CHARLESTON X

JULY 1983

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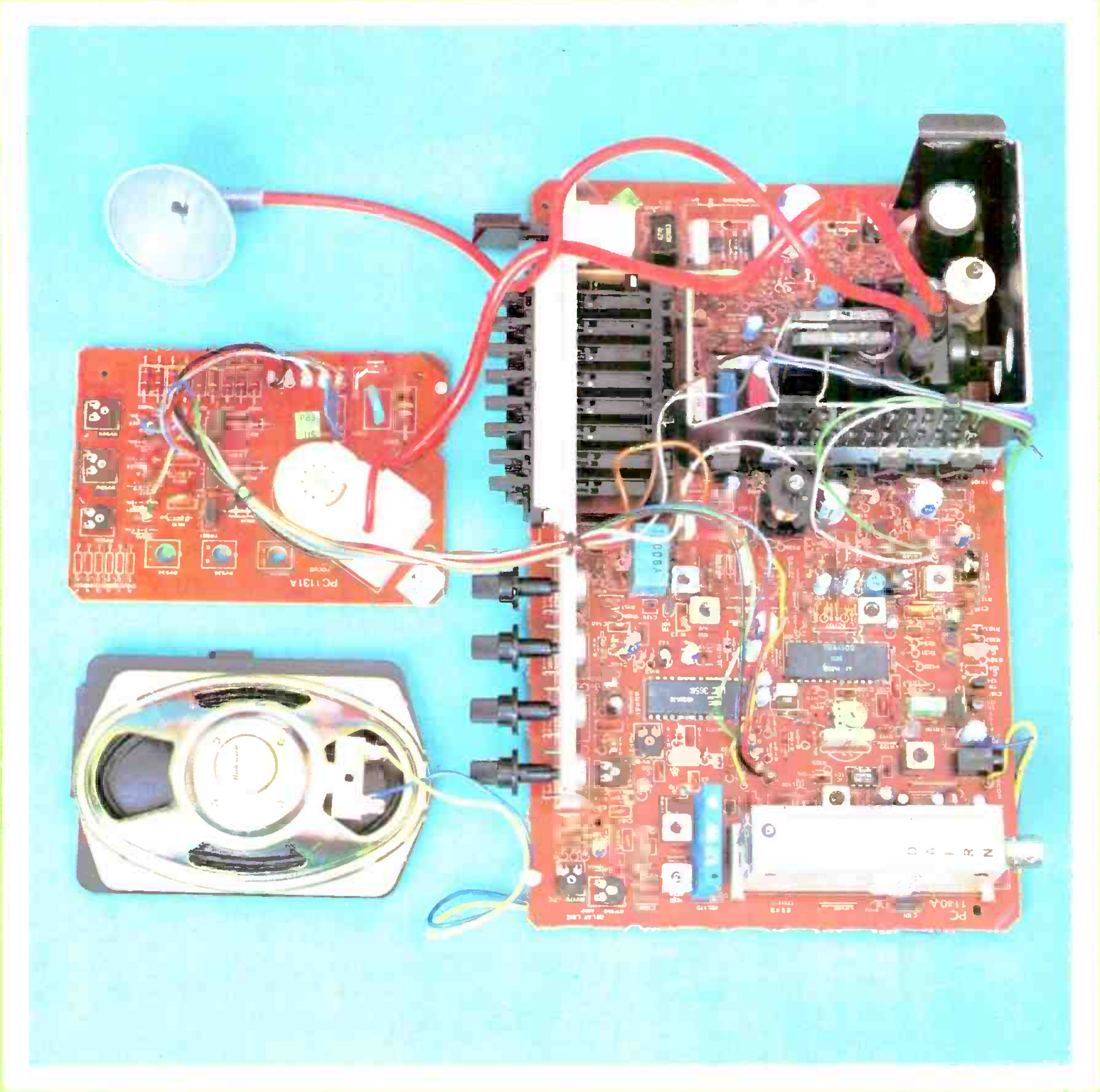
90p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



THORN'S NEW TX90 CHASSIS

AERIAL SYSTEMS & FAULTS

VCR CLINIC · TV FAULT REPORT

TELETEXT DECODER PROJECT UPDATE

AD CONVERSION FOR VCRs

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Z23	20 Assorted TV Knobs including: Push Button, Aluminium and Control types	£1.20
Z24	10 Assorted Valve bases B9A, EHT, etc.	£1.00
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
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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

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

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

*Axial. All others are Radial.

CAN TYPES

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

EHT DIODES

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

R.B.M. USERS LOOK!

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

SPECIAL OFFERS

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

12V BULBS on leads. Suitable for most **VIDEO RECORDERS.**

70p each 4 for £2

BY127 Type diodes. Unmarked, untested, Approximately 90% o.k. **100 for £2.95**
AC128 untested **100 for £3.95**

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
10 × SKE4F2/06 (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
TAA661B £1.00	6 for £5.00
SN76660N 50p	5 for £2.00

V.C.R. BATTERY PACKS.

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

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

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

MISCELLANEOUS

BG100 tripler for CVC45 etc.	only £3.50
Line output transformer for RBM823A	£4.25 each, 3 for £10.00
ITT VC200 4P/B Transistor Tuner. Suitable for some Pye and Philips sets. 3 hole fixing	£2.75 each
Decca Bradford Tuner. 5 button type	£4.00 each, 4 for £12.00
UHF Modulator UHF out Video in. Ch. 36. 2½"×2"×½" 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
Buch CTV 25 Quadrupler type Q25B equivalent to ITT TU25 3QK	£3.00 each, 2 for £5.00
Focus VDR Rods 2¾"×¼". Suitable for GEC, Decca etc.	75p each, 3 for £2.00
Grundig UHF/VHF Varicap Tuner for 1500GB, 3010GB.	£12.50 each, 3 for £30.00
EHT Lead with Anode cap (CTV) suitable for split Diodes sets 1m long	60p each, 3 for £1.50
EHT Cable	30p per metre, 10 metres £2.50
Anti Corona Caps	3 for £1.00
4.433 Mhz CTV Crystals	£1.00 each, 3 for £2.50
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 CT200 Control Knobs	8 for £1.00
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
Degaus VDRs. 1½" diam, for RBM etc.	5 for £1.00
Mains Neons	10 for £1.00
2k2 Screenfeed Resistors. White ceramic, 9 watt, with fusible link.	8 for £1.00
Philips G8 Transductor.	£1.20 each, 3 for £3.00
E.H.T. Discharge probe, with heavily insulated handle, with lead and chassis connector.	60p each, 3 for £1.50

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.

5kg £9.95 10kg £14.95

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
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"900/950" 3 stick triplers	£1.00, 3 for £2.50
"950" Can. 100 + 300 + 100 + 16µf	£1.00

"RIFA"

0·1µ 1000v Flameproof **5 for £1.00**

THYRISTOR CONVERGENCE POTS

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

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

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

July
1983

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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

457 **Leader**

459 **Teletopics**
News, comment and developments.

460 **Service Briefs – ITT**
Servicing notes on recent ITT chassis.

463 **Letters**

464 **Aerial Systems and Faults** *by Peter Richards*
A review of basic types of aerial installation and fault conditions.

466 **Laura's Dead Decca** *by Les Lawry-Johns*
The darling of the telephone department has Les running around. Amongst other matters, faults experienced with the Fidelity CTV14.

467 **Next Month in Television**

468 **Light on Servicing** *by Eugene Trundle*
The Ledu magnifier turns out to be the ideal solution for bench lighting. A couple of other optical aids have also been found useful.

469 **The New Thorn TX90 Chassis**
This new chassis for 14in. colour portables has been designed to compete in price, performance and reliability with anything produced in the Far East. How Thorn managed to achieve this price breakthrough and a description of the circuitry used, including the novel switch-mode boost supply.

472 **VCR Clinic**
Reports from Steve Beeching, T.Eng. (C.E.I.), Mike Sarre, Michael J. Cousins, T.Eng. (C.E.I.) and Mick Dutton.

474 **Long-distance Television** *by Roger Bunney*
Reports on DX reception and conditions and news from abroad. Also a note on how the performance of coaxial cable can deteriorate.

477 **Less Common TV Faults** *by S. Simon*
Following on from the Routine TV Receiver Tests series, some less common faults worth knowing about. Plus a note on interpreting voltages.

478 **AD Conversion for VCR Control** *by Richard Roscoe*
Some of the latest VCRs use AD conversion in the user control circuitry. How a typical system works.

480 **TV Fault Finding**
Fault finding notes from Richard Roscoe, John Coombes and George R. Wilding.

482 **Exhibition Report: Cable 83** *by Dave Lauder, B.Sc.*

482 **VCR Servicing, Part 19** *by Mike Phelan*
This time the 3V23's capstan servo, which incorporates edit control, and the reel servo used in the fast search mode.

487 **Teletext Decoder Update** *by Steve A. Money*
Modifications to the *Television* teletext decoder to deal with the increased number of teletext data lines and Oracle interleaving.

488 **Test Case 247**

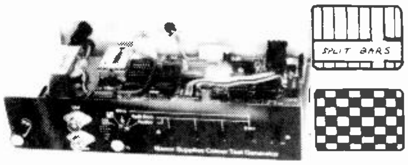
489 **Service Bureau**

OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 20

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 ($10\frac{1}{2}'' \times 6\frac{1}{2}'' \times 2\frac{1}{2}''$)	**£5.50**
De Luxe Case ($10'' \times 6'' \times 2\frac{1}{4}''$)	**£8.50**
Optional Sound Module (6MHz or 5.5MHz)	**£4.50**
Built & Tested in De Luxe Case including Sound Module	**£120.75**

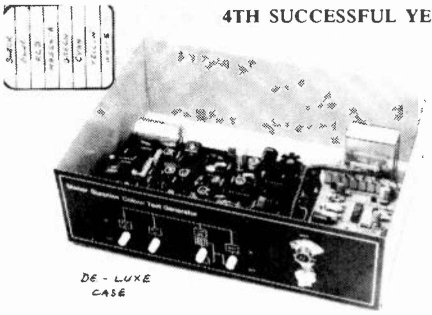
SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.50

All above prices include VAT 15%

PAL COLOUR BAR GENERATOR (Mk4)

4TH SUCCESSFUL YEAR



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

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

MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.
MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.80 P & P.
VHF MODULATOR (CHI to 4) FOR OVERSEAS £6.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.
(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

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

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

THORN TX9, TX10 SAW FILTER IF **PANELS £5.75** p.p. 85p.
SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND tested for T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
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SPECIAL OFFER TEXAS XMII TELETEXT DECODER NEW & TESTED, AT REDUCED PRICE **£57.50** p.p. £1.60.
PHILIPS-PYE G11 TYPE TELETEXT DECODERS **£34.50** p.p. £1.60.
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CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 60p. (ALUM CASE **£2.60** DE LUXE CASE **£5.50** p.p. £1.20.)
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UHF SIGNAL STRENGTH METER KIT £21.60 (VHF version also available). ALUM CASE **£2.60** DE LUXE CASE **£8.50** p.p. £1.80.
CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO **£29.40** p.p. £2.00.
BUSH A823 POWER £1.00 BASIC PCB. IN FIBREGLASS **£6.40** p.p.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
DECCA "Bradford" T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, SERIES, IF FRAME T.B. **£5.75 each** p.p. £1.40.
DECCA 80, 100 LINE T.B. salvaged **£11.50 each** p.p. £2.00.
GEC 2100 Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
GEC 2040 Convergence panels **£2.88** p.p. £1.80.
GEC 2040 DECODER PANEL **£2.88** p.p. £1.60.
THORN TX9 PANELS ex factory for small spares. Includes I.C.s & Semiconductors etc. **£5.75** p.p. £2.00.
THORN TX9 PANELS salvaged ex factory for spares incl. LOPT & mains transformers **£11.50** p.p. £2.80.
THORN TX9 PANELS ex factory salvaged complete cond **£23.00** p.p. £2.80.
THORN TX10 T.B. PANELS salvaged ex factory **£17.25** p.p. £3.00.
THORN 3000 LINE T.B., POWER PCB **£5.75 each** p.p. £1.30.
THORN 8000/8500 IF/DECODER PANELS salvaged **£3.70** p.p. £1.80.
THORN 8000/8500 FRAME T.B. PANELS salvaged/spares **£2.88** p.p. £1.40.
THORN 9000 SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
THORN 9000 IF/DECODER PANELS Salvaged **£5.75** p.p. £1.60.
PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 80p.
PHILIPS G8/G9 IF/DECODER Panels for small spares **£1.75** p.p. £1.40.
G8 IF PANELS for small spares **£1.15** p.p. 95p.
G8 Decoder panels salvaged £4.25. Panels for spares **£2.00** p.p. £1.40.
G9 Scan Panel. Basic PCB in fibreglass **£16.68** p.p. £1.80.
VARICAP, U321, U322, ELC 1043/06 ELC 1043/05 **£7.82** p.p. 80p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. MAKERS VARICAP CONTROLS Pye CT200 4PSN **£8.60,** A823 4PSN **£5.50,** Decca 6PSN **£6.70** p.p. 80p.
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BUSH "Touch Tune" Varicap Control Z179, Z718 types **£4.40** p.p. 95p.
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VARICAP VHF MULLARD ELC 1042 **£7.95** p.p. 80p.
UHF/625 Tuners, many different types in stock. **DECCA** Bradford 5 position **£2.88** p.p. £1.80 etc.
LOPT TESTER Service Dept approved **£17.82** p.p. £1.20.
LOPTS NEW & GUAR. P/P Mono **£1.35p,** Colour **£1.45p,** Bobbins **80p.**

BUSH 161 to 186 (twin panel)	**£6.80**	**R.B.M.** A823	**£5.60**
BUSH, MURPHY 774 series	**£9.80**	**R.B.M.** Z179	**£11.30**
BUSH, MURPHY A816 series	**£9.80**	**R.B.M.** T20. T22	**£11.30**
FERG., HMV, MARCONI, ULTRA		**R.B.M.** T20. T22 Bobbin	**£6.44**
950, 1400, 1500, 1580,1590. 1591	**£6.80**	**DECCA** Bradford (state Mod No).	**£10.15**
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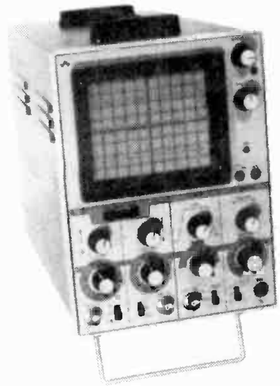

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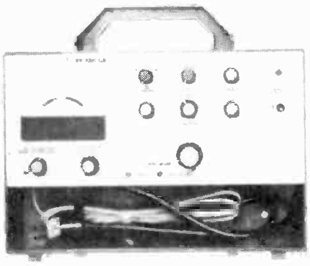

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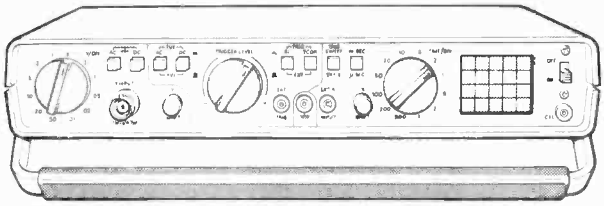

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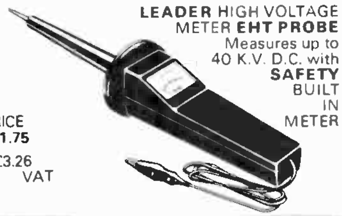

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CA555	46
CA741	25
CA748	45
CA3065	1.80
LA4031P	3.21
LA4102	3.37
LA4250	3.57
LA4400	3.05
LA4422	3.28
LC7130	5.93
LC7120	5.87
LC7137	5.50
LM1303N	2.63
HA1151	3.89
MC1307	1.99
MC1310P	1.60
MC1327	1.70
MC1351P	2.93
MC1330P	90
MC1349	1.99
MC1350	1.50
MC1352	1.75
MC1358P	1.50
MC1495L	3.00
MC14011BCP	66
MC14049UB	43
ML231/ETTR6016	2.20
MC232	2.20
ML236	5.35
ML237	2.50
ML238	6.00
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ML922	3.29
ML926	2.18
ML928	2.18
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MS1515L	3.28
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SAS570S	1.89
SAS580	2.90
SAS590	2.90
SL901B	5.50
SL917B	6.50
SL1310	1.80
SL1327Q	1.20
SL76544	2.05
SN76003N	2.49
=SN76013N	
SN76023N	2.00
SN76110N	1.15
SN76115N	2.27
SN76131N	2.00
SN76226(DN)	2.00
SN76227N	1.18
SN76532N	1.50
SN76533N	1.70
SN76033N	2.49
SN76544N	2.35
SN76650N	1.05
SN76660N	80
SN76666N	80
SN76530A	1.47
SW153	2.74
TA7050P	95
TA7051P	95
TA7074P	1.00
TA7108P	3.43
TA7120P	2.43
TA7129AP	3.76
TA7130P	1.93
TA7141P	95
TA7193P	5.67
TA7171P	1.85
TA7172P	1.85
TA7173P	1.85
TA7176P	2.50
TA7202P.	4.27
TA7204P	3.77
TA7205AP	3.72
TA7208P	3.40
TA7210P	6.60
TA7222	2.42
TA7223P	3.74
TA7227P	5.98
TA7228P	5.98
TA7310P	2.78
TA7609P	4.39
TA7611AP	2.92
TAA300	58
TAA310	2.83
TAA320	2.00
TAA350A	60
TAA550	55
TAA570	1.99
TAA630	3.90
TAA8400S1	1.96
TAA700B	1.70
TAA661B	1.20
TBA120A (A),(S),(AS),(SA).	80
TBA120B	1.30
TBA120SB	1.37
TBA120U	1.10
TBA395	1.20
TBA396	80
TBA440N (TBA1441)	2.75
TBA440P	2.50
TBA480(Q)	1.50
TBA510	3.00
TBA520Q	1.68
TBA530(Q)	1.38
TBA540	1.68
TBA550(Q)	1.58
TBA560Q	1.59
TBA570	1.79
TBA690	1.50
TBA641BX1	3.50
TBA673	2.45
TBA700	2.12
TBA72Q	2.64
TBA750	2.98
TBA800	1.62
TBA810AS	1.10
TBA820	1.70
TBA890	3.94
TBA920(Q)	3.00
TBA950(2X)	3.05
TBA970	4.09
TBA990	1.90
TCA160	1.20
TCA760	2.30
TCA270SQ	2.50
TCA800	3.10
TCA940	1.95
TDA440	2.20
TDA1002	1.95
TDA1003A	5.50
TDA1004A	2.95
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TDA1035	4.70
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TDA1170	3.00
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TDA1327	1.70
TDA1352B	1.60
TDA1412	1.20
TDA2002	2.80
TDA2140	5.95
TDA2190	4.70
TDA2020	4.66
TDA2030	2.80
TDA2521	4.17
TDA2522	2.40
TDA2523	3.40
TDA2524	2.25
TDA2540	3.84
TDA2541	3.84
TDA2560	3.50
TDA2571	2.56
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TDA2591	2.95
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TDA2640	2.92
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UPC1156H	4.26
UPC1158H	78
UPC1163-H	98
UPC1212C	1.34
UPC1230H	3.95
UPC1350C	4.15
UPC1367	3.45
UPC1378H	4.49
STK435	9.06

VOLTAGE REG.

7805	78
7806	78
7808	78
7812	78
7815	78
7818	78
7824	78
78L05	68
78L08	68
78L12	68
78L24	68
7905	98
7906	98
7908	98
7912	98
7915	98
7918	98
7924	98
79L05	72
79L12	72
79L15	72
79L24	72

I.C. SOCKETS

DIL to DIL

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

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

T.T.L. 74LS SERIES

74LS00	19
74LS02	19
74LS03	19
74LS04	20
74LS05	19
74LS08	19
74LS09	19
74LS10	19
74LS11	19
74LS13	37
74LS14	46
74LS15	19
74LS20	19
74LS21	19
74LS22	19
74LS26	19
74LS27	19
74LS30	19
74LS32	20
74LS37	19
74LS38	20
74LS40	20
74LS42	36
74LS47	80
74LS48	80
74LS49	80
74LS51	19
74LS54	19
74LS55	19
74LS73	28
74LS74	26
74LS75	46
74LS76	22
74LS78	22
74LS83A	60
74LS86	26
74LS85	62
74LS90	35
74LS92	35
74LS93	35
74LS107	46
74LS109	27
74LS112	27
74LS113	27
74LS114	27
74LS123	52
74LS125	46
74LS126	46
74LS132	46
74LS138	48
74LS139	48
74LS151	44
74LS153	44
74LS155	44
74LS156	44
74LS157	44
74LS158	44
74LS160	60
74LS161	60
74LS162	85
74LS163	60
74LS164	65
74LS165	65
74LS174	57
74LS175	47
74LS191	66
74LS192	65
74LS193	66
74LS194A	69
74LS197	80
74LS240	80
74LS241	80
74LS242	76
74LS243	76
74LS244	80
74LS245	1.18
74LS251	54
74LS253	1.00
74LS257	53
74LS258	67
74LS259	74
74LS273	80
74LS283	50
74LS293	70
74LS352	1.54
74LS353	1.10
74LS365	36
74LS366	36
74LS367	36
74LS368	36
74LS373	99
74LS374	99
74LS393	80
74LS670	1.20

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4001B	21
4002B	21
4008B	72
4011B	21
4012B	21
4013B	30
4014B	74
4015B	76
4016B	31
4017B	66
4018B	72
4020B	76
4021B	70
4022B	70
4023B	21
4024B	50
4025B	21
4027B	39
4028B	64
4029B	90
4032B	1.04
4035B	80
4038B	99
4040B	72
4042B	58
4043B	71
4044B	71
4046B	96
4047B	70
4049UB	32
4050B	32
4051B	72
4052B	72
4053B	72
4060B	96
4066B	43
4068B	22
4069B	22
4070B	22
4071B	22
4072B	22
4073B	22
4075B	22
4076B	80
4077B	22
4078B	22
4081B	22
4093B	43
4094B	1.56
4099B	1.20
4160B	72
4161B	72
4162B	72
4163B	72
4502B	72
4505B	1.88
4510B	76
4511B	76
4512B	72
4513B	1.68
4514B	1.88
4515B	1.88
4516B	76
4518B	76
4519B	64
4520B	76
4521B	1.68
4522B	88
4526B	88
4527B	1.20
4528B	88
4529B	1.04
4530B	62
4531B	72
4532B	1.00
4536B	2.64
4538B	1.04
4539B	77
4541B	96
4543B	1.12
4551B	96
4553B	2.40
4554B	1.20
4556B	48
4560B	1.76
4561B	74
4566B	1.20
4580B	3.60
4581B	1.84
4582B	80
4583B	1.00
4584B	40
4585B	88
4597B	1.84
4598B	2.40
4599B	2.00

SEMICONDUCTORS

AC107	35
AC126	30
AC127	32
AC128	32
AC128K	40
AC141K	39
AC142K	38
AC176	35
AC176K	32
AC186	41
AC187	35
AC187K	38
AC188	35
AC188K	39
AD143	82
AD149	98
AD161	54
AD161/2	1.15
AD162	54
AF106	49
AF114	89
AF118	1.20
AF121	75
AF124	48
AF125	46
AF126	46
AF127	38
AF139	58
AF178	1.54
AF239	60
AL102	2.00
AU106	2.50
AU107	2.00
AU113	2.00
BC107	20
(A),(B),(C)	20
BC108	20
(A),(B),(C)	20
BC109	20
(A),(B),(C)	20
BC114	12
BC115	17
BC116A	16
BC117	30
BC118	24
BC119	36
BC139	28
BC140	32
BC141	26
BC142	30
BC143	31
BC147	13
BC148	9
BC149	12
BC157	16
BC158	16
BC159	15
BC160	25
BC161	28
BC170B	15
BC171	15
BC171A	10
BC171B	10
BC172	15
BC172A	10
BC172B	10
BC172C	10
BC173C	12
BC174A/B	10
BC177	27
BC178	26
BC182	9
BC182L	12
BC183L	12
BC184L	14
BC204	10
BC208	13
BC209	10
BC212	9
BC212L	13
BC213	13
BC213B	10
BC213L	9
BC214	9
BC214	9
BC214L	15
BC237	14
BC238	14
(A),(B),(C)	
BC251A	18
BC252A	12
BC252B	12
BC261A/B	18
BC262A/B	18
BC300	50
BC301	33
BC303	33
BC307	20
BC308A/B	25
BC327	18
BC328	18
BC337	18
BC338	18
BC461	30
BC547	13
BC548	13
BCX32	30
BCX34	27
BC549	8
BC550	7
BC557	8
BC558	9
BCY72	13
BD115	45
BD116A	65
BD124P	79
BD131	50
BD132	49
BD133	60
BD135	38
BD136	38
BD137	38
BD138	35
BD139	35
BD140	44
BD144	1.70
BD159	65
BD160	1.90
BD166	52
BD179	70
BD182	1.20
BD183	75
BD201	85
BD202	91
BD203	80
BD204	99
BD222	46
BD223	56
BD225	47
BD232	68
BD233	60
BD234	63
BD235	60
BD236	65
BD237	57
BD238	65
BD243	85
BD244	85
BD410	79
BD434	74
BD437	86
BD438	94
BD507	52
BD508	55
BD509	56
BD510	60
BD517	60
BD520	75
BD526	62
BD696A	1.49
BD697	1.24
BD695	1.39
BD698	1.50
BD707	95
BDX32	2.10
BF115	38
BF117	36
BF125	26
BF127	47
BF154	23
BF158	18
BF160	27
BF167	24
BF173	22
BF177	52
BF178	46
BF179	28
BF180	39
BF181	39
BF182	36
BF183	29
BF184	36
BF185	36
BF194/394	16
BF195	16
BF196	16
BF197	16
BF198	18
BF199	21
BF200	35
BF224	25
BF225	20
BF241	25
BF256	55
BF257	28
BF258	25
BF259	35
BF262	84
BF263	75
BF271	24
BF273	24
BF274	24
BF310	30
BF311	30
BF336	36
BF337	41
BF338	41
BF355	56
BF362	68
BF363	72
BF371	30
BF457	35
BF458	43
BF459	43
BFR39	27
BFR90	1.74
BFT42	28
BFT43	28
BFW10	60
BFX29	40
BFX84	42
BFX85	30
BFX86	30
BFX88	46
BFY50	30
BFY51	30
BFY51	24
BFY52	24
BFY90	95
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BRC4444	98
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BT102/500	1.20
BT106	1.60
BT107	1.69
BT108	1.69
BT116	1.21
BT119	3.66
BT120	3.66
BT151/800	1.20
BU104	2.00
BU105	1.25
BU105	1.58
BU108	1.80
BU124	1.90
BU126	1.75
BU204	1.50
BU205	1.42
BU206	1.80
BU208	1.60
BU208A	1.65
BU208/02	2.10
BU326A	1.75
BU407	1.70
BU500	2.30
BU526	2.46
BU807	2.94
BUW81A	3.84
E1222	40
MJE340	68
MJ3000	1.98
OT112	1.91
OT121	1.91
R2008B	1.90
R2010B	1.92
R2265	1.50
R2322	62
R2323	67
R2461	1.50
R2540	2.80
RCA16334	90
RCA16335	90
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP34B	1.06
TIP41C	47
TIP42C	50
TIP47	70
TIP120	65
TIP2955	90
TIP3055	63
TIS91	21
TV106/02	1.80
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3054	60
2N3055	60
2N3702	11
2N3703	10
2N3705	10
2N3706	10
2N3708	17
2N2904	30
2N5294	48
2N5296	48
2N5298	69
2SB337	1.86
2N5496	53
2N6107	75
2N6109	81
2SA715	1.98
2SC495	1.10
2SC496	1.31
2SC643A	1.50
2SC1096	1.72
2SC1172Y	2.20
2SC1173Y	1.69
2SC1306	2.73
2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC2028	1.82
2SC2029	2.60
2SC2078	2.90
2SC2091	1.34
2SC2166	2.73

THY 15/80	2.20
THY 15/85	2.20

(General Purpose Thyristors)

THERMISTORS

VA1104	75
VA1040	75
VA8650	55
VA1039	35
GEC Dual Posistor	1.68
GEC Dual 2040 (CK1)	1.98

L.E.D.s

5mm
T1¾ TYPE

Red	14
Green	14
Yellow	14
Amber	22

T1 TYPE
3mm

Red	12
Green	14
Yellow	14

FLASHING

CQX21	62
CQX22	66

Red Only

3 COLOUR

Red/Green/Yellow V518P	76

PANEL CLIPS

3mm	4
5mm	4

CRYSTALS & FILTERS

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

NEW VALVES

30FL2	1.70
DY802	98
DY86/7	66
ECC81	1.08
ECC82	98
ECC83	1.07
ECC84	80
ECC85	98
ECC88	1.35
ECF80	80
ECF82	88
ECH81	1.60
ECH84	1.66
ECL80	84
ECL82	1.30
ECL86	1.99
EF80	95
EF86	1.96
EF183	99
EF184	1.09
EH90	1.02
EL34	3.50
EL84	1.05
EL90	82
EY86/7	68
EY500A	1.50
EZ80/1	56
GY501	1.45
GZ34	3.50
KT66	8.50
KT88	12.00
PC92	90
PC97	1.65
PCC85	85
PCC805	1.40
PCF80	1.00
PCF200	1.35
PCF800	1.38
PCF801	1.13
PCF802	1.12
PCF805	1.80
PCF806	1.30
PCF808	1.63
PCH200	1.45
PCL82	1.20
PCL84	1.20
PCL86	92
PCL805	1.09
PD500	2.93
PFL200	1.86
PL36	1.87
PL81	94
PL83	1.43
PL84	84
PL95	1.00
PL504	1.65
PL508	2.90
PL509/19	5.30
PY88	81
PY500A	2.30
PY800/1	69
UCH81	2.25
UCL82	1.60
UCL83	1.82
UY85	1.35
PL802T	4.00
40KD6	5.30
21LU8	3.00
17DW4A	1.60
3AT2B	2.25
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	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	9.45
GEC 2040	9.50
GEC 2200	6.65
ITT CVC 1-9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
THORN 3000 EHT	6.90
THORN 3000 SCAN	6.90
THORN 8000	11.33
THORN 8500	11.33
THORN 9000	10.65
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN 9800	19.90
THORN TX10	12.50
THORN 1615	9.75
PHILIPS KT3	8.15

WIREWOUND RESISTORS *

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

(Preferred values) *

CARBON RESISTORS *

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

Sold in packs of 10 per type

SOLDERING EQUIPMENT

WELLER Iron 15W	4.31
WELLER Iron 25W	4.31
WELLER Gun	12.00
Pair Tips Gun	42
3/16" Tips iron	51
ANTEX 15W Iron	5.20
ANTEX 25W Iron	5.20
Iron Stands	2.20
ANTEX bits	65
ANTEX elements	2.20
Solder Sucker	6.50
Solda Mop	72
DIY Solder	50
250G Solder	3.50
500G Solder	7.00

REBUILT COLOUR TUBES

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

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

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

Please ask for quotes on carriage costs for next day delivery on most tubes.

NEW MONO TUBES

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

MULLARD COLOUREX

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

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

SPECIFIC COMPONENTS

PHILIPS

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

THORN

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

DECCA

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

RR1

T.20 Focus Control	2.20

PYE

731 Mains Filter Choke	6.50

NEW PRODUCTS

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

NEW PRODUCTS

Fluorescent Torch	6.50
Travel Plugs	3.50
Philips Clock Radio	21.39
26" TV Stands*	8.50

* While stocks last

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

P. V. TUBES

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	2.12
PHILIPS 320 (400/400/200V)	2.07
DECCA 30 (400/400/350V)	3.40
DECCA 80 (400/350V)	3.66
DECCA 100 (800/250V)	3.97
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.30
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.70
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.66
RBM A823 (600/300V)	2.83
RBM Z146 (300/300/350V)	3.55
RR1 T20A (220/400V)	2,00
ITT CVC5/9 (200/200/75/25)	2.98
ITT CVC 20 (220/400V)	2,00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.20
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.78
THORN 3500 (1000/63V)	86
THORN 3500 (1000/70V)	86
THORN 8000/8500 (2500/2500/63V)	3.38
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.28
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25
THORN 4700 P/C 25V	1.20
PHILIPS 320 400/400/200V	2.74
THORN 1591/1691 4700/25V	1.20

CAPACITORS AXIAL

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

MIXED DIELECTRIC CAPS

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

DISC CERAMIC CAPACITORS

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

CERAMIC CAPACITORS

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

ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	8.40
Mullard ELC1043/06	8.40
4 P/B DECCA/GEC/ITT	6.88
6 P/B DECCA/GEC/ITT	7.50
4 P/B PYE	9.00
6 P/B PYE	16.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass. (Square/Early)	13.50
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.98
U321 UHF Tuner	7.50
THORN 8800 SELECTOR (HMV Model 2725/6 way round button)	7.50
THORN 9000 SELECTOR	11.40
U322	7.20
HITACHI 4 way Chan. Selector (Also Rank A823)	10.75
RR1 T20A 6 way Chan. Selector	9.75
RR1 T20/22/26	11.00
PHILIPS 8 way TIP Switch Unit (suitable for all G11)	23,00
ITT CVC8 (5 wheel modified)	£12
ITT 6 way with VCR	8.90
PHILIPS KT3	14.50
PHILIPS KT30	10.30
PYE 697 Repair Kits	6.97

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/Push	75
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/Off	66
A1 Beam Switch (THORN 3500)	70
A1 Controls 5m (THORN 3500)	89
GEC 2110 A1 Control IM5 (Red, Blue, Green)	58
GEC 2040 On/Off Switch	88
On/Off Switch G11/G12	1.58
On/Off Switch GEC/TCE TX9/10	1.06

SLIDER POTENT

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

SKELETON PRE-SET POTS

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

PANELS + UNITS

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

MIDGET CONTROLS

Insulated Spindle Length 44mm

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

THERMAL CUT OUT

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

MULTITURN POTS

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

THICK FILM RESISTOR NETWORK

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

EAGLE PRODUCTS

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

DF615 Full Range Speaker 6½"		8,95
Multimetres		
KEW 7N	2,000	5.25
KEW 20		14.50
EM5	5,000 opv	9.95
EM10	10,000 opv	11.50
EM50	50,000 opv	19.95
EMC321 Carrying Case for above		2.25
Digital Meter TS1000		44.50
MM20	20,000 O.P.V	21.95
MM50	50,000 O.P.V.	25.95
MM100	100,000 O.P.V.	36.50
MMT20		16.95
Case for MM100		15.95
T1206 2 Station Intercom		6.95

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

CONVERGENCE POTS

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

METRIC CONVERGENCE POTS

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

EVER READY RECHARGEABLE BATTERIES

CHARGERS

CH1/22 For PP3/NN1604 1 battery (RX22)	6.40
CH4/50 For HP7/NN1500 1-4 batteries (RX6)	5.55
CH3/RX6 For SP2/HP2/NN1300/SP11/HP11/NN1400/HP7/NN1500 2-4-6 batteries in pairs. (RX6-RX14-RX20)	14,00
CH3/RX4 For SP2/HP2/NN1300/SP11/HP11/NN1400/HP7/NN1500 2-4 batteries in pairs. (RX6-RX14-RX20)	9.55

BATTERIES

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

VIDEO/AUDIO

VHS E30	3.06
VHS E60	3.66
Scotch E120 Video Tape	5.00
Scotch E180 Video Tape	5.13
BETA L500	4.90
BETA L750	5.80
PHILIPS VCC 240	5.93
PHILIPS VCC 360	8.30
PHILIPS VCC 480	10.21

VIDEO CASSETTE CASES

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

ELECTROLUBE PRODUCTS

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

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Vic 20
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Atari 800
Lynx

Sharp
Oric
Dragon

We are also
authorised dealers
for the
BBC Micro
and accessories

FUSES

	Per type	Pack of 10
1¼" QUICK BLOW		
100ma		73
250ma-500ma-750ma-1A		60
1.5A-2A-2.5A-3A-5A		60
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A		
1.5A, 2A		1.70
2.5A, 3A, 5A		2.70
20mm ANTISURGE		
80ma		4.80
100ma		2.50
160ma, 200ma		2.20
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A		1.30
2.5A, 3.15A		1.90
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A		60
1" MAINS		
2A, 3A, 5A, 10A, 13A		1.00

AERIAL ACCESS.

Surface Mount. Splitter	1.70
Surface Mount. Outlets	80
Cable Clips per 100	1.18
Coax Plugs per 10	1.80
P.V.C. Tape	35
F.M. Plugs	25
PL259 Plugs	40
Line Connectors	35
Reducers for PL259	16
T.V. Filter 50db Rejection 27mhz	2.10
Attenuators 6db, 12db, 18db	1.80
Olympic II Set Top Aerial	2.30
M.H.A/P.U. the pair	18.00
Aerial Isolator Kit	2.08
4m Fly Lead	1.20
2m Fly Lead	90

ANTIFERENCE

SB11 Indoor Splitter	1.91
COB11 Single Outlet	80
TRR/VSP Transformer	2.83
CS200/SP Comb/Splitter	3.03
CS1000 Comb/Splitter	6,15
PU1240 Power Unit	11.10
UP1300 M.H.A. UHF/VHF	8.25
XTRABOOST XS2U	11.63
4 Way Amp UHF/VHF	33.75
6 Way Amp UHF/VHF	42.00
Super Set Top	5.50
XG8 High Gain Aerial A,B,CD or W/B	17.90

SUNDRY TUNER ACCESS.

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

SUNDRIES

Delay Lines DL60, DL700, DL50	2.20
CRT Tube Base	70
EHT Final Anode Cap	53
EHT Cable	25p mtr.
6.3V CRT Boost Trans.	4.35
13A Plug Top box 10	4.80
Quick Set Adhesive	78
Moulded Plastic Hex. 6mm Trim Tools	10
Double End 4mm/8mm Trim Tools	20
Focus Rod	1.25
Focus Holder	2.00
Keynector Safe Block (mains)	5.50
Cassette Drive Belts price each	
35mm	35
46mm	37
57mm	37
66mm	39
71mm	41
76mm	43
90mm	43
110mm	59
Torch (handy for tool box)	42
I.C. Inserter	1.18
SM Neon Screwdriver	40
DIN Plugs 3 pin	22
4 pin	22
180° 5 pin	20
Stnd. 5 pin	20
Phono Plugs	12
Car Aerial Plug	18
2.5mm Jack Plug	14
3.5mm Jack Plug	14
Stnd. Jack Plug	20
Stereo Jack Plug	36
5A Connector Block (12)	40
Fuse Wire 5A-15A-30A	5
Battery Plug Thorn TV's	28
Gen. Purpose Power Supply 9V 200ma	3.25
Mains Connector 4 way 13A	5.00

TEST EQUIPMENT

Portable Oscilloscope	150.00
Probes x10	10.90
Dynascan	340.00
CRT Tester/Rejuvenator	172.00
KHP30 Measuring Probe (30kv) EHT	29.95
T120 RF Signal Injector	4.00
Test Lead Set	4.20
Degaussing Coil (stick type)	17.00
Degaussing Coil (disc type)	24.00

SERVICE AIDS

SERVISOL Freeze-It	96
SUPER SERVISOL	88
SERVISOL Foam Cleanser	84
SERVISOL Plastics Seal	88
SERVISOL Silicone Grease	1,00
SERVISOL Tubes Silicone Grease	1.60
SERVISOL Aero Klene	78
SERVISOL Aero Duster	94
SERVISOL Excel Polish	76
SERVISOL Video Head Cleaner	80
Super 40	1.50
Fire Extinguisher 640G	2.80
Heat Sink Compound 25G	1.08
Silicone Rubber Tube 110G	2.98
Solda Mop standard reel	72

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
CM7068 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.*	50.00
CM6052 UHF/VHF PAL Colour Bar Gen.*	190.00

* While stocks last

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	4.55
THORN 1500 5 Stick	5.29
THORN 1600	3.90
THORN 3000/3500	7.98
THORN 8000	5.28
THORN 8500/8800	6.15
THORN 9000	7.93
DECCA 1730/1830	4.48
DECCA 1910/2213 Bradford	5.92
DECCA 30	6.76
DECCA 80	6.60
DECCA 100	6.14
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7,00
PHILIPS G8 Short Focus Lead	6.75
PHILIPS G8 Long Focus 550	6.75
PHILIPS G9	6.37
Pye/Philips K3 Tripler	6.65
PYE 691/3	6.58
PYE 713/4 Lead	7.00
PYE 713 Doubler 5 Lead	7.50
Philips/Pye KT3	6.67
PYE 731/725	7.60
R.B.M. A823 (plug in) AV	7.60
R.B.M. A823	7.60
KORTING (similar to Siemens TVK1)	7.32
ITT KB CVC5/9	6.90
ITT KB CVC20/25/30 (Mullard)	5.95
RRI T20	6.80

RECTIFIER STICKS

TV11	74	TV18	90
TV13	79	TV20	1.20

MAINS DROPPERS

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

DIODES

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

ZENER DIODES

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

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Type	Price (£)	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	0.56	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	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
AC126	0.36	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.	BC461	0.78	BD238	0.68	BF244*	0.51	BRC4443	1.76	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	1.65
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.05	BDX18	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	OC81D	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	2.89	OC139	1.30	2N1893	0.52	2N5064	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	2N5298	0.71
ACY28	0.98	BC147*	0.12	BC286	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	BC287	0.49	BD133	0.70	BF123	0.48	BF458	0.49	E1222	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	2N5458	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	2N2784	1.15	2N5494	0.85
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF158	0.25	BFR39	0.30	ME6001	0.18	R2323	0.85	2N2869	2.08	2N5496	1.05
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	0.75	BF161	0.84	BFR50	0.29	MJ3000	1.58	TIC44	0.25	2N2905*	0.39	2N6122	0.60
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	2N6178	1.07
AF116	1.28	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95	BFR61	0.29	MJE341	0.72	TIC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	1.32	BC168B	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
AF118	0.98	BC169C	0.15	BC317*	0.15	BD158	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	BFR80	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	BFR81	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	BF178	0.46	BFR88	0.42	MJE2955	1.20	TIP32A	0.56	2N3054	0.86	2SC930D	1.50
AF126	0.36	BC173*	0.22	BC321A&B	0.18	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	BF180	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	BF181	0.53	BFW11	1.02	MPF102	0.40	TIP34A	0.84	2N3254	0.58	2SD234	1.48
AF147	0.52	BC176	0.22	BC327	0.16	BD177	0.58	BF182	0.44	BFW30	2.58	MPS3702	0.33	TIP41A	0.72	2N3391A	0.38	3N128	1.60
AF149	0.45	BC177*	0.20	BC328	0.18	BD178	0.92	BF183	0.52	BFW59	0.19	MPS3705	0.30	TIP42A	0.80	2N3633	0.60	40250	0.98
AF178	1.35	BC178*	0.22	BC337	0.17	BD181	1.94	BF184	0.44	BFW60	0.20	MPS6521	0.36	TIP2955	0.77	2N3703	0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC338	0.17	BD182	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	BD183	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	BD184	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	BC348A & 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	BD188	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	BD189	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	BF198	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	BC186	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	0.59	BD233	0.62	BF218	0.42					ZTX304	0.26	2N3794	0.40	40654	0.89

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Type	Price (£)
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CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC400B	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SL432A	2.52
SL450	5.10
SL901B	4.75
SL917B	6.50
SL918A	5.95
SN72440N	2.21
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32

Type	Price (£)
SN76023ND	2.52
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	
	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.85
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
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20

Type	Price (£)
TBA480Q	1.84
TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	4.55
TBA641BX1	4.60
TBA651	2.42
TBA673	2.31
TBA700*	2.50
TBA750*	2.18
TBA800	2.05
TBA810AS	2.00
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA280A	1.43
TCA290A	3.46
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	3.85
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	1.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

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DIODES

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

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

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1/1.3W plastic	3.3-200V	**18p each**
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2 5W plastic	7.5-75V	**67p each**
20W stud	7 5-75V	**£1.31 each**

VDR's, etc.

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

VALVES

Type	Price (£)
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DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	3.80
PCL82	0.93
PCL83	5.25
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL519	6.20
PL802	5.60
PY81/P810	0.80

BRIDGES

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

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½W 10Ω-10MΩ (E24)	3p	25p	95p	£1.49	£5.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£26.90

Wirewound (5%)

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

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

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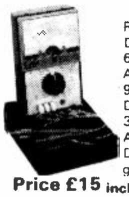

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The Real Lessons

The success of Japanese industry, in particular its achievements with consumer electronics products, make the methods and techniques used by the Japanese a subject of great interest. Just what makes them tick – those firms that seem to progress inexorably, and the Japanese people? Many suggestions are made, but very often one begins to have doubts when considering them more carefully.

It's said for example that there are no social barriers in Japan (I quote from an official Japanese source), managers and workers mixing freely and using the same canteen. Great emphasis is placed by Japanese management on the workshop as the hub of the firm, the place where wealth is created and the future of the firm is assured or not as the case may be.

This social barrier business calls for some interpretation however. The Japanese are by tradition both race and class conscious, perhaps more so than we are. Remember that Japan was a closed society for many centuries – until 1868. Japanese families go to great lengths to check whether possible in-laws are perhaps say Korean, or maybe part Korean. That doesn't do at all. There is also race consciousness within Japan. The Ainus of the northern island are considered to be a people apart. As for class consciousness, the Japanese know their exact position in the social structure – you simply wouldn't go to work in a car that was even in some superficial way possibly slightly superior to that of your boss. Perhaps the fact that the Japanese readily accept this state of affairs explains why social stresses don't seem to be a problem. There is also however the fact that social mobility is much greater than in many other class structured societies (also the pressure to achieve success). Possibly the very fact that the Japanese worker knows and accepts his current position is part of the success of the communal workplace and canteen. There is also undoubted mutual respect built into the system – provided you play your part, which of course you always do.

Another aspect of this business of the bosses mixing freely with the workforce is the emphasis placed by both on belonging to the firm, which is regarded as an extended family. But even here there's a class system of sorts at work. Those firms we hear so much about are the elite, who can pick and choose. It's an honour therefore to be taken on, and there's extraordinarily little changing from one firm to another – the exact opposite of silicon valley, where a sort of job musical chairs sometimes seems to be in operation. But beneath the well known names there's another layer, the smaller subcontractors who do the labour intensive bits. They can't guarantee jobs for life, neither can they provide the wages and conditions the major concerns can. Life for those at this level is less rosy. At a lower, underlying level there are the firms and organisations that provide basic services rather than branded goods. Life is tough here: the Japanese railways for example are as starved of capital as good old British Rail, and make much larger losses.

In some ways Japanese society is more akin to the Victorian ideals we've been exhorted to study of late. Paternalistic, with success breeding success, and a lot going on that's not exactly in the public eye.

All this leads one to suspect that emulating Japanese success is not going to be a simple matter. We obviously can't become Japanese any more than we can jump out of our skins. We can of course try to appreciate that wealth is created by successful manufacturing activities (amongst other things), to which all sides contribute. What else?

Frankly, the best UK firms appear to be as well run as their Japanese counterparts. Where appropriate investment is made and good labour relations exist, there is little to choose between them. After all, just as TV sets tend to look much the same nowadays whether they're made in Japan, Europe, S.E. Asia or the USA, so do many of the plants in which they are made. Much the same equipment is used, though sadly it comes from Japan or the USA rather than the UK. The fact that the best plants tend to be much of a muchness probably accounts for the fact that the Japanese can produce TVs in S. Wales or Scotland as effectively as in Japan. Maybe the managing director does use the canteen, but this seems unlikely to make much of a difference.

Is there no moral to be found in the Japanese success story then? It occurs to this observer that there are at least two points worth making. First an acknowledgement of the value of manufacturing activity and engineering generally. This never seems to have been quite accepted in the UK, where the captains of industry are apt to make out that they're really gentlemen farmers! We could do with a dose of industrial morale building (some profits would also help), though the politicians of all parties seem quite inept at this. It's strange how producing a specialist sports car or motorcycle at a rate of two a week in a country estate outhouse tends to be more highly regarded than mass producing goods that offer good value for money.

Time and again one finds the captains of Japanese industry emphasizing the prime importance of the end product. We'll only get this right when we learn the second lesson Japan can offer – investment in appropriate education. The Japanese produce large numbers of well qualified engineers whose training is orientated to the needs of industry (tut, tut!). In addition you find engineers at the head of major Japanese firms, which must be part of their success in making the right investment decisions that lead to the production of the right goods at the right time. The example is there for us to see, and there can be no excuse for ignoring it.

FRONT COVER

Our thanks to Thorn EMI Ferguson who lent us the TX90 chassis and set featured in our cover and inside photographs.

PCB SERVICE

The Readers' PCB Service continues in operation. Send orders to Readers' PCB Services Ltd. (TV), Fleet House, Welbeck St., Whitwell, Worksop, Notts. The latest boards to become available are as follows: In-circuit Transistor Tester (see page 410, June 1983) £1. Frequency Counter-Timer main board £15, others £1 each. Prices include VAT, postage and packing. Send remittance with orders. For further details see page 211, February 1983.

Teletopics

VIDEO DISC SYSTEMS

Quite a lot to report on the subject this month. First, the RCA CED/Selectavision system is due to be launched in the UK this autumn. The move is to be spearheaded by Hitachi, who at present are the sole manufacturers of CED disc players. The discs themselves are produced by RCA in the US. Players are also expected to be marketed by GEC-McMichael and ITT, both RCA licensees, though ITT have expressed reservations unless an adequate range of discs, say 200 titles, is available. The problem here is that all discs are at present NTSC encoded and will have to be remastered for 625-line PAL. The CED system was launched in the USA in 1981 and last year some 130,000 players were sold. Sales of discs were relatively more successful at 30 per player.

CED players are expected to retail in the UK at about £230-£250. This would be for a basic machine with wired remote control. Infra-red remote control might add something like £35 to the price. Provisionally suggested disc prices are £13 for a one-hour disc and £22 for a two-hour version. Technical details of the CED system have appeared in previous issues – CED stands for capacitance electronic disc, i.e. the signal is encoded in the disc in the form of capacitance variations, with the pickup linked to a resonant circuit.

Substantial reductions in the prices of Philips LaserVision disc players have meanwhile been announced, the aim being to take advantage of the rise in VCR prices recently as a result of the EEC-Japanese agreement on quotas. The basic VLP600 player now has a suggested price of £299 with the remote control VLP700 carrying a price tag of £349. The LaserVision disc catalogue is being expanded with the addition of a further 100 titles, and extensive promotion and advertising are planned. A more versatile player, the VLP830, is to be launched in the autumn at about £575. This machine will provide interactive features, i.e. preprogrammed stills and moving sequences from various sections of the disc, and pause operation with the long-playing (two hour) CLV discs. It will also incorporate the CX noise reduction system originally introduced on the Pioneer version of the player. A further player, Model VLP835, is to be introduced for commercial and educational use.

The JVC VHD disc system was launched in Japan last April. The latest VHD player comes from Mitsubishi – the VDP200 at 148,000 yen (approximately £400). The machine offers random access to any part of the programme on a disc plus a full range of reproduction modes including slow motion, picture search, reverse, still pictures, frame-by-frame advance and repeat. There's also Dolby noise reduction, full function infra-red remote control, and a microphone input to enable external sound to be mixed.

Matsushita's development of a record/playback optical disc has been mentioned in this column before. The system is now being introduced for computer use, offering a far higher storage density than conventional computer discs. Recordings are erasable – discs can be erased and re-recorded up to a million times, an 8mW laser being used for record/playback and a 10mW laser for erasure. During recording, the structure of the disc's recording layer is altered between crystalline and non-crystalline states to vary the reflectivity, the process being reversible. Matsushita suggest that it will take five to eight years to develop the system as a consumer product.

VCR LATEST

The start of VCR production at Sanyo's Lowestoft plant has been brought forward by two months to August. Equipment for the assembly of the first machine, the mid-range Betamax Model VTC5150, is at present being set up. Production during the remaining half of Sanyo's current financial year is expected to reach 60,000, rising to an annual figure of 200,000 by 1985. TV receiver production at the plant is now running at 96,000 sets a year. The start of production at Hitachi's Landsberg, Bavaria VCR plant is scheduled for this September. Plans are to start production at the rate of 180,000 machines a year with the prospect of doubling output. Meanwhile increasing criticism of the EEC-Japanese quota agreement is being made because of the inclusion of kits. This is at present hampering plans for increased assembly of VHS and Betamax machines in Europe. J2T are pressing for the removal of kit quotas next year, when the European content of their machines is expected to reach 35 per cent. J2T's production this year should be around 400,000 VCRs, and the group hopes to increase this to 700,000 in 1984.

In an analysis of the total number of VCRs in use world-wide, the May issue of *Screen Digest* estimates that 4·4 million machines are now in use in the UK, a penetration of 22·2 per cent of households with a TV receiver. This compares with 22·8 per cent in Japan, 15·6 per cent in W. Germany, 8·1 per cent in the USA and 5·6 per cent in France. *Screen Digest's* estimate of the total number of VCRs in use world-wide is thirty million.

Any suggestion of reservations about the V2000 system's future has been discounted by the introduction of new models by Philips and Grundig. Philips' "next generation" V2000 VCRs, which will be available this August, are Models VR2334 and VR2340. The former has mono sound and is designed to sell at around £540, the latter being a stereo sound version. The new machines have been substantially reduced in size and represent a complete redesign both mechanically and electrically. The cassette housing is electronically controlled and extra microcomputer i.c.s have been introduced in the control system. Grundig's Video 2×4, which supersedes the 2×4 Super, is also a more compact redesign. More versatile, easier to use timer arrangements are incorporated in all these machines.

Another system that's sprung back to life is Funai's CVC portable system. Grundig are marketing it as Model VP100, which at around £300 makes it extremely competitive – cheaper than VHS-C machines, though the cassettes cannot be used with standard VCRs. Visual Mar-Cam Systems Ltd. are the UK distributors of the "Microvideo Showcase", the Funai/Technicolour version. CVC cassettes are now available with 30, 45, 60 and 120 minute playing times.

An important development of the VHS system has been announced by Matsushita, "stereo high-definition sound". This employs a principle used in a few non-PAL Betamax machines – recording the sound along with the helical video tracks. For this purpose two extra audio heads are mounted in the video head drum. The effect is to increase the relative tape running speed for the audio signal to the same speed as for the video signal, making high-density audio recording possible with sound quality equal to that of state-of-the-art audio equipment. A model using this technique will be launched in the UK towards the end of the year, in the Panasonic range. An NTSC version of the machine is already on sale in Japan, at the equivalent of around £800.

The latest addition to the Mitsubishi range is the HS304, a compact, easy-to-use front loader designed to sell at around £499. Mitsubishi comment that they hope to start production "soon" at their Haddington plant in Scotland.

A new VHS cassette has been designed by Eko in Ireland. Production is expected to start at the rate of 3-4 million cassettes a year. Amongst the advantages claimed are a new, overhead tape braking system and anti-pirating features.

TX10 CHANGES

In the latest version of the Thorn TX10 chassis the metalwork around the panels has been replaced by a plastic frame with moulded cableform retainers. In addition to offering better value, the plastic frame helps to reduce radiation from within the set. At the same time the main panel layout has been redesigned and two new i.c.s have been introduced in the sync/line oscillator and field timebase sections.

MINI TVs

The Sony Watchman Model FD210, a hand-held TV set measuring 8 × 3½ × 1½in. and weighing 1¼ lb, has now gone on sale in the UK, with a suggested price of around £250. The heart of the set is a flat tube (the gun is mounted at the side of instead of behind the screen) giving a 2in. picture.

Sony have thus entered the market ahead of the Sinclair flat-screen mini TV set, whose production has been delayed by some six weeks by a dispute at the Timex Milton plant in Dundee (the dispute was over the production of watches and had nothing to do with TV). Sinclair's set is designed to sell at around £60 and is appreciably smaller in size. Sinclair claim to use more advanced tube technology, giving longer battery life. There are similarities between the tubes, for example the phosphor screen is at the rear of the tube which is viewed via a transparent biasing electrode at the front. The main difference appears to lie in the deflection arrangements used.

SAMSUNG IN UK

Samsung colour sets are to be marketed in the UK by Heron Electronics. The initial models will have 14 and 20in. tubes and are being produced at Samsung's Portuguese plant.

INTERNATIONAL INDUSTRIAL NEWS

Zanussi and Philips have signed a letter of intent relating to co-operation in the design and production of TV and video equipment. It's understood that talks between the two companies were initiated at the request of the Italian government, and that talks have also been held with the French concern Thomson-Brandt. Though the agreement between Philips and Zanussi is at this stage tentative, working groups are to be set up within the companies to discuss the possibilities of collaboration.

COMPACT, the Committee to Preserve American Colour Television, which has both company and union members, has filed a suit with the US Commerce Department claiming that S. Korea and Taiwan are dumping colour receivers on the US market. S. Korean manufacturers are alleged to be selling CTVs in the USA at a discount of 46 per cent on the price of the same sets sold in S. Korea, while the discount with Taiwanese sets is said to be as high as 60 per cent.

Grundig have decided to close down their TV receiver plant in Taiwan. The plant was originally set up in 1977 and makes tuners and clock radios in addition to both monochrome and colour TV sets. Though production costs are low, the plant has made losses in the last two years and Grundig consider that best results can be achieved by concentrating production at the main plants in Austria and W. Germany.

MITSUBISHI'S NEW COLOUR TUBE

Mitsubishi have developed a new 21in. shadowmask colour tube with a squarer, flatter faceplate. The former feature reduces loss of corner information whilst the latter reduces reflections. Improved magnetic and thermal characteristics have made it possible to obtain the increased display area whilst a gun with a multi-stage focus assembly gives improved resolution.

CCTV QUALIFICATION

Until recently there's been no formal national qualification in closed-circuit television. The Educational Television Unit of the West Bromwich College of Commerce and Technology has, in conjunction with the City and Guilds of London Institute, devised a course leading to the award of a C & G certificate entitled "The Special Certificate in Closed Circuit Television" C & G 278. The course starts in September 1983 as a two-year part-time provision for those who already have C & G 222, 224, 272 or sufficient electronics background. Details from the West Bromwich College of Commerce and Technology, Woden Road South, Wednesbury, Sandwell, W. Midlands WS10 0PE.

A51-570X REPLACEMENT

A cautionary tale in the latest issue of *Ferguson Feedback* draws attention to the fact that there are several versions of the Mullard A51-570X tube. The differences relate to the deflection yoke, which is bonded to the tube. Unless the correct type is obtained for a particular TV set, problems such as reduced width and excessive height can arise.

TELETEXT SET WITH BUILT-IN PRINTER

Due for release late this summer is the Philips Model 3890, a top-of-the-range 26in. set with teletext and a built-in printer. A 4 × 3in. paper copy of any teletext page takes less than thirty seconds to print. The printer uses thermo-sensitive paper to eliminate the need for chemicals, and each set comes with three rolls of paper – enough for 175 teletext pages. The printer is also useful for copying telesoftware transmissions for home computer use.

WAR ON PIRATES

The Copyright Amendment Act, which increases the penalties for video piracy very considerably, received the Royal Assent on May 13th. The new Act divides offences into two categories which can be summarised as follows: (1) Trading in pirate cassettes. Those who rent or sell pirate cassettes face a maximum fine of £1,000 per offence, and a further fine and up to two months' imprisonment for subsequent offences. (2) Making pirate cassettes. This more serious offence is now triable before a Crown Court and carries an unlimited fine and up to two years' imprisonment per offence. It applies to the making of pirate cassettes for commercial gain. The previous penalty for both offences was a maximum fine of £50. The new Act takes effect from July 1st.

In addition to the increased penalties, the Act gives the police powers to search and seize.

Two men who admitted being involved in an organisation that mass produced and sold pirated and counterfeit tapes were recently ordered by the High Court to pay more than £4 million in damages. The court action was taken under previous legislation by seeking an injunction.

DBS

The IBA has informed the Home Office that whilst awaiting the legislative changes required it has earmarked funds for a satellite launch slot to be made available at the earliest possible opportunity for ITV use. The IBA feels that it should be made responsible for two of the five satellite TV channels allocated to the UK (the BBC has been given responsibility for providing services on the first two channels).

In the USA, the FCC has given approval to Satellite Television Corporation to start work on a DBS service in the 12-14GHz band. STC are expected to launch a satellite to serve the eastern time zone in 1986. Eight other companies have received preliminary FCC approval for DBS services. Channel allocations and satellite positions for the band are at present being discussed by the western hemisphere Regional Administrative Radio Conference.

RTE in Ireland have expressed the intention of running a satellite TV operation. The Irish Ministry of Posts and Telegraphs is at present considering the situation. The five channels allocated to Ireland interleave with those allocated to the UK, and the polarisation and satellite positions are the same. It seems that Ireland could have services, which would of course overlap with the UK, in operation by 1987-8. Similar overlapping with satellite positions and interleaved channels applies to France and Luxembourg. The two governments have held talks on possible joint operations.

Wolsey Electronics have introduced a range of DBS dishes in sizes 0·7, 0·9 and 1·5m, with Cassegrain feed. An advantage of this type of feed is that the downconverter can be easily mounted and can be replaced without disturbing the aerial's alignment. Wolsey's downconverter uses four gallium arsenide f.e.t.s, two in the low-noise preamplifier and the other two as mixer and local oscillator, followed by a two-stage i.f. amplifier using bipolar transistors. A.C. power is fed to the converter via the coaxial cable. The converter has an overall gain of 35dB.

IPRE

The Incorporated Practitioners in Radio and Electronics (IPRE), which was founded in 1935 and came to a temporary end in 1982, has been officially relaunched as a division of the Society of Electronic and Radio Technicians. It will provide a complete range of professional services to staff holding non-ERB qualifications – entry is based on City and Guilds 224 or the previous 222 course, though similar qualifications may be accepted later. IPRE members will receive SERT's monthly journal *Electronic Engineering* and the fortnightly newspaper *Electronics Engineer*. Further details can be obtained from SERT at 57-61 Newington Causeway, London SE1 6BL.

SERVICE BRIEFS: ITT

The latest issue of ITT's bulletin "Service Information" contains the following advice on particular problems with various ITT chassis.

CVC30 series chassis: In the event of tripping at switch on, check that the voltage across the mains bridge rectifier's reservoir capacitor C35 is 320V. If low, suspect C35 or the bridge rectifier diodes D11-14.

CVC40 chassis: In the event of low output from the switch-mode power supply at switch on, progressively increasing to the correct 127V, suspect the chopper output smoothing capacitor C11 (22μF).

In the event of failure of the chopper transistor T807 (TE1233), check R833 which provides base bias for the driver transistor T806. The value should be 1·5MΩ, 5%. The recommendation is to change this resistor whenever a set is serviced.

Intermittent failure of the 1·6A (delay) mains fuse F1001 is often due to the 5·1Ω surge limiter resistor R1, which should be replaced even if it appears to be satisfactory.

If the set trips with the scan coils plug disconnected to isolate the line output stage and a 150W lamp connected as a dummy load, check the value of R809 (220kΩ, 5%) in the trip circuit (on module CMP40). If this item is o.k., suspect the two 1N4148 diodes D8 and D10 associated with the chopper driver transformer.

ITT 80-110° chassis: In the event of varying width and height after about a quarter of an hour, suspect R631 (82kΩ) – check by substitution. This resistor is in the potential divider chain that provides the sample h.t. feedback to the chopper control circuit.

CVC801 chassis: Low h.t. (110V rail) can occur due to zener diode D732 (type ZPD20) being defective – it stabilizes the 20V supply used in the chopper control circuit. In later production two zener diodes (D732/3) are connected in parallel – in this case replace both.

No h.t. (switch-mode power supply shut down) is sometimes caused by a fault in the horizontal shift transformer L506.

In the event of weak sound, replace the 100μF electrolytics C228 and C232 associated with the audio i.c. in the CMR800 r.f./i.f. module.

CVC802/1 chassis: This version of the CVC801 chassis features frequency-synthesis tuning (CMR803 r.f./i.f. module). Hunting and a noisy picture may be due to failure of the prescaler i.c. This is IC51, type U465B. The improved type U865B, fitted in current production, can be used as a replacement provided pin 7 is isolated either by cutting the copper on the panel as near as possible to the device, removing the copper pad, or alternatively cutting off the i.c. pin (take care to avoid damaging the i.c.).

CVC1200 series chassis: Modifications have been made to the base circuit of T703 in the start-up circuit. These should be carried out in the event of failure of the BU508A chopper transistor T713. Details will be given in an article on this power supply to appear in a forthcoming issue.

TRANSISTORS

AD161	32p	BCX34	11p	NKT453	1.65
AD162	32p	BD131	30p	PN107	7p
AC131	40p	BF137	20p	R1038	80p
AC138	40p	BF197	15p	R1039	80p
AC153	32p	BF199	15p	R2008B	1.80
AC141K	39p	BF238	20p	R2010B	1.10
AF139	38p	BF240	9p	R2030	70p
AF239	41p	BF255	10p	R2265	1.30
BC107B	15p	BF256S	20p	R2443	25p
BC108A	15p	BF257	28p	RCA16446	30p
BC109B	15p	BF259	28p	RCA16599	1.25
BC109C	15p	BF274	11p	RCA16600	1.40
BC117	21p	BF435	41p	2N3703	20p
BC142	30p	BF450	43p	2SA473	10p
BC153	16p	BF459	40p	2SC346	8p
BC154	16p	BF460	58p	2SC1162	48p
BC159	15p	BFR87	25p	2SC785R	12p
BC171	9p	BFT42	30p	2SC3020	15p
BC172	9p	BFT43	30p	2SC388A	20p
BC174B	23p	BFY51	34p	R2322	50p
BC182LB	12p	BFY52	34p	R2323	50p
BC184LC	12p	BU105	1.00	TIP31	35p
BC208	9p	BU126	1.10	TIP32	35p
BC237	12p	BU207	1.05	TIP110	80p
BC238	8p	BU208A	1.15	T9010V	1.45
BC251	8p	BU326A	1.30	T9016V	1.20
BC307	10p	C1172B	9p	T9017V	1.20
BC308	8p	C1129	9p	T9050V	1.50
BC347	8p	E9005	14p	T9051V	1.00
BC394	8p	E5386	14p	T9052V	1.30
BC454	8p	ME0404	8p	T9053V	1.30
BC455	8p	ME0412	8p	T9054V	98p
BC460-6	40p	ME6002	8p	T6059V	1.00
BC549	8p	MJE182	47p	S2800B	90p
BC556	8p	MJE340	50p	S2800C	1.00
BC559	8p	MJE520	65p	S2800D	1.25
BC595	8p	NKT241	8p	S2800E	1.40
		NKT276	20p	S2800M	2.00

Thorn 10Ω 20W (3500) R751 Safety Resistor	75p
Pye 713 Speaker 5" × 3" 70Ω	1.00
Pye 713 Complete Tube Base Panel with Focus Slider & Leads	2.75
Pye 713 Control Knobs	4 for 50p
Tube Base Socket ITT CVC32	45p
Tube Base Socket Thorn 3000/8000 etc	50p
IC Inserter 16 Pin	50p
Large IC Extractor	50p
Crystal 4.43MHz	65p
EHT Lead & Cap for Split Diode Lopt	90p
Anode Cap	47p
Sanyo Anode Cap Assy + Lead. 12TCD-CT-1G	65p
Degause Thermistors. PT37P. ITT/GEC	35p
Degause VDR E299D/HP230 3000/8000	25p
Casters Set of 4	1.90
Double Fuse Holder on Small Pax Board 20mm type	10p
Single Fuse Holder on Small Pax Board 20mm type	5p
Direct Panel Mounting 20mm Fuse Clips (pair)	15p
Single Fuse Holder on Small Pax Board. As per early 3000 mains input	6p
EHT Cable	Metre 25p
13A Plugs	12 for 4.80
TX9 Tube Base and Panel	65p
3K PSU PL22 edge connector. + Lum to PSU	40p
3K5 Complete Lum with all Plugs	2.00
LM340 T12 on Heatsink	25p
T9051V on Heatsink	60p
BF259 with Heatsink	14p
TIP110 with Heatsink	40p
L129/130/131 Coil	10p
6MHz Ceramic Filter	25p
DL700 (Philips) Chroma Delay Line	1.00
DL50 Chroma Delay Line	1.00
T9006A Lum Delay Line	1.00
8K5/9K Lum. Delay Line	65p
Plastic Cover for 3K5 SP8385	5p
TX9 Back Ground Control 10K	15p
TX9 Gain Control 100R	15p
1500 Metal Chassis Supports Pair	40p
Thorn 8K5 Focus Pot	2.40
Thorn 4000 Focus Pot	2.75
Mullard EL34	2.80

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AE. Socket & Lead. Pye, ITT, Thorn	25p
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AE. Socket & Lead. Pye 691/693	25p
AE. Socket & Lead. Philips KT3	25p
AE. Socket & Lead. Thorn col. portable	25p
AE. Socket & Lead. (long) Pye 725/731	25p
AE. Socket & Lead. ITT CVC32, etc	25p

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Line Connectors	38p
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Band Change Switch Assy, Pye 725	40p
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Thorn EHT TX 3000/3500	6.00
Thorn LOPT 9600	12.00
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Thorn LOPT 1590/91	7.25
Thorn LOPT TX9	9.85
Thorn LOPT 9800	17.00
ITT LOPT CVC1–9	9.60
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 169	9.70
GEC LOPT 3133	7.40
Diode Split LOPT AT2076/35	14.75
Sanyo LOPT AM–WM–21	6.75
Sanyo LDPT AM–WM–4	7.30

CAN TYPES

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

MULTISECTION CAPACITORS

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

CAPACITORS

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

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

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ML237B	2.00	TBA120CQ	70p
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SAA5010	6.00	TBA641	2.05
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AA119	8p	IN4742A	8p
AA143	8p	IN5254B	8p
BA115	8p	IN5349	14p
BA154	8p	IS025	8p
BB103	8p	IS131	8p
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BT106	1.50	MR854	35p
BT116	1.00	SKE1/02	20p
BY127	12p	MCR406	35p
BY204	26p	TIC106C	40p
BY298	22p	TIC45X	50p
BYX22/400	30p	2N4444	1.50
IN60	8p	Y827	80p
IN2070	8p	ZX150	12p
IN4001	4p	OA91	5p
IN4002	4p	MCR106/7	1.00
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6.2v, 12v.

BZY88 **10p each**
3.9v, 5.6v, 12v, 16v, 20v, 30v, 33v.

TOSHIBA 500MV **10p each**
5.6v, 6.8v, 7.5v, 8.2v, 11v, 15v.

BZX61 **16p each**
9.5v, 10v, 11v, 15v, 27v, 72v.

MAINS DROPPERS

Pye 78+161	50p
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50MA	10 for 70p	250MA	10 for 65p
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1A	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

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Thorn 4000 Coil L401	40p
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Pye 713 Coil L831/832	65p
Philips G8 Coil L482 Late Type	65p
Philips G9 Luma Delay Line	90p
Pye 713 Luma Delay Line	90p
Convergence Yoke Assy AT1023/05	5.90

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Rank A823 4 P/B Assy	5.80
Telpro 4 P/B Assy	5.80
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ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	65p
Thorn 3/3500 A1 Switch	50p
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HIGH VOLTAGE DISC

Most Values Available 2KV to 12KV

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Ambersil Amberclens Foaming Cleaner	13oz	1.26
Ambersil Circuit Lacquer	14oz	2.15

WIRE WOUNDS

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

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn TX9 main panel

Complete (no tuner) ex-factory	11.00

Thorn 3/3K5 ex equip panels untested

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

Autovox Decoder FG/01 new boxed	5.00
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Thorn 4000 Convergence panel ex-factory	3.75

Thorn 4000 PSU panel ex-factory	2.50
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Thorn 3K5 PSU bottom board PC206 new	2.75
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Letters

THORN 9000 CHASSIS

Having serviced sets fitted with the Thorn 9000 chassis for several years, I found your article on it in the May issue full of interest. I'd like to make the following additional points.

(1) As you say, the mains filter capacitor can go short-circuit. You didn't however mention the fact that it can often burn quite intensely – in one particular set I dealt with it seriously burnt the wiring loom, which had not been dressed back properly. In later versions of the chassis the filtering arrangements were altered.

(2) Diode W702 (in series with the Syclops transistor) can go short-circuit as well as open-circuit. When it goes short-circuit R7 (390Ω) on the tuner board usually burns up quite fiercely. This can cause confusion if you're not familiar with the chassis.

(3) As these sets get older I find more and more often that there's little or no first anode supply adjustment available from R721. This can usually be cured by replacing R722 (2·2MΩ) which is in series with R721 on the earthy side.

M. L. Pattenden,
Headley Down, Nr. Bordon, Hants.

RANK Z718 LOPT

We would like to draw attention to a problem associated with line output transformer harmonic tuning in the Rank Z718 chassis. Looking back through the articles you've published on this chassis, it appears that the side effects of fifth harmonic mistuning have never been touched upon.

On taking over the Rank transformer operation in Dublin some months ago, we carried out an investigation into the high failure rate of these units. This revealed that the vast majority failed as a direct result of 5L3 being mistuned. Judging by the core position on previously returned units, it appears that service engineers had been tuning the coil to eliminate striations on the raster. This simple method is convenient but extremely subjective and should never be relied upon for accurate tuning of this transformer.

To overcome the problem, we now pretune these units on test. We can supply an information sheet entitled "Reliability and Harmonic Tuning" on receipt of a stamped, addressed envelope.

E. F. Phelan, Technical Manager,
Woodsdale Components, 34 Field End Road,
Eastcote, Pinner, Middx. HA5 2QT.

ION TRAPS

We recently had in for repair a small monochrome portable of the type that's very familiar these days – it had the almost obligatory shiny white case, and worked quite well after the repair had been carried out (a faulty voltage regulator).

The c.r.t. had a white label, with the familiar red lettering. In place of the usual name Toshiba however it had the name Samsung, made in Korea. The c.r.t. type number was not unusual, though the ten-digit serial number looked somewhat out of place on such a small tube. Also present in red lettering were the usual warnings about high voltages and so on, and in small print there was the rather startling caution "do not use an ion trap".

Now as an old timer I can remember that ion traps were at one time a very necessary item in order to avoid screen damage from negative ions – since the ions are much heavier than the electrons given off by the tube's cathode, they are less affected by the magnetic deflection fields and thus tend to cause ion burn at the centre of the screen. Special gun arrangements were introduced to operate with an ion trap magnet, the idea being to separate the ions from the electron beam and direct them to an intervening anode. After a period of time it was necessary to readjust the magnet – a deft twist would usually restore a bright picture, and produce the odd fast buck! The ion trap went out with the use of aluminised screens however.

Some later tubes featured a steering magnet, adjustment of which not only restored the picture but would centre it horizontally and vertically. Such memories brought back thoughts of triode tubes, 2V heaters, heater-cathode shorts, round screens, and isolation transformers. On one occasion in a moment of desperation an innocent, unsuspecting audio output transformer was pressed into service as a heater isolation transformer.

It seems odd that a very modern TV set, manufactured by inscrutible gentlemen in a far away country, should trigger off such a trip down memory lane – all due to a strange warning in small print on the c.r.t. label! Or am I missing something?

A. S. Foster,
Brixham, Devon.

Editorial comment: Samsung is one of the two major Korean TV manufacturers. The company started to manufacture TV sets in 1969, in collaboration with Sanyo (the partnership was subsequently terminated). You certainly can't use an ion trap magnet on a tube not designed for it – and ion trap tubes were obsolete long before 1969. We can only assume that the warning is one of those things that goes on being repeated long after it's necessary. How many Koreans would know what an ion trap magnet was?!

TOSHIBA C81B

Reference was made in the June Service Bureau to the problem of h.t. fuse blowing and the line output transistor Q404 going short-circuit in the Toshiba Model C81B. I've also had this fault, which was eventually traced to the 105V h.t. series regulator transistor Q801 going leaky. It's mounted on a large, rather inaccessible heatsink and is type 2SC1195 – a BU126 can be used for improved reliability.

When Q801 goes leaky the h.t. rises and the line output transistor, which is operated with little margin, fails. Fuse F803 then blows.

The 2SC1172 transistor can be replaced with a BU208, which should also be a lot more reliable.

B. Knapp,
Cheltenham, Glos.

A NEW G8 FAULT?

A customer phoned to say that the picture was taking a long time to appear on his set, an old Philips G8 – anything from five minutes to half an hour. The sound was o.k. Two months previously I'd fitted a new transductor as the old one had burnt out, and at the time I'd checked the tube emission. This was low, so I'd given the customer a quote for a new tube. It seemed to be just a matter of a quick pick up, fit the new tube, and check for the fault.

I didn't bother to try the set before fitting the new tube, expecting the tube to solve all problems. All was indeed well when the set was switched on, so the convergence was set up and the receiver left on soak test. I later switched off whilst attending to another set, but when I switched on again for a final check before putting the back on there was no picture, no e.h.t., no blown fuses – in fact the set appeared to be just sitting there!

Out with the meter to check for drive and voltage at the line driver transistor, during which time the sound came on and within seconds there was e.h.t. and a picture – but the picture wasn't as bright as during the previous test. I stood back in amazement! Switch off, then on – no picture at all. So I was back to square one, though this time I'd a chance to look around. The line driver transistor's collector voltage was low but there was no fuse blowing, so as these sets are prone to faulty line output transformers a replacement was tried. Problem the same, and time to give up for the day.

The next day offered nothing more interesting than another G8, this time completely dead with a blown h.t. fuse due to shorted turns in the line output transformer – always keep one in stock! I went back to the first set and decided to try swapping over the line output units complete. The set now worked very well, so I looked around the first panel for the problem. One of the line output transistors had a collector-emitter leak – this has got to be it! Fitted two new BU208s, refitted the panel, but still no go, no e.h.t. or sound.

Out with the scope. The h.t. was disconnected from the line output stage (link PC1) and checks made on the driver stage. Plenty of drive on the primary of the transformer, and the voltages now correct. Replace PC1 and the collector voltage dropped. Attention was turned to the small subpanel which houses the line output transistors' base circuit components. Check all resistors and find that the two 10Ω damping resistors R527/9 are slightly high but within ten per cent tolerance. Tried fitting old scrap subpanel and everything came on smashing. For interest I interchanged the components one at a time and, would you believe it, it was the two damping resistors even though they were within tolerance.

Three days later the line output transformer died, but that's another story. I hope this tale may serve as a warning to others – what with all the running around I think I must have lost money on this one! Book it to experience.

K. D. Bunting,
Hartford, Cambs.

Aerial Systems and Faults

Peter Richards

There are many occasions when a service engineer finds that a fault he has been called to attend to is due to the aerial rather than the set. In this event it's a good idea to establish what's wrong with the aerial system so that the customer and/or aerial rigger can be told what needs to be done. A good aerial system will provide at least 1mV of ghost-free signal at the set's aerial socket – this is particularly important for teletext reception.

The TV transmitters in the BBC/IBA network range from very powerful to very weak – some relays are so weak that a line of sight location is no guarantee of good reception. For all transmitters however there's a "service area", which is defined as the area in which a reasonable aerial system will provide a 1mV signal at the set. This is open to interpretation. We will consider the various types of aerial systems in turn and see what can go wrong with them.

Indoor Aerials

Simplest of all is an indoor aerial, though no self-respecting salesman or engineer will suggest using one. Except for the odd special location, an indoor aerial will not give 1mV, while the strength and number of ghosts always varies as you walk around the room. This means that justice cannot be done to a colour set's performance capability and the customer is never completely happy.

Simple Aerial Systems

The aerial's job is to gather sufficient signal to overcome the losses in the downlead and leave at least 1mV at the end. For this purpose it must be large enough (depending on the field strength at the location), high enough (to overcome losses from obstruction in front), and correctly aligned (to avoid ghosts due to signals reflected from trees, buildings, etc.).

A ten-element aerial will suffice in strong signal areas, larger aerials being required towards the edges of a transmitter's service area. It's important that the cable connection to the aerial is secure and watertight, and that the cable itself, which should be of the low-loss u.h.f. type, is fixed securely down the mast, down the roof (every three or four tiles) and into the house, where it should terminate in a good, clean coaxial plug, with the inner conductor soldered.

The faults that can occur with such an installation are not too complicated. The aerial may blow down, or round (giving ghosts). The aerial and/or its connections may become corroded over the years, reducing the system's efficiency. The cable may go open-circuit (with most aerials the cable should normally read short-circuit across the coaxial plug) or short-circuit, or sustain other damage from not being properly fixed. It may also deteriorate from old age.

Renewal is the best policy. It's important however to remember that the installation may not have been adequate in the first place. An aerial in the loft for example will not be high enough in the vast majority of cases, nor free from obstruction, and will thus not provide the required signal.

Aerial Plus Amplifier

An amplifier must be used where the largest practical aerial does not give 1mV at the set. Amplifiers are available with different gains, according to requirements. To improve a slightly sub-standard signal in an otherwise good area, use a low-gain amplifier (gain 12dB or four times). Medium-gain amplifiers (20dB or ten times) are used mainly as repeater amplifiers to make up for losses in cables or losses due to the use of splitters in the aerial system. High-gain amplifiers (30dB or thirty times) are needed where the signal is poor, usually outside the service area.

An amplifier system usually consists of two parts, the amplifier itself and a power supply (see Fig. 1). The amplifier should be fixed to the mast near the aerial – but not too near as this can cause feedback. This position for the amplifier is important in order to minimise noise. The stronger the input signal, the more it will swamp the amplifier's noise. Hence mast mounting is preferable to the use of a set-back amplifier. The power supply will be in the house, usually behind the TV set. For safety reasons it must not be wired into the same plug as the television set.

Amplifier Faults

Faults with this sort of installation consist of those due to the amplifier in addition to those due to the aerial itself (see above). Power unit faults are easy to find simply by disconnecting the unit from the amplifier and making voltage checks. Alternatively the amplifier itself could be faulty: it may read open-circuit (usually an open-circuit powering choke or a connection), short-circuit (usually the zener diode or a connection), it may not be amplifying properly (possibly due to transistor failure), or it may simply be covered in water and corroded to bits because someone hasn't mounted it properly.

A more confusing fault is cross-modulation in the amplifier. This looks like either poor field interlace or one station in the background of another. The basic cause is excessive input signal, or a faulty amplifier. The signal levels in a particular area may be liable to fluctuation with weather conditions, and may have risen somewhat since the system was installed. Once more we must be on our guard against an inadequate installation. The installer may have skimped on the design of the system in a misguided attempt to save the customer money – the inevitable result of this is that when the system deteriorates a little, as all systems do, snow starts to appear on the screen and a service call is eventually made.

Multiple Amplifier Systems

Multiple amplifier systems are used when the aerial has to be sited some distance from the house – the distance may be some tens of metres to hundreds of metres up the side of a mountain. The system is similar to that previously described except that there will be repeater amplifiers every 80 metres or so – it may also contain attenuators and equalisers. This type of system is very difficult to design properly. Many are installed using rules of thumb. The results are generally not very good.

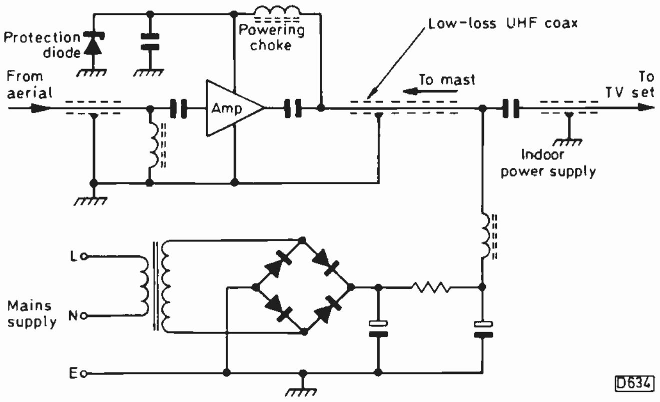

Fig. 1: Aerial amplifier and power supply. The power supply provides 12V or 24V according to type.

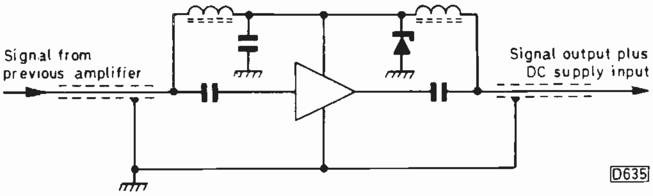

Fig. 2: Amplifier with through powering for use as a repeater in a multiple amplifier system.

Faults are usually simple to identify. The amplifiers will be line powered as shown in Fig. 2. Power supply faults can be sorted out initially by measuring the current taken from the power supply. This will give a clue to the total number of amplifiers taking current. Voltage checks at each amplifier will then probably lead to the fault. If the fault has not been found when you arrive at the aerial, a check on the signal at each amplifier on the way back will locate it.

Because of the accurate design and setting up required, this type of installation is prone to either cross-modulation or low output. The most difficult faults to find are those due to gradual deterioration and loss of performance in almost every item in the system.

Communal Aerial Arrangements

Communal systems are used to feed blocks of flats or even whole villages in mountainous areas. They are basically an expansion of the multiple amplifier system just described. The signal levels are usually much higher however, 30mV to 100mV being typical. Outlets to individual houses are through "tap-off boxes" which feed a small percentage of the total signal to each customer's house. Isolation is also provided to protect individuals and the system from the mains supply.

It's not unknown for outlets to individual houses to go faulty, generally due to corrosion, but most faults are of a communal nature. These faults are the same as those that affect a multiple amplifier system.

Conclusions

Finally some general comments. If the picture is snowy, check with a signal strength meter. Grain starts to show at about 400μV· The picture will be watchable at 200μV. If you haven't got a signal strength meter, you can make one very simply from a TV set reserved for test purposes. All that's needed is to connect a voltmeter to the set's a.g.c. line, calibrating this against a known source.

Don't be fooled or mislead by trying other sets – they may have slightly different gains or frequency responses. Use another set to prove the point, but not to make the initial diagnosis. Many a tuner has been changed in error!

Skimping on aerial work doesn't pay: remember that a wasted service call to look at a snowy picture can cost the dealer as much as the amplifier or a bigger aerial that should have been fitted in the first place.

The information above should enable an engineer to provide an accurate diagnosis of an aerial fault on any sort of system and advise the customer accordingly.

Laura's Dead Decca

Les Lawry-Johns

I'm sure you all remember Laura Lovitt, last reported as tampering with Titch the telephone man and giving me the old heave ho when she thought she was going to be busy one afternoon, and me going back to the shop to find another telephone chappie buggering about in the bedroom. Well, every dog has his day, he who laughs last, and all that.

The phone rang and it was Laura to say that her legs had at last given way and the Decca was now a damaged Decca. Could I call this afternoon?

"Are you sure your telephone's not tapped?" I asked.

Laura gave a gurgle. "He was only showing me how to fill in a football coupon. Very patient he was too."

"All right then. I'll be down this afternoon."

How to Oblige

And down I went to give the legs a close inspection before examining the Decca. The frame's woodwork had given way as though the legs had been asked to support an extra offset weight (perhaps the set had been shoved from the side?). I could see from the front of the Decca that the tube had lost is vacuum, and this was confirmed by the sight of the bowler hat on the rear cover. It was cracked and bowed in, the tube base was in pieces, and the tube's neck was beyond recall. I shook my head sadly. "Sorry Laura. It's right buggered."

"I know it's buggered" said Laura with no trace of sadness, "but it's also insured and I've been wanting a new set for a long time. Now I'm going to get it."

We discussed just what she wanted for some time, and as the bedroom was only a sliding door away I suggested that perhaps a smaller set with remote control would fill the bill, so that she could watch the late night programmes in bed, change channels and switch the thing off without getting up, then wheel it back into the lounge in the morning. This idea seemed to appeal to her, so I nipped back to the shop for a 20in. remote control model and had it installed and working in no time.

She said the picture was good and she liked the remote control but the front presented a sort of blank, black appearance. Would she like to come back to the shop to see some others then? No. They don't look the same in the shop. So she wouldn't really be able to tell.

To cut a long story short, I had to do quite a bit of running around before she finally liked the Pye 3262 with full remote control, and of course she had to be sure that everything worked as she lay on the bed (it's not easy trying to satisfy some people . . .). She said she'd let me have the cheque when the insurance had been settled. I'm still waiting.

Les the Bodger

I was asked to do a very quick job the other day. We'd had to write off Mr. Toolong's old 26in. Thorn 3500 as a dead loss. Until he bought a new set he was having to rely on his Philips 16in. portable (KT3 chassis, with remote control). This was in urgent demand by the family therefore, but had "gone funny".

The "funny" bit was that the colour was at maximum and couldn't be turned down. The controls consist of plus and minus buttons, but the colour couldn't be turned down no matter how many times the minus button was pressed. I rather suspected i.c. failure, and the first suspect (to me) was the SAF1032P remote control decoder i.c. (IC807), but there wasn't one in stock. The relevant bit of circuitry is shown in Fig. 1. Voltage checks confirmed that the control voltage at the emitter of transistor TS840 was over 4V and remained at this level instead of varying between 2V and 4V. This meant that TS840 was being turned on excessively because its base voltage was high. The voltage at the collector of TS836 was in turn high because there was lack of turn-on bias at its base. This suggested that either IC807 or R832 was faulty. R832 was in order – as were both transistors – so our suspicion of IC807 deepened. Frantic phone calls were made. "Sorry Les." "Sorry Uncle Les." "I'll have to send for one Mr. Toolong."

"But we want it today. Now!"

I looked at the preset R838. It didn't vary the voltage at all, but could be made to do so by wiring a little resistor across C839. Try 22kΩ. Not really. Try 15kΩ. Nice variation as the preset was turned.

"Well now Mr. Toolong, this control here is the ideal colour preset, and once I set it to your liking that's it."

He was quite pleased with this bodge up, and carried the set away smiling.

I was relieved too. It didn't have to be that particular i.c., because it gets its input from IC761, and there are various other complications.

Minimatic, Big Wallop!

Here's a warning – be careful of those small Yugoslavian Minimatics. I was trying to sort out the print side position of a transistor and reached over to locate just where it was with my right hand. I must have jumped a couple of feet in the air (well, say two metres) or more. Whilst the e.h.t. stick is fully shrouded, the e.h.t. connection isn't – it's just a solder blob exposed to all and sundry, including me. You may say that it serves me right for not looking where I put my hands. Quite so. But I wouldn't like you to get the same.

Fun with Fidelity

We've sold quite a few of these Fidelity CTV14R (and S) sets during the past year or so. Some have required attention recently.

The weak link appears to be the line output transformer, though this is not immediately obvious. The symptoms are that the h.t. builds up after switching on and then collapses with a tick, the process repeating. This

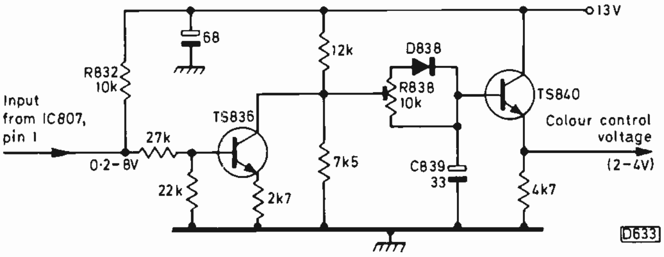

Fig. 1: Preset colour control circuit, Philips KT3 chassis (remote control version).

could of course be due to various overload possibilities or to the TDA2581 chopper control i.c. playing about. When the set is switched off, you may find that e.h.t. is present under the e.h.t. connector cap. This tends to suggest that the line output transformer is working correctly. When a replacement is fitted however the set works normally (for us, so far).

Removal of the transformer in the earlier model is quite easy – unsolder the tags, turn the tag round for exit, and remove the two screws at the top frame. In later models there's an extra strut on the frame. This covers the tag and means that the panel screws have to be removed to allow the panel to be raised from the frame.

Another frequent fault is failure of the chopper transistor TR13 (type BUX84 or BUV46). The transistor tends to go short-circuit, as a result of which the h.t. rises and the set shuts down.

The front control panel is also a bit flimsy and can develop cracked print, dry-joints and the like.

Intermittent operation, with all the channel LEDs coming on for a brief second, is often due to a dry-joint on one of the two long wirewounds at the rear left side. A moment spent resoldering these connections can be very rewarding.

Bette's G8

Bette Hind is a lady with a lot of gusto. It's like a hurricane hitting the place when she comes in. "Hallo Les Luv. Will you get my set out of the car for me only I'm on double yellow lines and can't get away with it now they're all women."

"I can" I smirked. "You've only to rub them all over with soft soap."

Anyway, I got Bette's 20in. Philips G8 out of the car and on to the bench, and caught sight of the worried look on her normally alive with laughter face.

"I think it's had it this time Les. The picture went and there was a hell of a stink, then the lot went off, puff, just like that."

"Don't worry Bette. In five minutes it'll be as good as new."

So I took off the rear cover (a screw in each corner instead of the usual G8 struggle fit). Over on the right side I could see the transductor looking sick, so I removed plug H (the red one) to stop that nonsense and plugged the set in. Nothing. There was voltage at the bottom end of the top section of the "dropper", but nothing at the top. I switched off and decided to short the dropper tag to earth to get rid of the charge on the reservoir capacitor. Bang it went, because I'd not bothered to use a resistor, risking the screwdriver blade instead.

Bette jumped two metres in the air, just as I'd done earlier. "I told you the bloody thing was finished" she bawled. "It'll kill us all. Mrs. Seer said she saw it in the cards the night before last."

"Shut up for Gawd's sake" I snapped. "The thing's nearly done now."

"Done in more like it" she moaned.

I put in the new dropper and checked the fuses. The lower one on the left side (800mA) had blown. With this replaced the set was switched on and a good picture appeared. Being a 20in. model, the absence of raster correction (plug H out) was not noticeable.

"That's bloody marvellous" exclaimed Bette. "What about the smell?"

"It's Ben" I explained. "He's been a bit loose lately."

next month in

TELEVISION

● THE BETAMAX SYSTEM
Most published material and courses on VCRs are based on the Philips N1500/N1700 or the JVC VHS system, simply because the former was the first to appear on the market while the latter has been the market leader throughout. This means that the Sony Betamax system is probably less well understood than the other systems, though some Beta machines have sold in large quantities. Next month Eugene Trundle sets out to redress the balance with a new series on Beta video. The emphasis will be on areas where there are fundamental differences between the Beta VCR system and its better understood rivals.

● SERVICING THE PHILIPS TX CHASSIS
Pye and Philips monochrome portables fitted with the TX chassis have been good sellers for several years. John Coombes provides a quick fault-finding guide.

● VINTAGE TV – THE PILOT VS9
Pilot Radio was a well known name just before and after World War 2, mainly because of the firm's innovatory radio sets. When the first Pilot TV set, the VS9 came along it too had unusual aspects. Chas E. Miller delves into another interesting bit of TV history.

● A MATTER OF SAFETY
Those who deal with dozens of TV sets often tend to become blasé about safety matters. Nevertheless a TV set, especially a defective one, can be a very dangerous object. Tony Thomson deals with the various aspects of the subject, both in the workshop and in the field.

● CTV BATTERY OPERATION
George Wilding takes a look at various approaches to supplying colour portables from a 12V or 24V battery. The TA126 converter used with later versions of the Thorn TX9 chassis is considered in detail.

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Light on Servicing

Eugene Trundle

IT'S strange how the habits of a lifetime die hard. For years I've been using a conventional spring-arm bench lamp for close illumination while servicing TV equipment – the familiar type with a heavy base, cantilever arm system with compensating springs and a conical shade/reflector. It never occurred to me that anything better might be available. The disadvantages of this type of lamp are several, and perhaps not appreciated until one thinks about it.

The light coming from the small glow area of a filament bulb tends to cast shadows, making it necessary to move the lamp about to get satisfactory illumination. Then the bulb and its shade get uncomfortably hot, which is fine for setting epoxy-resin joints, but inconvenient for the operator and disastrous if the lamp, forgotten for a few minutes perhaps, is allowed to dwell near the plastic cabinets and covers that are common on consumer equipment these days. My lamp seems to suffer more than most from "brewer's droop", and on three occasions lately the 75W bulb has descended on to plastic TV backs and VCR deck covers with strange and fantastic, also expensive and smelly, results. The bulb always seems to fail at the crucial moment, and if a higher rated bulb than specified is fitted the result will be premature failure, often accompanied by an evil smell from the overheated bulbholder. Power consumption is yet another factor. This matters little in mains operated workshops, but I met a man who services radio-telephone equipment recently: he has to count the watts like Les counts the calories!

There are several types of illuminated magnifier on the market for close work on intricate equipment – they've long been used by watchmakers, factory operatives, dental technicians and so on. I found three listed in the catalogues of well known suppliers to our trade, and selected for review the Ledu type 271 which is available from Philips Service.

The Ledu Magnifier

It's the least expensive of the full size types, and seems to offer as much as the competition. The counterpoised cantilever arm stems from a "pod" at the base, in which the flourescent tube's control gear is housed. The arms are longer than the conventional bench/desk lamp, giving a wide arc of movement. At the business end a 24cm. diameter circular plastic housing contains a ring type 22W flourescent lamp. An on-off switch is incorporated in the housing, and inset in the middle is a 12cm. diameter precision ground glass lens with a magnification factor of 1·75.

The flourescent tube is protected from damage by a plastic diffuser with a faceted surface to spread the light wide. The ensemble is fairly heavy, and is supported by means of a clamp-on bench socket. The sockets are available separately, so that one lamp can be used in several positions around the workshop, plugged in and supported wherever needed. The lamp itself has a vaguely medical or dental look about it, which may be daunting to some – especially when laid beside the syringe and scalpel that forms part of our tool kit!

The first thing that struck me in use was the brightness of the illumination provided by the 22W tube. Because of the large source diameter and the action of the diffuser, no shadows are created. The light has a bluish quality – rather like the Gro-Lux tube in my fish tank at home. With the lamp poised over a TV chassis or VCR deck, I found that I could see all that was going on with the lamp a couple of feet away from the works. Used in this way, as a bench lamp, the device can be swung well away when not in use.

The focal length of the central lens is about 30cm., beyond which the defocusing effect is accompanied by a sort of blue/yellow misconvergence! The 30cm. focus depth enabled me to work on panels, mechanics etc. while viewing through the lens – an ideal situation for soldering small assemblies, checking joints, and particularly servicing and adjusting audio and video decks. Some service manuals these days contain circuits in which the equivalent of about three TVs is crammed into a single page – these myopic diagrams are much more easy to read with the aid of this instrument. I found that the cantilever arm assembly is well balanced and well behaved – a couple of knobs are provided to adjust the friction.

A few words on safety. The lamp has a three-core lead, with the earth conductor connected directly to the metal arms and springs. I would have been happier with a twin-core lead, with double insulation if possible, because a large and accessible earthed mass in such close proximity to live electrical equipment is not, so far as I am concerned, a good idea. A shock hazard can arise even when an isolating transformer is used, so I disconnected and insulated the earth wire at the plug end, after checking for good insulation resistance between the mains leads and exposed metalwork.

The other hazard, perhaps not immediately obvious, is the possible fire risk when the magnifier is left unattended with the sun shining on it. Experimenting in the garden one sunny day I had no problem in igniting a newspaper in five seconds flat! A lens cap is provided to prevent such happenings.

A good and worthwhile service aid then for the modern workshop. Good service aids are not cheap, but £52-00 plus VAT (net to the trade) is not excessive for this instrument. Its large physical size is a disadvantage only when one suddenly bobs up from a tape deck or whatever to find oneself crowned and haloed! The Philips Service stock number is 395-37125.

Other Optical Aids

In conclusion it might be worth mentioning a couple of other optical aids I've found helpful for TV and VCR servicing. Both are from the expanding optical aids section of the RS Components catalogue, are relatively inexpensive and very useful.

The first is a watchmaker's eyeglass (stock no. 544-055) with a magnification factor of eight and a focal length of 31mm. It's useful for inspecting video heads, tape guides and small electronic components, and works well for checking beam landing (purity) in shadowmask tubes.

The tape path in a domestic VCR is such that many critical mechanical and electrical deck components are difficult to see, clean and check. Cotton buds are very useful for cleaning, and a dental-style angled inspection mirror is almost indispensible when working on such equipment. The one marketed by RS Components (stock no. 549-319) has the useful feature of being fully insulated. I can heartily recommend it.

The New Thorn TX90 Chassis

The story behind the Thorn TX90 chassis is no less fascinating than the set itself, with its novel mechanical and electrical arrangements. The challenge was to produce a quality small-screen colour portable that could compete in price with anything likely to come from the Far East. A small-screen portable was seen by Thorn to be important for two reasons. First, this section of the market is expanding faster than any other – sales of colour portables in the UK exceeded 900,000 in 1982 and are expected to reach 1,100,000 this year. Secondly, getting a competitive set into production would have important consequences for Thorn's TV plants in terms of the economies of large-scale production.

Thorn have invested £2·5 million in production facilities for the TX90 at their Gosport plant, where CTV production is being built up from some 500,000 a year to 700,000 a year. Production of TX90 sets is already running at a rate of 150,000 a year and is being built up to 215,000. The plant also produces the 1790 series monochrome portables, with production at present running at a rate of 300,000 a year. An additional 250,000 colour sets, using the TX10 chassis, are produced at the Enfield plant.

These figures give an idea of the importance in terms of scale of having a range of chassis to meet all requirements, from large-screen 110° models with full remote control and teletext to the TX90 14in. portable. There is certainly a market for the TX90, and with its suggested price of around £169 for the initial Model 37140 it's evident that Thorn have got their costs right. Just how is production of sets to sell at this price possible? The answers relate to simple mechanical layout, reduced component count and, in particular, efficient manufacturing technology.

Production Aspects

The key to the latter is to make maximum use of the capabilities of the latest automatic component insertion equipment. To put it simply, the TX90 has been designed and laid out so that two complete chassis, including the c.r.t. base panels, occupy the space of a single standard panel (made from a 345 × 375mm Euroblank). Since the automatic component insertion equipment is designed to handle this size of panel, two TX90s can be produced simultaneously on the same panel and be separated at a later stage for testing and assembly into complete receivers. In comparison, you get just one TX9 or TX10 chassis from a Euroblank.

The electrical design of the TX90 was to a large extent determined by this need to get two sets out of one standard panel and thus make optimum use of the production facilities. Three factors enabled this requirement to be met. First the choice of suitable circuitry, to which we'll return. Secondly the use of a new i.c., type TDA4500, which incorporates all the signal processing circuitry, including the timebase generators, apart from the decoder. Thirdly much greater use is made of upright (radial) component mounting – there are 184 radially mounted components and 54 axially mounted components. A further constraint on the electronic design was imposed by the fact that there's a limit to the number of different types of component that the automatic component insertion equipment can handle. This, together with cost considerations, explains the fact that the component count is not as low as theoretically possible, i.e. groups of small resistors are used in several places instead of one larger resistor. The limit to the number of component values that can be used imposes a further discipline on the electronic design.

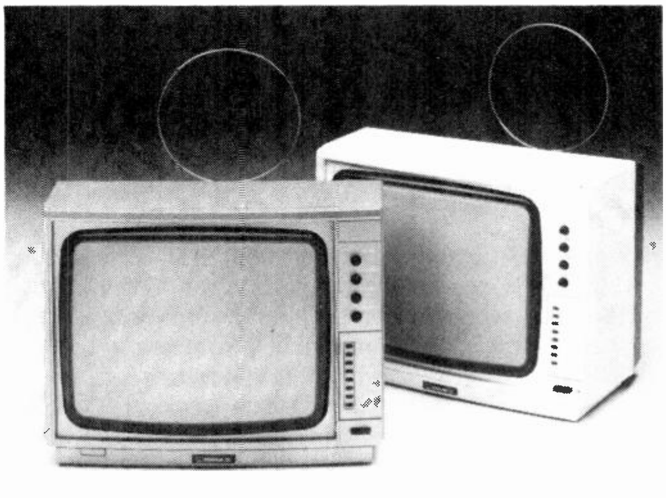
Mechanical Arrangements

The other major factor contributing to the low cost of the TX90 is the mechanical arrangement. The moulded cabinet has just two sections, the cabinet itself and the back panel. The main printed panel is held by moulded runners on the left-hand side of the cabinet and is secured by the back panel and a single screw. The user controls are all mounted on the main panel, protruding through cutouts in the front of the cabinet. These arrangements were first used in the 1790 monochrome portable chassis (see *Television*, February 1983). Mounting the controls in this way eliminates the need for separate and costly control panel wiring and assembly work.

The 14in. tube is also a key element in the design. The tube/yoke assembly is of the pincushion distortion free type, eliminating the need of EW correction. The tube neck is of the "mini" type, i.e. the diameter is 22·5mm. This enables a smaller yoke to be used, in turn reducing the scanning energy requirement by 20 per cent – in comparison with the TX9's 90° narrow-neck (29mm) tube. There's a further advantage since the reduced glass weight simplifies the cabinet design.

The Electronics

So much for the production and mechanical aspects. We'll turn now to the electical design. Fig. 1 shows a block diagram of the electronics. Perhaps the most surprising feature at first sight is the use of a simple mains trans-



The first sets fitted with the new TX90 chassis – the Ferguson Model 37140, in silver or white.

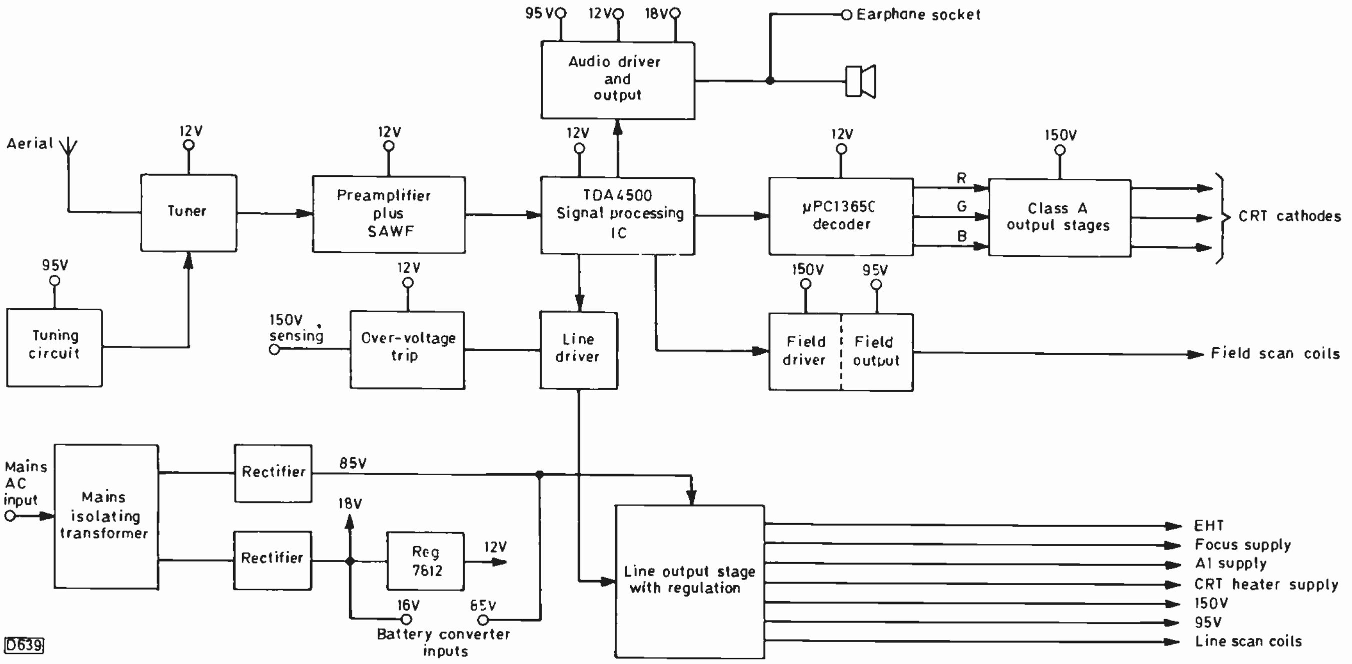


Fig. 1: Block diagram of the TX90 chassis. The power consumption is less than 40W at black level – this compares with 45W for the TX9 chassis.

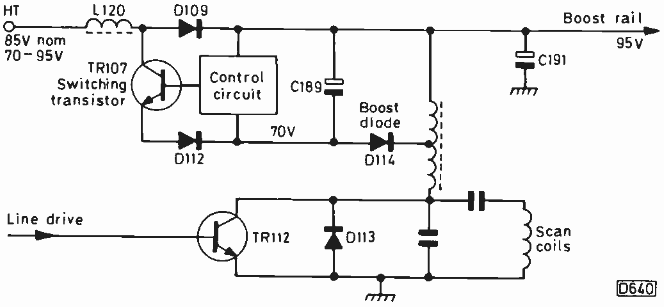


Fig. 2: Principle of the switch-mode boost supply circuit.

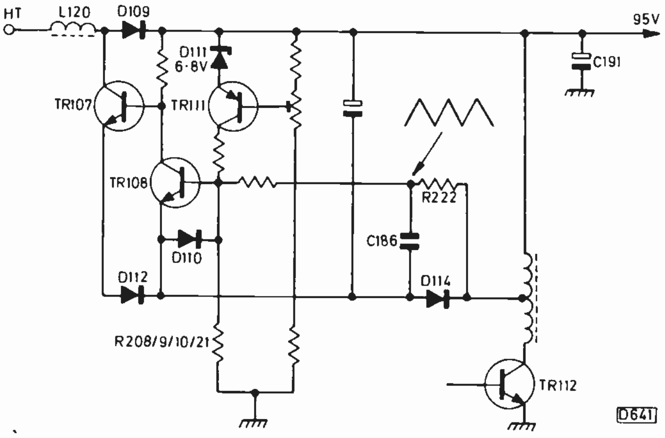


Fig. 3: The switching transistor's control circuit.

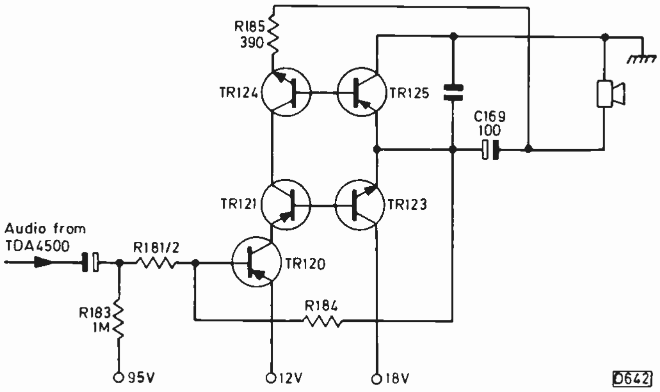


Fig. 4: The audio circuit.

former which provides isolation and feeds two rectifier circuits. These provide outputs at 85V and 18V. The latter feeds a 12V regulator that supplies the low-voltage stages in the receiver. This arrangement provokes the question "what no chopper?" The h.t. regulation required is in fact built into the line output stage, which employs what could be described as a switch-mode boost supply (95V) circuit. The use of this novel arrangement instead of a conventional chopper system is part of the process of getting everything on to a small (280 × 172·5mm) main panel. One disadvantage of a chopper circuit is radiation problems, which necessitate elaborate mains filtering plus anti-radiation measures within the chopper power supply. Such problems are neatly avoided by the arrangement adopted. The mains transformer is mounted separately at the right-hand side of the set.

With the exception of the TDA4500 i.c., most of the rest of the circuitry is reasonably conventional. Simple class A RGB output stages are used, with presets to control the black level only. There's provision on the c.r.t. base panel to include high-light controls if required, but the tolerances of the tubes at present being used make this unnecessary. A standard class B field output stage is used, fed from the 95V rail. This is less efficient than the use of a flyback boost system but has the advantage of reduced circuit complexity. For similar reasons the field driver is fed from the 150V rail, obviating the need for a bootstrap network. The lower output transistor and the driver transistor comprise a Darlington pair with a shared encapsulation. The sound output stage incorporates a novel feature to remove crossover distortion and regulate the quiescent current, enabling the output transistors to operate without heatsinks under a wide range of environmental conditions.

The 28-pin TDA4500 was jointly developed by Thorn and Philips for the TX90 chassis, though it will be used in other chassis at a later date. Basically it accepts the i.f. input from the SAWF and provides a composite video output at pin 16, a post volume control audio signal at pin 12, a field drive output at pin 2 and a line drive output at pin 27. Field feedback is applied to pin 3 and line feedback, for the flywheel sync circuit, to pin 5. Only two adjustable coils are required in the i.f./intercarrier sound department: one is for the sound detector circuit while the other acts jointly for both the video detector and a.f.c. detector (in conjunction with an internal 90° phase shifter). This chip represents a major step in TV circuit integration. There's even sound muting between channels, a feature that was added to meet recent W. German statutory requirements.

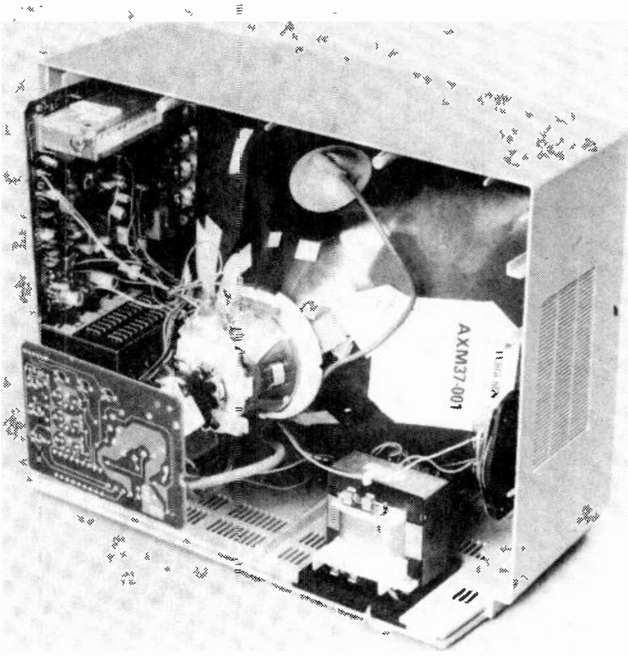
Circuit Features

Fig. 2 shows the basic principle of the switch-mode boost circuit, which is designed to hold the 95V boost rail constant against h.t. variations over the range 70-95V. Let's initially ignore the switching transistor TR107 and its control circuit. D114 is the boost diode which conducts (along with the efficiency diode D113) during the first part of the line scan, when the line output transistor TR112 is off. As a result, the reservoir capacitor C191 is charged to obtain the boost voltage. For the boost rail to be stabilised at 95V, the voltage at the anode of D114 must be held steady at 70V. This is the function of the switch-mode circuit – TR107 and its associated components. To take the extreme conditions, if the voltage at the collector of TR107 rises to 95V, D109 conducts, TR107 is cut off and the boost circuit is shorted out; if the voltage at the collector of TR107 falls to 70V, TR107 remains on, supplying 70V to the anode of D114. At any voltage between 70-95V, TR107 is switched on and off at line rate to hold the voltage at the anode of D114 at 70V, i.e. the control circuit supplies a variable mark-space ratio drive to the base of TR107 so that it's on/off times produce 70V at the anode of D114.

The circuit is efficient in operation since when TR107 conducts the excess voltage (h.t. – 70V) appears across the 5μH choke L120. The energy stored in L120 is proportional to this excess voltage and the conduction time of TR107. When TR107 switches off, the voltage at the anode of D109 swings positively: D109 then conducts, charging C191.

The switching transistor's drive circuit is shown in Fig. 3. The error transistor TR111 sets the d.c. conditions at the base of the driver transistor TR108. TR111's emitter voltage is held constant by the 6·8V zener diode D111 while its base senses the boost voltage. The driver transistor TR108 acts as a pulse-width modulator. The line flyback pulses appearing at the cathode of D114 are integrated by R222 and C186 to produce a sawtooth at the base of TR108. The point during the sawtooth when TR108 switches on (and TR107 switches off) is determined by the conduction of TR111 which is in turn determined by the boost voltage. In this way a variable mark-space ratio line-frequency drive waveform is produced to switch TR107 on and off and thus stabilise the voltages in the circuit.

The over-voltage trip consists of a pair of transistors in a regenerative switch configuration. In the event of excessive voltage on the 150V line the transistors switch on to remove the line drive. The result is loss of sound and raster – the trip resets automatically when the over-voltage condition clears. In addition, the 12V regulator incorporates overload, thermal and short-circuit protection – the result will again be loss of sound and raster as the TDA4500 will close down.



Inside the Ferguson Model 37140.

The audio circuit is shown in Fig. 4. The driver is TR120, whose load resistor R185 is connected in the conventional bootstrap fashion, with C169 acting as the output coupling and bootstrap capacitor. The gain of this stage is set at 12 by the ratio of the feedback resistor R184 to the input resistors R181/2. Bias is supplied from the 95V line via R183 and this, in conjunction with the feedback resistor R184, sets the midpoint voltage of the output stage.

The novel bit consists of transistors TR121 and TR124 which replace the conventional bias stabilising diode. When a transistor is operated with a low collector-emitter voltage, its gain is proportional to that voltage. The voltage across TR121 and TR124 cannot exceed 2·4V (the 0·6V base-emitter voltages of the stabilising and output transistors combined). Stabilisation is achieved since a rise in the voltage across one transistor will result in a compensating decrease in the voltage across the other one. When an audio drive signal is applied, the gains of the two stabilising transistors will change continuously over each cycle, thus maintaining the correct bias conditions in the output stage.

So much for the technical highlights of the chassis. The production time per set brings out the efficiency of the manufacturing process. The total time taken to produce, test and pack a TX90 set is only 1·4 hours. This compares with 3·5 hours in the case of a TX9 receiver and the six hours it took to produce a 9000 series set. During initial production of the TX90, 75 per cent of the components are being auto-inserted. This will rise to 90 per cent when further equipment has been installed.

On a more sombre note, in 1976/7 the Gosport plant required a labour force of 3,204 to produce a total of 600,000 colour and monochrome sets (mainly monochrome). In 1982/3 a reduced workforce of 1,945 will produce 900,000 sets, mainly colour. But as an interesting aside, it appears that there's a shortage of TV development engineers. It seems that newly qualified engineers are mainly interested in digital circuitry.

VCR Clinic

Steve Beeching, T.Eng. (C.E.I.), Mike Sarre, Mick Dutton and Michael J. Cousins, T.Eng. (C.E.I.)

JVC/Ferguson HR3330/3V00

There are several causes, listed below, for the following fault on these machines – when play is selected the tape threads and starts to run, then the keys release and the tape unthreads.

(1) The AN318 drum servo i.c. not producing the flip-flop signal and/or connector problems, i.e. the flip-flop signal doesn't arrive at the mechacon panel.

(2) The take-up spool not rotating and/or the tape counter not rotating, thus no take-up spool signal.

(3) Defective cassette compartment lamp and/or tape end sensors.

(4) After loading switch not making contact.

(5) This one is more difficult – C12 (33μF) in the pause delay circuit on the mechacon panel low in value.

Our method of tackling the problem is to short-circuit to chassis the base of X5 on the mechacon panel to inhibit the key release relay and then check the above items. **S.B.**

Some Quickies

Hitachi VT9300: In the event of no E-E or playback, change units CP205 and CP206 (3MHz filter and phase delay equalizer). The fault is usually in the delay block.

Sharp VC9300: Poor replay on a machine only four months old was traced to one video head having an open-circuit winding.

Toshiba V8600: Inability to set the hours of the clock display – change the timer microcomputer i.c.

Sony C7 and C5: A couple of problems. First no E-E audio: change the TBA120U i.c. in the sound i.f. department. This fault is not uncommon. Secondly no rewind: fit new rewind kit. Lots of these machines will need modifying as it's a very common problem.

National Panasonic NV7200: No pushbutton functions can be due to the cassette compartment light. There are two infra-red LEDs wired in series. Check the switching pulses across them: if more than 3-4V, i.e. 12V, change one of the LEDs.

For erratic system control on this range of machines check the voltage dropper diode that provides 5V from the 6V line. **S.B.**

Ferguson 3V23

We've had a few cases where the remote control system operates the mechanical functions but not the tuner/timer, with no channel selection or tape counter. The remote control unit may be faulty, but the fault is more likely to be on the tuner/timer control panel. If there's no display, change the 400kHz ceramic resonators CF1 and CF2. If there is a display, suspect the TA57 (TA1) remote control gating i.c. associated with the tuner control microcomputer ICI. **S.B.**

Sanyo VTC5000/5300

We've had complaints of the playback being covered in white spots on several of these machines. The actual symptom is intermittent noisy pictures. This is not due to head clogging or tape damage – the solution is to solder a short piece of wire to the casing of the video head preamplifier, connecting the other end to a solder tag on the adjacent earthed metal clamp, in order to link the preamplifier screen earthing to the main earth run. **S.B.**

Advance Warning!

(1) An eccentricity gauge will be required to fit video heads on the new long-play JVC/Ferguson machines – Models HR7655 and 3V32 respectively.

(2) Don't take the covers off the VHS-C portable as an oxide wiring loom for the lower drum assembly can be damaged – a new lower drum assembly will then be required. **S.B.**

Ferguson 3V23

A 3V23 sent in from another branch had a note attached saying "no sound". On inspection it was clear that various boards had been changed, so we proceeded with care. Prerecorded tapes could be played back with perfect sound, but there was no E-E sound. Selecting channel set and ramping in a station gave the first clue: as the station was approached, it ramped straight through and continued up the band. In the sweep mode the sound is muted until sync pulses are detected and compared with a line-frequency oscillator (IC15) on the tuner/timer control panel. Investigation showed that the sync comparator IC14 was in the no sync mode, due to X15 (between IC15 and the relevant part of IC14) being short-circuit collector-to-emitter.

Unfortunately the no E-E sound fault was still present, though stations could now be ramped in and stored. Swapping boards revealed that the repaired board produced E-E sound in another machine, while the original fault was still present in the first machine.

An accident gave us the next clue – touching the audio head while in the E-E mode produced a hum through the monitor set, indicating that although the video was supposed to be in the E-E mode it was actually in playback all the time. Checks revealed that the playback line from the mechacon panel was high due to X36 having an emitter-collector leak. When replacing this transistor produced only very low E-E sound we had to move over to the i.f. panel where the core of the 6MHz transformer T5 was found to be missing.

I can only assume that these faults originally came from different machines and were all lumped into one by panel swapping, since there cannot be a logical reason for three different faults all giving the same symptom! **M.J.C.**

JVC/Ferguson HR7200/3V29

There was no clock display (no illumination) on this machine. As a first step the voltage across the display device's filament pins 1/2 and 25 was checked. It was correct at 2·4V r.m.s. We next checked the supply to the microcomputer control i.c. on this panel, IC401. This was again correct at 10V. Time to use the scope to check this i.c.'s clock oscillator at pins 1 and 42 – this is one of the first things to check, as the clock runs everything else here.

The microcomputer's heart you might say. Well, this one had had a heart attack! Replacing the 400kHz ceramic resonator and the microcomputer failed to get things working, but changing the associated capacitor C407 (220pF) brought everything back to normal. **M.S.**

Sony C7

The fault on this machine was intermittent loss of colour on record – the playback and E-E colour were o.k. To speed things up I started by consulting the video block diagram. The point at which the record and playback chroma diverge is pin 4 of IC2, i.e. at the output from the frequency converter (or rather the following buffer stage). There was plenty of output here but no output from the following amplifier Q55/6, i.e. at test point 26. Tracing back from the base of Q55 brought us to the low-pass filter L30, L29 etc. The fault was that L29 was open-circuit. **M.S.**

Sanyo VTC9300

The counter on this machine went forward in the reverse mode . . . The circuitry concerned is on timer panel W20, the count up/down input being at pin 4 of plug/socket S1602 – it goes high in the rewind modes. This input was o.k. The command is passed to the TMS1070 microcomputer i.c. via a 10kΩ resistor (R1605) and the switching transistor Q1602. A check at the base of this transistor showed that the voltage was increasing, but not sufficiently to switch it off. There's a smoothing capacitor here, C1618 (0·47μF electrolytic), and this turned out to be leaky. **M.S.**

Ferguson 3V30

We've had several 3V30s in with the fault that the machine threads up but won't play. Everything appears normal except that the pinch roller doesn't engage at the end of the threading cycle. The pin linking the mechanism and the play solenoid was in each case found to be hanging out, refitting and sealing providing a cure. **M.S.**

Panasonic NV8600

The complaint with a National Panasonic NV8600 was that the eject key was jammed. There was no tape in the machine, but we noticed that it was not fully retracted from the play mode – the two guide rollers were part way round the head drum assembly. When the key was pressed nothing happened and the cassette lamp didn't light. A check on the 4A fuse showed that it had blown, due to one half of rectifier D105 being short-circuit. Replacing these items provided a cure. **M.D.**

Cassette Fault

This one was a cassette rather than a VCR fault. The customer's complaint was that his machine sometimes wouldn't record in the timer mode. As the VCR was only a couple of weeks old we decided to take another machine along and swap them over in the interests of good customer relations. This we did but despite a long soak test we could find nothing wrong with the first machine. Then, after a couple of days, the customer phoned to say that he had the same problem with the second machine.

This time we tried doing a timed recording in the customer's house. Sure enough the machine wouldn't go into record. Removing the tape and replacing it in the machine allowed record to be selected however. A close examination of the cassette then showed that the anti-record tab was weak. What had been happening was that the tab was giving under the push of the sensor arm after the cassette had been in the machine for a while. So the machine thought the anti-record tab was missing. If the tape was pushed into the machine and record was selected straight away the tab was strong enough to hold the sensor out. **M.D.**

Toshiba V5250B

The problem with a Toshiba 5250B was that the motor wouldn't rotate: a quick check revealed that its supply was missing. Tracing back, we found that the stop solenoid switch 59503 was not making proper contact. Replacing this item restored normal operation. **M.D.**

Sharp VC9300

A Sharp 9300 wouldn't wind the tape back into the cassette before ejecting it. We removed the lid and cassette holder and, after finding the appropriate microswitches, put the machine into play. This was o.k. so we pressed stop. The cassette arms retracted correctly, but no drive was supplied to the supply wheel to rewind the tape. This drive is obtained from the motor via a wheel which flips between the take-up and supply spools depending on the mode selected. The problem was that the wheel was slightly tight on its shaft, as a result of which it stuck and would not move over to provide the rewind during tape unthreading. **M.D.**

Toshiba V5470B

The customer's complaint with a Toshiba 5470B was that the machine would intermittently stop playing and go into the stop mode. The problem when the machine reached us was that it was impossible to select play (or any other function) because the stop solenoid operated immediately. We removed the top cover and loaded the machine, without a tape, by pressing the two lever-operated switches in the cassette compartment. The loading system worked, but the head didn't rotate. Pressing play made the stop solenoid operate instantly, and there was still no head rotation.

The bottom cover was removed and the video board hinged out to gain access to the drum drive circuit. The head motor on these machines is of the brushless d.c. type, which requires a supply of 12V and a control voltage of approximately 7·5V to operate the electronic switches used instead of brushes. This latter is the servo-controlled voltage. The 12V supply was present but the control voltage was absent.

We followed the circuit back through the amplifier stage and found that there was no output from the servo panel. In fact there was a short from the output of the servo i.c. to chassis. Removing plug P507 removed this short, and we then noticed that the servo i.c.'s output is also taken to one side of the stop solenoid microswitch. A check here revealed that the switch was permanently shorted to chassis. On dismantling the switch we found that a tiny thread of the brass contact was bridging the switch out. Cleaning it with a relay cleaning strip solved the problem, restoring normal operation. **M.D.**

Long-Distance Television

Roger Bunney

April was rather a quiet month – too quiet for my liking. The good mid-April Sporadic E opening that indicates a good season in prospect was unfortunately missing, though early May produced an excellent SpE opening, so hopefully an active season will follow.

There was little tropospheric reception during April. A lift was noted over the 13-15th, with W. German u.h.f. signals being just received in the midlands, and a further enhancement occurred on the 30th. MS (meteor scatter) provided signals daily, though less so than in earlier months. F2 layer propagation improved around the 24-25th, reaching to 40MHz (just) at mid-day on a southerly path, but by the 27th had fallen to a struggling 35MHz.

The depleted SpE log is as follows:

8/4/83 SR (Sweden) ch. E2.
13/4/83 NOS (Holland) and NRK (Norway) ch. E4. Note the short skip distance – NOS was received in Anglesey.
21/4/83 TVP (Poland) ch. R1.
1/5/83 RTVE (Spain) chs. E2, 3, 4, mid-morning.
2/5/83 A good late morning/early afternoon SpE opening. TVP R1, 2, 3; TSS (USSR) R1, 2, 3; ORF (Austria) E2a; CST (Czechoslovakia) R1; DFF (E. Germany) E4 – a really strong signal here at 1345; BR (W. German Bayerischer Rundfunk network) E2; RTVE E2.
3/5/83 RTVE E2.
6/5/83 SR E2, 4, early morning.

Thanks to Iain Menzies (Aberdeen), Cyril Willis (Ely), Arthur Milliken (Wigan), Hugh Cocks (Sussex), Mel James (Anglesey) and Ryn Muntjewerff (Holland) for sending in reception reports.

Jim Maden (S. Africa) wrote to report an excellent TE (trans-equatorial evening skip) opening that occurred on March 20th, giving him RAI (Italy) ch. IA and RTVE ch. E2. Unfortunately a lightning strike ended his reception, and two replacement ET021 tuners are now on their way to S. Africa. Jim also reports that the Stat-T 714MHz satellite at 99°E is now using the later USSR electronic pattern with identification "UT = TSA TAY ". The satellite is received at 0° elevation in S. Africa, with reasonable quality.

For QSL hunters YLE (Finland) have issued a picture postcard to confirm TV-DX reception. Write to Oy. Yleisradio Ab., Kesakatu 2, 00260 Helsinki 26, Finland with details (and preferably a photo) of your reception. Just for the record, the Tampere ch. E2 outlet has closed and we are left with Tervola ch. E3 20kW e.r.p., Ruka ch. E4 2kW e.r.p. and Vuokatti ch. E4 4kW e.r.p. These stations are all in the TV1 network.

News Items

UK: In case you missed the note in Teletopics last month, the 405-line network (system A) is to close on December 31st, 1984. The 97·6-102·1MHz Band II spectrum at present used by various emergency services is to be cleared gradually at about 1MHz a year, starting in 1985 and continuing to December 31st, 1989, to accommodate two additional national radio networks. The allocation 102·1-104·6MHz will eventually be given to local radio, extending to 105MHz, while the remaining spectrum to 108MHz will be used for BBC radio network extension.

Holland: A new law instructs all cable firms to switch off equipment dedicated to specific channels at close down. The purpose is to prevent pirate TV stations "squatting" on particular channels, reaching the cable subscribers through a network's head-end electronics.

Italy: A new video signal transmission technique is being tested by RAI on the Milan-Rome link. To avoid system congestion at times, time-compression is used to enable two video signals to be carried in a common channel. The signals are first separated into their luminance and colour-difference components and then arranged in a time-division multiplex as shown in Fig. 1. Note that the sync pulses are stripped out, a narrow (0·8μsec) line-frequency pulse being added. Signal compression and expansion are carried out digitally.

Coincidentally Bell Labs in the USA have been experimenting with a complex arrangement to enable two TV signals to be carried simultaneously in a single channel. Engineers think that a third signal could be carried in this way, though with some degradation of overall video quality. The intention is to use the system for satellite relay use. In the Bell system, only the differential information for every other field is transmitted; in an upper band by means of double-sideband suppressed-carrier modulation. Elaborate video signal processing is required, with field stores.

South Africa: The TV2 and TV3 networks commenced in January. The PM5544 test pattern is used for all three networks. In the case of the English/Africaans service from Johannesburg the identification "TV1" is carried at the top, with a centre right digital clock and "SABC/ SAUK JHB" at the bottom. The Zulu/Xhosa service has "TV2" at the top and the other identifications as TV1. The Iswana/Sotha service is the same but with "TV3" at the top. A South West African service started last year: the PM5544 pattern carries "Windhoek" at the top and a digital clock at centre right – the lower panel is blank.

Receiving Equipment

A new tunable head amplifier from Schrader, type RB45, has a gain of 26dB and a noise figure of 1·6dB. A Dutch enthusiast comments that the results are very good. It covers down to the 430MHz amateur band.

Some enthusiasts who built the varicap tuning system featured in the March 1982 issue (page 236), with ET021 tuner unit, have experienced instability at approximately 50MHz. This can be removed by adding a 10 or 22μF 63V electrolytic at the output pin of the 7824 voltage stabiliser IC1.

Issue no. 122 of the BATC magazine *CQ-TV* contains an

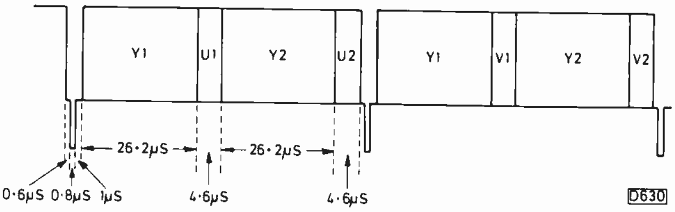


Fig. 1: Two channels in one: time-compressed signal system in experimental use by RAI (Italy).

article, with PCB, on an f.m. TV receiver. It's an ideal system for use as a satellite receiver, and includes sound tap-off facilities. Membership now costs £4 annually – an application form (include SAE) can be obtained from E. Summers, 13 Church Street, Gainsborough, Lincs. BATC interest in 1·3GHz transmission and f.m. video is increasing, and further information is expected in future issues of the magazine – so now may be the time to join! The f.m. TV receiver circuit mentioned above has been used successfully for reception of the Gorizont 3·675GHz signals.

Amplifiers and Feeders

A problem has become evident with the widely used Labgear CM7060/65/66 etc. series of amplifiers in round, plastic boxes for masthead mounting. If thick low-loss cable is used (as it should be), air flow within the box becomes restricted or the box may be air tight. Cable entry is via two holes in the bottom, through tightly fitting grommets. As a result, condensation can occur with a build up of water droplets inside the case. The solution is to drill a quarter inch hole in the recess between the two cable entry grommets.

The quality of the coaxial cable supplied for TV use has declined in recent years. The braid density has been reduced, and the PVC covering can be affected by exposure to sunlight. During manufacture, the PVC outer cover of domestic type coaxial cable has a plasticizer added to make it more flexible. After installation however a phenomenon called "plasticizer migration" occurs – the added chemical starts to leak through the braid to the polythene dielectric. After a few years the characteristics of the dielectric are altered and the result is increasing signal attenuation. The problem can be minimised by avoiding the use of cellular foam dielectric coaxial cable (air-spaced polythene cables, with four or five air cores, are less affected by this problem) and by routing the cable down the north side of the mast to reduce exposure to direct sunlight.

From our Correspondents . . .

Interference is becoming an increasing problem and Cyril Willis reports both success and gloom. A 49MHz cordless phone was established recently at Ely, causing severe ch. R1 interference. The operator was recognised but denied using 49MHz. A call from Cyril was monitored "on-air", using a Patrolman 50 Tandy/Taiwan receiver. Cyril then asked the operator to cease using 49MHz and advised British Telecom – eventually contact was made with the "Illicit Attachment Dept."! Communication followed between BT and the operator, who has apparently decided to "go legal" at 47MHz. BT can cut off the phone and press for a fine for the use of non-approved equipment – the new Telecommunications Bill will make the use of 49MHz equipment an offence.

Both Cyril and Iain Menzies report problems as a result of 50MHz amateur radio operation. I've not personally experienced this, though such transmissions will increase dramatically from the end of 1984.

Gosta van der Linden has sent details of the channels available to him in Rotterdam on cable TV – some fifteen in all, including Dutch, UK, French, Belgian and W. German services. The French system L and UK system I signals are converted to system G. The cable service also supplies 23 radio channels from W. European sources – even the American Forces network.

SOUTH WEST AERIAL SYSTEMS

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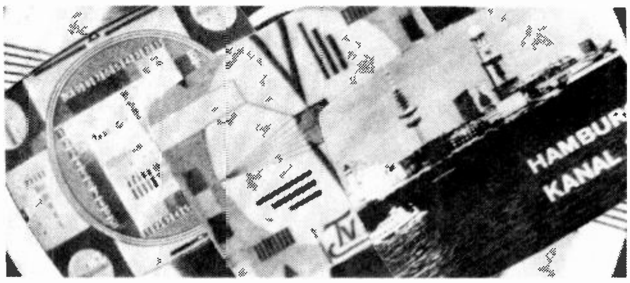

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Wolsey. Budget high gain (18dBd) multi-element HG36 (Grps. A,B,C/D) £32.75
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NB. Grid kits include low loss combining filter, clamps, cross support masts.

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Antiference XGs also available – send 54p for our extensive 1983 catalogue detailing aerials, amplifiers, filters etc. etc. Include SAE for satellite leaflet or for our new 'Wideband UHF Aerials' leaflet – essential reading for fringe UHF enthusiasts. **Access/Barclaycard welcome**.

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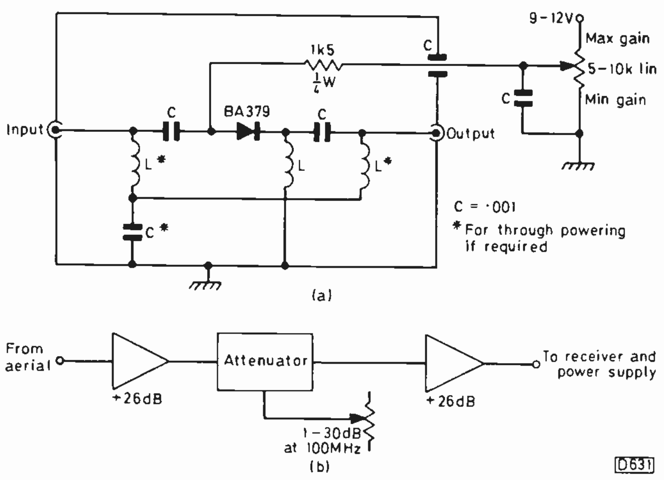


Fig. 2: (a) Simple in-line pin diode variable attenuator, with through powering if required. The chokes have 8 turns close spaced 26g at u.h.f., 14 turns at v.h.f. (b) The arrangement used by Seppo Pirhonen.

Neil Carnegie (Glasgow) has been on holiday in Ireland recently and reports on the "free" TV situation there. The only pirate station is at Trapmore, rebroadcasting UK services. "Nova TV" has equipment but is not yet in operation. Boyneside TV is now off-air due to transmitter failure. Dublin TV has ceased operation.

Seppo Pirhonen (Helsinki) has sent in some remarkable photos of his reception – using stacked Hirschmann aerials. One shot is of ZDF reception on ch. E21. Seppo has also received NDR (W. German) signals at u.h.f. The Russian Tallinn u.h.f. station presents a problem locally and Seppo is trying out a variable-gain system, with the gain at maximum when TSS is off-air. The simple circuit being tried is shown in Fig. 2 – it's fitted between the CM7066 head amplifier and the CM7080 cascade amplifier. Maximum attenuation should be around 30dB, falling to an insertion loss of 1dB.

Petri Pöppönen (Lahti, Finland) has sent in some shots of the UK Satellite TV Ltd. programmes which are now present for some two-three hours a night via the OTS-2 satellite at 11·6GHz. The programmes are available on cable networks at Helsinki, Turku and Rovaniemi, and are shortly to become available at Vaasa and Lahti. Signals from the Gorizont craft at 4GHz are being received successfully on dishes of diameter down to 1·2m.

Finally a note on the installation here at Romsey. All the aerials on the main lattice mast, together with the now hardened cable, have been removed in readiness for a complete change of aerials. It's typical that as soon as derigging was completed on May 2nd, with only temporary aerials available, wide open SpE conditions occurred.

Band III European Channel Allocations

Last month we discussed reception of European signals in Bands I/II. Table 1 this month lists the Band III European channel allocations.

Long-distance reception in Band III relies mainly on the weather-related phenomenon known as tropospheric propagation – stable, slow-moving high-pressure systems give improved reception of distant v.h.f. and u.h.f. signals. The best times for reception are from dawn through to perhaps 1000-1100 – at sunrise and soon after, the heating effect of the sun often produces a characteristic temperature inversion, with the upper air warmer than the Earth's surface – the reverse happens at dusk. During such inversion conditions tropospheric ducting can often carry Band III/u.h.f. signals over many hundreds of miles (this phenomenon is common in the Gulf area, where co-channel interference is a problem). Another weather condition helpful to tropospheric propagation is fog with high-pressure, particularly in the autumn. Also watch out for an approaching cold or warm front, which if approaching rapidly can give short-lived signal enhancement along the line of the front.

At times SpE reflection can occur in Band III, particularly when Band II is very active. MS reception also occurs in Band III, though a high-gain receiver with stable timebases and accurate channel frequency setting is essential. Patience is required for Band III MS reception, though it will appear given the right conditions and equipment – at distances akin to SpE.

Tropospheric signals are generally slow-fading and stable, unlike SpE with its characteristics of rapidly fluctuating signal levels and unstable polarisation.

Table 1: Band III Channel Allocations

Channel	*Vision (MHz)*	*Sound (MHz)*	*System*
B6	179·75	176·25	A
B7	184·75	181·25	A
B8	189·75	186·25	A
B9	194·75	191·25	A
B10	199·75	196·25	A
B11	204·75	201·25	A
B12	209·75	206·25	A
B13	214·75	211·25	A
E5	175·25	180·75	B
E6	182·25	187·75	B
E7	189·25	194·75	B
E8	196·25	201·75	B
E9	203·25	208·75	B
E10	210·25	215·75	B
E11	217·25	222·75	B
E12	224·25	229·75	B
ID	175·25	180·75	B
IE	183·75	189·25	B
IF	192·25	197·75	B
IG	201·25	206·75	B
IH	210·25	215·75	B
IH1	217·25	222·75	B
R6	175·25	181·75	D
R7	183·25	189·75	D
R8	191·25	197·75	D
R9	199·25	205·75	D
R10	207·25	213·75	D
R11	215·25	221·75	D
R12	223·25	229·75	D
F5	164	175·15	E
F6	173·40	162·25	E
F7	177·15	188·30	E
F8	186·65	175·40	E
F8A	185·25	174·1	E
F9	190·3	201·45	E
F10	199·7	188·55	E
F11	203·45	214·6	E
F12	212·85	201·7	E
ID	175·25	181·25	I
IE	183·25	189·25	I
IF	191·25	197·25	I
IG	199·25	205·25	I
IH	207·25	213·25	I
IJ	215·25	221·25	I
1*	176	182·5	L
2*	184	190·5	L
3*	192	198·5	L
4*	200	206·5	L
5*	208	214·5	L
6*	216	222·5	L

*New French channels
System A UK, System B W. Europe, System D E. Europe, System E old French, System I Ireland, System L new French.

Less Common TV Faults

S. Simon

Common faults in a wide range of popular CTV chassis were discussed in the Routine TV Receiver Tests series of articles. The aim was to assist those perhaps not too familiar with particular chassis. Nearly all these chassis have tricks which can cause most of us headaches from time to time however.

Thorn 9600 Chassis

For example, we mentioned last month that W810 in the EW diode modulator circuit in the Thorn 9600 chassis has a habit of decomposing and that it should be replaced with a more robust component. The effect when W810 decomposes is to cause the sides of the raster to bow inwards. The other diode in the circuit, W818, is also a BY298. Although it doesn't decompose, it does have the habit of occasionally going short-circuit. The effect of this is more drastic: it causes complete shut down of the chopper circuit, i.e. there's plenty of voltage at the collector of the chopper transistor VT512 but the driver transistor VT511 is rendered inoperative, with a low collector voltage.

If the h.t. supply plug to the centre, horizontal timebase panel is removed (right side as viewed from the rear, i.e. PL801 in Fig. 3 last month), the chopper circuit may burst into life when the set is switched on again. This proves that the fault is on the centre panel, and although it could be due to several things the fact that the three fuses on the supply panel are intact suggests that the trouble is in the line output stage. It is prudent therefore to check this diode for being short-circuit at an early stage in the proceedings in order to save time. A BY298 can be used in this position as it doesn't lead such a strenuous life as W810. It's located more towards the centre of the board.

Rank T20 and T22 Chassis

The EW modulator diodes 5D6/7 in the Rank T20 and T22 chassis often give trouble. Though it's common to check the diodes in situ, this can be misleading. If 5D6 is leaky, the effect will be irregular edges with the width and pincushion correction controls not having the required effect. The rule should be to remove the diodes for a more accurate check on the reverse reading. The SKE4G type is more suspect than the BYX71.

GEC C2110 Series

One point we didn't mention when discussing the GEC C2110 series was the habit of the right side field timebase panel developing a poor contact at the earthing pin of the plug and socket. This gives rise to intermittent field roll which is easily mistaken for lack of sync. Locate the earth socket connection and solder a lead direct from this to the main frame (joining up with the other earthing lead).

Thorn 3000/3500 Chassis

When the chopper in the Thorn 3000/3500 series chassis fails to start and you've checked all the usual things, spare a thought for R620 in the monostable circuit. If the colours are bright it's probably o.k. If they are not bright, take it out and measure it – you'll probably find that it's fallen in value to something like 500Ω. The correct value is 2·7kΩ. This is not terribly critical, but something like a few hundred ohms certainly won't do. It's under the rear of the power supply panel, towards the mains transformer.

GEC 20AX CTVs

Still on the subject of switch-mode power supplies, it would appear that many service engineers are still not aware of what causes the BU126 in the GEC 20AX series receivers to go short-circuit. It's been mentioned on various occasions, but in case you didn't notice them the point is to check the value of R515 before replacing the BU126 chopper transistor if you find that this is short-circuit. R515 should be 150kΩ (1W). It tends to go high in value, thus keeping the BU126 turned on for too long. The value of 150kΩ is not too critical (up to 220kΩ will do), but the wattage rating is important. Preferably fit a 2W component for lasting reliability.

Pye 697 Chassis

There are still plenty of Pye hybrid colour sets around. In the event of intermittent loss of picture signals, remember that the front controls are connected directly to the printed panel. A dry-joint on any one control (mainly the contrast control it seems) can cause a lot of head scratching – particularly if the fault appears for only a brief period every few hours.

Also remember that the audio output i.c. (those sets using an i.c. instead of a module) has its own power supply rectifier at the bottom right side. This can go open-circuit, thus shutting off the sound completely without affecting the other l.t. circuits.

Thorn TX10 Chassis

Now to a more recent chassis, the Thorn TX10. Repeated failure of the BU208A line output transistor TR831 can well be due to intermittent leakage through the scan coupling/correction capacitor C831 (0·33μF). The misleading thing about this is that C831 may appear to be 100 per cent when tested. An increase in the voltage rating to 1kV would appear to be prudent. The main cause of chopper transistor failure was mentioned in the May letters column – a defective focus unit.

Interpreting Voltage Readings

These few snippets may have given the impression that normal servicing routines no longer hold good. This is far from true. In ninety cases out of a hundred, careful and painstaking voltage checks, carried out with the circuit in mind, will quickly reveal the source of the trouble. The circuit is the important point in that last sentence.

For example, if the cathode voltages are absent or very low when a tube base check is made on say a Thorn 3500 chassis, you don't immediately chase the voltage supply. You carry on to check the other tube base voltages, and shouldn't be surprised to find that the first anode supply voltages are also absent. This may well indicate that the basic cause of the trouble lies in the line output stage – because failure of the line output stage will remove the clamp pulses to the video stages, leaving these turned on hard all the time – hence the low cathode voltages.

If you encounter this fault and the h.t. fuse on the power supply panel is intact, remove the beam limiter panel (top right) and check the 60V supply from the left side entry to the line timebase through coil L502. If you're lucky, you could well find that the cause of the trouble is a soldered connection to this coil, i.e. a lovely dry-joint which has probably been sparking for some time, with the parallel 18Ω resistor R528 burnt out of course. If you're unlucky, the fault could lie deeper in the line output stage.

Whilst a few volts more or less are of little consequence when dealing with an h.t. line of say 200V, such latitude cannot be allowed in low-voltage circuits. If the service manual says that the voltage on the a.g.c. line should be say 8V, a reading of 6V is a serious error and will make the difference between a clear picture and a very grainy one. If one failed to heed the voltage discrepancy, a fault in the aerial input or the tuner unit could be suspected, rather than trouble in say the first i.f. stage.

Small voltage changes can make a big difference when it comes to transistors and i.c.s – 0·1V is indeed a difference of potential!

AD Conversion for VCR Control

Richard Roscoe

The biggest problem facing the designer of a VCR's control circuitry is interfacing – that is, how to get all the necessary signals to and from the rest of the machine into and out of the microcomputer control chip. Modern large-scale integration technology makes it possible to put the whole control system for even the most sophisticated machines into a single chip. The trouble is that this chip would require 80 to 100 pins. So various arrangements are used to make each available pin (about 40) do as many jobs as possible.

As an example, consider one major source of input signals, the customer controls – that ever increasing array of yummy buttons just waiting to be pressed. Many earlier VCRs used a scanning system in which all the buttons are connected to an arrangement of rows and columns. This technique was described in an article on microcomputer control in the October 1982 issue. The idea is that pulses are used to scan the row/column matrix to discover which switch has been closed by the user. The drawbacks to this are that quite a few pins are still required (sixteen switches require eight pins), and since the microcomputer has to be connected directly to the switches a simple remote control implementation is difficult to achieve. To overcome these problems, later designs have gone over to a system of AD (analogue-to-digital) conversion.

With this system each button produces a unique analogue voltage when pressed. This voltage is then equated with a corresponding digital code. How this is done can be demonstrated by considering the circuit used in the Ferguson 3V29/30 machines (see Fig. 1). The arrangement is typical of many. It uses a type of analogue-to-digital conversion known as a ramp or count-up converter. There are other types of AD converter, i.e. successive approximation and parallel types, which are faster and more expensive. The slowness of the ramp type is of little consequence for VCR use however, whilst its simplicity in terms of hardware is an advantage.

The operation of the circuit is as follows. Pins C0, 1, 2 and 3 of the microcomputer IC2 supply parallel four-bit pulse trains via the buffer stages in IC11 to the resistor ladder network in resistor pack RA6. The resistors in this network have values in the ratio 2:1. Fig. 2 shows the parallel pulse trains and the effect produced as these are added – a ramp or staircase with sixteen steps between about 0·1V and 9·5V is produced, with the voltage level of each step very precisely defined. Some machines, such as the Hitachi VT series, use a different ladder network called a weighted resistor network, in which each "rung"

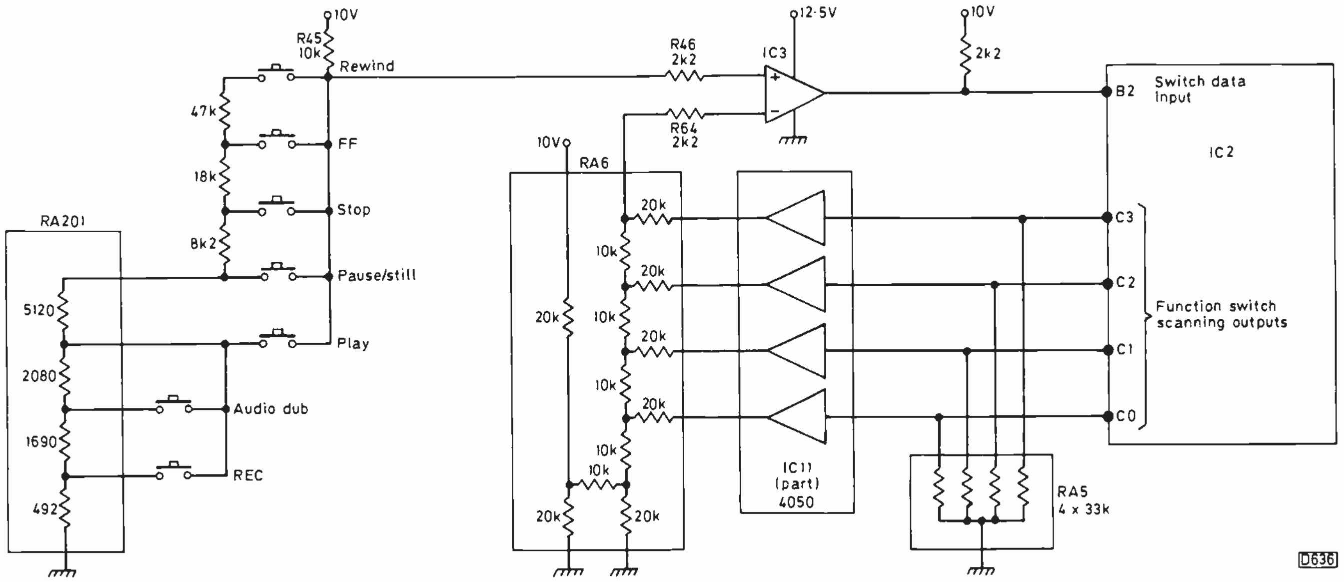


Fig. 1: Ramp type AD conversion circuit used in the Ferguson Models 3V29 and 3V30.

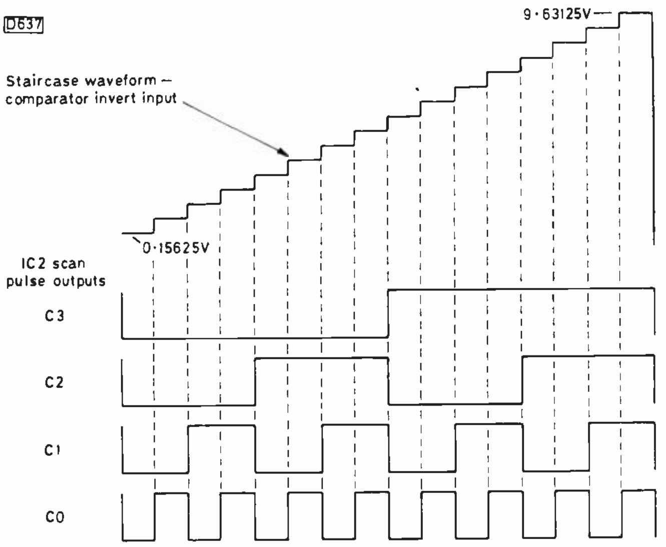


Fig. 2: Scan pulse and staircase waveforms used for AD conversion in the circuit shown in Fig. 1.

of the ladder has twice the value of its neighbour. The result is the same however.

Returning to Fig. 1, the staircase waveform is applied to the inverting input (−) of IC3, which acts as a comparator, i.e. it compares the voltages at its two inputs and sets its output high or low depending on which input is higher than the other. The non-inverting input (+) is initially at 10V, which is applied via R45/6. Note that this voltage is above the level of any of the steps in the staircase applied to the inverting input. Consequently the comparator's output is high, which is read by the microcomputer's B2 input pin as an indication that no operation has been selected.

The function switches are connected between the junction of R45/6 and various points along another resistor chain whose bottom end is connected to chassis. When any switch is closed, R45 and the appropriate portion of the resistor chain in circuit form a potential divider so that the comparator's non-invert input is reduced accordingly. The value of the resistors in this chain are arranged so that each switch or combination of switches when closed produces a voltage that lies between the steps of the staircase waveform.

Fig. 3 shows what happens to the comparator's input and output waveforms when the play button is operated. The principle is the same for each user function. The play switch applies 2·99V to the comparator's non-invert input. When the staircase waveform applied to the other input rises through this value, the output goes from high to low. The microcomputer detects the fact that a function switch has been closed, though at this stage it does not know which one had been operated, and resets the four-bit parallel data to 0000. As a result the comparator's output goes high again and the up-count is restarted. When the comparator's output again goes low, the count is stopped – in this example at 0101, which the microcomputer recognises as the play instruction. The microcomputer then repeats the count sequence as a double check and, if the instruction is verified, it acts accordingly to put the VCR into the play mode. The whole sequence takes between 10 and 20msec.

This AD technique enables up to sixteen commands to be accommodated using just five microcomputer pins, C0, 1, 2, 3 and B2. It's thus economical in the use of microcomputer pins while, because of the way in which the switches are connected, a remote control system using a two-wire cable is easy to arrange – a changeover jack socket is all that's needed.

Whilst the basic principles remain the same, the circuitry and voltage levels used in other VCRs may differ.

As to faults, we had one case (with an Hitachi VT8000) of an open-circuit resistor in the comparator circuit. This led the microcomputer i.c. to misinterpret the mode instructions and, apparently in total confusion, it switched the machine off! Since there's no one-to-one relationship between the switching and the action taken, various wierd and wonderful symptoms could be possible. The explanation given here however, with some scope checks around the comparator and ladder networks, should make it possible to ascertain whether the AD conversion is working properly or not.

All service engineers will by now be aware of the increasing use of digital techniques in TV/video equipment. Inevitably the need to come to terms with things like AD and DA conversion will become more pressing. Hopefully this short article, though dealing with only one aspect of the matter, will have thrown some light on this area of circuit operation.

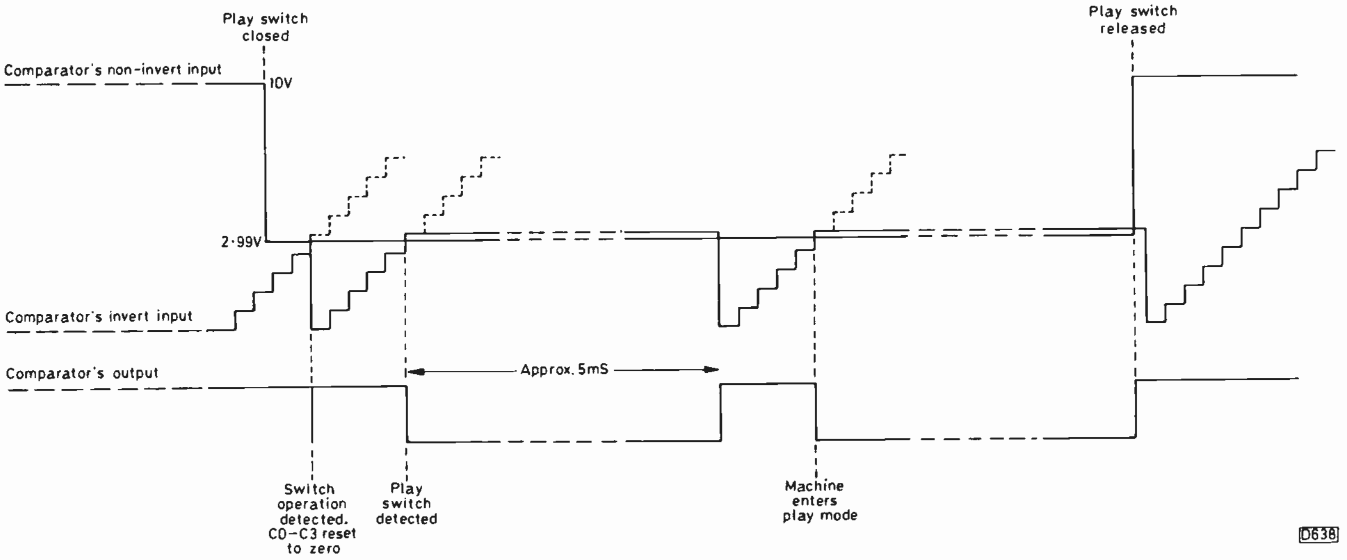


Fig. 3: Operation of the circuit when the play switch is closed.

TV Fault Finding

Reports from Richard Roscoe, John Coombes and George R. Wilding

More often than not the process of repairing a TV set consists of simply changing the component or components that experience tells us are the usual cause of the fault. This means that servicing can be done speedily and cheaply, without the luxury of having to resort to true diagnosis. This is fine of course, but what happens when the usual culprit is not responsible? After fighting back the initial panic we then have to bring our considerable powers of deductive reasoning to bear upon the problem, i.e. where's the service manual? Having found that we can begin to think about the fault itself — but only if the manual has a clear circuit diagram and a sensible circuit description. All too often the manual seems to consist of a photo of the set, followed by fourteen pages of neatly tabulated part numbers and finally a fold-out sheet labelled circuit diagram, apparently produced by dipping mice in ink and letting them run about. Surely the priorities here are wrong? Who amongst us wouldn't swap the knowledge that a 100kΩ ¼W resistor can be obtained by quoting the appropriate ten-digit code for a bit of a clue as to how the diode modulator or beam limiter is supposed to work?

Given the disincentives, it's hardly surprising that so many engineers can't or won't practice the art of logical fault analysis. Instead, they opt to extend the swap it and see principle until the faulty component is discovered by trial and error. Unfortunately a lot of perfectly good components get damaged or thrown away in the process, the printed tracks can suffer damage, and the quality of the soldered joints may be affected. Thus the whole area under investigation becomes a future trouble spot.

This is all leading up to a certain Pye 731 (later version) chassis that came our way recently. The fault was intermittent field jitter, and the customer told us she'd had it put right some six months ago before she'd moved to our area. When we switched the set on we found that the picture wasn't too bad, if a little flat. But if the scene changed the picture would become unsteady, jump slightly, then settle down again. It was not too bad, but enough to be annoying. Now the cause of this sort of trouble in sets that use a thyristor regulated power supply is usually in the power supply rather than the field timebase. The thyristor itself can be responsible, or its triggering may be defective. Alternatively if the regulation is faulty the h.t. can rise, as a result of which the over-voltage trip operates, producing a picture that flutters (in this chassis, at any rate).

When we removed the back we were appalled at what we discovered. Extensive and not very careful soldering had been carried out all over the power supply panel. Various diodes and capacitors were hanging off the print side, and jumper leads replaced damaged portions of track. The swap it and see policy had obviously been applied with a vengeance.

Without disturbing anything, we connected the meter to the h.t. line. It was continuously varying between about 190V and 200V, depending (or so it seemed) on the picture content. Thus little or no regulating action was taking place, though the h.t. was not far off — a bit on the high side. We next took a look at the presets. The h.t. controls (coarse and fine) were set at minimum. Carefully advancing the setting of the coarse control increased the picture jitter, with the h.t. jittering in sympathy — clearly the over-voltage circuit was working. Tweaking the over-voltage preset allowed the h.t. to shoot up and we hurriedly backed it off again. It looked as if the previous repair had been no such thing but instead a bodge culminating in a desperate resetting of the presets to disguise the fault. Couple this with a judicious lowering of the contrast control setting (hence the flat picture) to smooth out the current demand and bob's your uncle (for a while).

After the board had been removed and tidied up as best we could we were ready to tackle the fault. We assumed that the obvious things — the thyristor and diac — had been replaced, and concentrated on the clue that there was little or no regulation. This led to a check on the feedback resistor R897, which should have a value of 470kΩ. It read over 10MΩ! Replace it and set up the adjustments and we'd an excellent picture. What a lot of trouble a little thought would have saved! **R.R.**

Toshiba Model C2295B

We've sold many of these sets and have a number out on rental. Our fault experiences have been as follows.

Low gain: Check for 12V at pin 2 of the tuner interface panel on which the a.g.c. amplifier and i.f. preamplifier stages are mounted. If the 12V supply is present here but not at the collectors of the preamplifier transistors 1TR32/3, 1R56 (4·7Ω) is probably open-circuit. If the voltages are present, check the preamplifier transistors 1TR32 (BF198) and 1TR33 (BF199).

Colour faults: The decoder module T146A consists mainly of the large decoder chip IC501, type TA7193P, which can be responsible for no colour, intermittent loss of colour, Venetian blind effect and no red, green or blue. Other things to check in the event of no colour are the 4·43MHz crystal XL501 and the delay line driver transistor TR502 (BC557A).

Loud whistle: Several things can cause this, but the most likely culprit is the line driver transformer T401. Check by replacement.

Channel selector locked to one channel – signal tunable but memory inoperative: This is usually due to the digital control i.c. (ICA01, type TC9002AP) which must be handled with care to avoid damage. Other items to check if necessary are diode DE12 (1N4148) and zener diode DE11 (ZPD24) – by replacement.

Memory fails to operate: Check the memory i.c. (ICA02, type TMM841P) by replacement. If necessary check the clock oscillator tuning capacitors CA11 and CA12 (120pF) and the coil (LA01) which can go open-circuit.

Audible noise when changing channels: Connect a 4·7μF capacitor between pins 53 and 54 on the main panel, positive side to pin 54. **J.C.**

Toshiba Model C2095B1

The Toshiba C2095B1 shares many panels in common with the C2295B, the information given above applying to this set as well. One difference is the use of an over-voltage circuit which shuts down the line oscillator in IC301 (TA7609P). If the circuit comes into operation when the set is otherwise working normally, check the over-voltage transistor TR471 (BC557A) by replacement and its base bias components R476 (1MΩ) and D472 (BZX79-B6V2). The zener diode can leak and the resistor can change value. **J.C.**

GEC Series 2

No sound or raster but a slight hum from the speaker confirmed that the valves had warmed up and that h.t. was present. There was ample voltage at the anode of the PL504 line output valve, but not the slightest suggestion of a spark. On touching the PL504's envelope we found that it was running cool. Likely causes were an internal valve defect or the screen grid feed resistor open-circuit. There was full h.t. at the screen grid pins, while the absence of a negative voltage at the control grid pins suggested that the valve was indeed defective. Surprisingly, a replacement failed to restore normal operation. The only possible remaining cause of the fault was an open-circuit connection to the valve's cathode: the print looked all right, but fitting a short jumper lead from pin 8 to an adjacent earthed point finally solved the problem. **G.R.W.**

Saba H Chassis

A Saba Model TS6735 (H chassis) came our way recently with the complaint that while it would usually work for a few minutes after switching on it would then change channels spasmodically and erratically before going off to leave an unmodulated raster with only hiss from the speaker. After this, operation of the remote or on-set channel change controls had no effect.

As with all electronic tuning systems, the chips involved are the prime suspects. There's an SN74141 BCD decoder, an SN74190 BCD counter, and an SN7413 dual-NAND Schmitt trigger. The latter could be ruled out since it's operational on remote control only. Before replacing the other two i.c.s we decided to check the l.t. supplies. The TBA625 5V regulator i.c. was found to be providing only some 3V, though its 10V input was correct. Replacing this i.c. restored normal channel selection, but a few days later the set was back with the complaint "no results" due to a short-circuit diode in the 20V bridge rectifier blowing the associated fuse.

Replacing the diode and fuse restored the l.t. supplies, except that from the 5V regulator. This time we didn't have a TBA625, but found that a 7805 was a satisfactory substitute. **G.R.W.**

Capacitor Colour Codes

Miniature tantalum capacitors of various makes are found in continental TV sets. Whilst those manufactured by Bosch and NSF have the values and voltage ratings printed on them, some Ero/Frako and SEL capacitors use a colour coding arrangement. Details are given in Fig. 1 and Table 1. **G.R.W.**

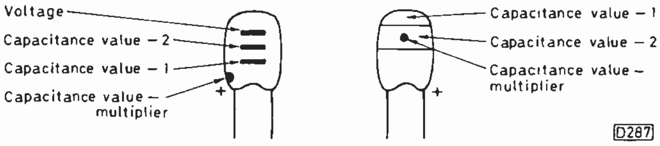


Fig. 1: Colour coding systems used on Ero/Frako (left) and SEL (right) miniature tantalum capacitors.

Table 1: Tantalum capacitor colour coding.

	Capacitance (μF)			
Colour	*First figure*	*Second figure*	*Multiplier*	*DC voltage*
Black	–	0	×1	10V
Brown	1	1	×10	1·5V
Red	2	2	–	–
Orange	3	3	–	–
Yellow	4	4	–	6·3V
Green	5	5	–	16V
Blue	6	6	–	20V
Mauve	7	7	×0·001	50V
Grey	8	8	×0·01	25V
White	9	9	×0·1	3V
Pink	–	–	–	35V

Rediffusion Mk I Chassis

This hybrid colour set gave perfect results apart from the fact that the width would often vary erratically by about half an inch on either side. The 5MΩ width control is connected to the usual VDR arrangement and looked decidedly the worse for wear, but replacing it made no difference. Attention was therefore turned to the associated high-value resistors. These sets are now several years old, and the small panel on which the width control and various other components are housed is mounted close to the line output stage valves. R501 (1·5MΩ) in series with the width control's slider and R500 (3·3MΩ) which is in series with its track were replaced, completely curing the width variations – the heat from the valves was almost certainly responsible for the deterioration of these resistors over the years. **G.R.W.**

B & O 3400 Chassis

The problem with this hybrid colour set was bad NS raster distortion – being an early 110° set, the raster correction circuitry is quite elaborate. Anyway, replacing 12C2 (0·1μF) in the NS output transformer tuning network and readjusting the four presets on the NS correction panel cured the trouble.

An almost equally annoying fault, though apparently not noticed by the set's owner, was the raster's tendency to balloon when the brightness was well advanced. Worse still, the focusing then deteriorated as the e.h.t. fell. The basic cause was poor e.h.t. regulation of course: changing the GY501 e.h.t. rectifier improved matters but didn't completely remove the effect. A new boost diode produced a further marginal improvement, and the trouble was finally resolved by bringing the boost voltage up to the correct figure of 840V from 750V (boost adjustment preset 8R5) then readjusting the preset width control 6R24. In most hybrid sets there's a single preset width control which also sets the boost voltage, but in this chassis there are two independent controls. Measure the boost voltage at test point TPa4. **G.R.W.**

Correction

Finally, our apologies for a printing error last month. R913 in the Decca 110 chassis' first anode control network is 220kΩ, not 22kΩ.

Exhibition Report: Cable 83

Dave Lauder, B.Sc.

The organisers of the "Cable 83" exhibition and conference, which was held at the Wembley Conference Centre on May 10-12th, described it as "Europe's first major exhibition of cable TV products and services". It was actually two shows combined, the other one being the "London Satellite Television and Cable TV Show" which was due to have been held in July.

Although many exhibits were for cable operators and broadcasters, there was much to interest those of us at the receiving end. Satellite TV receiving systems were conspicuous on a number of stands, as were live displays of Soviet TV via the Gorizont satellite. The prices of such 4GHz equipment have fallen steadily, and Megasat were offering a system comprising a 1·5 metre dish aerial with mount and electronics for £1,250, plus installation and VAT. For maximum enjoyment however a SECAM colour TV receiver and a knowledge of the Russian language would be an advantage!

As it was essentially a trade show, there was little aimed at the amateur constructor: some exhibitors could not even quote prices for individual parts of their systems. March Microwave however were exhibiting 4GHz low-noise amplifiers (LNAs) and combined LNA/down-converters made by Dexcel Inc. in the USA. Although the prices are in the region of £300, some constructors are interested in them due to the difficulties of building a front end to work at these frequencies.

A potential problem for Gorizont viewers is that the satellite's orbit is becoming inclined, and the time may come when auto tracking or twice daily dish adjustment becomes necessary. It's not clear whether the orbit can or will be corrected, as the satellite is intended only as a link between studios and transmitters.

With direct broadcasting at 12GHz due to start in Europe in 1985 there was surprisingly little DBS equipment to be seen. This could in part be due to the lack of any decisions so far about the type of transmission to use. While some dishes on display were suitable for frequencies up to 12GHz, the surface accuracy of many was insufficient for use above 4GHz. No European made equipment was evident in the field of 12GHz electronics. The Japanese appear to have gained a lead in this area – they have after all had a 12GHz direct broadcasting satellite in use, though it's no longer in operation.

BBC Engineering were present and had information sheets mentioning the use of the MAC system for satellite broadcasting. The IBA, which developed MAC, was not represented however. This was somewhat surprising in view of the EBU's favourable view of MAC (despite that however governments and broadcasting organisations are still arguing about what system to adopt).

The cable TV aspects of the exhibition covered all the distribution hardware, much of which consisted of well established US products. There were machines to dig ditches, and even to install cables in sewers . . . Displays of advanced cable technology included switched stars and optical fibres, and there were simulations of the type of services that interactive cables could provide.

At the end of the day one cannot help but wonder how many viewers will be prepared to bear the cost of satellite receivers/decoders, or of connections to cable, bearing in mind the recurring cost of licences or subscription channels. Large audiences will be attracted only when high quality programmes are available at reasonable cost – but this in turn requires a large audience to start with, a typical chicken and egg situation.

VCR Servicing

Part 19

Mike Phelan

Having had a month to recover from the 3V23's drum servo, we'll now take a look at the capstan servo (see Fig. 85). This is fairly conventional, with both a speed control loop and a phase control loop, as in the drum servo. The bulk of the circuitry is contained within IC12 (AN6341), but a BA841 is used for still/slow/frame advance/double speed – this operates in the same way as in the 3V16 (see Part 14). There are also facilities for assembly edit, i.e. successive recordings can be made without noise between them, which is essential for camera work.

Capstan Motor Drive

For a change we'll start at the motor end of the circuit, see Fig. 86. The motor is a conventional brush type d.c. motor, but unlike those used in previous models has ballraces instead of sintered bronze bearings. This gave rise to a little problem, more of which later.

The speed error voltage is applied to pin 6 of IC13, the operational amplifier's inverting input. The phase error voltage is applied to the non-inverting input at pin 5 – the diodes etc. connected to this pin are for the usual limiting and filtering. There is also frequency-sensitive negative feedback. The output at pin 7 combines both error voltages and feeds the motor drive amplifier X21, X2 through D21, which is forward biased of course. The motor's other terminal is normally earthed due to X4 conducting. X22, X3 and X1 are normally off.

When the capstan is rotating, the motor control output from pin 38 of IC14 is high. It goes low to stop the motor. This results in two things. First the two inverters (part of IC10) earth the anode of D21 so that it's cut off. This removes the input to the motor drive amplifier so that the motor comes to rest. Secondly X8 turns on, taking pin 6 of IC13 high and therefore pin 7 low. This prevents pin 7 rising to 12V as the servo tries to correct for the fact that the motor has stopped.

This all happens when we press stop, rewind, fast forward, still or slow. In the latter two modes however the slow-drive circuit takes over. This operates almost exactly

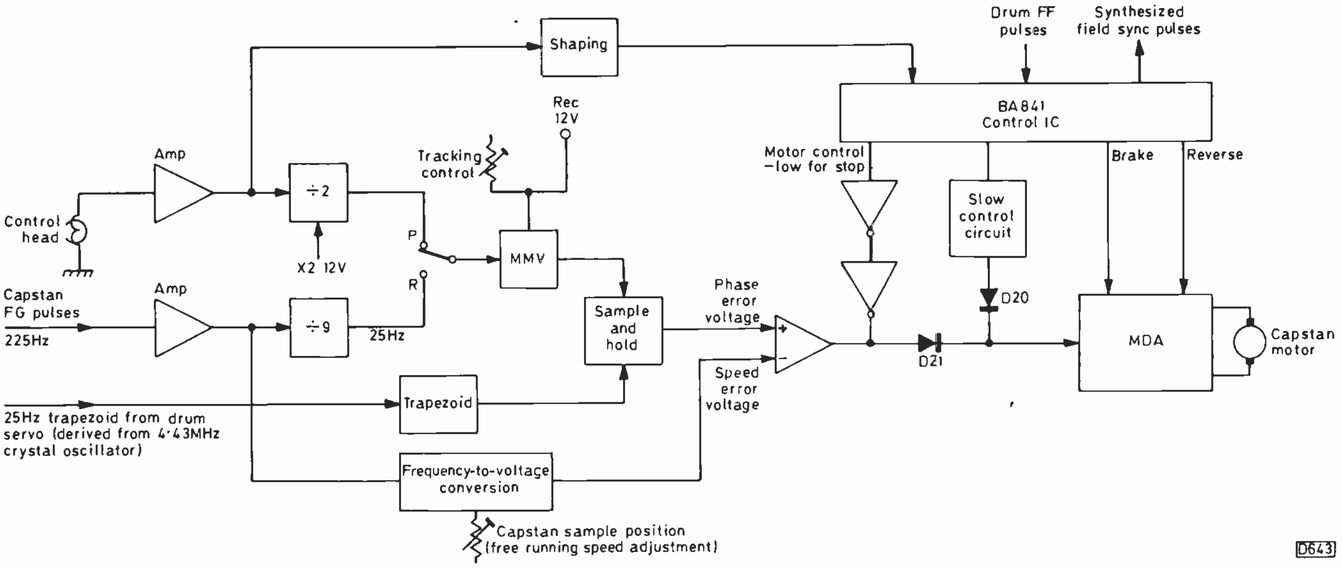


Fig. 85: Simplified block diagram of the capstan servo.

as in the 3V16, but with one slight difference. To recap. If we are in playback, FF2 (IC14 pin 30) is high so that X23 is on and X1 is off. FF1 (pin 29) is low and pin 38 (motor control) is high. When we press pause, pin 38 goes low, turning on X8 and also earthing the anode of D21 via IC10. FF2 also goes low, turning on X1 to brake the motor – as X4 is already on, this effectively places a short-circuit across the motor. With the motor used in the 3V16 this was fine, but the ball-bearing motor used in the 3V23 will not stop instantly even when shorted. This is where the circuit to the right of the motor, connected to pin 28 of IC14, comes in.

Every time FF2 goes low to brake the motor, pin 28 produces a 10msec pulse. This turns on X22, X3 and X24 and turns off X4. So the normally negative end of the motor is connected to 22V for 10msec. As X1 is now on, this pulls up the motor instantly. To digress briefly, it's important not to fit this type of motor to the 3V16, which doesn't have the reverse brake circuit, as the stopping point will be badly defined, with noise bars on slow and still.

Back to the 3V23. The tape has now stopped and the machine waits for the third drum flip-flop pulse. This changes the states of FF1 and FF2, removing the brake by turning X1 off, and triggering the slow-pulse generator. This, as you may recall, produces a 20msec pulse which is added to a lower amplitude pulse of variable length – the initial part overcomes the motor's inertia. The tape moves, typically for 60msec, until 17msec after an off-tape control pulse is read. FF1 and FF2 then both change state, ending the drive pulse and braking the motor with the 10msec reverse braking pulse. This process is repeated

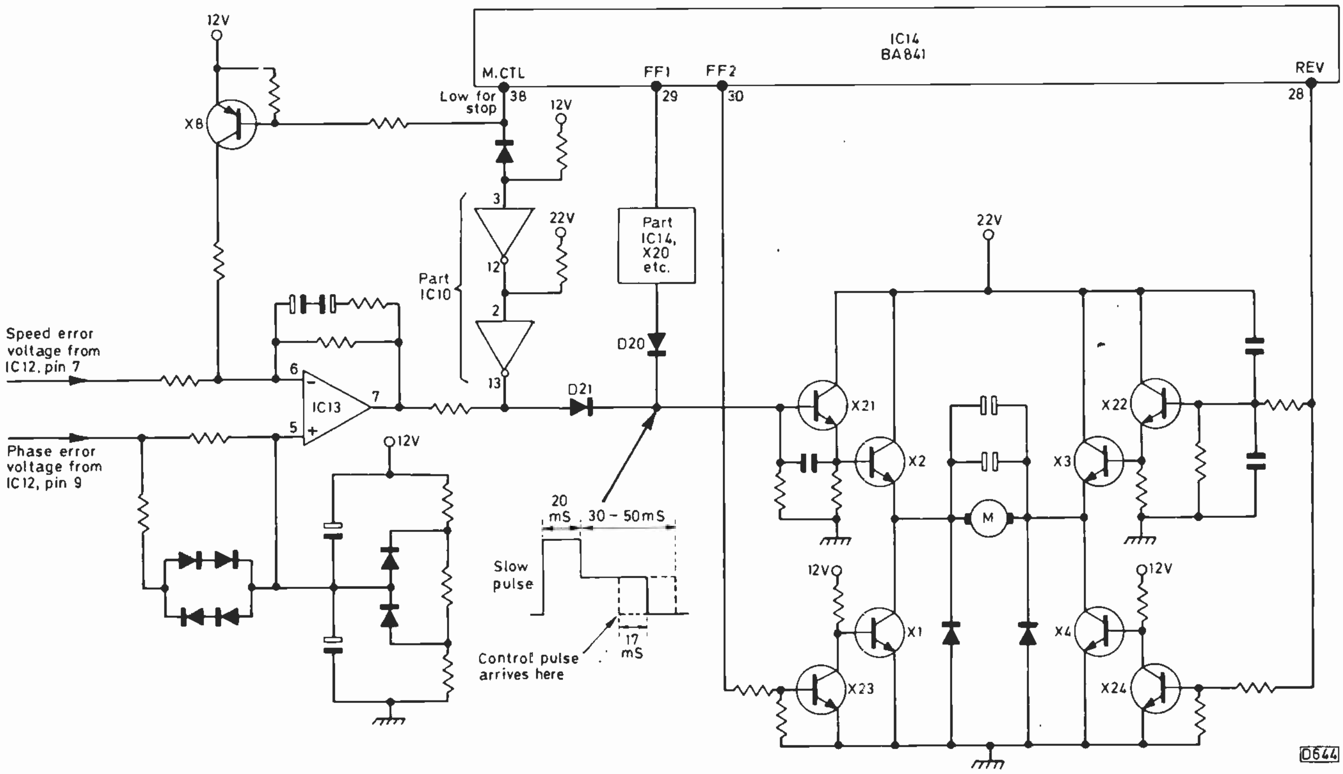


Fig. 86: Capstan motor drive arrangements.

four times, the tape transport then stopping completely, unless in the slow mode when further drive pulses are produced at intervals. The pulse length is adjustable by varying the amplitude of the second part of the pulse. This has the effect of altering the motor current and therefore its speed: the faster it goes, the sooner the next off-tape control pulse arrives, and as this makes the drive pulse end 17msec later the pulse length is varied.

Capstan Servo – Playback

The "front end" of the capstan servo is shown in Fig. 87. During normal playback it operates as follows. First the speed control loop. The 225Hz capstan frequency gear (FG) signal is amplified by IC7 and X5 and presented to pin 16 of IC12 which contains two divide by two flip-flops followed by a frequency-to-voltage converter that works on the same principle as the arrangement used in the drum servo. The speed error voltage is produced at pin 7 of IC12 and then goes to pin 6 of IC13 as previously mentioned. During normal playback D27 is biased off so that the second flip-flop is inoperative. In the double speed mode D27 is forward biased since pin 10 of IC11 goes low: the FG signal, now at 450Hz, is divided by two a second time to restore the correct conditions in the servo.

The phase control loop compares the trapezoid from the drum servo at pin 13 of IC12 with the timing of the off-tape control pulses. The block marked "trapezoid" in IC12 alters the slope and timing of the drum trapezoid.

All the servo functions are controlled by the inputs applied to connections 51, 55 and 58. The latter is the double speed 12V line. 51 and 55 are both low during playback. This sets IC9 so that its Q output (pin 15) is low while its inverted Q output (pin 14) is high. X6 is on, disabling IC8 (we'll see what this does later). The off-tape control pulses are amplified by IC1 and X1 and then fed to the monostable IC2 whose cycle time is 30msec. As the control pulses are spaced by 40msec, this simply alters their width. X2 inverts the pulses and IC3 shortens them to 13msec, this time being fixed by the two resistors and capacitor connected to pins 1 and 2. X3 is off because pin 10 of IC11 is high, and thus has no effect. X4 inverts the pulses, which next pass through two NAND gates to pin 15 of IC12. The FG pulses from pin 10 of IC6 cannot get through as the first NAND gate (IC4c) is disabled by a low on its second input (from IC9's Q output). X10 and X11 are off while X13 is on, so the time-constant of the tracking MMV in IC12 is set by the manual and preset tracking controls and R120.

Two things occur in the double speed play mode. First, as we've seen, the now 450Hz FG pulses are divided by two again in the speed control loop, since D27 is forward biased. Secondly X3 is turned on by pin 10 of IC11 going low. This shorts out part of the time-constant controlling IC3 so that its cycle period is now 7msec. But, you say, the off-tape control pulses are now arriving at 50Hz! Not so, at least not after IC2: the 30msec period of this MMV now effectively divides them by two, since the pulses are spaced by 25msec at the input and IC2 is now triggered on every other pulse.

Capstan Servo – Record

On record, the 51 and 55 connections are both high, so that IC9's Q and inverted Q outputs are both changed – Q is high, inverted Q low. The speed control loop remains the same, but the sample for the phase control loop is now the FG signal divided by nine to give 25Hz. X6 is off, so IC8 is enabled, squaring up the control pulses and sending them to the control head via the noise trap D7/8. These pulses get as far as X4, but no farther, as NAND gate IC4a is blocked by a low input from the inverted Q output of IC9.

The FG signal, after being squared by the Schmitt trigger IC17, is fed to pin 14 of the 4017 IC6. The 4017 can be made to divide by any number up to ten. It has ten output pins, designated Q0-Q9. Each goes low in turn when we feed a pulse to pin 14, the clock input. When pin 15 (reset) is taken low, the count starts at Q0 again. In this application we want to divide by nine, so Q9 is connected to the reset pin via X7 and the NAND gate IC4d which is enabled. Thus every time Q9 goes low so does the reset pin and we get division by nine. The other two NAND gates IC4c/b are enabled, so the output pulse goes to pin 15 of IC12. The Q4 output is used, but any would do. NAND gate IC4d is used as an inverter for the reset pulse – pin 2 is high since NAND gate IC4a is disabled. If one input of a NAND gate is low, the output is high: if one input is high, the gate acts as an inverter. The three gates in this part of the circuit are thus used to route the sample signals.

Finally X11 is on, cutting out the tracking controls. X10 and X13 are both off.

Edit Start Control

We now come to the interesting bit, the edit start control. If you're unsure what's meant by editing, consider the case where several recordings are made on one tape – maybe by pressing the pause control during the commercials, or when using a camera (the VCR goes into pause every time the camera's trigger is released). When the tape is played back there will be lots of noise between each "take" as the servos lock up again. On this machine the drum servo would run free when the signal was interrupted, and would need time to lock up again. Even when pause is pressed during the advertisements and the signal is not interrupted, stopping the tape will alter the spacing between the control pulses on the tape, upsetting the capstan servo on playback. In the worst case there'll be a 20msec space between the last pulse of the previous section of recording and the first pulse of the next section. Even without this, both servos will take a second or two to relock.

On the 3V23 however we can press pause during record, then restart by pressing the play button, or use a camera trigger to do this, the result on playback being perfect edits – just as if channels have been changed.

How is this magic performed? When record pause is selected, the pinch wheel comes out, the tape winds back through some 25 frames (assuming that there's already a recording on the tape), then stops. This is controlled by the microcomputer i.c. on the mechacon panel. When recording is restarted, the ESC (edit start control) routine starts. In this state connection 55 is high but 51 is low, unlike normal record. IC9's Q output is low and its inverted Q output is high, as in playback. Let's stop at this point to consider exactly what the problem we're trying to overcome is.

Having wound the tape back, we have 25-30 frames of the previous recording which can be used for comparison purposes and to stall for time while the drum servo locks up. We mustn't actually record during this time, because we don't want to erase anything, but the drum servo

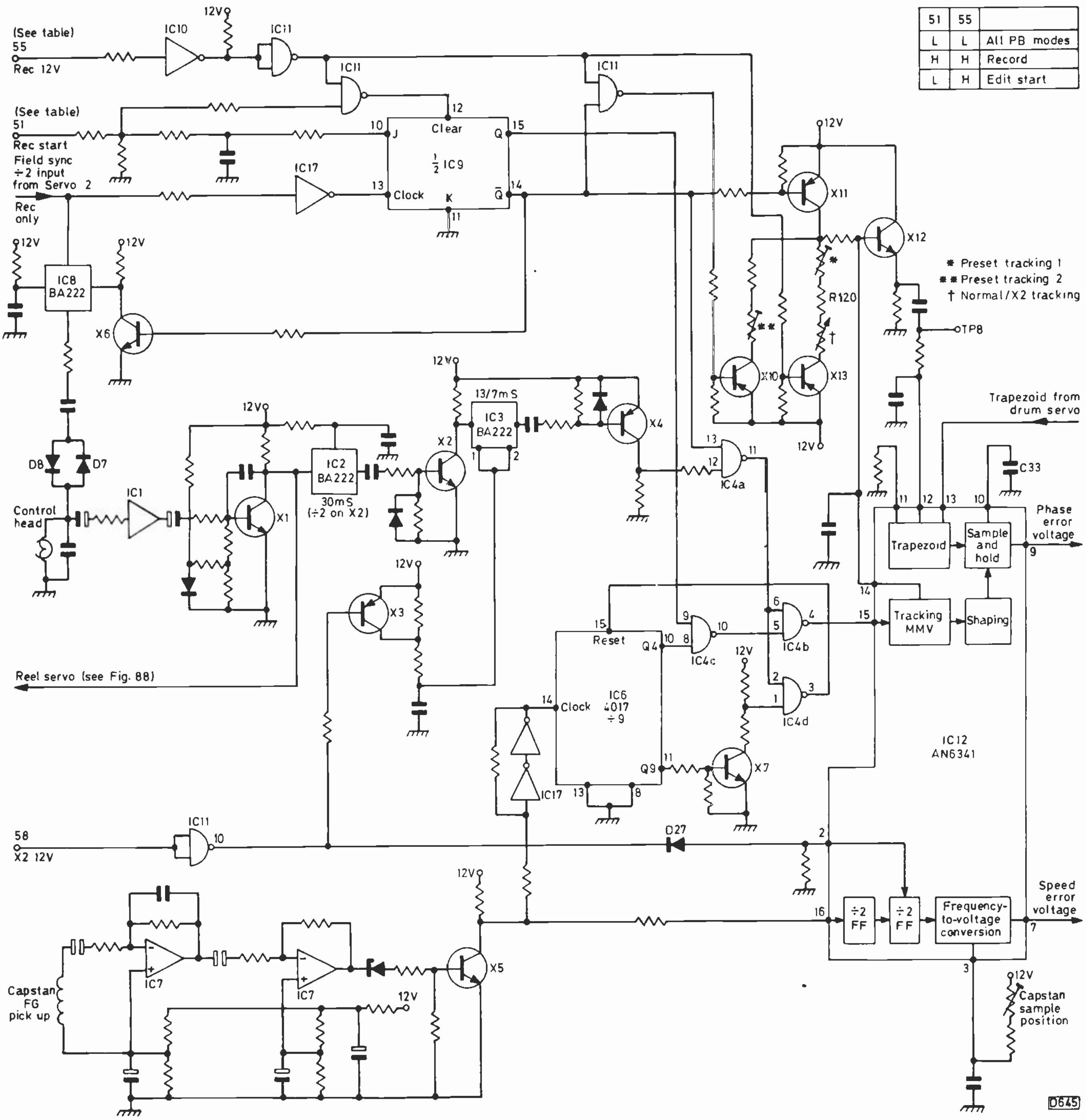


Fig. 87: Capstan servo – the "front end".

must be in the record mode. This is not quite the whole story, because it's necessary to ensure even spacing of the last control pulse of the previous take and the first control pulse of the next take. This is done by putting the capstan servo into playback, so that it's locked by the control pulses, then somehow switching everything back to record before the 25 or so frames have been passed.

This is how it's done, using the items we've already considered in Fig. 87. Remember that the drum servo is unaltered, remaining in its normal record mode. We're recording and press pause. The tape winds back 25-30 frames then stops. When we restart the recording, the ESC sequence starts – connection 55 stays high, but connection 51 stays low for 12 frames then goes high to put the machine back into normal record. Nothing is recorded on the tape during the ESC period. The drum servo locks up to the new input signal, so that it's well and truly locked by the end of the ESC time. Remember that it's running at the correct speed all the time, even in the absence of an incoming signal.

It's in the capstan servo however that the interesting things occur. During the ESC period the FG divided by nine output from pin 10 of IC6 is blocked because pin 9 of IC4 (IC9's Q output) is low. IC9's inverted Q output is high, so gates IC4a and IC4b pass the off-tape control pulses to IC12. In other words the capstan servo is in the playback mode, locked to the final off-tape control pulses from the previous recording. IC6 is still fed with amplified FG signals, but can't at first divide by nine because pin 2 of IC4 is not held high as it is in playback, so there are no reset pulses from IC6's Q9 output to its reset pin. The result is division by ten instead, giving an output at 22·5Hz. Pin 2 of IC4 (the reset gate) is fed with the off-tape control pulses in the ESC mode, so this pin goes high

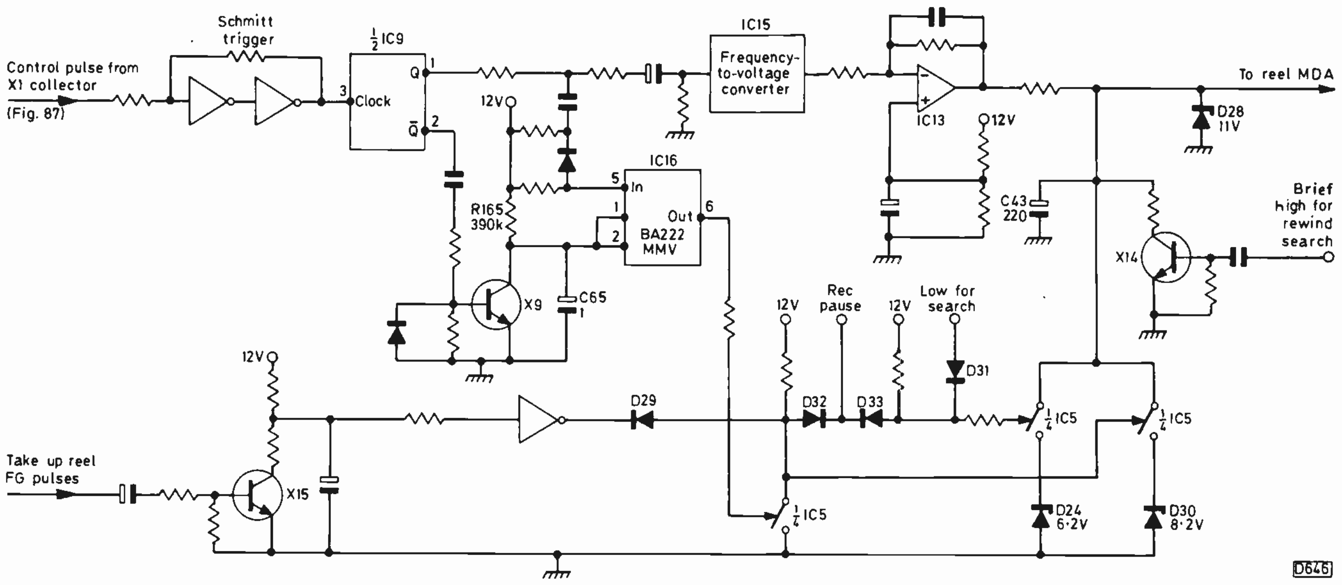


Fig. 88: The reel servo.

25 times a second. As the Q9 output is at 22·5Hz, a control pulse will arrive at pin 2 of IC4 at the same time as the Q9 pulse within the 12 frame period (approximately half a second). IC4d will then pass a low output to the reset pin. If this occurs early in the ESC sequence the counter will divide by nine every time, since the Q9 bit and control pulse are coincident.

At the end of the ESC sequence the machine switches back to record, IC9's Q and inverted Q outputs change state, the gates of IC4 block the control pulses and the reset gate is permanently on. So the new recording starts with a slight overlap, but the clever bits with the reset gate and the counter ensure that there's no "glitch" between the control pulses on playback, while the drum servo has had plenty of time to lock up anyway. The edits are perfect and take place within a single frame.

To summarise, 12 frames of the previous recording are played back, with the drum servo in record and the capstan servo in playback, while the counter is synchronised with the off-tape control pulses being played back. After twelve frames both servos are stable and the machine starts to record.

The Reel Servo

We'll finally look at the third and simplest servo system, the reel servo – see Fig. 88. We've already seen that the microcomputer's D port (see Fig. 68) controls the reel motor. It does this in conjunction with a series of gates that switch various voltages to the reel motor via transistors. In fast search however the reel motor is servo controlled: the servo controls the speed, the microcomputer the direction.

As the tape is running at ten times the normal speed, the control pulses arrive at 250Hz. After being squared by the Schmitt trigger, the other half of IC9 divides them by two. The 125Hz pulses are then fed to the frequency-to-voltage converter IC15, whose error voltage output is applied to the motor drive amplifier via IC13.

IC16 forms a monostable whose time-constant is approximately 400msec. Any pulse fed to pin 5 of this i.c. is thus stretched to 400msec, unless X9 conducts and shorts out C65, resetting the MMV. As the Q and inverted Q outputs from IC9 alternately fire and reset the MMV, pin 6 produces a series of pulses whose width varies with frequency. Each pulse closes two switches in IC5, connecting C43 to the 8·2V zener diode D30. This arrangement prevents hunting. When not in search, D31 is forward biased so that D24 maintains the charge on C43 at 6·2V. If C43 was fully charged or discharged when going from play to search, the reel motor would either stall or speed up, with unfortunate results for the tape.

Reverse Search

When reverse search is selected X14 momentarily conducts, discharging C43, with the result that the motor stops and restarts gradually in reverse as C43 charges – this avoids snatch.

Edit Start Backspacing

The "record pause" input opens the first two switches of IC5 and closes the last one, setting the speed of the backspacing for the edit start with D30.

Correction

Next month we'll continue with the 3V23's signal sections, starting with the audio department which has some interesting features. Before going any farther however a correction is required. Due to an editorial misunderstanding, there were several references to forward and *reverse* slow motion in Part 17 (see page 373). This is incorrect: the two controls are for *faster* or *slower* than the preset slow motion speed selected on going from normal play to slow motion.

Colour Supplement

Another point worth making relates to the photographic colour fault guide in the May issue. In some cases, particularly photos 10 and 13, the fault condition is not easy to see. The reason for this is that it's necessary to use a camera exposure covering two complete fields or more. This unfortunately means that noise and other minor disturbances, being random, tend to be integrated out.

Teletext Decoder Update

Steve A. Money

The *Television* teletext decoder was updated in 1979 (see June-August 1979 issues) to provide colour. Since then some changes have taken place in the transmission of both Ceefax and Oracle and some modifications to the decoder are required to obtain correct operation. The main change has been the increase in the number of teletext data lines transmitted per field – four lines are now used instead of two, giving faster access to pages and the possibility of larger magazines.

A relatively simple modification will deal with the extra lines. All that's required is to alter the timing and width of the data gating signal. Fig. 1 shows the modification, which involves changing the values of the timing components for the two monostables in IC4 (74221). C5 is reduced to 0·033μF to give a delay of about 650μsec so that data is accepted from about ten lines after the field sync pulse, while the value of C4 is increased to 0·033μF to allow eight-ten lines through to the decoding logic. Because of the relatively wide value tolerance of the capacitors, it's advisable to add a 10kΩ trimmer potentiometer (RV1) in series with R4, which is reduced in value from 33kΩ to 27kΩ.

To set up the decoder for four-line data operation, tune to a BBC channel, select page roll, and adjust RV1 until the text rows are all being displayed. If the delay is too short or too long, one or two lines in every four on the page will be lost.

Oracle Interleaving

Changes in the Oracle service present a further problem which involves a more complex modification. At the time of adding the extra data lines the transmission sequence of the Oracle data was also changed. Whereas with Ceefax all the lines for a page are sent as a single block, the Oracle data signals for several pages in different magazines are interleaved so that one set of four lines might be for say page 110 while the next four data lines could be for page 250 and so on. This scheme relies on the fact that the magazine code (hundreds in the page number) is sent at the start of every data row though the complete page number is sent only on header rows. Since the *Television* teletext decoder carries out a page number check only during the header rows, it assumes that all the following data until the next header is for the same page. The result, when trying to receive Oracle, is a scrambled mixture of lines from several different pages.

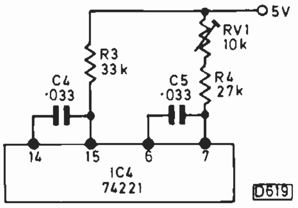
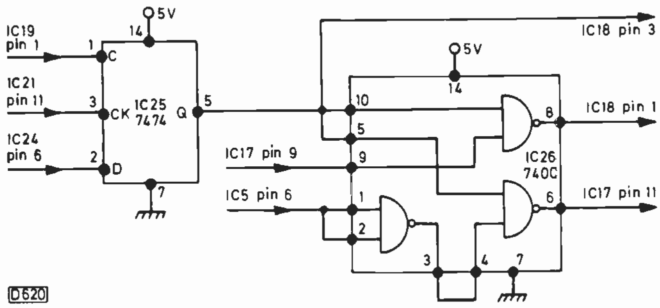


Fig. 1 (left): Modification for receiving extra lines.

Fig. 2 (below): Modification for dealing with Oracle interleaved page lines.



It was initially thought that the input logic board might have to be virtually rebuilt to resolve the Oracle signals. Several different modification schemes were tried with varying degrees of success. Eventually a relatively straightforward modification involving the addition of just two i.c.s on the board was devised and seems to be successful. The additional logic is shown in Fig. 2.

The flip-flop IC25 (7474) detects a match in the magazine code as each data line is received. This is done by clocking the flip-flop when the magazine code is present on the data lines DB1 to DB8, and setting it to the output state of the code comparator IC24 (pin 6). This output goes to 1 when a match exists, so the Q output of IC25 will be set at 1 when the received data line is from the requested magazine. IC25's Q output is gated with the page accept signal from IC17b, and controls the writing of data into the page memory. Thus only lines with the correct magazine code are written into the memory.

Header rows for pages from other magazines may be interleaved with data for the selected page. To prevent these header rows from resetting the page accept flip-flop IC17b, its clear input from the row 0 detector gate IC20 is disconnected and its clock pulse is gated with the output of IC25. As a result IC17b responds only to page headers from the selected magazine.

Finally, to give correct rolling header operation the signal from IC25 is also fed to gate IC18a so that only header rows from the selected magazine are displayed when the decoder is searching for a newly selected page.

The additional logic shown in Fig. 2 can be mounted on a small piece of 0·1in. pitch Vero stripboard which can be wired directly to the input logic board so that it's supported directly above the i.c.s on the main board.

On the input logic board the tracks to pin 13 of IC17 (7474) must be cut so that pin 13 is isolated. One track is on the component side and the other on the reverse side of the board. A link must be used to bridge the separated parts of the track so that pin 2 of IC17 is still connected to pin 2 of IC15. If IC17 is in a socket, a simpler solution is to bend up pin 13 of IC17 so that it doesn't enter the socket. For reliable operation it's advisable to connect pin 13 of IC17 to the 5V rail. When the tracks are cut this can be done by bridging pins 13 and 14 of IC17.

The track from pin 8 of IC17 to pin 1 of IC18 and the link between pins 3 and 4 of IC18 (7410) must also be cut.

The additional logic circuits are wired into the board by making connections to IC5, IC17, IC18, IC19, IC21 and IC24 as indicated in Fig. 2. Note that 5V and chassis connections are required for the extra i.c.s.

No setting up is required. If the system is working, then with page roll selected only those pages with the selected magazine number will be displayed – i.e. if page 100 is selected, only pages 100 to 199 will appear. Because the decoder has no error detection and correction circuits for address decoding, any errors in the received data for page and magazine codes may cause parts of pages other than the selected one to be displayed. Provided reception is reasonably error free however this problem will be infrequent.

TEST CASE

247

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.

For some years now colour receiver circuit design has varied little from chassis to chassis in many areas. For example, in most current colour sets you'll find a SAW filter to shape the i.f. passband, a one-chip colour decoder, and a diode-split e.h.t. rectifier system. The major exception to this seems to be the power supply, where a multiplicity of designs is to be found. As a result, when confronted with a dead set the circuit diagram has to be consulted – unless it's a chassis with which you are familiar.

This month's case concerns just such a situation – a dead ITT set fitted with the CVC40 chassis. On initial examination the 300V h.t. output from the mains bridge rectifier was found to be present, but there was no sound, not a peep from the timebases, and no "pumping" effect at switch on. This symptom is often due to the chopper transistor T807 having gone short-circuit, betrayed by the fact that the tuning voltage supply feed resistor R3A has sprung open, but in this case both these items were intact while the 127V line (chopper circuit output) was quite dead. It looked as if the chopper transistor was not being driven, which was confirmed by oscilloscope tests at the chopper driver transformer.

In this chassis the switch-mode power supply is driven at line rate by a pulse train generated by the TBA920 sync separator/line oscillator chip. The pulse train is taken from pin 5 of connector G on the sync/line oscillator panel to pin 1 of connector R on the switch-mode control panel (see Fig. 1). The pulses are shaped by T801 and its associated components and are then fed to a pulse-width modulator (T802/3) whose output in turn drives the base of the chopper driver transistor T806. The TBA920 and T801 are powered from the 12V rail once the set gets going. Since the 12V supply is derived from the line output transformer however, start-up feeds are required.

The TBA920's start-up supply comes from the 300V rail via R4 and R3 (both 9·1kΩ). In our set these two resistors were warm, indicating that current was flowing. A 15·625kHz squarewave was present at the TBA920's output pin 2, and was present at pin 1 of connector R on the switch-mode module (CMP40). T801's start-up supply comes from the 300V line via connector R10 and R806 (470kΩ). A meter check confirmed that 300V was present at R10, so why didn't the set perk up?

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TELEVISION JULY 1983

We decided to check for an overload on the 127V rail. Resistance readings were normal however and experimental disconnection of the 22V rectifier diode D11, which is also fed from the chopper transformer, had no effect. Withdrawing the scan yoke plug (this isolates the line output/e.h.t. circuit) made no difference either. Back to the CMP40 module.

This is easy to work on when plugged into the print side of the mother board. Thus set up we scoped the unit to discover what was going on. The driver transistor T806 was dormant, and there was no activity around the transistors in the pulse-width modulator circuit (T802/3). The electrode voltages here were way out, but didn't suggest any problems with the transistors themselves, rather lack of drive. Moving back to T801, we found a small and strange waveform at its collector, while a triangular one was present at its base! Time to try fitting a new CMP40 panel. In it went, we switched on . . . and all was as quiet as before. Further checks showed that in both modules the voltages at T801/4/5 (the latter two transistors comprise an overload trip and are powered in the same way as T801) were very low, with no more than 4V at the emitter of T801. This gave us an idea which turned out to be correct. More next month!

ANSWER TO TEST CASE 246
– page 432 last month –

Our battered Ferguson 3V20 VCR, described last month, would persistently unthread and stop after about five seconds' operation. We'd investigated several of the sensors on the deck and confirmed that they were giving correct information to the MSM5830 mechanism control chip. There are two rotation detectors in this machine: that for the take-up spool was operating correctly, but the head drum rotation signal was missing.

This is fed to pin 7 of the MSM5830 in the form of the drum flip-flop pulse, a 25Hz squarewave. No squarewave could we find however, either on the mechacon or the servo panel. The drum flip-flop pulse is generated within an i.c. on the servo panel – it comes from an internal bistable, which of course needs triggering pulses.

These are normally generated by a tachometer coil which is mounted close to the head drum flywheel. The coil is regularly exited by the passage of a small magnet mounted on the flywheel. What had happened of course was that on impact (remember that the machine had been

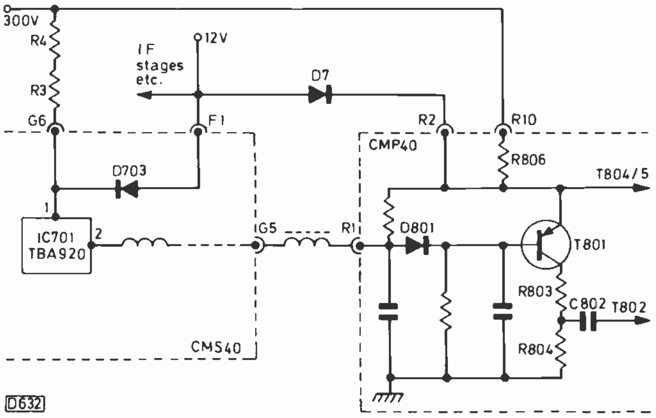

Fig. 1: Line oscillator and power supply start-up resistor feeds in the ITT CVC40 chassis.

dropped) the flywheel had jolted down the head drum shaft, taking the magnet out of range of the tachometer coil. So no triggering pulses and no squarewave. A couple of minutes with an Allen key put the machine to rights. It now sits on the shop shelf, fearfully awaiting its next customer.

Service Bureau

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ITT FT110

The picture broke into lines whilst the set was being viewed. Switching off and on restored the picture, but after a while the raster collapsed towards the centre. The set is now dead.

First check whether the surge limiter resistor R765 (5·1Ω) is open-circuit or the mains rectifier D708 short-circuit. If these items are in order it's likely that the switch-mode power supply has stopped due to an overload. There's no single common fault unfortunately. First check whether any of the rectifier diodes D713/4/5/11 is short-circuit. If R789 is open-circuit, check the BU208 converter transistor T712. Further possibilities include the BU208 line output transistor T501, the tripler, and C517 (0·001μF) at the earthy end of the e.h.t. overwinding. If the power supply comes to life when the tripler is disconnected from the line output transformer, replace the tripler.

KUBA FLORENCE

There's a bright white line down the centre of the screen, with centre foldover, and R514 across the line coils is cooking. The field scan appears to be normal and there's full width. The original fault was no e.h.t. due to lack of line drive as a result of the l.t. bridge rectifier D606 going short-circuit and blowing the fuse.

The fact that R514 is overheating indicates that there's a break in the scan circuit on the raster correction panel (removing the panel will have the same effect). Check for continuity from pins 5/6 through one winding of the linearity coil L551, then the corner convergence transductor L552, the EW correction transductor L555 (the blue one) and its parallel resistor R561 (15Ω), the second corner correction transductor L553, the other linearity coil winding and finally pins 7/8. L555 is not fitted on some panels.

BUSH TV300

The main problem is poor field linearity, which no adjustment will cure – the field linearity control has no effect. The sound output transistor also seems to be excessively hot.

We suggest you check the field drive coupling capacitor C411 (47μF) and the output coupler C413 (470μF), preferably by substitution, before suspecting the driver and output transistors. These are TR19 (2SC945) and TR20 (2SD152). If the audio output transistor TR15 (2SD152) is excessively hot it's probably leaky.

SONY KV1800UB

The trouble is the convergence. The blue horizontal lines are wider than the red and green ones and can't be superimposed on them.

Assuming that the static convergence (screen centre) is correct (if not, adjust the vertical static convergence plate, whose tab points upwards), you'll have to move the deflection yoke (flared end) carefully to the right, as viewed from the rear of the set. When the convergence is correct, wedge and seal the yoke.

GEC 3133

The fault with this set is no results. There's 300V at the collector of the pump transistor TR451, but the start up bias at the junction of R403/4 is only 1·5V instead of 5·8V. The pump and line output transistors are both o.k. and no component defects can be found on the power panel.

We suggest you feed an external 6V supply to the junction of R403/4, i.e. the anode of the start-up diode D403, then check with an oscilloscope whether line drive is present. If so, C404/5 (across R403/4) and D403 are suspect. If not, check the line driver transistor TR202 then suspect the 12V zener diode D201 and the timebase generator IC251.

THORN 8500 CHASSIS

The picture is very good with the brightness turned down, but there's severe smearing when the brightness is advanced – especially on peak white. The tube has been tested, all voltages seem to be correct and the grey-scale tracking has been set up as per the instructions in the manual.

Flaring at high brightness levels is the result of the RGB output stages bottoming. Make sure that the beam limiter circuit diodes W601/2 on the c.r.t. base panel are o.k., then turn down the preset brightness control R205 – it's in the middle of the signals panel – compensating for this by increasing the settings of the c.r.t. first anode presets. After doing this ensure that all three drive controls R214/6/8 are set to maximum and that the contrast control is not over advanced.

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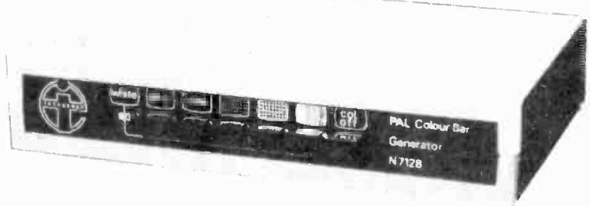

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AD149	0.480	BT106	0.900	LM309K	1.000	7400	0.110
AD161	0.220	BT116	0.900	7805	0.350	7401	0.110
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BC107	0.070	BU208A	0.850	78L12	0.300	7425	0.110
BC108	0.070	BU326	0.850	78L18	0.300	7441	0.300
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BC157	0.055	BY164	0.220	2SC2029	1.200	7475	0.150
BC159	0.055	OA47	0.060	2SC2078	1.200	7485	0.300
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BD158	0.380	TBA810S	0.600	ECC83	0.430	74LS240	0.580
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BD177	0.300	TBA990	0.800	ECH84	0.520	8 PIN	0.070
BD179	0.320	TCA800	0.800	ECL80	0.570	14 PIN	0.080
BD181	0.450	TCA940	0.850	ECL82	0.590	16 PIN	0.090
BD433	0.320	TDA1170	0.900	ECL84	0.570	18 PIN	0.120
BD535	0.400	TOA2522	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
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MC1358P	1.60	TBA530Q	1.00	TDA2611A	1.50
MC1330P	.90	TBA540Q	1.20	TDA2640	1.80
ML231B	1.95	TBA550Q	1.40	TDA3560	5.10
ML232B	1.70	TBA560Q	1.45	UPC1156H	2.95
MR475	2.00	TBA750Q	2.30		
SAS560S	1.65	TBA800	.80		
SAS570S	1.75	TBA810AS	1.15		
SAS580	2.40	TBA820	1.40		
SAS590	2.40	TBA890	2.95		
SL901B	4.80	TBA920Q	1.50		
SL917B	6.40	TBA950/2X	2.15		
SL1327Q	1.30	TBA990	1.55		
SN76003N	1.80	TCA270SQ	1.30		
SN76013N	1.80	TCA800	1.95		
SN76023N	1.80	TCA940	1.55		
SN76110N	.90	TDA1002A	1.50		
SN76226DN	1.45	TDA1003A	2.80		
SN76227N	1.00	TDA1004A	2.70		
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TN7120P	2.05	TDA1170	1.80		
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TAA550	.28	TDA2522	1.80		
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TBA120AS	.70	TDA2530	2.10		
TBA120B	.90	TDA2532	2.20		
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TBA120U	1.00	TDA2560	1.80		
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BY227M	.23
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AC128K	.30	BC212L	.10	BF184	.28	BU208A	1.40
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AC142K	.30	BC214L	.10	BF194/394	.12	BU326A	1.30
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AC176K	.30	BC300	.25	BF196	.11	BU500	1.80
AC187K	.30	BC303	.26	BF197	.11	BU526	2.00
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AD149	.70	BC338	.10	BF241	.15	MJE340	.40
AD161	.42	BC547	.10	BF256LC	.25	MJE3000	1.50
AD162	.42	BC548	.10	BF258	.25	R2008B	1.40
AF126	.38	BC557	.10	BF259	.26	R2010B	1.40
AF127	.36	BC558	.10	BF337	.28	R2540	2.35
AU110	2.10	BD124P	.55	BF338	.30	TIP29C	.45
AU113	1.85	BD131	.33	BF355	.32	TIP30C	.45
BC107B	.14	BD132	.33	BF362	.38	TIP31C	.46
BC108B	.14	BD201	.70	BF458	.30	TIP32C	.47
BC109B	.14	BD202	.70	BF459	.36	TIP33B	.80
BC139	.24	BD203	.70	BFR90	1.50	TIP41C	.46
BC140	.26	BD204	.75	BFT42	.30	TIP42C	.46
BC141	.26	BD222	.50	BFT43	.30	TIP2955	.70
BC142	.23	BD232	.50	BFX85	.30	TIP3055	.55
BC143	.25	BD233	.37	BFY51	.22	TV106/02	1.60
BC147	.09	BD234	.40	BR100	.18	2N3054	.55
BC148	.09	BD235	.32	BR101	.32	2N3055	.50
BC157	.10	BD236	.43	BR103	.55	2N3703	.12
BC158	.11	BD237	.40	BT106	1.15	2N5496	.50
BC159	.11	BD238	.34	BT116	1.15	2SC1172Y	1.85
BC160	.22	BD410	.50	BT106/2	1.58	2SC2029	2.00
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Mail Order Protection Scheme
If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

(1) You have not received the goods or had your money returned; and

(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

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

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

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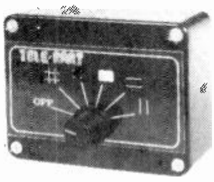

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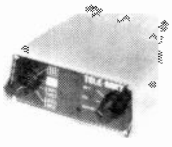

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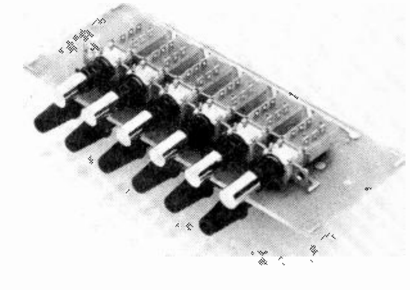

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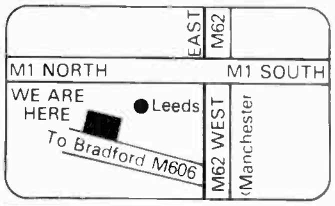

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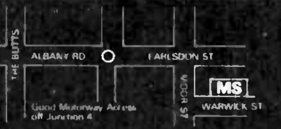

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OA 90	8p
OA 91	10p
IN 60	5p
IN 541	5p
IN 914	5p
IN 2069a	10p
IN 2070	10p
IN 4001	3p
IN 4002	3p
IN 4004	10p
IN 4005	5p
IN 4006	6p
IN 4007	7p
IN 4148	5p
IN 4448	10p
IN 4742	10p
IN 4722	10p
IN 4751	10p
IN 5235	10p
IN 5254	10p
IN 5392	10p
IN 5928B	10p
IA 5401	10p
IAV 30	10p
IM 72Z55	10p
IR 106a	20p
IR 3051	10p
IS 164	10p
IS 921	10p
IS 3011a	10p
IS 3072a	10p
IS 5024a	50p
IS 5030	50p
ITT 921	10p
ITT 923	10p
ITT 1075	10p
ITT 2001	10p
ITT 2002	10p
ITT 4150	10p
ZE 1.5	10p
ZF 3.0	10p
ZF 3.3	10p
ZF 4.3	10p
ZF 10	10p
ZF 11	10p
ZF 12	10p
ZF 15	10p
ZF 33	10p
ZF 43	10p
ZF 47	10p
ZF 82	10p
ZPD 3.9	10p
ZPD 4.7	10p
ZPD 5.6	10p
ZPD 10	10p
ZPD 47	10p
ZPY 8v2	10p
ZPY 12	10p
ZPY 16	10p
ZPY 24	10p
ZPY 43	10p
ZPY 47	10p
ZPY 56	10p
ZTE 2	10p
ZTK 22	10p
ZTK 33	10p
ZTK 33a	10p
ZTX 102c	10p
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 384	10p
ZTX 450	10p
ZTX 451	10p
ZTX 550	10p
ZW 13	12p
ZW 27	10p
ZW 43	10p
ZW 310	10p
ZX 68	50p
ZY 47	10p
ZY 72	10p
AA 112	10p
AA 113	10p
AA 119	10p
AA 143	10p
AA 144	10p
BA 102c	10p
BA 157	8p
BA 159	8p
BA 173	8p
BA 182	8p
BA 201	8p
BA 202	8p
BA 243	8p
BA 248	8p
BA 316	8p
BAV 10	10p
BAV 21	10p
BAW 21	10p
BB 103	10p
BB 105A	10p
BB 105B	10p
BB 105G	10p
BB 121a	10p
BZX 46c22	15p
BZX 61c110	6p
BZX 61c15	6p
BZX 61c20	10p
BZX 61c30	10p
BZX 61c220	10p
BZX 70c33	8p
BZX 79c2v4	10p
BZX 79c4v7	8p
BZX 79c5v6	8p
BZX 79c6v2	8p
BZX 79c6v8	8p
BZX 79c8v2	8p
BZX 79c11	10p
BZX 79c12	8p
BZX 79c22	8p
BZX 79c30	8p
BZX 79c43	8p
BZX 79c47	8p
BZX 83c4v3	10p
BZX 83c5v6	10p
BZX 83c8v2	10p
BZX 83b12	10p
BRC 83c13	10p

BZX 83c20	10p
BZX 83c27	10p
BZX 83c33	10p
BZX 84c6v8×10	30p
BZX 85c8v2	10p
BZX 87c5v1	10p
BZY 88c0v7	10p
BZY 88c3v9	10p
BZY 884v3	10p
BZY 88 6.8v	20p
BZY 88 6v2	20p
BZY 88c12	20p
CV 8617	10p
Y 716	20p
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Y 933	5p
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Alternative diodes eg IN 4448/ BY 298 will be sent should we be out of stock.

R 1038	50p
R 1039	50p
R 2008b	£1
R 2009	£1
R 2010b	£1
R 2029	50p
R 2210	60p
R 2257	60p
R 2265	50p
R 2305	50p
R 2306	50p
R 2322/2323	pair 80p
R 2323	15p
R 2461	£1
R 2030	£1
R 2443=BD124	40p
R 2540	£1.25
R2737=TIP31A	40p
R2738=TIP41	30p
R2775=TIP41c	40p
R2928=BU 208	60p
R 2813	£1
R3129=TIP47	40p
R 3018	60p
R 3019	60p

BU 105	75p
BU 105/04	80p
BU 108	£1
BU 124	50p
BU 126	80p
BU 137	£1
BU 180a	65p
BU 204	60p
BU 205	£1
BU 206	£1
BU 207	£1
BU 208	60p
BU 208a	£1.20
BU 222	£1
BU 326	£1
BU 407	60p
BU 426V	60p
BU 500	£1
BU 526	75p
BUX 84	50p
BUW 84	30p
BUY 71	£1

TIC 106a	30p
TIC 116d	30p
TIC 116n	35p
TIC 126	40p
TIC 206m	30p
TIC 226m	30p
TIC 236m	30p
TICV 106D (T092 case 2A/400V)	10p
TIP 29A	20p
TIP 30	30p
TIP 30A	35p
TIP 31	30p
TIP 31B	40p
TIP 32	25p
TIP 33	50p
TIP 34	50p
TIP 35	50p
TIP 36	50p
TIP 41A	30p
TIP 41B	40p
TIP 41c	40p
TIP 42	30p
TIP 42B	40p
TIP 47	40p
TIP 48	40p
TIP 49	30p
TIP 100	30p
TIP 112	30p
TIP 117	50p
TIP 120	30p
TIP 125	35p
TIP 130	30p
TIP 131	30p
TIP 136	30p
TIP 640	£1
TIP 2955	35p
TIP 3055	35p

MJ 2253	60p
MJ 3040	60p
MJE 1300S	30p
MJE 2955C3	30p
MV 2209	10p
SP 8385	25p

Voltage Regulators

5V/UA78PO5SC	60p
5V/LM79MO5CP	25p
8V/79M08c	30p
12V/MC 7912	20p
12V/LM 340T12	25p
15V/78M15	15p
18V/MC78M18	20p
24V/78M24	30p
TIS 90	20p
TIS 91	30p
TIS 92	30p

CB Radio transistor
16119 2A/40v.50Meg
5 for £1.

U 14727	15p
U 19885	40p
U 3832	15p
U 3845	15p
MR 856	10p
MR 508	10p
MR 501	10p
MR 502	20p
MR 852	20p
MR 854	10p
BYF 1202	10p
BYF 1204	10p
BYF 3123	40p
BYF 3126	40p
BYF 3214	40p
BYX 10	6p
BYX 36/600	50p
BYX 38/300	25p
BYX 38/600	50p
BYX 55/350	10p
BYX 71/350	20p
BYX 71/600	50p
BYX 72/300	20p
BYV 95	8p
BYV 96D	10p
BYZ 106	10p
BPW 41	15p
BYW 56 2A/1000v	8p
BZY 93	50p
BZV 15/12	30p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p

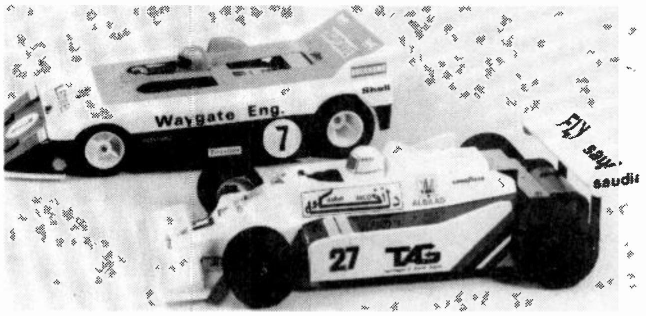
Bush thyristor RCA 76122	£1
ITT computer bookset 2020	£4
G8 20 turn 100K pot	35p
Transformer 240v/20v-500Ma	75p
Viewdata torroidals + £2 postage	£5
Mitsumi tape motor	75p
Sankyo tape motor	75p
Swiss made 250rpm/240V motor very small	75p
Sharp tape motor 400-040	£1.50
Mono scan coil 110° small neck	£1.50
Infra red led LD57CA	15p
Mono scan coil	£3
G 8 transductor	£1
Thorn 4000 tube base	£4
A1 pots Thorn 3500	50p
2K5 Lin pot with 40mm spindle	20p

BRIDGES

KBL 005	30p
KBL 02	30p
KBP 04	30p
W02	15p
W004	15p
W005	20p
GEC remote panel. Main transformer 3/ic SAA 1025/SN 74141/TBA 231	£6
AT 2076/55 GEC split diode transformer	£10
AT 2048/11 LOPTI Mullard	£2.50
75R/25 Watt	25p
18R/11 Watt	25p
TV Sound Tuner Kit, ideal for TV sound on your Hi-Fi	£9.50
Front End Music Center. VHF/MW/LW 13"×3½"	£5
Output Stage for music center	£5
Both items circuit supplied (as previous ad)	£9
SONY 1400KV Chroma Panel	£6
SONY 1400KV Tuner unit	£3.50
SONY 1400KV Touch button unit	£3.50
4 books/Electronic Systems/First steps into TV/Guide to Printed Circuits + 1 other **Special Offer**	£1.75

Panel VDP 12/80 D2N 720
Issue 3. Complete with All
I.C.'s. Usually £100.
ONLY £10.
VIEWDATE
DECODER
PANEL TEXAS

PHILIPS DIY HOME SECURITY ALARMS KITS
Send for details. Prices **£54 to £112.**



MARDAVE MODEL RACING CARS
Nickel Cadmium Battery driven
Please send for details

Various Tools and Accessories

Sellotape PVC Black 25mm × 20M **50p** 50mm × 20M	70p
Telescopic aerials (radio)	£1
Xcelite pliers	£3.90
Xcelite snips	£5
Xcelite cutters	£3.90
GKN Supascrew kits; 180 items in box with British made screwdriver. Was £4.99. **ONLY**	£2.50
VU meter	45p
Pull up large aerial	75p
Soldering iron 6v/23w	£2.50
Portable TV aerial	75p
Neon screwdriver	50p
Phillips snips	£2
2 way baby alarm/intercom with long leads	£5
Phillips universal battery tester/charger, fuse/bulb tester	£5
Volt/ohm test meters 1000 ohm/volt	£5
Eisenmann NICAD CHARGER 5.5V/150 ma	£2
¾" × ½" microphone/speaker	50p
Continental 2 pin plug with 5½ft mains lead (black & blue)	5 for £1
7" Ferrite rod with LW/MW coils	50p
Xcekute 5" bent nose plier	£3.50
De-solder pump + 2 nozzels	£5.20
Plastic box for i.c.s with anti-static pad 6"×3"×½"	50p

Quantity Reductions

BY204/4	25 for £1.00
BY206	25 for £1.00
BD132/676a	20 for £2
W005 bridge	20 for £2
G11 touch button red	5 for £1
6Meg filter	10 for £2.60
BY210/600	25 for £1.00
BY298 3 amp/fast/R	20 for £1.50
BD239	20 for £2.00
MR856	25 for £1.50
BU126	10 for £6.00
BU208	10 for £5.00
BU204	20 for £8.00
BU205	10 for £8.00
BU105	10 for £6.00
2SC2122A	10 for £8.00
BF458	10 for £1.00
BD136	10 for £1.25
BF224	20 for £1.40
OA90	40 for £1.00
IN4148	40 for £1.00
IN4448	40 for £1.00
BYX10	100 for £4.00
KT3 multicaps	10 for £7.50
50 High voltage ceramic condensers	£1.50
Mixed Mounting Kit for Power Transistors	50p
300 Condensers	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs	40p
100 Diodes	£1.50
VMOS Data (Ferranti)	£1.40
Full line condensed catologue (Fairchild)	£1.40

100 Fuses	£2.00
100 W/W Res.	£1.50
20 Slider Knobs	70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads	£1.00

Mixed Packs

Pack of mixed coloured wire	£1.00
25 LED red/yellow/green	£1.50
20I/C Holders	£1.20
20 Large LED Red	£1.00
20 Small LED Red	£1.00
10×20 Turn 100K Pots	£1.00
100 Mixed Transistor	£2.50
20 Convergence Pots	80p
100 Mixed Sticks	£1.00
10 Thermistors	50p
20 Slider Pots	£1.00
30 Presets	50p
15 VDR + thermistors, degaussing, HT, etc.	£1.00
40 glass reed switch	£1
10 press to make switch	£1
40 Pots	£1.50
10 Gun Switches	50p
5 Tube Bases	£1.00
1,000 Diodes, Condensers, Resistors on Bandolier	£3.00
Lucky Dip 600 gram	£1.00
25 mixed High voltage pulse consdenser	£1.00
Opto-electronic data book (Fairchild)	£1.40

SENDZ COMPONENTS

63 Bishopsteignton,
Shoeburyness, ESSEX SS3 8AF
SAME DAY SERVICE
All items subject to availability.
No Accounts : No Credit Cards
Postal Order/Cheque with order
Add 15% VAT, then 50p P+P
Add Postage for overseas
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Southend. Tel. 0702-332992

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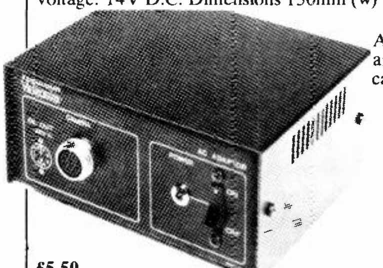
Add Postage for overseas
Callers: To shop at 212 London Rd.,
Southend. Tel. 0702-332992

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



£5.50

Transducer Hand Set insert, crystal, tranducer, 11C SAA 1124 & lead	£3.50
THORN 4000 ultra sonic hand set insert with 7 buttons (no case)	£5
4.000 Thorn thick film.	
00S1 012 E004	£1.00
00S1 012 E002	£1.00
00S1 012 010B	£1.00
00S1 018D	£1.00
Rank/Toshiba preh unit 0354	£9.50
4 Push button unit preh	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
6 Push button Unit Thorn	£1.00
6 Push button unit for GEC 2040 and ELC 1043/05	£6.00
7 Lamps for P.B./Unit	10p

Mains Droppers

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

Speakers

6×4G11	25 ohm	£1.00
5¼×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
5×3	15 ohm	80p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
8×5	8 ohm	£1.50
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p

Diodes

BY 127	10p
BY 133	10p
BY 134	10p
BY 164	30p
BY 176 type	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 210/400	5p
BY 210/600	8p
BY 210/800	10p
BY 223	80p
BY 224/600	50p
BY 226	15p
BY 227	15p
BY 228	20p
BY 229/400	30p
BY 237	5p
BY 254	10p
BY 255	10p
BY 298	10p
BY 299	10p
BY 527	20p
BY 407a	10p
BY 602	10p
F 247	10p
XK 3102	50p
XK 3123	50p
Thorn A1	10p

Line Transformers

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

CVC32 ITT	£7.50
EHT Split Diode Leads	£1.00

Triplers

11 TEZ Rank	£3.00
9000 Thorn	£5.00
KT3	£4.00
CVC-20-25-30	£4.00
G9 Philips	£4.00
GEC 2110	£4.00
9500 Thorn	£4.50
2040 GEC	£3.50
G8 Philips	£4.50
Decca 80 100	£4.50
LP1194 Pye 731	£3.50
Grundig TVK 52	£2.50
11TBQ	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
BG 100/61	£3.25
New Philips Infra Red Transmitter 9ch & Vol. & brightness change	£7.00
THORN Tuner Panel. 6 Slider pots. Knobs, touch button. Ultrasonic transductor, ICs, components & mains switch	£3.75
GEC Portable Line Trans.	£3.00
THORN portable mono chassis U788F	£10.00
9000 front panel	£5.00
9000 front panel (remote)	£8.00
G8 Convergence Panel	£12.00
T/text ultrasonic rec'r panel	£14.00
Handset G11 (2 button unit)	£12.00
THORN 9000 Syclops panel	£1.50
THORN 8000/8500 timebase panel	£8.00
THORN 8000/8500/8800 chroma panel	£15.00
THORN 8500 convergence panel	£6.00
THORN 8800 remote control unit U705	£6.00
Philips Infra-Red (full remote transmitter) Philips KT3 16C928/20C934 Pye KT3 7228/7324 K12 26C 797/1ST 66K 1826	£12
G11 handset. Full remote top	£12.00
Video cassette lamps on lead, 12-14V.	50p or 3 for £1.00
GEC 8 touch unit assy complete with all I.C.'s + pots	£6.00
9000 Frame Panel	£7.00
G11: 8 touch button unit	£20.00
Transmitter Decca RC11	£14
Transmitter Decca RC12	£14
G11 Tuner Units	£6.00
G11 6 Button Key Switch	£2.00
G11 E/W Transformer	50p
G11 Line OSE Tran.	50p
G11 Transient Suppressors 245V	10 for £1.00
G11 Scan Coils	£5.00
KT3 AE Sockets	25p
4000 Thorn Frame Panel	£5.00
4000 Thorn Power Supply	£3.00
4000 Thorn Line OP Panel	£20.00
NPN PNP 80V 6 Amp TO66 O.P. Trans.	pair 25p
GEC IC CBF16848. SN16861. SN1682	each 50p
Thorn 3500 IF Panel NEW	£3.00
Thorn Tuner Panel 6-100K Pots & Components NEW No Tuner	£2.00
6 button 100K pots + cursors on panel for varicap tuning	£1.50
THORN 1600 mains lead: switch: 3 slider assy.	£2.00
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
Tube base + base unit for 820 Euro chassis	£4.00
CVC 9 IF panel and decoder	£7.00

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

Rec & Trans

G11 Ultrasonic t/text transmitter G26C 674/02 G22 C66/02	£19
Infra Red (full ramote transmitter) Dynatron TV CTV 62, 63, 64	£19
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg.	30p
Thorn T605 1V NPN TO66 80V 6A	10p
20 GEC Black Spark Gaps	£1.00
G11 Line Driver Transformer	35p
2 SD350A BU208A	£1.00
G11 IF Detector	£3.00
Complete CVC 825 Chassis (both panels)	£40.00
G11 Teletext Transmitter	£19.00
BG200/43 Tripler	£3.00
DECCA IF 80-100	£3.50
G11 Time Base Panel	£12.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670	£3.00
Thorn 900 Sound OP Panel NEW	£1.00
U321 T/Unit on Panel Cum 40 ITT	£6.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F	£3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q	£2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P	£1.50
Tuner Unit VHF Sylvania GTR Videon MTS900 BIP VHF	£2.50
G11 dynamic correction panel	£6
CVC 20 Front panel with sliders + mains input panel	£4
THORN 3500 Tuner panel (ELC 1043/05 + pots)	£7
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots	£14
CVC 5 Mains on/off + 5 pots	£2
GEC Convergence panel (We have 900) TO CLEAR	£1

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

Condensers

1500/16	20p
3300/16	20p
10000/16	25p
15000/16	50p
3300/18	20p
470/25	5p
680/25	5p
1000/25 Radial	10p
1250/25	10p
1500/25	10p
2200/25	10p
3300/25	20p
4700/25	25p
5000/25	25p
10000/25	50p
1500/30	20p
3300/30	30p
1500/35	10p
2200/35	25p
50/40	5p
220/40	5p
400/40	25p
680/40	5p
1250/40	20p
1500/40	20p
200/40	25p
2000/40	25p
2200/40	25p
2500/40	25p
3300/40	25p
6800/40	35p
750/50	10p
1000/50	20p
1250/50	25p
2000/50	20p
3000/50	25p
15/63	5p
47/63 Bipolar	15p
2200/63	50p
250/64	10p
3300/70	50p
.1/100	5p
4.7M/100	5p
140/100	25p
470/100	20p
800/160	50p
G11 0.91/210 scan coil correction	25p
.1/250 Pulse	5p
G11 0.47/250	10p
2,2 250v	10p
3n3/250	10p
4n7/250 tested 5KV	25p
22/250	15p
47/250	10p
100/250	20p
500/250	50p
GEC600/250	60p
800/250	40p
8/300	8p
4/350	5p
8/350	8p
12/300	10p
4.7M/350v	10p
16/350	25p
50/350	10p
220/350	30p
300/350	40p
700/350	50p
22/375	15p
330/385 CVC 820HT	60p
0.1/400	15p
.56K/400v	20p
8/400	15p
33/400	20p
220/400	50p
400/400	40p
2×10,000Pf/400 in box	40p
33/450	15p
220/450	40p
0.1/600	15p
.047/600	15p
0.1/800	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
.15/1000	20p
.001K/1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n2/1500	15p
G11.11000/1500	15p
G11.8200/2KV	15p
0.1/2KV	20p
10n/2KV	15p
3n9/2KV	15p
210/8KV	10p
0.0015/2KV	10p
5n2/2KV	10p
6n2/2KV	15p
7500pf/2KV	10p
4n7/2KV	15p
8n2/2KV	15p
0.0082/2500	15p
150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
170/8KV	10p
180/8KV	10p
210/8KV	10p
270/8KV	10p
1000/10KV	10p
210/12KV	10p
1000/12KV	10p
1200/12KV	10p

Multi-Caps

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

ITT Panels

CMA 10	£2.00
CMA 11	£2.00
CMA 30	£2.00
CMA 40	£1.50
CMC 10/2	£5.00
CMC 15	£10.00
CMC 16	£4.00
CMC 19	£12.00
CMC 45	£1.50
CMC 47	£1.00
CMC 54	£10.00
CMC 56	£5.00
CMC 58	£8.00
CMC 59	£8.00
CMC 67	£3.75
CMC 67/2	£4.00
CMC 68	£4.00
CMD 12	£10
CMD 40	£5.00
CMF 25	£2.00
CMF 40	£2.00
CMH 10	£1.50
CMH 31	£1.50
CMK 12 (untested)	£4.00
CMN 20	£1.50
CMN 40	£1.00
CMP 10	£2.00
CMP 11	£2.00
CMP 40	£2.00
CMS 11	£2.00
CMS 40	£2.00
CMU 14	£8.00
CMU 30	£7.00
CMU 40	£7.00
CMU 45	£5.00
VMC 34	£5.00
VMC 44 + 45	£4.00

Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Mains Remote Switch 2365 ohm	£1.50
G11 Mains Switch	40p
ITT Mains Switch 4 amp	30p
GEC Mains Switch 4 amp	30p
Petrick Mains Switch 4 amp	30p
G8 Mains Switch	75p
Mains Dropper PYE 3R5+15R+45R	50p
Thyristor 600/4 amp C106/2	24p
G11 Preh Red LED P/Button for C.H. Change	20p
2SC2073 on Heat Sink 150 NPN 1.5 Amps	7p
RANK TOSHIBA Transductors TPC-2011	50p
Remote Unit THORN 11 I C. Mains Transformers Relay & 5 volt Reg & Component Unit	£2.25
Thorn I.C. board with 11 various sn 74 I.C.'s	£1
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BD562	30p
BD595	35p
BD596	35p
BD646	50p
BD678	50p
BD681	25p
BD807	20p
BD948	30p
BF115	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF167	20p
BF173	10p
BF178	25p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	20p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	20p
BF245b	20p
BF256	10p
BF257	20p
BF258	25p
BF259	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF301	10p
BF324	25p
BF336	30p
BF338	25p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF423	15p
BF448	30p
BF450	20p
BF457	10p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	30p
BF480	50p
BF594	10p
BF597	10p
BF694	10p
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BC115	10p
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BC117	20p
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BC139	10p
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BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC182L	10p
BC183	10p
BC184	10p
BC187	10p
BC204	10p
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BC213	10p
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BC238	8p
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BC252	10p
BC262	10p
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BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC447	10p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
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BC463	10p
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