controlled by a TDA4600 i.c. So the converter (type TA126), which again works with either a 12V or 24V battery, simply steps up the voltage to provide the 300V or so required by the chopper. It will not drive versions of the set with teletext or full-feature remote control, but can be used with the simple remote control systems U718 and U725, though in the latter case the standby facility will not be available.

The TA126 Converter

The complete circuit, simplified by omitting the links for 12/24V operation, is shown in Fig. 1. Transistors Tr1 and Tr4 form a push-pull oscillator with feedback via transformer T1 to their bases. R9 provides a start-up supply. The natural frequency of oscillation is 5kHz, but the addition of the saturation choke L1 raises this to 15kHz. In operation a 550V peak-to-peak waveform is produced across the winding that feeds bridge rectifier D4-7. As a result an unstabilised output of between 260V and 370V, depending on the input, is delivered via the interference suppressor choke L2 and fuse FS1 to the main chassis. D2 produces a chopper start-up supply of about 65V across C2. The main board chopper system with automatic overload protection is thus in operation with either a mains or battery input. An additional trip in the converter comes into operation if the battery voltage is excessive.

The receiver's normal on/off switch operates in both modes, there being no separate switch on the converter. As with the TA92 converter, the positive side of the battery is connected to chassis via pin 3 of plug 3. Thus one side of the receiver's on/off switch can be used to supply l.t. to fuse FS2. With the set switched off and the battery connected, the two transistors Tr2 and Tr3 will be forward biased via R10, shorting out the base-emitter junctions of Tr1 and Tr4 so that the oscillator is inoperative. With the set switched on, Tr5 is forward biased via FS2, R11 and R12. The bias to Tr2 and Tr3 is thus removed and the oscillator comes into operation.

Tr6 provides the trip action. It's normally non-conductive since there's insufficient voltage for the zener diode D8 to conduct. If the battery voltage exceeds 16V, as could happen under heavy charge or at charge completion, D8 conducts and Tr6 switches on. Tr5 is thus switched off and the oscillator is stopped via Tr2 and Tr3 as when the set is switched off. Note that D8 must be changed to a 27V type when the unit is used with a 24V battery. With a low battery voltage the under-voltage trip in the chopper circuit will come into operation, the receiver cycling on and off.

Fitting the TA126 converter is simplicity itself. The original plug-in mains lead is removed, since the converter is supplied with a separate mains lead with two-pin connector for inserting into the rear shutter socket. PL3 is then plugged into the socket previously used by the original mains lead and PL31 connected. With no internal or external adjustments, the converter provides a neat solution to battery operation. There's an in-line fuse in the battery lead (negative side): this must be rated at 8A with a 12V battery and 4A with a 24V battery.

Dotty Daydreams

Les Lawry-Johns

Before I tell you about Dotty, I must first tell you about the visit we had from a well known contributor to *Television.* During a quiet moment one morning the door opened and in walked this tall, handsome fellow, a sort of cross between Howard Keel and Humphrey Bogart.

"Is this Tiny Tim's shop?" he asked.

"Yes sir" I replied, thinking it was the inspector of taxes.

"Keith Cummins, glad to meet you" he announced.

"Well bugger me sideways" I stammered. "What a nice surprise. Come and meet Keith, Honey Bunch."

So we exchanged pleasantries before getting down to the serious business of running down the editor. After a while we agreed that maybe he wasn't quite such a bad bloke really, and after all someone had to think of the readers sometime or another.

During the conversation an assortment of characters wandered in and out, giving us their views on life and death, talking as though their affairs were of great importance and not realising how important were the people to whom they were addressing their trivialities. One was the author Alex Granger, who had just written a book about himself and signed a copy for us. Another was Johnny Moon who is, er, Johnny Moon.

The morning passed pleasantly enough, and in due course Keith had to go, collect his wife, and wend his way back to Southampton. Cheers Keith! Nice to have met you.

Brown Eyes

My dream girl true has eyes of blue,
but I think I could go for brown.
A picture of love, was this turtle dove,
from her head to her feet right down.

H.B. had been to visit her sister, and on her return reported that the HMV radiogram had at last broken down. It had been agreed that I would pay a visit to repair it. Which is how I came to be ringing her door bell that morning.

Dorothy answered and gave me a welcoming smile. When Dorothy smiles you know you're being smiled at. I've never really got used to those enormous brown eyes, those generous lips and perfect white teeth. She always seems to have a look of surprise on her face, and very nice it is too, except that is when she's addressing her son Fraser. A state of war has existed between them for several years, and there seems little likelihood of a truce at this late stage.

"Come in Les. Try not to tread on Tiny (the small dog) and steer clear of Gillie – she's been playing with the hedgehogs again and is full of fleas." Gillie is another small dog, though not as tiny as Tiny. "Keep away from Fraser too. He's smothered his face with his father's after shave again and stinks of the muck. Can't think why the girls keep phoning up for him. Queer taste some people have. Can't think what they see or smell in him."

"Henry Cooper says it works" growled Fraser.

Sensing that a battle was about to begin, I decided it was time to start on the radiogram. Switching on produced a click and an audio hum, so the trouble was probably in the i.f. stages and with a bit of luck it would have AF117s in it. Easy to deal with – with a bit of luck. I removed the long rear cover.

"What do you think it is Les?" asked Fraser. "A bit of AF117 trouble?"

I looked at him amazed. "What makes you think that?"

"It said it was likely in that daft little book you wrote called questions and answers. You've probably forgotten and I don't blame you. I just looked in the back and saw some transistors that looked like them."

I couldn't agree with him of course. "No Fraser, it's probably the double diode triode's load resistor that's gone high in value."

Fraser looked at me for a long time. He's got a nice line in repartee. "Bullshit" he said.

The battle between Dorothy and Fraser then flared up briefly before Fraser got the message and went off on his bike. Meanwhile I'd crept behind the radiogram and carefully snipped the screen leads of the AF117s. The radio them boomed to life. In case you're wondering about this, the screen connection tends to short internally to the collector.

"I do apologise for Fraser" said Dorothy. "Don't know where he gets it from. Even his dad's a gentleman compared to that horror. He argues with his father about motor bikes. It never seems to stop. I can't bear it much longer. I've asked the doctor for some drop dead pills, but I'll probably end up by taking them myself..."

I packed my bag as quickly as I could. "I'll be off now Dot. Just in case Fraser comes back."

I told Honey Bunch about Fraser when I got back. She cheered me up no end. "Fraser starts work next week. At the builders on the corner." Fraser working, thirty yards away...

Another Disaster

Another Wally. When Walter came in carrying his Thorn 9600 I knew I was in for trouble. Not from the set I hoped. It's his way of rambling on about the old days. At the outbreak of war, before we both joined the Fleet Air Arm (that answers a few questions, doesn't it?). Wally said that the sides of the picture were bowed in, so naturally I thought of the BY298 in the EW modulator circuit. It does lead a hard life. So I turned the set on its side, slapped a BYX71 across it on the print side, and snipped the supect from the top.

I turned the set upright and switched on. There was still slight bowing, but this was easily corrected by the presets on the small correction panel. The upsetting thing was that everything on the left side of the screen appeared in the wrong colours. People on the left-hand side had blue faces and didn't become normal until they moved to the centre of the screen. I questioned Wally about this, but he maintained that everything had been fine until I'd upended the set. I was not inclined to suspect the decoder, but did have fears about the shadowmask. If it had slipped, would it go back or did it need help? I turned the set up on the opposite end and gave it a sharp slap.

"Oh charming" said Wally. "I bring my set in for repair and you bash it to bits."

On the level the picture remained the same. With blue faces on the left. I didn't know what to do. So I muttered something about leaving it to bed itself in for a while.

This gave Wally the opportunity to tell H.B. about the time when we were both operators (projectionists) at the Majestic cinema (now ABC 1, 2 and 3) at the beginning of 1940. I'd been there only a couple of days and hadn't had a chance to get to know where everything was. It was the chief's day off, and as the second was having his tea break I was in charge. It was the organ interlude. Up came the mighty Crompton, with Tom Linn playing it. Wally showed the slides so that people could sing, and I kept Tom in the spotlight. The final slide was shown and it was time for the organ to descend again into the depths from which it has sprung some ten minutes before. Nothing happened and Tom looked around and up at us. People began to laugh as they realised that the organ was there to stay. It was up to me to do something however. After all I was in charge. "Close the tabs Wally" I bawled, "I'll nip down and see what's wrong." Or words to that effect.

So I rushed down the ten thousand stairs, knocking over the ice cream girl (complete with tray) on the way. Down into the stalls, through to back stage, down into the organ room. Still strangely empty. I looked around at all the fuse boxes and my heart sank. Too many. But something had to be done and done quickly. I pressed the buttons near the motor, but nothing happened. No juice to the motor. Then I saw a handle on a clip at the rear of the motor. There was a clip to engage a gear for manual operation.

Quick as a flash I inserted the handle and engaged the gear. I turned as fast as I could but it was a pretty low gear. I turned and turned and the organ came down an inch or so. Couldn't turn any faster and all of a sudden my hand slipped. The handle whizzed round and the organ gathered speed on its descent. Faster and faster it came. What if? The organ was by now out of sight of the audience, and again I had to do something. Stupidly I tried to grab the spinning handle. Incredibly it stopped – it must have been a very low gear. And so I was able to wind Tom down the last few inches, while Wally'd got the news on the screen. By this time I was flaked out across the motor.

The next day the chief informed me that it was only a fuse that had failed, and that I should have checked them first. Willy Stagg was his name.

When Wally had completed the tale the blue faces on the left of the screen didn't look so blue, so with a certain amount of trepidation I told him to take it away as it would find its own level. It did.

Servicing the Philips TX Chassis

John Coombes

The Philips TX monochrome portable chassis has been in production for several years and large numbers have been sold in the Philips and Pye model ranges. There have been several versions, with 12 and 14in. tubes, and with/without remote control. There have also been a number of modifications – most of these are of little significance from the servicing point of view, though it's worth noting that a simplified field generator stage is used in later production.

Power Supply Circuit

As with any set, the power supply is the key to what goes on. The circuit of the TX's power supply, which consists basically of a transformer-fed mains bridge rectifier followed by a series regulator, is shown in Fig. 5. This is conventional though there are one or two points worth noting. First, one of the diodes in the bridge rectifier circuit, D110, also serves as the reverse polarity protection diode on battery operation. Switch SK2 is part of the battery input socket. This can cause problems, as we shall see. Secondly the error detector/amplifier transistor TS112 is operated from the line output stage derived 26V boost rail. This provides protection against excessive voltages in the line output stage, since excessive boost voltage will cut off TS112 and in turn TS111 and TS110.

In the event of line output stage failure, TS112, TS111 and TS110 will again be cut off. The result could be excess voltage on the 10·8V line which will also be unstabilised, i.e. fed via R110 only. This would damage the tube, whose heater is connected across the 10·8V rail. To avoid this situation, diodes D115 and D116 conduct when the line output stage is not working, thus reducing the voltage on the 10·8V line. These diodes were not fitted in early production sets.

The fourth transistor TS113 provides the tuner with a stabilized 11·3V supply. The tuning voltage is stabilized by a TAA550 in the usual way.

Line Timebase

The line generator circuit (Fig. 6) is rather unusual. The first transistor TS380 provides the flywheel sync action: a line-frequency sawtooth is applied to its emitter while the line sync pulses are applied to its base. Following the flywheel sync filter, TS392 sets the voltage conditions in the line hold control network. The oscillator itself consists of TS390 and TS391 which are connected in an emitter-coupled astable multivibrator configuration.

The driver and output stages (Fig. 7) follow normal practice. D450 is the efficiency diode, D451 the boost diode, C451 the boost reservoir capacitor and C450 the flyback tuning capacitor. The output stage provides 9·5kV e.h.t. for the tube, a 350V supply for the tube's first anode, a 95V supply for the video output stage and the tuning system, and the 26V boost line.

No Sound or Raster

If there's no sound or raster, check the voltage at the emitter of TS110. If there's no voltage here, check the fuses – VL100 (on the mains transformer), VL110 and VL111. If VL100 or VL110 is open-circuit, check the bridge rectifier diodes D110/111/113/114 and the protection capacitors C116-9 for shorts and if necessary the mains transformer T110 for shorted turns. If VL111 is open-circuit, the l.t. reservoir capacitor C112 could be leaky. Alternatively there could be a short-circuit in the line or sound output stage. Check the output transistor TS450, then D450, C450 and the scan coupling capacitor C455 in the line output stage. Check the smoothing

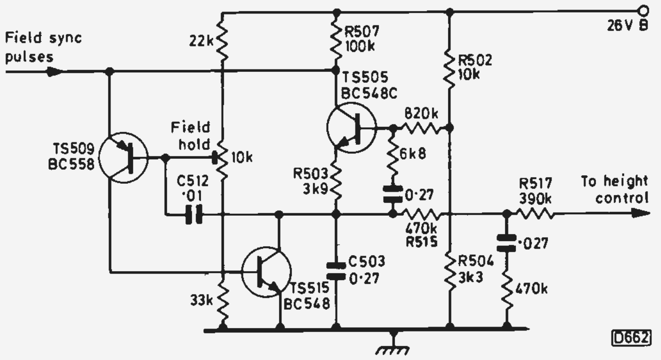


Fig. 1: Early field generator circuit with constant-current transistor TS505.

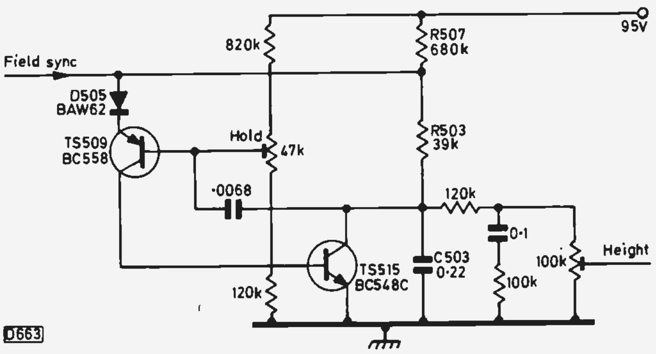


Fig. 2: Later field generator circuit.

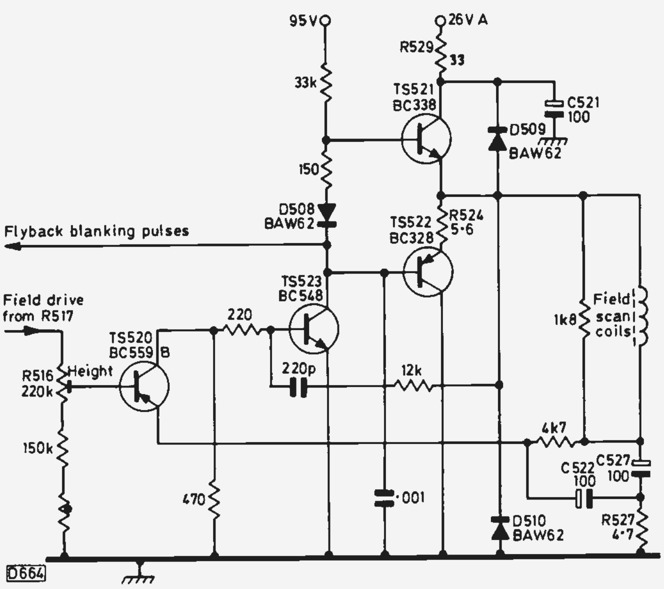


Fig. 3: Field driver and output stage circuit.

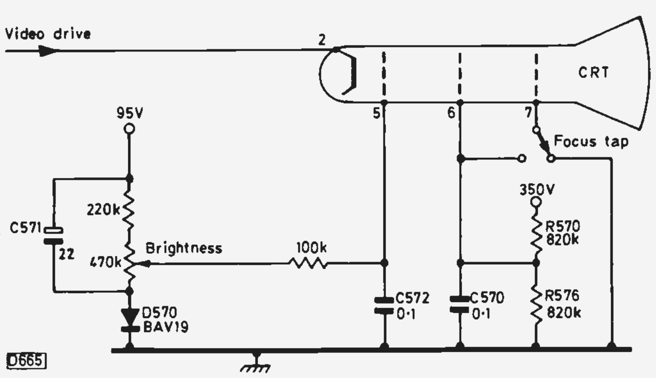


Fig. 4: C.R.T. biasing arrangements. D570/C571 provide switch-off spot suppression.

capacitor C314 (47μF) and the output coupling capacitor C311 (100μF) in the audio output stage.

If the fuses are o.k., check the voltage at the collector of TS110. If this is low at 2-8V, check TS110, TS111 and TS112 as necessary. If the voltage at the collector of TS110 is more than 8V, check the boost voltage – at pin 6 of the line output transformer. If the voltage here is less than 15V, check the line output transistor, check whether C455 is leaky, then check the line output transformer by substitution. If the voltage at pin 6 is in excess of 15V, check whether R451 is open-circuit, thus removing the supply to the line oscillator. In the event of R451 being open-circuit, check for shorts in the field generator circuit. If R451 is o.k., check the voltage at the base of the line driver transistor TS410. The reading should be about −0·1V. If this is present, check TS410 and TS450. If the reading is absent, check whether R401 is open-circuit, thus removing the supply to the line oscillator stage. Finally check TS390, TS391 and TS410 by replacement.

Normal Sound, No Raster

For the sound normal, no raster condition, first check whether the tube's heater is alight. If not, check the continuity of the heater winding. Next remove the aerial plug. If there's insufficient brightness, check the a.g.c. amplifier transistor TS351 (BC548) by replacement. If there's still no brightness, turn the contrast to minimum, the brightness to maximum, and make voltage checks at the c.r.t. base. The cathode voltage (pin 2) should be 67V. If this is incorrect, check the video output transistor TS560 (BF422) and if necessary the field flyback blanking transistor TS565 (BC548C). If the voltage at pin 2 is correct, check the grid voltage (pin 5) which should be about 57V. If this voltage is missing, check whether the grid decoupling capacitor C572 (0·1μF) is short-circuit, then check whether the 95V supply is being developed across C452. If not, check R450 and D453 for being open-circuit. Next check the first anode voltage (pin 6) which should be 160V. If not, check R570 (820kΩ), R452 and D455. Finally check the e.h.t. circuit if necessary – from pin 8 of the line output transformer through the rectifier to the final anode of the c.r.t.

Normal Sound, Weak or No Picture

In the event of normal sound with a weak picture or no picture, check the voltage at the emitter of the video output transistor TS560. This should be 3·3V. If incorrect, check TS560; if correct, check the video driver transistor TS350 (BC558).

Field Collapse

In the event of field collapse, check whether the field output stage feed resistor R529 (33Ω) is open-circuit. If so replace it and check the output transistors TS521/2 (BC338/BC328). Next check the field output stage mid-point voltage – 10·1V at the emitter of TS521. If this is incorrect, check the output transistors, the field driver transistor TS523 (BC548) and the preamplifier transistor TS520 (BC559B). If necessary check the scan coupling capacitor C527 (100μF) and the earth return resistor R527 (4·7Ω), then suspect the field generator circuit. Check the transistors TS505/TS509/TS515 and the values of resistors R515 (470kΩ), R517 (390kΩ) and R516 (height control – 220kΩ).

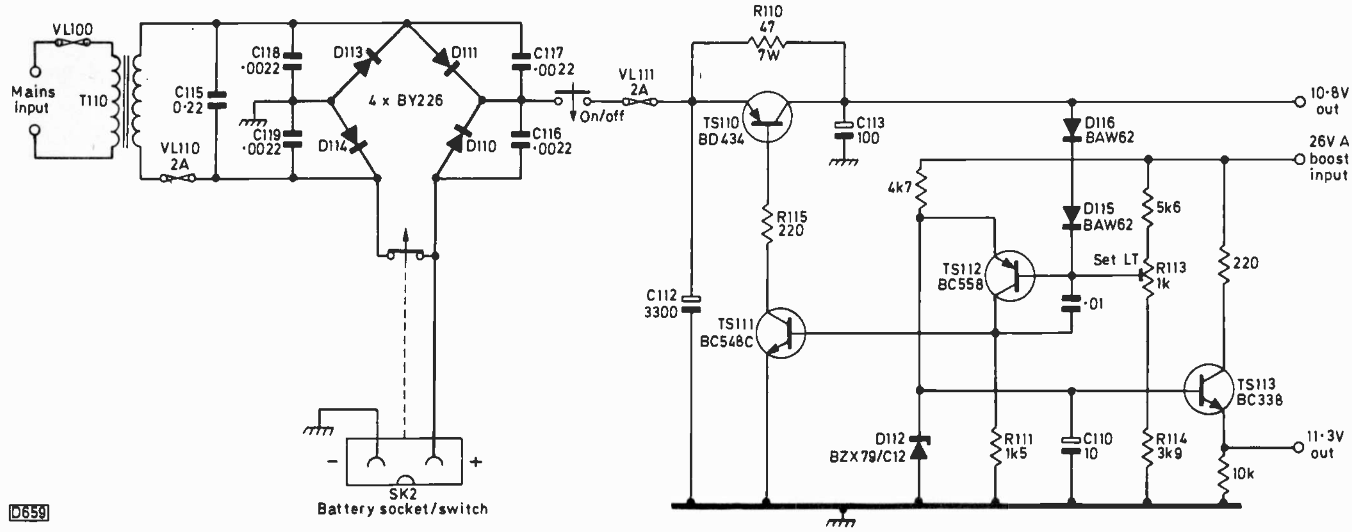


Fig. 5: Power supply circuit. In some sets TS110 is a BD202, with R115 150Ω, R110 22Ω and R111 5·6kΩ.

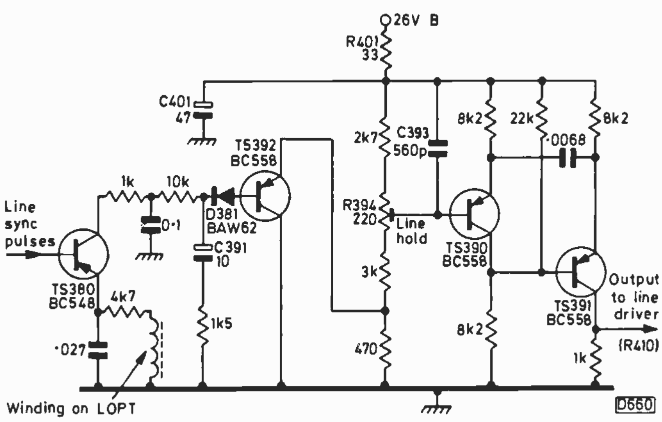


Fig. 6: Line generator circuit.

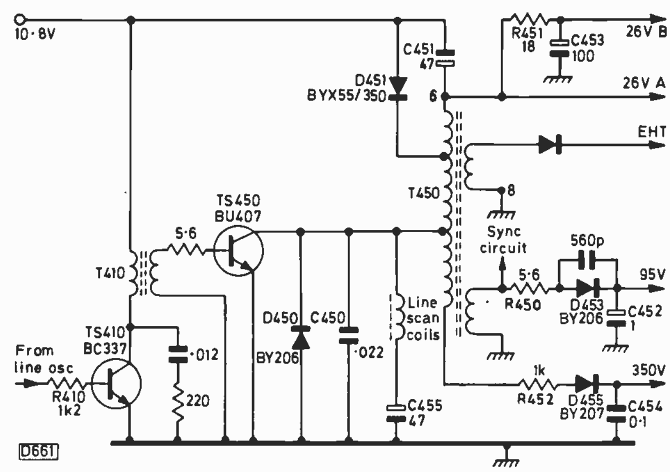


Fig. 7: Line driver and output stages. In 14in. sets C455 is C465, 3·3μF.

The original field generator circuit is shown in Fig. 1. The charging capacitor C503 charges from the 26V rail via R503, R507 and the constant-current transistor TS505. When the ramp at the emitter of TS505 reaches the voltage at its base, set by R502/4, TS505 switches off. The positive-going voltage at its collector then switches TS509 on, and in turn TS515 to discharge C503. The later simplified circuit is shown in Fig. 2. This time C503 charges from the 95V line via R503 and R507. When the voltage at the junction of R503/7 exceeds the voltage at the base of TS509, both transistors switch on as before. In normal operation the positive-going field sync pulses fed to the emitter of TS509 drive this transistor on just ahead of the free-running switch-on-point.

Loss of Line Sync

In the event of loss of line sync, first remove the aerial input and check that the l.t. line is correctly set for 10·8V. If the correct voltage cannot be obtained by adjusting R113, check TS110, TS111, TS112 and make sure that R114 is 3·9kΩ (in some sets it's 4·7kΩ). If the supplies are correct, check the voltage at the positive side of the a.g.c. smoothing capacitor C351 (47μF). With the aerial disconnected the reading should be 4·3V. With the aerial connected a reading of 6-8V should be obtained. If the voltage conditions are incorrect, suspect the a.g.c. amplifier transistor TS351 (BC548).

If necessary, try adjusting the line hold control R394 with the emitter of the flywheel sync transistor TS380 shorted to chassis and the aerial connected. If line lock cannot be obtained, replace the line oscillator transistors TS390 and TS391. If line lock can be obtained but the sync floats on removing the shorting link, suspect TS380 and TS392.

Miscellaneous Faults and Modifications

Sound buzz with unstable picture, possibly intermittent: Suspect the battery socket – the switch can become tarnished. Replacement cures.
Uncontrollable sound: Suspect the d.c. volume control R302 (4·7kΩ) or the TBA120AS intercarrier sound chip (IC310).
Intermittent line collapse, with vertical line: Change C393 to 0·0015μF. Philips advise that the value of C393 in all sets bearing factory code HU on the chassis or serial plate is checked and changed to 0·0015μF if necessary.
Bright vertical line at left-hand side: If a replacement line output transformer does not cure this, change C412 to 0·0068μF and TS410 to a BC637 (note that the base connections differ).
Distortion at low volume: Change R300 to 18kΩ, R311 to 56Ω, R312 to 3·3kΩ and R315 to 120kΩ.
Brightness range: Where the tube is type 12VCUP4, R576 should be 470kΩ. Where the tube is type 12BJP4 it should be 820kΩ.

Vintage TV: The Pilot Model VS9

Chas E. Miller

NOW just a forgotten name recalled only when one browses through old service sheets, Pilot was at one time a leading radio manufacturer. They were perhaps best known for their series of "Little Maestro" receivers, small mains table sets which obviously derived from US "midget" models though they were considerably more refined. The firm also produced some of the first portable sets able to work on a.c./d.c. mains supplies or self-contained batteries. This was the "Twin Miracle" range, introduced just prior to World War 2.

At that time Pilot catered for the upper section of the market with some large table models of frankly American appearance (and very similar to some contemporary Ferguson sets). They featured high-quality push-pull output stages. After the war came some more fine sets, such as Model BS648 which had seven wavebands, an r.f. amplifier and bandspread tuning on the short waves. With this sort of pedigree, it was predictable that Pilot's first TV receiver would be of individual design, using mainly American type valves.

The Pilot VS9 was a 9in. console model for use in the London area only, having a t.r.f. receiver unit. It was for a.c. mains operation only, and was built on three separate chassis, i.e. vision and sound, timebases plus audio output, and h.t. plus e.h.t. power supplies. These chassis were interconnected by means of colour-coded octal plugs and sockets, making dismantling easy.

The TRF Stages

On the r.f. side, there was one common stage followed by three vision only and two sound only stages. These all used 8D3 valves, which were miniature r.f. pentodes similar to the Mullard EF91 and with the miniature all-glass B7G base. The contrast was controlled by varying the screen grid voltage applied to the common vision/sound stage and the first vision only stage, a curious method since contrast adjustment would alter the sound level as well.

The vision strip was aligned to the upper sideband. The significance of this was the fact that the Alexandra Palace transmitter used double-sideband transmission. It continued in operation until March 1956, when Crystal Palace came on air. Crystal Palace used vestigial sideband transmission, in common with the other transmitters, and the vestige was the upper sideband. So the Pilot VS9 and other sets that were similarly tuned had to be realigned for Crystal Palace reception.

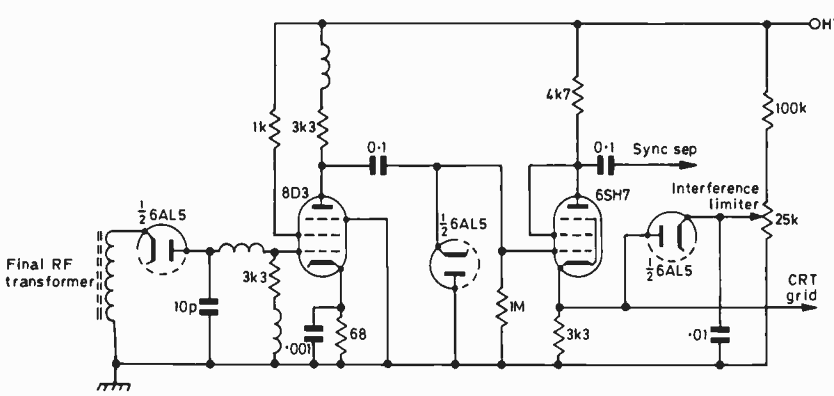
Video Circuit

The video department was quite elaborate (see Fig. 1). For vision demodulation one half of a 6AL5 double diode was used – the other section was not used. Another 8D3 was employed as the video amplifier, and this was followed by a further 6AL5, one section of which provided d.c. restoration while the second section acted as an interference limiter. The following valve acted as a cathode-follower for the video output, which was used to modulate the c.r.t.'s grid. The feed to the sync separator was taken from its anode. The valve chosen for this job was the 6SH7, an r.f. pentode that had been used in vast quantities during the war in American radar equipment. Here however it was strapped as a triode.

This valve and most of the rest had the octal base of blessed memory. Since the last valves featuring this base – line output types such as the PL36 – disappeared from UK TV sets some twenty years ago, few young engineers will have had the pleasure of their company. There were eight strong pins spaced equally around a central spigot which had a key to ensure correct insertion into the holder – even at arm's length in a darkened room! Anyone who has struggled to fit a PFL200 and bent the pins umpteen times would appreciate the octal base no end!

Timebases

A 6J7 was used as the sync separator. This type of valve was usually associated with tasks such as grid-leak detection in cheap t.r.f. midget radios! The line sync pulses were



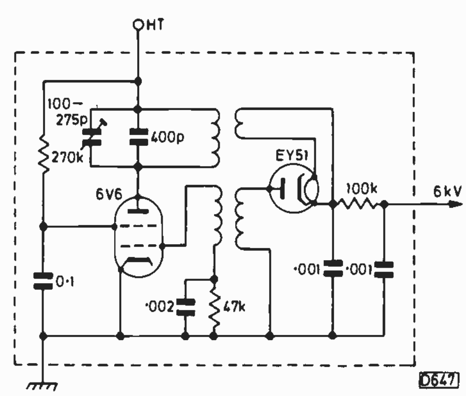


Fig. 1 (left): The video circuitry used in the Pilot Model VS9. The video drive was applied to the c.r.t.'s grid, the brightness control setting the cathode voltage. The interference limiter is a simple peak clipper circuit.
Fig. 2 (right): The e.h.t. generator circuit, consisting of an r.f. oscillator and rectifier. The resonant circuit employed air-cored coils and was tuned for maximum power output. Screening was required to avoid interference.

taken directly from the anode of this valve, but the field sync pulses were passed to an 8D3 that acted as a pulse clipper. The anode of this valve was tied to that of the 6J5 triode field blocking oscillator. For field output a 6V6 was used, in a rather unusual manner. It was not uncommon in the early days for the output valve to be *RC* coupled to high-impedance scan coils, but Pilot went a stage further – with *RC* coupling to a conventional transformer that drove low-impedance scan coils. The declared intention of this arrangement was to prevent d.c. passing through the transformer, but to what end was not stated. Height control was effected by varying the 6V6's cathode voltage by means of a 1kΩ variable resistor.

A similar arrangement was used for width control in the line output stage. Another similarity was the use of a 6J5 line blocking oscillator. How oddly simple these early timebases look to modern eyes! The line output stage had only a plain two-winding transformer, with no boost line or flyback e.h.t. system. Linearity was controlled by means of a series connected *RC* network across the transformer's secondary winding. The output valve was an 807, another veteran of war and peace in its more familiar role as a transmitter power amplifier. It was capable of giving 50W of r.f., whilst a pair could easily provide 120W of audio. It should have had little trouble in scanning a 9in. c.r.t. with a modest 55° deflection angle.

Audio Circuit

A third 6AL5 was used as the audio detector and interference limiter. This was followed by a 6J5, here fulfilling its intended role as an audio amplifier. The audio output valve was an EL33, and it's a minor mystery why Pilot should have chosen a continental type valve for this purpose rather than the to be expected US type such as a 6V6.

Power Supplies

There was a second 6V6 in the set however. It was employed as an r.f. oscillator in the e.h.t. generator section (see Fig. 2). The voltage developed across the transformer's overwinding was rectified by an EY51 to provide approximately 6kV for the tube's final anode.

The h.t. supply came from a power pack of almost unbelievable complexity. Two 5V4G rectifiers were used in a full-wave circuit to provide 410V which was then dropped to around 290V by a smoothing network comprising no fewer than four iron-cored chokes, the c.r.t.'s focus coil, and nine electrolytic capacitors. This was a true a.c.-only design, with a double-wound mains transformer. Thus the chassis was "dead" irrespective of how the mains plug was inserted (we've come a long way, haven't we!). Despite its monstrosity, this power pack needed only a 2A mains fuse, demonstrating its modest appetite for current and inherent resistance to surges.

Later Models

Pilot went on to build further interesting radio and TV sets during the 50s, but by the end of the decade the firm had been taken over by Ultra Electric Ltd. Ultra sets appeared thinly veiled as Pilots for a while, in the all too familiar manner of the early 60s badge engineering explosion, but before long Ultra shed their domestic electronics interests and in the process yet another two marques were added to the ranks of Thorn products. T'was so often thus!

TV Fault Finding

Some symptoms can be caused by several defects rather than a single faulty component – this is particularly so in cases of low gain, poor definition or poor field linearity. A rather rare complaint came our way recently when the owner of an old Hitachi colour set (Model CSP680) phoned to say that the "red colouring was all grainy". Inspection showed that all the colouring was in fact grainy, and that there was still too much noise on the picture when the colour was removed by turning the control to minimum.

The first step was to check the aerial input connections – about the only weakness of these older Hitachi colour sets is a tendency for the outer ring of the coaxial socket to break away from the base, leaving the aerial's braid connection "floating". The plug and socket were both o.k. in this case, but we found that the short aerial input lead came from a splitter. It transpired that the owner was using a single downlead from his TV and f.m. radio loft aerials, with another splitter in the loft. The cable itself was of the 405-line variety, and followed a circuitous route inside the house: the trouble was further compounded by the fact that after heavy rain the roof and nearby trees acted as signal screens.

Running the set directly from the loft aerial instead of via the splitters produced a big improvement, but there was still a bit of grain noticeable in highly coloured areas of the picture. There's an a.g.c. preset (R267) on the signals panel in these Hitachi sets, and on adjusting this virtually all picture noise disappeared. **G.R.W.**

Fidelity CTV14R

The symptoms were very unusual – noise on the screen and hiss from the speaker when tuning between channels, both ceasing at the optimum tuning point though the picture and sound failed to appear. The culprit was the TDA440 i.f. chip. **G.R.W.**

Sanyo 80P Chassis

This colour portable (Model CTP3106) uses a self-oscillating chopper circuit with the chopper transformer T301 providing mains isolation. In the event of no results, first check whether the 110V line is present. If not, check the mains fuse F1001 (2A). If this is open-circuit, check for shorts in the mains filter capacitor C1001 (0·1μF), the chopper supply rectifier D301 (ERC04-10) and its reservoir capacitor C308 (100μF).

If the mains fuse is o.k., check the chopper supply fuse F301 (0·8A). If this is open-circuit, check the chopper transistor Q304 (2SD841 or 2SC3047) and C315 (1,500pF) in the snubber network across the chopper transistor. If necessary check the following items: the error transistor Q301 (2SC536) and the drivers Q302 (2SB774) and Q303 (2SC536) for being open-circuit; diodes D305 (EQA01-08RG zener) and D307 (1S2095A) for being open-circuit (D307 may sometimes be found short-circuit instead); the chopper coupling capacitor C314 (47μF) for being short- or open-circuit; and the 110V rectifier D320 (UF3N) for being short-circuit. If necessary check the chopper transformer T301 which could have short-circuit turns.

If the chopper supply fuse F301 is o.k., check the voltage across the chopper supply reservoir capacitor C308. If absent, check whether any of the following items is open-circuit: filter choke L1001, the on/off switch SW1001, the surge limiter resistor R301 (6·8Ω) and filter choke L302.

If there is 300V across C308, check the waveform at the collector of the chopper transistor Q304. If this is present and correct (520V peak-to-peak), check whether Q303 or D306 (ERB28-04) is short-circuit or D320 open-circuit (no 110V line). Then check C460 (33μF h.t. decoupler) and C461 (1·5μF scan coil coupling) in the line output stage for being short-circuit. Alternatively the chopper transformer T301 could be open-circuit.

If there's no waveform at the collector of Q304, check the voltage between its collector and emitter. If there is no voltage, check R318 (0·33Ω) and R313 (2·7Ω) in its emitter circuit. Either could be open-circuit, as could T301. If the voltage is 300V or more, Q304 or its base bias resistor R302 (390kΩ) could be open-circuit, as could either R314 (27Ω) or C313 (0·1μF), hence no chopper drive. If not, suspect the chopper transformer T301 for open or shorted turns. **J.C.**

Rank T26A Chassis

Loss of sound and raster, maybe intermittently, should lead to a check on the BU208A line output transistor and if necessary diode 5D12 (BY228) which can go open- or short-circuit. **J.C.**

Decca 70 Series Chassis

Set tripping with no fuses blown presents something of a problem. The usual cause is that C633 (680pF) is short-circuit. This capacitor is part of a snubber network across one of the chopper transformer's secondary windings. **J.C.**

Grundig CUC95 Chassis

Failure of the chopper transistor TR634 (BU208A) at switch on was traced to R646 (270kΩ) in the start-up circuit going high in value. **T.L.B.**

Fidelity CTV14R

The problem of striations over the screen was traced to the 180V video h.t. line reservoir capacitor C903 (4·7μF) being open-circuit. **T.L.B.**

ITT CVC40 Chassis

This solid-state receiver gave the symptoms of a set with lazy timebase valves! Both the width and height were initially insufficient, resulting in approximately twenty per cent underscan. Over a period of some ten minutes the picture gradually expanded to fill the screen. Checks made during this time revealed that the regulated 127V rail was low to start with, at about 108V, slowly rising to the correct level some minutes later.

The effect was found to be insensitive to temperature variations, and the cause was eventually traced to the

Reports from George R. Wilding, John Coombes, T. L. Bingham, Peter H. Dolman and Mick Dutton

chopper output smoothing capacitor C11 (22μF, 375V). At switch on its capacitance was low, resulting in a line frequency ripple variation on the 127V rail. Only the most positive excursions were being sensed by the control circuit, so the average rail potential remained low. After some minutes the capacitor reformed, as a result of which the 127V rail's level and ripple content became normal. **P.H.D.**

Mitsubishi Colour Portable

A Mitsubishi colour portable had given excellent service for about seven years, until the owner had stored it for a while. When he came to use it again there was no raster. When we switched on there was a healthy e.h.t. rustle and we could see that the tube heaters were alight. The sound was normal, so we started to make checks on the tube base voltages. The first anode voltages were low.

When we tried to advance the settings of the red and blue controls the voltages dropped. With these controls off, there was a faint green picture. The tube base is of the enclosed type, similar to that used in the Rank Z718 chassis, and had developed leakage between the metal earth ring and both the red and blue first anode pins. The leakage could be measured on an Avo, with the tube base removed. Stripping the base down and cleaning it resolved the problem. **M.D.**

Hitachi NP6C Chassis

The problem with an Hitachi CWP132 colour portable (NP6C chassis) was that the power supply would intermittently fail to start – the switch-mode transformer in the power supply would also make some most peculiar screeching noises. We removed the main panel from the set and checked around the power supply for poor joints. There were some very bad connections to module CP901, which provides the reference voltage and h.t. sensing, and when these were resoldered the problems were completely cured. **M.D.**

VCR Servicing

Part 20 — ***Mike Phelan***

This month we'll look at the signals section of the 3V23. This consists of the pre-rec board, the YC board and the audio board. With the exception of the latter, the circuitry is much simpler than that used in the machines we've described previously, due mainly to the elimination of many discrete components through the use of larger scale integration. The audio board is quite complicated, because we now have Dolby noise reduction and frequency shift on double-speed playback, but more on this later.

The pre-rec board (see Fig. 89) is very straightforward and simpler than in previous models in the JVC/Ferguson range. Improvements on the YC board and the inclusion of f.m. a.g.c. have enabled the playback f.m. level and balance controls to be eliminated. The drop-out compensation circuit is now on this board. The circuit doesn't warrant much description, as it's simpler than the one already discussed. Transistors X6 and X7 are incorporated to mute the input while the machine is in the "record start" mode, i.e. ten seconds before the start of a timed recording, to allow the tape to lace up. When the exact record time arrives the record start 12V line from the mechacon panel goes to zero – by this time the servos are locked, so the recording starts without a lot of noise on the picture.

Luminance Record Path

The YC board is mounted above the tape deck on a hinge, so that it's screened by the metal cabinet. There are six main i.c.s and several smaller devices. We'll look at the luminance record path first (see Fig. 90). The input is

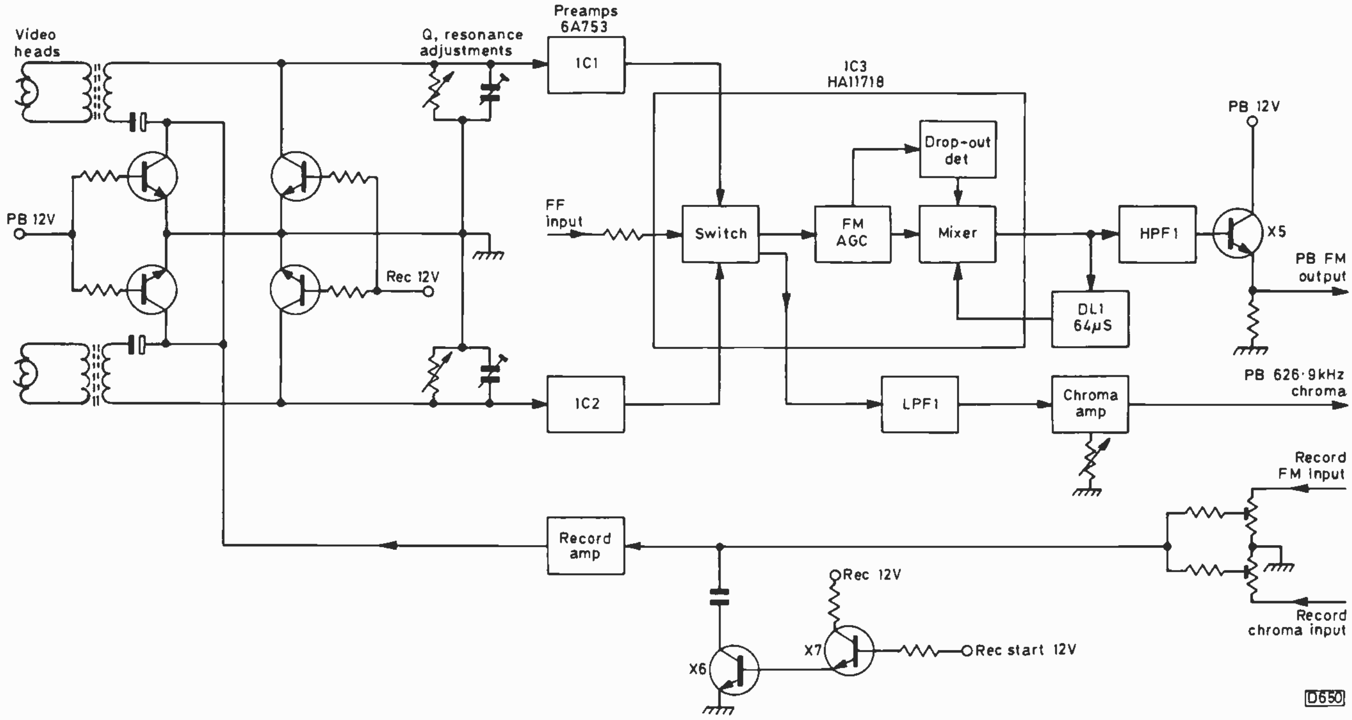


Fig. 89: Block diagram of the pre-rec board.

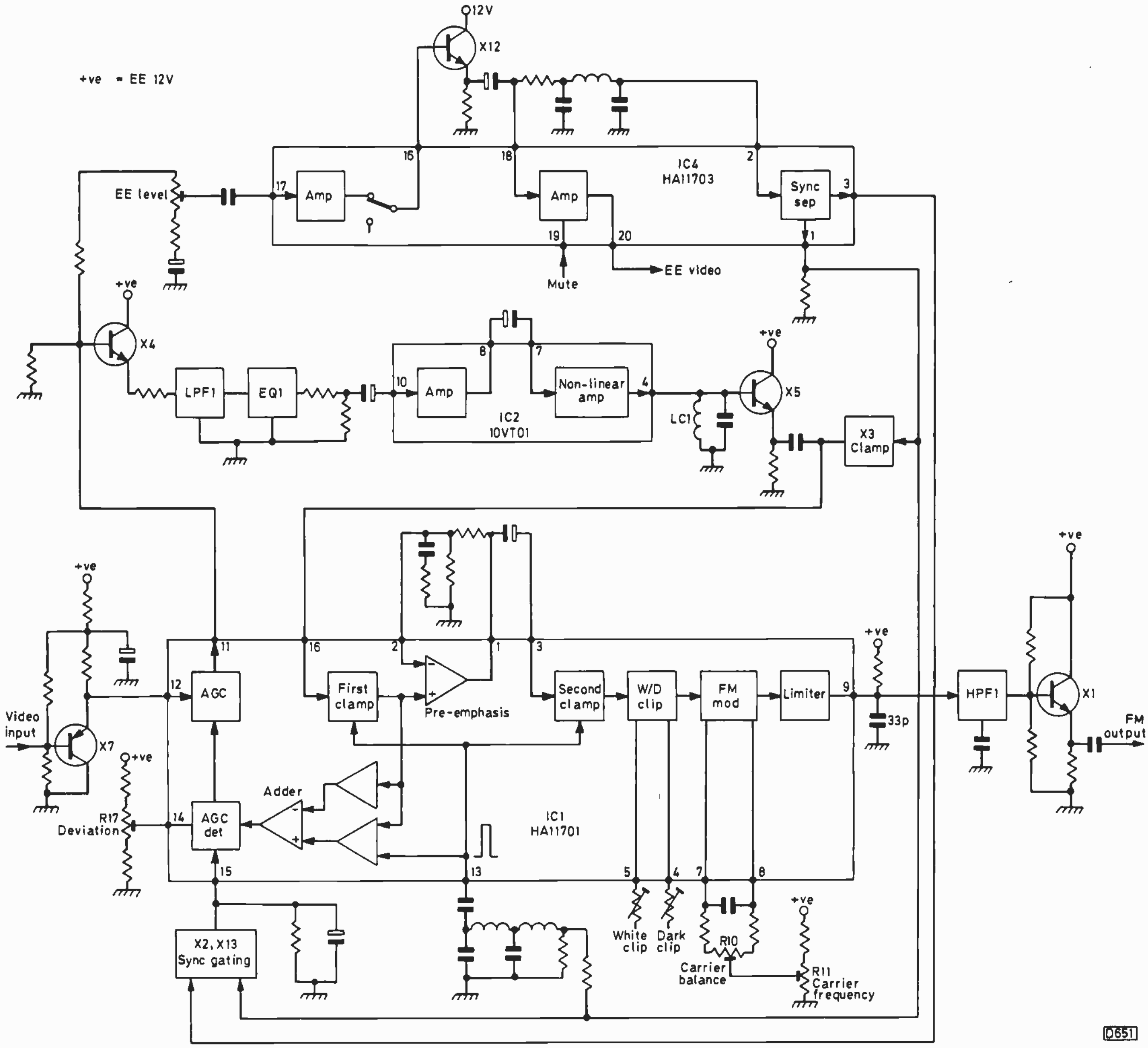


Fig. 90: The luminance signal path (YC board) on record.

applied to the base of X7 and then passes to the gain-controlled amplifier in IC1. This stage sets the signal at a level controlled by the deviation preset R17, which determines the highest frequency obtained from the f.m. modulator on peak whites. A delayed sync pulse, coincident with the signal's back porch, enters the i.c. at pin 13: this, together with the video signal, goes to an adder – we'll return to this bit later. The a.g.c. time-constant components hang on pin 15. X2 and X13 provide sync gating for the a.g.c.

The luminance output at pin 11 is split two ways. The E-E signal goes to pin 17 of IC4 for amplification, then via the emitter-follower X12 to the mute circuit between pins 18 and 20. The mute action is operated by a voltage from the junction board when the test signal is selected. IC4 also contains a sync separator which provides clamping/gating pulses.

The record signal proper passes via X4 to low-pass filter 1 (LPF1), which provides a roll-off at 3·5MHz to remove the chroma. Equaliser EQ1 compensates for the loss of h.f. caused by this. The following non-linear amplifier in IC2, together with the tuned circuit LC1 and X5, act as a compressor so that low-amplitude signals are boosted. We'll see why this is necessary shortly. X3 clamps the signal at the sync level, the following first clamp in ICI clamping the back porch (black level). Thus the black level of the signal at this point is fixed, though the sync pulse amplitude is variable.

We can now see how the a.g.c. detector works, and why the clamp pulses to it are delayed. The video signal goes to both inputs of the adder (it's a subtractor actually), but one signal has a pulse on its back porch. The video signal cancells out, leaving a pulse whose amplitude is determined by the difference between the sync and black levels.

Pre-emphasis comes next: because of the compression previously applied, the net effect is of greater pre-emphasis with low-level signals. This improves the signal-to-noise ratio. The signal is then clamped again before passing through dark and white clip circuits which remove the pre-emphasis spikes. Next comes the f.m. modulator, which in this machine is integrated: though an i.c. is now used, the circuit configuration is similar to that in the 3V00. Pins 7 and 8 are connected to the emitters of the two oscillator transistors, so that R11 sets the frequency

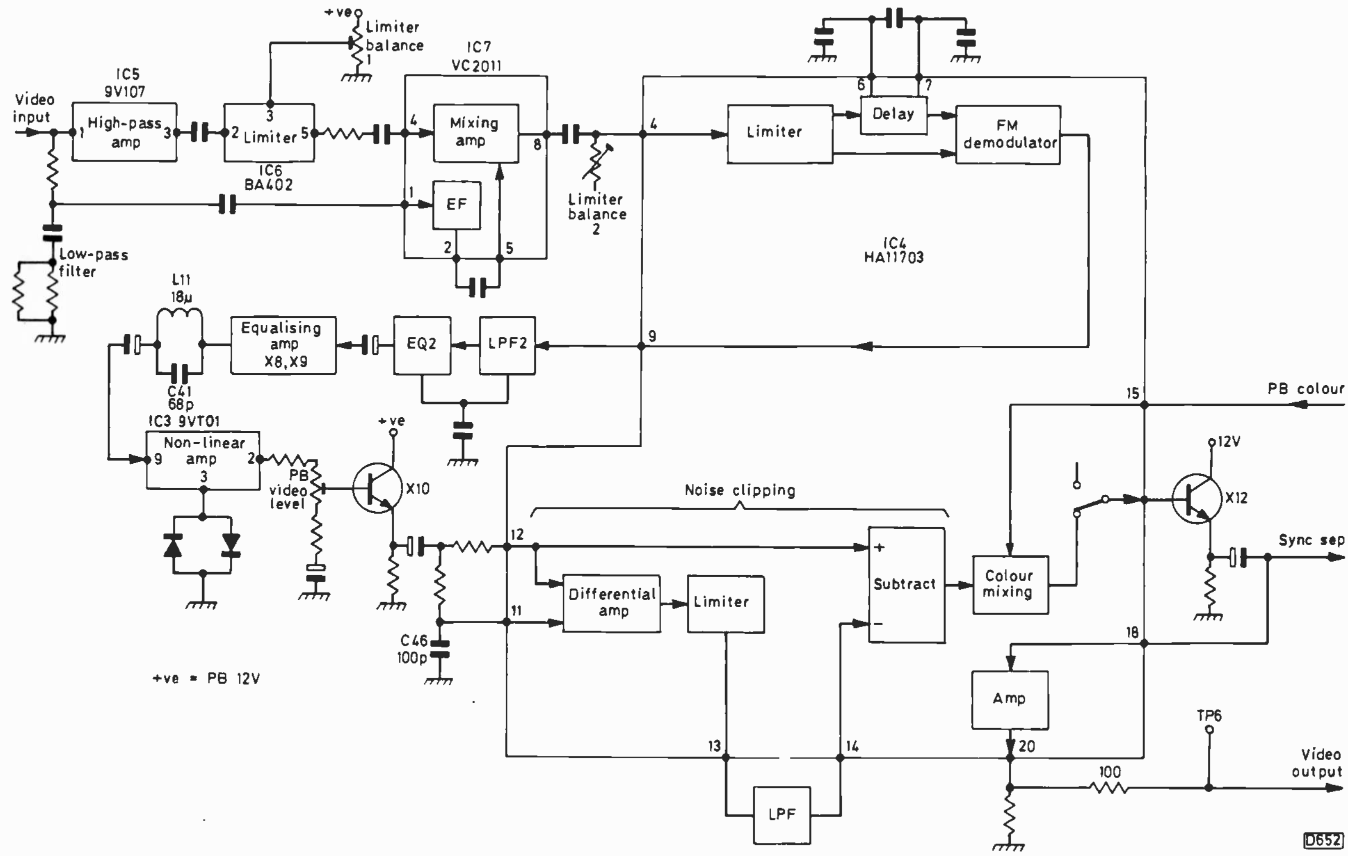


Fig. 91: The luminance signal path (YC board) on playback.

and R10 the mark-space ratio (for 50:50). The limited f.m. signal emerges at pin 9 and then passes via HPF1, which provides a roll-off below about 1MHz, and X1 to the pre-rec board, where it's mixed with the 626·9kHz chroma.

Luminance Playback Path

On playback (see Fig. 91) the f.m. from X5 on the pre-rec board goes first to pin 1 of the high-pass amplifier IC5. The lower frequencies are separated and go to pin 1 of IC7 while the higher frequencies are limited by IC6 and then go to pin 4 of IC7, which mixes the limited h.f. and unlimited l.f. components of the signal. The resulting output passes to another limiter in IC4. This double limiting idea was used in the 3V00, the purpose being to prevent loss of the l.f. components. The f.m. demodulator in IC4 works on the pulse width, but unlike the one in the 3V00 uses a pi-network of capacitors connected to pins 6 and 7 instead of a delay line.

LPF2 and EQ2 remove remnants of the f.m. carrier while the equalizing amplifier X8/9 artificially enhances the signal's h.f. response. The non-linear amplifier in IC3 compensates for the signal compression on record by giving a corresponding expansion. C41/L11 provide the main de-emphasis, but a small amount of this occurs in the equalising stages X8/9.

After X10 the signal is split into two paths which go to the two inputs of the differential amplifer in IC4. C46 removes the h.f. component of the signal applied to pin 11. Thus the output from the differential amplifier contains only the h.f. signal component, including noise. The noise is of generally greater amplitude than the signal and is removed by the limiter. The network between pins 13 and 14 removes all but the highest frequencies: these, mainly noise, are then subtracted from the original input at pin 12.

Finally the colour is added, entering via pin 15, and after further amplification the composite video signal is ready to go to the junction board on its way to the r.f. modulator.

Chroma Circuits

The chroma signal circuit (see Figs. 92 and 93) does not require detailed description since it works in precisely the same way as that in the 3V00 (see Parts 5 and 6). Most of

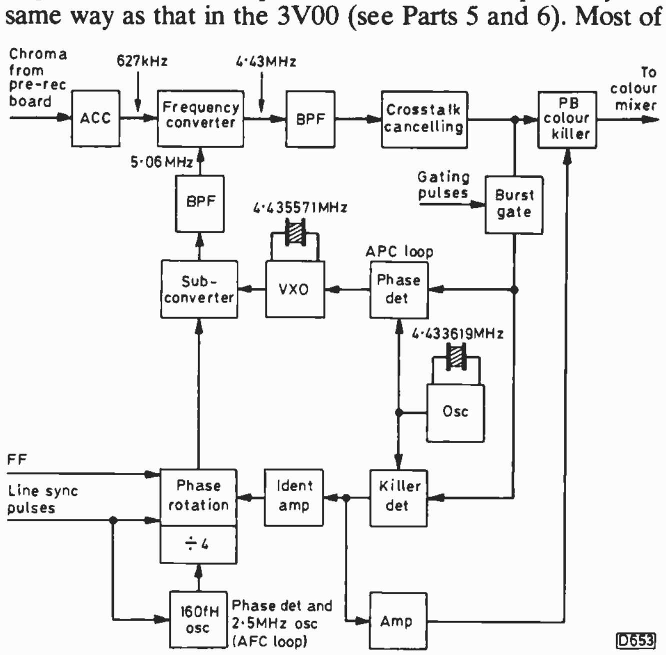


Fig. 92: Block diagram of the playback colour system.

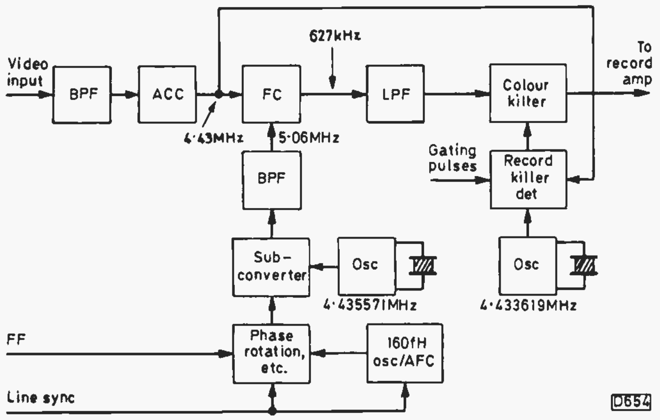


Fig. 93: Block diagram of the record colour system.

the important bits are in four i.c.s, IC201 (HA11710), IC202 (HA11717), IC203 and IC206 (both HA11706).

The Audio Panel

The audio circuit contains several interesting features. First, there's provision for Dolby noise reduction. This can be switched off at the front panel. There is also a system to record a cue signal on the tape for one second at the beginning of every new recording. Finally there's a feature which is probably unique – on double-speed playback the sound is halved in frequency to make it more intelligible.

The basic audio circuit centres around an HA12005 i.c. which carries out the same functions as the AN262 in the 3V00. There is auto level control and muting (for still, slow and fast search).

The double-speed frequency shifting circuit brings us to a bucket-brigade device or BBD (see Fig. 94). The MN3010 contains two 512-stage BBDs. These can be considered as a sort of shift register or delay line which can handle an analogue (e.g. audio) signal. Two clock signals, in opposite phase to each other, are required. Each clock pulse transfers the signal along from one stage to the next, so that it arrives at the output 513 clock pulses later. A glance at Fig. 94 shows how this happens.

When inverted Q is low, non-inverted Q is high. Thus T1, T3 etc. conduct. C1 is charged by the signal. When the clock pulses change polarity, T2 etc. conduct. The charge on C1 is thus transferred to C2 and so on. The signal is in this way stepped through all 512 stages, giving us a sort of delay line. We can do one thing with it we cannot do with a delay line however – we can alter the delay time by changing the clock frequency.

Say we run the clock for 512 cycles with a signal input, thus filling up the BBD. If we then halve the clock frequency for the next 512 cycles, the signal will emerge at half frequency, i.e. shifted down one octave, which is exactly what we want for double-speed playback. While this is happening however the signal is being clocked in at half speed, which is of no use to us. So we need two BBDs to run alternately (see Fig. 95). The MN3010 contains the required BBDs. For 512 clock cycles S1, S4 and S6 are closed so that the signal enters BBD1 at normal speed (clock Q1) but is read out of BBD2 at half speed (clock Q2). As S5 is open, the signal coming out of BBD1 at normal speed is not used. After 512 cycles the Q11 output changes state, S2, S3 and S5 close, and the signal comes out of BBD1 at half speed. And so on.

The two balance potentiometers are adjusted to null out any residual clock frequency signal and the low-pass filter

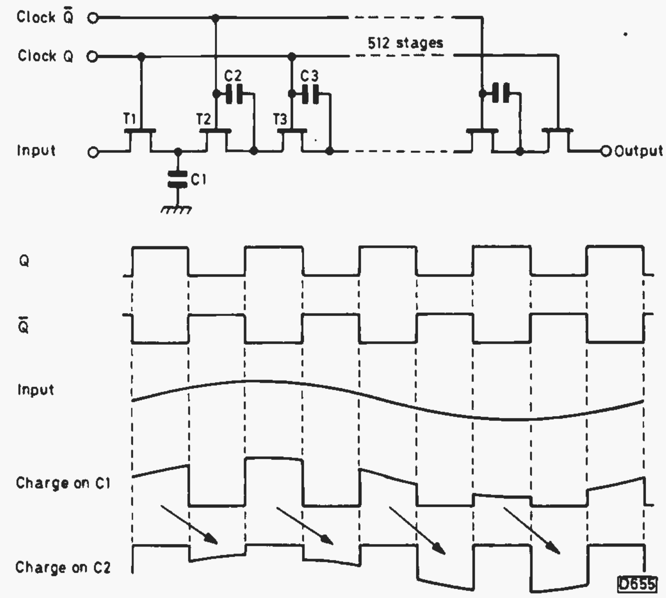


Fig. 94: Operation of the BBD sound frequency halving system for double-speed playback operation. The output is the same as the input, though delayed, after filtering to remove the switching waveform component.

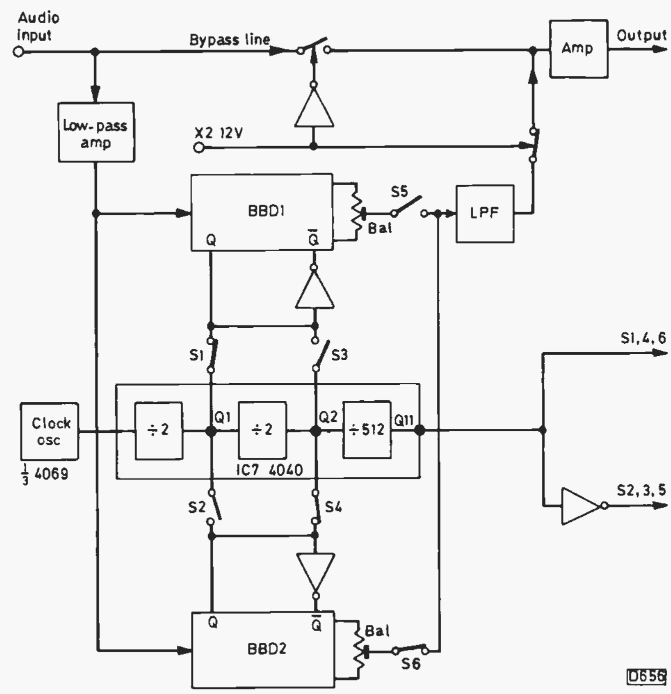


Fig. 95: Block diagram of the BBD frequency halving system.

converts the squarewave back into an analogue signal. During normal playback the bypass path is closed. All the switches are 4066 quad bilateral switch i.c.s.

Finally the cue facility (see Fig. 96). For one second at the start of each recording the cue set line from the mechacon panel goes low, starting the oscillator by turning on X20 and also energising the relay so that the 30Hz output is fed to the full erase head and recorded on the tape. After one second the cue set line goes high, X20 turns off and the erase head is reconnected to the bias oscillator. This happens on every recording regardless of the setting of the cue switch.

On playback the 30Hz signal has no effect, but on rewind or fast forward the cue head is still in contact with the tape although the latter is not laced up. Due to the tape speed, the cue signal is replayed at something like 400Hz. X48 and the first half of IC40 amplify it, while

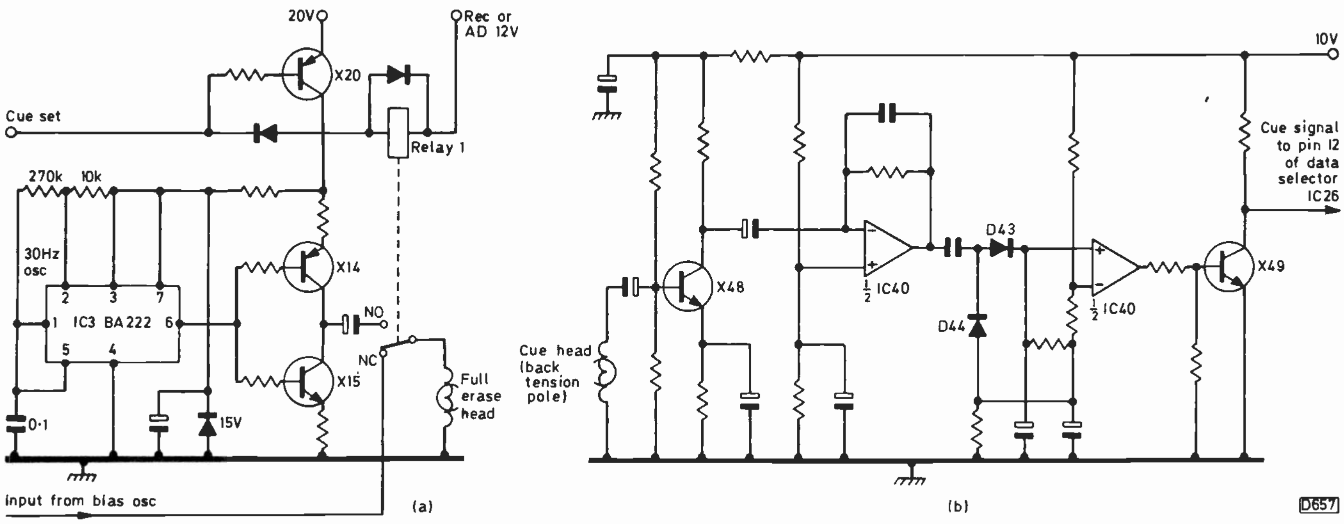


Fig. 96: The cue system. (a) Circuit for recording the cue signal. (b) Cue playback circuit. The record circuit is on the audio board, the playback circuit on the mechacon panel.

D43 and D44 form a diode pump which takes the non-inverting input of the second operational amplifier high after a few cycles. The base of X49 thus goes high, while its collector voltage falls from 10V to zero, i.e. logic zero. This is conveyed to the microcomputer via one of the four data selectors in IC26.

That's all for now. Next time we'll look at the tuner/timer board (another two microcomputer i.c.s!).

A Matter of Safety

Tony Thompson

It's hoped that as responsible engineers most of you give every consideration to the safety of TV viewers by checking, as a matter of course, the sets you are servicing. Likewise when replacing components you probably fit correctly rated and type fuses, capacitors, resistors and so on, and follow makers' instructions regarding safety components. And so you should. But on the personal level there's an unfortunate tendency to plough on regardless of what could happen, even though it's inevitable that our work, involving as it does journeys to customers' homes where we deal on a daily basis with an invisible, instant and potentially lethal source of power, places us all at some risk some of the time. It's a classic case of familiarity breeding contempt!

In this article I've endeavoured to identify the main danger areas and make suggestions on how to minimize accidents or rather the likelihood of them happening. It's possible that you may be unable to recall when you last felt the effects of a sharp stab of electricity. If so you might be forgiven for thinking that these comments don't apply to you. But think of this. Accidents are not all electrical, while there's always a first time for a severe shock. You never know when, you're never expecting it, and the first shock could be the last.

Test Equipment

We all have pet ideas on safe practice. Some time ago I was taken to task by a reader for stating that test equipment should not be earthed. Now this was a simplification and requires qualification. It's my opinion that any piece of workshop test equipment that might conceivably be used at any time for field servicing should have its earthing disconnected. This is all the more important with metal-cased items such as mains-powered soldering irons, signal generators, oscilloscopes and such like. The fact that scopes are likely to have earthed-screen probes makes them especially hazardous in use.

The workshop itself should of course be equipped with an adequately rated isolation transformer for each bench, though I'm sure that many of us will be aware of workshops that are not so equipped. It goes without saying that both the sets being serviced and the equipment used to service them should be powered from an isolated mains supply. It's an unfortunate fact however that few isolating transformers could be considered even remotely suitable for the hard-pressed field service engineer to lug around on his calls. Every outside call exposes the service engineer to the danger of raw mains.

Most TV sets have a live chassis, i.e. the metalwork, screening cans and structural members are used as a convenient return to one side of the mains, intended to be the neutral side, isolated by the receiver's on-off switch. Unfortunately the connections to the mains plug or socket can be incorrectly polarised, as a result of which the metalwork becomes truly live. It should also be remembered that the neutral lead could be open-circuit, due to a faulty switch for example. The chassis will again be at full mains potential. For reasons of impedance, the danger of a fatal shock from this latter state of affairs is slight, though some receivers have a very low input impedance, so low that a possibly dangerous current could under certain circumstances flow.

More directly dangerous under such fault conditions is the use of earthed servicing equipment. One hand on the earthed casing, another on the exposed, live metalwork, and you've got the right conditions for experiencing something rather nasty.

Most sets produced in recent years incorporate a bridge rectifier in the mains input circuit, as a result of which the chassis is always at half mains potential. Care is needed but shocks due to this are likely to be slight unless earthed test equipment is used. With such chassis however another hazard is with us. Get your earthed iron or scope lead in contact with the metalwork and you'll blow a fuse. Accidentally touch other more sensitive areas and away will go that expensive output transistor or hard to replace thyristor etc. The use of an unearthed soldering iron on half-mains potential chassis is not to be recommended either, due to the possibility of leakage within the insulation system of the iron presenting the chassis with an opposed polarity, again blowing fuses or offering a shock hazard. The answer here is to use a low-voltage, transformer-fed tool: one of the quick-heat variety gun-style irons might be your preference, or a "soldering station" type with its transformer within an insulated casing that doubles as an iron rest. It's a good idea that iron rest: we've all burnt customers' carpets, and ourselves, by balancing the hot iron on the edge of the toolbox!

Basic Precautions

In case you're not aware of the fact, it can take only a few milliamperes across the heart muscles to make you feel very sick, sometimes for several days. If you're really unlucky, such an apparently innocuous current when delivered at high potential can be terminal, especially if informed help is not at hand to provide resuscitation.

It's essential to take precautions against all elements of chance or luck. First, periodic checks should be made on test equipment. Inspect the condition of mains leads and the tightness and correct wiring of plugs and connectors. This task should be carried out as routine, preferably by a senior engineer specifically charged with this duty and allowed time to carry it out effectively. This is likely to be wishful thinking for many of us of course: so it's up to you, the front line man, to protect yourself and carry out such checks.

A point here about the correct wiring of plugs. No, not polarity: surely that's obvious? What's not so obvious, at least it wasn't to me until recently, is the following tip which I pass on as good advice. When wiring the plug, arrange things so that the live connecting wire is the shortest within the plug body. That way if the wire gets wrenched free of the clamp the connection to break first will be the live one. The other connection(s) should have a little slack left. Simple, isn't it?

You should go about your day-to-day business wearing a wet suit and thick rubber gloves. Though probably effective, that wouldn't be very practical however. So what can we do to provide ourselves with a measure of protection without inconveniencing ourselves unduly? First, the outside engineer should wear insulating footwear, with plastic or rubber soles. As most shoes are made like this nowadays, this shouldn't be much of a problem. Leather soles are not too good for insulation, especially when wet.

Secondly, put only one hand at a time inside a set – unless it's essential to use two, say when adjusting the convergence. This way you'll minimise the risk of forming a circuit with your arms as conductors. Your free hand should be well away from the chassis metalwork, or any other metalwork for that matter. If you must, keep your free hand behind your back or in your pocket.

It's not a good idea to wear loose neck or wrist chains that can dangle down into an open chassis just when you've got your mind on some difficult bit of fault diagnosis. If you do, you may find the missing voltage without recourse to your meter!

Whenever possible stand on a carpet, never a stone floor. If you are in doubt, a wad of old newspapers makes a good insulator.

I've been emphasizing electrical dangers, but in practice deaths from or as a direct result of electrical shocks form a very low proportion of the range of injuries suffered in our trade. One death is too many of course, so we must be on our guard at all times. There are other dangers however. Here are a few points to help guard against these.

The Tube

First, the e.h.t. cavity should always be discharged before changing a tube. You knew that one of course. When a set is having its tube changed, it should be completely disconnected from the mains supply. Ignore these two elementary precautions, put your thumb in the e.h.t. cavity or catch your knuckles on the set's mains switch whilst carrying the tube, and the results could be most instructive. Follow recommended safety procedures when tube changing. These involve protecting the eyes against possible implosion (rare these days thank goodness), holding tubes correctly (i.e. not by the neck), plus safe storage and packing of new and used tubes that have been manufactured or rebuilt to proper standards. Many regunning firms nowadays have their products BSI certified.

Physical Injuries

Physically, the sheer weight and awkwardness of TV sets can be a problem, as letters in this magazine have pointed out in the past. Backache, slipped discs, lumbar trouble, and damage – sometimes permanent – to the arm and neck muscles, wrists and fingers, are very real hazards. It must be emphasized, especially to the young and eager, that such injuries can permanently affect one's livelihood and career prospects. It's only too obvious that to eliminate the possibility of all such injuries completely is impractical, but with thought one can limit their occurrence and minimise their extent.

Whenever possible avoid single-handed carrying of large, awkward to handle sets – say the older 26in. or consolette types of sets. Always carry sets with the tube face towards you to keep the weight close to your own centre of gravity. This places much less strain on your arms and back. It's sometimes easier to carry a set "on end": this can lead to problems with displaced shadowmasks however, so it's best to keep the set horizontal whenever you can. When picking up a set from the floor, keep you knees together and bend from the knee and not the back. This way you can avoid getting a slipped disc or being ruptured.

Radiation

Due to the e.h.t. colour sets produce X-ray radiation. For this reason screening cans around the line output stage should always be replaced, even though it's a fact that modern sets are less efficient X-ray generators than earlier types that used thermionic valves in the e.h.t. circuit. The c.r.t. itself radiates X-rays, the thick glass minimizing but not eliminating the problem. Manufacturers claim that the dose rate is so low that it's acceptable. The problem is that a fault resulting in excessive e.h.t. will produce a correspondingly higher radiation level, something that's clearly undesirable for engineer and viewer alike.

If you are in doubt as to symptoms, a good generalisation might be that a correctly sized and linear (especially linear horizontally) picture is probably an indication that the e.h.t. is at a satisfactory level. Conversely a small or horizontally narrow picture that doesn't "bloom" when the brightness level is altered, and seems pin sharp and "hard" in detail, possibly accompanied by spitting or arcing from the cavity connector or from points around the line output transformer and the c.r.t. spark gaps, tells a very different story. Experience tells here – so does an e.h.t. meter!

In Conclusion

There are acts of Parliament (Health and Safety at Work, Factories Act, Consumer Safety, etc.) that deal with some of the points I've raised, especially with working conditions. Anyone with grounds for suspecting that his or her situation is such that an unacceptable degree of discomfort or danger is present is urged to read up on these – local libraries can help.

By their very nature accidents are avoidable. Yet we all suffer them at one time or another. If you think ahead, consider the problems carefully, avoid being unduly rushed, and work defensively in the ways outlined here, you should survive any minor problems. These may then become a matter to joke about rather than a painfully permanent reminder of one's carelessness.

Letters

SONY KV1810UB

I read with interest the excellent article by David Botto in the March issue on servicing the Sony Model KV1810UB. However the waveforms shown in Fig. 3 (a) and (b) refer I think to the collector of the chopper driver transistor Q604 rather than, as stated, the collector of the predriver transistor Q605. The waveform at the collector of this latter transistor should be a ramp of about 2V peak-to-peak.

Also, I find it prudent to check the start-up circuit comprising the GCS Q602 and associated components. It's not uncommon to find Q602 defective in some way. If it's short-circuit, R608 and D605 may have suffered as well. If this start-up supply is not present and the 19V rail is externally powered, a great deal of time could be spent checking other things. I trust this will be of some value to other readers.

P. Hardy,
Reading, Berks.

David Botto comments: When the Sony KV1810UB is operating with a 240V a.c. mains input the waveform at the collector of Q605 will be as shown in Fig. 1 (a). If the receiver is not connected to the a.c. mains however, and tests are made — as recommended in my article — using an 18V d.c. supply connected to pin 17 of the power regulator board, negative to chassis, then a different waveform will be observed at the collector of Q605. On our workshop oscilloscope, using an 18V d.c. supply only, it appears as shown in Fig. 1 (b). As Mr. Hardy says, the waveforms shown in Fig. 3 (a) and (b) in my article were not correct, and I apologise to readers for this.

The important thing about this waveform when making tests is not so much its exact shape as that it must be "clean", not with ragged edges as shown in Fig. 1 (c). If the waveform is ragged in this way, C624 (47μF, 25V electrolytic) must be replaced. Once the external 18V d.c. supply has been removed and the 240V a.c. mains supply connected, the waveform at the collector of Q605 must of course be as shown in Fig. 1 (a). Note that the waveforms shown in Fig. 1 (b) and (c) may vary a little as the line oscillator is running free.

BUSH T20/T22 CHASSIS

A couple of Bush T20/T22 receivers have caused me some problems recently. A report may help others confronted with the same symptoms.

The first set, a T20, produced no results other than some arcing noises. I soon discovered that the tripler was responsible for this — there was a pinhole fracture in the

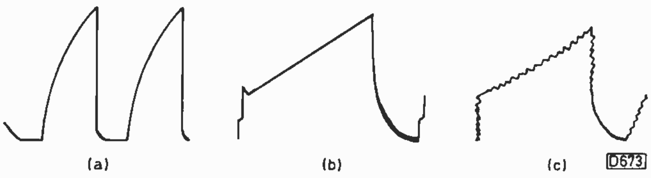


Fig. 1: Sony KV1810UB waveforms – see comments on letter from P. Hardy.

casing. A new one produced a picture and sound, but turning up either the brightness or contrast controls resulted in severe arcing at the e.h.t. cap. The surround was cleaned and treated with silicone grease, but this had no effect on the fault. Assuming that the e.h.t. was high I replaced the line flyback tuning capacitor 5C14, the h.t. being correct at 200V. This again made no difference, so I decided to replace the line output transformer, whose notoriety is well documented. As luck would have it, a T22 had just come in for repair, so panel swapping was tried. Fitting the line output panel didn't change the fault however. In desperation the whole chassis were interchanged. Still the same! It was the tube of course.

This was by no means the end of the story unfortunately. On a soak test arcing sounds were heard from the set accompanied by tracking effects on the screen, along with focus variations. I quickly turned down the lighting and peered at the e.h.t. cap. Not from there this time but from the focus pin. The white surround was blackened and badly burnt, and nice flashes could be seen in the dark. A new base was fitted together with a new focus unit — there were signs that it had been running warm, and anyway I was nervous.

On looking at the screen yet another fault had put in an appearance. There were four regular dark and light vertical bands an inch wide and and inch apart, starting at the left and gradually diminishing in intensity towards the right. Many components were bridged or tested while trying to trace the cause of this one. The culprit was eventually discovered to be 5C17 (0.47μF) which forms a reservoir for the clipper diode in the tripler, i.e. the feed to the beam limiting circuit. Bridging it was not sufficient to clear the fault.

On a soak test the set was fine apart from a tendency to show very quick changes in contrast level on a "contrasty" scene. The cause of this fluttering effect also took a while to find, due to its intermittent nature – it wouldn't show up on a test card display. It was eventually traced to the a.g.c. preset on the i.f. subpanel.

The set was now fit to be returned to its owner — and I wasn't sorry to see it go!

The second problem set was a T22 which came in for replacement of the tripler and line output transformer. After refitting the panel all was thought to be well. When the set was switched on however there was a normal picture but no sound. Thinking I'd disconnected the speaker leads, I checked these first. But no! The i.f. subpanel is prone to causing intermittent sound in these sets, so a disturbance test was carried out. Again no luck. Turning the volume up produced some audio noise, so I tried the effect of tuning. This gave very edgy sound but no picture/sound sync.

I decided to check the 12V supply to the TDA2190 sound chip and found this to be 22V. Switch off quickly and ponder about the possible damage done — and the cause! Cold checks on the 12V regulator failed to reveal anything amiss, so I had to switch on again. A check at the input to the regulator gave a reading of zero volts. What! With no 36V line (input to the 12V regulator etc.) there should be no 12V line and as this feeds the signals circuits and the line oscillator there should be no results! The 36V line is produced by the EW diode modulator, across the reservoir capacitor 5C8 (1,500μF), and the line output transistor sits on this line. A check directly at the emitter of the BU208A produced a reading of 0V, but a check directly across 5C8 gave the correct reading of 36V. It was now apparent what had happened — a slight turn of the line output panel earthing screw produced a normal 36V line and normal 12V regulator action. Still no sound however as the TDA2190 had been killed.

That was an interesting one indeed. This T22 lived happily ever after, once I'd replaced the on/off switch (intermittent) and the seven-segment channel display unit (one segment unlit, another dim), plus the TDA2190 (expensive!) of course. I suppose you're wondering where that 22V came from if not from the 12V regulator? Well so am I, and after this collection of nightmares I don't feel particularly inclined to speculate on the matter! Any ideas?

Stephen Leatherbarrow,
Middleton, Manchester.

PLUGS, SOCKETS AND SAFETY

I fail to understand why Victor Rizzo (letters, June) goes to such lengths to devise his 13A to 5A plug adaptor when one could be made more quickly from a 13A trailing outlet wired to a 5A plug. This would also be much safer.

I am also worried by P. Richard's letter (same issue) in connection with Victor Rizzo's portable light unit. He's concerned about the earthed metal box used in the construction of the unit, but unless the mains powered transformer unit is constructed to IEC Class II standard ("all insulated" or "double insulated" — see BS2754) the exposed metalwork must be earthed (IEC Class I). Class 0 equipment, in which no earth is provided and protection against shock relies upon basic insulation only, is not permitted in the UK under the Electrical Equipment (Safety) Regulations, 1975.

Thus earthing the light unit is necessary to ensure its safe operation. In the example quoted of the light unit being used next to a live TV chassis, the TV set should of course be run via a mains isolation transformer. The hazard is not in the use of the earthed light unit but in the TV set with its exposed live chassis not being used with an isolating transformer.

Andrew Longbottom,
Glasgow.

Your June issue carried a letter from Victor Rizzo outlining a method he'd devised to overcome the problem of installations with 5A socket outlets and equipment fitted with 13A plugs. With all due respect, I sincerely trust that no one ever decides to follow his example and make the sort of ad hoc arrangements suggested and illustrated. It's absolutely contrary to the principle which the electrical industry has been advocating for so long, i.e. the need for continued and increased safety levels for electrical equipment of all types.

5A socket outlets are made for accepting 5A plugs, likewise with 13A sockets and plugs. To carry out the sort of lash-up suggested is to invite the risk of danger and possible injury to the individual no matter how experienced he may be in electrical matters. It's far better to spend a little time changing the plug to the correct rating of the socket than to encourage the use of unorthodox and potentially dangerous methods. Better to be a live service engineer who does occasionally have to take the time to change a plug than a dead one who has hastened his departure from this life by trying to be just a little too clever.

J.J. Fallon,
Director — External Relations,
MK Electric Ltd.

Long-distance Television

Roger Bunney

The 1983 SpE season has had one of the latest and slowest starts of any I can recall, and I've been TV-DXing for over twenty years! Following the excellent opening on May 2nd, reported last month, there were two weeks of relatively quiet conditions punctuated by small openings and it wasn't until the 25th that the first really good opening occurred. Since then there's been some sort of activity on most days, indicating that the season has at last got under way. The SpE log for the period is as follows.

6/5/83 SR (Sweden) chs. E2 and 4; Swiss SRG E2; TSS (USSR) R1; CST (Czechoslovakia) R1; RTVE (Spain) E2.

12/5/83 TSS R1, 2; TVP (Poland) R1; MTV-1 (Hungary) R1.

13/5/83 TSS R1, 2; TVP R1, 2.

16/5/83 A good opening. RAI (Italy) IA, B; RTVE E3, 4; JRT (Yugoslavia) E3; CST R1; TVP R1, 2; TSS R1, 2; Swiss SRG E2.

17/5/83 TSS R1; MTV-1 R1; RTVE E2; NRK (Norway) E2; SR E2. The USSR 0249 monochrome test pattern was seen on ch. R1 with reduced width/height!

20/5/83 WG (W. Germany) BR-1 E2; TSS R1; RTVE E2.

21/5/83 RTVE E2.

22/5/83 Buster Keaton film on ch. R1 (unidentified) during the afternoon.

23/5/83 RTVE E2, 3.

24/5/83 TSS R1, 2; RTP (Portugal) E3; RTVE E2.

25/5/83 A very good opening from late afternoon onwards. TSS R1-4; TVP R1-3; MTV-1 R1, 2; ORF (Austria) E2a; RAI IA, B; JRT E4; CST R1; RTP E2, 3; RTVE E2-4; Swiss SRG E2; unidentified signals and JTV (Jordan) E3.

26/5/83 NRK E2.

27-28/5/83 RTVE E2.

31/5/83 RAI IA, B; RTP E3.

2/6/83 TSS R1; unidentified ch. R1 colour bars at 0910.

3/6/83 TSS R1-3 (noted by C. Willis at 0500); CST R1, 2; RTVE E2-4; TVR (Rumania) R2; ORF E2a; TVP R1, 2; RTP E2, 3; NRK E2-4; SR E2-4; RTVE Canary Islands E3 blockboard test card with Izana identification at the bottom received by H. Cocks.

4/6/83 TSS R1, 2; TVP R1; RTVE E2-4; RTP E3.

6/6/83 TSS R1, 2; TVP R1; CST R1; NTV (Nigeria) Sokoto E3 received by H. Cocks at 1600-1730 (coloured dancers).

On May 12th Ryn Muntjewerff (Holland) noted the TSS electronic "Leningrad" pattern with the identification KHEE. The JTV reception on May 25 was by Ian Johnson in Bromsgrove and lasted for an hour starting at 1900. At the time I was receiving at Romsey a ch. E4 news announcer with "Groucho" moustache and captions with French wording – thoughts are that this could be CLT (Lebanon).

On May 31st Cyril Willis received Gwelo ZTV (Zimbabwe) ch. E2 very strongly from 1840-1910 with "Flintstones" cartoons. This signal was via TE skip. A scratchy aurora was noted in Aberdeen on May 17th from 2000-2300. Following severe thunderstorms on June 5th, an unusual "fluttery" tropospheric lift was noted on semi-distant signals – most unusual!

My thanks to Ian Johnson (Bromsgrove), Hugh Cocks (E. Sussex), Tim Anderson (Stroud), Mel James (Anglesey), Cyril Willis (Ely), Arthur Milliken (Wigan), Ian Menzies (Aberdeen), Gosta van der Linden and Ryn Muntjewerff (Holland) whose reports supplement my own loggings.

New Aerial Arrangements

I was very busy during May changing all the aerials on the main lattice mast and renewing the coaxial feeders. After seven years of faithful service, the Antiference XG21W was scrapped and replaced with a twin Triax panel grid stack – the system was described in my article on wideband u.h.f. aerials in the August issue last year. A wideband coupler provides in-phase coupling and the signals then go to a low-gain, low-noise Labgear CM7060 u.h.f. amplifier (gain 10dB, noise 1·8dB). A Wolsey Orbit amplifier provides a gain of 16-18dB, with 3·5dB noise, some thirty feet down the mast.

The results obtained with this new u.h.f. installation have been startling. Crystal Palace ch. 23 at 65 miles previously provided some 520μV on average via an amplifier with similar gain. This is now up to 1·05mV average! In group C/D the gain is perhaps an odd dB or so down, but the polar response is much smoother with a lack of side lobes.

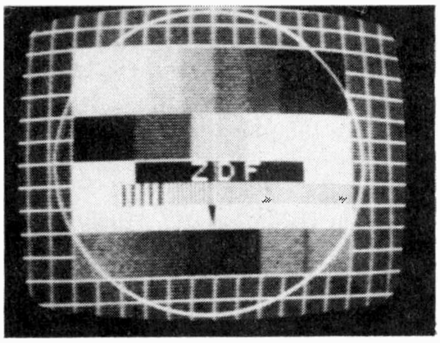
The Band I array consists of a modified type WB2 with a widely spaced, three-element reflector: the aerial is mounted so that it apparently points straight up into the sky. The spacing was chosen to obtain a response slightly above the horizontal level, with the aim of reducing interference pick up from below. With such a wideband system it's impossible to achieve optimum spacing throughout the spectrum for the required polar response. The ideal spacing is 0·25λ, but I chose 0·27λ at 55MHz. At 61·5MHz this provides only a 3·9dB interference reduction, but at 49·5MHz the reduction is 16dB (measured as signal voltage).

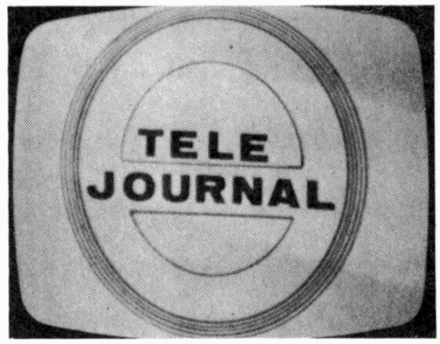
A 13-element Triax wideband array is used for Band III – it's a really heavy aerial, due to the use of half inch elements. An active aerial has been installed below the Band III array. This is mainly for experimental use and for Band II (TV). The Band I system is mounted at 67ft, the u.h.f. aerials at 60ft and the Band III array at 55ft. The indoor amplifier/filter arrangements are now due for replacement – the new system will incorporate braid break filters in all input feeders.

The new u.h.f. system has proved very useful for assessing ATV reception at 435MHz during the past month – some eight signals have been logged. Picture material varies from a BATC test card with identification to views of an operator, his equipment etc., obtained via a camera, or computer originated information from a ZX81, Spectrum, etc.

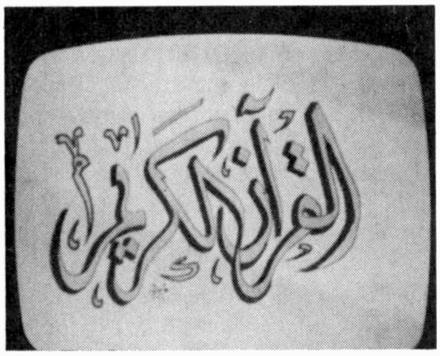
News Items

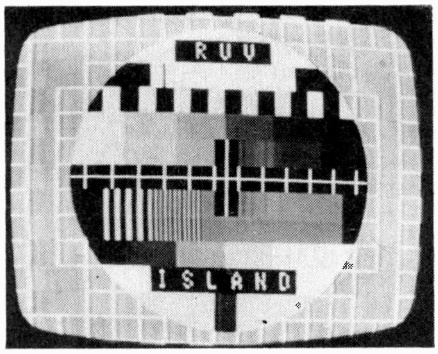
Medium wave a.m. stereo: Sansui have developed a stereo decoder chip that will decode any of the four a.m. stereo systems at present being introduced in the USA. The chip

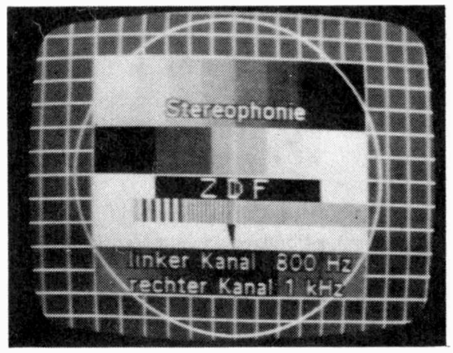




Left: U.H.F. DX. ZDF (W. Germany) ch. E21 received in Helsinki by Seppo Pirhonen. Centre: ATV reception at Romsey, showing a Spectrum microcomputer derived identification. Right: French news caption via RTM (Morocco), ch. E4.







Left: The Koran, via RTM ch. E4 (photo taken in Morocco). Centre: The PM5544 pattern, received from Iceland on ch. E4 via SpE – photo from Keith Harmer, Derby. Right: The FUBK pattern with stereo sound test transmission received by Garry Smith (Derby) via tropospheric propagation.

switches automatically between standards. Sansui have also developed a PLL synchronous detector that would increase the price of a standard a.m. radio receiver by only 20 per cent.

France: It seems that the new fourth service, 4-Canal Plus, which is due to come into operation around May 1984, will be scrambled. The viewer will require a magnetic card to insert into his descrambler, the scrambling being a random system.

Satellites: Some 48 prime programme channels are expected to be available in the USA by the end of this year – these are channels for cable operators or domestic reception via 6ft dishes plus terminals. When more specialised channels (religious etc.) are taken into account the total will be something like 70. There's talk of 150 channels being available by 1987. Just what the programme standards will be like is anybody's guess.

Hungary is planning a DBS service to come into operation in late 1986 or early 1987. The programmes will differ from the MTV-1 and -2 services.

AFN: An American Forces Network TV station is to be installed at Svesterberg (Holland) and may use system M chs. A5 and 6 or A80 and 83.

From our Correspondents . . .

John Abbot (South Africa) has replaced the dish he's been using for reception of the Russian Stat-T satellite transmissions at 714MHz, 99°E with a broadside array of Wolsey Colour Kings. The signals are amplified by a 38dB gain preamplifier with a 1·8dB noise figure and, having retuned the sound i.f. in his Philips monochrome receiver to 6·5MHz, he can now watch TSS-1 in comfort.

Anthony Mann, previously at Perth, Western Australia and now at Baton Rouge, USA, has identified a spurious 26·19MHz emission from KABC Los Angeles, ch. A7. This was received in New Zealand recently but another distantly received spurious TV signal at 26MHz has yet to be identified. The SpE season in the USA opened up on May 5th, with signals virtually daily.

Tim Anderson (Stroud, Gloucestershire) has been DXing for some two years but recently moved to premises that have restricted his installation. Even so a Plustron TVR5D with its whip aerial is giving excellent results. A WB3 Band I aerial, Vorta 14-element Band III array and Vorta VPX22W were previously used, with RTE to the west received daily at fair to good quality. He has a ch. E3 dipole in the roof space and this has given good SpE signals, proof that even minimal equipment can be used to good effect. Tim occasionally goes mobile with his VPX22W.

Transmitters Local and Exotic

The latest edition of the IBA's "Transmitting Stations – a Pocket Guide", dated May 1983, has now been published. Copies are available from Engineering Information, IBA, Crawley Court, Winchester, Hants SO21 2QA.

A list of exotic Band I stations that could be received in NW Europe via multiple-hop SpE, TE or F2 has been produced by the BDXC (Holland). These, plus a couple of additions, are as follows, arranged in channel order.

Channel E2: Dubai (UAE), Fih (Lebanon), Freetown (Sierra Leone), Gwelo (Zimbabwe), Jounieh (Lebanon),

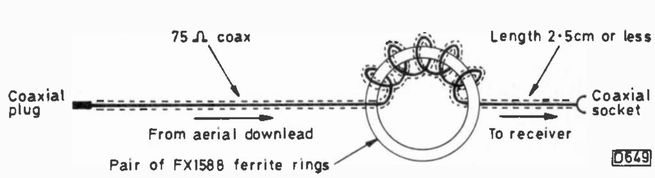


Fig. 1: Braid break filter suggested by the Home Office. Use five turns on a pair of FX1588 rings for 40-220MHz (13 turns on FX1587 or FX1588 rings for 3-40MHz).

Kabwe (Zambia), Kissi (Ghana), Kisumi (Kenya), Malabo (Equatorial Guinea).
Channel E3: Abafon/Ibadan (Nigeria), Bulajewo (Zimbabwe), Dharan (Saudi Arabia), Jamasi (Ghana), Jaradi/Sokoto (Nigeria), Lusaka (Zambia), Mougu (Zambia), Nabi-Saleh (Syria), Suweilih (Jordan).
Channel E4: Ajancote (Ghana), Al-Aineh (Yemen), Big Bend (Swaziland), Harare (Zimbabwe), Hassake (Syria), Ibadan (Nigeria), Isa Town (Bahrain), Jaji/Kaduna (Nigeria), Kitwe (Zambia), Laayoune (Morocco), Maaser el Chouf (Lebanon), Malherbes (Mozambique), Nairobi (Kenya), Scaba (Swaziland).

Quite a few of these transmitters have been received in the UK in recent years, some fairly regularly.

Developments in Band I

By now most enthusiasts will probably have noticed signals from cordless phones, 50MHz amateur stations and other sources spreading across the European Band I TV spectrum. Recently at Romsey I noticed a form of personal mobile radio operating at 64·19MHz and two other discrete frequencies under 100kHz away. The signals consisted of varying tone sequences. Contacting two main PMR companies revealed nothing – they didn't operate below 72MHz. There are however many smaller companies operating in this field. One was contacted about the 64·19MHz signals. Denials were made, along with suggestions of "continental interference". The firm was known to have installed a certain make of equipment however, and this is advertised as going into the 60MHz region. They were told that the Home Office was being informed about the intrusion. That same night the transmissions ceased!

Cordless phones are an increasing problem. I recently heard that a London company is installing a 49MHz system with a range of thirty miles! Apart from phone harassment and informing British Telecom there's little one can do until the new Telecomms bill comes into force.

Amateur radio operators had a chunk of Band I until the forties, losing it when the 405-line service spread across the UK. They are now getting part of it back. In the meantime however the use of Band I has changed both locally and internationally. Amateur operators could cause serious interference to TV services in those countries still using (and likely to go on using) Band I, especially via SpE in the summer months.

The interests of DXers carry little weight of course, but I still feel that we could make representations to the Home Office and would be interested to hear others' views. Interference to other services would be the thing to emphasize – for example the proposed 50-52MHz allocation could be shifted to 50·5-52·5MHz to slot in between the ch. R1 and IA carriers.

A simple notch filter can be used by those experiencing high-level amateur interference – suitable designs have been featured in this column in the past and are also shown in my DX-TV book (Babani Press). A very simple but effective 25dB notch filter can be made by winding ten turns of 26g enamelled wire on a T50-12 Ambit ferrite ring, with a 2-22pF trimmer across the winding to tune the circuit. Connect the aerial to the centre of the winding and take the output from one end or the other. A suitable braid break filter (see Fig. 1) is described in a leaflet available from the Radio Regulatory Dept., Home Office, Waterloo Bridge House, Waterloo Road, London SE1 8UA (called "Ferrite Ring Filters FS64/1A and FS64/2A"). Many CB/amateur radio shops sell ferrite rings – Bredhurst Electronics sell them at 80p a pair, though CB shops often charge up to £1 each.

SERVICE BRIEFS – THORN

The following items have appeared in recent editions of *Ferguson Feedback*. **1696/7 monochrome chassis:** In later production a 100μF, 25V electrolytic capacitor was added between the supply and chassis pins 1/16 of the TDA1180 sync/line oscillator i.c. to provide extra smoothing and thus prevent hum on the line scan causing distorted verticals.
1790 monochrome chassis: In the event of slight field cramp, check that C51 in the field driver stage is 82pF and not 150pF.
TX9 chassis: The sync separator bias resistor R203 (main panels PC1040/PC1044) has been increased in value from 1MΩ to 1·5MΩ to improve the sync performance when a set is used in conjunction with poor quality video signals, e.g. from home computers, TV games, etc.

To eliminate the possibility of random dot patterning in versions using a chopper power supply (PC1044 panel), a 470pF capacitor has been added across the 12·5V rectifier D67 and its series choke L101, which should be of the air-cored type (part no. 06D0-244-001). In addition the inductance of L66 has been reduced to 2·2μH to optimise the drive to the base of the chopper transistor.
TX10 chassis: A rare fault that could cause some difficulty with diagnosis: distorted verticals followed by loss of width and eventual tripping has been traced to the line output transistor's base-emitter junction protection diode D831 going open-circuit.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 545 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

THORN 3500 CHASSIS

The trouble with this set is that the sync separator transistor VT203 keeps going short-circuit collector to emitter at switch on. A replacement lasts anything from a few days to a few months. All the components in the sync separator circuit have been checked and found to be in order.

The position of VT203 on the chassis is such that it's vulnerable to e.h.t. spark-overs from either the e.h.t. cable or the degaussing shield. Dress the cable well away from the video and decoder panels and make sure that the earthing leads from the tripler, the c.r.t. base and the line output stage are all firmly connected to the shield. If these points are in order and the c.r.t. spark gaps are o.k., a higher rated transistor such as a BC142 could be tried.

SONY KV2000UB

The trouble is irregular start-up. The set normally starts up at switch on and works all right until switched off. Occasionally however the set fails to start, with the indicator neon pulsing weakly at about one second intervals and an accompanying plop from the loudspeaker. If left for a day or two the set is once more o.k.

We suggest you replace the start-up diode D507 on the timebase panel, then C612 (3·3μF) and Q604 on the power supply panel – the former is the 21V reservoir capacitor and the latter is one of the two transistors in the pulse width modulator circuit. The CX158 line generator chip IC508 occasionally causes this trouble – check that it's being supplied at pin 8 (7V or more) when the fault is present.

THORN 1400 CHASSIS

There's no raster on either system and the boost line reads just over 200V. Whilst investigating the fault the line scan coils became open-circuit with the result that the boost voltage returned to normal and a vertical white line appeared on both systems.

The problem appears to be shorting turns in the line section of the yoke, as a result of which the line timebase is being loaded down.

TANDBERG CTV2-2 CHASSIS

There have been several faults on this set – mostly in connection with the line output transformer derived 12V supply and the transformer's 60V tap off, due mainly to a dry-joint on the transformer. Everything is now in order apart from the horizontal convergence. The relevant controls have no effect, but no component faults can be found in this area.

The problem is fairly common on this chassis and is almost always due to a dry or open-circuit joint at the EW modulator transformer T752 on the timebase panel. Any discontinuity between the secondary on T752 and the convergence coil L902 will have the same effect.

THORN 3500 CHASSIS

Squiggly lines start at the top and bottom left-hand corners of the picture and continue for about four inches towards the centre of the screen. These lines are still present when the signal path is disconnected. The picture is otherwise good.

This sort of thing is usually caused by the tube's Aquadag coating not being earthed. There should be three leads from the degaussing shield, to the tripler, the line output stage and the c.r.t. base. If all these are in order, check the h.t. smoothing capacitor C619 (replace with one of 220μF, 100V), the line linearity coil damping resistor R521 (1·2kΩ), capacitors C631 and C616 (0·01μF) in the power supply and that the core of L502 is present.

KÖRTING HYBRID COLOUR CHASSIS

There are two faults on this set. First the picture pulls to the right, almost going into a circle. I suspect the AA133 flywheel sync discriminator diodes but can't obtain replacements. Any suggestions for alternatives? Secondly there's an ident fault, the faces turning from red to green.

The flywheel sync discriminator diodes could be the cause of the first fault and almost any pair of diodes can be used – BA155s are commonly used for this purpose. Other things worth checking are the PCF802 line oscillator valve and the 25μF decoupling capacitor C417 in this stage. The PAL switch (red/green faces) is in the TAA630 i.c., but before condemning this check the settings of the ident amplitude and frequency controls R883 and R887, especially the former (if it has little effect, check the electrolytic C819 – 1μF – which is in series with it). Also check for dry joints around the ident transistor T748. The manufacturers suggest using a scope to adjust R883 and R887, but if necessary try adjusting each in turn, restoring them to their initial settings if no improvement is obtained.

PHILIPS N1502

The problem is with the two-minute delay circuit which doesn't switch off automatically. The release relay is activated by the monostable multivibrator TS115/6, and shorting out TS115 produces correct operation. Checks on the preceding transistors TS110, TS111 and TS112 have failed to reveal the cause of the trouble however.

The first transistor in the circuit, TS110, is turned on by various function switches. To eliminate switching problems, short-circuit the base and emitter of TS110 and monitor its collector voltage to check that it rises. It's difficult to check the following f.e.t. TS111's action since there will be little change in its drain voltage if it switches on. TS112 can be checked by putting a resistor of approximately 10kΩ between its base and chassis. TS112 should then switch TS116 on. D121 which is between these stages could be open-circuit, or TS115 could be failing to turn on. These checks should enable the circuit's operation to be evaluated, thereby tracing the source of the fault.

TEST CASE

248

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 Thorn 1600 chassis has always seemed to us to be a strange one – unable to make up its mind whether or not it's a portable, a bit wasteful on power consumption with 400Ω in its dropper section and a shunt stabiliser, also precarious to work on with its hinged chassis and "peek-a-boo" through-board arrangement for the c.r.t. neck and base. Electrically it's fairly conventional however, and most of the faults that occur are easy enough to diagnose. Our most recent encounter with one took us rather longer than it should have done, as you will see as the story unfolds.

The reported symptom was that the set took a very long time to "warm up" and come on. This in itself is unusual in a solid-state chassis. We switched on and found that we had sound (not very good) immediately, but there was no discernible picture of any sort for three-four minutes. Finally a small, distorted and blurred image appeared, indicating that all was not well in the line output stage. The tube's heater is fed from the line output transformer, which would explain the delay before any image became visible. After a minute or two more the picture slowly expanded to fill the screen – the e.h.t. regulation was poor however, and upon changing channels we were again confronted with a small "wiggly" image broken into lines and accompanied by a rough squeal from the area of the line output transformer – ugh! We switched off and felt the temperature of the BU205 line output transistor – you could have fried an egg on it!

In view of the loss of line lock we started our investigation in the line oscillator stage, which is of the usual sinewave type with two npn transistors VT13 and VT14 and feedback via the coil L19. The coil's centre tap is grounded from the a.c. point of view by C113 (100μF), and as we've had trouble in this area in other sets we fitted a new electolytic. There was no change in the symptom, and the low voltage readings we found around the two transistors were probably due to the main problem, which we decided must lay elsewhere, especially as the line oscillator's output waveform P, at the emitter of VT14, looked reasonably like that shown in the manual. Time to shift one place right (in the computer parlance we're also currently struggling with) and look at the line driver stage, VT15 and its associated components.

The voltage at the collector of VT15 should read 140V, but what we found was 180V, virtually the same as the heavily-loaded h.t. line. This suggested that VT15 was drawing very little current and, in contrast to the throbbing line output transistor VT16, both VT15 and its collector feed resistor R142 (2·2kΩ, fusible) were very cool. VT15's collector waveform Q was around 40V peak-to-peak instead of 210V p-p, and very far from the square shape it should have had. The key to the problem was perhaps revealed when we switched the scope to d.c. coupling and found that the transistor was not bottoming on the "negative" half-cycles of its output waveform – they reached down to only about 130V. Had we thought about this more deeply, we would probably have gone straight to the faulty component. As it was, we changed the BF337 line driver transistor, using the recommended BF259, and tested the two perfectly good diodes in its emitter circuit before we got wise. So what was the culprit? We'll confirm your diagnosis next month!

ANSWER TO TEST CASE 247
– page 488 last month –

Last month's case involved an ITT CVC40 chassis which was completely dead so far as sound and picture were concerned, though you'll remember that the 300V line (output from the mains bridge rectifier) was found to be present and that the line oscillator was working (from its start-up feed via R4 and R3). The problem appeared to be in the CMP40 switch-mode control module, but a new one had made no difference to the symptoms.

The clue to the problem was the low voltage reading at the emitter of T801. The supply here comes from the set's 12V line, via D7, when the set is running normally, though there's a start-up feed via R806 since the 12V supply is derived from the line output transformer. This start-up feed has a high source impedance – R806 is 470kΩ – and during start-up is isolated from the rest of the set by D7 which is then reverse biased. D7 is mounted on the mother board, and what had happened was that it was leaky and was thus allowing the i.f. strip, the tuner, the decoder and various other circuits to hang on the end of R806, thus mopping up most of the available energy with the result that the switch-mode power supply, and in particular T801, couldn't get started.

If we'd hooked up an independent 12V supply the set would have worked perfectly, but that would not necessarily have made the diagnosis any easier!

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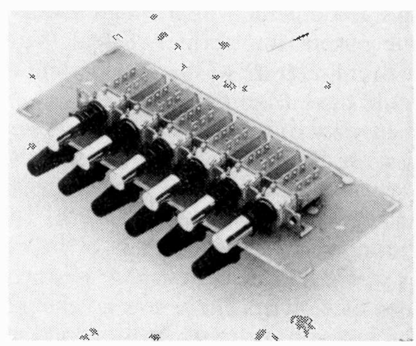

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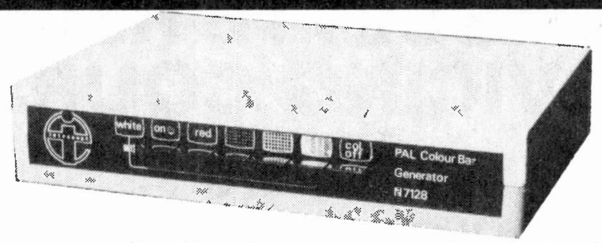

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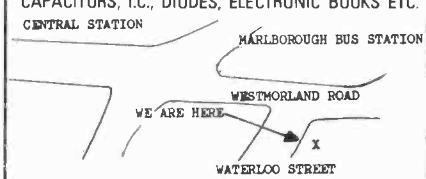

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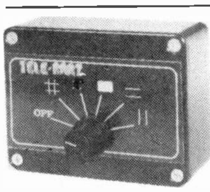

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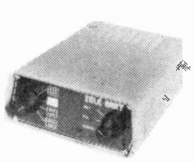

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ZF 11	10p
ZF 12	10p
ZF 15	10p
ZF 33	10p
ZF 43	10p
ZF 47	10p
ZF 82	10p
ZPD 3.9	10p
ZPD 4.7	10p
ZPD 5.6	10p
ZPD 10	10p
ZPD 47	10p
ZPY 8v2	10p
ZPY 12	10p
ZPY 16	10p
ZPY 24	10p
ZPY 43	10p
ZPY 47	10p
ZPY 56	10p
ZTE 2	10p
ZTK 22	10p
ZTK 33	10p
ZTK 33a	10p
ZTX 102c	10p
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 384	10p
ZTX 450	10p
ZTX 451	10p
ZTX 550	10p
ZW 13	12p
ZW 27	10p
ZW 43	10p
ZW 310	10p
ZX 68	50p
ZY 47	10p
ZY 72	10p
AA 112	10p
AA 113	10p
AA 119	8p
AA 143	10p
AA 144	10p
BA 102c	10p
BA 157	8p
BA 159	8p
BA 173	8p
BA 182	8p
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BA 243	8p
BA 248	8p
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BZX 79c2v4	10p
BZX 79c4v7	8p
BZX 79c5v6	8p
BZX 79c6v2	8p
BZX 79c6v8	8p
BZX 79c8v2	8p
BZX 79c11	10p
BZX 79c12	8p
BZX 79c22	8p
BZX 79c30	8p
BZX 79c43	8p
BZX 79c47	8p
BZX 83c4v3	10p
BZX 83c5v6	10p
BZX 83c8v2	10p
BZX 83b12	10p
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00S1 012 010B £1.00
00S1 018D £1.00
Rank/Toshiba preh unit 0354 £9.50
4 Push button unit preh £1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
KT3 12 PBu £3.00
6 Push button Unit Thorn £1.00
6 Push button unit for GEC 2040 and ELC 1043/05 £6.00
7 Lamps for P.B./Unit 10p

Mains Droppers

Pye 731 3+56+27R 50p
3500 Thorn 6/1/100 60p
Thorn 50/17/1K5 £1.00
120/20/20/48/117 £1.00
270/10/6 for Thorn 4000 50p
18/320/70/39 £1.10
Thorn 50-40R-1K5 50p
Aerial Socket and Lead 35p
Pye, Thorn, ITT, Thyristor, Philips G11 122 60p
Rank Toshiba Tube Bases 30p

Speakers

6×4G11	25 ohm	£1.00
5½×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
5×3	15 ohm	80p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6½" dia	4 ohm	£1.50
6½" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p

Diodes

BY 127 10p
BY 133 10p
BY 134 10p
BY 164 30p
BY 176 type 25p
BY 179 40p
BY 184 25p
BY 187 10p
BY 190 40p
BY 196 30p
BY 198 10p
BY 204/4 8p
BY 206 8p
BY 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
F 247 10p
~~XK 3102~~ 50p
XK 3123 50p
Thorn A1 10p

Line Transformers

G8 Trans. Philips £7.50
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
CVC40 Split Diode ITT £10.00
GEC 2040 £5.00
Pye mono £3.00
Rank mono T704A £3.50

CVC32 ITT £7.50
EHT Split Diode Leads £1.00

Triplers

Universal Tripler £3.50
11 TEZ Rank £3.00
9000 Thorn £5.00
KT3 £4.00
CVC-20-25-30 £4.00
G9 Philips £4.00
GEC 2110 £4.00
9500 Thorn £4.50
2040 GEC £3.50
G8 Philips £4.50
Decca 80 100 £4.50
LP1194 Pye 731 £3.50
Grundig TVK 52 £2.50
11TBQ £3.00
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
BG 100/61 £3.25
New Philips Infra Red Transmitter 9ch & Vol. & brightness change £7.00
THORN Tuner Panel. 6 Slider pots. Knobs, touch button. Ultrasonic transductor, ICs, components & mains switch £3.75
GEC Portable Line Trans. £3.00
THORN portable mono chassis U788F £10.00
9000 front panel £5.00
9000 front panel (remote) £8.00
THORN 8800/9000 Remote Unit U705 £6.00
THORN 9000 Frame Panel £8.00
G8 Convergence Panel £12.00
T/text ultrasonic rec'r panel £14.00
Handset G11 (2 button unit) £12.00
THORN 9000 Syclops panel £1.50
THORN 8000/8500 timebase panel £8.00
THORN 8000/8500/8800 chroma panel £15.00
THORN 8500 convergence panel £6.00
THORN 8800 remote control unit U705 £6.00

Philips Infra-Red (full remote transmitter)

Philips KT3 16C928/20C934
Pye KT3 7228/7324 K12 26C
797/1ST 66K 1826 £12
G11 handset. Full remote top £12.00
Video cassette lamps on lead. 12-14V. 50p or 3 for £1.00
GEC 8 touch unit assy complete with all I.C.'s + pots £6.00
9000 Frame Panel £7.00
G11: 8 touch button unit £20.00
Transmitter Decca RC11 £14
Transmitter Decca RC12 £14
G11 Tuner Unit/U321 £6.00
G11 6 Button Key Switch £2.00
G11 E/W Transformer 50p
G11 Line OSE Tran. 50p
G11 Transient Suppressors 245V 10 for £1.00
G11 Scan Coils £5.00
KT3 AE Sockets 25p
4000 Thorn Frame Panel £5.00
4000 Thorn Power Supply £3.00
4000 Thorn Line OP Panel £20.00
NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
GEC IC CBF16848. SN16861. SN1682 each 50p
Thorn 3500 IF Panel NEW £3.00
Thorn Tuner Panel 6-100K Pots & Components NEW No Tuner £2.00
6 button 100K pots + cursors on panel for varicap tuning £1.50
THORN 1600 mains lead: switch: 3 slider assy. £2.00
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50

Tube base + base unit for 820 Euro chassis £4.00
CVC 9 IF panel and decoder £7.00
GEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel (untested) £5
CVC 40/45 IF panel £5
Mains Panel with switch and lead £1.50
Thorn 3500 6 push button unit & cable form £1.50

Rec & Trans

G11 Ultrasonic t/text transmitter
G26C 674/02
G22 C66/02 £19
Handset Rank Infra Red £10.00
Infra Red (full ramote transmitter)
~~Dynatron TV CTV 62, 63, 64 £19~~
40K Transducer 50p
~~PHILIPS NE511N £1.20~~
~~LM337M Reg.~~ 30p
~~Thorn T603 TV NPN TO66 80V~~ 6A 10p
20 GEC Black Spark Gaps £1.00
G11 Line Driver Transformer 35p
2 SD350A BU208A £1.00
G11 IF Detector £3.00
Complete CVC 825 Chassis (both panels) £40.00
G11 Teletext Transmitter £19.00
BG200/43 Tripler £3.00
DECCA IF 80-100 £3.50
G11 Time Base Panel £12.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Thorn 900 Sound OP Panel NEW £1.00
U321 T/Unit on Panel Cum 40 ITT £6.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F £3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q £2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+ SC9503P £1.50
Tuner Unit VHF Sylvania GTR Videon MTS900 BIP VHF £2.50
G11 dynamic correction panel £6
CVC 20 Front panel with sliders + mains input panel £4
THORN 3500 Tuner panel (ELC 1043/05 + pots) £7
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £14
CVC 5 Mains on/off + 5 pots £2
GEC Convergence panel (We have 750) TO CLEAR £1
Universal Focus. Fits Pye, Thorn and Decca Units. Large Type 75p

Decca Small 75p
KT3 Focus Unit 75p
ITT Small for use with Split Diode 50p
Thorn 3500 Focus Unit £1.50
TV11 50p
Remo TV12SP 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
16 Button Key Pad 1 to 0 + * + # + 4 blank £3.00

Condensers

470/16 6p
1500/16 20p
3300/16 20p
10000/16 25p
15000/16 50p
3300/18 20p
470/25 5p
680/25 5p
1000/25 Radial 10p
1250/25 10p
1500/25 10p
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
3000/50 25p
15/63 5p
47/63 Bipolar 15p
2200/63 50p
250/64 10p
3300/70 50p
.1/100 5p
4.7M/100 5p
140/100 25p
470/100 20p
470/160 20p
800/160 50p
G11 0.91/210 scan coil correction 25p
.1/250 Pulse 5p
G11 0.47/250 10p
2,2 250v 10p
3n3/250 10p
4n7/250 tested 5KV 25p
22/250 15p
47/250 10p
100/250 20p
500/250 50p
GEC600/250 60p
800/250 40p
8/300 8p
4/350 5p
8/350 8p

12/300 10p
4.7M/350v 10p
16/350 25p
50/350 10p
220/350 30p
300/350 40p
700/350 50p
22/375 15p
330/385 CVC 820HT 60p
0.1/400 15p
.56K/400v 20p
8/400 15p
33/400 20p
220/400 50p
400/400 40p
2×10,000Pf/400 in box 40p
33/450 15p
220/450 40p
0.1/600 15p
.047/600 15p
0.1/800 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.15/1000 20p
.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
0.1/2KV 20p
10n/2KV 15p
3n9/2KV 15p
210/8KV 10p
0.0015/2KV 10p
5n2/2KV 10p
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

Multi-Caps

Thorn 3500
175/100/100/350v £2.00
KT3/200/25/25/385v £1.00
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
470/470/250v 50p
150/200/200/300v 70p
400/400/200v £1.70
300/100/100/16/275v £1.50
100/200/325v 40p
400/200/200/350v £1.50
200/200/100/300v 60p
200/350v + 300/100/32/300v £2.00
200/200/100/32/350v £1.50
200/47/350v 60p
100/300/200/100/16/350v £2.00
200/100/100/375v £2.00
100/100/35v 60p
1000/1000/35v 60p
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
300+300/300 £1.00
225+25/380 70p

ITT Panels

CMA 10 £2.00
CMA 11 £2.00
CMA 30 £2.00
CMA 40 £1.50
CMC 10/2 £5.00
CMC 16 £4.00
CMC 19 £12.00
CMC 45 £1.50
CMC 47 £1.00
CMC 54 £10.00
CMC 56 £5.00
CMC 58 £8.00
CMC 59 £8.00
CMC 67 £3.75
CMC 67/2 £4.00
CMC 68 £4.00
CMD 12 £10
CMD 40 £5.00
CMF 25 £2.00
CMF 40 £2.00
CMH 10 £1.50
CMH 31 £1.50
CMK 12 (untested) £4.00
CMN 20 £1.50
CMN 40 £1.00
CMP 10 £2.00
CMP 11 £2.00
CMP 40 £2.00
CMS 11 £2.00
CMS 40 £2.00
CMU 14 £8.00
CMU 30 £7.00
CMU 40 £7.00
CMU 45 £5.00
VCA 21 £10.00
VMC 34 £5.00
VMC 44 + 45 £4.00

Infra Red and Ultrasonic G11 ~~Teletext Decoder~~ Panel £30
~~RANK & ITT Mains Remote On-Off Switch (720R)~~ £1.50
RANK & ITT Mains Remote Switch 2865 ohm £1.50
G11 Mains Switch 40p
ITT Mains Switch 4 amp 30p
GEC Mains Switch 4 amp 30p
Petrick Mains Switch 4 amp 30p
THORN Rotary Mains Switch 50p
G8 Mains Switch 75p
Mains Dropper PYE 3R5+15R+45R 50p
Thyristor 600/4 amp C106/2 24p
G11 Preh Reg LED P/Button for C.H. Change 20p
2SC2073 on Heat Sink 150 NPN 1.5 Amps 7p
RANK TOSHIBA Transductors TPC-2011 50p
Remote Unit THORN 11 I.C. Mains Transformers Relay & 5 volt Reg & Component Unit £2.25
Thorn I.C. board with 11 various sn 74 I.C.'s £1
CVC 5 Mains on/off +250K+100K+500K+50K+500K Pot on Panel £2.00

~~International Rectifier~~ EHT Diodes G770/HV34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p
SKE 1/02 20p
20 × W005 Bridge £2.00

EHT Rectifier wire ends 16Kv 10p
25A473 PNP C/P 10p
Mains transformer 240v/20v 500mA 75p

SENDZ COMPONENTS

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Tuner Units

ELC1043/05 Mullard	£6.00
ELC1043 (Ex Panel)	£3.75
ELC1042 ,,	£5.00
ELC2000 ,,	£7.00
ELC2004	£10.00
EL2060 ,,	£7.00
ELC2060 on panel NEW	£5.00
U321 (UHF) Mullard	£6.00
U322 (UHF) ,,	£4.00
V314 (VHF) ,,	£5.00
ELC1043/05 Thorn	£5.00
Small V/Cap Mitsumi UHF ,,	£4.00
VHF ,,	£3.00
VHF Rotary Mitsumi	£1.00
Portable & rotary Tuners Sanyo & Mitsumi UHF	£5.00
Mossfit UHF VHF NSF. ET021 DX	£8.00
Sylvania UHF VHF F6013 (Fits Rank)	£4.50
Sylvania UHF	£6.00
Sylvania VHF	£6.00
Decca Bradford Tuner 5 Button	£4.00
NSF AEG UHF/VHF	£6.00
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. Mechanical Tuner
THORN 1500 4P.B. Mechanical Tuner
THORN 1590 4P.B. Mechanical Tuner
THORN 3500 4P.B. Mechanical Tuner
THORN 8000 4P.B. Mechanical Tuner
THORN 8500 4P.B. Mechanical Tuner
All new & boxed £4 each + £1 postage each

Diodes

1 Amp 1600v	7p
3 Amp 100v	7p
3 Amp 1200v	10p
7 Seg Display, Led Red	50p
Delay Lines	
TAU80	£1.00
DL11	50p
DL20A	80p
DL50	£1.00
DL70	£1.00
DL600	£1.00
DL700	£1.00
KT 3 Luminence	75p
Luminance Delay Line MDL-CBL Min.	50p
3.15 Fuses	4p
Co-Ax Joint	12p
Co-Ax Belling Lee Plug	12p
UHF Modulator CCIR.	£3.00
Infra Red Emitting Diode	20p
NE286H Small Neon Lamps GEC	5p
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

AM25LS23PC	£1.00
BAV40	40p
BRC-M-200	50p
BRC-M-300	60p
BRC 1330	75p
CA270AE	50p
CA270CE	50p
CA270CW	50p
CA927	40p
CA3065	50p
CA3089Q	50p
CA3094AE	50p
CA3146	£1.00
CA920AE	£1.00
CA1310	50p
CBF16848	50p
DM7492	50p
HEF4001	10p
HBF4011AF	10p
HEF4016	15p
HEF4053B	30p
M1024	£2.00
M1025	£2.00
MC476p	£1.00
MC1307	75p
MC1327	75p
MC1330	75p
MC1349	50p
MC1352	£1.00
MC1358	£1.00
MC14001	£1.00
MC14013	£1.00
MC14016	£1.00
MC14066BCP	£1.00
MC14069	£1.00
MC14514	50p
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
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	£2.50
SAA5020	£3.50
SAA5040	£2.50
SAA5050	£3.50
SAS560	£1.00
SAS570	£1.00
SAS5660	£1.00
SAS670	£1.00
SL918-SL917 MOD	£2.50
TAA320A	50p
TAA470	£1.50
TAA550	30p
TAA570	75p
TAA611	£1.50
TAA621	£2.00
TAA641	£1.50
TA7117	£1.00
TA7315	£1.00
TA7607	£1.00
TA7609	£1.00
TBA120A	40p
TBA120AS	40p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120SQ	£1.00
TBA120U	40p
TBA120C	40p
TBA1441-TBA440	£1.00
TBA231	75p
TBA395	50p
TBA396	75p
TBA440	£1.00
TBA440C	£1.00
TBA480Q	£1.00
TBA510	£1.00
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
TBA641BX1	£2.00
TBA651	£1.00
TBA673	£1.00
TBA720A	£1.00
TBA750Q	£1.00
TBA800	40p
TBA810S	70p
TBA820	70p
TBA890	£1.00
TBA920	£1.00
TBA920Q	£1.00
TBA950	£1.00
TBA990Q	£1.00
TMS1943NL	£2.00
TMS9980	£12.00
TMS9901	£6.00
TMS2716	£6.00
TMS3529	£6.00
TMS4014	£2.50
TX012	£5.00
~~TMS9902~~	~~£6.00~~
UPD2114C 4K RAM	75p
~~SN29848~~	50p
SN74107	£1.00
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50
SN76033	£1.50
SN76115	50p
SN76131	50p
SN76226	£1.00
SN76227	60p
SN76228N	£1.00
SN76530P	60p
SN76532N	50p
SN76544N	£2.00
SN76545	£3.50
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76650	50p
SN76660	40p
SN76620AN	50p
SN76666	£1.00
SN76707N	75p
SN76708N	75p
ML231	£2.50
ML232R	£1.20
BJT6016	£1.20
ML236E	£1.50
ML237B	£1.50
ML238B	£3.50
BTT822	£1.00
BTT6018-ML237B	£1.50
BTT8124	£1.00
BTT8224	£1.00
UA783P3C	40p
UPC1365C	£1.50
KT3 2SD 200 Line Transistor	£2.00
BT119	£1.00
BT120	£1.00
BT109	£1.00
BT138/10A	70p
BT146	£1.00
TCA270	£1.00
TCA270Q	£1.00
TCA940	£1.00
TCA4500A	£1.00
TCA640	£1.00
TCA650	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£1.00
TCA830	£1.00
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TDA1003A	£1.00
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TDA1170	£1.00
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TDA1327A	£1.00
TDA1412	30p
TDA2010	£1.00
TDA2140	£3.50
TDA2522	£1.00
TDA2530	£1.00
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2575A	£1.00
TDA2590	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£4.25
TDA2653	£1.00
TDA2002	£1.00
TDA2640	80p
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3500	£2.00
TDA3560	£3.50
TDA3571Q	£1.50
TDA3950	£1.50
SN74LS 125AN	30p
SN16862AN	£1.00
SN16964AN	50p
SN29764	£1.00
SN297728N	50p
RGP30G	10p
MPSA43	10p
E1222	20p
MJE51T	25p
~~MJE340~~	28p
MJE660	25p
MJE661	25p
~~MJE3055~~	~~£1.00~~
MJE2801	30p
MJE2955	50p
Sanikron Diode SKE262/04	30p

Semiconductors

BT100A	30p
BT106	£1.00
BT106 Plastic	50p

Transistors

A1222	20p
A1223	20p
AC121	20p
AC128	20p
AC151	20p
AC131	20p
AC138	20p
AC152	30p
AC153K	20p
AC142K	20p
AC176	20p
AC176K	20p
AC179	20p
AC186	20p
AC187K	20p
AC188	20p
AC188K	26p
ACY21	25p
AD143	50p
AD149	50p
AD161/162 pair	40p
AF139	25p
AF239	25p
AF367	25p
AL102	£1.75
AU113	£1.20
BD437/438 on heat sink	60p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD532	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD595	35p
BD596	35p
BD646	50p
BD678	50p
BD681	25p
BD807	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
BF245b	20p
BF256	10p
BF257	20p
BF258	25p
BF259	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF301	10p
BF324	25p
BF336	30p
BF338	25p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF423	15p
BF448	30p
BF450	20p
BF457	10p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	30p
BF480	50p
BF594	10p
BF597	10p
BF694	10p
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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
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BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC447	10p
BC453	10p
BC454	10p
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