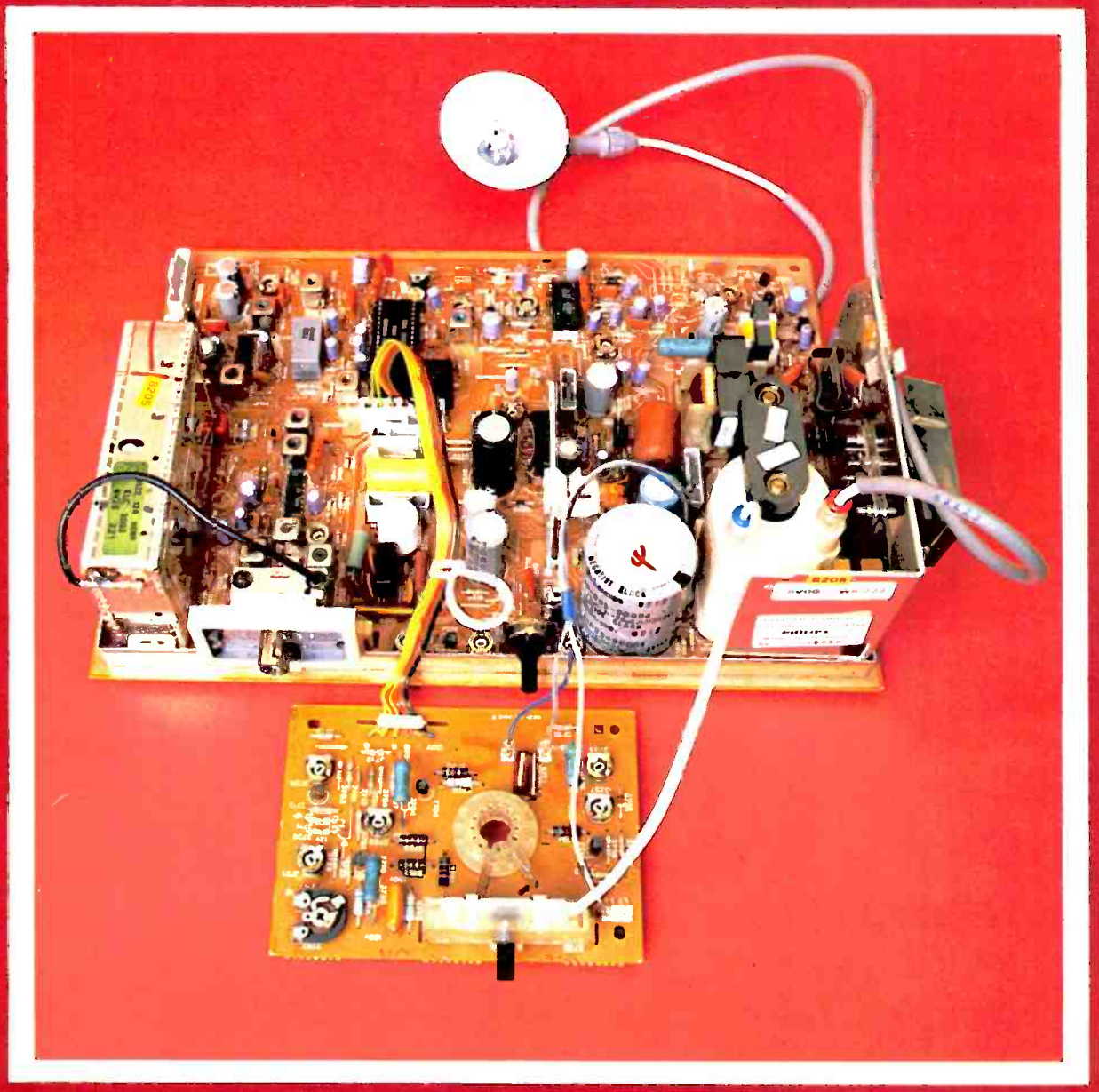
JANUARY 1983

Australia $1.74; New Zealand $2.00; Malaysia $5.50; I.R. £1.19 (inc. VAT)

80p

TELEVISION

SERVICING-VIDEO-CONSTRUCTION-DEVELOPMENTS



PHILIPS' NEW CTX CHASSIS

COMPONENT DISTRIBUTION GUIDE

FREEZE FRAME & SLOW MOTION

QUICK CHECKS : PYE 713 CHASSIS

CABINET REPAIRS

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
Z3	300 mixed capacitors, most types amazing value	£3.95
Z4	100 mixed electrolytics	£2.20
Z5	100 mixed Polystyrene Capacitors	£2.20
Z6	300 mixed Printed Circuit Components	£1.95
Z7	300 mixed Printed Circuit resistors	£1.45
Z8	100 mixed High Wattage Resistors, wirewounds etc.	£2.95
Z9	100 mixed Miniature Ceramic and Plate caps	£1.50
Z10	25 Assorted Potentiometers	£1.50
Z11	25 Assorted Presets, Skeleton etc.	£1.00
Z12	20 Assorted VDR's and Thermistors	£1.20
Z13	1 lb Mixed Hardware, Nuts, Bolts, Selftappers, "P" clips etc.	£1.20
Z14	100 mixed New and marked transistors, all full spec. includes: PBC108, BC148, BF154, BF274, BC121L, BC238, BC184L and/or Lots of similar types	ONLY £4.95
(Z14A)	200 Transistors as above but including power types like BD131, 2N3055, AC128, BFY50 etc.	£9.95
Z15	100 Mixed Diodes including: Zener, Power, Bridge, Signal, Germanium, Silicon etc. All full spec.	£4.95
Z16	20 1N4148 Gen Purpose Diodes	£1.00
Z17	20 1N4003/10D2	£1.00
Z18	20 Assorted Zeners. 1 watt and 400 mw	£1.50
Z20	10 Assorted switches including: Pushbutton, Slide, Multipole, Miniature etc. Fantastic Value	£1.20
Z21	100 Assorted Silver Mica caps	£2.20
Z22	10 Mixed TV convergence Pots	£1.00
Z23	20 Assorted TV Knobs including: Push Button, Aluminium and Control types	£1.20
Z24	10 Assorted Valve bases B9A, EHT, etc.	£1.00
Z25	10 Spark Gaps	£1.00
Z26	20 Assorted Sync Diode Blocks	£1.00
Z27	12 Assorted IC Sockets	£1.00
Z28	20 General Purpose Germanium Diodes	£1.00
Z29	20 Assorted Miniature Tantalum Capacitors. Superb Buy at	£1.20
Z30	40 Miniature Terry clips, ideal for small Tools etc.	£1.00
Z31	5 CTV Tube Bases	£1.00
Z32	10 EY87/DY87 EHT bases	£1.00
Z33	20×PP3 Battery Connectors	£1.00
Z34	6×Miniature "Press to Make" Switches, Red Knob	£1.00
Z35	12 Sub Min S.P.C.O. Slide Switches	£1.00
Z36	12 Min D.P.C.O. Slide Switches	£1.00
Z37	8 Standard 2 Pole 3 Pos Switches	£1.00
Z38	4×HP11 Batt Holders (2×2 Flat type)	4 for £1.00
Z39	3.5mm Jack Sockets, switched, enclosed Type	8 for £1.00
Z40	100 Miniature Reed Switches	£2.30
Z41	100 Subminiature Reed Switches	£4.20
Z42	20 Miniature Reed Switches	£1.00
Z43	12 Subminiature Reed Switches	£1.00
Z44	TO3 Mounting kits (BU208)	8 for 60p
Z45	TO220 Mounting kits (TIP33)	10 for 60p
Z46	TO126 Mounting kits (BD131)	12 for 60p
Z47	Pack of each Mounting kit. All include insulators and washers	£1.50
Z48	3a 1000v Diodes (IN5408 type)	8 for £1.00
Z49	Brushed Aluminium Push Button Knobs, 15mm long × 11mm Diam. Fit standard 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

SPECIAL OFFER

Etch Kit with Instructions, 150 sq ins Paxolin Board, 1 Nylon Etch Resist Tray, Set of 3 Etch Pens, Tweezers, Abrasive Cleaner, Thermometer, 1lb Ferric Chloride. **ONLY £5.95.**

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
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 16v	10 for £1.00
1000µf 25v*	8 for £1.00
1000µf 35v	6 for £1.00

*Axial. All others are Radial.

CAN TYPES

100+200 350v	£1.00
2000µf 100v	£1.00
1000µf 100v	60p
2,200µf 40v	60p
2,200µf 63v	70p
3,500µf 35v	50p
4,500µf 35v	60p
220µf 400v ITT/RBM	£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

TRANSISTORS

BC154, BC149, BC157, BF195, PBC108, BF393S 2N3702, BC148B, BC159, ZTX107, ME8001, BC651, BF324 12 of one type	£1.00
Any 6 packs of 12	£5
2N3055H	60p each
BD181	50p each
BD131	4 for £1
BD132	4 for £1.00
AF186	4 for £1

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	
10 of one value	£1.00
10 of each	£2.50

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
25 × IN4002	£1.00
10 × SKE 4F2/06 (600v 2a fast switching)	£1.00
12 × BY127	£1.00
8 × BY255 (3A 1000V)	£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
TAA 661B £1.00	6 for £5.00
SN76660N 50p	5 for £2.00

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
"1600" Dropper 18 + 320 + 70 + 39Ω	3 for £1.50
"950" Can. 100 + 300 + 100 + 16µf	£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.
These are untested units which contain **10× "C" size (HP11) Nicads,** which alone would cost in excess of **£20.** A Real Bargain at **£10 each 3 for £25**

MISCELLANEOUS

BG100 tripler for CVC45 etc.	only £3.50
Line output transformer for RBM 823A	£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 Tuners, 5 button type	£3.00 each, 5 for £12.50
UHF Modulator UHF out Video in. Ch. 36. 2½"×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
PYE 697 Line and power Panel, damaged with some components missing but ideal for spares	£2.20 each, 3 for £6.00
Grundig UHF/VHF Varicap Tuner for 1500 GB, 3010 GB	£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
Cassette Mains Leads, 7ft with fig 8 plug	60p each, 3 for £1.50
6 MHZ sound filters, ceramic 3 pin "TAIYO" type	50p each, 3 for £1.00
10.7 MHz Ceramic Filters "Vernitron" FM4	50p each, 3 for £1.00
PYE CT2000 Control Knobs	8 for £1.00
High quality Metal Coax Plug. Grub screw fixing	5 for £1.00, 100 for £12.50
Cassette/Calc Leads. 2m long, figure 8 skt. to flat pin. American plug	60p each, 3 for £1.50
3.5mm Jack Plug on 2m of screened lead	5 for £1.00
Mains Neons	10 for £1.00
Mini Grundig Motors. Regulated, variable.	
2k2 Screenfeed Resistors.	
White ceramic, 9 watt. with fusible link.	8 for £1.00
Phillips 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

THEY'RE BACK

We can now again offer our special **TV BARGAIN PARCELS.** These contain all manner of useful bits and pieces. Components, semiconductors, videogame boards etc. which we have accumulated over the past year and must clear as we need the space.
1kg £3.95
5kg £9.95 **10kg £14.95**

"RIFA"

0·1µ 1000v Flameproof **5 for £1.00**

THYRISTOR

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

CONVERGENCE POTS

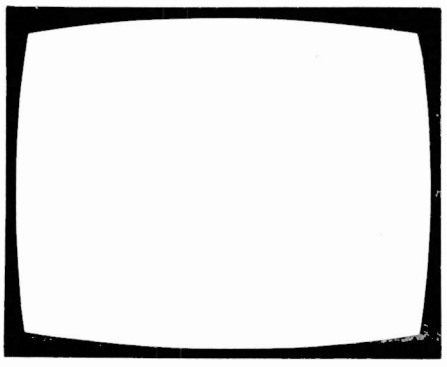
5Ω, 10Ω, 20Ω, 30Ω, 50Ω, 100Ω, 200Ω, 1K. **8 of one type £1.00. 8 of each type £6.00.**

REGULATORS

7812 12v 1a	3 for £1.00
7805 5v 1a	3 for £1.00

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

January 1983

Vol. 33, No. 3
Issue 387

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

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An annual subscription costs £10 in the UK, £11 overseas ($24.20 Canada or USA). Send orders with payment to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

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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").

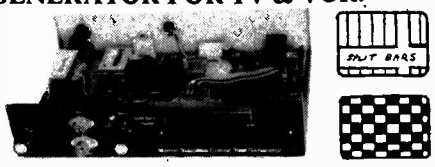
this month

OUR NEXT ISSUE DATED FEBRUARY WILL BE PUBLISHED ON JANUARY 19

MANOR SUPPLIES

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

TEST DEMONSTRATIONS AT 172 WEST END LANE



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

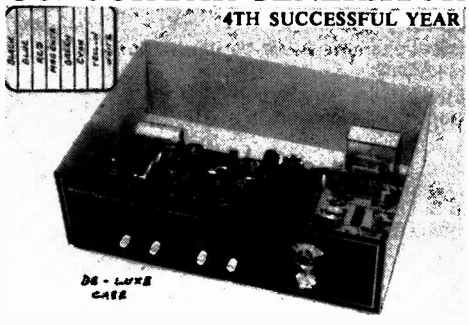
Price of Kit	**£80.50**
Standard Case (10½"×6½"×2½")	**£5.50**
De Luxe Case (10"×6"×2¼")	**£8.50**
Optional Sound Module (6MHz or 5.5MHz)	**£4.50**
Built & Tested in De Luxe Case including Sound Module	**£115.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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

PAL COLOUR BAR GENERATOR (Mk 4)

4TH SUCCESSFUL YEAR



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

PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £40.25 P&P £1.20. DE-LUXE CASE £8.50. ALUMINIUM CASE £3.30, P&P £1.20, BATT HOLDERS £1.70 P&P 85p, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55 (Combined P&P £1.80).

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

(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

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

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

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

SPECIAL OFFER THORN 8000A, 8500 Power & Sound Panels (new and boxed) **£5.75** p.p. £1.25.

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

SPECIAL OFFER Leading makers Tuner-Timer in De Luxe Case. 12 station touch tune UHF-VHF + IF amp. Video Audio Outputs, Digital Clock etc. Less than half original trade price **£74.75** p-p £3.50.
TV SOUND IF PANELS, FULLY TESTED **£7.82** p.p. £1.00.
SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND tested for T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
SPECIAL OFFER TEXAS XMII TELETEXT MODULE NEW & TESTED, AT REDUCED PRICE **£57.50** p.p. £1.60.
TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£7.80** p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 60p. (ALUM CASE **£2.60** DE LUXE CASE **£5.50** p.p. £1.20.) ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £21.60 (VHF version also available). ALUM CASE **£2.00** DE LUXE CASE **£8.50** p.p. £1.80.
CRT TESTER & REACTIVATOR PROJECT. KIT FOR COLOUR & MONO **£29.40** p.p. £2.00.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
DECCA "Bradford" IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, 100 SERIES, IF, FRAME T.B. **£5.75 each** p.p. £1.40.
GEC SERIES I MONO PANELS **£2.10** p.p. £1.30.
GEC 2110 Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
GEC 2040 DECODER PANEL **£2.88** p.p. £1.60.
GEC 2040 IF PANEL **£3.22** p.p. £1.40.
GEC 2040 (SERIES) CDA PANEL **£2.88** p.p. £1.40.
THORN TX9 PANELS ex factory for small spares. Includes I.C.s & Semiconductors etc. **£5.75** p.p. £2.00
THORN 3000 LINE T.B., POWER PCB **£5.75 each** p.p. £1.30.
THORN 3000 CONVERGENCE PANEL **£5.75** p.p. £1.80.
THORN 3000 VID, IF, DEC, Ex Rental **£3.70 each** p.p. £1.30.
THORN 8800 Varicap channel selector & front control unit **£4.37** p.p. £1.80.
THORN 8000/8500 IF/DECODER PANELS salvaged **£3.70** p.p. £1.80.
THORN 8000/8500 FRAME T.B. PANELS salvaged **£2.88** p.p. £1.40.
THORN 9000 LINE T.B. (incl. Lopt etc.), Salv., spares **£8.62** p.p. £2.00.
THORN 9000 SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
THORN 9000 IF/DECODER PANELS Salvaged **£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 **£2.88** p.p. £1.40.
G8 IF Panels for small spares **£1.75** p.p. 95p.
G8 Decoder panels salvaged **£4.25.** Decoder panels for spares **£2.00** p.p. £1.40.
VARICAP, U321, U322, ELC 1043/06 ELC 1043/05 **£7.82** p.p. 80p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. Control units, 3PSN **£1.40,** 4PSN **£1.75,** 5PSN **£2.00,** 6PSN **£4.00** p.p. 60p. Makers special types available.
SPECIAL OFFER ELEVEN POSITION VARICAP CONTROL UNIT UHF/VHF **£2.10** p.p. £1.00.
BUSH "Touch Tune" Varicap Control 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. **UHF** tuners transisted. incl. s/m drive, Mullard 4 position push button **£4.80** p.p. £1.50.
LOPTS NEW & GUAR. P/P Mono **£1.35p,** Colour **£1.45p,** Bobbins **80p.**

BUSH 161 to 186S	£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
DECCA 20/24, 1700, 2000, 2401.	£8.80	R.B.M. T20, T22 Bobbin	£6.44
FERG., HMV, MARCONI, ULTRA 950, 1400, 1500, 1580, 1590, 1591	£6.80	DECCA Bradford (state Mod No.)	£10.15
THORN 1600, 1615, 1690, 1691	£10.50	DECCA 80, 100	£10.15
GEC 2000 to 2038 series	£7.80	GEC 2028	£5.60
GEC series 1 & 2	£9.20	GEC 2040	£6.70
INDESIT 20/24EGB	£8.80	GEC 2110 Series	£12.20
ITT/KB VC1, 200, 300	£8.80	ITT CVC 5 to 9	£11.30
MURPHY 1910 to 2414 series	£6.80	ITT CVC 20	£11.30
PHILIPS 19TG 170, 210, 300	£8.80	ITT CVC25, CVC30 series	£10.15
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	£8.80	PYE 691-697	£14.80
		PYE 713, 715, 731 to 741	£7.85
SPECIAL OFFER		PYE 725 (90°)	£10.60
GEC 2114J/Junior Fineline	£3.25	PHILIPS G8, G9	£10.15
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AD161	0.220	BT116	0.900	7805	0.350	7401	0.110
AD162	0.220	BT119	1.100	7812	0.380	7402	0.120
AF139	0.220	BT120	1.100	7818	0.380	7405	0.100
AF239	0.220	BU126	0.700	7824	0.380	7407	0.200
AU106	1.000	BU205	0.750	7905	0.350	7413	0.190
AU110	1.100	BU208	0.800	78L05	0.300	7414	0.250
BC107	0.070	BU208A	0.850	78L12	0.300	7425	0.110
BC108	0.070	BU326	0.850	78L18	0.300	7441	0.300
BC109	0.070	BU407	0.750	78L24	0.300	7442	0.300
BC147	0.055	BU526	0.800	2SC495	0.700	7447	0.400
BC148	0.055	BY127	0.080	2SC1306	1.000	7473	0.190
BC149	0.055	BY133	0.080	2SC1969	1.300	7474	0.180
BC157	0.055	BY164	0.220	2SC2029	1.200	7475	0.150
BC159	0.055	OA47	0.060	2SC2078	1.200	7485	0.300
BD131	0.250	OC28	1.000	MB3712	1.500	7486	0.160
BD132	0.250	OC29	0.800	TA7205	1.500	7489	1.100
BD135	0.200	OC35	1.000	UPC575	1.000	7490	0.220
BD136	0.200	R2008B	0.800	LM380	0.500	7493	0.250
BD137	0.200	R2010B	0.800	LM381A	0.600	74123	0.160
BD138	0.200	TBA520	0.750			74141	0.250
BD139	0.200	TBA530	0.750			74393	0.500
BD140	0.200	TBA540	0.750			74LS09	0.120
BD144	1.100	TBA550	0.750	**VALVES**		74LS164	0.300
BD150	0.300	TBA560	0.700	0Y802	0.450	74LS197	0.350
BD157	0.380	TBA800	0.350	ECC82	0.400	74LS221	0.420
BD158	0.380	TBA810S	0.600	ECC83	0.430	74LS240	0.580
BD159	0.400	TBA820	0.750	ECC84	0.400	74LS244	0.580
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BD535	0.400	TDA2522	0.800	ECL85	0.570	20 PIN	0.140
BD536	0.400	TDA2530	0.800	ECL86	0.490	22 PIN	0.160
BD537	0.420	TDA2532	0.750	EF80	0.310	24 PIN	0.180
BD538	0.420	TDA2540	0.700	EF85	0.340	28 PIN	0.200
BDX65	0.800	TDA2560	0.700	EF89	0.430	40 PIN	0.250
BF180	0.160	TDA2593	0.800	EY86	0.310		
BF181	0.180	TDA2640	0.800	EY87	0.310	**LED**	
BF194	0.050	TIP29	0.150	PC97	1.000	3mm Red	0.050
BF195	0.050	TIP41A	0.220	PCF802	0.570	3mm Yellow	0.100
BF196	0.060	TIP42A	0.220	PCL81	0.540	3mm Green	0.100
BF199	0.060	TIP2955	0.340	PCL82	0.700	5mm Red	0.050
BF200	0.160	TIP3055	0.340	PCL84	0.500	5mm Yellow	0.100
BF258	0.180	2N3053	0.180	PCL85	0.550	5mm Green	0.100
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MC1351P	1.50	SN76115N	2.27	TAA700	1.70	TCA270SQ	1.25
MC1330P	90	SN76131N	1.30	TAA661B	1.20	TCA800	2.15
MC1349	1.20	SN76226(DN)	1.55	TBA120A	70	TCA940	1.65
MC1350	96	SN76227N	1.18	TBA120S	70	TDA440	2.20
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ML232	2.20	SW153	2.74	TBA440N (TBA1441)	2.75	TDA1190	2.60
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ML239	2.50	TA7108P	3.43	TBA520Q	1.20	TDA1352B	1.60
ML920	4.12	TA7120P	2.43	TBA530(Q)	1.28	TDA1412	1.20
ML922	3.29	TA7130P	1.93	TBA540	1.49	TDA2002	2.50
ML926	2.18	TA7141P	95	TBA550(Q)	1.58	TDA2140	5.95
ML928	2.18	TA7193P	5.67	TBA560Q	1.58	TDA2190	4.70
MRF475	2.50	TA7171P	1.85	TBA570	1.00	TDA2020	4.66
MRF477	10.00	TA7172P	1.85	TBA690	1.50	TDA2030	2.80
MSN5807	7.87	TA7173P	1.85	TBA641BX1	3.50	TDA2521	4.17
PLL02AG	9.89	TA7176P	2.50			TDA2522	2.40
						TDA2523	2.20

TDA2530	2.70
TDA2532	2.45
TDA2524	2.25
TDA2540	3.84
TDA2541	2.65
TDA2560	2.15
TDA2581	2.25
TDA2590	3.25
TDA2591	2.95
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TDA2600	3.70
TDA2611A	1.95
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7812	78	7912	98
7815	78	7915	98
7818	78	7918	98
7824	78	7924	98
78L05	68	79L05	72
78L08	68	79L12	72
78L12	68	79L15	72
78L24	68	79L24	72

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74LS02	19	74LS38	20	74LS93	35	74LS161	60	74LS253	1.00
74LS03	19	74LS40	20	74LS107	46	74LS162	85	74LS257	53
74LS04	20	74LS42	36	74LS109	27	74LS163	60	74LS258	67
74LS05	19	74LS47	80	74LS112	27	74LS164	65	74LS259	74
74LS08	19	74LS48	80	74LS113	27	74LS165	65	74LS273	80
74LS09	19	74LS49	80	74LS114	27	74LS174	57	74LS283	50
74LS10	19	74LS51	19	74LS123	52	74LS175	47	74LS293	70
74LS11	19	74LS54	19	74LS125	46	74LS191	66	74LS352	1.54
74LS13	37	74LS55	19	74LS126	46	74LS192	65	74LS353	1.10
74LS14	46	74LS73	28	74LS132	46	74LS193	66	74LS365	36
74LS15	19	74LS74	26	74LS138	48	74LS194A	69	74LS366	36
74LS20	19	74LS75	46	74LS139	48	74LS197	80	74LS367	36
74LS21	19	74LS76	22	74LS151	44	74LS240	80	74LS368	36
74LS22	19	74LS78	22	74LS153	44	74LS241	80	74LS373	99
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4008B	72	4029B	90	4071B	22	4513B	1.68	4543B	1.12
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4015B	76	4042B	58	4077B	22	4519B	64	4560B	1.76
4016B	31	4043B	71	4078B	22	4520B	76	4561B	74
4017B	66	4044B	71	4081B	22	4521B	1.68	4566B	1.20
4018B	72	4046B	96	4093B	43	4522B	88	4580B	3.60
4020B	76	4047B	70	4094B	1.56	4526B	88	4581B	1.84
4021B	70	4049UB	32	4099B	1.20	4527B	1.20	4582B	80
4022B	70	4050B	32	4160B	72	4528B	88	4583B	1.00
4023B	21	4051B	72	4161B	72	4529B	1.04	4584B	40
4024B	50	4052B	72	4162B	72	4530B	62	4585B	88
4025B	21	4053B	72	4163B	72	4531B	72	4597B	1.84
		4060B	96	4502B	72	4532B	1.00	4598B	2.40
		4066B	43	4505B	1.88	4536B	2.64	4599B	2.00
		4068B	22	4510B	76	4538B	1.04		

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AC126	22	BC107B	20	BC182	9	BC550	7	BD434	55	BF225	20
AC127	22	BC108	20	BC182LB	10	BC557	8	BD437	86	BF241	15
AC128	20	BC108A	20	BC183LB	10	BC558	9	BD438	94	BF256LC	28
AC128K	32	BC108B	20	BC184L/B/C		BCX34	27	BD507	52	BF256	28
AC141K	34	BC108C	20		10	BCY72	13	BD508	55	BF257	28
AC142K	30	BC109	20	BC204	10	BD115	32	BD509	56	BF258	25
AC176	25	BC109B	20	BC208	13	BD116A	65	BD510	60	BF259	24
AC176K	32	BC109C	20	BC209	10	BD124P	60	BD517	60	BF262	84
AC186	41	BC114	12	BC212	9	BD131	33	BD520	75	BF263	50
AC187	26	BC115	17	BC212L	9	BD132	35	BD526	62	BF271	24
AC187K	28	BC116A	12	BC213	9	BD133	40	BD696A	1.49	BF273	12
AC188	25	BC117	20	BC213B	10	BD135	26	BD707	95	BF274	24
AC188K	37	BC118	24	BC213L	9	BD136	27	BDX32	1.50	BF310	30
AD143	82	BC119	36	BC214	9	BD137	26	BF115	35	BF311	30
AD149	79	BC139	26	BC214L	10	BD138	23	BF117	36	BF336	36
AD161	42	BC140	32	BC237B	12	BD139	28	BF125	26	BF337	30
AD161/2		BC141	26	BC238A/B/C		BD140	31	BF127	26	BF338	34
	1.15	BC142	21		8	BD144	1.20	BF154	12	BF355	37
AD162	42	BC143	24	BC251A	12	BD159	65	BF158	18	BF362	37
AF106	49	BC147	9	BC252A	12	BD160	1.30	BF160	27	BF363	33
AF114	89	BC148	9	BC252B	12	BD166	52	BF167	24	BF371	30
AF118	62	BC149	10	BC261A	18	BD179	52	BF173	22	BF457	35
AF121	56	BC157	11	BC261B	15	BD182	72	BF177	35	BF458	28
AF124	34	BC158	10	BC262A	15	BD183	75	BF178	26	BF459	35
AF125	35	BC159	10	BC262B	15	BD201	85	BF179	28	BFR39	27
AF126	34	BC160	25	BC300	33	BD202	80	BF180	36	BFR90	1.74
AF127	32	BC161	28	BC301	28	BD203	80	BF181	36	BFT42	28
AF139	42	BC170B	15	BC303	28	BD204	84	BF182	30	BFT43	28
AF178	1.54	BC171	9	BC307	10	BD222	46	BF183	29	BFW10	60
AF239	45	BC171A	10	BC308A/B	17	BD223	56	BF184	30	BFX29	30
AF279	97	BC171B	10	BC327	11	BD225	47	BF185	30	BFX84	27
AL102	2.00	BC172	9	BC328	9	BD232	45	BF194/394	11	BFX85	28
AU106	2.50	BC172B	10	BC337	11	BD233	35	BF195	11	BFX86	30
AU107	2.00	BC172C	10	BC338	9	BD234	37	BF196	10	BFX88	25
AU110	2.00	BC173C	12	BC461	30	BD235	33	BF197	11	BFY50	20
AU113	1.40	BC174A/B	10	BC547	10	BD236	40	BF198	18	BFY51	22
BC107	20	BC177	27	BC548	10	BD237	33	BF199	15	BFY52	20
				BCX32	30p	BD238	35	BF200	30	BFY90	75

BR100	17	MJE340	40	2N2904	51
BR101	30	MJ3000	1.98	2N2905	28
BR103	59	DT112	1.91	2N3054	60
BRC4443	80	DT121	1.91	2N3055	60
BRX46	40	SW150	3.90	2N3702	11
BRY39	30	SW153A		2N3703	10
BRY56	57		2.74	2N3705	10
BT100/02	92	BU105/02		2N3706	10
BT101	1.20		1.58	2N3708	17
BT102/500R		DC71	27	2N2904	30
	1.20	DC79	20	2N5294	48
BT106	1.60	R2008B	1.80	2N5296	48
BT107	1.69	R2010B	1.80	2N5298	69
BT108	1.69	R2265	1.40	2SB337	1.86
BT116	1.21	R2322	58	2N5496	53
BT119	3.66	R2323	67	2N6107	75
BT120	3.66	R2461	1.50	2N6109	81
BT151/800R		R2540	2.80	2SA715	1.98
	1.20	RCA16334		2SC495	1.10
BU104	2.00		90	2SC496	1.31
BU105	1.25	RCA16335		2SC643A	
BU108	1.80		80		1.50
BU124	1.30	TIP29C	43	2SC1096	1.72
BU126	1.49	TIP30A	47	2SC1172Y	
BU204	1.50	TIP30C	43		2.20
BU205	1.34	TIP31C	55	2SC1173Y	
BU206	1.80	TIP32C	42		1.69
BU208	1.60	TIP33B	75	2SC1306	2.73
BU208A	1.65	TIP41C	46	2SC1307	3.00
BU208/02		TIP42C	47	2SC1449	1.67
	2.10	TIP47	70	2SC1520	68
BU326A	1.42	TIP120	65	2SC1678	2.67
BU407	1.25	TIP2955	90	2SC1909	2.90
BU500	1.95	TIP3055	63	2SC1953	1.44
BU526	2.46	TIS91	21	2SC2028	1.82
BU807	2.94	TV106/02		2SC2029	2.60
BUW81A			1.55	2SC2078	2.90
	3.84	2N696	21	2SC2091	1.34
E1222	28	2N918	82	2SC2186	2.73

I.C. SOCKETS

DIL to DIL

8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	34
24 way	36

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

CERAMIC FILTERS

6Mhz	74
5.5Mhz	74

THERMISTORS

VA1104	75
VA1040	
VA8650	55
VA1039	35
GEC Dual Posistor	1.50
GEC Dual 2040 (CK1)	1.50

CRYSTALS

4.3Mhz	1.30
8.8Mhz	1.30
10.692Mhz	6.00

NEW VALVES

30FL2	1.60	EZ80/1	56	PD500	2.93
DY802	72	GY501	1.45	PFL200	1.35
DY86/7	66	GZ34	1.56	PL36	1.15
ECC81	60	KT66	7.00	PL81	94
ECC82	68	KT88	8.00	PL82	46
ECC83	60	PC86	81	PL83	1.43
ECC84	80	PC88	81	PL84	84
ECC85	98	PC92	90	PL95	1.00
ECC88	1.35	PC97	1.14	PL504	1.50
ECF80	80	PC900	80	PL508	2.90
ECF82	88	PCC84	70	PL509/19	4.50
ECF86	1.50	PCC85	85	PL802	3.25
ECH81	1.04	PCC88	82	PY33	81
ECH84	1.13	PCC89	79	PY88	81
ECL80	84	PCC189	1.02	PY500A	1.90
ECL82	77	PCC805	1.40	PY800/1	69
ECL86	84	PCF80	75	UCF80	67
EF80	68	PCF86	1.13	UCH81	1.43
EF85	68	PCF200	1.35	UCL82	84
EF86	1.19	PCF800	1.38	UCL83	94
EF89	1.43	PCF801	1.13	UL84	1.02
EF183	68	PCF802	86	U26	1.30
EF184	68	PCF805	1.80	U191	95
EH90	1.02	PCF806	1.30	6F23	85
EL34	3.50	PCF808	1.63	UY85	80
EL81	2.05	PCH200	1.45	PL802T	3.00
EL84	68	PCL82	78	40KD6	5.30
EL90	82	PCL84	81	21LU8	3.00
EL509	4.50	PCL85/805	90	17DW4A	1.60
EY86/7	68	PCL86	81	3AT2B	2.25
EY500A	1.50			12BY7A	3.75

LINE OUTPUT TRANS.

R.B.M. T20A	13.95
R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	17.50
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 691/3	17.75
PYE 697 (Printed)	14.50
PYE 713/731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80/100	8.50
DECCA 1700	9.00
DECCA 1730	8.50
DECCA 2230	8.50
GEC 2110	9.45
GEC 2040	9.50
GEC 2200	8.65
ITT CVC 1-9	9.60
ITT CVC 25/30/32	8.00
ITT CVC 20	7.75
THORN 3000 EHT	6.90
THORN 3000 SCAN	6.90
THORN 8000	11.33
THORN 8500	11.33
THORN9000	10.65
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN 9800	18.00
THORN TX10	12.50
THORN 1615	9.75

L.E.D.'s

5mm

T1 ¾ PACKAGE

Red	12
Green	14
Yellow	14
Amber	22

T1 PACKAGE

3mm

Red	12
Green	14
Yellow	14

FLASHING L.E.D.

COX21	62
COX22 RED ONLY	66

THREE COLOUR L.E.D.

3 Colour options Red/Green/Yellow

V518P	76

PANEL CLIPS

For stnd. range L.E.D. as above

3mm	4
5mm	4

REBUILT COLOUR TUBES

ALL AVAILABLE EX-STOCK ON GLASS FOR GLASS EXCHANGE BASIS FROM TRADE COUNTER

17" A44/271X	30.00
18" A47/343X (Stnd Focus)	30.00
18" A47/342X (Low Focus)	30.00
19" A49/120X	30.00
20" A51/110X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
25" A63/200X	34.00
26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (400) 110°	36.00
26" A66/140X (410) 110°	36.00
26" A51/161X	50.00
22" A56/510X	50.00

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

NB Mail Order supplies of tubes. We will send 12" + 14" portable for £5 carriage. For 20" + 24" Mono and all Colour tubes please ring for quotes on next day delivery service and quotes for the return of old glass. Certain tube types can be supplied without a glass exchange with a basic glass charge incurred. Please ask – we will try to help.

NEW MONO TUBES

MULLARD A31/510 110° 12"	18.50	A61/120WR 24"	16.90
MULLARD A34/510 110° 14"	28.00	VEGA 12" 90° (Japanese Types)	15.00
A50/120WR 20"	14.50	CME1520 (15" Mono)	15.00

*CARBON RESISTORS

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

WIREWOUND RESISTORS*

(Preferred Values)*

4W 1R-10K	20p each
7W 1R-22K	21p each
11W 1R-22K	24p each
17W 1R-22K	28p each

MULLARD COLOUREX/ NEW LIFE

18" A47/343X	59.00
19" A49/120X	53.00
20" A51/110X	53.00
22" A56/120X	43.00
25" A63/200X	55.00
26" A66/120X	53.00
26" A67/120X	53.00

SPECIFIC COMPONENTS

PHILIPS

G8 Knobs S	50
G11 EHT Final Anode Lead	1.50
E.W. Correction Coil G11	1.95
Transductor 90°	2.60

THORN

1591 Speakers Sm	4.10
Lg	4.50
1500 Frame Hold 390K	32
1500 Line Hole 470K	32
1500 Contrast 1K5	32
Focus Control Thorn/GEC	1.83
8500 Mains Filter Choke	4.99
8500 Focus Unit	4.75
TX9 Focus Controls	3.50

DECCA 100

Bridge Transformer	97
30 Series Width Control	50
3R9 Modulohm	60
Height Control 2M2	25
RR1 T20 Focus Control	2.20

PYE

731 Mains Filter Choke	4.99

SOLDERING EQUIPMENT

Solder Iron Stands	2.50
WELLER Iron 15W	4.31
WELLER Iron 25W	4.31
WELLER 3/16" Single Flat Tip	51
MIN Soldering Iron	5.00
WELLER Heat Gun	11.75
(Pair) Tips for Gun	42
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	5.20
Solder Remover Sucker	6.50
Solda Mop	72
500G Reel Solder	7.00
DIY Type Solder	43
250G Solder	3.50

CHANNEL 4

Aerials, coax cables, splitter combiners etc. and a full range of aerial equipment available from trade counter.

P. V. TUBES

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	2.12
PHILIPS 320 (400/400/200V)	2.07
DECCA 30 (400/400/350V)	2.96
DECCA 80 (400/350V)	3.15
DECCA 100 (800/250V)	3.15
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.21
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.39
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.26
RBM A823 (600/300V)	2.30
RBM Z146 (300/300/350V)	3.15
RR1 T20A (220/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.47
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 140 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.01
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.46
THORN 3500 (1000/63V)	65
THORN 3500 (1000/70V)	84
THORN 8000/8500 (2500/2500/63V)	1.54
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.05
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25

CAPACITORS AXIAL

Volts	Mfd	Price
6V3	33	9
10V	22	8
	47	8
	100	10
	220	12
	470	20
16V	33	11
	68	11
	220	14
	1000	20
	3300	53
25V	10	8
	22	8
	47	10
	100	12
	220	19
	470	24
	1000	38
	2200	48
	4700	80
40V	10	10
	22	10
	400	30
63V	1	8
	2 2	8
	4.7	8
	10	10
	15	12
	22	10
	47	18
	100	20
	220	32
	470	40
	1000	56
	2200	85
100V	10	13
	22	15
	47	20
	100	29
	220	35
450	1	25
	4.7	30
	10	30
	22	58
	33	64
500	1	32
	10	32
600	1	35

MIXEO DIELECTRIC CAPS

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

CERAMIC CAPACITORS

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

DISC CERAMIC CAPACITORS

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

ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	7.60
Mullard ELC1043/06	7.60
4 P/B DECCA/GEC/ITT	5.80
6 P/B DECCA/GEC/ITT	7.00
4 P/B PYE	9.00
6 P/B PYE	16.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass (Square/Early)	13.50
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.75
U321 UHF Tuner Mullard	7.50
THORN 8800 SELECTOR (HMV Model 2725/6 way round button)	7.50
THORN 9000 SELECTOR	11.40
U322	7.20
HITACHI 4 way Chan. Selector (Also Rank A823)	8.00
RR1 T20A 6 way Chan. Selector	9.75
RR1 T20/22/26	11.00
PHILIPS 8 way TIP Switch Unit (suitable for all G11)	23.00
ITT CVC8 (5 wheel modified).	£12

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/Push	66
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/Off	66
A1 Beam Switch (THORN 3500)	70
A1 Controls 5m (THORN 3500)	69
GEC 2110 A1 Control IM5 (Red, Blue, Green)	58
GEC 2040 On/Off Switch	88
On/Off Switch G11/G12	1.58
On/Off Switch GEC/TCE TX9/10	1.06

FUSES

	Per type	Pack of 10
1¼" QUICK BLOW		
100ma		73
250ma-500ma-750ma-1A		54
1 5A-2A-2 5A-3A-5A		45
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1 25A		
1 5A, 2A		1.60
2 5A, 3A, 5A		2.49
20m ANTISURGE		
80ma		3.43
100ma		2.30
160ma, 200ma		2.09
315ma, 500ma, 630ma, 800ma, 1A, 1 25A, 1 6A, 2A		1.18
2 5A, 3 15A		1.53
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		81
1A, 1 25A, 1 6A, 2A, 2.5A, 3 15A, 5A		40
1" MAINS		
2A, 3A, 5A, 10A, 13A		91

AERIAL ACCESS.

Surface Mount. Splitter	1.70
Surface Mount Outlets	80
Cable Clips per 100	1.18
Coax Plugs per 10	1.80
P.V.C Tape	35
F.M. Plugs	25
PL259 Plugs	40
Line Connectors	35
Reducers for PL259	16
T.V. Filter 50db Rejection 27mhz	2.10
Attenuators 6db, 12db, 18db	1.60
Olympic II Set Top	2.20
M.H.A.P.U. the pair	18.00
Aerial Isolator Kit	2.08
4m Fly Lead	1.20
2m Fly Lead	90

ANTIFERENCE

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

MINIATURE SKELETON PRESET POTS

Horizontal or Vertical

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

STANDARD SKELETON PRESET POTS

Horizontal or Vertical

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

SLIDER POTENTIOMETERS

Lin or Log

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

MIOGET CONTROLS

Insulated Spindle Length 44mm

Log or Lin Without Switch
5K-10K-25K-50K-100K-250K-500K-1M **39p**
With D.P.S.T. Switch
Log: 5K-10K-25K-50K-100K **81p**
250K, 500K, 1M, 2M Dual gang Controls **1.25**
16mm Rotary Controls 10K, 22K, 100K, 1M, 10K **39p**

THERMAL CUT OUT

THORN 3000 2A Metal	1.60
THORN 8500 2 5 Plastic	1.60
GEC 2040 Metal	2.50

MULTITURN POTS

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

THICK FILM RESISTOR NETWORK

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

EAGLE PRODUCTS

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

DF615 Full Range Speaker 6½"		8.95
Multimeters		
KEW 7N	2,000 opv	5.25
KEW 20		14.50
EM5	5,000 opv	9.95
EM10	10,000 opv	11.50
EM50	50,000 opv	19.95
EMC321 Carrying Case for above		2.25
Digital Meter TS1000		44.50
MM20	20,000 O.P.V	21.95
MM50	50,000 O.P.V.	25.95
MM100	100,000 O.P.V	36.50
MMT20		16.95
Case for MM100		15.95
T1206 2 Station Intercom		6.95

DATA BOOKS (No VAT)

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

Please ensure that you order out of the latest magazine to avoid missing some inevitable price changes.

ELECTROLUBE PROOUCTS

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

CONVERGENCE PRE-SETS

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

METRIC CONVERGENCE POTS

PHILIPS G8
5R-10R-20R-50R 35

EVER READY

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

EVER READY RECHARGEABLE BATTERIES

CHARGERS

CH1/22 For PP3/NN1604 6.40
1 battery (RX22)

CH4/50 For HP7/NN1500 5.55
1-4 batteries (RX6)

CH3/RX6 For SP2/HP2/NN1300
SP11/HP11/NN1400
HP7/NN1500 14.00
2-4-6 batteries in pairs. (RX6-RX14-RX20)

CH3/RX4 For SP2/HP2/NN1300
SP11/HP11/NN1400
HP7/NN1500 9.55
2-4 batteries in pairs (RX6-RX14-RX20)

BATTERIES

RX6 - HP7/NN1500	1.39
RX14 - SP11/HP11/NN1400	2.17
RX20 - SP2/HP2/NN1300	2.34
RX22 - PP3/NN1604	4.69

VIDEO/AUDIO

VHS E30	£3.80
E60	£4.20
Scotch E120 Video Tape	5.35
E180 Video Tape	6.15
Beta L500	5.35
L750	£7
Philips VCC 240	7.62
VCC 360	10.36
VCC 480	15.50
VIDEO CASSETTE CASES	
Red/Blue/Green/Brown	80p
Book Type - Any Format	
Scotch Audio Tape	
C90 Ferric	65p
C90 Super Ferric	96p
Video Recorder Heads	
VHS	£38
Philips V2000	52.00

Coloured Book Type Video Cases. Any Format. 8 on carved wooden stand 15.50

PANELS + UNITS

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

SUNDRY TUNER ACCESS.

RANK Tuner P B	
1⅜" × ½"-2" × ⅜"-2" × ⅜"	35
RANK Drive Cams	10
GEC 2110 Tuner Neons	14

SUNDRIES

Delay Lines DL60, DL700, DL50	2.20
CRT Tube Base	70
EHT Final Anode Cap	53
EHT Cable	25p mtr.
6.3V CRT Boost Trans	4.35
13A Plug Top box 12	4.80
Quick Set Adhesive	78
Moulded Plastic Hex 6mm Trim Tools	10
Double End 4mm/8mm Trim Tools	20
Focus Rod	1.25
Focus Holder	2.00
Keynector Safe Block (mains)	5.50
Cassette Drive Belts per pack of 5	
44.5mm	1.65
64mm	1.71
74mm	1.80
57mm	1.65
89mm	1.90
Torch (handy for tool box)	42
I.C Inserter	1.18
SM Neon Screwdriver	40
DIN Plugs 3 pin	22
4 pin	22
180° 5 pin	20
Stnd 5 pin	20
Phono Plugs	12
Car Aerial Plug	18
2.5mm Jack Plug	14
3.5mm Jack Plug	14
Stnd Jack Plug	20
Stereo Jack Plug	36
5A Connector Block (12)	40
Fuse Wire 5A-15A-30A	5
Battery Plug Thorn TV's	28
Gen. Purpose Power Supply 9V 200ma 12V 200ma	3.25
Mains Connector 4 way 13A	5.00

TEST EQUIPMENT

Portable Oscilloscope	150.00
Probes x10	10.90
TF200 Frequency Meter	155.00
CRT Tester/Rejuvenator	172.00
KHP30 Measuring Probe (3 okv) EHT	29.95
T120 RF Signal Injector	4.00
Avo 8 Test Lead Set	4.20
Degaussing Coil (stick type)	£17

SERVICE AIDS

SERVISOL Freeze-It	92
SUPER SERVISOL	84
SERVISOL Foam Cleanser	82
SERVISOL Plastics Seal	85
SERVISOL Silicone Grease	98
SERVISOL Tubes Silicone Grease	1.56
SERVISOL Aero Klene	72
SERVISOL Aero Duster	90
SERVISOL Excel Polish	74
SERVISOL Video Head Cleaner	80
Penetrating Fluid	70
Fire Extinguisher 640G	2.60
Heat Sink Compound 25G	1.05
Silicone Rubber Tube 110G	2.98
Solda Mop standard reel	72

LABGEAR

CM7061 Power Unit 12V	10.19
CM7062 Reg. Power Unit 12V	11.11
CM7060 MHA 10db 12V W/B	8.51
CM7065 VHF UHF MHA W/B 12V	12.39
CM7067 UHF 12V MHA (Specify A-B or C/D)	9.26
CM7068 UHF 12V MHA High Gain (Specify A-B or C/D)	13.78
CM7053 Behind Set UHF Amp (Mains)	11.24
CM7054 Behind Set UHF Amp (Battery e g Caravans)	9.00
CM7043 Second Set Amp UHF	10.47
CM7093 Behind Set UHF Amp 3 Sets	13.20
CM7063 Dist Amp VHF/UHF 17db/output 12V	19.14
CM7073 VHF/UHF 8+1 Dist Amp	37.37
CM9700 27mhz CB Suppress	3.50
CM6011 Outdoor Splitter (2 way) W/B	6.76
CM9003 Flush Single Outlet	1.27
CM9010 Flush Twin Outlet	1.69
CM9034 UHF Group Filters with DC Through Pass (state A/B/CD).	6.64
CM6006 6 Way Passive Splitter	10.97
CM7042 TV Games Combin	2.43
CM9009 Flush TV/FM Outlet	2.63
CM7069 Tri Star Amplified Set Top Aerial W/B	16.75
CM7090 Amplified Caravan Aerial 12V DC W/B	14.78
CM6038 UHF/VHF 625 Pattern Gen	91.47
CM6052 UHF/VHF PAL Colour Bar Gen	223.86

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	4.55
THORN 1500 5 Stick	4.95
THORN 1600	3.90
THORN 3000/3500	7.39
THORN 8000	4.25
THORN 8500/8800	6.10
THORN 9000	7.93
DECCA 1730/1830	4.08
DECCA 1910/2213 Bradford	5.92
DECCA 30	6.26
DECCA 80	6.40
DECCA 100	6.14
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	5.79
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	6.35
PHILIPS G8 Long Focus 550	6.35
PHILIPS G9	6.37
Pye/Philips K3 Tnpler	6.6F
PYE 691/3	5.83
PYE 713/4 Lead	7.00
PYE 713 Doubler 5 Lead	7.50
Philips/Pye KT3	6.67
PYE 731/25	6.75
R B M A823 (plug in) AV	6.45
R B M A823	6.45
KORTING (similar to Siemens TVK1)	6.65
ITT KB CVC5/9	5.95
ITT KB CVC20/25/30 (Mullard)	5.95
RRI T20	6.80

RECTIFIER STICKS

TV11	74	TV18	81
TV13	75	TV20	95

MAINS DROPPERS

DECCA 20	2.20
DECCA 2R5	85
DFCCA 27R/47R	1.40
DECCA 56R/6R8	1.40
R B M A823	88
R B M 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 713/15 3R5/15/45R	1.70
PYE 725/31 3R0/56R/27R	1.19
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2k85	1.75
PHILIPS 210/5051 -/118R/148R	93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	95
THORN 1400	1.15
THORN 1500	1.32
THORN 1600	1.60
THORN 3500	94
THORN 8000	96
THORN 8500	88

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA317	26
BAX13	4
BAX16	8
BB105B	30
BB105G	30
BY126	12
BY127	11
BY133	15
BY164	45
BY176	85
BY179	63
BY182	87
BY184	55
BY199	28
BY206	14
BY210/600	28
BY210/800	33
BY223	90
BY227	28
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX36/600	35
BYX55/600	30
BYX71/600	90
OA47	9
OA90	10
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	5
IN4007	6
IN4148	2
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	16
ITT44	4
ITT2002	11
Y969 (30V Thorn 3500)	89
BZV15-24R	1.18
BZV-15-12R	1.18

ZENER DIODES

BZX61/85 (1.3W) 20 6V2-7V5-8V2-9V1-10V-11V-12V-13V-15V etc up to 75V	**BZY93C** 18v 1.18 **BZY88 (400MW)** 10 2V7-3V-3V3-3V6-3V9-4V3-4V7-5V1 etc up to 24V

HOW TO ORDER

ADD 65p per order for Post and Packing (UK) (Export orders will be charged at cost)
THEN ADD 15% VAT TO TOTAL COST.
Orders which contain aerosols or degaussing coils are very heavy - please add extra 30p per can/coil
First Class Mail is used whenever possible.
All enquiries S.A.E. please.
VAT invoice on request.
SEE SPECIAL NOTE RE MAIL ORDER TUBE COSTS.
Goods are despatched on the day we receive your order If for any reason we are out of stock we will try to inform you as quickly as possible
We try our best to give a speedy fair and efficient service As our regular customers know, orders telephoned in before 4 p m will be despatched the same day
Give us a ring - we'll give you service
Please ask if what you need is not listed - we will try to help

POST A PART, ELECTRONICS.

SEMICONDUCTORS

BC153	10p	BD131	25p	BU126	1.00p
BC154	10p	BD183	1.00p	ME0404	7p
BC171	7p	BF137	20p	ME0412	7p
BC172	7p	BF240	8p	ME6002	7p
BC208	7p	BF255	10p	NKT241	7p
BC237	10p	BF256c	35p	NKT276	20p
BC238	7p	BF256LC	35p	PN107	7p
BC250	7p	BF257	30p	R2010B	1.00p
BC251	7p	BF259	40p	R2443	25p
BC307	10p	BF274	10p	R2540	1.00p
BC308	7p	BF337	25p	R2781	1.25p
BC347	7p	BF391	7p	RCA16446	30p
BC394	7p	BF394	8p	TIS90	20p
BC455	7p	BF458	80p	TIS91	20p
BC546	7p	BF596	7p	2N2193	7p
BC549	7p	BFR87	25p	2N3703	20p
BC556	7p	BU105	75p	2SA473	12p
BC559	7p	BU108	1.00p	2SC346	7p
BC595	7p	BU207	1.00p	TIC106C	30p
BCX34	10p	BU208	1.00p	R2265	1.35p

MIXED PACKS

300 mixed resistors	1.50	20 mixed valve bases	1.00
300 mixed capacitors	1.50	10 spark gaps	1.00
150 mixed electrolytics	2.00	10-16 pin Quil IC socket	90p
100 W W resistors	1.00	20 assorted T V knobs	1.00
20 mixed conv pots	1.00	10-16 pin Quil to Dil IC socket	90p
40 mixed potentiometers	1.50	100 mixed diodes	1.00
20 mixed sliders	1.00	50 mixed mica washers	65p
40 mixed presets	60p	300 mixed resistors & capacitors	1.50
20 mixed VDR & thermistors	1.00	10-16 pin Dil to Dil IC socket	1.00
20 mixed ferrite cores	50p		

DIODES

AA112	8p	BZU15C12R		IN2070	8p
AA119	8p		14p	IN5254B	8p
AA143	8p	BY204	8p	IN4742A	8p
BA115	8p	BYX22/400	8p	IS025	8p
BA131	8p	BZY79C 20V		IS1858	8p
BA154	8p		8p	ITT638 CV9	
BA157	8p	DA002	8p		6p
BB103	8p	IM102255	8p	ZX150	8p
BR303	26p	IN60	8p	SKE1/02	18p
BY127	12p	IN5349	8p	MR854	30p
BY133	10p			MCR406	35p

INTEGRATED CIRCUITS

BAV40	50p	SN74123N	40p	TBA480	1.00
BRC/M/200	1.00	SN74154N	1.40	TBA1440C	1.00
BRC/M/300	1.00	SN76110N	40p	TDA2680	40p
DM74123N	50p	SN6622N	40p	TDA2680A	40p
SN15846N	40p	TAA570	1.00	TBA540	90p

General purpose mono scan coils Thorn etc. 3.40
Tube base ITT CVC32 85p
Thorn 8000 red green blue static controls and blue lateral control 3.75
Thorn 8000 coil L401 55p
Thorn 8000 coil L701 2.3 25p
Keying shift pot 50R 75p
Philips G9 tone delay line 1.25
7 segment display red Toshibar TLR306 1.45
4 segment display red Toshibar TLR307 1.10
4 push button switch assy, 20K resistance 2.55
3500 4 push button unit plus knobs Thorn 3 cap 1.00
Most values of presets available. Horizontal or vertical miniature or standard 10 of any value 1.00

E.H.T. TRAYS

Thorn 8000 EHT doubler	3.12	Thorn 4000	5.00
LP1174	3.50	Pye 18" early type	3.50
PYE731	4.00	Pye 18" late type	4.00
Thorn 8500	5.00	Thorn 900/950	2.50
Thorn 9000	5.00	Thorn 3000	6.00

E.H.T. STICK FOR THORN

950/1400/1500 triplers E.C.T. type 80/150 5p
E.H.T. stick. 83/200 5p

FUSES 20mm

50MA	10 for 70p	500MA	10 for 40p
315MA	10 for 50p	1 Amp	10 for 40p

Thorn 3000 metal 2A cut out 1.25
Thorn 8500 plastic 2.5A cut out 1.25
Degauss thermistor PT37P ITT/GEC 25p
+ fits some Pye/Bush etc.
Degauss VDR type E299D/H P230 3000/8000 25p

TRANSFORMERS/LOPT

Mains TX 3000/3500	10.00
Mains TX 8000/8500	10.00
S.O.P.T. 8000/8500	3.50
3000/3500 Scan TX	6.00
3000/3500 EHT TX	6.00
8000 LOPT	9.35
8500 LOPT	10.65
9000 LOPT	10.15
Mono portable LOPT. Thorn, GEC, etc.	3.75
Mullard diode splitting LOPT. GEC, etc.	14.75

DROPPERS

Pye 78+161	40p
Pye 147+280	40p
Thorn 6+1+100 3K	50p
Thorn 56+1K+47+12	1.00
Thorn 350+20+148+1K5+317	1.00
Thorn 50+40+1K5	50p
RBM 250+14+58TV161	50p
3R5 + 15R + 45R 28W Working @ 140+140 28W	90p 40p

3000 8500 Thorn focus pot 1.25
9000 Thorn focus pot 1.00
IC inserters 16 pin 50p
Large IC extractor 50p
Crystals 4.433619MHz 50p
EHT lead for split diode LOPT 1.00
Litesold 20 watt 240V soldering iron element 65p each or 4 for 2.00
EHT final anode cap 47p
6MHz ceramic filter 30p
ITT bridge rec FXS 244 2A 15p
Castors sets of 4 2.50
Direct panel mounting 20mm fuse clips pair for 25p

WIRE WOUNDS

1.5R 5W Thorn 3K	30p	270R 5W	15p
2R 5W Thorn 3K	30p	270R 7W	16p
2.2R 4W	15p	280R 17W	23p
3.3R 9W	30p	330R 5W	15p
4R 11W fusible	25p	330R 7W	16p
7R 9W fusible	25p	330R 11W fusible Thorn	25p
8.2 7W	15p	370R 17W	23p
10R 7W	15p	820R 4W	15p
12R 9W	20p	1K2 9W Thorn 3K/4K	18p
15R 5W fusible	25p	1K2 11W fusible	25p
15R 7W	16p	2K2 5W fusible	25p
15R 11W Thorn 3K	30p	2K2 7W	16p
15R 17W	23p	2K2 7W fusible	25p
22R 4W	15p	2K2 9W fusible	25p
22R 9W fusible	25p	2K3 5W	15p
27R 7W	16p	2K7 9W fusible	25p
27R 7W fusible	25p	3K9 5W fusible	25p
36R 17W	23p	3K3 4W	15p
82R 4W	15p	4K7 7W fusible	25p
82R 9W fusible	25p	5K1 7W	16p
100R 5W fusible	25p	8K2 7W	15p
220R 7W Korting fusible	30p	8K2 9W 8K Thorn	23p
220R 17W	23p	10K 7W	15p
235R 9W fusible	25p	10K 9W	16p
240R 9W Thorn 4K	30p	39K 4W	15p

8500 IF decoder panel Ex-equipment untested 4.75
Mains on off switch rotary 20p
Mains on off switch push 20p
A1 switch Thorn 3000 3500 50p
A1 switch Thorn 4000 - less ITT Pye 50p
A1 pot 5M 3000 3500 70p
100K 40 turn pots for v cap tuners 25p
Double fuse holder on small pax board (20mm type) 10p
Single fuse holder on small pax board (20mm type) 5p
In line fuse holder (1" type) 50p

Ex-equipment untested 3000 3500 panels any specified panel 3.75
UHF aerial socket & lead Pye ITT Thorn 25p
UHF aerial socket & lead GEC 25p
UHF aerial socket & long lead GEC 35p
UHF aerial socket & mounting bracket for Thorn 4000 40p
UHF TV aerial for portable 50p
625 aerials + fittings available. Price list on request
Coax plugs 12p
Switched fuse holder aerial outlet (white) 1.20

CARBON RESISTORS

12R ¼W, 22R ¼W, 27R ¼W, 39R ¼W, 56R ¼W, 56R ½W, 62R 1W, 68R ¼W, 68R ½W, 68R ¼W, 75R ½W, 82R ¼W, 100R ¼W, 120R ¼W, 120R ½W, 130R 2W, 150R ¼W, 180R 1W, 220R ¼W, 220R 2W, 240R ¼W, 240R R1W, 270R ¼W, 270R 1W, 300R ¼W, 330R ¼W, 470R ¼W, 560R ¼W, 680R ¼W, 820R R½W, 820R1W, 1K ¼W, 1K 1W, 1K2W, 1K 5¼W, 1K 5.1W, 1K 8¼W, 2K 2.1W, 2K 7.1W, 4K 7¼W, 11K ¼W, 12K ¼W, 18K 2W, 22K 1W, 33K ¼W, 36K ¼W, 47K ¼W, 68K ¼W, 100K ¼W, 110K ¼W, 270K ¼W, 330K ¼W, 330K 1W, 390K ¼W, 500K ¼W, 1MEG ¼W, 1MEG 2W, 2M 2½W, 2M 7¼W, 4M 7.1W, 10M ¾W any 10 for 25p

Thorn 9K thick film units FR1 or FR3 1.25
10 Meg thick film focus resistor 65p

EX-EQUIPMENT SPARES

Conversion plug 3000 3500 1.75
Scart lead 3000 3500 2.75
please state which
8000 8500 LB (tested) 50p each
L501 L502 L503 L504 T502 T501
8000 8500 PS1 (tested) 50p each
T502 T401
4000 3500 characteristic filter DL401 (tested) 65p
8000 8500 time delay line DL501 (tested) 65p
8500 (tested) 50p each
T751 T752 T753 T754
3000 3500 frame output transformer (tested) 1.00

CAPACITORS

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

Any 10 @ £1.00

ELECTROLYTICS

1MF 63V	20/£1	100MF 100V	10/£1
1.5MF 63V	20/£1	100MF 160V	10/£1
2.2MF 25V	20/£1	125MF 16V	10/£1
4MF 64V	20/£1	150MF 25V	20/£1
4MF 350V	10/£1	160MF 25V	20/£1
6.8MF 40V	20/£1	160MF 40V	10/£1
10MF 40V	20/£1	220MF 40V	10/£1
10MF 160V	10/£1	250MF 25V	10/£1
15MF 16V	20/£1	330MF 10V	20/£1
15MF 63V	20/£1	330MF 35V	10/£1
22MF 10V	20/£1	330MF 63V	10/£1
22MF 40V	20/£1	470MF 6.3V	20/£1
22MF 63V	20/£1	470MF 10V	10/£1
22MF 160V	10/£1	470MF 25V	10/£1
32MF 275V	10/£1	470MF 40V	10/£1
33MF 40V	20/£1	640MF 10V	20/£1
33MF 50V	20/£1	680MF 16V	20/£1
33MF 250V	10/£1	680MF 40V	10/£1
47MF 350V	10/£1	1000MF 10V	10/£1
50MF 25V	20/£1	1500MF 16V	10/£1
68MF 250V	10/£1	2200MF 25V	6/£1
100MF 18V	10/£1	3300MF 25V	10/£1

MULTI SECTION CAPACITORS

175+175+175+100 350V Thorn	2.00	200+200+100 350V	70p
100+150+50+50 350V	50p	200+100+50+300V	65p
200+100+100+100 350V	50p	150+150+100+300V Thorn 1K5	1.90
2500+2500+8V Thorn 8K	1.20	32+32+16 350V 32+32+16 300V	40p 30p
200+100+100+50 350V	50p	200+100+32 325V 200+47 250V	70p 65p

CAN TYPES

2MF 20V	50p	800MF 250V	70p
22MF 375V	50p	1250MF 30V	50p
50MF 350V	50p	1250MF 50V	50p
100MF 250V	65p	1500MF 70V Thorn 8K	1.00
220MF 400V Thorn 8K	1.30	2000MF 30V	50p
200MF 450V Thorn 8K	1.30	2200MF 40V Thorn 8K	1.00
400MF 350V Thorn 8K	90p	2500MF 25V	65p
800MF 250V print type	80p	2500MF 30V	65p
		3000MF 25V	50p
		3300MF 25V	60p

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30,000 opv Including test leads and case.
AC volts - 0·25-10-25-100-250-500-1,000
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DC current - 0-50ua 0-5ma-50ma 0-12amps
Resistance - 0-6K ohms-70K ohms-6meg ohms-60meg ohms
Decibels - -20db to plus 56db
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Dims - 160 x 110 x 50mm

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Miniature round nose side cutters insulated handles 3½inch length Order No YO43

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Miniature end nippers insulated handles 4¼inch length Order No YO46

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All with insulated handles

ALL AT 1.25 each

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A flexible shaft screwdriver for those awkward to get at screws Overall length 8¾inch Order No FS·1 Flat blade 4mm FS·2 Cross point no 1 £1.75 each

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6inch long screwdriver with spring loaded grip on end to hold screws in position while reaching into those difficult places Order No SD·1 Flat blade 4mm SD·2 Cross point no 0 95p each

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Set of 5 BA spanner shafts plus universal handle in roll-up wallet Sizes 0BA 2·4·6·8BA Order no T192 £2.75 set

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7½in blade order no NS1 £0.65p each
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Satisfaction or your money back has always been BI-PAK's GUARANTEE and it still is All these Sale items are in stock in quantity and we will despatch the same day as your order is received

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Glass Type similar IN4000 SERIES IN4001-IN4004
50 — 500v — uncoded — you select for VLTS
ALL perfect devices — NO duds Min 50v
50 for £1.00 — worth double ORDER NO SX76

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Like BC182L — 183L — 184L
VCBO 45 VCEO 30 IC200mA Hfe 100-400

ALL perfect devices — uncoded ORDER AS SX183L
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£2.00 £3.50 £15.00 £25.00
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DIGITAL VOLT METER MODULE

3 x 7 segment displays Basic Circuit 0-2V± instructions provided to extend voltage & current ranges Operating voltage 9-12v Typ Power Consumption 50mA
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ELECTRONIC SIREN 12v DC

Red plastic case with adjustable fixing bracket 6mm high pitched warbling tone at varying pitch 100 cycles per minute
Dims 98mm (dia) 60mm (depth)
Power 12 v DC
Our Price:- £5.50

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The lowest price ever.

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Pin	10 off	50 off	100 off
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TO220	Positive +	Negative +
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	7815 — 50p	7915 — 55p
	7824 — 50p	7924 — 55p

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A selection of Large & Small size LED's in Red, Green, Yellow and Clear, plus shaped devices of different types. 7 Segment displays, photo transistors, emitters and detectors.
Types like MEL11, FPT100 etc. Plus Cadmium Cell ORP12 and germ photo transistor OCP71

O/NO SX57A
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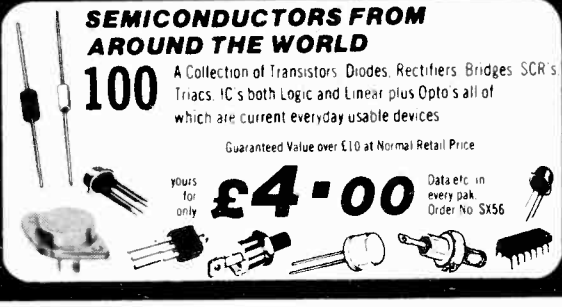

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Universal Ni-Cad battery charger All plastic case with lift up lid Charge/Test switch LED indicators at each of the five charging points

Charges —	Power —
PP3 (9V)	220-240V AC
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U11 (1·5V 'C')	210 x 100 x 50mm
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Power supply fits directly into 13 amp socket
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Input — 240V AC 50HZ Output —3 4 5 6 7·5 9 & 12V DC Rating — 300 ma MW88

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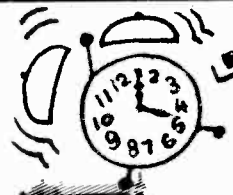

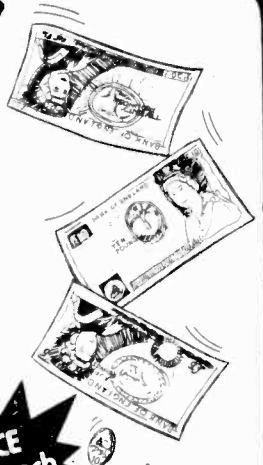

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Immediately tells the condition of a suspect LOFT without desoldering or removal.

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Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.58	BC377	0.29	BD234	0.68	BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.63	BF224 & J	0.22	BR101	0.83	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
AC126	0.38	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63	BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68	BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
AC128	0.46	BC107*	0.16	BC207*	0.37	BC461	0.78	BD23B	0.68	BF244*	0.51	BRC4443	1.75	MPSU60	0.82	2N696	0.46	2N3905	0.20
AC128K	0.55	BC108*	0.15	BC208*	0.37	BC477	0.30	BD253	1.58	BF245*	0.43	BRY39	0.60	MPU131	0.59	2N697	0.46	2N3906	0.20
AC141	0.65	BC109*	0.16	BC209*	0.39	BC478	0.25	BD410	1.65	BF254	0.48	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.65	BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70	BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
AC142K	0.65	BC115	0.24	BC212L*	0.17	BC548*	0.13	BD436	0.71	BF257	0.47	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	0.17
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD437	0.74	BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
AC152	0.36	BC117	0.30	BC213L*	0.16	BC550	0.24	BD438	0.75	BF259	0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	0.32
AC153	0.42	BC118	0.24	BC214*	0.18	BC556	0.23	BD519	0.88	BF262	0.73	BU102	2.85	OC44	0.68	2N1164	10.29	2N4292	0.32
AC153K	0.52	BC119	0.34	BC214L*	0.18	BC557*	0.16	BD520	0.88	BF263	0.88	BU105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.16	BD599	0.87	BF270	0.47	BU105/02	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
AC176	0.45	BC126	0.30	BC237*	0.16	BC559*	0.17	BD600	1.23	BF271	0.47	BU108	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
AC178	0.51	BC132	0.20	BC238*	0.15	BCY10	0.30	BD663BR	0.86	BF273	0.33	BU126	2.91	OC72	0.73	2N1307	1.32	2N5042	1.85
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	BDX1B	1.55	BF274	0.34	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BDX32	2.95	BF336	0.63	BU205	2.58	OCB1D	0.95	2N1711	0.47	2N5061	0.30
AC187K	0.65	BC136	0.22	BC252*	0.26	BCY34A	1.02	BDY16A	0.63	BF337	0.65	BU206	2.59	OC139	1.30	2N1893	0.52	2N5084	0.63
AC188	0.52	BC137	0.30	BC253*	0.38	BCY72	0.27	BDY18	1.55	BF338	0.68	BU208	2.75	OC140	1.35	2N2102	0.71	2N5086	0.49
AC188K	0.61	BC138	0.352	BC261A*	0.28	BD115	1.35	BDY20	2.29	BF355	0.72	BU407	1.38	OC170	0.80	2N2217	0.55	2N5087	0.50
AC193K	0.70	BC140	0.36	BC262A*	0.28	BD123	1.50	BDY38	1.38	BF362	0.49	C106D	0.80	OC171	0.82	2N2218	0.38	2N5208	0.59
AC194K	0.74	BC141	0.44	BC263*	0.26	BD124	1.85	BF115	0.48	BF363	0.49	C106F	0.43	OC200	3.90	2N2219	0.42	2N5294	0.66
ACY17	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF367	0.29	C111E	0.46	OC201	3.95	2N2221A	0.26	2N5296	0.68
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF451	0.43	D40N1	0.64	OC202	2.40	2N2222A	0.41	2N529B	0.71
ACY2B	0.96	BC147*	0.12	BC2B6	0.40	BD132	0.68	BF121	0.85	BF457	0.46	E300	0.42	OC205	3.95	2N2369A	0.40	2N5322	1.16
ACY39	2.02	BC148*	0.12	BC2B7	0.49	BD133	0.70	BF123	0.48	BF45B	0.49	ET222	0.47	OCP71	1.98	2N2401	0.80	2N5449	0.18
AD140	1.79	BC149*	0.13	BC291	0.27	BD135	0.37	BF125	0.55	BF459	0.52	E5024	0.19	ON236A	0.94	2N2484	0.35	2N5457	0.46
AD142	1.90	BC152	0.42	BC294	0.37	BD136	0.38	BF127	0.51	BF594	0.16	GET872	0.46	R2008B	2.72	2N2570	0.74	2N545B	0.40
AD143	1.78	BC153	0.38	BC297	0.36	BD137	0.40	BF137F	0.78	BF596	0.17	ME0402	0.18	R2010B	2.79	2N2646	0.82	2N5459	0.58
AD149	1.42	BC154	0.41	BC300	0.62	BD138	0.42	BF152	0.19	BF597	0.27	MF0404/02	0.18	R2322	0.75	2N27B4	1.15	2N5494	0.85
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF15B	0.25	BFR39	0.30	ME6001	0.18	R2323	0.85	2N2869	2.08	2N5496	1.06
AD161/162	1.22	BC158*	0.12	BC302	0.86	BD140	0.50	BF159	0.27	BFR40	0.29	ME6002	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
AD162	0.71	BC159*	0.14	BC303	0.64	BD144	2.24	BF160	0.20	BFR41	0.30	MJ2955	1.30	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	1.32	BC160	0.52	BC304	0.44	BD145	0.76	BF161	0.84	BFR50	0.29	MJ3000	1.58	TIC44	0.25	2N2905*	0.39	2N6122	0.80
AF115	1.26	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65	BFR52	0.33	MJE340	0.68	TIC46	0.35	2N2906*	0.36	2N617B	1.07
AF116	1.28	BC167B	0.16	BC308*	0.14	BD155	0.90	BF164	0.98	BFR61	0.29	MJE341	0.72	TIC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	1.32	BC16BB	0.14	BC309*	0.18	BD157	0.51	BF166	0.50	BFR62	0.28	MJE370	0.74	TIP29A	0.47	2N2926O	0.14	2N6211	2.74
AF11B	0.98	BC169C	0.15	BC317*	0.15	BD15B	0.75	BF167	0.38	BFR79	0.30	MJE371	0.79	TIP30A	0.50	2N2926Y	0.14	2SB337BP	4.28
AF121	0.68	BC170*	0.15	BC318*	0.15	BD159	0.68	BF173	0.35	BFRB0	0.29	MJE520	0.85	TIP31A	0.51	2N2955	1.12	2SC458C	0.78
AF124	0.38	BC171*	0.15	BC319*	0.19	BD160	2.69	BF177	0.36	BFRB1	0.30	MJE521	0.95	TIP31C	0.67	2N3053	0.48	2SC643A	2.25
AF125	0.38	BC172*	0.14	BC320	0.17	BD163	0.67	BF17B	0.46	BFRB8	0.42	MJE2955	1.20	TIP32A	0.56	2N3054	0.86	2SC930D	1.50
AF126	0.36	BC173*	0.22	BC321A&B	0.15	BD165	0.66	BF179	0.58	BFT41	0.48	MJE3000	1.95	TIP32C	0.72	2N3055	0.72	2SC1061	1.45
AF127	0.86	BC174A & B		BC322	0.28	BD166	0.88	BF1B0	0.53	BFT43	0.55	MJE3055	1.22	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.55
AF139	0.58		0.26	BC323	1.15	BD175	0.90	BF1B1	0.53	BFW11	1.02	MPF102	0.40	TIP34A	0.84	2N3254	0.58	2SD234	1.48
AF147	0.52	BC176	0.22	BC327	0.18	BD177	0.58	BF1B2	0.44	BFW30	2.58	MPS3702	0.33	TIP41A	0.72	2N3391A	0.38	3N12B	1.60
AF149	0.45	BC177*	0.20	BC32B	0.18	BD17B	0.92	BF1B3	0.52	BFW59	0.19	MPS3705	0.30	TIP42A	0.80	2N3633	0.60	40250	0.98
AF17B	1.35	BC178*	0.22	BC337	0.17	BD1B1	1.94	BF1B4	0.44	BFW60	0.20	MPS6521	0.36	TIP2955	0.77	2N3703	0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC33B	0.17	BD1B2	2.10	BF185	0.42	BFW90	1.65	MPS6523	0.36	TIP3055	0.58	2N3704	0.19	40327	0.67
AF180	1.35	BC182*	0.15	BC340	0.19	BD1B3	1.34	BF186	0.42	BFX29	0.38	MPS6566	0.44	TIS43	0.44	2N3705	0.17	40361	0.48
AF181	1.33	BC182L*	0.15	BC347*	0.17	BD1B4	2.30	BF194*	0.14	BFX84	0.42	MPSA05	0.30	TIS73	1.36	2N3706	0.16	40362	0.50
AF186	1.48	BC183*	0.14	BC34BA & B		BD187	1.20	BF195*	0.13	BFY50	0.38	MPSA06	0.32	TIS90	0.23	2N3707	0.18	40410	0.94
AF202	0.27	BC183L*	0.14		0.17	BD1BB	1.25	BF196	0.14	BFY51	0.37	MPSA55	0.43	TIS91	0.28	2N3708	0.17	40429	0.88
AF239	0.73	BC184*	0.15	BC349B	0.17	BD1B9	0.71	BF197	0.15	BFY52	0.36	MPSA56	0.45	ZTX108	0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	0.15	BC350*	0.24	BD222	0.91	BF19B	0.29	BFY53	0.36	MPSA93	0.56	ZTX109	0.16	2N3771	2.09	40595	1.39
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29	BFY90	1.98	MPSL01	0.33	ZTX213	0.2	2N3772	2.08	40603	1.13
AL100	1.30	BC1B6	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25	BPX25	1.62	MPSU01	0.61	ZTX300	0.16	2N3773	2.90	40636	1.25
AL103	2.55	BC187	0.27	BC360	0.69	BD233	0.62	BF218	0.42					ZTX304	0.26	2N3794	0.40	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
CA3020A	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*	1.66
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC400B	0.85
MFC4060A	0.98
MFC8040	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
SN76023ND	1.40
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	3.85
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	2.85
TAA621AXI	4.75
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.32
TBA240A	3.98
TBA2B1	2.07
TBA395*	2.56
TBA396	2.40
TBA400	2.20
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
TBA6418X1	4.60
TBA651	2.42
TBA673	2.31
TBA700*	2.60
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
TCAB20	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	3.85
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	1.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

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

* Indicates Q version is also available.

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25 × AU110 for **£40.00**

DIODES

Type	Price (£)
AA113	0.17
AA119	0.21
AA129	0.28
AA143	0.18
AAY30	0.28
AAZ13	0.42
AAZ15	0.35
AAZ17	0.28
AY102	3.85
BA100	0.24
BA102	0.36
BA104	0.18
BA110	0.80
BA111	0.70
BA115	0.17
BA116	0.86
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
BA31B	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
BY114	0.60
BY11B	1.10
BY126	0.20
BY127	0.21
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY1B2	1.14
BY1B4	0.44
BY1B9	5.30
BY190	4.90
BY206	0.26
BY23B	0.25
BYX10	0.30
BYX3B/600	0.70
BYX70/500	0.53
ITT44	0.08
ITT210	0.83
ITT827	0.80
MCR101	0.45
MR854	1.10
OA5	0.88
OA10	0.58
OA47	0.20
OAB1	0.19
OA90	0.13
OA91	0.15
OA95	0.20
OA200	0.13
OA202	0.13
OA210	0.89
TIL209	0.14
TIL211	0.18
TV20	2.25
IN914	0.06
IN916	0.06
IN4001	0.06
IN4002	0.07
IN4003	0.08
IN4004	0.08
IN4005	0.09
IN4006	0.10
IN4007	0.12
IN5400	0.15
IN5401	0.17
IN5402	0.20
IS920	0.09
IS921	0.11

ZENER DIODES

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

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A25B	0.25
E29BED	
/A25B	0.22
/A26O	0.22
/A26Z	0.22
/A26S	0.22
/P26B	0.22
E29BZZ	
/05	0.25
/08	0.22
E299DD/P116-P354	all 0.23
E29BDH	
/P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055a/56a/66a/67a	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.68
VA110B/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF80B	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 (£)
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400V	0.40
600V	0.50
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200V	0.65
400V	0.61
600V	0.67
800V	0.80
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Wirewound (5%)

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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)
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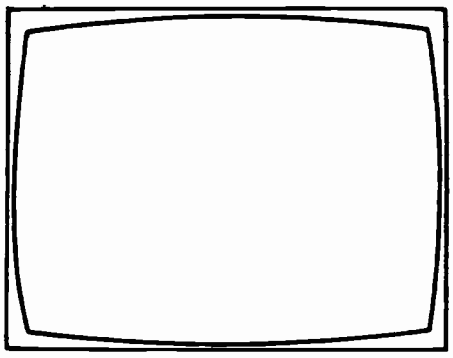

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PRICE INCREASE
Our annual price adjustment takes effect next month. From the February issue the price of *Television* will be 90p.

READERS' PCB SERVICE
Due to shortage of space in the present issue it has not been possible to include the usual Readers' PCB Service box. The details given last month (page 99) still apply.

CORRECTION
The triple-standard JVC VCR mentioned last month (page 71) should have been shown as Model HR3330TR, not HR3330TS.

COVER PHOTO
This month's cover photo shows the new Philips CTX chassis. Our thanks to Philips Video for the loan set provided.

Who wants a better picture?

Ever since the start of TV effort has been put into improving the quality of the picture. Baird's extraordinary 30-line pictures got things going, with experimental transmissions that commenced back in 1930. The pictures suffered from poor contrast, weak sync and lack of resolution, but served to prove the point. Giant steps had been taken by 1936, when the BBC's 405-line transmissions started. EMI had developed the cameras and the electronics to make this possible. In subsequent years good pictures became better as pick-up tube technology advanced. Development in the UK came to a halt in 1939, when all effort had to be switched to radar, and was slow to resume after the war. Meanwhile further giant strides were being taken in the USA, first with the 525-line system and then in the early 50s with colour.

From the start, TV has been an optical illusion – a wholly effective one. As the technology advances the illusion gets better, but in contrast the public by and large shows little interest. This is unfortunate for the TV trade and industry. A more critical public would be prepared to spend more on TV equipment, benefitting the trade and encouraging technological innovation. But you have to try awfully hard to get the UK public to take to new developments. Think how difficult it's been putting teletext across. Until, by juggling the trade terms, teletext came almost for free the public wasn't interested!

Time and again the old point about the public happily viewing sets that produce atrocious pictures has been made. This is perhaps not as surprising as it may appear to the professionals. Sets deteriorate gradually, and the viewer adjusts – sometimes until things get so bad that sync is lost! Then again, are sets actually watched or are they switched on to provide video wallpaper? I'd hazard a guess and say that most sets get switched on and are then paid attention to only when the odd item grabs the family's interest. If this is in fact general telly behaviour, it's not surprising that there's little criticism of or interest in picture quality. Most of what's wrong with the pictures actually viewed is the fault of the owner and his set, and as it's all part of the great illusion the public settles for what it will tolerate. More recently the public has quite happily accepted VCR pictures of less than broadcast specification. Philips are pushing LaserVision discs in part on the basis of the superior picture and sound they provide, and quite right too. But the public is more likely to respond to the fact that the discs are relatively cheap.

While people contentedly watch bleary, over coloured pictures, the video technology continues to race ahead. At the same time the burgeoning electronics industry ensures that new technology can be made available to the public at bargain prices (imagine what the cost of a teletext decoder using thermionic diodes and triode bistables would be!). We've now arrived at a point where the provision of much improved TV pictures can be looked forward to. Satellite TV is opening up all sorts of prospects. The great problem is that this involves delicate decisions about the best course to follow, decisions that can have a profound influence for better or worse for years to come. It's not helped by the fact that the public couldn't care less so long as the old soap operas keep coming up in some sort of visible form.

A few months back we reported, in connection with an NHK demonstration to the EBU General Assembly at Killarney, CBS's head of engineering and development Joe Flaherty's comment that "somewhere during the period 1986-90 a high-definition television system is going to do to the current generation of domestic TV systems what colour did to black-and-white in the 60s." One feels that 1986 is rather too close a date considering the politics and economics of such a development, but by 1990 well, yes, it's decidedly feasible, though the operative word so far as the UK is concerned is probably "somewhere"!

What would it have? More lines of course – 1,125 in the NHK system – and maybe, again as in the NHK system, an aspect ratio of 5:3. The improved resolution offered by a system with some 1,000 lines makes a vast improvement with a large display, and large displays are part of what high-definition TV is all about. But in practice the public has tended to opt for smaller screen sizes in recent years! Certainly projection TV, which would benefit enormously from an increased number of lines, is never likely to catch on to any great extent. People just don't live in rooms of a size that justifies it. The real puzzle to this commentator is why anyone should want to muck about with the aspect ratio. The traditional 4:3 was not something that was adopted for some compromise reason. It's roughly the ratio that's common to the stage, most films, photographs and so on. It seems to tally with the basic human field of vision. Cinemascope may be all right for film epics, but for most purposes it's not how one looks at the world.

Satellite transmissions are likely to be free of those irritating colour patterning effects, probably the biggest defect at present. It would also be nice to get rid of the annoying picture jitter associated with the field frequency, though no one seems to be tackling that one.

The UK has to try to keep in the forefront of the development of TV technology. We've always been there, and the future of our TV industry depends on our staying there. But one wonders whether the public will be all that interested in what it can be offered. It's all too likely that if the cable operators get going the public will settle for a rock-bottom system which it'll happily watch on clapped out old tellys!

Long-distance Television

Roger Bunney

OCTOBER was a busy month: lots of news and reception. Before plunging in however Clive Athowe (Norwich) has been in contact regarding his exotic reception during the excellent tropospheric opening on September 14-15th. It seems that he broke all records with a Band III tropospheric catch on the 14th at 2315BST – a channel E11 signal from JRT (Yugoslavia). The EBU list suggests that the signal came from Vlasic (600kW e.r.p.). Our congratulations to Clive on this quite remarkable reception. Ray Davies (also Norwich) comments that the following morning produced TSS (USSR) on channels R21-29 inclusive and in addition three Band III channels!

Reception during October was widespread and varied, the month ending with another short but spectacular tropospheric opening. For many enthusiasts this was better even than the September 14-15th opening. Here are some of the more interesting loggings:

6/10/82 RTVE (Spain) chs. E2-4; ZTV (Zimbabwe) ch. E2 (TE).
8/10/82 Unidentified F2 signals from the SSE during the mid-afternoon on ch. E3.
9/10/82 RTVE E2-3; RTP (Portugal) E2-4.
10/10/82 RTVE E3; RAI (Italy) IA; SR (Sweden) E2. These signals appeared during an SpE opening at 1400. GBC (Ghana) ch. E2, very strong, at 1400-1600 via F2; later ZTV via TE.
15/10/82 RTVE E2-4, including an E4 Madrid relay; TSS R1-2; MTV (Hungary) R1. Unidentified F2 signal at 1230 on ch. E2.
16/10/82 RTVE E2, 3.
17/10/82 TSS R1 very strong; Dubai E2; afternoon F2 reception from the south with ZTV and GBC ch. E2.
18/10/82 RTVE E2-4; NRK (Norway) E2. Also Dubai E2 via F2.
19/10/82 NRK E2, SR E4.
20/10/82 RTVE E2. Good MS (meteor shower) reception reported.
21/10/82 TSS R1 via F2.
23/10/82 TSS R1.
24/10/82 RTVE E2-4; RTVE-2 E2; RTP E3, 4. Note that RTVE-2 Santiago is still on air!
26/10/82 SR E2; NRK E2; TSS R1, 2.
27/10/82 JRT E2.
28/10/82 GBC E2 via F2.
31/10/82 RTVE E2.

Reception via SpE unless otherwise indicated.

There was a tropospheric lift on the 19/20th, with W. German signals along the east coast. The main tropospheric event came on the night of the 29th/daytime 30th, when a slow-moving high pressure system lifted to give Band III/u.h.f. signals at high strength from central/eastern Europe – the u.h.f. band looked more like conditions associated with SpE! TVP (Poland) and CST (Czechoslovakia) were widely received in Band III and at u.h.f. I was alerted by Trevor Rose (Lowestoft) who got in touch to report the wide-open conditions, with his reception of CST chs. R22 and 32, and thanks to him I logged for the first time at Romsey CST-1 from Usti Nad Laben on ch. R12.

Signals came mostly from the east and south east, with TDF (France) swamping the bands. Clive Athowe received two ORF (Austrian) Band III stations, three DFF (GDR) transmitters and CST chs. R7 and R11. Hugh Cocks (E. Sussex) reported CST and TVP throughout Band III. Several enthusiasts just switched off due to the u.h.f. band being jammed up with programmes! At his screened location at New Radnor, Wales, Simon Hamer received several ARD (W. German) transmitters plus BRT/RTB (Belgium) and NOS (Holland) in Band III and at u.h.f., the signals coming in "thick and fast". Conditions were best early in the morning on the 30th, continuing through to the afternoon when the signals started to fade. CST was still visible at close down, but next morning produced a dead u.h.f. band.

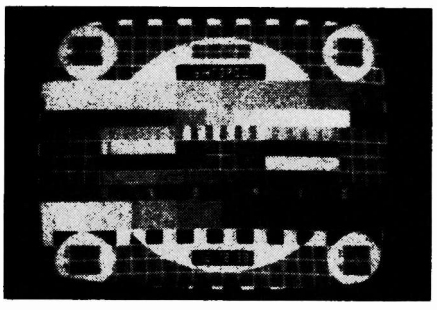
Improving F2 conditions were confirmed by reception of very low-level Australian ch. 0 signals on the 26th. Though some F2 signals are arriving, it's evident that conditions are not nearly as good as last Autumn. I suspect that this may be the last season for Band I activity during the present sunspot cycle.

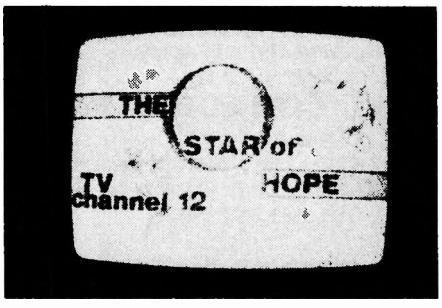
Thanks to Hugh Cocks, Clive Athowe, Ray Davies, Simon Hamer, Trevor Rose, Robin Crossley (St. Albans), Cyril Willis (Ely), Arthur Milliken (Wigan), Graeme Wilson (Middlesborough), David Moller (Eastbourne) and our Dutch correspondents Ryn Muntjewerff and Gosta van der Linden for reception reports.

News Items

Japan: A teletext service was started in the Tokyo area during December, with facilities provided by the Tokyo Broadcasting Company.

Luxembourg: Hugh Cocks has been monitoring high-level





Left: Litvius TV, Western USSR ch. R8, received via tropospheric propagation on September 14th. Centre: Ryn Muntjewerff's mystery signal now identified as Uzhgorod, USSR. Right: "The Star of Hope" identification, ch. E12,a pirate once offshore Cyprus.

test signals from RTL on ch. E7 – at higher signal strengths than the transmissions prior to the collapse of the mast. System B has been used for these tests – RTL normally uses system C (positive-going video) on ch. E7. There are rumours of a standards change to system B. A u.h.f. transmitter to provide a system B service to Holland and Belgium is understood to be under construction at Marnach – a signal has been noted on ch. E23.

In brief: A Basque language TV service, Euskal-Telebista, is due to commence early this year – no connection with RTVE. The RTVE-3 regional service is to start first in Andalusia ... To prevent video copying, identifications are increasingly being inserted on films/serials. ARD (W. Germany) includes the identification for 30 seconds in every fifteen minutes at the upper right corner, ZDF similarly at the upper right and the BR third programme at the upper left. TSI (Switzerland) inserts RTSI in each corner in sequence for 15 seconds each minute. TMC (Monte Carlo) has the insertion at the upper right.

Meteor Showers

The dates for the main 1983 meteor showers are as follows – our thanks for these to George Spalding, Director Meteor Section of the BAA.

Quadrantids (strong shower)	January 1-6, peaking at 0600 GMT (plus/minus a few hours) on the 4th.
Lyrids (weak)	April 19-25, peaking on the 22nd.
May Aquarids (moderate)	April 24-May 20, peaking on the 5th.
Delta Aquarids (moderate)	July 15-August 20, peaking on the 28th.
Perseids (strong)	July 23-August 20, peaking on the 12th.
Orionids (moderate)	October 16-26, peaking on the 20/22nd.
Taurids (weak)	October 20-November 30, peaking on the 1-10th.
Leonids (weak)	November 15-20, peaking on the 17th.
Geminids (strong)	December 7-15, peaking on the 13th.
Ursids (weak)	December 17-24, peaking on the 22nd.

DX-TV Clubs

From time to time I receive letters asking whether there's a local DX-TV club. Unfortunately clubs are few and far between, though interest has been growing in recent years. Here's a club update.

DX/TV RX Group. Formed by Dave Lauder, 18 Burnside Close, Barnet, Herts EN5 5LN. First news letter currently available. Send s.a.e. for first issue. A further six first class post stamps will ensure receipt of the following three issues which will appear at intervals of about three months.

Cyril Willis is considering publishing a DX-TV magazine from 17 Main St., Little Downham, Ely, Cambs. CB6 2ST. Anyone interested in contributing etc. should send a s.a.e. with details to Cyril.

Tele-Audiovision is a German TV/FM-DX magazine of relatively high quality containing a short English translation. Photographs are included and the present

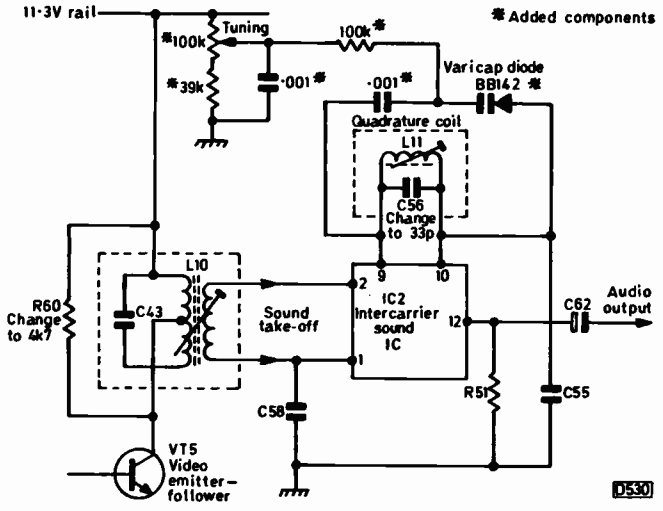


Fig. 1: Robin Crossley's tunable sound i.f. circuit. To align, set the potentiometer mid-way, tune in a 6MHz signal and peak L10/11 for maximum sound. Tune in 5·5 and 6MHz transmissions and check the potentiometer's tuning range (should exceed ±1·5MHz about centre). Repeak if necessary.

issue has 62 pages plus cover. A sample subscription (three issues) is offered for ten IRC or 10DM. Write to Tele-Audiovision, Postfach 801965, D-8000 Munchen 80, W. Germany.

The Benelux DX Club produces a similarly high-quality folded A4 offset-format bulletin covering SW, Utility, FM and TV with extensive photographs and news, reception logs and English summaries. Annual membership of this Dutch club costs f39. Details and a sample can be obtained from the Benelux DX Club, Postbus 1306, 6501 BH Nijmegen, Netherlands for three IRC.

The French DX-TV club AFATELD publishes five bulletins a year called "Television sans Frontieres" containing on average some 24 A4 stapled format typed/Xerox pages, all in French. Photographs, diagrams, reviews and loggings are included. Annual subscription outside France costs 120 francs. Write to AFATELD, Siege Social, Place de Mons, Cenac 33360, Latresne, France. Include four IRCs for a sample.

Variable Intercarrier Sound

Standard system I receivers have a sound i.f. of 6MHz, making it impossible to resolve the 5·5MHz system B/G sound or the 6·5MHz system D sound. Robin Crossley has been giving thought to this problem and has come up with a system of tunable i.f. working which he's incorporated in his sets (Ferguson monochrome portables fitted with the Thorn 1690 chassis). The modifications required are shown in Fig. 1. Other chassis could be modified along similar lines. Our thanks to Robin for his research and for passing on the information.

From our Correspondents . . .

Ryn Muntjewerff received a mystery Russian electronic test pattern with identification back in August (see photo). This has been identified by Igor Hajek, who is now living in California, as coming from the Uzhgorod transmitter in the western USSR. We've been unable to resolve what the Cyrillic identification "ORPS" on a similar electronic pattern signifies.

Mel Thurlburn has recently returned from Cyprus where he kept up his TV-DXing. He's sent us several interesting photos, including a unique "Star of Hope" identification from the Israeli offshore pirate on ch. E12.

Jim Maden (Vereeniging, S. Africa) is now using a 12ft dish mounted at 30ft on his lattice mast to receive the Russian Ekran/Stat-T satellite TV transmissions at 714MHz. This has produced a startling improvement, with virtually noise-free monochrome pictures and good quality sound. The elevation to the satellite at Jim's location is virtually 0°.

The May column featured a ZX81 programme devised by Petri Pöppönen for DX-TV use. Ian Mitchell (Westerham, Kent) has since sent us a variation which tends to help as you go along and avoids a "crash" half way through: major additions are storage of your own coordinates (receiving site) so that only those of the distant transmitter need to be entered, and the ability to produce a print out.

Nick Harold (Essex) reports successful reception of the Russian 4GHz satellite transmissions with equipment which is virtually all home made. Despite using a 4ft diameter dish with a focal length of only 12in. – unsuitable for such a relatively low microwave frequency since it was originally designed for 9·4GHz radar use – Nick is receiving good quality SECAM colour plus sound from Gorizont 1 (3·675MHz), and noisy monochrome signals from Gorizont 4 (3·825GHz) and Gorizont 5 (3·875GHz). We hope to give further details of Nick's equipment next month.

Simple 4GHz Receiver

The simple 4GHz satellite receiver I described in the November issue provided an output at 70MHz. It's prompted questions about what to do with this if you don't have a suitable tuner, e.g. an ELC2000 or ET021 varicap tuner that covers this part of the spectrum. A natty solution was given in the May 1982 issue of *Radio-Electronics*. A high-speed flip-flop i.c. is used as a divide-by-two circuit (see Fig. 2) following a 70MHz bandpass filter and amplifier. The input is fed to pin 6 of the i.c., the 35MHz output being taken from pin 3. This is fed to a phase-locked loop detector (NE564 etc.). The 1kΩ bias potentiometer connected between pins 14/15 is adjusted to bias the flip-flop so that the 70MHz input makes it switch. Since the bias source and the flip-flop are on the same chip, temperature compensation is provided.

The same article describes a suitable 70MHz bandpass filter. The November 1982 issue of the BATC magazine *CQ-TV* also describes such a filter. The May-July 1982 issues of *Radio-Electronics* featured a series on a satellite receiver and are well worth getting (it didn't include the feed horn electronics package with 4GHz low-noise amplifier — input to the receiver is at 4GHz). *Radio-Electronics* is published by Gernsback Publications Inc., 200 Park Avenue South, New York, NY 100003. Individual copies cost $1·25 each.

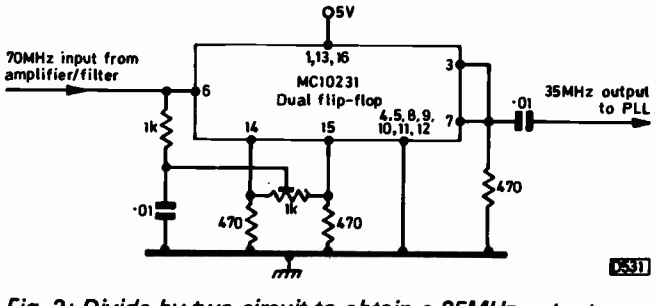


Fig. 2: Divide-by-two circuit to obtain a 35MHz output.

Test Report

Eugene Trundle

INNOVATIVE design, new features and techniques are very much the rule these days in consumer electronics equipment. One sometimes feels that it's very difficult to keep up with all these developments. Great improvements are also being made in the field of test equipment, though most of us have used the same sort of tackle for servicing for many years – a reasonably sensitive 10MHz oscilloscope, a good multimeter, perhaps a digital multimeter and such other gear as we may be able to afford.

It was with great interest then that I noticed the announcement of a new oscilloscope intended specifically for TV and video servicing, with several new features. I was fortunate in securing one for review.

Features and Construction

Briefly, the Scopex 14D-10V is a 2mV, 10MHz scope with a 10 × 8cm screen, X-Y facilities, a TV trigger circuit and a timebase delay system for accurate examination of individual TV lines. It's a big oscilloscope, and remarkably light since the usual 50Hz mains transformer has been dispensed with. Its place is taken by a switch-mode power supply, with mains isolation provided by a surprisingly small ferrite transformer. The circuit is of the Siemens self-oscillating chopper type, similar to that used in the Rank T20/T22 chassis, the Tandberg CTV2 series and many others. An interesting feature is the method of mains input voltage selection – when 110V operation is required, a single link is fitted to turn the mains bridge rectifier and reservoir capacitors into a voltage doubler.

Inside the scope I found a single large PCB for most of the circuitry, with thirteen i.c.s. A smaller PCB at the rear, behind a screening can, houses the switch-mode power supply. The front panel-mounted potentiometers are similar to those used in certain TV sets. I've known them to give trouble, but if it was ever necessary they are easy enough to replace. The case is of sheet aluminium, with a plastic front panel, the tilt stand doubling as a carrying handle. A comprehensive instruction manual is supplied, complete with circuit diagram, calibration instructions and circuit description. This is a useful point. Coupled with the fact that many of the components used are standard, readily-available types, any maintenance necessary should be easy.

Y Amplifiers

The Y amplifiers have twelve fixed-gain settings between 2mV and 10V per division. These days a sensitivity of 2mV/division is becoming more important for many applications, and in the 14D-10V the Y amplifiers each consist of a wideband i.c. differential amplifier driving a complementary transistor chain for push-pull deflection of the c.r.t. beam. There's push-

button selection of dual- or single-trace operation, and for X-Y operation channel A drives the X deflection system. The X-Y mode is useful to have, even with the reduced bandwidth of 500kHz on the X axis, and who knows what applications we may find for it in the future?

Further manipulation of the Y select push-buttons brings us to the add and invert facilities. In the add mode the sum of the A and B (Y1 and Y2) signals appears as a single trace. The crudest use I found for this was to double the sensitivity by connecting both probes to the same point! When B invert is selected in this mode the A and B signals are subtracted, the result appearing as a single trace. Thus equal amplitude, in-phase signals cancel, leaving a straight line across the screen. This mode is very useful where small signals ride on large waveforms as the latter can be cancelled out. This mode also shows up glitches in digital equipment, phase shifts, and provides amplitude and gain checks in any "dual" system. With the probes on a common signal source it's also a very severe test of gain balance in the scope itself – the review machine came through this test well.

For certain applications in the differential mode the lack of a continuously variable gain control on at least one Y channel is a slight handicap – on the other hand its absence prevents errors due to its misadjustment! The 2-5-10 sequence of the gain switch is quite adequate for normal use.

Trigger and Timebase

The range of sweep speeds provided was suitable for all the servicing requirements I had, and it was seldom necessary to make use of the X5 magnification facility on the X axis (this robs the display of some brightness). The 2-5-10 sequence is again followed for the sweep-speed selector, with no continuously variable control. The sweep is linear and well within the quoted calibration accuracy.

An active TV sync separator is incorporated. I got good solid lock from composite waveforms, even filtered chroma. No complaints here. Much ado is often made by users of scopes about the trigger performance of this instrument and that. I've always felt that external triggering is a far better idea, giving solid lock regardless of the displayed waveform's changing amplitude and polarity. We are getting used to having to do this in VCR servicing, where a great deal of work is done with the scope locked to field-rate reference pulses. In the Scopex instrument, external sync is conveniently applied to a third BNC front panel mounted socket, which deserves a probe of its own.

Sweep output and probe test sockets are provided, the former for use with a wobbulator, the latter a useful and quick means of setting up the compression trimmer in the body of the divider probe.

Display

The c.r.t. is the heart of an oscilloscope, and the type of tube used depends very much on the cost of the instrument. In the £300 price range you'll usually get a non-PDA (post-deflection acceleration) tube, and this is the type used in the 14D-10V. It operates at a respectable 2kV e.h.t., and the 10 × 8 screen is larger than with most comparable scopes. The focus and brightness are reasonable, though the review model had a slight tendency to astigmatism at high brightness levels. For optimum focus, medium brightness is to be preferred.

ABRIDGED SPECIFICATION

Vertical System

Dual-trace: Chopped (at 110kHz) up to 1msec/cm, alternate at higher sweep speeds.
Sensitivity: 2mV/div. to 10V/div. in 12 ranges. 1-2-5 sequence.
Accuracy: ±3%.
Bandwidth: D.C. to 10MHz – 3dB. 3Hz to 10MHz a.c. coupled.
Rise time: 35μsec.
Maximum input voltage: 400V peak.
Input impedance: 1MΩ/33pF to BNC socket.
Operating modes: Dual, single, X-Y (500kHz), add, invert B.

Horizontal System

Sweep Speeds: 1μsec/div. to 100msec/div. in 16 ranges. 1-2-5 sequence.
Accuracy: ±3%.
Magnifier: X5 (increases fastest sweep to 200nsec/div.).
Sweep output: 1.5-10V sawtooth at rear panel.

Trigger System

Sources: Vertical channel A or external.
Modes: Normal, TV line, TV field, delayed.
TV delay: Continuously adjustable, line 17 to line 312.
Bright line auto: Free-running sweep with no trigger signal (facility to disable).
Polarity and level: Selected by front panel controls.

Display

Graticule: 10 × 8 divisions. 1 division = 1cm.
CRT: P31 phosphor standard, P7 optional, operated at 2kV.
Trace locate: Returns over-scanned trace to display area.

General

Power supply: 210-250V or 105-125V a.c., 50/60Hz, 25VA.
Dimensions: 153mm high × 312mm wide × 435mm deep.
Weight: 5kg.
Optional extras: High-impedance probes, protectomuff.

Where strobe operation is used, i.e. X expansion by one means or another, the duty cycle of the display is low and the trace brightness is correspondingly low. The only way round this is to fork out many hundreds of pounds for a PDA-tube scope, or to go well into four figures for a storage scope. Few of us could justify this!

I do have a couple of criticisms in this department however. At the low brightness levels that can be encountered in certain modes of operation a viewing hood is almost essential. The review instrument did not have one. Worse than this, the distance between the c.r.t. face and the graticule is so great that a shocking parallax error in reading the display is possible.

TV Delay

So we come to the main feature of this scope so far as I'm concerned, the TV delay facility. The idea of a delayed timebase is to trigger the sweep at some time after applying a trigger pulse, the delay being set precisely by the user. Thus for TV purposes we can start timing from the field sync pulse and "reach down" into the picture for say 10msec. This brings us to line 156, and if we then initiate one 64μsec sweep we shall see just this line. If the process is repeated after each field sync pulse we'll have "strobed out" line 156 and will be able to examine it in isolation.

Let's assume that we keep the 20μsec delay and reduce the sweep speed to 200μsec. We'll now see lines 156, 157 and 158 of each field and so on. In fact on single-trace operation we'll get not only line 156 in the above example

but its partnering line 469 in the even field. This is no detriment because it will probably be identical and the two will overlay to give a useful increase in brightness.

Now line 156 may not be of burning interest (unless one is constructing an electronic pattern generator or analysing the waveform of an optical one), but certain TV lines are very important to us. Amongst these are the lines on which the TV picture starts and finishes, and those that carry equalising pulses, test signals and teletext waveforms during the field blanking period. Towards the end of each field comes the VCR head changeover point, while video disc systems perform their still-motion and trick-speed operations during the field blanking period. So the ability to be able to strobe out lines is becoming more significant.

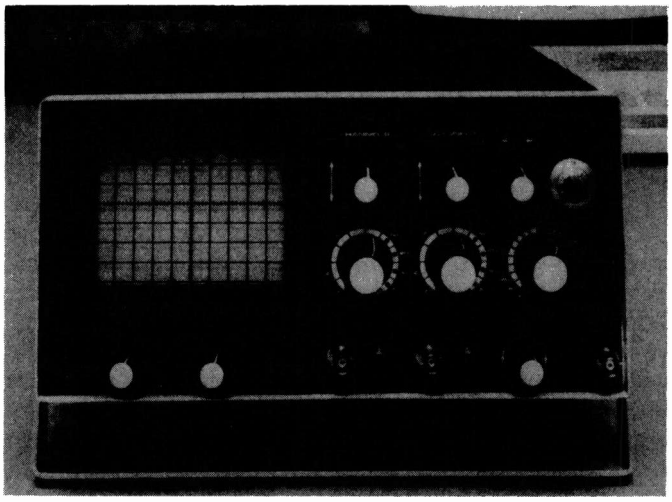
In the past only expensive oscilloscopes boasted delayed timebases, and this was usually done by having in effect two variable timebases, the second ramp (the sweep) being initiated at the end of the first (the delay). This system requires very precise triggering and impeccable circuit design if jitter is to be avoided. A more recent approach, applicable really only to TV signal analysis, is to use digital circuitry to count the lines, starting from the field sync pulse and counting a preset number of lines before initiating the sweep. This approach is facilitated by the availability of suitable digital i.c.s, and this is how it's done in the 14D-10V.

In the TV delay mode an electronic cursor, in the form of a blanked slice as it were, is superimposed on the waveform to indicate the delay setting and mark the TV line required. A precision ten-turn vernier potentiometer is used for this, after which delay sweep is selected and up comes the required line. If necessary, video waveforms down almost to picture element level can be examined by stretching out the sweep with the X5 switch, though by this time the trace brightness is quite low.

How does it work in practice? Very well I found. The review instrument started at line 16 and was continuously adjustable up to line 312. I examined the text lines of the broadcast signal in detail, and was able to get well locked and beautifully reproduced traces of the pulse-and-bar waveform and the teletext test line (line 20). I successfully made eyeheight measurements (for further details see page 128, January 1978, and page 648, October 1982). Briefly, line 20 and its partner line 333 together provide a test for eyeheight or decoding margin of the broadcast text signals, the pulses on line 333 being complementary to those on line 20 when displayed as a single stationary test line.

Now at the sweep speeds used for this test the scope is in the alternate-trace mode so far as the Y amplifiers are concerned, so for this and other tests a single line per picture can be observed on each of the dual traces, or the two can be superimposed by selecting "A only". This is ideal for any form of line-by-line analysis. It's possible for example to study the alternate line phasing of the PAL colour burst with ease.

After wondering at the BBC's "remote control line" number 21, I selected a much longer delay and was able to look at VCR head switching events and the run up to the sync pulse at the end of the field. I experienced no jitter whatever, and discovered an inherent virtue of digital delay that no analogue delay system has. With a jittering signal such as comes from any mechanically reproduced video recording system, i.e. tape or disc, the counting system relies on the line numbers rather than the time, so that jitter-free traces are produced even after a delay of almost a full field. In fact the ten-turn vernier delay



The Scopex 14D-10V oscilloscope.

control, which is fitted with a locking device, is so stable and accurate that I found it possible to set it for a certain line number and come back two days later and find that same line would be reproduced on a different transmission and at a different room temperature. The circuit would be amenable to a calibrated dial-a-line control system with a potentiometer or thumbwheel controls. When using the digital delay system, the displayed line sync pulses stand still and delay adjustment makes the lines of video jump across them, giving an effect similar to that of tilting a TV camera vertically. With an analogue delay arrangement the whole trace moves sideways (X shift effect) with delay adjustment.

Conclusion

This instrument is a workshop type and belongs on the bench where its full potential can be exploited. The large screen, mains operation and the facilities it offers make it ideal for TV, video, text and much digital work. Technical colleges, polytechnics and similar establishments should also find the 14D-10V of interest – many of them have to work with a very restricted budget these days, and for demonstrating modern TV tecniques this instrument is very useful. The necessity to operate the instrument at low ambient light levels in certain modes is a small price to pay in view of the low cost of the 14D-10V.

Since this review was originally prepared a viewing hood has been introduced and comes as standard with the instrument. The makers say that they intend to fit a c.r.t. with an internal graticule at some future date. These points will overcome the two small grouses I've made. The design is a good one and capable of further development – for instance the incorporation of thumbwheel line selection, a vernier Y gain control on channel A and a PDA tube operating at a higher e.h.t. for brighter traces in the strobe mode. All these would add to the expense of course, but I'm sure there would be a market for a de-luxe version alongside the standard model.

As it stands, the 14D-10V is incredibly good value for money at £260 plus VAT, with two probes and delivery included. It's available from Scopex Instruments Ltd., Pixmore Avenue, Letchworth, Herts SG6 1JJ (telephone 04 626 72771). I can wholeheartedly recommend it, not only for its intrinsic virtues but as a piece of British innovation in a field which is being steadily encroached upon by the Oriental big boys. Well done Scopex!

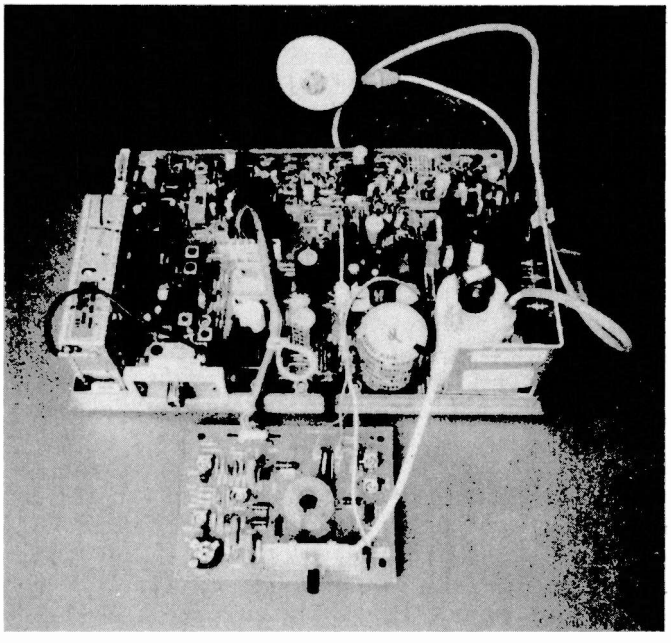
The Philips CTX Chassis

THE new Philips CTX colour chassis is designed to drive 90° colour tubes of the 570X type. Mechanically, the chassis is very different from the KT3 which it will replace. While the KT3 used the mother/daughter board principle, with a large vertically mounted main panel into which seven subpanels were plugged, the CTX has a single horizontally mounted panel plus a rather larger c.r.t. base panel than its predecessor. Packing most of the circuitry on to a single panel at the base of the cabinet gives room for a larger c.r.t. base panel on which the RGB output stages and the focus unit can be mounted. Altogether a much neater scheme.

An initial glance at the circuit reveals that many of the features of the KT3 have been retained. So how has the component count been substantially reduced and space saved? One space saver is the use of a compact diode-split line output transformer instead of a separate transformer/tripler combination. Then a TDA3651 i.c. is used to provide the field output whilst another i.c., a TDA2577, takes care of quite a lot of things, containing as it does the sync circuits, the field generator and the line frequency generator. The new circuitry has enabled the power consumption to be reduced to 39W average in comparison to the KT3's 70W.

The chassis is neatly laid out and easy to get at. The low power consumption should ensure reliable operation. Perhaps we should say extremely reliable, since the KT3 itself established an enviable reputation for reliability.

The main similarities between the CTX and the KT3 lie in the signals circuitry and in the use of a tandem chopper/line output arrangement, i.e. the line output transistor is driven by a secondary winding on the chopper transformer. The tuner is quite large, and along with the discrete component i.f. filter takes up quite a large proportion of the main panel. The filter is identical to that used in the KT3. The TDA2540 i.f. i.c. is also the same, whilst the decoder consists of a TDA3560 as in the KT3 Mk. II. The sound channel is also the same, consisting of the well tried TBA120S intercarrier sound i.c. followed by a TDA2611AQ audio i.c. Fig. 1 shows the CTX's circuit and power supply arrangements in block diagram form.



The Philips CTX chassis.

Class A RGB output stages replace the KT3's class AB circuits. This simplifies the circuitry, and since the output stages are now on the c.r.t. base panel the capacitance they have to drive is much reduced. The performance is perfectly adequate, especially when one considers the limitations on picture resolution imposed by modern tubes.

The item that's brought about the greatest changes in comparison with the KT3 chassis is the TDA2577 i.c. This, with some extra discrete component circuitry, replaces the TDA2571/TDA2581 sync/line oscillator/chopper drive combination and the discrete component field generator circuit. It contains the sync circuitry and the line and field frequency generators. It also produces the sandcastle pulse for the decoder and contains a pulse-width modulator for chopper control. This latter feature is not used however. Instead control of the chopper drive is carried out in the external discrete component circuitry (see Fig. 2).

The drive waveform produced at pin 11 of the TDA2577 consists of a line frequency pulse with a sawtooth leading edge. This waveform is a.c. coupled to the base of TR7322 which is forward biased by R3317. As a result, TR7322 switches off on the negative-going pulse transition. The same conditions apply at the base of the chopper driver transistor TR7353, which is forward biased via R3319 and receives the squarewave output from TR7322 via C2319. Control is provided by TR7323 which senses the 125V h.t. rail at its base. The conduction of TR7323 varies with the h.t. voltage therefore. Since TR7323 is part of TR7322's load, the effect is to introduce a variable delay in the switch-on conditions at the base of TR7353, thus providing the regulatory action. The key to this is that C2319 is instantly discharged when TR7322 switches on, but charges via the parallel combination of R3318 with TR7323/R3320 when TR7322 is switched off.

It's a neat arrangement, since over-voltage protection is applied at the same time. If the h.t. voltage rises, TR7323 is driven towards cut-off and the chopper drive is thus reduced. If TR7322/3 go either short- or open-circuit the drive to the chopper is removed, while if the chopper goes short-circuit there's no drive to the line output transistor and thus no e.h.t., so the circuit incorporates inherent protection.

Excess current protection is provided by TR7330/1. D6334 acts as the chopper circuit efficiency diode, switching on to maintain the h.t. current when the chopper transistor TR7355 switches off. Excessive h.t. current produces negative pulses across the sensing resistor R3337 of sufficient amplitude to switch TR7330 on. TR7331 in turn conducts and the two transistors latch on, removing the pulse input to TR7322 via D6317.

With the field drive produced by the TDA2577, all that the TDA3651 field chip has to do is to drive the scan coils and generate the flyback.

Since the TDA2577 controls the line and field

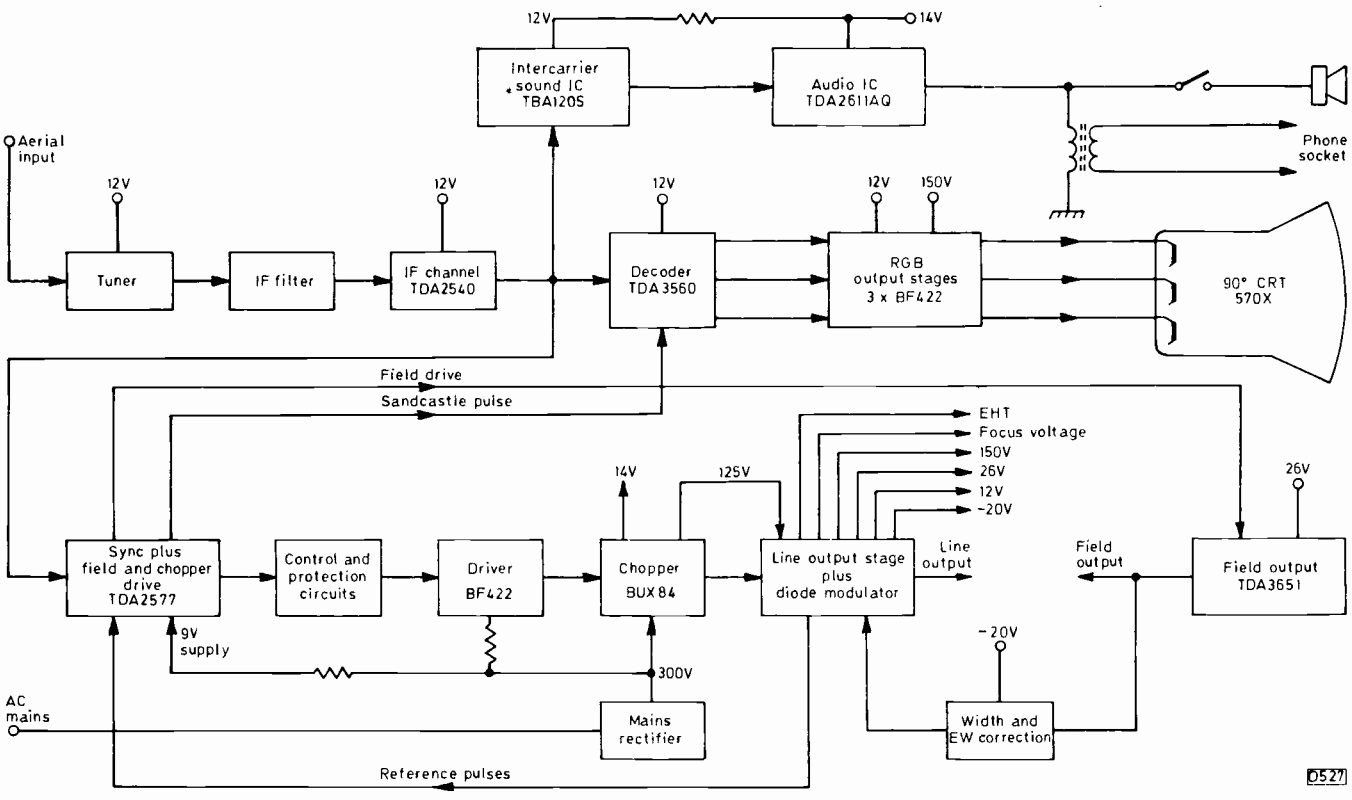


Fig. 1: Block diagram of the Philips CTX chassis.

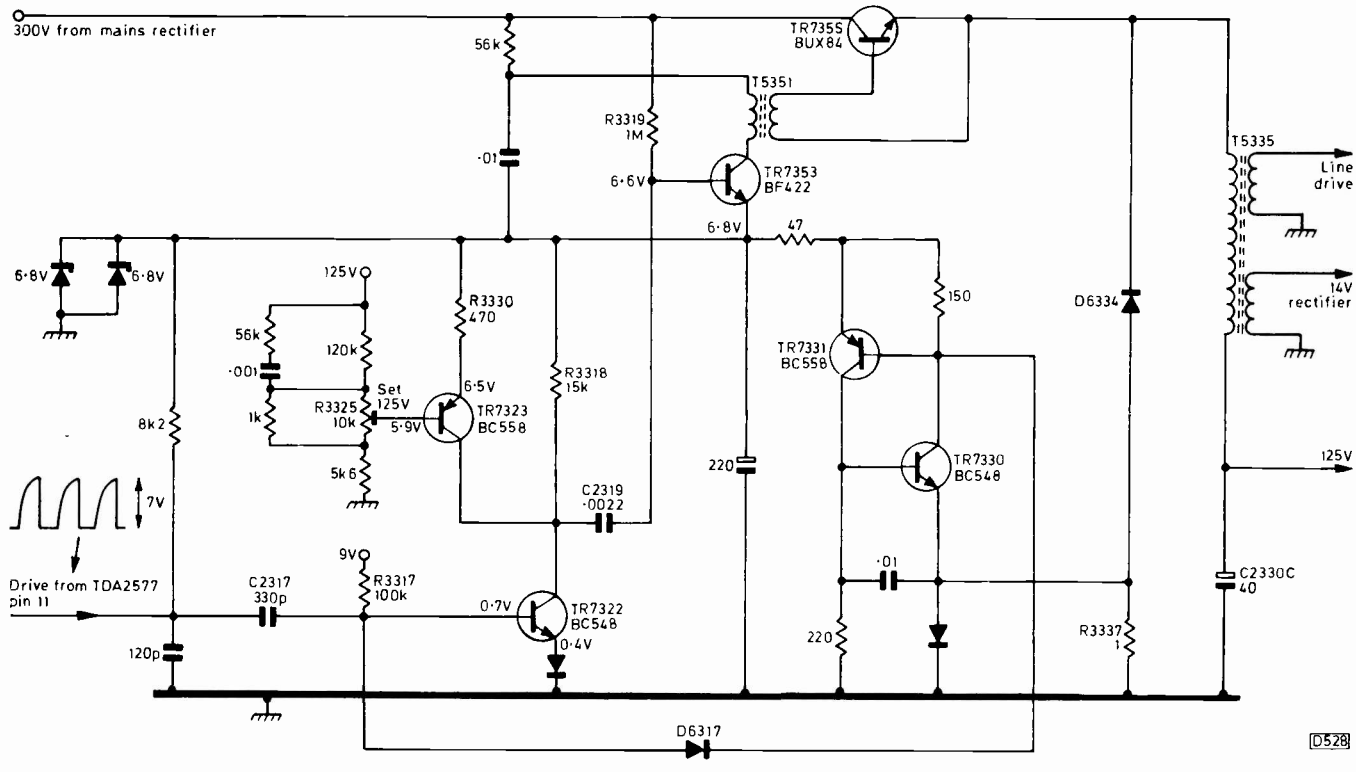


Fig. 2: The chopper transistor TR7355 and its control circuit. The chopper part of the circuit is shown in simplified form.

frequency scanning, most of the timebase controls, including the line and field hold, line shift and height controls, operate in conjunction with it. The height control adjusts the field feedback – there's no field linearity control. The width control sets the d.c. conditions in the EW modulator circuit.

So there we have it. A nice blend of new and established circuitry, all admirably laid out. The 14in. set (Model CT2006) we've had in the workshop has performed very well. Its suggested retail price is a very competitive £179 inclusive of VAT. The next model is to be a 16in. one with remote control, and 20in. models are to follow. Whilst CTX production will initially be abroad, the Philips Croydon TV plant will shortly start production of CTX sets.

The first Pye CTX set (14in.) is Model 2060.

The Adventures of Tiny Tim

Les Lawry-Johns

The Awakening

IT was Tiny Tim's turn to get up first. So he rubbed the sleep from his little eyes, tumbled out of bed and set about making breakfast for the dog, his wife and himself, leaving the cat till later as she doesn't like Tiny Tim feeding her. He's often bad tempered in the morning, and has been known to kick her.

The Breakfast

He put the crumpets under the grill, filled the kettle and plugged it in, then prepared the scrambled eggs the way the dog likes them. Beat up the eggs, add a little milk, grate in some cheddar cheese and add vinegar, salt and pepper to taste. Slice a couple of tomatoes and put under the grill with the crumpets. Turn the crumpets and stir the scrambled eggs in their little saucepan.

Take out crumpets and butter them. Spread with cheese spread and return under the grill to brown. Make the tea and wonder what the day will bring. Look at headlines in the morning paper and realise that the scrambled eggs are burning. This didn't upset Tiny Tim since it gave them a nice nutty flavour which the dog liked.

Out with the crumpets, all sizzling on their plates. Cover with tomatoes scraped from their skins. Cut into sections so the dog can eat them better, and cover with scrambled egg. Leave the dog's to cool, pour out tea, take wife's breakfast upstairs and return to find letters on the mat. Tiny Tim gave the dog his breakfast whilst opening the letters and sipping his tea. About to start eating when there's this knock on the door.

The Intruders

"We're not open yet" bawled Tiny Tim.

"I know, but I'm on my way to work and can't call later."

So Tiny Tim opened the shop door and a man struggled in with a 26in. Philips G11. "Buttons won't stay in mate."

As he was going out, a lady pushed her way in holding an old Morphy Richards iron with two inches of lead coming from it. In her other hand she held about a metre of unsuitable cable.

"I'm going down town shopping so I'll leave this with you. Just put this lead on the iron and I'll collect it on the way back."

Now Tiny Tim is normally a very obliging fellow. But as the cat will tell you he's often nasty first thing in the morning, especially if he hasn't had his breakfast.

It wouldn't be right to tell you what Tiny Tim told the lady to do with her iron, but she left in a high old huff to spend the rest of her days spreading evil rumours about Tiny Tim and his rotten little shop.

The Walk

So Tiny Tim locked the door and returned to his kitchen. The crumpet was cold and if there was one thing he didn't like it was cold crumpet.

It was then time to take the dog out for his walk. The cat was outside, waiting for them to go so that she could jump in through the window and scream her orders at Mrs. Tim who was already on her way down having been thoroughly upset at Tiny's outburst at the poor innocent woman who would never darken their door again. She was in time to see Tiny Tim over on the green, chasing after the dog who was being chased by a cat he'd accidentally disturbed, being short sighted as he was.

The cat eventually gave up as he wasn't a good runner – he seemed to throw his legs out sort of sideways, scattering along rather than running, as most Siamese cats are in the habit of doing.

Tiny Tim and the dog resumed their normal walk and took a sniff around the large block of flats at the rear of which stood a row of parked cars. One caught Tiny's eye. A Hillman Hunter that appeared to have a list to starboard.

The rear off-side leaf spring's going thought Tiny, with his habit of getting everything wrong. Still gawping at the car he walked straight into a rain filled pot-hole he'd been carefully avoiding for months. "Oh dear" cried Tiny. "Why don't I look where I'm going?" His little feet felt most uncomfortable for the rest of his walk home, where there was a lot more work waiting for him than had been there ten minutes before.

The Letters

First Tiny browsed through the letters that had been delivered earlier. One was from the insurance company that had paid for the front window smashed a couple of weeks previously. They thought the cost of the replacement window had been excessive and wanted an estimate for the entire shop front. Probably so that they could put up his premiums Tim thought gloomily. He worked out what he'd paid over the last few years and thought what a handsome profit they still had. But the fact remained that they'd asked for this estimate.

So Tiny went round to the nearby builders and had a chat with them. They didn't know and talked about brick work as well as windows. This made Tiny think about a bloody great big lorry rushing into his shop front out of control, demolishing the shop and all those inside. Tiny Tim shivered and made his way back, feeling worse than ever.

The Estimate

An old boy came in and asked for a battery. He'd worked for the builders years before so Tiny asked him how much house bricks were. "Ninepence each" the old boy remembered. Later Tim went out front and counted the bricks in twelves. He'd two reasons for doing this. First he couldn't bring himself to say the number that follows twelve. Secondly twelve ninepences make nine shillings, making his calculations easier since all he then had to do was add the cost of a bag of cement and some sand which he could get from the beach at Ramsgate in the summer.

With the figure for brickwork worked out, Tiny added

the cost of the window and half again for the smaller one. This gave him the estimate the insurance company wanted. He carefully sent this off in an envelope and hasn't heard a word since. He could now tackle the jobs.

The G11

First the G11 which he'd forgotten about. After thinking for a bit he remembered that the complaint had been about buttons that wouldn't stay in. Tiny took out the selector unit and stripped it down. The spring that tensions the clicker plate was broken and Tiny Tim didn't have one. What was Tiny to do? He decided to make a replacement out of one of the loose coil springs Bush tuners used to have behind the buttons. It took Tiny an awfully long time to do this simple job, but then it always does. It worked however and Tiny Tim was quite pleased with the result. Except that the picture had bowed-in sides which the man hadn't mentioned. Shining his torch on the line output panel, Tiny looked and looked for ten minutes before he saw it – the dry joint. It was in the most obvious position and looked like the top of a volcano.

The Cassette Recorder

A lady then came in with a mains/battery tape recorder which she said didn't work. Tiny Tim plugged it into the multiway socket and pushed down the play button. Nothing happened so he thought he'd start at the beginning and check the continuity of the mains transformer primary winding etc. by connecting his ohmmeter across the pins of the mains plug. He removed the plug from the multiway socket and put the test prods across it. There was no reading at all, so the fuse, lead and connections would all have to be carefully checked. First he stripped the plug to test the fuse and leads. He thought there was something familiar about the plug, but then one plug looks pretty much like another so Tiny persevered.

The fuse was intact and the connections good, so Tiny whipped the back off the recorder and proceeded to check from the input socket to the transformer, which proved to have continuity after all. Tiny Tim frowned and this made him look old. He caught sight of himself in the bench mirror so he stopped frowning quickly. He would now have to check the lead and socket. So he pulled on the lead and up came his Weller soldering iron, which of course had continuity only when the trigger was pressed. No wonder the plug had looked familiar!

Tim was really cross with himself over this. No wonder all those remote control TVs confuse him when he keeps doing such silly things. Having identified the correct plug, Tiny found a lead disconnected. So he put the back on the recorder and checked with a tape in it. The machine worked all right and as it had a radio section Tiny tried this just to be sure. It didn't work. Oh dear.

With the machine still switched to radio Tiny pressed the play button. On came the radio. This made Tiny Tim even angrier, and he swore as he once again removed the rear cover. It took a long time to trace the supply leads, as there was no voltage at the radio switch. Tim was patient however and traced them down to another little switch marked "sleep". When this was operated the radio worked normally without the play button pressed, and Tiny remembered how he had demonstrated this sleep facility to a lady only the other day – so that she could lay in bed and doze off safe in the knowledge that the radio would switch itself off when the cassette came to an end.

Once again Tim had been caught out by a silly thing. "Coffee" he bawled in a loud voice as he put the cassette recorder back together again for the second time, reflecting on how much time he'd wasted. His New Year's resolution must be to be more sensible and to think more logically. But how was he to do this?

Perhaps he could buy a book like the one called Thinking to Some Purpose he'd read years before but never understood. The trouble was that he now didn't seem to be able to understand anything the least bit complicated. Look at his performance the other day when he delivered a new TV set to a customer and demonstrated it. The other lady in the house said she couldn't get channel 4 on her set, so Tiny had volunteered to tune it in for her.

The Grundig Portable

The set turned out to be a 16in. Grundig colour portable that Tiny had never seen before. There were no friendly knobs for him to twiddle. He asked if the instructions were available, but when Tim looked at them he couldn't make head nor tail of the words despite their being in English and designed for customer use. He eventually found a flap on the front. This concealed a little switch which when it was up pointed to three buttons with arrows on them and when it was down pointed to another three, one marked M. The arrows seemed to indicate some sort of search, so Tiny presumed that when the switch was up you could search one way or the other through the channels. Whilst he was pondering upon this a small boy came in.

The Small Boy

"What's up auntie?"

"The man is trying to tune in channel 4 for us, but he can't quite understand it."

The small boy picked up the remote control unit which Tim hadn't noticed over on the armchair. He pressed a button, then went over to the set and pressed search. BBC-2 came on and went. Channel 4 hove into sight and the little horror pressed the M button.

"O.K. auntie. It'll be all right now. Can I have an apple?"

Tim slunk away and wondered what all his years had done for him and how little boys could understand at a glance how complicated things worked. I bet he couldn't handle a T20 thought Tim viciously.

Mr. Styles' New Set

Mr. Styles is a nice man who lives at the top of Telegraph Hill. This means that he has superb reception. He popped in last week to buy a clock radio and to say that he would be back for a 26in. colour set later in the week. When he came back we had a nice new Pye 26in. set ready for him.

We showed him how it worked and how to change channels to take advantage of his position. He took it off whilst we completed the four year insurance etc. A few days later he returned to say that his reception was terrible. We checked the set and came to the conclusion that the U321 tuner was responsible. So we fitted a new one and everything was fine. When we opened up the faulty tuner we found that it had received previous attention. In a new set!???

Teletopics

THORN'S NEW PORTABLES

Thorn's latest 12in. monochrome portables are the 38020 (black cabinet) and 38030 (white cabinet), the suggested retail price for both being a very competitive £49·95. How have Thorn managed to do it? The answer is a radically new chassis, the 1790 series chassis, which makes use of a very interesting i.c. to reduce the component count to a very low total. The Motorola MC13002 is a 28-pin i.c. that incorporates the i.f., video processing, a.g.c. and sync circuits plus the field and line generators. So all that's required in addition is a tuner, i.f. filter, video output stage, audio channel and power supply plus field and line driver and output stages. Further details will be given next month.

Thorn have developed this new chassis in the belief that the increasing number of video sources and programmes will lead to a greater demand for additional TV sets in the home. The previous 1696 series chassis is being phased out.

PLESSEY'S SYNTHESIZER IC

Plessey Semiconductors were showing an interesting new TV tuning i.c. at the recent Munich Electronica exhibition. It's a single-chip frequency-synthesis tuning system provisionally designated type XP5000. Previous i.c. frequency-synthesis tuning arrangements have used a couple of chips, with a high-speed prescaler. It appears that Plessey have a world lead in this field, which could amount to a market of several million i.c.s a year. Setmakers are at present evaluating the device, which is expected to go into production this spring.

DISC COMINGS AND GOINGS

Video disc prospects are still far from bright. The JVC VHD system has been further postponed and Thorn EMI have put into mothballs their two VHD disc pressing plants at Swindon and Cologne. The Thorn EMI view is that for the present the UK video market is adequately catered for by VCRs.

This leaves the UK video disc market to the Philips LaserVision system for the time being. Philips have now been joined by Pioneer who produce LaserVision players and discs in Japan for the Japanese and US markets. Pioneer's UK player will be known as the LaserDisc Model LD1100. It will sell for rather more than the Philips players, at a suggested retail price of just under £500, but will incorporate extra features including a CX noise-reduction system in the sound channel, audio in the still frame mode and built-in interfacing for use with a microcomputer.

Pioneer have sold some 100,000 LaserVision players in Japan and the USA and are hoping for sales of around 5,000 during the first year in the UK. They comment that market growth over the past couple of years has been comparable with the early growth of the VCR market. A training school for service engineers is being set up at Pioneer's new Greenford, Middx. headquarters so that dealers will be able to service the machines, though all initial repair work will be done at Greenford.

Philips recently reduced the price of their basic LaserVision disc player to just under £400, the remote-control version having a price tag of around £450. It seems that at least half the sales of LaserVision players have been to people who already own a VCR.

A major boost to video disc systems is likely to come from their use for video games, giving normal pictures rather than the strange shapes that go with the present generation of video games. It's understood that the VHD system had interactive capability from the start, and there are rumours that Philips may introduce computer games interfacing with the LaserVision system in the US market before long.

SANYO LOWESTOFT IN PRODUCTION

Production of Sanyo colour sets at the ex-Pye/Philips Lowestoft plant has now started. Sanyo have spent £2 million on installing highly automated assembly lines. Initial models are the CTP3131 (14in.), CTP4101 (16in.), CTP7130 and CTP7131 (both 22in.). The CTP4101 and CTP7131 feature full infra-red remote control. 20 and 26in. models are to follow, also teletext models.

PART BACKS MAC

The Part committee has recommended in an official report to the Home Office that the IBA's MAC (multiplexed analogue component) system should be used for UK satellite TV transmissions. In the MAC system the chroma and luminance components of the signal are separated, compressed and then transmitted on separate sections of each line. The receiver thus requires a converter to restore the signal to the conventional form prior to display. According to the IBA, converters could be produced cheaply using charge-coupled memory i.c.s to expand and rearrange the signal.

The report has drawn a furious response from the BBC which had hoped to start satellite TV transmissions on two channels in 1986. The BBC feels that the added complexity of MAC could jeopardize the economics of satellite broadcasting – the BBC had hoped to use a system that's compatible with existing receivers. The Part committee took the view that the MAC system could become an international standard for European use and benefit UK setmakers by giving them a technical headstart. There are doubts however as to whether France and Germany in particular would be prepared to accept the system.

ORACLE 4

As mentioned last month, Channel 4 is now carrying the Oracle teletext service. Some Oracle pages are now on ITV, others on Channel 4. This reduces the access time to about eight seconds maximum, but the catch is that not all areas have Channel 4 at present, so some viewers get only half the Oracle service.

FERGUSON FEEDBACK

At last there's a successor to Thorn's much respected servicing publication **Scope**. The new publication is called **Ferguson Feedback** and will be published at six weekly intervals. The aim is to provide technical information on new chassis, modifications and the latest technical innovations, and a "Workshop Wisdom" feature will be included. The editor is Frank Pack, who has been with Thorn for seventeen years (prior to that he was with GEC). Frank has been involved with the servicing side of

the industry since leaving the Air Force in 1948, and spent several years as a technical liaison officer in the Ferguson Service Division. Ferguson believe that the new publication will be a useful addition to the workshop bookshelf, and with the first issue engineers have received a Ferguson Feedback binder.

TRANSMITTER NEWS

News nowadays includes both openings and closures. The following relay transmitters have or will shortly come into operation (see Ceefax page 196 for exact opening dates),
Holmhead, Strathclyde Scottish Television ch. 41, BBC-2 ch. 44, Channel 4 (future) ch. 47, BBC-1 (Scotland) ch. 51.
Portishead, Avon BBC-2 ch. 39, HTV West ch. 49, BBC-1 (West) ch. 66, Channel 4 ch. 68. Wideband aerials are required for reception of this station.
Portreath, Cornwall Television South West ch. 23, BBC-2 ch. 26, Channel 4 (future) ch. 29, BBC-1 (South West) ch. 33.
Redcliff Bay, Avon BBC-1 (West) ch. 30, HTV West ch. 34, BBC-2 ch. 56, Channel 4 ch. 67. Group W aerials horizontally mounted are required for reception of this station.
Turves Green, Birmingham BBC-1 (Midlands) ch. 56, Central Independent Television ch. 62, BBC-2 ch. 66, Channel 4 ch. 68.

Polarisation is vertical unless otherwise indicated.

The closures are the **Wenvoe** and **Kilvey Hill** South Wales 405-line transmitters which will close down in the first week of January.

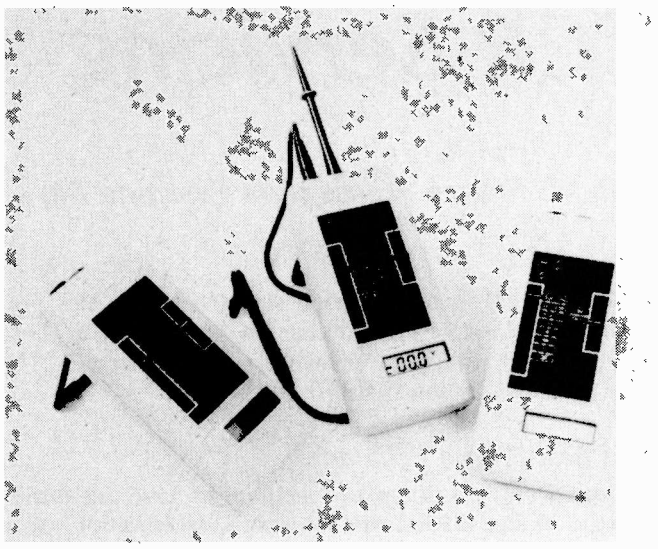
LATEST VCRs

One of the most striking VCRs to come on the market recently is the Hitachi VT11E (see photo last month) which has won a Manufacturing Industries Technology Innovation award in Japan. Despite having full function remote control and all the usual features, including freeze frame, the suggested retail price is only £399. Of particular interest are the multi-function control buttons – a single button is used for play, record, fast forward, fast rewind and fast visual search in both directions.

A third front-loading VHS recorder, Model VC9500H, has been added to the Sharp range. Selling at £30 more than Sharp's budget model, the VC9500H incorporates a more flexible timer.

Front-loading is also a feature of the latest VHS machine from Panasonic, the NV777. This has a full specification including infra-red remote control and Dolby sound and a recommended price of £611. An LCD indicates cassette loaded and tape-remaining time. Panasonic have also introduced a tape editing system consisting of two VCRs and an automatic controller and a new portable system. The latter is similar to the recently announced Olympus system, with the WVP100E camera giving positive-negative picture reversal. The NV100E portable recorder weighs under 8·8lb with battery pack and is partnered by the NVV10B tuner/timer/power supply system.

The latest V2000 system VCR from Bang and Olufsen is the Beocord 8802V. Features include picture search at seven times normal speed forwards and five times normal speed in reverse, freeze frame, dynamic noise suppression and remote control, all for a suggested retail price of £475. B and O claim to have improved the vision signal-to-noise ratio by 2dB (minimum) and extended the audio bass response to 40Hz in comparison with the standard V2000 system specification.



The new AVO 2000 range of digital multimeters. For further details see page 151.

An intriguing colour video camera, the Konica Color VC, is due to be launched on the UK market this summer by Konishiroku. It's claimed to be the world's smallest, weighing only 690g including cable, despite having a 10-30mm zoom lens and optional electronic viewfinder. The pick-up tube is a half inch SM Saticon and the power consumption 4·1W at 12V d.c.

HARRISON'S 4GHz EQUIPMENT

Harrison Bros. of 22 Milton Road, Westcliffe-on-Sea, Essex now have available receiving equipment for use with satellites operating in the 4GHz band. This includes a feed horn at £65, 1·9m parabolic dish at £265, a downconverter at £410, tripod assembly at £21 and stand at £170. An alternative economy dish is available at £85, and work is continuing on the development of a wideband f.m. receiver, also on a 3m dish and weather satellite receiving and display equipment. Tests have provided noise-free pictures from the Gorizont satellite, with good colour when used with a SECAM colour set. Data sheets are available on receipt of a stamped, addressed envelope. Alternatively phone 0702 32338. The prices above exclude carriage and VAT.

EUROPEAN SETMAKERS JOIN FORCES

The major French and W. German consumer electronics firms Thomson-Brandt and Grundig are to join forces – Thomson-Brandt will take a 75 per cent share in Grundig, in which Philips already has a 25 per cent share. Thomson-Brandt also own the W. German firms NordMende and Saba. This major consolidation of the W. European consumer electronics industry has been undertaken in an effort to meet growing competition from Japanese manufacturers. It could have a significant effect on European VCR production since Thomson had been planning to produce VHS machines.

SERVICE BRIEF – PHILIPS

TX chassis: C393 which decouples the slider of the line hold control has been increased in value from 560pF to 0·0015μF to prevent intermittent line collapse. Sets bearing the factory code HU on the chassis serial plate should be checked to ensure that this value capacitor is fitted.

VCR Servicing

Part 14: Freeze Frame plus Fast and Slow Playback.

Mike Phelan

HAVING covered the initial basic machine in the Ferguson/JVC range in some detail, it's time to look at those models that do things other than play tapes normally. The most common option is still frame.

The Still Frame Problem

One of the first domestic machines to have this facility was the Philips N1502. It's interesting to consider how it provided the still frame feature. If we simply stop the rotation of the capstan, the tape stops but the video heads continue to rotate. Since each recorded track consists of one field, if we don't mute the signal the result will be a still picture with a certain amount of noise. Why the noise?

The point to consider is the angle at which the video heads scan the tape. If the tape is stationary, the angle will correspond to the tilt of the head axis with respect to the tape. When the tape moves forward during normal record/playback however the head scans the tape in a shorter time since both are moving. To put it another way, the writing speed, i.e. the effective head-to-tape speed, is increased. The important factor from our point of view however is that the angle of the scanned track is greater, the track being shorter. See Fig. 60(a).

What this means is that the recordings are made at a particular speed and scanning angle, so that if the tape is stopped on playback the scanning angle will be reduced. Refer to Fig. 60(b). On this machine (Philips N1502) there are spaces between the tracks (guard bands) to reduce crosstalk between adjacent tracks. With the tape stopped, the rotating head will cross the spaces between the tracks. Hence the noise. The use of guard bands instead of slant-azimuth head mounting means that the heads can play back each other's tracks. So the tape can be stopped to get a still picture and the only problem is the slight amount of noise introduced when a head crosses a guard band.

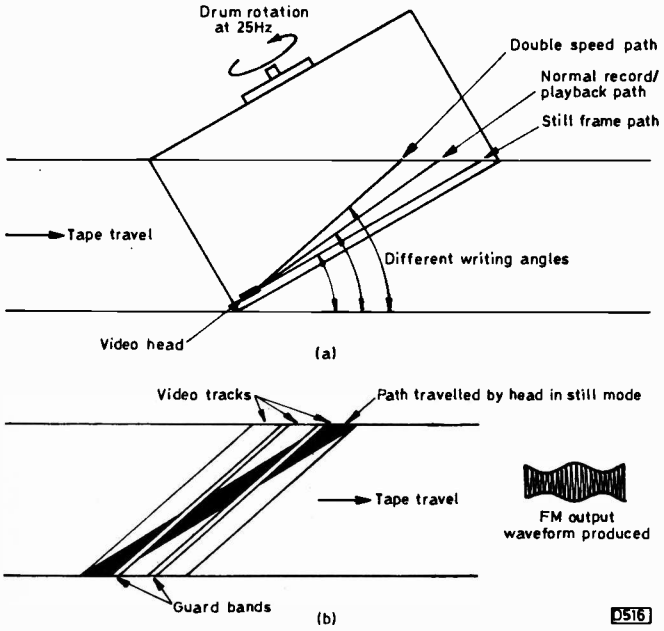


Fig. 60: Different head scanning angles on normal playback, still frame and double speed (a). Still frame conditions with the Philips Model N1502 (b).

The slant-azimuth mounting of the heads with the VHS system means that each head can play back only its own tracks (see Fig. 61). So the best we can hope for when we stop the tape is a noise-free output from one head and very little output from the other. The exact f.m. output envelopes obtained will depend on the point where the tape stops. Two examples are shown in Fig. 61.

The JVC Solution

Suppose we stop the tape in such a position that the channel 1 output is at maximum and that we use a wider head for channel 2 (see Fig. 62). The wide channel 2 head will now scan some of the channel 2 track *above* the channel 1 track being scanned. As a result, the f.m. envelope obtained is much improved. It's necessary to make the channel 1 head slightly wider as well, otherwise the tracks would be recorded with greatly differing widths.

We are left with two problems. First the point of minimum f.m. now coincides with the position of the field sync pulse on the tape. The result could be field jitter or rolling. The second problem is to stop the tape in the correct place every time. The first problem can be overcome by adding a synthesized field sync pulse – there's a second reason, which we'll explain later, for doing this.

The Ferguson 3V16

Though very similar to the 3V00 previously described, the Ferguson 3V16 (JVC HR3660) has in addition to normal playback still frame when the pause control is depressed and a plug-in remote control system giving double-speed playback, still frame and variable-speed slow motion. The main difference between the two machines lies in the servo circuitry, which is moved off the audio board on to a large board at the rear of the machine, behind the pre-rec board.

The 3V00 was a drum-controlled machine, i.e. the drum servo is phase-controlled on playback by the control pulses recorded on the tape, the capstan servo merely ensuring that the tape speed is constant on record and playback. To make it easier to produce the "trick-effects", the 3V16 is a capstan-controlled machine. Before delving into the still-frame mode, we'll look at the basic operation of the servos (see Fig. 63).

Basic Servo Operation

Both servos are under the control of a 32kHz crystal oscillator which together with most of the servo circuitry is in IC4. The oscillator's output is fed to a switchable

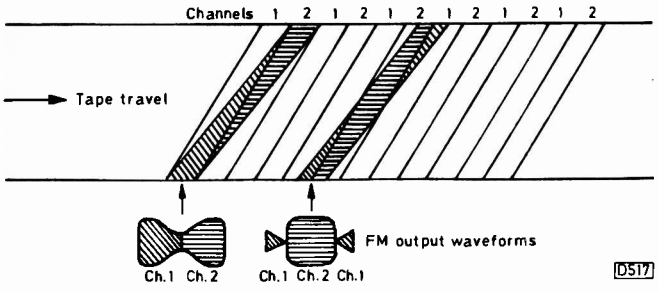


Fig. 61: Conditions when the tape is stopped with the JVC/ Ferguson HR3330/3V00.

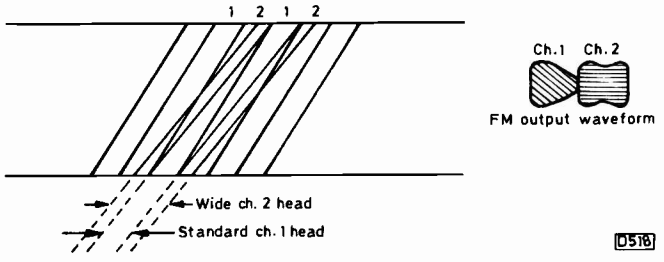


Fig. 62: Same conditions with the HR3660/3V16 with its wide channel 2 head.

divider that gives a 25Hz output on playback and 21Hz on record. On record, the capstan servo is controlled by taking a signal from what JVC call a "frequency gear" (FG for short). This replaces the flywheel magnets used on the 3V00 and consists of an annular plastic magnet on the flywheel with a stationary printed coil nearby. The coil gives an output of 126Hz when the capstan speed is correct. This is divided by six in IC4 and then compared with the 21Hz trapezoid obtained from the 32kHz oscillator. The output from the sample-and-hold circuit is fed via an external operational amplifier (IC7) to the motor drive amplifier and the capstan motor.

On playback, the divider is switched to give a 25Hz reference output. The trapezoid derived from this is compared with the amplified off-tape control pulses, thus precisely determining the position of the video tracks with respect to the heads.

As we said in an earlier instalment, it doesn't matter which of the two servos we control with the off-tape pulses on playback, but the head drum must be locked to the field sync pulses on record so that each track consists of a complete field. To this end IC1 separates the field sync pulses from the video signal and IC6 (a monostable) divides the output by two to obtain a 25Hz signal. This goes two ways. First though another monostable (part of IC1) which is enabled in the record mode only. The output from this goes to the control head to be recorded on the tape. The other path is via two monostables in IC4. The timing of the output from the second monostable can be adjusted by means of the tracking control, but only on playback – the control is bypassed on record, as with the 3V00. The tracking monostable's output goes to a sample-and-hold circuit, again within IC4, for comparison with the trapezoid derived from the drum flywheel pulses, again as in the 3V00.

On playback we have the same trapezoid as before, derived from the drum flywheel pulses, but the reference pulses now come from the 32kHz oscillator, the following divider being switched to give 25Hz on playback. The output from the sample-and-hold circuit goes to the motor driver transistors via the usual operational amplifier, with current sensing and loop gain adjustment as in the 3V00.

Motor Control & Slow/Pause Inputs

The motor control input stops the capstan motor when no keys are depressed. The slow-pause intput drives the motor in these two modes, the servo then not being in operation. The normal position control enables the position of the control pulse on the trapezoid ramp to be

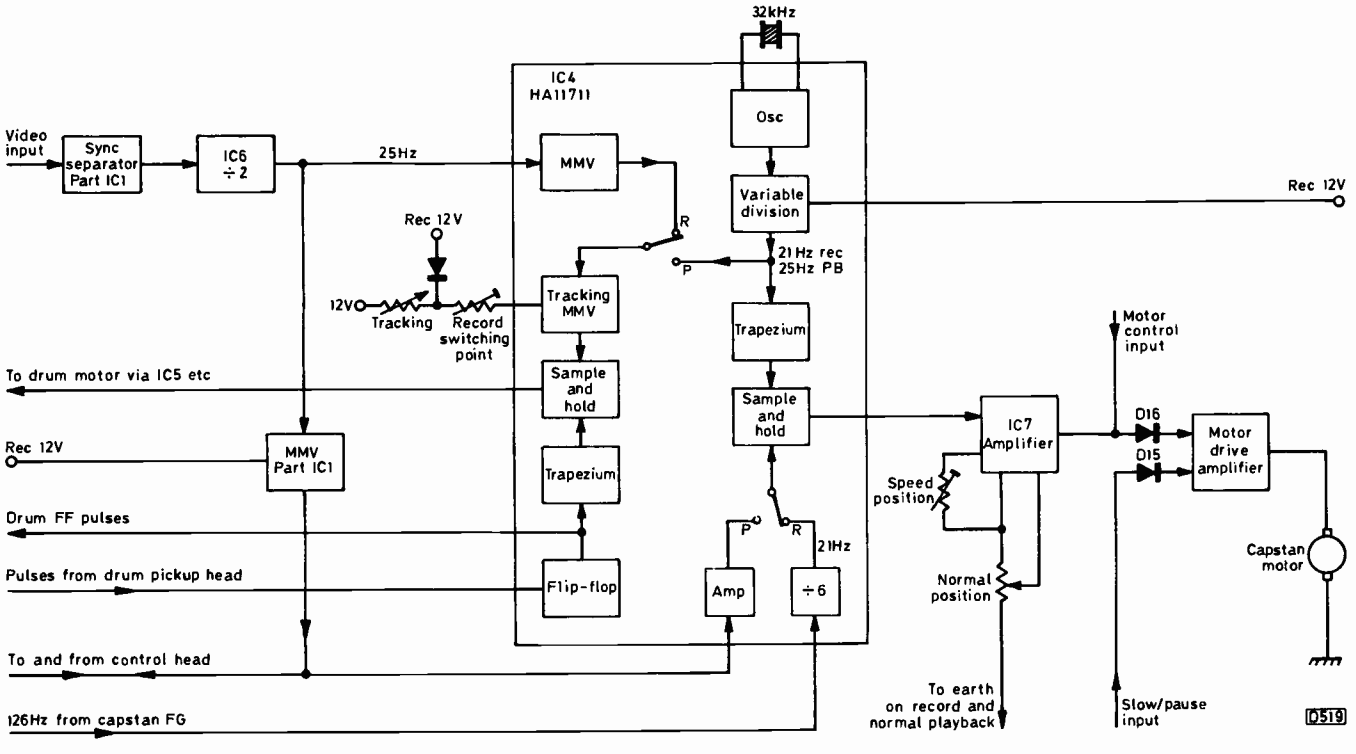


Fig. 63: Block diagram of the servos used in the HR3660/3V16.

varied on playback, its lower end being earthed via an electronic switch (in IC6) that opens when double speed is selected. This varies the d.c. conditions in the servo, with the result that the motor runs twice as fast. The speed position control adjusts the control pulse position on the ramp in the double-speed mode. Both controls are interdependent, and the servo operates quite happily with the control pulses arriving at double speed.

Trick Mode Control IC

The electronics for the various trick modes of operation are taken care of mainly by a special purpose i.c. – IC6, type BA841, on the servo board. See Fig. 64. To run through the connections quickly, pin 10 goes to the collector of transistor X8 which is turned off when the remote handset is plugged in, disabling the pause key on the machine itself so that it's now controlled by the inputs from the handset on pins 7, 8 and 9. These are connected to chassis when the appropriate function is selected by the handset. The slow-speed control on the handset is connected to pin 20.

At pins 4 and 15 respectively we have the off-tape control (CTL) and drum switching (drum FF) pulse inputs to drive the logic that stops the tape in the correct place when still or slow is selected. The drum FF input is also used to generate the synthesized field sync pulse. Presets connected to pins 17 and 18 provide adjustments for the pulse position on odd and even fields – one of these is accessible to the customer for minimising jitter. The synthesized sync pulse leaves at pin 37 to go to the Y-C board where it's added to the luminance signal. Pins 26 and 27 are the input and output to the monostable previously mentioned – the one which divides the field sync pulses by two to provide the control pulses on record.

Pins 34 and 35 provide outputs on slow and still. Both go to the audio board for muting purposes and to the mechacon board to inhibit the tripping that would otherwise occur due to the fact that the take-up reel is not rotating normally. Pin 39 is the drum motor control output to stop the head when no function is selected. The remaining three outputs play a large part in the slow and still modes. They are pin 38, capstan motor control, which removes the output from IC7 to stop the motor; pin 30 (FF2) which also stops the motor by switching X17 on when it goes low; and pin 29 (FF1) which drives the slow-pulse circuit consisting of IC8, X10/11/14 and the associated components.

Double Speed

As previously mentioned, on twice speed pin 32 goes open-circuit to disconnect the normal position preset's earth connection, altering the d.c. conditions in the servo so that the motor runs at double speed. Pin 31 goes low to mute the audio.

Ensuring that the Tape Stops at the Correct Point

Now for a closer look at the FF1 and FF2 outputs. On normal playback FF1 is set low and FF2 high, neither of the flip-flops that produce these outputs being operational. When slow or still is selected, both flip-flops are enabled by the logic within IC6 and work as follows. A monostable multivibrator (MMV1) driven by the off-tape control pulses causes the outputs to go low, another (MMV2) driven by the drum FF pulses makes them go high. The time-constant of MMV2 actually divides the drum FF pulses by three.

So we're in normal playback, with FF1 low and FF2 high, and we press pause. At the next control pulse, plus the time delay introduced by MMV1 (see Fig. 65), the output (CM) at pin 38 goes low, removing the servo output from IC7 and stopping the capstan motor. FF2 goes low, turning on X17 and placing a dead short across the capstan motor. The tape stops dead. FF1 stays low, and on this machine the pinch roller is not withdrawn.

The tape has now stopped, but probably not in the right place. After two more drum FF pulses, MMV2 resets FF1 and FF2. FF2 goes high, removing the short across the motor (X17). FF1 also goes high, driving the slow-pulse circuit (Fig. 64). This moves the tape (output via D15) until another control pulse is picked up by the control head. The control pulse sets FF1 and FF2 low via MMV1, stopping the motor again. This sequence happens three more times, the final control pulse setting FF1 and FF2 low permanently (see the timing chart).

What's this all about? Well, while the tape is running in the normal playback mode the relationship between the off-tape control and drum FF pulses is fixed. Once the tape has stopped there are no more control pulses, which is why the motor is pulsed four times – to ensure that the tape finally stops with the control pulse in the correct position so that the video tracks are in the optimum position for a still picture display (when the control pulse has passed the head, the tape moves by a distance determined by MMV1).

Generating the Slow Pulse

The slow pulse output from X14 consists of two parts. The first part is of high amplitude and lasts for 20msec. This gets the motor moving by overcoming its inertia. A reduced amplitude part then lasts for 40msec to keep the motor moving. When FF1 goes high, the monostable multivibrator in IC8 is triggered, producing the 20msec section of the pulse waveform. X10 is switched off. At the end of the monostable's cycle, D21 switches off. The output from FF1 is still high, and the potential divider R97/8 applies a reduced voltage to the base of X14 via D20 to give the 40msec part of the pulse waveform. When FF1 goes low, X11 switches off, X10 switches on to short-circuit the base of X14 and the pulse waveform comes to an end.

The slow-pulse preset in X14's emitter circuit may appear to set the amplitude of the pulse, but in practice it alters the length of the 40msec section. Strange? Not really. The pulse ends when the off-tape control pulse fires MMV1 and resets FF1 (and FF2). The bigger the shove we give the motor, the sooner this occurs. Thus the higher the setting of R114 the faster the tape is driven and the shorter output obtained.

Slow Motion

For slow motion the capstan servo alternates between still and normal speed playback. When slow motion is selected, the above sequence takes place. After stopping, there's a variable stop period set by means of the slow-speed control. This is achieved by interposing another monostable whose cycle of operation can be varied. So what happens is that a normal two-field picture is produced, followed by a still picture with variable delay, and

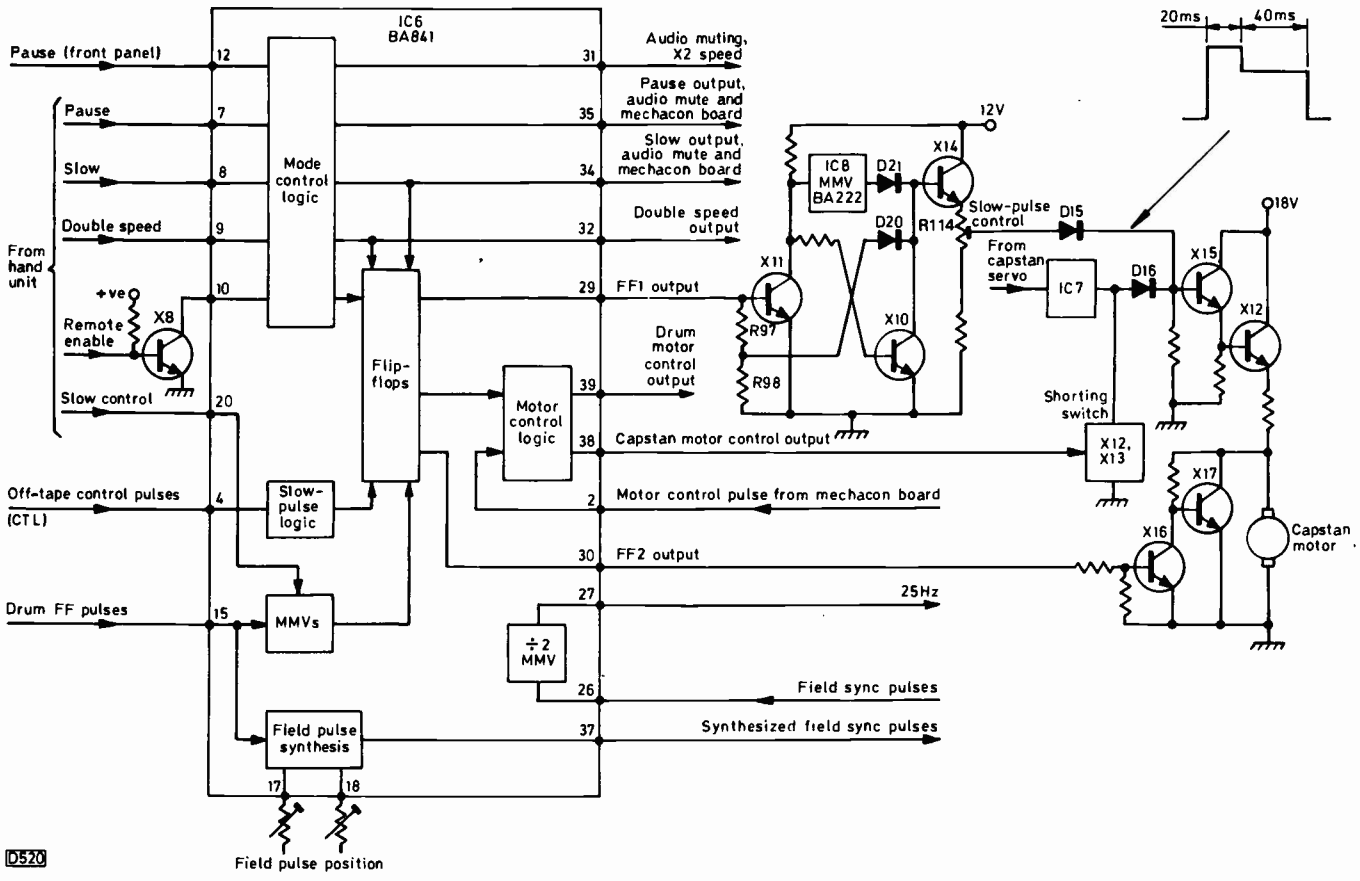


Fig. 64: Motor control arrangements for freeze frame and slow motion.

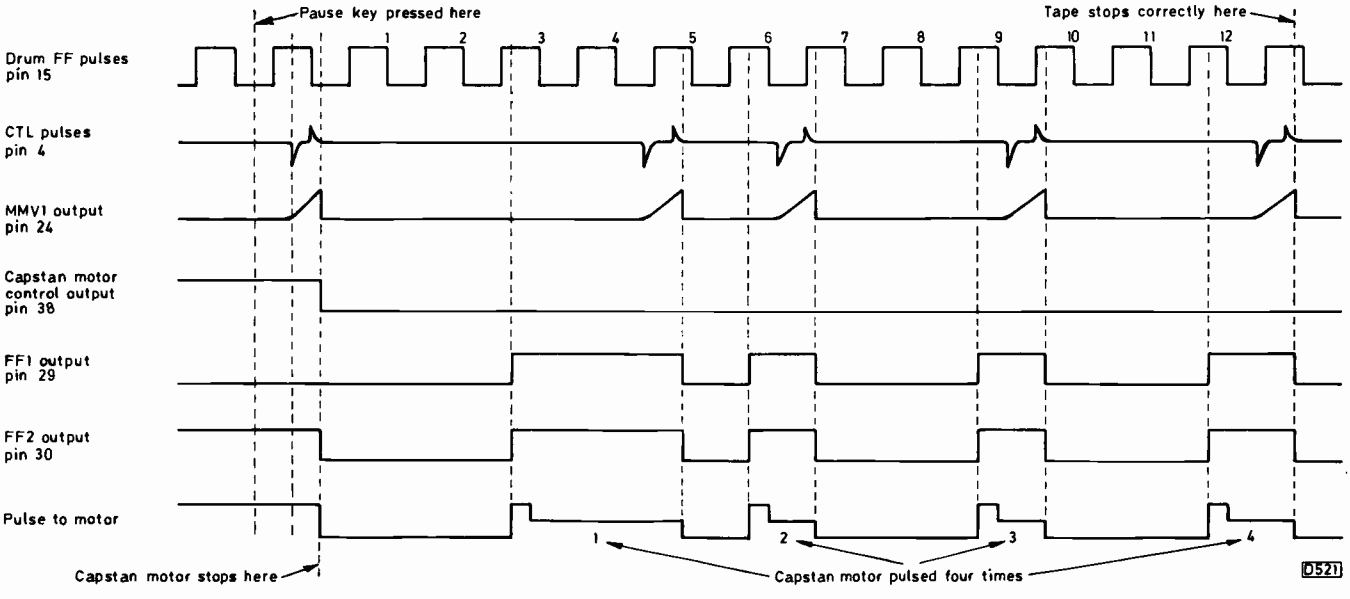


Fig. 65: Timing chart for freeze frame operation.

so on. On then going from slow to still, if the tape is stopped it remains so, if it's moving it stops when the slow pulse is completed.

Synthesized Field Sync Pulses

We said earlier that a synthesized field sync pulse is necessary in the still-frame mode because of the low level of the f.m. output waveform at the field sync position on the tape. There's another reason for producing a synthesized field sync pulse in the trick modes. When the tape is stopped, the heads scan longer paths across the tape. The drum is still rotating at 25Hz, and the result is a picture consisting of 628 lines, the duration of each line being shortened in the same ratio (by approximately 0·46 per cent). Also, odd and even fields no longer have the same number of lines. The converse occurs at double speed – there are then fewer lines per field. All this would lead to jitter, hence the need for the synthesized field sync pulses – separate adjustments are provided for channel 1 and 2 sync. If the difference in relative head-to-tape speed in the trick modes was any greater, it would be necessary to alter the head speed to avoid loosing line lock on the displayed picture.

TV COMPONENT DISTRIBUTION DIRECTORY

Code: C1 new CRTs; C2 rebuilt CRTs; C3 valves; LT LOPTs; TR triplers; TU tuners; RP direct replacement parts; AC active components; PC passive components; TE test equipment; TV used TVs; TL tools; SA service aids.

Supplier	C1	C2	C3	LT	TR	TU	RP	AC	PC	TE	TV	TL	SA	See page
Adcola Products Ltd., Gauden Rd., London SW4 6LH.												●	●	—
Apollo Electronics, 43 Clarke Crescent, Little Hulton, Worsley, Manchester M28 6XM. 061 799 0854		●									●			126
Axiom Electronics Ltd., Turnpike Rd., Cressx Estate, High Wycombe, Bucks. 0494 442181								●	●	●		●	●	—
Barry TV Services, 36 Milton Rd., Cambridge. 0223 69215. 32 Broad St., Ely. 0353 61462											●			166
J. Baker & Co., 1 Old Shoreham Rd., Southwick, Sussex BN4 4RD. 0273 593315										●				165
Billington Valves, 23 Irwin Drive, Horsham, W. Sussex RH1Z 1NL.	●		●											—
Bi-Pak Semiconductors, PO Box 6, 63A High St., Ware, Herts.								●	●	●		●	●	119
BK Electronics, 37 Whitehouse, Meadows, Eastwood, Leigh-on-Sea, Essex SS9 5TY. 0702 527572										●		●	●	125
Blore-Barton Ltd., Reedham House, Burnham, Bucks.									●					—
Cambridge Learning Ltd., Rivermill Lodge, St. Ives, Cambs. PE17 4EP.													●	—
Campbell Electronics Ltd., Unit 5, Heath Hill Estate, Dawley, Telford, Shrops.		●	●		●	●	●	●	●		●		●	164
John Carter (Electrical) Ltd., Furnace Rd., Gallows Inn, Ilkeston, Derbyshire.											●			—
CMJ Electronics, 52-54 Worcester St., Wolverhampton.										●				164
Hugh Cocks TV Services, Cripps Corner, Robertsbridge, Sussex.						●		●						166
East Cornwall Components, 119 High St., Wem, Shrops. SY4 5TT. 0939 32763			●				●	●	●	●		●	●	120
Electronic Mailorder Ltd., 62 Bridge St., Ramsbottom, Bury, Lancs. BL0 9AG.			●								●			163
Forgestone Colour Developments Ltd., Ketteringham, Wymondham, Norfolk NR18 9RY.	●			●	●	●	●	●	●					—
General Factors, 3-5 Union St., Doncaster, Yorks.											●			166
Hammond Components (Midland) Ltd., 416 Moseley Rd., Birmingham B12 9AX.				●	●									123
House of Instruments Ltd., Clifton Chambrs, 62 High St., Saffron Walden, Essex.										●				—
Intracept Electronics Ltd., 203 Picton Rd., Liverpool L15 4LG.										●				127
A. J. Jeffries, 16 Manor Gardens, South Ruislip, Middx. 01-895 2036	●	●									●			—
JLC Electronics, Triangle Buildings, 234R Green Lanes, London N13 5UD. 01-882 3531	●			●		●		●	●					—
Lavite Ltd., Viaduct Mills, off Savile St., Milnsbridge, Huddersfield, W. Yorks.			●	●	●	●					●			165
Manor Supplies, 172 West End Lane, London NW6 1SD.			●	●	●	●	●		●	●			●	114
Marco Trading, The Maltings, High St., Wem, Shrops. SY4 5EN. 0939 32763.								●	●	●		●		—

NJ Electronics, Unit 94, Storforth Lane Trading Estate, Hasland, Chesterfield, S41 0SN.		●	●	●	●	●	●	●	●				●	126
Papworth Transformers, 80 Merton High St., London SW19 1BE.				●										159
Post-A-Part Electronics, 39 High Rd., North Stifford, Grays, Essex.		●	●	●	●	●	●	●	●	●			●	115
PV Tubes, 38A Water St., Accrington, Lancs. BB5 6PX. 0254 36521/32611	●	●	●	●	●	●	●	●	●	●		●	●	—
Quick Save TV Spares, Muxton House, Muxton, Telford, Shrops.				●	●	●	●							160
Retach Ltd., 78 High St., Northwood, Middx. 01-652 7019	●	●									●			164
Retube Ltd., North Somercotes, Louth, Lincs. LN11 7QU.		●	●	●										—
Sandhurst Publications, 49C Yorktown Rd., Sandhurst, Camberley, Surrey GU17 7AG.													●	167
Sendz Components, 63 Bishopsteignton, Shoeburyness, Essex SS3 8AF.	●			●	●	●	●	●	●			●	●	168
Shieldway Ltd., Swan Lane Mill, 3 Higher Swan Lane, Bolton, Lancs. BL3 3BJ. 0204 64746	●	●												—
South London Television, 45 Griffiths Rd., London SW19. 01-543 5437											●			165
Technical Information Service, 76 Church St., Larkhall, Lanarkshire. ML9 1HE.													●	167
Technomatic Ltd., 15-17 Burnley Rd., London NW10. 01-452 1500. 305 Edgware Rd., London W2.								●						—
Tektronix (UK) Ltd., 36-38 Coldharbour Lane, Harpenden, Herts. AL5 4UP. 05827 63141										●				—
Telepart, 13-14 Worcester St., Wolverhampton, W. Midlands. WV2 4LJ.			●	●	●	●	●	●	●	●				156
Teletronic (North East) Ltd., See Vu Works, Strangford Rd., Seaham, Co. Durham. SR7 8QE.		●												164
Thandar Electronics Ltd., London Rd., St. Ives, Cambs.										●				—
Tidman Mail Order Ltd., 236 Sandycombe Rd., Richmond, Surrey TW9 2EQ. 01-948 3702				●	●									123
Trident TV Tube Co., Lyttleton Rd., Leyton, London E10 5NH. 01-558 3749		●												—
TSR Vacuonics Ltd., Tom Stewart Lane, Industrial Estate, St. Andrews, Fife. XY16 8YH. 0334 74035		●												—
TV Sales and Service Centre, 3 High St., Elstree, Herts. 01-207 0073			●	●	●	●	●	●	●		●			—
U-View (Tubes), 29 Warmsworth Rd., Doncaster, Yorks. DN4 0RP. 0302 855017		●												—
Watford Electronics, 33 Cardiff Rd., Watford, Herts.								●	●			●	●	—
Weltech Picture Tubes, Unit 3,10 Wembley Commercial Centre, East Lane, Wembley, HA9 7QR. 01-908 1816		●												—
Western Whybrow Engineering, The Square, Marazion, Cornwall. TR17 0AP.		●								●				—
P. E. White, 22 York Rd., Camberley, Surrey. GU15 4HR.							●							—
Stan Willets (Wholesale Supplies), 37 High St., West Bromwich, W. Midlands. B76 6PB. 021 553 0186										●	●	●	●	—
Willow Vale Electronics Ltd., Old Hall Works, Arborfield Rd., Shinfield, Reading. 0734 884444.	●		●	●	●	●	●	●	●	●		●	●	—
Willow Vale Electronics Ltd., 74 Maxwellton Rd., Paisley, Renfrewshire. 041 887 4949	●		●	●	●	●	●	●	●	●		●	●	—
Willow Vale Electronics Ltd., 4 The Broadway, Hanwell, London W7. 01-567 5400	●		●	●	●	●	●	●	●	●		●	●	—
Wing Electronics, MO Dept., 15 Waylands, Off Tudor Rd., Hayes End, Middx.					●									—
Wizard Distributors, Empress St. Works, Empress St., Manchester. M16 9EN. 061 872 5438	●	●	●	●	●	●	●	●	●		●	●	●	164

Fault Report

Notes from Richard Roscoe, John Coombes and S. Leatherbarrow

Two Toshibas

We don't get many call outs to Toshiba sets. Straightforward circuitry, cool-running chassis and well-supported PCBs with a good layout all contribute to a satisfyingly low failure rate amongst those under our charge. The other day however we had two in trouble, both 20in. C2090Bs, both recently installed and both with the fault intermittent no results.

The first fault was simple. The set burst into life, chatted briefly, then died. A pat on its bottom produced a repeat performance. Inside we found that the plug from the on/off switch to the small mains filter panel had worked loose. After pushing it well home we got normal results and, much encouraged, set off for the next one. After all these years you'd think we would know better!

This one came on and stayed on. No amount of bottom patting or even a severe clout made any difference. We had to leave a loan set and take it back to the workshop. On the bench it ran for a couple of hours then stopped with a squawk. Off with the back and in with the meter probes. First check for 112V at the output from the series regulator circuit. The reading we got was 130V, so the power supply was there but insufficient current was being drawn for the normal regulating action to occur. Our next check was on the line driver transistor TR402, which was cut off due to lack of drive from the timebase (sync plus line and field oscillators) chip IC301. A faulty chip? Not necessarily.

These sets have a trip which shuts down the line-frequency output from the i.c. in the event of a fault which causes excessive e.h.t. The circuit is shown in Fig. 1. A 226V supply is derived from the line output transformer and is applied to TR471 and the associated components. The potential divider network R471/2/3/4 presents a portion of this voltage to the emitter of TR471, whose base is held at 6·2V by the zener diode. Normally, TR471 is cut off. If the 226V rail rises however – indicating that the e.h.t. has also risen – TR471 will conduct and the voltage (normally zero) across R482 will be applied to pin 3 of IC301 – Toshiba grimly refer to this pin as "X-rays". A check at pin 3 proved that the trip circuit had indeed operated.

For test purposes R482 can be short-circuited (points marked D and E on the panel) – this should obviously be done with caution to avoid damage to other parts of the set. When we did this we got perfect results, so the fault was probably in the trip circuit itself. We next removed TR471 to block the tripping action and then discovered that the voltage across the 6·2V zener diode was low at about 4V. Either the diode was leaky, or R476 had risen to such a high value that the diode was starved of current. The latter turned out to be the case, R476 reading open-circuit on the meter. TR471 must have been on the point of conduction permanently, being switched on to give the intermittent tripping by a minor voltage fluctuation.

Note that this chassis is also known as the **Rank T24E** chassis. **R.R.**

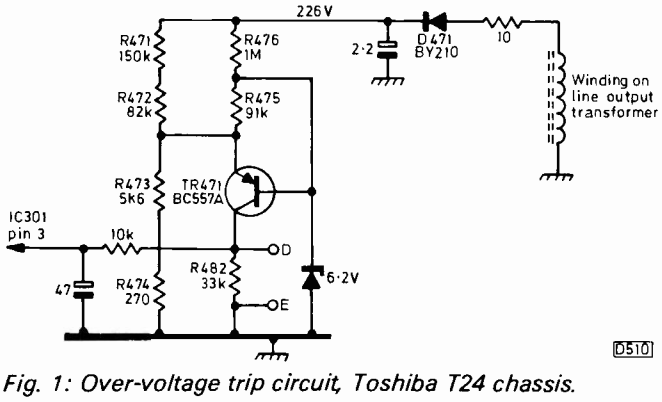


Fig. 1: Over-voltage trip circuit, Toshiba T24 chassis.

B and O 3400 Chassis

There are still quite a few of these hybrid B and O receivers in use. The other day we were called back to one that had had a new line output transformer fitted only a few days previously. The customer was not happy with the picture – "the close-ups are perfect" he said, "but everything in the background looks fuzzy." Now we've heard this description many times, and always the fault turns out to be poor focus. It seems that all those arty, soft-focused shots the advertisers are so fond of have got people used to less sharpness, hence the "perfect close-ups". Anyway when the picture came on, sure enough it was out of focus.

We took off the back and lifted the board holding the four valves (PY88, PY500A and two PL509s) used in the dual line output stage, thus gaining access to the focus control. Adjusting this produced a reasonably sharp picture – for a time. Then, as we watched, it went out of focus again – again and yet again. In fact every time we readjusted the control the focus would eventually drift off. This wasn't the usual gradual drift that occurs when one of the resistors in the focus control network changes value, but we changed the resistors nevertheless. Needless to say there was no improvement. Next we changed the focus control and the BY176 focus supply rectifier. Still no improvement. We then replaced the 68pF, 7kV reservoir capacitor in case it was leaking. It wasn't. Totally baffled and wondering whether the new transformer was in some way responsible, we had to pack up the set and take it back to the workshop.

When we had it on the bench we switched on and found a dramatic change. This time there was no picture at all! Our problems had been simplified however. There was no raster because the tube's heaters weren't alight. They're powered from a secondary winding on the mains transformer, via a 6A fuse. On examination we found that one of the connections to this transformer was very heavily oxidised. Cleaning and resoldering this joint restored the picture, and once the focus control was set up the picture remained sharp with no sign of drift.

We came to the conclusion that the joint must have been disturbed when we'd fitted the new line output transformer, and had started to act as a variable resistance in series with the heaters. This would make the heater voltage vary, in turn varying the tube's emission

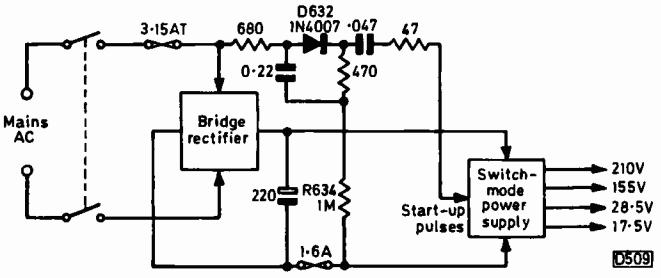


Fig. 2: Start-up circuit, Körting chassis 9.

and thus, as with a low-emission tube, the focusing would be affected. **R.R.**

Körting Chassis 9

Like many setmakers, Körting have adopted the self-oscillating chopper power supply (Siemens circuit) and transistor line output stage in their more recent sets. The problem we occasionally get is no sound or raster – the fault is sometimes intermittent. The most common cause is failure of resistor R634 (1MΩ) in the start-up circuit (see Fig. 2). Körting suggest that if necessary the value of this resistor can be reduced to 470kΩ. Another item worth checking for this fault is the start-up diode D632 (1N4007). **J.C.**

Rank T26 Chassis

A modification well worth noting on the Rank T26 chassis is the addition of an 0·0022μF capacitor across R15 in the over-voltage trip circuit. In later production it's included across the holes for the collector of TR1 and the emitter of TR2. It's purpose is to prevent random tripping, something that can lead to hair tearing. **J.C.**

Rank T16A Chassis

The trouble we had with a Bush BM6514 monochrome portable (T16A chassis) was weak field sync. Everything was fine when the set was first switched on, but after a few minutes the sync was impaired, with a tendency to trip on scene change. As a start, we carried out d.c. checks on the transistors used in the field oscillator circuit (a multivibrator). As expected, these revealed little, so we tried replacements. This made no difference, so we checked the resistors in the circuit. Once again nothing amiss could be found. As the fault was temperature sensitive, we next tried spraying the resistors, capacitors and transistors in the circuit with freezer. This had no effect and it began to look as though wholesale component replacement would be necessary. We then noticed a couple of likely looking 1N4148 diodes nearby (D4/5, one in the sync pulse feed circuit and the other to isolate the charging circuit). Replacing these with BY206s restored good field sync. **S.L.**

Thorn 1691 Chassis

The problem with a Thorn 1691 monochrome portable was intermittent loss of signals. Touching the board in the vicinity of the first i.f. transistor under the fault condition produced a good picture, so the transistor was replaced. Four hours later the signals again disappeared. This time the a.g.c. amplifier transistor seemed to be the culprit, replacement curing the fault. I had the set at home for a thorough soak test, and a couple of days later we were back with the no signals fault. This time no voltage discrepancies could be detected, except possibly a slight increase in the tuner a.g.c. voltage. All the other tuner voltages were correct, with a nicely varying tuning voltage, but the tuner wouldn't respond.

After fitting a Mullard ELC1043/05 tuner we had no further trouble. Whether the tuner was the culprit all along, the others being red herrings, is difficult to tell (both transistors tested perfectly with an ohmmeter). Faults like this always leave one with the feeling that every knock on the door could be the disgruntled owner returning with his set. **S.L.**

Grundig Model 1500

A 22in. Grundig colour set (Model 1500GB) caught us nicely the other day. It came in with a simple sound, no raster fault, and the line output valve's fusible screen grid feed resistor was found to be open-circuit. Fitting a new valve and resoldering the resistor restored the e.h.t., but the picture was lacking in width, with convergence errors accompanied by a kind of tracking effect across the screen. The first two problems responded to adjustment, but the third took somewhat longer to deal with.

Having seen a similar fault before on these sets (picture quality degraded, with horizontal grouping of lines and streaks appearing intermittently), I removed the i.f. strip and went over it with a hot iron. This must be done quickly and carefully as the unit is easily damaged — go for the joints around the chokes in the detector circuit. After doing this, refitting the unit and switching on the fault was still there. Thinking that I'd damaged the unit I tried a new one. Still no luck.

If the above procedure hasn't been successful in the past, we've usually found that the BF258 luminance output transistor is at fault. Not this time however. Looking again at the symptoms on the screen led me to think about the possibility of arcing/tracking in the line output stage. The valves were tapped, and as they seemed to be all right a new tripler was tried – I thought that maybe an internal discharge was taking place. It wasn't, so the original was refitted.

At this point I noticed that the focus unit was clogged up with accumulated gunge. Sure enough when the set was switched on there were tiny sparks between the slider and the VDR rod. Removing the unit and dismantling it enabled us to get at it with methylated spirits, and on refitting the unit the fault had at last been cleared. Much time had been wasted on this one because I'd not observed the symptoms carefully enough – the focusing had remained perfect throughout however. **S.L.**

Plastic Control Shafts

Here's a tip I'd like to pass on. How many people out there have difficulty fitting the plastic shafted type of potentiometer? Not fitting as such, but cutting the shaft to the required length to produce a nice fit. Small saws always leave rough edges, and cutters can split the shaft into a million pieces. It's much more elegant to use a loop of fine wire and a soldering iron. Loop the wire round the shaft at the required point, then pull the wire down gently whilst simultaneously heating the wire as closely as possible to the shaft. The wire will melt the plastic, passing through it with little resistance to leave a very straight, sharp finish. Any small edges can be removed with a small file. **S.L.**

Letters

VCR HINT

One of the most common problems with used Philips VCRs is worn audio/control heads. The symptoms are glitches on the replayed picture accompanied by wow on sound. This is due to grooves worn in the head block causing minute variations in the tape path. As a result, the pulses recorded on the control track get missed by the head on replay.

I adopt the following procedure to remove such grooves. First lay a sheet of 400 grade wet and dry on a smooth, flat surface. Then rub the head block across the paper from side to side, following the contours of the block, until the grooves have gone – this takes only two-three minutes. Finally lay a soft cloth on a flat surface, put some metal polish on it, and polish the head block. It's not necessary to achieve a mirror finish.

This procedure has worked perfectly for me on a number of occasions, and results in a considerable financial saving for five minutes work!

Eamonn Galvin,
Ovens, Co. Cork.

TELEFUNKEN 711 CHASSIS

I feel I must write concerning the Telefunken 711 fault mentioned by Mick Dutton in the November issue (page 25). As a past workshop supervisor for Telefunken in the UK I think I can claim to know this chassis fairly well.

The fault described by Mick Dutton is a very common one on this chassis, but I suspect that the sequence of events was not quite as outlined. To get things into perspective, Fig. 1 shows the basic power supply arrangements. Thyristor Ty421 provides a regulated 190V h.t. supply (U1). This thyristor is fired by T424 which is fed from a 26V rail provided by D427 and clamped to the regulated 12V supply (U3) via D422/3/4. Thus if the 12V supply is missing, the 26V rail will fall to 14V. The thyristor will then produce a very low output, usually about 10-30V, which is insufficient to cause any problems with the line driver transistor T561.

Mick Dutton's fault is nearly always caused by the sync/line oscillator i.c. TBA950 going open-circuit. From the line drive point of view, this i.c. forms part of a potential divider with R549 for T561's base current. So when the TBA950 goes open-circuit, T561's base is effectively left at 12V. The transistor switches hard on and attempts to short-circuit the h.t. line via R550 and R564. When you find that R550 has burnt out, the answer is to replace it along with T561 and the TBA950 i.c. It's as well to mention that early versions of the 711 chassis didn't include R550 – R564 was then 470Ω. As a result, the fault could see the end of the driver transformer Tr561 as well.

Early chassis also used a different line oscillator circuit, with component variations. Fitting the later TBA950-2X i.c. can cause problems when attempting to set the line hold for the usual float through with test points M531a/b shorted. The answer is to change the value of R540 (10·5kΩ, H.S.) to something approaching 9·1kΩ. The exact value must be found by experiment as there are several makes of chip which differ slightly on the market.

I suspect that what happened in Mick Dutton's set was that he accidentally killed the 12V supply whilst fault-finding – something which I can assure him wasn't unknown even in Telefunken's workshops!

Alan J. Tuck,
Uxbridge, Middx.

SALESBURY ELECTRONICS FAIR

The above fair will be held on April 30th-May 2nd and is intended to show the public a wide range of working exhibits of modern electronics in action. We particularly want a working satellite TV demonstration – any firm or group prepared to attend will be given a prior choice of facilities to avoid interference from other exhibits. There is no charge for indoor or outdoor space, but the public will be charged for admission. Security and insurance arrangements will be made, and it seems likely that TV personality Fred Dibnah will open and attend the fair.

Enquiries from potential trade exhibitors would be welcome. The venture is in aid of fund raising for church roof repairs. We aim to have something for all the family to look forward to over the May Day bank holiday weekend. It could be a marvellous shop window: maximum local and national media coverage will be sought, AA signs erected, etc. I would be pleased to answer any questions.

W.H. Jarvis, M.A., M.Inst.P., Saleweel House,
Salesbury Hall Rd., Ribchester, Preston, Lancs. PR3 3XU.

SACK THE EDITOR!

Your November leader (Channel 4) contained several swipes at sport. As a firm believer that sport actually helps

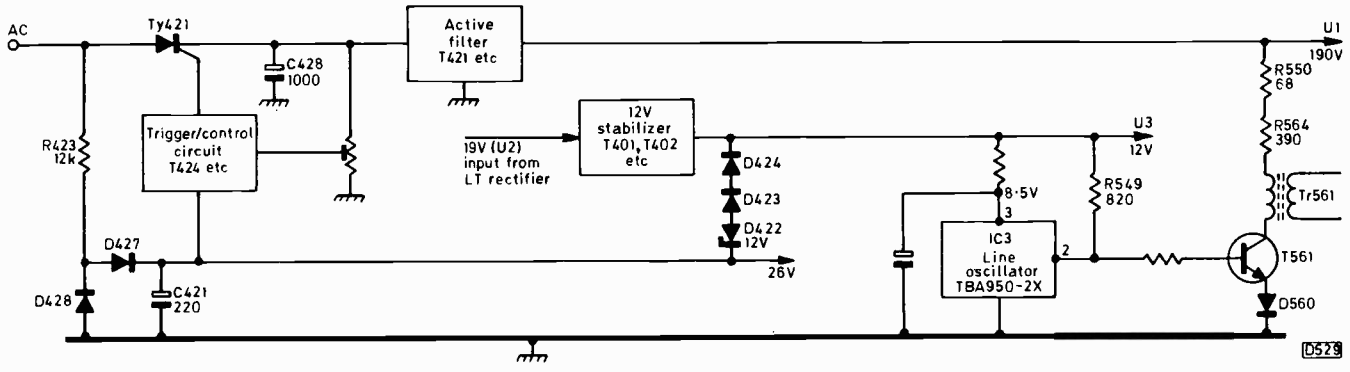


Fig. 1: Outline of the power supply arrangements used in the Telefunken 711 chassis. In the absence of an output from the 12V regulator, D422 will attempt to take over the supply to the U3 rail and the 26V line will fall to around 14V.

sell tellys, due to its popularity, let me have a swipe or three in retaliation!

I can hardly believe your line of criticism that lumps sport against music or films. This must imply that all music is good, all films are good, and all sport is bad (on TV at any rate). My goodness, such prejudice deserves two panel games! Unfortunately your comments showed not just prejudice but ignorance as well. Sport played in our climate is often curtailed or postponed. It's undermined by strikes and abused by politicians world-wide in a way unknown in other entertainment.

I doubt very much if sport is "easy TV" – possibly the reverse is true. As to "commentators waffling", it must be said that seldom have any four editorial lines included so much contentious copy. The last paragraph refers to "thirty indistinct horses". Does this reflect the writer's viewing habits, his Saturday liquid intake, or a faulty tube? Where I live I see thirty of what other writers have described as one of God's noblest creatures. I see them clearly enough on my Co-op TV. I agree incidentally with the other points made.

James Kaney,
Foxbar, Paisley.

I was surprised and disappointed that the editorial in the November issue should erroneously claim that many of the cable channels available in places like Brussels "are simply being pinched". Unpaid for use of the BBC and ITV channels and those from other foreign sources in Belgium occurs only where direct reception is also possible with individual aerials, just as in the case of the UK where cable companies distribute the BBC and ITV programmes without paying charges for obtaining the signals. Does the editor think these signals are also being "pinched". If so he should say so, and presumably include users with individual aerials as guilty of his newly invented crime of receiving broadcast programmes. In both Belgium and the UK, the broadcast receiving licence is simply an authorisation to install and use the appropriate receiving equipment, and in strict legal terms has nothing to do with the supply of programmes, provided only that they come from "authorised broadcasting stations".

Indeed it is precisely because it has not yet been possible for the local cable operators and the BBC to reach agreement that we still have no BBC (or ITV) programmes on the cable in Brussels, which is outside the area in which direct reception is in principle possible.

The information in Teletopics on the cost of cabling, without any qualification, also seems to be highly questionable. A report by CIT Research, quoted in the *Sunday Times,* estimates that the cost would be half the suggested figure. Estimates depend on the assumptions made, but for your information I pay some £40 annually for the cable which supplies thirteen TV programmes and twelve f.m. radio programmes (with at least two spare TV channels at present occupied by test signals) – yet the *Sunday Times* article says "realists about cable know that they will have to charge about £10 per month"!

It seems incredible to me that nobody writing about cable appears to realise that broadcasting economics depend on a mass audience to provide economies of scale: it costs the same to produce a programme that nobody watches, so to bring the cost down to what people are prepared to pay the potential audience must be vast. Only if the cable distributes programmes for which a mass audience already exists (such as foreign broadcast programmes) can the marginal cost per subscriber be kept at a level where people are willing to pay for it.

Because of my professional position, I must ask to remain anonymous.
(Name and address supplied.)

Editorial comment: Well I never: I seem to have sparked something off this time! Whilst admitting to a bit of prejudice about the *amount* of sports broadcasting, this was not really the point. My complaint is about programme scheduling. The competing networks consider it essential to put the two things you want to see on at the same time and to leave other large chunks of TV time full of things you don't want to see. If sport helps sell tellys however I suppose this scheduling helps to sell VCRs, so perhaps we shouldn't complain!

In reply to the gent from Brussels, UK cable operators *have* to distribute the BBC and ITV programmes – few (at present) are allowed to distribute anything else. The licence is indeed permission to instal receiving equipment, but the revenue in the UK goes to the BBC for the provision of programmes. The point I was making was that in one way or another we have to pay for the programmes we get, and that this will be as true for additional cable channels – something our correspondent appears to agree with in his later remarks. As to the cost of cable installation, we have only quoted estimates from other sources, not our own. There is a great deal of guesstimation about this – inevitably, since decisions on type of network etc. have yet to be made and no one knows how many households will avail themselves of the option once cable becomes available to them. A charge of £40 a year for a service that's yet to be costed let alone installed seems unlikely to say the least – unless it's "given" away at the start to get it going. Recent comments from cable organisations suggest that it will be several years before such operations begin to show a profit. It seems that in the USA the only organisations making much of a profit out of cable TV are those providing the programmes rather than the cable service itself.

THORN TX9 CHASSIS

AN error occurred in our notes on this chassis last month (page 72). The earlier main panel is type PC1001, not PC1002 – panel PC1002 is the tube base panel. Thorn have issued some additional recommendations on the problem of random mains fuse blowing. Where the problem could be due to transient spikes on the mains supply, i.e. in areas where the mains supply is "dirty", it's worth fitting the 002 version of the reservoir inductor L65. This has been specially designed to deal with this sort of difficulty. Note also that the zener diode now recommended for use in the D85/W85 position (over-voltage sensing) has been selected for improved characteristics in this application. The part number is 02V4-718 (there's a three-segmented circle symbol on the body). Other steps that can be taken are as follows:

(1) Change C134/5 to 0·01μF, 1kV, part no. C5100-EW410-CBC1.

The following apply to panel PC1001 only, having been implemented on later panels.

(2) Change C146 to 220μF (16V).
(3) Change R223 to 470Ω (½W, 5% fusible).
(4) Change R216 to 1kΩ ½W, 5%.
(5) Replace VT67/TR67 with the Thorn in-house transistor type T6059V, part no. 01V0-953.

Routine TV Receiver Tests: Pye 713 Series Chassis

S. Simon

LARGE numbers of 18in. colour sets were produced by Pye during the early/mid-70s. The initial model was the CT200, which was fitted with the 713 chassis. The subsequent CT200/1 was fitted with the 715 chassis while the later CT218 was fitted with the 717 chassis. The chassis was also used in Philips models, and was then known as the 570 chassis. There are many differences, which can be confusing. The main one was the use of a unipotential (low focus voltage) tube in the earlier chassis and a bipotential (high focus voltage) tube in the later chassis. From a general handling point of view however the differences are minimal, the basic design remaining the same.

The mains fuse is F526 which is rated at 1·6A (delay). In later versions there's a second mains fuse F542 (3·15A delay) which is in the feed to the degaussing circuit. This means that on early models the 1·6A fuse is subjected to pretty heavy treatment. We'll take this as our starting point.

Dead Set

The mains input goes to the on/off switch and from this to the main board, front left side, plugging into a two-pin socket. This is where the mains fuse(s) are located. If the 1·6A fuse is open-circuit, examine it to determine the mode of its death. If it's not blackened, replace it and try again. If it's blackened, check the resistance reading across the four BY127 diodes in the bridge rectifier circuit. One or two are likely to be short-circuit. If not, lift one end of the 0·33μF mains filter capacitor C501 off the print and check it – this capacitor is just to the right of the fuses. If it's not at fault, check the BT106 thyristor farther to the centre for shorts between its metal body and the long cathode leg. The large electrolytic can (C535/6, h.t. reservoir/smoothing) in the corner of the board could be at fault but this is less likely. If there are no shorts, leave the filter capacitor disconnected at one end and try another fuse.

Not so Dead Set

Note that the tube's heaters receive their supply from the line output transformer. Thus if the set appears to be dead there could still be plenty of h.t. around, as a check at the rear left resistive assembly may show. Check each section (R544/5/6) in case one is open-circuit. The value of the surge limiter section R544 varies with the different versions of the chassis, but will be between 3·3Ω and 5·6Ω. If this is intact and the thyristor is working the h.t. reservoir electrolytic C535 (600μF) will be fully charged, so take care if R545 or R546 is open-circuit. Switch off and discharge C535 to chassis through a resistor of say 100Ω.

Note also the cluster of fuses in the centre of the main board, under the tube. There are four. F541 (630mA delay) is the main h.t. fuse and 155V should be recorded here. It's the second one from the front. The one next to it (F691, 500mA), i.e. the second one from the rear, also has h.t. on it. It feeds the line output stage. The front fuse F683 (500mA) is the l.t. fuse (18V line). It feeds the 12V regulator on the i.f. panel and also provides bias for the sync separator which is in the TBA920Q i.c. The rearmost fuse F678 (315mA) is in the 40V supply to the field timebase and the audio output stage. This is the fuse most likely to be found open-circuit, with consequent loss of sound and field scan. It can fail on its own or can be blown by a shorted transistor or transistors in the field or sound output stage.

Blow LT Fuses

The BD233 and BD234 field output transistors (VT751/VT754) are at the rear edge of the panel, roughly in the centre. The two BD131 audio output transistors are on the left-side i.f. panel, which also carries the tuner and the i.f. gain/filter and demodulator units. If there's doubt or a resistance check is inconclusive, switch the multimeter to the 500mA range and apply the probes across the fuseholder. If this restores the sound and field scan and the reading is well under 300mA, the fuse can be judged to have failed on its own, or perhaps there's an intermittent fault which shows up only now and again or maybe when the transistors have become hot. If a short is present, removal of the supply plug to the i.f. panel (to socket SK259) will show whether the fault is on this or the main panel and provide a starting point for the search. If replacement of the fuse restores sound but not the field scan or vice versa, it's likely that the series feed resistor to either stage has been damaged. In the case of the audio output stage it's R249 (12Ω) while in the case of the field output stage it's R746 (22Ω).

Complete loss of sound and vision signals directs attention to the front fuse F683 (500mA). There should be 18V at both ends. This voltage is fed to the i.f. panel where the BD131 12V regulator transistor VT210 lives at the top front. If there's an 18V supply here (fuse intact) it's likely that the BD131 is open-circuit, as may be revealed by a high reading at its collector (should be 15V, not 18V). A quick check on the forward and reverse readings, base to emitter and base to collector, will confirm this.

The Line Timebase

We've found the line timebase fairly reliable. The oscillator is in the TBA920Q i.c., which receives its supply at pins 1 and 4 from the 155V line via R617 (2·7kΩ), stabilised by the 12V zener diode D618 (BZX79). In the event of non-operation, check the supply at these pins. If absent, touch R617. If it's cold, ensure that there's 155V at one end and nothing at the other before pronouncing it open-circuit. If it's hot but there's no 12V supply, suspect the zener diode and check it for being short-circuit.

The i.c.'s output is fed to the line driver transistor

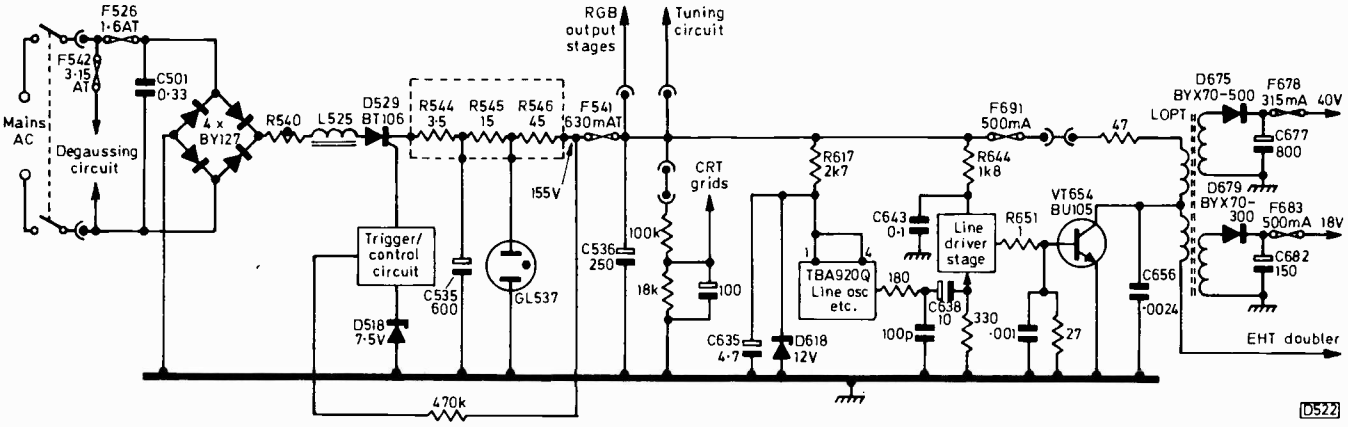


Fig. 1: Basic power supply arrangements used in the Pye 713/5/7 series chassis. Use of the mains bridge rectifier means that the chassis is at half mains potential. The line output transformer also feeds the line shift and c.r.t. first anode supply rectifiers.

VT647 (BF337) via a 10μF electrolytic capacitor (C638). There should be 5·3V at the base of this transistor and 105V at its collector. If the base voltage is absent and the collector voltage is 155V (h.t.), either the transistor is faulty or C638 is open-circuit. If the collector voltage is low, with R644 in its feed circuit hot, the transistor is likely to be short-circuit though the decoupler C643 (0·1μF) could be leaky. A less likely possibility is that the driver transformer has a primary to secondary short.

The damping components across the driver transformer's primary winding are important to the life of the BU105 line output transistor. In the event of non-operation of the line output stage, don't overlook the 1Ω resistor R651 in series with its base.

If fuse F691 is open-circuit, check the BU105/BU205 line output transistor and the l.t. rectifier diodes D679 (BYX70-300) and D675 (BYX70-500) for shorts, remembering that a short recorded across the diodes could indicate a shorted reservoir electrolytic (C682/C677) rather than a shorted diode. The BY206 and BY207 are suitable replacement diodes for D679 and D675 respectively. The third low-voltage diode D670 (BA148) provides the line shift voltage. There's also a high-voltage diode, D657 (BYX10), which produces a 570V supply for the tube's first anodes. The reservoir capacitor is C655 (0·01μF) which can short to the 155V line.

An overwinding on the transformer feeds the e.h.t. doubler, which is first in line for disconnection in the event of F691 having failed. The doubler also feeds the focus network, which is on the tube base panel. There are four 4·7MΩ resistors in a series chain before the focus control, which supplies some 3·5kV to the focus pin (9) on the tube base – we're talking about the bipotential tube, the earlier unipotential tube having its focus pin fed from a tapped resistor chain supplied from the first anode supply rectifier. The output from the doubler is some 18-20kV. A sudden and possibly nasty increase in the e.h.t., with arcing from the tube connector and perhaps the doubler, should direct attention to the flyback tuning capacitor C656 (0·0027μF on earlier models, 0·0024μF on later ones) which is of the special high-voltage type. The line output transistor could well fail before these uncomfortable symptoms can materialise, which is probably why these firecracker antics are not too well known.

IF and Decoder Panels

The i.f. and decoder panels are on the left-hand side and are almost identical to those used in the Pye 725 series covered last month. The same remarks apply, particularly to the i.f. gain/filter module where a sudden loss of gain may well give the impression that there's a fault in the tuner. Resoldering the through-connections in the filter part of the unit, coils and capacitors, will normally resolve the problem without need to replace the module. The same type of thick-film resistor unit is employed at the top of the decoder panel (the upper one), and is the cause of a wrong grey scale in most instances. The unit contains the 4·7kΩ RGB output transistor collector load resistors and the 27kΩ feedback resistors. A voltmeter check with the set switched on or a resistance check with it off should quickly reveal any differences between the operating conditions in the three stages.

One expects to find h.t. at the top of the decoder panel but not, perhaps, on the i.f. panel. The feed resistor to the tuning voltage supply, R209 22kΩ, lives at the bottom of the i.f. panel however. It has, or should have, 155V at the end nearest the socket from whence it obtains this voltage (at pin 6).

All we said about the left-side section of the 725 chassis last month (and we didn't say a lot) also applies to these sets. The panels cannot be interchanged however because the sockets have a different configuration. It's the main panel which may perhaps appear to be strange and a bit awkward to those who are not familiar with it.

Over-voltage Protection

The over-voltage protection arrangement used in these chassis is simple indeed – just a single glow switch (GL537). It strikes in the event of excessive h.t., shorting the h.t. line and blowing the mains fuse. The usual cause is a faulty thyristor (D529). You would have discovered this from examination of the fuse as outlined earlier. Another possibility is zener diode D518 (BZY88, 7·5V) going open-circuit.

VCR Operation

To reduce the time-constant of the flywheel line sync circuit for use with a VCR, connect pin 10 of the TBA920Q i.c. to chassis, i.e. connect points Y1 and Y2 together. If this results in poor line lock with an off-air signal, fit a switch so that the connection can be opened. Some Philips sets have a VCR button on the six-latch unit, and this is what it does in addition to the normal tuning.

Cabinet Renovations

Tony Thompson

ASK any used car dealer what sells cars and the chances are he'll confirm what you suspect already: appearances are all important. It's the same when people buy a used television set. Potential customers want to see a good picture of course, and may well be reassured by the offer of a guarantee, but as few purchasers are technically minded the look of the set can be as important as your carefully set convergence. In this article I've set out ways of enhancing the appearance of most sets. Some you may know already, others may be new to you: I've tried them all, and provided the procedures are followed carefully you should be pleasantly surprised at the overall improvement that can be achieved. Let's make one thing clear from the start however: we're not embarking on a master cabinet maker's refresher course! The methods are simple and require the minimum of skill (but the maximum of common sense, something you have in abundance, yes?). They can more aptly be described as "patch and hide" rather than "repair".

Materials Required

The items you'll require are as follows:

(1) Aerosol foam cleaner (Servisol or similar).
(2) Topp's scratch-cover polish, medium and dark.
(3) Plastic wood – tubes for teak and mahogany.
(4) Touch-up paint – use Humbrol modeller's tins.
(5) A fine watercolour or hobbyist's paint brush – size 0, sable.
(6) Scraper – Skarsten or other type, see below.
(7) Stanley craft knife no. 199. Blades no. 1992.
(8) Black and brown shades of cobbler's heel-ball or similar wax.
(9) Small tin of Brasso metal polish and/or T cut car paintwork restorer.
(10) Small tins of silver paint and gloss or matt black as required.
(11) Tin of wax furniture polish. Shoe polish is useful too.
(12) Aerosol polyurethane varnish, Humbrol or similar.

Some of these things you'll already have of course. Cobbler's heel-ball wax can be obtained from one of those old-fashioned shoe repairers hidden away in the back streets of all towns and cities. If you ask nicely, he may well give you the butt ends of wax sticks he finds too short for convenient use – he would probably throw them away anyway. Even if you have to buy or get him to order a couple of sticks for you it's inexpensive stuff. Failure to locate a source of heel-ball wax should lead you to the local arts/crafts shop where you can buy wax as used for brass rubbings. As a last resort, the wax crayons kids use to draw pictures with will do, provided the colours are right.

Skarsten scrapers are usually available from tool shops and ironmongers. They are professional shave-hooks with replaceable blades, designed to strip paint or varnish from wood. A standard cabinet maker's scraper will serve just as well – if you can find someone who knows what one is. You could even use a good, sharp smoothing plane blade – remove it from the plane first!

Foam cleaner is amazing stuff, magic with difficult surfaces like grained leatherette, but if you want a cheap substitute you can half fill a jam jar with warm water and add a squeeze of washing up liquid. The resulting mixture can be used effectively with a soft nylon-bristled long-arm brush – of the type sold for cleaning toilet pans. Get small tubes of plastic wood: tins dry up too quickly, and in any case other fillers may be preferable.

Types of Cabinet

There are two basic forms of cabinet. First the all plastic type, usually in the form of a single major moulding to which the decorative emblems, the handles etc. are attached. These would once have automatically been produced in thermosetting material, e.g. Bakelite, but nowadays many seem to be made of thermoplastic material, especially the cheaper types of portables. Secondly wood construction. Such cabinets may be made of chipboard (particles of timber resin-bonded into a grain and warp-free solid) or plywood, in either case with a surface finish designed to hide the true nature of the material used.

The added surface may be a genuine wood veneer, but increasingly the finish is imitation wood grain in the form of plastic sheet. Some of the larger plastic cabinets have a wet-printed wood-effect finish. From our point of view it's a pity that teak has been so popular where a genuine wood veneer is used. There are so many attractive and far more durable timbers around. Teak is difficult to work, very easily marked and damaged and a problem to repair. Finally there are a few sets around with a painted finish, probably cellulose sprayed.

Initial Cleaning

Initial cleaning is essential and should be carried out carefully and thoroughly if best results are to be obtained. Foam cleaner or the wash-up liquid alternative will lift the grime of years out of wood grain and remove layers of greasy dirt from the facia panel and knobs. Take especial care where lettering is applied however: this may lift with over zealous cleaning, particularly where emblems and logos are screened on to hard, shiny surfaces or chromium panels.

Pay particular attention to the area immediately surrounding the c.r.t. mask or push-through seal, because it's here that much thick and resistant gunge lies unsuspected. One of the beauties of foam cleaner is its ease of use, there being no real need to remove items such as control knobs for separate cleaning. When using wash-up liquid it's best to pull off the knobs or sliders and scrub them with an old toothbrush – useful indeed where the knobs are fluted.

After cleaning, dry thoroughly with towelling or other absorbent material and you're ready to examine the set critically.

Minor Blemishes

Any blemishes should be very apparent after thorough cleaning. Minor (surface) scratches and scrubs tend to disappear when polished with the appropriate shade of

scratch-cover polish, but go carefully on teak. Slight marks on this type of wood tend to darken, so you can actually get the opposite effect to that required. Look at the scratches carefully before starting. Is the surface broken or just depressed below the surrounding wood? If it *is* broken, your best bet may be plain (i.e. non-coloured) polish. Polishing will not of itself remove the marks of course, but a good cleaning will have shifted any accumulation of dirt and together with the covering effect of the wax layer the result will be that the blemishes are much less obvious. If you really want to be rid of the mark it's got to be levelled.

Filling

This is essential where there are deeper marks, perhaps penetrating through the veneer to the base timber. In such cases a more aggressive approach is needed. Fill with plastic wood or other suitable filler so that the depression is built up to the level of the surrounding wood. Avoid the use of sandpaper whenever you can: you may end up having to revarnish the entire top or side to make it look acceptable. Plastic wood is available in shades to suit almost any TV cabinet, but tends to show on any but the smallest blemish – especially on teak.

Modeller's paint is helpful here – the type you buy in inch high tins. Humbrol no. 9 is a close match for teak for example, being a sort of tan colour. Apply the paint to the filled and levelled surface not in brushfulls but with the brush almost dry, stippling the paint on. Use levelling techniques as described later for plastic finishes. Build the stippling up slowly, observing the results. With practice you'll find you can blend your repair almost perfectly. If the area is large you'll need a couple of other darker brown shades to stipple on to give the illusion of wood grain. Don't laugh – it works! Remember that you're right close up to the repair, seeing it under strong direct light and knowing it's there. Others won't notice it if you do it well enough.

One big problem with plastic wood, something that does little to endear the stuff to me, is its tendency to drop out due to shrinkage, especially if the hole is shallow. It may seem paradoxical to make the hole deeper in order to hide it, but that's what you've often got to do, digging in with the Stanley knife or a fine chisel to undercut the edges sufficiently to provide a key for the filler. You can use Polyfilla, other similar fillers or even car body fillers when you intend to paint the "wood" back on. These fillers usually stay in place well and are resistant to crumbling. Take care to avoid such fillers spreading into the surrounding woodgrain, as this can prove very difficult to clean subsequently.

Veneer

In case you're in any doubt, veneer consists of a thin sheet of quality wood firmly bonded to a base. Many years ago veneers were held in place with animal glues which, being heat softenable, could be spot lifted and repaired. Such glues are no longer used in mass-production work – once bonded, modern veneers are intended to stay that way.

Due mainly to the fact that veneer is so very thin, the corners, edges and other narrow areas such as those around the front edges of the cabinet often tend to split and crack. With its deeply grained texture, teak easily gets caught with a duster and rips away nicely. Other kinds of damage may be caused by stains or watermarking of one kind or another. My favourite timber teak is especially prone to watermarking, which shows up as white patches or rings where the previous set owner perched cups of tea or vases of flowers (brimming over nicely). The damage this can cause to the innards of a set is enough to give any engineer a nervous twitch, but we're concerned with appearances. These marks can be a real problem. They won't hide with scratch cover, though they will diminish slightly.

The surface of many teak cabinets is finished with a polyurethane or similar sealer. The amateur is unlikely to achieve a satisfactory surface finish due to the oily nature of the wood – it's this very quality that makes teak ideal for the decks of yachts! One way to tackle the problem is as follows. Using the scraper, carefully remove the entire top or side until you've reached a level to which the water has not penetrated. Use the scraper gently, always along the grain and outwards off the edges to avoid lifting or cracking the delicate veneer. A power sander can make light work of finishing the job, or you can hand sand then wirewool to a smooth finish. Make no mistake: this is hard work and you'll need to spend a lot of time getting a good surface. The finished surface may well have a slightly different colour and texture to the untreated areas. There's little that can be done to improve this, as timber weathers and often gains or loses surface colour after months or years of exposure.

Finishes

Once the surface has been prepared, the choice of finish is yours. Waxing with a cream-type furniture polish gives a nice stain finish, or you could use teak oil. Brushing varnish on teak cannot be recommended because, due to the oiliness previously mentioned, you end up with a tacky, gooey surface that takes ages to dry properly and is anything but attractive. It's possible however to use an aerosol spray varnish as outlined below for other timbers, provided you first degrease the wood thoroughly with white spirit. Rub along the grain vigorously, go over quickly with a dry cloth, then spray immediately.

Other wood veneers can be successfully revarnished as follows. Strip with a scraper or with paint stripper if preferred until all traces of the original finish have been removed. Smooth down with glasspaper, working from medium through the grades to very fine or flour quality. Wire wool, then soak a lint-free cloth such as a piece of old shirt in white spirit, fold it into a pad, and rub along the grain. This is called a tack rag and will lift very fine wood dust from the grain. It goes without saying that the room where the varnishing is to be done should be dust free. I use my garage on still days, wetting the concrete floor to avoid rising dust. Mask off all areas not requiring treatment, using masking tape (not Sellotape, as this can damage the cabinet when being removed) and newspaper. Several passes are better than one heavy one. The varnish dries more quickly, minimising dust pick up. When hard dry, the surface can be left glossy or wirewooled and waxed.

Iron-on Veneer

Narrow front surfaces come in for a lot of hammer, but there's an answer in the form of iron-on Conti-strip or similar rolled, pre-glued strips of veneer designed for easy finishing of the edges of veneered chipboard panels.

Simply cut the strip to length, strip off the remains of the original veneer – a task which should be relatively easy as a result of the brittle glues used – and iron on the new veneer, mitring the corners as you go. Trim the edges with the Stanley knife, wirewool smooth and finish by rubbing on clear varnish quickly with a cloth or waxing. If the shade of wood is too light, use scratch-cover polish instead.

It's now possible to buy complete sheets of iron-on veneer with which a complete cabinet could presumably be reveneered. I've not tried this, but if I did I would first remove any broken veneer areas, then level with filler. The entire cabinet would require roughing or scoring to give a key for the new veneer. I'd not recommend the removal of existing sound veneer surfaces.

Plastic Cabinets

When it comes to plastic cabinets we have to take special care. The quality of finish ranges from hard as Formica excellence to what can only be described as grotty. Treatments that work well on the more durable finishes can easily destroy the wood effect of the poorer types, so it's important to bear in mind what could happen and wherever possible experiment in a less obvious place than the top centre of the cabinet.

The dirt should have lifted o.k. with the cleaner (but steady with the brush when using wash-up liquid). You'll probably find spots of paint in evidence: I always do. Seems nobody bothers to cover the telly when doing the annual decorating – or perhaps they can't bear to miss favourite programmes and paint only during the commercials . . . These spots can be removed with Brasso and *very* gentle rubbing. If this produces a "too clean" effect the whole panel can be gently cleaned. Sometimes, depending on the method used to apply the wood grain effect, scratches show through whitish and obvious. Spot these out with your watercolour brush, stippling on suitable paint as previously outlined. It won't fill the scratch, but it's effective camouflage.

Deep, wide scoremarks, sharp dents, gouges and even missing corners can make a good set virtually unsaleable. Such damage can be repaired with heel-ball wax. To repair a flat surface, have it horizontal then melt a little wax either with a match or your soldering iron and allow it to flow into the damaged area. It's worth warming the damaged area first, using a hairdryer, as this assists the flow of wax by preventing premature chilling. Judicious local heating of the wax pool with the iron also helps, but avoid touching sound plastic areas.

Once the wax has set, usually a matter of moments, it can be scraped down carefully layer by layer using a Stanley blade held in the fingers until you're down to the surrounding level again. With a backward tilt to the blade and only slight pressure you are unlikely to damage the good surrounding area, but you can stop the corners of the blade digging in by sticking strips of masking tape or paper tape on either side of the repair, allowing the blade ends to rest on this as you scrape. The big advantage is that if you do go wrong and the wax breaks free, it can easily be remelted and you can try again. And again if necessary.

Corners can be repaired in much the same way, but you have to build up a "dam" to form the missing side or sides. Use waxed card or smooth pieces of plastic, held in place with masking tape. The wax can be blended to suit by mixing various shades in a spoon held over a candle. It's inflammable, but not violently so. Still, take care. When repairs are complete, finish the entire cabinet with scratch cover or shoe polish.

Large areas around channel switches or on the tops of sets where hands have rested umpteen times whilst selecting stations will sometimes be found to be stripped of print or worn very thin. Small areas can be touched in as described earlier. If the area is extensive however this won't work. What then? It's possible to remove the whole printed area with T cut or fine wet and dry paper, used wet and lubricated with a bar of soap. Such a job can be finished with Brasso or left T cut for a medium shine! Often the finish obtained is dark grey. You could spray paint this, using a car aerosol, but at all costs avoid using cellulose or you could end up with a crackle finish due to interaction between the cellulose and the plastic base (it's a good solvent for many types of plastic). Fortunately, car aerosols are increasingly non-cellulose, being mainly of a synthetic enamel formation (acrylic). Look on the tin, read the manufacturer's literature or seek advice on the spot before purchase, and test a small hidden area first.

Another possible finish is Con-Tact or Fablon self-adhesive plastic sheet. This strong thin film is readily available in a wide range of photographed finishes. Not all cabinets can be recovered successfully in this way however. Heat generated within the set can lead to failure of adhesion and a buckling or shrinking of the film. If the cabinet allows, a wrap-around and tuck-in form of covering should minimise such problems, but I cannot recommend using this recovering technique where cabinets have side mounted speakers with grilles of thin, slatted form, and I do recommend covering in one continuous length – up one side, across the top and down the other. Leave a generous overlap underneath, but take care not to block air vents.

Other Types of Cabinet

White or coloured cabinets may be revived with Brasso, but check somewhere inconspicuous that the colour is sound or that the plastic is self-coloured. Grained effect plastics are best simply polished after cleaning.

Panels and Masks

One of the focal points of a set for the prospective purchaser is the front panel. Marks here or on the c.r.t. surround are very obvious. Control panels are often black, either gloss or matt, with white lettering screened on. The paint often cracks away due to poor chemical adhesion with the smooth metal surface beneath, taking with it portions of the lettering. Spotting in with appropriate paint colour is very effective, but remember the golden rule: built it up slowly. It's relatively easy to reletter using Letraset transfer lettering, which is available from stationers. Some mask edges have a thin line of silver paint which wears away here and there. It's your choice whether to remove or repaint, but don't leave it half and half!

Backs and Stands

The back of the set should not escape attention. Clean plastic backs as you would the cabinets, and remove extraneous labelling as far as possible. If you can't shift them, cover them with one of your own! Fibre type backs

can be more untidy, because attempts to remove unwanted labels can easily result in large surface areas being ripped off. Best advice is to take care. Mains leads get filthy, but can easily be cleaned with scouring powder on a dampened cloth. Wrap the cloth round the lead and pull through.

Don't neglect the stands. Metal castored types can be cleaned with Brasso or even resprayed or if need be painted. Wood types and plastic wood-effect cross members respond very well to scratch cover.

Conclusion

So there you are! A little time spent methodically tidying the average set will pay handsome dividends since your work will look that much more professional and more nearly justify the use of a "fully reconditioned" tag. Many of the methods described can be used on cabinets of other than the types specified. For example, there's no reason why wax cannot be used on a wooden cabinet, or Polyfilla on a plastic cabinet. By and large though the methods outlined should prove best.

TV TEST EQUIPMENT

Two interesting devices have been introduced by Video Techniques (101 Derby St., Bolton, Lancs BL3 6HH). First is an active sync separator to enable a scope to be triggered from composite video waveforms (with negative-going sync pulses or standard 70:30 video). The device is suitable for TV receiver, VCR/camera, CCTV or computer VDU servicing, and for easy circuit connections can be used with an X1/X10 scope probe. One off price is £29 including UK post but not VAT. The second item is a delayed timebase trigger unit which converts an inexpensive scope without delay facilities to a delayed timebase unit giving viewing access to the field blanking interval and the VITS/teletext lines – handy for use with teletext receivers. The one off price is £43 plus VAT.

Viewdata test signal simulators are available from Team Services, 17 Stokesay Way, Sutton Heights, Telford, Shropshire TF7 4QF. The units simulate a viewdata computer and telephone link, giving displays that enable a wide range of tests to be carried out without having to pay for access to a viewdata computer.

AVO'S 2000 SERIES

A newly designed range of hand-held digital multimeters, the AVO 2000 series, has been launched by Thorn EMI Instruments. There are initially three meters, for specific applications – the Digiminor 2000 which is intended for maintenance applications, the Vehicle Test 2002, and the one of interest to the TV engineer, the AVOmeter 2001. All these meters feature direct entry prods to give true one-hand operation, a 3½ digit LCD readout at the base of the housing to give improved readability, and slide switching for positive, dustproof range selection.

The 2001's ranges are: 200mV-1kV a.c. and d.c.; 0·2mA-10A a.c. and d.c.; 200Ω-20MΩ resistance; plus a diode test facility and continuity buzzer. Correct mode and range selection are ensured by the inclusion of an audible alarm that signals any discrepancy, while both the unit and mode are shown on the LCD. The 2001's trade price is £85·40 excluding VAT.

VCR Clinic

Reports from Derek Snelling, John Coombes and Mike Phelan

Hitachi VT8500

Why is it that when I have only two or three VCRs a day to deal with the problems are simple, like replacing the 12V regulator transistor on the Sanyo VTC9300 or showing the customer how to use the tracking control, but as soon as eight or more VCRs a day are lined up the interesting faults appear? Take last week. The first machine was a Hitachi VT8500 which came in with the complaint that the recording was intermittent. This was soon traced to the thick-film unit IC201 which does most of the final processing of the video signal prior to the heads.

Whilst working on the machine however I noticed that the picture was not being blanked as it should be when threading up, though it was blanked when the machine unthreaded the tape. In fact I'd at first wondered whether this had anything to do with the record problem, but it didn't. Now in this machine a microprocessor, IC901, detects when the play button is pressed. It then starts the threading motor and sends appropriate instructions to the reel motor, the brakes and in addition informs a second microprocessor IC902 that the play mode has been selected. This second i.c. lights up the play indicator, starts the head rotating and produces a load signal which is amplified by Q915 and Q917 and is then used to blank the picture and sound whilst threading up. In this model the load signal also puts an index pulse on the tape. Sure enough, a quick check showed that the tape index system was not working either. By using the meter it was a simple matter to find that the pulse was leaving the i.c. and passing via Q915 to the base of Q917 where it stopped. Q917 turned out to be open-circuit. **D.S.**

Ferguson 3V30

The problem with the first Ferguson 3V30 that came along was that whilst play was o.k. forward and reverse visual search produced only lines on the screen – it was obvious in fact that the machine was going too fast. In the search mode the tape is moved by the reel motor, albeit at a slower speed than during rewind or fast forward. The speed of the reel motor depends on whether Q15 (see Fig. 1) is switched on or not. A check here showed that this transistor was switching correctly, but before further checks could be made the motor came to a stop. This was soon traced to lack of voltage at pin 10 of the reel motor drive i.c., which gave rise to a minor problem – resistor R48 is no longer fitted, having been replaced by a "circuit protection device" consisting of a fuse in a transistor case. I found the modification sheet covering this, and fortunately we'd one in stock, having had previous problems with one of these items used in the timer back-up circuit of another 3V30. Fitting the replacement got the motor going again and enabled us to return to the original fault. The next check, on Q16, revealed that this was defective, a replacement restoring normal operation. **D.S.**

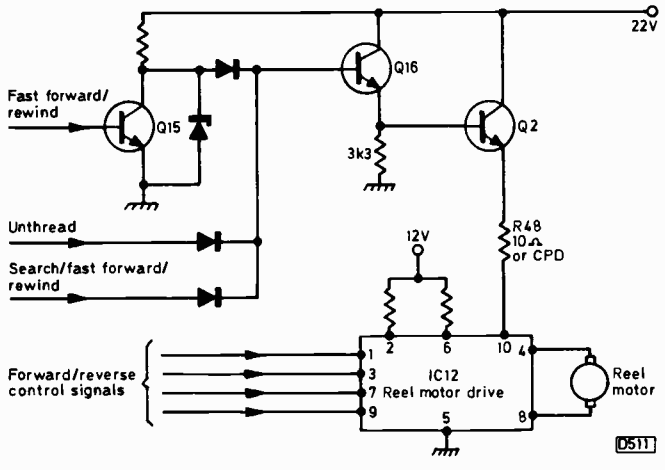


Fig. 1: Reel motor drive/control arrangement used in the Ferguson 3V29 and 3V30.

Another 3V30

All functions were correct until record was selected on the second 3V30. At this point the machine would go into pause and nothing would get it out again except stop, whereupon it would work perfectly until the next time record was selected. The obvious thing to do was to find out where the pause signal was coming from. This took us back to the output expander/latch i.c. (IC4) on the mechacon board. This i.c. takes its instructions from the microcomputer IC2, via four data lines which it interprets and acts upon. So were the instructions wrong, or was IC4 misinterpreting them? One could check the lines of course, but we decided it would be simpler and quicker to change the i.c.s. We went for IC4 first as it was the smaller one, and of course it was IC2 that was causing the problem.

This is a μPD553C-164: the last three numbers are important as they indicate how the device is programmed. The 3V30 also uses a μPD553C-100, which is the same device programmed to act as a timer and channel selector. The point is worth noting as several microcomputer manufacturers use this numbering system. **D.S.**

Toshiba V5470/Bush BV6900

The following is a summary of faults we've experienced with the Toshiba V5470/Bush BV6900 machine.

Selected button trips: First check the plugs and sockets. Then try removing plug P903 on the pause circuit board (PW2113). If the drum fails to rotate after record/playback has been selected, check the drum drive circuitry on board PW2115 – the main suspect is transistor Q961 (2SD235X) which should be checked by substitution. If the transistor is all right, check the servo i.c. (IC501 type TM4216P). If after removing P903 the capstan motor fails to operate, again IC501 may be at fault. Also check for tape movement failure – this may be due to faulty drive belts, play idler or the tape guides.

Record button jumps out on a timed recording: This was a common problem on early machines. The solution is to change R619 on the logic board (PW2110) from 150kΩ to 330kΩ.

No illumination of digits, incorrect time settings, days will

not change on programme setting or inoperative on second programme: For the first fault check for dry-joints around IC861 (TC5038P) on the programme timer board (PW2112). For the latter faults check the i.c. itself.
Tuning drift: Can be caused by any of three i.c.s. The most common offender is the digital control i.c. (ICA01, type TC9002AP). If still in trouble check the TMM841P memory i.c. (ICC01) and/or the TA7619AP memory control i.c. (ICC02) by substitution or fit a replacement selector panel (PW2106).
Rewind fault: If during rewind the tape slows down and sometimes stops (this makes a screeching sound) then speeds up again, replace the rewind idler.
Wow and flutter: Very carefully check the tape guides and the tape path. Check the play idler. Before replacing this, proceed as follows. Open up the clutch section and clean the felt pads. Clean dust from the plastic face plates. Also check the rubber tyre, removing glaze with wet and dry and cleaning up with alcohol. Re-install, check the play belt and ensure that the play torque is 80-120g/cm. If still in trouble, replace the play idler. The trouble may also be due to the capstan flywheel: clean and lubricate the base of the spindle. If this is ineffective, replace the flywheel or if necessary the capstan motor.
Patterning/poor quality picture: Check the tracking control setting, the tape guides and the slide switch S101 for intermittency or poor contact. S101 can be responsible for video break-up or even chroma drop out. If the machine is used with a stand that brings it too close to the TV set, the two can interact to give severe patterning or chroma drop out. It's simple to check for this by moving the VCR. A cure is to fit a section of cooking foil between the two. Check also that patterning is not due to incorrect setting of the VCR's u.h.f. output.
Smearing on playback: Check IC402 (TA7636P) on the video board (PW2109) by substitution.
Head faults: These machines do tend to get through video heads. The symptom that arises is poor quality pictures. The cause may be lack of cleaning or damage due to customer misuse. The heads can develop a sharp edge which can cut away at the tape.
Eject switch problems: Check the TM4216P servo i.c. (IC501) and the CX141 logic i.c. (IC601) by substitution.
Prerecorded tape trouble with TV Model BC7300: The complaint was line jitter, picture break up and generally poor quality. We checked the machine with a Murphy MC7340 and obtained a perfect picture. The problem is due to the fact that the additional pole for VCR switching is not present on customer control unit type T515A (the sixth switch position). The extra pole applies 12V to pin 11 of 5SIC1 (TDA2593). **J.C.**

Ferguson 3V29

We've had a couple of tuning voltage problems recently on the JVC/Ferguson HR7200/3V29. On the first machine the tuning voltage altered when going from stop to record. On checking, we found that the voltage at the collector of transistor Q8 in the tuning voltage regulator circuit (see Fig. 2) was only about 19V instead of 31·5V. The obvious thing to do was to change the zener diode IC3 and check for leaks. Still the same. We eventually found that D8 was short-circuit, as a result of which Q8 was not being turned on fully.

On the second machine the symptom was a hum bar on the E-to-E picture. This time the tuning voltage was found to be 45V, but it was still possible to tune in the stations as

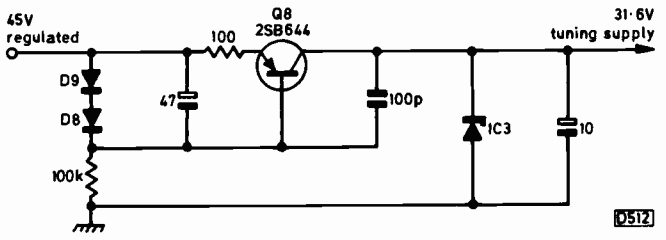


Fig. 2: Tuning voltage supply circuit, Ferguson 3V29 and 3V30. Q8 is forward biased by D8/9 and acts as a constant-current source for IC3.

we receive our signals from the Winter Hill transmitter which operates near the top of the band. This time Q8 was short-circuit and IC3 had been damaged by the excessive current. **M.P.**

Grundig 2 × 4 Super

Here's a very interesting fault we had on a Grundig 2 × 4 Super. The machine displayed a ghost about an inch to the left of the image on all tapes. The ghost was clearly visible on the luminance staircase waveform of a monochrome bar signal at all points. Going back to the f.m. demodulator, before the f.m. is filtered out, we could still see it on the scope. For convenience we first tried another luminance board, then another head amplifier panel. Still the same so we replaced the originals. What could it be? In desperation we tried another head drum – and this cured it! **M.P.**

Ferguson 3V30

The problem we had with a JVC/Ferguson HR7300/3V30 was no clock display. The timer i.c. has an internal 400kHz oscillator which operates in conjunction with an external ceramic filter and a couple of timing capacitors, C405 (220pF) and C404 (120pF). A check at pins 1 and 42 of the i.c. revealed that the oscillations were absent, so we changed the ceramic filter. No good. It turned out that C405 was leaky. **M.P.**

Philips VR2020

A Philips VR2020 came in with the complaint that it played prerecorded tapes o.k. but there was excessive wow and flutter on its own recordings. It seemed that the capstan servo was at fault, but whilst looking for the cause of the trouble we noticed that transistor T7001 in the capstan motor drive circuit (see Fig. 3) had been running hot. A few voltage checks then showed that T7005 had no collector voltage because R3037 was open-circuit. Thus T7001 had been driving the capstan motor via T7005's base-emitter junction. **M.P.**

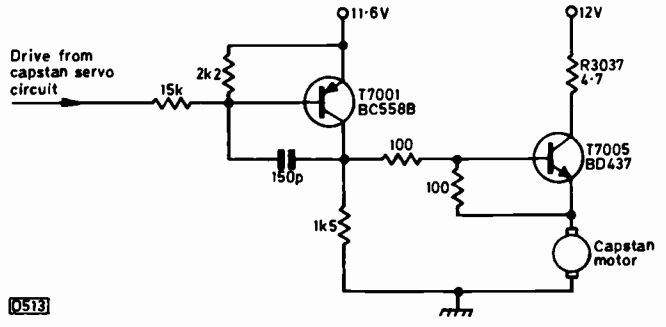


Fig. 3: Capstan drive circuit, Philips VR2020.

Service Bureau

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PHILIPS 320 CHASSIS

There's no picture on this set. With the sound perfect, the screen blanks out completely. Under no signal conditions there's a raster. A weak picture can be tuned in, but the sound is then poor. The h.t. and l.t. supply lines are correct and the TBA550Q video/sync/a.g.c. chip has been replaced.

These puzzling symptoms are usually due to trouble in the a.g.c. circuit. First check for 12V at the cathode of zener diode D2220, then check that gating pulses are reaching pin 3 of the TBA550Q via R2208. If all is well here, the a.g.c. smoothing capacitor C2207 (68μF) and the controlled i.f. transistor T2828 (BF196) are suspect.

THORN 9600 CHASSIS

The field scan is giving trouble. Over the last three months I've had to adjust the height control, the vertical shift control and the N/S balance control several times. The top of the picture kept rising and now the bottom is cramped whilst the top is expanded. Also the top of the picture bows downwards at the middle while the bottom edge bows upwards. The controls are now set for a full screen raster after a run of one and a half hours. At switch on the raster is half an inch up at the bottom and three-quarters of an inch down at the top: it expands slowly as the set warms up.

First check the 24V line at C803. If it's wrong, check the 24V regulator circuit – transistors VT812/3 and the 24V zener diode W819. Next ensure that the 34V line is correct at C821. If not, check W518, C523 (470μF) and C821 (2,200μF). If the fault persists with these lines in order, suspect the field output transistors VT807 and VT809. Since the fault is temperature-dependent, judicious use of a freezer aerosol in the field timebase after the set's been on for a time should quickly narrow the area of search.

GRUNDIG 6010

First the cutout tripped. The tripler was disconnected and the trip reset. This restored normal operation, though with low e.h.t. from the overwinding on the line output transformer. A replacement tripler was fitted, but when the set was switched on a spark shot from R504 (in series with the output end of the width transductor) to chassis. It does this every time, blowing the trip. I suspect the line output transformer.

First make sure that there's d.c. continuity from R504 through both the commutator coil and the width transductor, and that there are no dry-joints on any of the wound components. If necessary, check Di504 (in parallel with R504) and the components in the pulse shaping network that drives the gate of the scan thyristor – C515, R515 and L515. If all these are in order the line output transformer is suspect (assuming that the tripler is of the correct type and that it's correctly connected).

KÖRTING HYBRID COLOUR CHASSIS

There is a "waisting" effect on the line scan, a narrowing of the picture. This usually moves up or down the raster, but is sometimes stationary.

The first suspect is the line oscillator's h.t. decoupling capacitor C417 (25μF). This often goes open-circuit. Otherwise, check for heater-cathode leakage in the PCF802 and PL509 valves by lifting the h.t. fuse Si5 (1A) on the top panel with the set on and noting whether the hum bar goes before the valves cool down.

RANK A823AV CHASSIS

The picture reverts to monochrome on changing channels – pressing the channel change button several times will usually restore the colour. I've changed the chroma amplifier and ident transistors and the SL917 decoder chip. For some reason the ident control has to be turned fully clockwise before colour can be obtained – turning clockwise should disable the colour.

Start by checking that the stabiliser transistor 3VT2 is producing the correct 11V at 3TP27 and that the amplitude of the line frequency pulse fed to pin 5 of the SL917 chip is correct. If these points are in order, and 3RV2 (burst gain) and 3T1 (burst gate pulse timing) are correctly set, check the 50μF electrolytic decouplers 3C2 (burst output circuit) and 3C17 (5V line smoothing). It would be helpful to check the amplitude of the chroma signal at 2TP12 during the presence of the fault.

HITACHI CPB226

The convergence on this set is very bad, with red, green and blue lines here and there. The set is unlike most I've dealt with however so I'd appreciate your guidance on what to do.

Convergence is effected by adjusting the magnets on the tube neck. Remove the green output lead from the decoder and adjust the four-pole magnets (nearest the screen) relative to each other to converge the red and blue verticals, then rotate the two together to converge the red and blue horizontals. Replace the green drive lead and if necessary adjust the six-pole magnets (middle pair) for a white central cross. The rear pair of magnets are the purity rings. Should dynamic convergence be necessary, tilt the scan yoke vertically and horizontally for best results, then wedge in position with rubber wedges.

PYE 713 CHASSIS

The line oscillator won't start up when the set is switched on from cold. Once it has started (switching on and off repeatedly gets it going) the set runs all right, though with slight lack of width and intermittent colour drop out. I've tested the chip with freezer but before condemning it would like your verdict.

We suspect that the chip (TBA920Q) is in trouble, but before you replace it we suggest you check that the oscillator frequency has not drifted off. To do this, short out the two pins of PC7 and adjust R634 until the picture slowly runs through.

TEST CASE

241

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.

In the current festive season a young man's mind turns to thoughts of many things – including TV games. We sell lot's of TV games consoles and cartridges at this time of the year, the top of the pops for us being the Atari Video Computer Console, which is something of a misnomer since several more computer-oriented games have since come on the market. The Atari VCS is the most commonly available type however, with the widest range of software. This includes the compatible Activision cartridges, which seem to be more popular than the Atari ones because of their better graphics and brighter colours.

One of our more affluent customers bought an Atari VCS and took it home along with the free cartridge (Combat) which comes in the box. Within a few weeks he had our tills ringing like church bells on the receipts from Night Driver, Video Pinball and a collection of others. This particular customer is also a leading patron of our video library, his tastes being very wide – Confessions of a Window Cleaner one night, Watership Down the next. With such a range of locally-generated video signals available to him, we suspect that he seldom watches the off-air TV programmes on his main TV set. Which is why he's about the only one (so far as we can tell!) of our 3,000 or so customers who doesn't immediately pick up the phone and ring us when the local relay station croaks out.

As his family became more expert at TV games, they felt the need to record their triumphs on tape. And why not? Button 7 on the TV set was tuned to the console's output and button 8 to the VCR's output. VCR buttons 1, 2, 3 and 4 were occupied by the local TV transmissions, so button 5 was tuned to the Atari's output. Away they went with Laser Blast, using the TV set to monitor the action whilst recording it for posterity.

But what happened to the Universe? What alien being had filled outer space with swirling patterns and waves? Whatever was happening out there must be due to some force immune from lasers. Time to call out Dan Dare from the service department, with his multimeter and screwdriver . . .

When we arrived, a cartridge was inserted in the console and a demonstration game was played. It was incredible, involving a chicken being taken across a double six-lane freeway in the rush hour. So far as we could see, if a car collided with the chicken it disappeared with a great cluck and a cloud of feathers! Dragging ourselves away from the game itself, we studied the picture's background. It was overlaid with patterning which would change and swirl slightly with different background colours and with the sound effects. And all this was recorded on the tape.

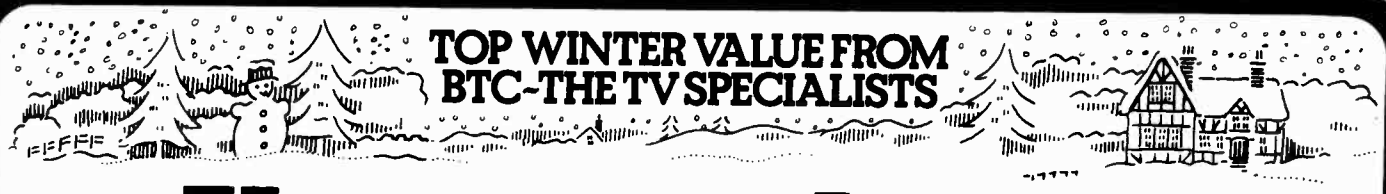
We switched off the VCR, a Sanyo VTC9300P, and plugged the console's output into the TV set directly. The patterning disappeared. Next we fed the console's output into the VCR's aerial socket, using the loop-through facility, with button 7 selected on the TV set and the VCR switched off. Again no patterning. Switch on the VCR and the patterning appears. What was happening? Answer next month.

ANSWER TO TEST CASE 240
— page 101 last month —

The Bush BC6100 (Rank Z718 chassis) we were doing battle with last month had a balance problem in the line output stage. The symptoms were reduced width, high e.h.t. and excessive dissipation in 5R6 which feeds the h.t. supply to the driver stage. This supply is taken from the junction of the two series-connected line output transistors. The transistors had been replaced and the components in their base drive circuits checked. All to no avail. The imbalance was such that 6V a.c. was being developed across 5R6, measured on the 10V range of our AVO.

Reduced width with high e.h.t. usually means that the flyback tuning is incorrect. This case was no exception! We removed the two flyback tuning capacitors 5C9 and 5C10 (both 3,600pF) and checked them on an *RC* bridge. One gave a reading of about 1,000pF and the other 2,900pF! They appeared to be o.k. physically, and were obviously from the same manufacturing batch. Anyway, in went two new 3,600pF capacitors with the correct voltage and current ratings and we then had no difficulty in balancing the stage. A new 5R6 (correct 2W type) ran cool, and normal scan amplitudes were now present. After setting up the harmonic tuning coil 5L3 and making other adjustments as necessary the set was pronounced fit and well.

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by The Riverside Press Ltd., Thanet Way, Whitstable, Kent. Distributed by IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £10, Overseas £11 per annum payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.



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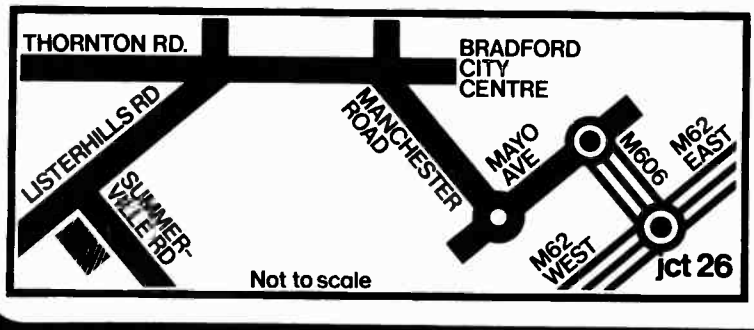

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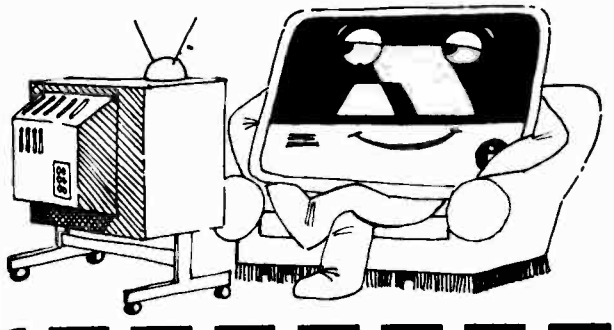

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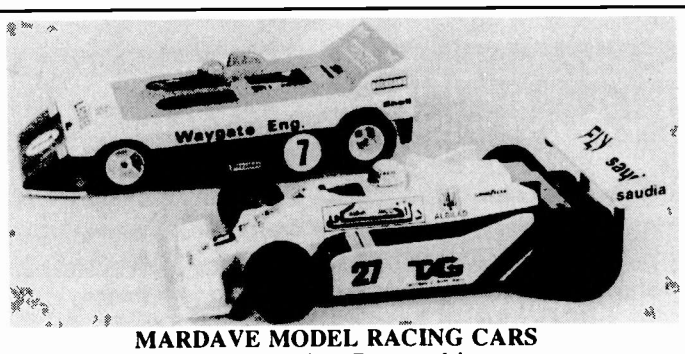

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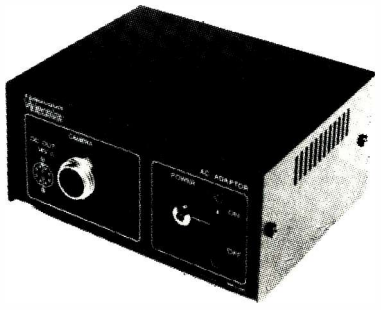

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BY226	15p
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BY237	5p
BY254	10p
BY255	10p
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BY298	10p
BY299	10p
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BF182	20p
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BF198	7p
BF199	7p
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BF257	25p
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