MARCH 1983

Australia $1.74: New Zealand $2.00: Malaysia $5.50: I.R. £1.33 (inc. VAT)

90p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

SERVICING THE SONY KV1810UB

ITT's CHOPPER CIRCUITS

JUNKING FOR JOY

TEST REPORT • VCR CLINIC

QUICK CHECKS : THORN 8000/8500

Interested in Television Servicing?

Try a ZED Pack. Effect Repairs at Minimum Cost.

Z1	300 mixed $\frac{1}{2}$ and $\frac{1}{4}$ watt and miniature resistors	£1.95
Z2	150 mixed 1 and 2 watt resistors	£1.95
Z3	300 mixed capacitors, most types amazing value	£3.95
Z4	100 mixed electrolytics	£2.20
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Z6	300 mixed Printed Circuit Components	£1.95
Z7	300 mixed Printed Circuit resistors	£1.45
Z8	100 mixed High Wattage Resistors, wirewounds etc.	£2.95
Z9	100 mixed Miniature Ceramic and Plate caps	£1.50
Z10	25 Assorted Potentiometers	£1.50
Z11	25 Assorted Presets, Skeleton etc.	£1.00
Z12	20 Assorted VDR's and Thermistors	£1.20
Z13	1 lb Mixed Hardware, Nuts, Bolts, Selftappers, "P" clips etc.	£1.20
Z14	100 mixed New and marked transistors, all full spec. includes: PBC108, BC148, BF154, BF274, BC121L, BC238, BC184L and/or Lots of similar types	ONLY £4.95
(Z14A)	200 Transistors as above but including power types like BD131, 2N3055, AC128, BFY50 etc.	£9.95
Z15	100 Mixed Diodes including: Zener, Power, Bridge, Signal, Germanium, Silicon etc. All full spec.	£4.95
Z16	20 IN4148 Gen Purpose Diodes	£1.00
Z17	20 IN4003/10D2	£1.00
Z18	20 Assorted Zeners. 1 watt and 400 mw	£1.50
Z20	10 Assorted switches including: Pushbutton, Slide, Multipole, Miniature etc. Fantastic Value	£1.20
Z21	100 Assorted Silver Mica caps	£2.20
Z22	10 Mixed TV convergence Pots	£1.00
Z23	20 Assorted TV Knobs including: Push Button, Aluminium and Control types	£1.20
Z24	10 Assorted Valve bases B9A, EHT, etc.	£1.00
Z25	10 Spark Gaps	£1.00
Z26	20 Assorted Sync Diode Blocks	£1.00
Z27	12 Assorted IC Sockets	£1.00
Z28	20 General Purpose Germanium Diodes	£1.00
Z29	20 Assorted Miniature Tantalum Capacitors. Superb Buy at	£1.20
Z30	40 Miniature Terry clips, ideal for small Tools etc.	£1.00
Z31	5 CTV Tube Bases	£1.00
Z32	10 EY87/DY87 EHT bases	£1.00
Z33	20 × PP3 Battery Connectors	£1.00
Z34	6 × Miniature "Press to Make" Switches, Red Knob	£1.00
Z35	12 Sub Min S.P.C.O. Slide Switches	£1.00
Z36	12 Min D.P.C.O. Slide Switches	£1.00
Z37	8 Standard 2 Pole 3 Pos Switches	£1.00
Z38	4 × HP11 Batt Holders (2×2 Flat type)	4 for £1.00
Z39	3.5mm Jack Sockets, switched, enclosed Type	8 for £1.00
Z40	100 Miniature Reed Switches	£2.30
Z41	100 Subminiature Reed Switches	£4.20
Z42	20 Miniature Reed Switches	£1.00
Z43	12 Subminiature Reed Switches	£1.00
Z44	TO3 Mounting kits (BU208)	8 for 60p
Z45	TO220 Mounting kits (TIP33)	10 for 60p
Z46	TO126 Mounting kits (BD131)	12 for 60p
Z47	Pack of each Mounting kit. All include insulators and washers	£1.50
Z48	3a 1000v Diodes (IN5408 type)	8 for £1.00
Z49	Brushed Aluminium Push Button Knobs, 15mm long × 11mm Diam. Fit standard 3$\frac{1}{2}$mm square shafts	10 for £1.00
Z50	Chrome finish 10mm × 10mm Diam as above	10 for £1.00
Z51	Aluminium Finish. Standard Fitting Slider Knobs. (Decca)	10 for £1.00
Z52	Decca "Bradford" Control Knobs Black and Chrome. $\frac{1}{4}$" Shaft	8 for £1.00
Z53	Tuner P/B Knobs, Black and Chrome. Fit most small Diam Shafts, ITT, THORN, GEC etc.	8 for £1.00
Z54	Spun Aluminium Control Knobs (ITT) $\frac{1}{4}$" Shaft, suitable for most sets with recessed spindles	8 for £1.00
Z55	14 Pin DIL I.C. Sockets	12 for £1.00
Z56	16 Pin Quil I.C. Sockets	12 for £1.00
Z57	16 Pin DIL TO QUIL I.C. Sockets	10 for £1.00
Z58	22 Pin DIL I.C. Sockets	10 for £1.00
Z59	B9A Valve Bases P.C. Type	20 for £1.00
Z60	0.47Ω $\frac{1}{2}$ Watt Emitter Resistors	40 for £1.00

V.C.R. BATTERY PACKS.

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

THORN "VIDEOSTAR" 3V25/26 Nicad pack. Type VA214. Also suitable for J.V.C. etc.

These are untested units which contain **10× "C" size (HP11) Nicads,** which alone would cost in excess of **£20.** A Real Bargain at **£10 each 3 for £25**

SPECIAL OFFER

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

ELECTROLYTIC

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

*Axial. All others are Radial.

CAN TYPES

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

EHT DIODES

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

R.B.M. USERS LOOK!

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

SPECIAL OFFERS

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

TRANSISTORS

BC154, BC149, BC157, BF195, PBC108, BF393S, 2N3702, BC148B, BC159, ZTX107, ME8001, BC651, BF324

12 of one type	£1.00
Any 6 packs of 12	£5
2N3055H	60p each
BD181	50p each
BD131	4 for £1
BD132	4 for £1.00
AF186	4 for £1

ZENER DIODES

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

10 of one value	80p
10 of each	£6.60
1.3 watt, 12v, 13v, 18v	
10 of one value	£1.00
10 of each	£2.50

DIODES

25 × IN4002	£1.00
	100 for £2.50
20 × IN4003	£1.00
	100 for £3.00
20 × IN4005	£1.50
	100 for £5.00
20 × IN4148	£1.00
	100 for £2.50
25 × IN4002	£1.00
10 × 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

MISCELLANEOUS

BG100 tripler for CVC45 etc.	only £3.50
Line output transformer for RBM 823A	£4.25 each, 3 for £10.00
ITT VC200 4P/B Transistor Tuner. Suitable for some Pye and Philips sets. 3 hole fixing	£2.75 each
Decca Bradford Tuners, 5 button type	£4.00 each. 4 for £12.00
UHF Modulator UHF out Video in. Ch. 36. 2$\frac{1}{4}$" × 2" × $\frac{1}{2}$" complete with 9 foot coaxial lead and plug. With connection data	£3.00 each, 2 for £5.00
GEC Hybrid 2040 series Focus Assembly with lead and VDR rod	£2.00 each, 3 for £5.00
Convergence Panel for above. Brand new leads and plug.	£3.00 each
GEC 2010 Transistor Rotary Tuner with AE, SKT, and leads	£1.95 each, 3 for £5.00
Bush CTV 25 Quadrupler type Q25B equivalent to ITT TU25 3QK	£3.00 each, 2 for £5.00
PYE 697 Line and power Panel, damaged with some components missing but ideal for spares	£2.20 each, 3 for £6.00
Grundig UHF/VHF Varicap Tuner for 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
High quality Metal Coax Plug. Grub screw fixing	5 for £1.00, 100 for £12.50
Cassette/Calc Leads. 2m long, figure 8 skt. to flat pin. American plug	60p each, 3 for £1.50
3.5mm Jack Plug on 2m of screened lead	5 for £1.00
Mains Neons	10 for £1.00
Mini Grundig Motors. Regulated, variable.	
2k2 Screenfeed Resistors.	
White ceramic, 9 watt, with fusible link.	8 for £1.00
Phillips G8 Transductor.	£1.20 each. 3 for £3.00
E.H.T. Discharge probe, with heavily insulated handle, with lead and chassis connector.	60p each. 3 for £1.50

THEY'RE BACK

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

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
"1500" Jellypot. L.O.P.T. Pinkspot	£3.50
"900/950" 3 stick triplers	£1.00, 3 for £2.50
"950" Can. 100 + 300 + 100 + 16µf	£1.00

"RIFA"

0·1µ 1000v Flameproof — **5 for £1.00**

THYRISTOR

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

CONVERGENCE POTS

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

REGULATORS

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

GEMINI ELECTRONIC COMPONENTS

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

Please quote ZED code where shown. Send cheque* or Postal Order. Add 60p P&P and 15% VAT.
***Schools etc. SEND OFFICIAL ORDER. Allow up to 28 days for delivery. Most orders despatched same day.**
ZED PACKS now available for CALLERS at 50 Deptford Broadway, London, S.E.8.
Send large S.A.E. for list of Quantity, Prices and Clearance Lines etc.

TELEVISION

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

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

BACK NUMBERS
Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at 85p inclusive of postage and packing.

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

this month

OUR NEXT ISSUE DATED APRIL WILL BE PUBLISHED ON MARCH 16

P. V. TUBES

REPLACEMENT ELECTROLYTICS

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

CAPACITORS AXIAL

Volts	Mfd	Price
6V3	33	9
10V	22	8
	47	8
	100	10
	220	12
	470	20
16V	33	11
	68	11
	220	14
	1000	20
	3300	53
25V	10	8
	22	8
	47	10
	100	12
	220	19
	470	24
	1000	38
	2200	48
	4700	80
40V	10	10
	22	10
	400	30
63V	1	8
	2.2	8
	4.7	8
	10	10
	15	12
	22	10
	47	18
	100	20
	220	32
	470	40
	1000	56
	2200	85
100V	10	13
	22	15
	47	20
	100	29
	220	35
450	1	25
	4.7	30
	10	30
	22	58
	33	64
500	1	32
	10	32
600	1	35

MIXED DIELECTRIC CAPS

Volts D.C.	
250V 0.91mF	84
400V 0.22mF	20
600V 0.1mF	38
1000V 0.01mF	20
0.047mF	29
0.033mF	31
0.1mF	32
0.22mF	48
0.47mF	75
1250V 0.1mF	45
0.91mF	1.15
1500V 0.0022mF	19
0.0047mF	20
0.022mF	24
0.033mF	59
0.005mF	60
2000V 0.0052mF	1.20

CERAMIC CAPACITORS

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

ELECTRONIC TUNERS AND ASSEMBLIES

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

SWITCHES

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

FUSES

	Per type	Pack of 10
1¼" QUICK BLOW		
100ma		73
250ma-500ma-750ma-1A		54
1.5A-2A-2.5A-3A-5A		45
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A		
1.5A, 2A		1.60
2.5A, 3A, 5A		2.49
20m ANTISURGE		
80ma		3.43
100ma		2.30
160ma, 200ma		2.09
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A		1.18
2.5A, 3.15A		1.53
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		81
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A		40
1" MAINS		
2A, 3A, 5A, 10A, 13A		91

AERIAL ACCESS.

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

ANTIFERENCE

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

LABGEAR

CM7061 Power Unit 12V	10.70
CM7062 Reg. Power Unit 12V	11.67
CM7060 MHA 10db 12V W/B	8.94
CM7065 VHF UHF MHA W/B 12V	13.01
CM7067 UHF 12V MHA (Specify A-B or C/D)	9.73
CM7068 UHF 12V MHA High Gain (Specify A-B or C/D)	14.47
CM7053 Behind Set UHF Amp. (Mains)	11.81
CM7054 Behind Set UHF Amp (Battery e.g. Caravans)	9.45
CM7043 Second Set Amp UHF	11.00
CM7093 Behind Set UHF Amp 3 Sets	13.86
CM7063 Dist. Amp VHF/UHF 17db/output 12v	20.10
CM7073 VHF/UHF 8+1 Dist. Amp	39.24
CM9700 27mhz CB Suppress	3.68
CM6011 Outdoor Splitter (2 way) W/B	7.10
CM9003 Flush Single Outlet	1.34
CM9010 Flush Twin Outlet	1.78
CM9034 UHF Group Filters with DC Through Pass (state A/B/CD).	6.98
CM6006 6 Way Passive Splitter	11.52
CM7042 TV Games Combin.	2.56
CM9009 Flush TV/FM Outlet	2.77
CM7069 Tri Star Amplified Set Top Aerial W/E	17.59
CM7090 Amplified Caravan Aerial 12V DC W/B	15.52
CM6038 UHF/VHF 625 Pattern Gen	96.05
CM6052 UHF/VHF PAL Colour Bar Gen	235.06

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	4.55
THORN 1500 5 Stick	4.95
THORN 1600	3.90
THORN 3000/3500	7.39
THORN 8000	4.25
THORN 8500/8800	6.10
THORN 9000	7.93
DECCA 1730/1830	4.08
DECCA 1910/2213 Bradford	5.92
DECCA 30	6.26
DECCA 80	6.40
DECCA 100	6.14
UNIVERSAL ITT or REMD	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	5.79
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	6.35
PHILIPS G8 Long Focus 550	6.35
PHILIPS G9	6.37
Pye/Philips K3 Tripler	6.66
PYE 691/3	5.83
PYE 713/4 Lead	7.00
PYE 713 Doubler 5 Lead	7.50
Philips/Pye KT3	6.67
PYE 731/25	6.75
R.B.M. A823 (plug in) AV	6.45
R.B.M. A823	6.45
KORTING (similar to Siemens TVK1)	6.65
ITT KB CVC5/9	5.95
ITT KB CVC20/25/30 (Mullard)	5.95
RRI T20	6.80

RECTIFIER STICKS

TV11	74	TV18	81
TV13	75	TV20	95

MAINS DROPPERS

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

DIODES

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

ZENER DIODES

BZX61/85 (1.3W) 20 6V2-7V5-8V2-9V1-10V-11V-12V-13V-15V etc up to 75V

BZY93C 18v 1.18

BZY88 (400MW) 10 2V7-3V-3V3-3V6-3V9-4V3-4V7-5V1 etc up to 24V

MINIATURE SKELETON PRESET POTS

Horizontal or Vertical

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

STANDARD SKELETON PRESET POTS

Horizontal or Vertical

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

SLIDER POTENTIOMETERS

Lin or Log

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

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

DATA BOOKS (No VAT)

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

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

DISC CERAMIC CAPACITORS

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

ELECTROLUBE PRODUCTS

Electrolube Adhesive	62
Electro-Mech lubricant	1.49
Elect cleaning solvent	1.82
Freezer	1.49
Foam cleanser	1.12
Heat transfer compound	1.14
Silicone compound	1.94
Special contact fluid (Snorkel)	3.20
Permagard	1.52
Elec. mech. lubricant pen	74

CONVERGENCE PRE-SETS

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

METRIC CONVERGENCE POTS

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

EVER READY

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

EVER READY RECHARGEABLE BATTERIES

CHARGERS

CH1/22 For PP3/NN1604 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	£3.80
E60	£4.20
Scotch E120 Video Tape	5.35
E180 Video Tape	6.15
Beta L500	5.35
L750	£7
Philips VCC 240	7.82
VCC 360	10.36
VCC 480	15.50
VIDEO CASSETTE CASES Red/Blue/Green/Brown	80p
Book Type – Any Format	
Scotch Audio Tape C90 Ferric	65p
C90 Super Ferric	96p
Video Recorder Heads VHS	£38
Philips V2000	52.00
Coloured Book Type Video Cases. Any Format. 8 on carved wooden stand	15.50

PANELS + UNITS

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

SUNDRY TUNER ACCESS.

RANK Tuner P.B. 1¼" × 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 12	4.80
Quick Set Adhesive	78
Moulded Plastic Hex. 6mm Trim Tools	10
Double End 4mm/8mm Trim Tools	20
Focus Rod	1.25
Focus Holder	2.00
Keynector Safe Block (mains)	5.50
Cassette Drive Belts, 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 12V 200ma	3.25
Mains Connector 4 way 13A	5.00

TEST EQUIPMENT

Portable Oscilloscope	150.00
Probes x10	10.90
TF200 Frequency Meter	155.00
CRT Tester/Rejuvenator	172.00
KHP30 Measuring Probe (3 okv) EHT	29.95
T120 RF Signal Injector	4.00
Avo 8 Test Lead Set	4.20
Degaussing Coil (stick type)	£17
Degaussing Coil (disc type)	24.00
Universal Battery Charger	7.50

SERVICE AIDS

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

HOW TO ORDER

ADD 65p per order for Post and Packing (UK) (Export orders will be charged at cost.) **THEN ADD 15% VAT TO TOTAL COST.**

Orders which contain aerosols or degaussing coils are very heavy – please add extra 30p per can/coil **First Class Mail is used whenever possible. All enquiries S.A.E. please. VAT invoice on request. SEE SPECIAL NOTE RE MAIL ORDER TUBE COSTS.**

Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible.

We try our best to give a speedy, fair and efficient service. As our regular customers know, orders telephoned in before 4 p.m. will be despatched the same day.

Give us a ring – we'll give you service.

Please ask if what you need is not listed – we will try to help.

TRANSISTORS, ETC.

Type	Price (£)
AC107	0.48
AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.46
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.42
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	1.32
AF115	1.26
AF116	1.28
AF117	1.32
AF118	0.96
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.36
AF180	1.35
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	2.55

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

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

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	0.13
BC548*	0.13
BC549*	0.15
BC550	0.24
BC556	0.23
BC557*	0.16
BC558*	0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.05
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	0.37
BD136	0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	0.51
BD155	0.90
BD157	0.51
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.88
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
3D222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

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

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

Type	Price (£)
BPX29	1.62
BR101	0.53
BR103	0.64
BR303	1.06
BRC4443	1.76
BRY39	0.60
BRY56	0.44
BSS27	0.92
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	2.85
BU105	1.80
BU105/02	1.95
BU108	2.98
BU126	2.91
BU204	2.50
BU205	2.58
BU206	2.59
BU208	2.76
BU407	1.38
C106D	0.80
C106F	0.43
C111E	0.46
D40N1	0.64
E300	0.42
E1222	0.47
E5024	0.19
GETB72	0.46
ME0402	0.18
MF0404/02	0.18
ME6001	0.18
ME6002	0.18
MJ2955	1.30
MJ3000	1.58
MJE340	0.68
MJE341	0.72
MJE370	0.74
MJE371	0.79
MJE520	0.85
MJE521	0.95
MJE2955	1.20
MJE3000	1.95
MJE3055	1.22
MPF102	0.40
MPS3702	0.33
MPS3705	0.30
MPS6521	0.36
MPS6523	0.36
MPS6566	0.36
MPSA05	0.30
MPSA06	0.32
MPSA55	0.43
MPSA56	0.45
MPSA93	0.56
MPSL01	0.33
MPSU01	0.61

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

Type	Price (£)
ZTX500	0.18
ZTX502	0.22
ZTX504	0.28
2N404	1.30
2N696	0.46
2N697	0.46
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.46
2N918	0.54
2N930	0.29
2N1164	10.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.45
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	0.15
2N29260	0.14
2N2926Y	0.14
2N2955	1.12
2N3053	0.48
2N3054	0.86
2N3055	0.72
2N3250	0.52
2N3254	0.35
2N3391A	0.38
2N3633	0.60
2N3703	0.17
2N3704	0.19
2N3705	0.17
2N3706	0.16
2N3707	0.18
2N3708	0.17
2N3715	1.70
2N3771	2.09
2N3772	2.08
2N3773	2.90
2N3794	0.40

Type	Price (£)
2N3819	0.47
2N3820	0.72
2N3866	1.08
2N3904	0.20
2N3905	0.20
2N3906	0.20
2N4036	0.94
2N4123	0.17
2N4124	0.17
2N4126	0.17
2N4236	2.20
2N4289	0.32
2N4292	0.32
2N4416	0.85
2N4444	1.90
2N4921	0.80
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2N5060	0.28
2N5061	0.30
2N5064	0.63
2N5086	0.49
2N5087	0.50
2N5208	0.59
2N5294	0.66
2N5296	0.68
2N5298	0.71
2N5322	1.16
2N5449	0.18
2N5457	0.46
2N5458	0.40
2N5459	0.58
2N5494	0.85
2N5496	1.05
2N6027	0.55
2N6107	0.71
2N6122	0.60
2N6178	1.07
2N6180	1.39
2N6211	2.74
2SB3378P	4.28
2SC458C	0.78
2SC643A	2.25
2SC930D	1.50
2SC1061	1.45
2SC1172Y	3.56
2SD234	1.48
3N128	1.60
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40251	1.14
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40362	0.50
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MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC4008	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	1.10
ML231	3.57
ML232	3.57
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NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
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SAS570	2.01
SC9503P	1.40
SL432A	2.52
SL450	5.10
SL901B	4.7
SL917B	6.50
SL918A	5.95
SN72440N	2.21
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32

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SN76033N	2.20
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SN76115N	1.62
SN76116N	1.78
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SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.8
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
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TAA611B	2.85
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TAA630Q	3.91
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TAA661B	1.75
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TBA550*	3.13
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TBA940	3.52
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BA116	0.56
BA121	0.85
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BA148	0.19
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BA155	0.17
BA156	0.12
BA157	0.25
BA158	0.28
BA159	0.40
BA164	0.14
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BA201	0.13
BA202	0.14
BA203	0.14
BA216	0.08
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BA243	0.45
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BAX17	0.19
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BY190	4.90
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BY238	0.25
BYX10	0.30
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ITT210	0.63
ITT827	0.80
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MR854	1.10
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OA10	0.58
OA47	0.20
OA81	0.19
OA90	0.13
OA91	0.15
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OA202	0.13
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IN916	0.06
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IN4004	0.08
IN4005	0.09
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/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
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/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
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VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
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PCC85	0.79
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PCC189	0.94
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PCF86	0.87
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PCF802	1.20
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PCF808	3.80
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PCL83	5.25
PCL84	0.66
PCL86	1.27
PCL805/85	1.00
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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
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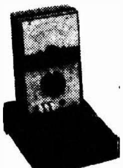

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Getting the Act Together

Many years ago I was trying to find out exactly what a JK flip-flop was. The things were being referred to all over the place, but a definition was hard to find. Someone suggested that I consult a book by Frederick E. Terman, since this was then the bible of digital electronics. When I eventually got hold of a dusty old copy of the book it did indeed solve the puzzle, and several others I was worrying about. And it gave circuits of all those new wonders, AND and OR gates and so on – using valves!

Professor Terman seems to have been an outstanding figure. Apart from his work on computing, he was to become known as the Father of Silicon Valley. Back in 1947 he called for greater co-operation between industry and the universities, and his position at Stanford University enabled him to develop the theme in practice: Silicon Valley started on the campus of Stanford University. It was the first of what have come to be known as "science parks", and now spreads for some thirty miles along the valley to the south of San Francisco.

Other things helped Silicon Valley to become the heartland of modern electronics. The space race for example made vast sums available in the USA for a time for development and research. But the link between university and innovators able to develop and sell practical hardware was the essential ingredient in the success of Silicon Valley.

One of the firms that became established in Silicon Valley in its early days was Hewlett-Packard. Mr. Hewlett was one of Professor Terman's students, and was helped by him in starting up his business. In a recent *Financial Times* supplement on science parks John Young, Hewlett-Packard's president, is quoted as commenting that "a special kind of technical ferment exists here. The closeness of other electronics firms and some very fine universities have produced a business climate in which innovation flourishes". There is probably more to it than that. The relaxed atmosphere in California must have helped for a start. Innovation is not so easy in an atmosphere of suspicion and distrust. Successful research has been carried out under conditions of great secrecy, as successful developments during the war show. But the point about Silicon Valley is not just the electronic know-how: it's the linking of this to businesses that can translate it into products that sell.

The idea of links between industry and the universities to the benefit of both is neither all that new nor confined to the USA. Science/research parks have been established in the UK since the early 70s and close industrial links, for example at Manchester, go back a great deal farther. It remains a fact that failure of the educational system in the UK to meet the needs of technology and industry is often and with good cause given as being one of the reasons for the UK's relative industrial failure in the post-war era.

The problem exists not only at university level of course but throughout the educational system. Successful firms require all sorts of skills to develop and sell products profitably. The important point is that production and commerce have not been held in sufficient esteem by many of those who have had control of the educational system. They do things rather better elsewhere, as we've learnt to our cost.

There are signs that in the present harsh industrial climate a major change of attitudes is at last under way. Something just has to be done to get UK Ltd. moving industrially. It's all very well to talk of the "post-industrial future" as is sometimes done – some sort of national state of retirement in which we'd all be engaged in less demanding "service" tasks. The fact is that products will still be needed and that if we don't produce them we have to import them. When oil ceases to gush from the North Sea we'll know exactly what this implies.

It's a bit unnerving that we're coming to depend so much on foreign firms establishing plants in the UK. The government sets great store by getting Nissan to set up a car production plant in the UK, and what the state of the UK's TV manufacturing industry would have been like without the contributions made by Sony, Panasonic, Toshiba and so on doesn't bear thinking about. The problem with this sort of thing is that the plants are controlled from elsewhere, the development work also being done in other parts. Becoming a sort of international assembly line is not what industrial rejuvenation is about.

It's also odd that so much UK investment goes overseas. This seems to provide confirmation that there remains something very wrong about the way in which things are done in the UK, something that can be traced to fundamental factors such as labour relations – and the educational system. As the Wilson committee discovered some years ago, there's no shortage of investment funds in the UK. But they don't get used to finance technical/manufacturing innovation.

Bringing education and industry closer together must be part of a solution to our present predicament. In particular it's essential that the needs of industry are better understood all round. We have for example a government of landowners who seem to have little understanding of what industry is about: having investment fund managers trained to look for a short-term profit is another failing. One can only hope that growing awareness of the need for closer links between industry and education, and of a greater appreciation generally of industrial needs, have not come too late. Silicon Valley shows what can be achieved given the right conditions.

COVER PHOTO

Our cover photograph this month shows 20in. colour sets being soak tested at Fidelity's north London plant. Our thanks to Fidelity Radio plc for enabling us to visit and photograph the colour receiver production area.

Servicing the Sony KV1810UB

David Botto

MANY service engineers are apprehensive when a Sony KV1810UB comes into the workshop. This is because these sets have a tendency to go dead suddenly after working well for a number of years. You then usually find that the 2·5A fuse F601 has blown while the chopper Q603 on the power supply panel and the line output device Q510 on the timebase panel have both gone short-circuit. These last two items are gate-controlled switches – from the way they're drawn on the circuit diagrams, they look like transistors with two emitters each. They have to be obtained from Sony, and are very expensive.

The logical thing to do is to check for shorts and then if all's well to replace the fuse and the two gate-controlled switches. Unless further action is taken however the result is likely to be further failure of these items either (1) at switch on, (2) after an hour or two or (3) after several days. This is especially likely if most of the components in the set are the original ones. These sets can be repaired and made to work reliably – but it will not be a cheap job.

Fig. 2 shows the chopper power supply used in the KV1810UB. It consists basically of a monostable multivibrator Q606/7 which acts as a pulse-width modulator under the control of Q608, and a driver section Q605/4 which drives the base of the chopper GCS Q603. During normal operation, the monostable and driver, also the line oscillator on the timebase panel, are powered from a line output transformer derived 19V rail. This raises the problem of how to get things going at switch on. A start-up supply is provided by the other GCS Q602, diode D605 and the associated resistors. As the voltage on the 19V line rises, so the chopper and the line timebase come into operation and at about 15V D610 conducts, switching Q601 on. This shorts the base of Q602 to chassis and the start-up circuit is thus deactivated.

The 19V supply is provided by D514/C541 on the timebase panel. Unfortunately, if either the 19V supply or the start-up supply from D605 is absent the two main GCSs Q603 and Q510 will be instantly destroyed. The line oscillator is in IC501 on the timebase panel. It's vital that this i.c. starts up immediately following switch on, and that it remains on for a little longer than the rest of the set when the mains power is switched off.

For the rest of this article we'll use the board identification letters used by Sony – PR for the power/regulator panel and VH for the timebase panel. The chopper Q603 provides a regulated 130V output at pins 19 and 22 on the PR panel. Fortunately the pin numbers are shown on the actual board.

Dealing with a Dead Set

It's essential to have a means of varying the mains input from about 80 to 240V a.c. when repairing KV1810UBs. Either a variac or a tapped mains transformer can be used. An 18V d.c. supply is also required. This is best made up from batteries – we use two PP9s – to ensure that there is no ripple whatsoever.

So you've a dead set and you've had to replace fuse F601, Q603 and Q510. Make sure you replace the insulating washers along with Q603/Q510. Don't connect the set to the mains yet. If the PR board has all its original components fitted, replace the following capacitors: C624 47μF, 25V electrolytic; C620 4·7μF 50V electrolytic; C609 0·0022μF 1kV film. These values are all critical, and if the capacitors have deteriorated or leaked the result can be disaster. Our workshop policy is to replace them automatically – we find it best to obtain the replacements from Sony. Next check diode D604, type UF-01, and measure the value of R642 carefully (220Ω, 2W). If R642 shows any sign of overheating, replace D604 anyway. Also check R640 (560Ω, 1W) and R622 (10Ω, 2W), and have a good look around the PR board for any signs of corrosion – especially around any of the remaining capacitors.

There are various numbered pins on the PR board from which wires lead to different parts of the set. Connect your 18V supply from the two PP9 batteries to pin 17, negative to chassis. Do not apply the mains supply. Clip an oscilloscope to pin 18, via a 10:1 probe, and observe the line-frequency waveform. Next check the waveform at the collector of Q605 (junction with R640). It should resemble Fig. 3(a). If C624 had not been changed it would probably have ragged edges as shown in Fig. 3(b). Make sure this waveform is correct or the set will come back dead with F601 blown and Q603/Q510 once more short-circuit.

We're still not ready to switch on the mains supply. Quite a few components on the VH panel must be replaced if they are the original ones. The reason is that the line oscillator must, as previously mentioned, start up first at switch on to apply drive to the line output GCS Q510; and it must continue to work momentarily after the rest of the set when the mains power is switched off. Otherwise it's Q603, Q510 and F601 again. So replace the following, and don't be tempted to leave any of them in: the 19V rectifier diode D514 (type S-34); the efficiency diode D517 (type TD-15, best replaced with type SID-30); the oscillator i.c. IC501 (type CX104A); the electrolytics C537 (4·7μF, 25V), C538 and C539 (both 0·47μF, 50V); the line output transformer tuning capacitor C542 (18,000pF, 1·5kV) and the flashover protection capacitor C552 (330pF, 1·5kV). Check the pre-driver transistor Q508 (2SC1363) and the driver Q509 (2SC1475) for leakage and corrosion on the leads – if in the slightest doubt, replace them. One last but very important thing – if the mains on/off switch is the original one, replace this as well. Otherwise it may spark and track

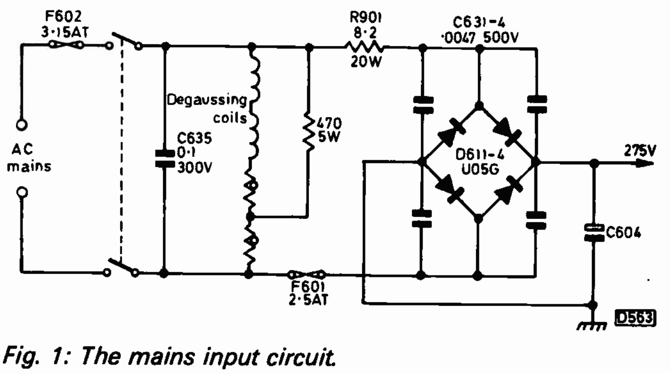


Fig. 1: The mains input circuit

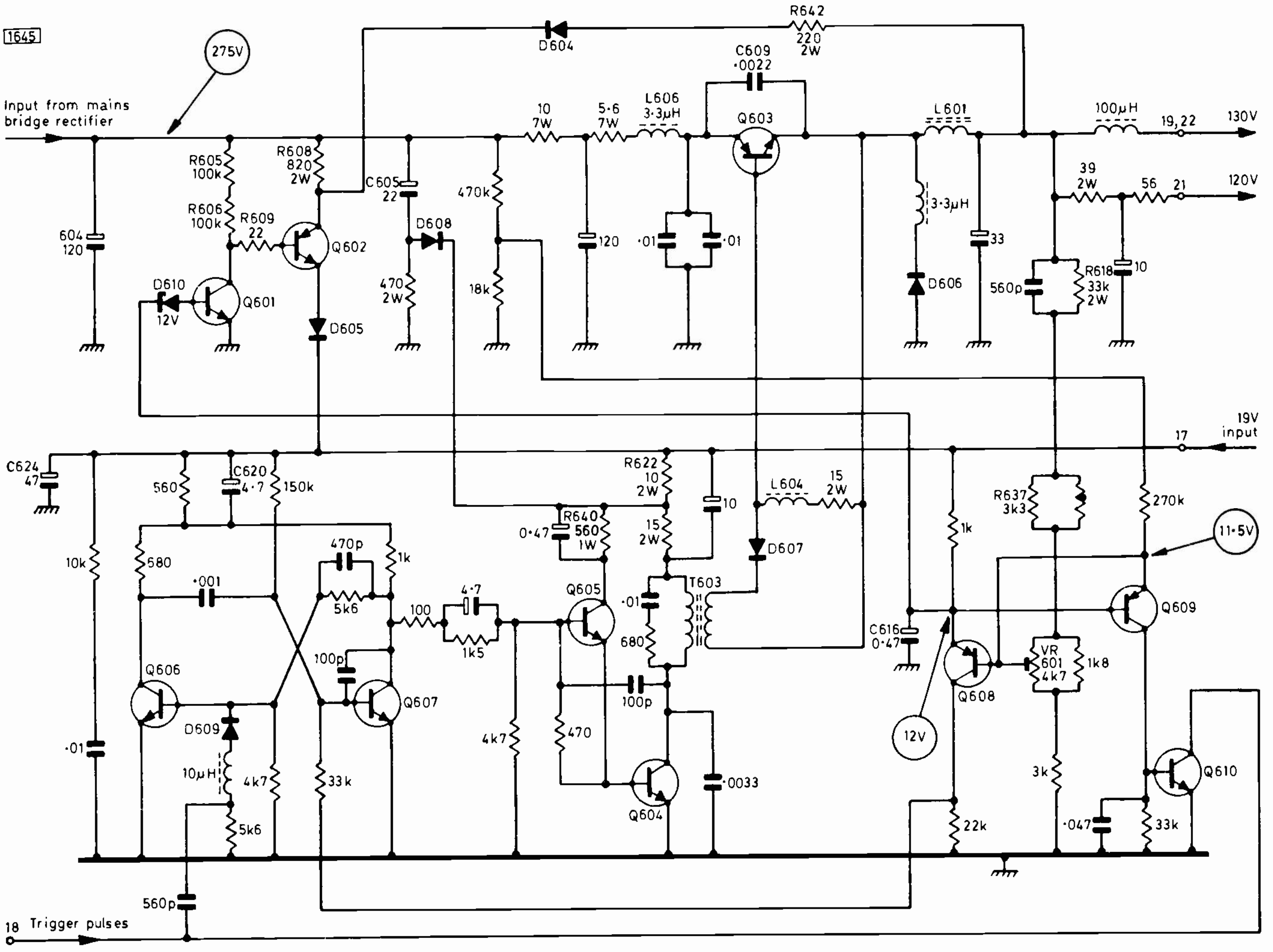


Fig. 2: The chopper circuit used in the Sony Model KV1810UB.

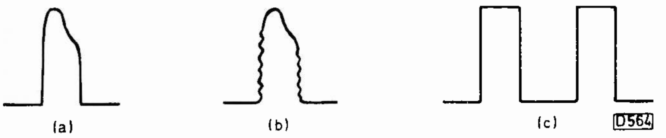


Fig. 3: Correct (a) and incorrect (b) waveforms at the junction of R640/Q605. (c) Waveform at pin 16 of IC501: line frequency and 5V peak-to-peak.

and by now you know the rest! Examine the whole VH board very carefully for possible dry-joints and corrosion.

With the 18V battery supply connected but still not the mains, check the line drive waveform at pin 16 of IC501 – see Fig. 3(c). Also put your probe on the base of Q510 – make both measurements via a 10:1 probe – to check that line drive is present here. It's a good idea to recheck the waveform at the collector of Q605 on the PR board before proceeding.

After a final check around we're ready to connect the mains supply – but with the 18V d.c. supply still connected between pin 17 and chassis on the PR board. Using the variac or tapped input transformer, start off with an input of about 70V a.c., having first connected a d.c. voltmeter between the junction of L606 and Q603 on the PR board and chassis. It's a good idea to connect a second d.c. meter between pin 22 and chassis. You should now get a d.c. reading of 80V or so at L606. As the mains input is increased, a d.c. voltage should begin to appear at pin 22. Should you have missed something, this procedure will save you ruining two more GCSs. As you increase the mains input voltage, don't let it stay at around 90-110V a.c. or clouds of smoke will come from some of the resistors on the PR board.

When the a.c. input is up to around 190V the set should be working quite well, with a slightly small picture. If so the full 240V can be applied. Adjust VR601 on the PR board for 125V at pin 22. Run the set for a couple of hours, then readjust VR601 for 130V. Leave the 18V battery supply connected for a while as you test the set. After about three hours, switch off the set, remove the batteries and switch on again.

All this may seem like a lot of work. It is! But the procedure is based on a lot of experience of these sets gained over the years – and, in the past, quite a lot of expensive phone calls to Sony's service department. Provided you've replaced all the items mentioned, many or most being special items obtained from Sony, the set will continue to give further good and reliable service.

Q603 and Q510 are type SG613 in the KV1810UB Mk. II. They are type SG608 in the earlier version of the chassis. The later replacement is type SG6533. It's in order to fit either of these three types of GCS.

The Rest of the Receiver

Some of these sets may be found to have a protection board fitted. We generally remove this board and fit the missing excess-voltage protection transistor Q610 (2SC1363) on the PR board – so, it's rumoured, do Sony! If this protection board is left in circuit it must be very carefully set up or F601 will keep blowing for no apparent reason.

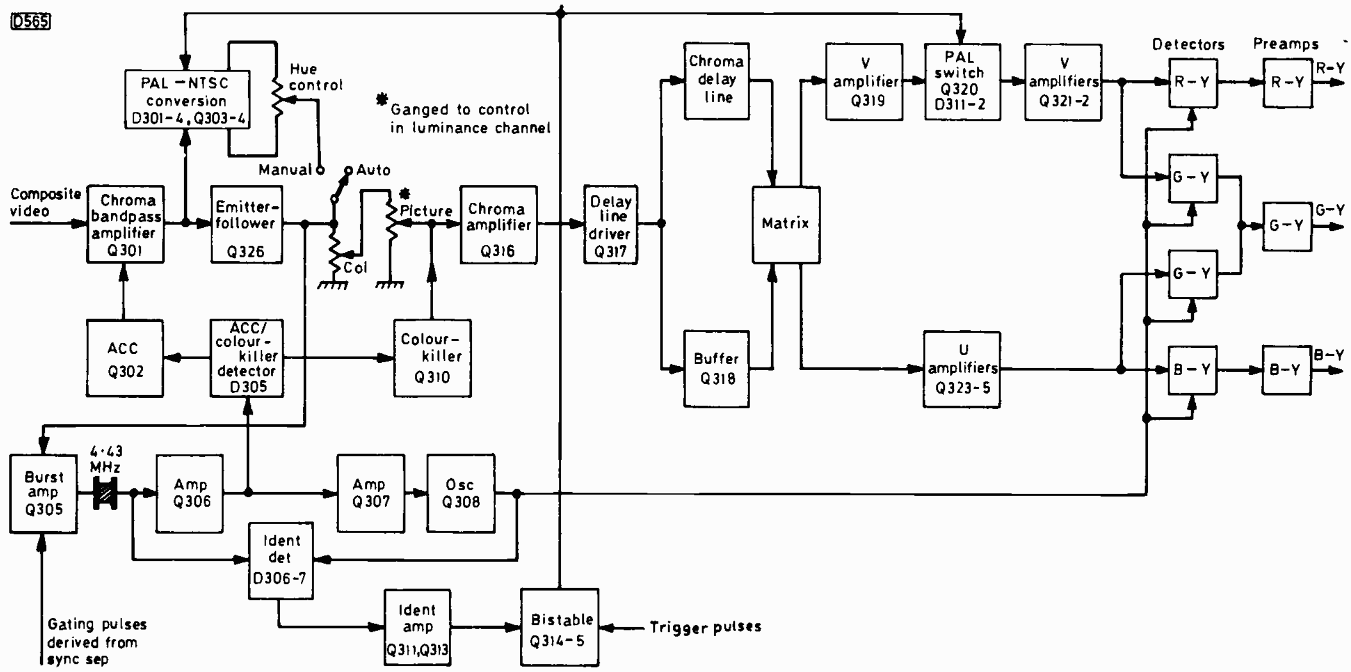


Fig. 4: Block diagram of the KV1810UB's decoder.

The line output transformer T501 seems to be very reliable. A separate transformer T801 drives the tripler. We've never had to replace either transformer, and tripler failures have been few.

If the field scan is unsteady or varying in height, check the output stage bias stabilising thermistor TH501 (type TH1500). This is easy to do by spraying it with a little freezer. If the picture steadies, fit a replacement. If it's the original one we replace it to avoid future trouble.

The decoupling electrolytics C559 (1μF, 160V) and C523* (470μF, 16V) and the couplers C522* (22μF, 16V) and C577* (47μF, 16V) tend to dry up and corrode and can cause trouble. On rare occasions we've known the two 2SC867 field output transistors Q503/Q504 to become leaky, giving half or no field scan. Be sure to check the bias resistor R543 (12Ω, 1W) when replacing these transistors. We've found that if only one of them is leaky it's still best to replace them both. The other two field timebase transistors Q501 (2SC1363) and Q502 (2SC1124) should be checked whilst you're at it, though they seem to give little trouble.

The field oscillator is in IC501 with the line oscillator. A fault that's not easy to locate is very intermittent field roll. Replace the electrolytic C504 (1μF, 50V) and all will be well.

We've rarely had to change the tuner, which seems to be quite reliable. If it does give trouble, a new one is best obtained from Sony.

Trouble in the i.f. strip can cause low gain – a weak and noisy picture. You will usually find on examination that there is corrosion on the leads of one or more of the i.f. transistors Q201/2 (both type 2SC1129) and Q203 (2SC1128) – these are on the S panel. Change them all and a good picture will be restored.

The sound section consists of an i.c. (IC201) and a single transistor output stage (Q901, 2SC867). The transistor can leak, causing distortion or no sound. The i.c. (CX095) is extremely reliable and rarely fails. The same can be said of the other i.c. on the S panel, IC202. This provides the a.f.c. action.

The decoder is fairly straightforward, though the colour system is complicated by a seemingly unnecessary automatic/manual colour control system. In the manual position, a hue control is introduced into the circuit. Apart from that the only other unusual feature is the use of a passive subcarrier regenerator circuit, i.e. the bursts drive the crystal directly, with no burst detector. The luminance channel and the sync separator also live on this panel. The RGB output transistors are on the c.r.t. base panel. These are Q701/2/3, all type 2SC1127. They are easy to check if one colour is missing or predominates.

As with other parts of the receiver, the tubular electrolytics on the decoder panel C tend to dry up and leak with age. Often just touching them will result in the connecting wire breaking off at one end, showing corrosion. C343 (1μF, 50V) couples the regenerated subcarrier to the a.c.c. detector D305 and the colour-killer transistor Q310: no colour and various weird effects can occur when it begins to fail. Check the colour-killer reservoir capacitor C347 (10μF, 16V) for corrosion at the same time. Dry-joints on various parts of the board are another cause of intermittent colour drop-out. Examine the print very closely before starting on extensive tests: it may save you a lot of time! Check too for corrosion on the leads of the transistors. If you find any, replace them. Even if they are working all right they will soon give trouble.

The decoder adjustments don't seem to vary much and are best left alone unless you are sure that the panel needs setting up, i.e. persons unknown have got at it.

A picture with bowed in sides is sometimes produced when the pincushion driver transistor Q586 (2SC1124) fails. When you replace it, check its emitter resistor R594 (82Ω, 2W) for correct value and the various tubular electrolytics in the circuit for any signs of corrosion or drying up. These are C587* (330μF, 6·3V), C566 (47μF, 16V) C585 (4·7μF, 100V) and C556 (0·47μF, 50V).

Finally, after all repairs have been carried out it's a good idea to spray a *very* thin coat of circuit varnish on every newly soldered joint. This helps prevent corrosion troubles in the future.

Capacitors marked with an asterisk have different values in the earlier version of the chassis as follows: C522 10μF 16V; C523 1,000μF 10V; C577 100μF 16V; C587 1,000μF 10V.

Letters

DECCA 80 CHASSIS

Other readers might be interested in an unusual problem we had recently with one of these sets. With the set switched on there was a sound similar to e.h.t. arcing. Prodding the timebase panel would change the pitch of the sound, or sometimes make it disappear temporarily. With the lights out and the chassis swung upwards however there was no sign of tracking.

The problem was eventually traced to the fusible resistor R342 in the 23V regulator circuit. It's situated in the top right-hand corner of the timebase panel. The cause of the noise was the porcelain sleeves on each lead – they tend to rattle and produce a sound similar to e.h.t. tracking. To cure the problem, squeeze two blobs of silicone rubber to bind the sleeves to the board.

J. McMaster,
Chester.

PROVISION OF SERVICE INFORMATION

As you say (Teletopics January), the return of *Scope* in its new guise of *Ferguson Feedback* is welcome. Unfortunately however Thorn charged £6 plus VAT for issue number one (with the binder) to non-account customers. I try to be conscientious in my work, and this is greatly assisted by the provision of good service manuals and, equally important I feel, the issue of manual updates, modification details and so on. *Feedback,* the Philips *Link,* and other bulletins provide this information, but at what cost? Since I've an account with Philips I get *Link* free. As I don't have an account with Thorn I have to pay for *Feedback,* though I received *Scope* free. I do hope that Thorn will reconsider their new policy in this respect, as lack of adequate information is a great hindrance to a service engineer trying to do a good job.

The whole matter of pricing policy for service data supplied to non-dealer/account customers is in a state of disarray, being quite different from company to company. There's much that could be done to help the unfortunate service engineer in this respect.

Finally, may I make a plea that firms publishing bulletins like *Feedback* include lists of new service manuals as they become available, so that those of us who do not receive them automatically don't miss out? Philips do this admirably in *Link.* Thorn please note.

D. Hazell, Television Service,
Witney, Oxon.

EFFECT OF TOBACCO SMOKE

An issue I've not seen raised in your columns before is that of the effect of tobacco smoke on TV tuner heads. First to outline the problem. The electrostatic charge developed on the outside of the tube attracts to itself and the surrounding cabinet smoke particles and tar vapours, which condense on these surfaces. Since the tuner head comes within this ambit it gets its share. Having a plastic frame or case, it develops its own charge – pinching some from the c.r.t. as it were, especially when the tuner head is immediately under the c.r.t. The resultant intermittent voltage output from tuner head can be very misleading, giving rise to a number of faults ranging from outright loss of sound and vision to occasional colour drop out. If you are aware of this, sniffing the tuner head is enough to give the game away – but do it soon, as the aroma fades away in a few hours, presumably because the tar hardens quickly.

I find that the only effective solution to the problem is to replace the tuner head. What's really needed however is a liquid cleaner in which heads can be immersed to loosen the deposit that coats the contacts and carbon tracks. I've tried all the cleaners available to us in the trade, but none seem to be very effective or reliable for this purpose.

G.J. Noyce,
Littlehampton, W. Sussex.

Comment: A firm that rebuilds tuner heads advises us that the ultimate solution is to clean them in an ultrasonic bath. Cleaning the tracks and contacts with Servisol, then applying a very thin film of silicone grease, seems to be effective in many cases. Maybe other readers would like to comment?

THEN AND NOW

When I started in the television trade, if you could repair a TV set you were expected to be able to mend almost anything. In addition to radio sets, record players and tape recorders, there were vacuum cleaners, irons, toasters and even bicycles (we also charged accumulators).

How simple those early sets were. Two valves and half a dozen other components and you had a timebase. How different now! When confronted with a new chassis my mind goes blank. I find it difficult to identify anything except perhaps the line output stage. This has led to several embarrassing incidents in customers' homes, when I've been unable to find out how to turn the set on or where the other controls are hidden. I remember one set of foreign origin where I never did find out how to get to the front of the convergence panel.

Is it that in the days of steel chassis and discrete components you could see what went on, or is it just that I'm getting old? Certainly your articles on vintage TV sets, some of which I used to repair for a living, make me feel it!

Peter Nutkins,
Charmouth, Dorset.

TESTING ZENER DIODES

Victor Rizzo finds that zener diodes connected to his home built checker (Letters, October 1982) often show voltages that are not true to their markings. He shouldn't be surprised at this. The tester is not actually measuring the zener voltage. It's supplying the zener diode under test with full-wave rectified a.c., and the meter is measuring the average voltage, which will always be less than the level at which the zener diode is clipping the waveform. The addition of a suitable reservoir capacitor would make the instrument accurate, but on the other hand mains isolation dependent on a 22kΩ ½W resistor is not generally considered adequate.

Alan Willcox,
Cardiff.

BETA SOUND SYSTEMS

There was an error in your report on the Sony C9 VCR in last month's Teletopics, where reference was made to its BNR (Beta Noise Reduction) sound system. This technique is in effect similar to the well known Dolby system, in that amplitude dependent h.f. lift is given to the signal during record, a complementary h.f. roll-off being introduced on playback. This offers an overall signal-to-noise ratio of better than 43dB. It's applicable to the conventional longitudinal sound recording system and is particularly relevant where narrow sound tracks are used, as in the C9.

The quite different technique of recording the sound in the helically scanned tracks on a subcarrier is known as "Beta Hi-Fi" and was reported in the December 1982 Teletopics. This offers a 20Hz-20kHz frequency response, 80dB dynamic range and 0·3 per cent distortion, though it seems that as yet the technique can be used only with NTSC system Betamax machines. With an NTSC signal the luminance and chrominance information occupies less bandwidth (and thus less tape spectrum space) than with a PAL signal, leaving sufficient room for the sound subcarrier.

Your writer seems to have confused the two systems. It's easily done – they were announced at about the same time and are both aimed at overcoming the limitations of longitudinal sound recording in domestic VCRs, with their low linear tape speed.

E. Trundle,
St. Leonards on Sea, E. Sussex.

VCR Servicing

Part 16

Mike Phelan

THE first part of the Ferguson 3V23 we'll look at is the power supply (see Fig.67). It's fairly straightforward when separated into its individual parts. All the outputs are derived from a large mains transformer, with series regulators to stabilise most of the lines. Some of the outputs can be switched off by the "power off", "tuner off" etc. commands.

When we switch the mains on at the rear of the machine, only the three lines shown at the top in Fig. 67 will be present. The 12V "always" line supplies the aerial amplifier/splitter – otherwise our normal TV picture would be grainy. The 10V and 5·6V lines supply the digital logic circuits on the mechanism control panel – otherwise we couldn't switch the machine "on" at the front, i.e. out of standby.

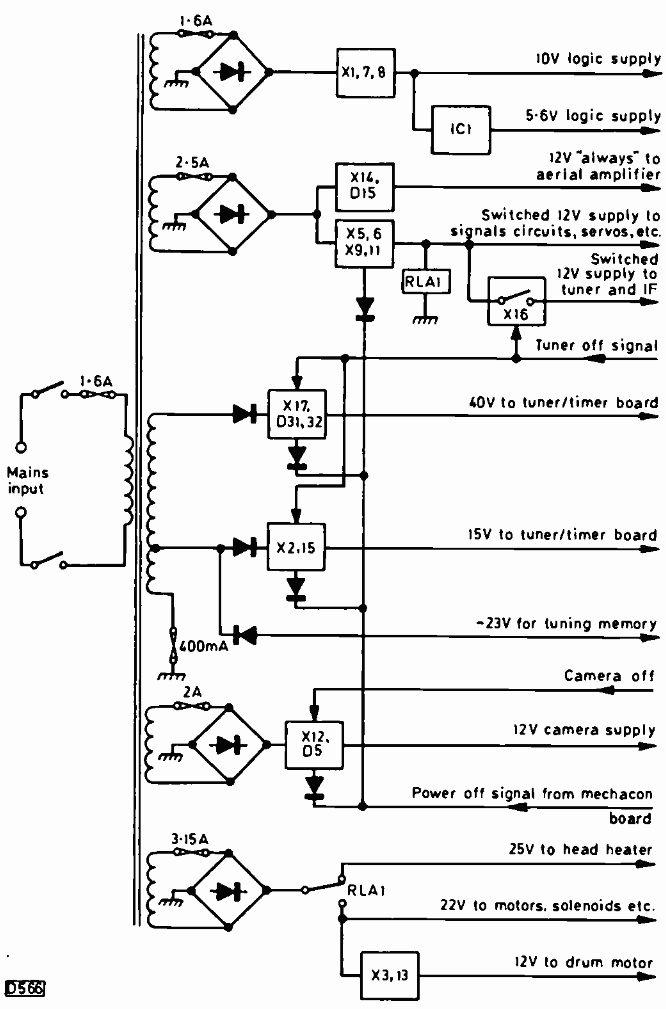


Fig. 67: The 3V23's power supply arrangements.

The switched supplies – 12V, 40V, 15V and camera 12V – are held off by the power-off signal (a logic low) from the mechanism control (mechacon) board. When we switch on at the front, via the microcomputer i.c., this line goes high and brings the regulators into operation. The camera and tuner supplies are switched directly by the camera/tuner/auxiliary switches on the front – these also operate electronic switches (4066s) on the junction board to route the video and audio signals as required. This board also carries the test signal oscillator. Note that the head drum heater is powered only when the machine is "off" – via the single-pole changeover relay.

Microcomputer Control

We'll move on next to examine the 3V23's mechanism control system. We mentiond briefly last month that all the mechanical functions are controlled by a microprocessor – actually a microcomputer i.c. This is a μPD553C072. The "072" bit indicates the programme that's been written into the i.c. It's not necessary to have a detailed knowledge of the functioning of microcomputers to understand how the machine works. None of the buttons on the machine operates anything directly, not even the "power on" button. They merely ask the appropriate microcomputer to do this: if there is no reason to the contrary, it does so.

The mechacon system is shown in block diagram form in Fig. 68. The microcomputer IC1 has outputs to control the electromechanical devices (solenoids and motors) that carry out the various machine functions.

Before proceeding we'll take a short break to discuss one or two terms used with microcomputers and logic circuitry. As most of you will know, logic signals are either high or low, being within a fraction of a volt of either side of the supply, i.e. earth and 10V in this case. A "bit" is a single binary digit, i.e. 0 or 1. Where we have more than one bit in the signal that conveys information the bits can be arranged in serial or parallel form. A four-bit serial signal might consist for example of 0110, 0110 etc. transmitted sequentially and repeated. A change to say 0100, 0100 etc. indicates a change in the information being transmitted. This sequential method of transmitting signals takes more time but has the advantage that only one path is required. If we have four paths, i.e. wires or

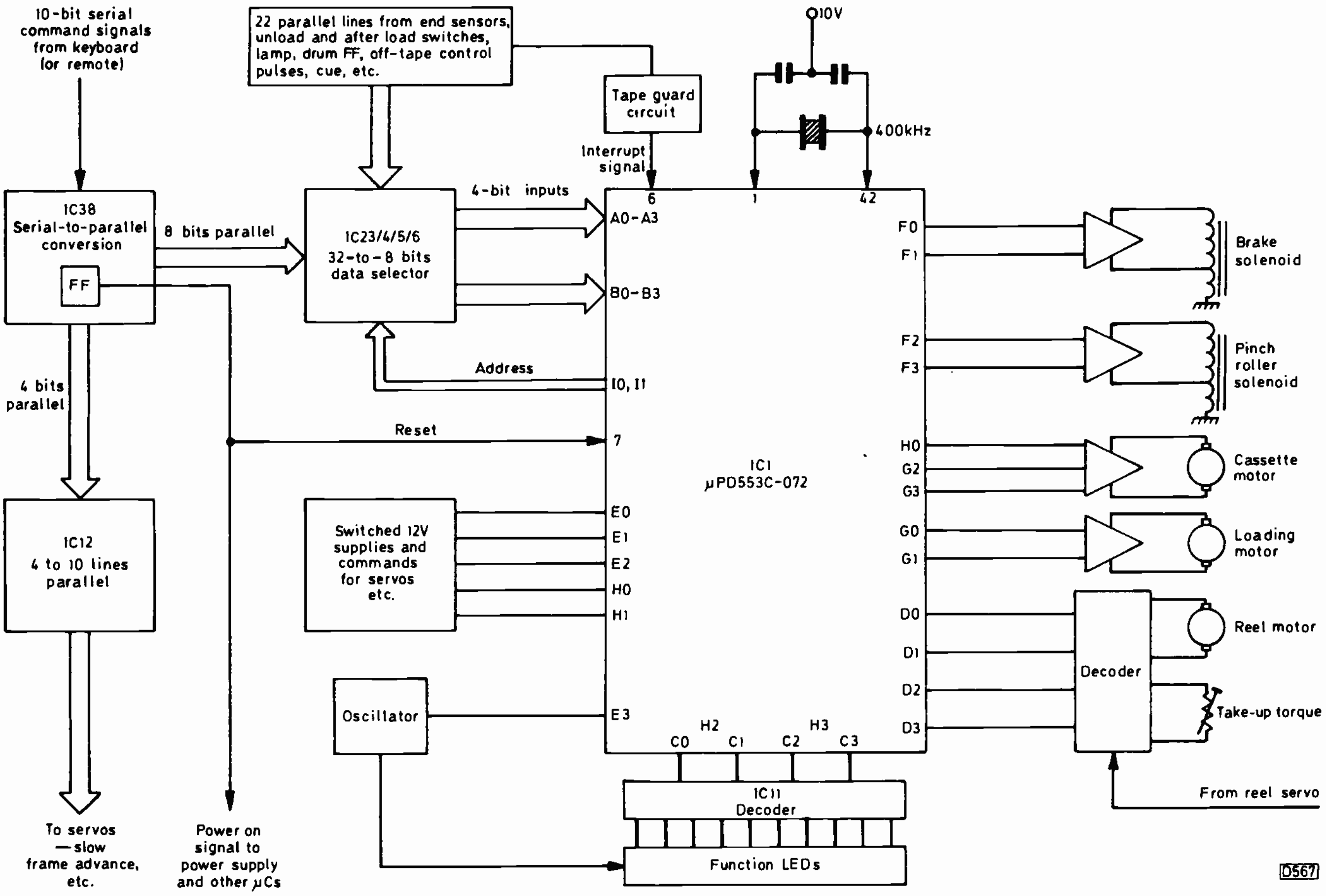


Fig. 68: The microcomputer control system.

tracks, they can each be used to carry one of the bits and we have a parallel four-bit code.

The microcomputers used in the 3V23 employ four-bit codes. The inputs and outputs enter via what are called ports. Each of these is linked to a group of parallel data lines (usually four) which are numbered E0, E1, E2, E3 etc. where E is the designation of the port concerned. The microcomputer's operations are controlled by an internal oscillator (clock) that operates at 400kHz – the oscillator is linked to the ceramic resonator connected between pins 1 and 42.

When the mains supply is switched on, the microcomputers must be reset so that their programme starts at the beginning and not at some random point. This is done by taking pin 7 high momentarily. There is also an "interrupt" routine, which is started by taking pin 6 low. This checks the "tape guard" system for bulb failure, no drum FF pulses and no take-up reel rotation so that the machine can take the appropriate course of action.

Microcomputer Outputs

As can be seen from Fig. 68, the F port drives the two solenoids, each of which has a pull-in and a hold winding. The pull-in winding is energised for a brief period only, timed by the microcomputer. The G and H0 ports control the cassette and loading motors. The former loads or ejects the cassette while the latter drives the loading rings that pull the tape out of the cassette. As both these motors must be reversible, they are driven by a four transistor bridge circuit. The D port feeds a decoder to apply the appropriate torque to the reel motor, which is also reversible. The reel discs are driven via a movable idler wheel which is pushed in either direction to contact the supply or the take-up reel disc (see Fig. 69) depending on the motor's direction of rotation. The decoder circuit supplies the different voltages required by the motor – high for fast forward and rewind, less (adjustable) for playback. This avoids the use of a slipping clutch. During fast search a reel servo controls the tape speed, so the input from this goes to the decoder. We'll look at this circuit in more detail later. The H2, H3 and C ports control the LEDs at the front of the machine, via the decoder IC11 and a lamp-flash signal from the E3 port. So much for the outputs, now for the inputs.

Inputs to the Microcomputer

As well as the user commands from the keyboard, there are all the various safety checks (lamp failure, head stopped, etc.). The keyboard commands end up as eight parallel bits. The safety functions need 22 bits, so we've a total input of 30 parallel bits. This presents a problem as the microcomputer has only two four-bit ports available. To get over this the block labelled data selector is used.

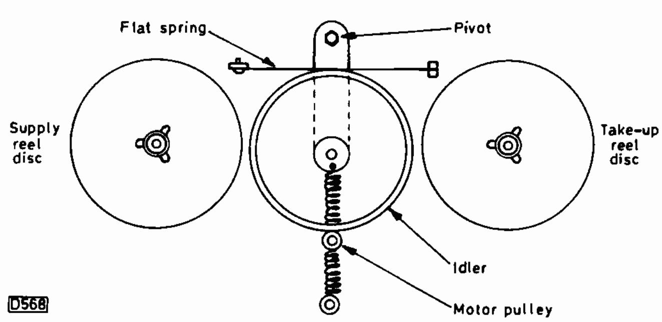


Fig. 69: Reel drive system.

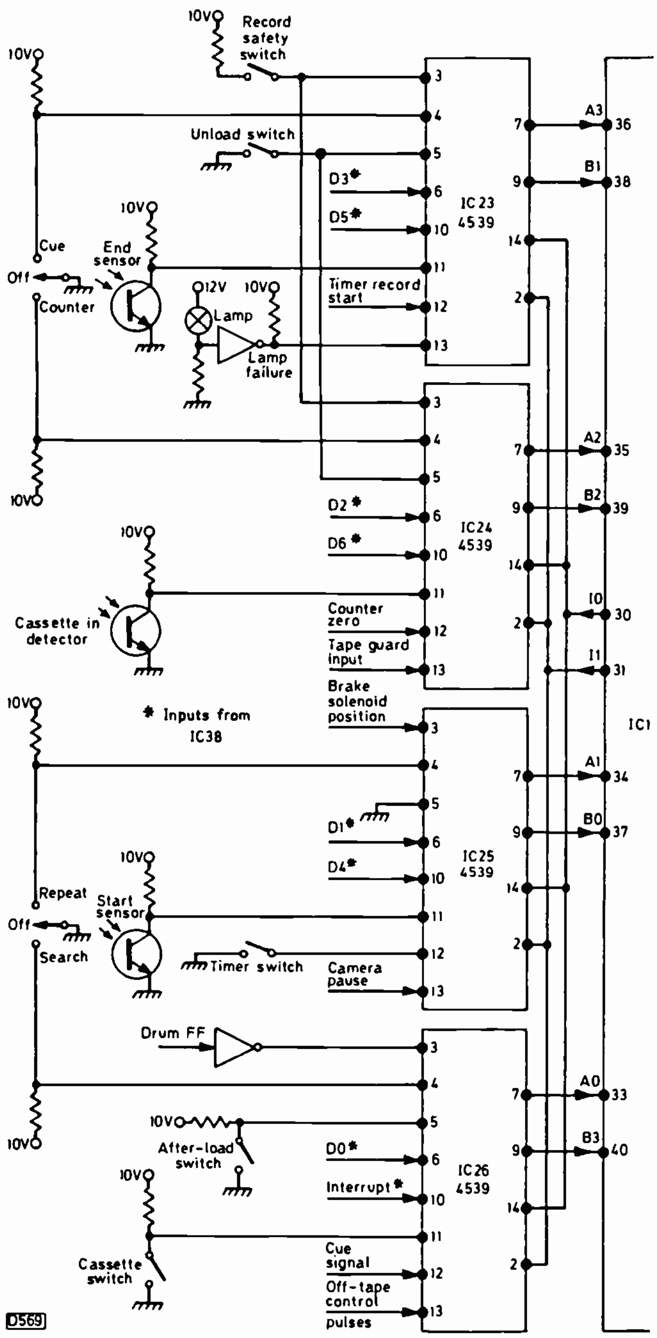


Fig. 70: Data selection arrangement.

See Fig. 70. Four type 4539 i.c.s are used here, each converting eight bits of parallel input data to two lines of serial output data.

Each of these i.c.s is addressed by the microcomputer's two-bit I port. There are only four possibilities with a two-bit code – 00, 01, 10 and 11 – so these are repeated in turn. Each address change allows two of the inputs to the data selector i.c.s to appear at their output pins 7 and 9. Thus for the four changes in the address code, all the inputs are switched to the output ports sequentially.

Most of the inputs shown in Fig. 70 are self explanatory. In manufacturers' information you will find a line over the top of many inputs and outputs. This indicates that the line goes low to indicate a change of condition, e.g. counter zero with a line over it indicates that the line goes low when zero is reached. To simplify matters, we've omitted these lines here.

The cue signal (IC26, pin 12) is recorded on the tape at the beginning of a recording, to enable this point to be found more easily. Further details of this later. The cue/off/counter and repeat/off/search switches are on the front panel, enabling the user to select different modes of operation, e.g. playing a recording from the start to counter 0000 then auto-rewinding and continuing ad infinitum. There are six possible combinations.

The tape guard input comes from a circuit that senses the following conditions: both reels and the head rotating. If these conditions are not met the machine stops. The D0 to D6 inputs are the command signals. The input to IC26 pin 10 is another command signal – the result of a parity check to ensure that the command word has been read correctly. This input is normally high: if low, the command is ignored. Note that this is nothing to do with the input to pin 6 of IC1. This goes low if there's a tape guard warning, interrupting the microcomputer's programme and causing it to check all relevant inputs and take the necessary action.

User Commands

The keyboard circuit works in a similar way to many remote control TV hand units. It uses a special i.c., type M50115, which produces five key scan signals (see Fig. 71). These are linked back to any of five inputs, giving the possibility of up to 25 key-selected functions. Only 13 are required. When a key is pressed a ten-bit serial output is produced at pin 17. If two keys are pressed simultaneously there's no output. We need to press two keys at the same time when recording or when in audio dub, so these keys operate on pins 9 and 10 of the i.c. directly instead of via the matrix. Forget transistor X1 for a moment.

The serial output passes through gates which enable the remote control inputs to be introduced. The remote control hand unit is a duplicate of the manual keyboard. These gates are arranged to give manual control priority. After this there's a noise filter which unfortunately introduces some slight integration of the signal. So a Schmitt trigger is included to restore the signal's square shape. The following M50117 i.c. converts the signal to an eight-bit parallel one. After inversion the bits are fed to pins 6 and 10 of the 4539 data selector i.c.s previously mentioned.

The input to pin 10 of IC26 is for parity checking. Of the ten bits in the serial data feed from the M50115 i.c., one bit is added in such a manner that the total number of 1s in the ten-bit word is always an odd number. This enables missing or spurious bits to be detected. In this event pin 10 of IC26 goes low and the command is not accepted. In addition the command received LED doesn't light up.

The Power-on Command

Finally the power-on command. Remember that the mains switch at the rear of the machine is left on permanently. When the machine is "off", the 10V and 5·6V logic supply lines are present, so the oscillators in the M50115, M50117 and the microcomputer i.c. are running. The power supply is "off" because pin 11 of the MC50117 i.c. (IC38) is low. This pin is the output from an internal flip-flop (bistable). The output is low when pin 17 (reset) is low. When pin 17 is high *and* the correct serial input (1001010000) for "power on" is present at pin 16, pin 11 goes high (see Fig. 72).

When we press "on" (the switch stays in), or when the machine is in the timer mode and the pre-start signal

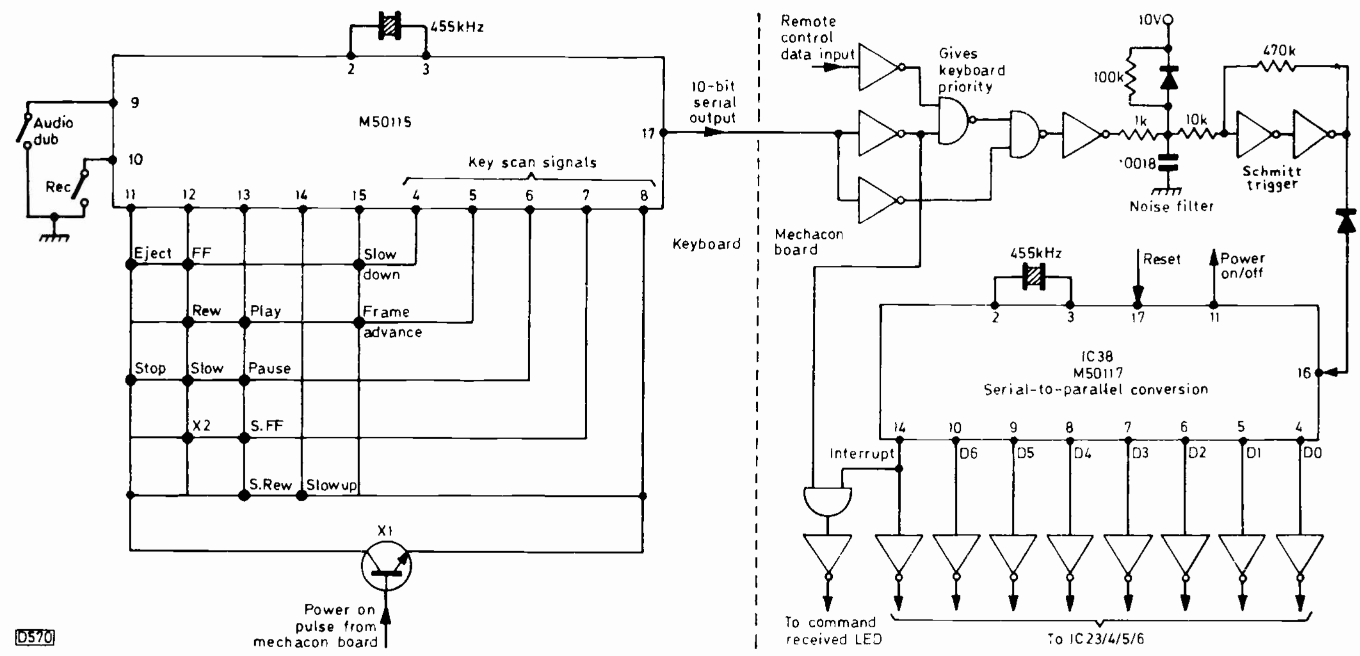


Fig. 71: The user command arrangement.

arrives from the tuner/timer board ten seconds before the time at which the machine has been set to start, the output at pin 4 of the AND gate in IC20 goes low. Pin 17 of IC38 thus goes high (via the inverter) while C14 in conjunction with the associated resistors produces a 250msec negative-going pulse which is squared and inverted by the following gates and is fed to the base of transistor X1 (back to Fig. 71) on the keyboard. X1 switches on, connecting pins 8 and 11 of the M50115 i.c., which as a result produces the "power on" signal for pin 16 of IC38. The decoder in IC38 sets the flip-flop and pin 11 goes high. The power supply switches on and all the microcomputers are reset.

When we press "off", the "on" key is simply released. There are no electrical connections. Pin 17 of IC38 goes low, pin 11 follows suit and the power supply is switched off.

If the mains supply was switched on with the "on" button pressed, the 250msec pulse might be produced before the 10V and 5·6V lines were fully established – the mind boggles at the possible consequences of this. The delay circuit in Fig. 72 prevents a pulse being produced

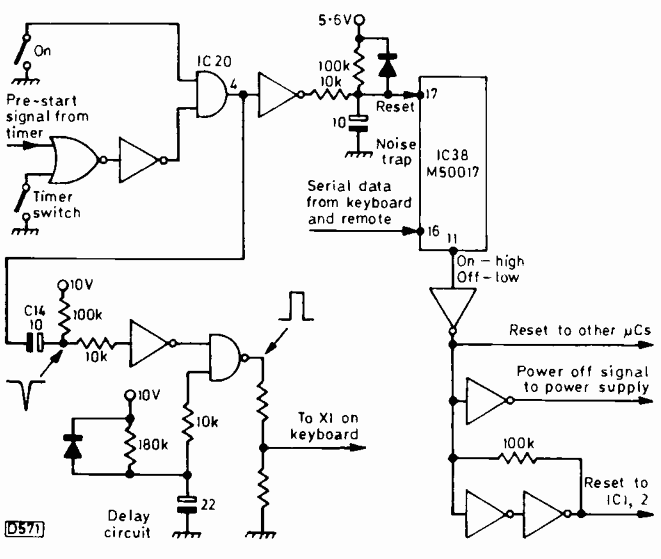


Fig. 72: Power-on switching system.

until about five seconds after switch on – it's then necessary to switch "off" then "on" at the front panel. The machine can be switched on and off by remote control provided the front panel switch is at "on", i.e. pin 17 of IC38 is high.

Next month we'll look at a bit more of this rather complex mechacon board.

Teletopics

UK VCR PRODUCTION

It seems that in addition to being one of the world's largest VCR markets the UK could soon become a major producer of the machines. The J2T joint venture run by Thorn at Newhaven is now on stream, assembling Ferguson machines from kits imported from JVC, and production is building up to the planned rate of 240,000 a year. The new announcements come from Sanyo and Mitsubishi. It had been hoped from the start that Sanyo would eventually assemble VCRs at the Lowestoft plant they took over from Pye. The go ahead has now been given for production to start later this year at an initial rate of 60,000 machines a year. The latest entrant in the field is Mitsubishi, who will be assembling VCRs for the UK/European market at their Haddington plant, again at an initial rate of 60,000 a year. In addition, Hitachi-Maxell have announced plans to build a £25 million plant for the production of video cassettes at Telford new town, Shropshire.

3D TV IN COLOUR

An add-on unit to give a 3D effect to the TV display has been announced by Saba and NordMende, both subsidiaries of Thomson-Brandt. It works on the well known principle of separating the green and red components of the picture, with the viewer having to wear red/green spectacles. The technique seems to be to extract one of the video signals, either red or green, pass it through a delay circuit and then reinsert it in the appropriate video channel. The delay is carried out on a small panel which can be added to models in the current Saba/NordMende ranges. This will cost some £25, inclusive of glasses. Installation is simple since the connections are made by means of plugs and sockets. The idea is similar to the "synthesized stereo sound" now used in some sets. Operation of the remote control unit brings the circuit into operation: when the saturation level is increased to a certain point, the 3D circuit is switched in. This is neat since additional output is presumably required to compensate for the loss due to the spectacles.

The system works with standard TV transmissions/tapes and has the advantage over previously demonstrated systems that the display is in full colour. We haven't at the time of writing had an opportunity to observe the results, so can't comment on the quality of the display.

CONSUMER PRESTEL PROJECT

A pilot project is being started in the Birmingham area to test domestic consumer reaction to Prestel. The project is being backed by £100,000 from the Department of Industry and is being run by Viewtel, a subsidiary of the Birmingham Post and Mail group. Subscribers will be provided with a Prestel terminal for the same rental charge as a teletext set for a six month period, after which the rental will be increased by £3 monthly. There's a subscription fee of £4 a month, but users will pay only local call charges instead of a page charge for the use of the information available from the computer. It's hoped to persuade some 2,500 of the potential 300,000 users in the area to join the scheme – known as Club 403, after the Prestel page on which the information starts – during the first six months' operation. Services provided will include shopping, banking and booking via Prestel. More than 25 companies are participating, including Lloyds Bank, Debenhams, American Express, Bejam, the National Bus Company and several building societies. It should certainly provide an interesting check on potential domestic consumer demand for viewdata services. Eighty five per cent of current Prestel users are business firms.

WHICH? ON VCRs

The January issue of *Which?* reported on VCRs. Whilst V2000 system machines provided the best still pictures and slow/fast motion displays, their reliability was found to be rather worse than that of VHS and Betamax machines. Twenty eight per cent of all machines had required servicing attention, but this rose to 56 per cent with V2000 machines. Panasonic turned out to be the most reliable brand in the sample – only 14 per cent required attention. Some ex-guarantee repairs can cost as much as £100. Readers of *Which?* recorded off-air for six hours a week on average, with six hours playback and a further three hours use of prerecorded tapes. Sixty per cent bought or rented prerecorded tapes regularly.

ITT's LATEST SETS

The new ITT CVC1100 chassis was mentioned in this column last month and an account of its novel switch-mode power supply appears on a later page this month – the chassis is known as the Pico. Three new models fitted with the chassis have now been announced, the 14in. CP2212 and two 16in. models, the CP2342 and CP2352, the latter having ten-channel infra-red remote control.

Another new chassis, the CVC1200 series chassis, has been announced. This will be used to drive the larger-screen 22 and 26in. models with 110° tubes. The CVC1204 is the standard version with the CVC1203 incorporating frequency-synthesis tuning. Features include class AB video output stages and a chopper power supply that provides mains isolation.

In future ITT will be supplying V2000 system VCRs to certain large customers only. Dealers will be offered ITT's VHS machines.

LATEST VIDEO EQUIPMENT

Two interesting VCRs have been added to the JVC range. The HR7350EK is the first mid-range model to have two-channel audio capability, bringing stereo sound to a wider market. Simultaneous transmissions on TV/f.m. stereo radio can be recorded via the audio recording select switch. As a further improvement to the sound quality the machine is equipped with a Dolby noise reduction system. The machine comes with full-function wired remote control.

The HR7600MS is a new multi-standard machine which can record and replay signals from nearly all the world's TV broadcasting systems. System selection switches and automatic detection circuits choose the appropriate circuitry for the input signal. An automatic detection system similarly identifies the standard on which a tape was recorded and plays it back through the appropriate circuit for display on a switchable multi-standard monitor. Amongst the many features are the usual playback effects, insert and assemble editing, Dolby noise reduction and infra-red remote control.

Canon is the latest photographic firm to enter the video market, with a portable VHS system produced by

Matsushita (Panasonic). Canon have added their own features to the camera, including the CAFS auto-focus system and motorised zoom lens. The equipment will be distributed through photographic outlets.

Visionhire, which previously concentrated on V2000 machines, is now offering VHS machines in quantity.

BBC SERVICES

The BBC is to start regular transmissions of computer programmes (telesoftware) this month, via teletext. An adaptor costing £225 will be required to link the teletext receiver to a BBC-Acorn computer. Experimental telesoftware transmissions have been carried out over the past five years: the results of some of these experiments have been reported in this column.

For professional users the BBC and the computer bureau Datasolve are to start a service called World Reporter. Information provided by the BBC – mainly news and economic reports – and by *The Economist* will be stored in the computer at Datasolve's Sunbury headquarters and made available over various links depending on location.

FERGUSON'S "ULTIMATE SECOND SET"

A 16in. colour portable equipped with teletext, Model 37023, has been added to the Ferguson range. The basic chassis is the TX9 and the aim is that when the optional battery adaptor is used teletext can be received under a wide range of circumstances.

SERVICE BRIEFS

Servicing comments from the latest issues of *Philips Link* and *Ferguson Feedback.*

Philips G11 chassis: To avoid random mains fuse blowing, a 1Ω 4W resistor (part no. 113 80245) can be connected in series with the anode of each of the mains rectifier thyristors 4018/4020. Crop the leads and fit neatly between the thyristors and filter coil 4009.

Philips KT3/K30 chassis: An occasional complaint is spurious shut-down of the h.t. supply. The following points should be checked: the mains supply plug, socket and fuse for possible intermittent contact; the h.t. control adjustment; the c.r.t. Aquadag and protection band earth connections and, on the K30, the e.h.t. lead connections at both ends; also check for dry-joints that may cause arcing, and for poor edge connections to modules. In later production an 0·1μF capacitor is fitted between the base and emitter of transistor T7336 on the power supply control panel to avoid an h.t. variation at switch on, change of channel or sometimes when retuning. It's worth adding this capacitor where not fitted. It's also worth changing the value of R7354 on this board from 270Ω to 560Ω, but before doing so make sure that a 2·7Ω resistor is not fitted across R1461 on the mother board. If this resistor is present, remove it before altering the value of R7354 or fitting the later BY02 version of the panel.

Philips G7000 games unit: Where interference from a local TV transmitter is experienced, the output from the u.h.f. modulator can be adjusted over a range of approximately three channels by means of the oscillator coil L650 – this can be identified as the larger hole in the modulator's screening cover.

Thorn TX9 chassis: Horizontal picture displacement occurs if either R212 or R217 (220kΩ) goes high-resistance or open-circuit. In earlier production 0·5W carbon film resistors were used in this position. In later production high-voltage metal glaze resistors (part no. R6220-GM02-MU18) are fitted – this type should be used for replacement purposes.

Thorn TX10 chassis: In earlier production the power supply control i.c. was type TDA2576 and R691 on the signals panel was 820Ω. In later production the i.c. is type TDA2576A and R627 (in the R691 position) is 15kΩ. Colour flicker or loss of colour on adjusting the height control can occur if these components are incorrect after replacing one of the panels.

CB Interference: The blocking diodes in series with the sliders of the tuning potentiometers can rectify interference signals, e.g. from CB equipment, with the result that the set goes off tune. The effect can be reduced by decoupling the tuner's tuning pin (pin 5 with the SC4 tuner), using a 470pF ceramic capacitor.

THE HITACHI VT11

Derek Snelling writes: We've had several deliveries of the new Hitachi VT11 VCR and now that the service manual has come along I can provide a brief summary of how it compares with previously released models. Its styling is certainly distinctive, and at under £400 with freeze frame, visual search forwards and backwards, an electronic counter and wired remote control it represents good value. Comparing it with the 9000 series enables one to see where economies have been possible. Thus the drum motor is now a single-phase direct drive instead of a three-phase type, while the capstan motor is a d.c. instead of a three-phase type. There's no separate fast forward/rewind motor, these actions being provided by pulleys driven from the capstan motor (a step backwards in my opinion). So the mechanical chassis is completely different. The signals circuitry is the same, though the layout and panels are different. The servo systems differ in that phase control of the motors is now carried out digitally. Naturally this means different control i.c.s – the number of different microprocessor i.c.s used in the various machines is beginning to reach ridiculous proportions.

All in all a nice machine for the price, and another new design apart from the signals circuits. In the past two years we've had from Hitachi the VT8000/VT8500, their follow-ups the VT8300/VT8700 with slightly changed power supplies and a redesigned servo control panel, then the completely new VT9300/VT9500/VT9700 and now the almost entirely new VT11 – and this doesn't include the portables. It's getting rather difficult to keep up – and other manufacturers aren't much better!

RECENT BOOKS

A new edition, the seventh, of Newnes *Television Engineers' Pocket Book* has been published. The book has 324 pages and costs £7·95. Extensive revision has been required since the last edition was published in 1973. This has been admirably done by Malcolm Burrell. There is extensive coverage of switch-mode power supplies, and chapters have been added on teletext/viewdata and on video equipment, including VCRs, disc systems and cameras. A most useful guide to the circuitry used in TV and video equipment and servicing procedures – and a very thorough up-date throughout.

Newnes have also published a *Beginner's Guide to Video,* by David K. Matthewson. This covers a wide range of subjects from basics to video games and various projection systems. Useful for reference as well as serving as an introduction to the subject.

Routine TV Receiver Tests: Thorn 8000 Series Chassis

S. Simon

WE'LL deal with the Thorn 8000 series chassis in two parts. This first instalment covers the original 8000 chassis: a following article will cover later variants such as the 8500 and 8800. The original 8000 design ran concurrently with the 3500 series chassis, providing a small-screen, low-cost alternative.

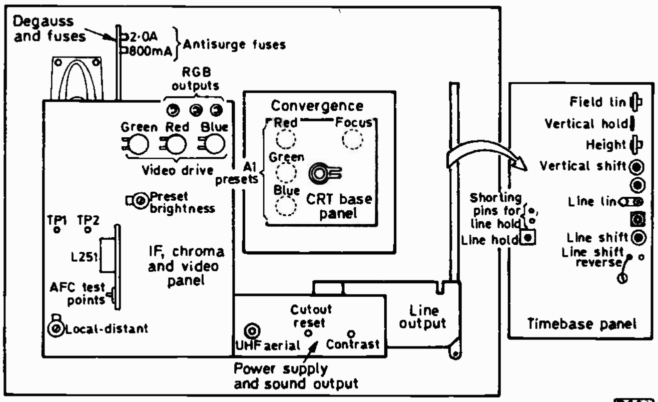
Layout

Viewed from the rear, the chassis forms a box around the tube which carries the convergence controls on a panel mounted at the rear of the scan coils, with the focus and first anode presets on the tube base panel (see Fig. 1). The small 17in. tube required only a low focus voltage, which is derived from the same source as the supply for the first anodes. The first anode presets are on the left-hand side of the base panel with the focus control at the top right. If this tube control layout is not present, you're not dealing with the original 8000 chassis and the focus unit will be found at the lower right-hand side, presenting a more orthodox appearance.

Over on the extreme left-hand side is the solitary mains "dropper" resistor, mounted vertically. The two lower sections comprise R721, 12Ω. This is the surge limiter, which is a primary suspect in the event of no results other than the tube's heaters glowing. The upper section R709 (47Ω) is the h.t. smoothing resistor. This seems to fare better, being subject to less stress. The power pack is at bottom centre – on later versions it's on the left-hand side and is more accessible.

The a.c. from the surge limiter reaches the power panel at pin 2 of socket 9 (see Fig. 2). It's fed to a BY127 rectifier which is included to take the pressure off the following thyristor W703 (BRC4443). The BY127 will often be found in a distressed condition for no apparent reason, and this is another common cause of the no results symptom. The associated print may have to receive attention.

The large panel on the left-hand side contains the signal circuits – the i.f. strip and the colour decoder up to and including the RGB output stages. Three plugs at the top of the board supply the RGB outputs. On the early type panel there are three i.c.s and a lot of transistors. In contrast, later versions have more i.c.s and fewer transistors.



Note: Positioning and layout of the AFC panel may differ in some receivers

Fig. 1: Rear chassis view.

The large panel on the right-hand side contains the field timebase, including the class B output stage, also the line oscillator and driver stages. The line output transistor is mounted on a separate insulated heatsink at the centre next to the transformer, under the tube to the right of the power panel. The e.h.t. rectifier is in a small housing screwed to the front of this lower centre section: it consists of two rectifiers connected in series, with no doubling capacitors, and is arranged in a U-shaped configuration.

The Tuner

The tuner unit is of the simple four-button, push-bar type which suffers from two basic faults. The first is the obvious one where the push-bar is loose in the forked arms – or the arms may be fractured. This is a mechanical fault and requires no more than a general tighten up and resoldering. The second condition is more obscure but still well known: the symptoms are that channels at the lower end of the band (say 21 to 33) are intermittent or cannot be received at all. It's caused by poor earthing or contact between the earthing leaves of the bulkhead and the tuning capacitor's rotary spindle. This is normally due to the presence of grease, which is non-conductive, or loss of tension between the leaf spring and the rotor. In any case the correct procedure is to unsolder the two leaves at the oscillator-mixer end, bend them into shape, and clean off all the grease on the rotor spindle. Refit the leaves and solder them securely. The alternative is to spray a degreasing agent such as Aero-Kleen on to the grease whilst rotating the spindle. This may prove effective, but removal of the springs is the proper and lasting cure.

IF Strip

The i.f. input is the next trouble spot. Poor reception is generally blamed on the tuner, but in a lot of cases intermittent or constantly grainy signals are due to the plug and socket connection at the bottom left of the signals panel, where the output from the tuner is fed to the input of the i.f. filter unit. No more than a movement of the plug is often all that's required to clear up the condition, but it's also often necessary to tighten things up generally and perhaps resolder the coupling capacitors on the reverse side of the panel.

A faulty transistor in the i.f. strip will result in a more drastic loss of gain, and the a.g.c. circuit and preset control should not be overlooked.

Colour Faults

Loss of colour is a common fault on these receivers, and the following procedure is recommended. First check

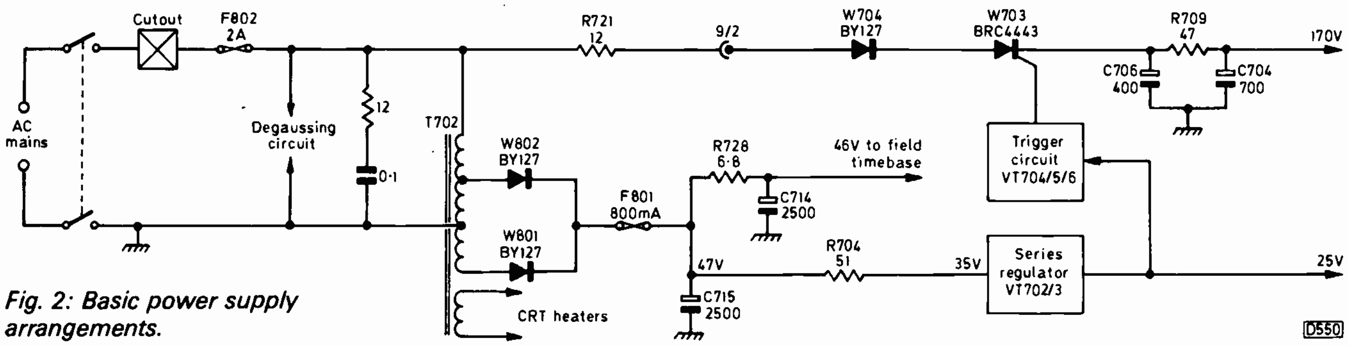


Fig. 2: Basic power supply arrangements.

resistor R404 (33kΩ) which is mounted on the lower edge of the right-hand side timebase panel. This is the burst gate pulse timing resistor and frequently changes value. Next suspect the f.e.t. d.c. amplifier VT110 (BF256LC) and the 4·43MHz crystal. Whilst the crystal is rarely suspect in most receivers it's a common offender in these models and much time can be wasted if this is overlooked.

After this a general check on the transistors, testing their conductivity cold and their working voltages, should reveal the weak link if a scope is not available to monitor the waveforms in the decoder.

Loss of one colour is another common complaint. It's often due to a poor connection at the top of the signals panel in the vicinity of the three output plugs. A careful inspection and check from the socket back to the collector of the output transistor in the relevant channel will often be rewarding. A simple voltage check at the tube base cathode connections can be misleading. Examine the print at the rear of the signals panel and the connections to the peaking coils. If these connections are good and the transistors turn out to be in order, the trouble may be farther back in the MC1327/SN76227 i.c. (IC3) which is d.c. coupled to the output transistors.

The Timebases

The field timebase is relatively trouble free, the main problems being the occasional dry-joint or the odd transistor failure. Concentrate on the top of the board, looking for the tell-tale signs of dry-joints, mainly to the output transistors VT410/1. These are a matched pnp/npn pair and are preceded by a Darlington driver stage VT408/9. The oscillator consists of another pnp/npn combination, VT406/7, with a single timing capacitor C430 (0·47μF). If the transistors are in order, a possible trouble spot is the field R/G balance control R460 which can develop a dead spot or become dry-jointed.

When dealing with loss of height, don't omit to check the bootstrap capacitor C438 (10μF). The field scan coupling capacitor C439 (160μF) is a prime suspect when the loss of height is almost total.

The line oscillator and driver stages occupy the front centre of the panel downwards, and some irritating troubles can occur here. The line driver transistor VT402 is an MJE340 which is operated from the 170V h.t. rail. It can fail for no good reason, but don't ignore diode W417 (1S44) which is connected between its base and emitter. This can also fail and remove the line drive.

The line drive is taken from the timebase panel to the line output transistor on its detachable heatsink via a two-pin plug and socket. Compared to later models in the series, the output transistor's base-emitter circuit is very simple and replacement of the BU105 transistor takes only a matter of minutes. This is as well, since it's a frequent cause of an h.t. short-circuit. Use the more reliable BU208 as a replacement.

The e.h.t. rectifier occasionally shorts, promoting the demise of the transistor, and once in a while this will result in shorted turns in the line output transformer. The latter is otherwise quite reliable. On the subject of the little U-shaped e.h.t. units, it's a good plan to keep a few in stock since they often save replacing the line output transformer in those Thorn monochrome portables (Ferguson 3840 etc.) that have a combined rectifier/transformer assembly – when the rectifier shorts, as it often does, an additional one can be wired in series to return the set to its normal working condition. The insulation and mounting of the units used in the 8000 chassis make them wholly suitable for the job.

The Power Supply Panel

The power supply panel is under the centre section and is not so easy to get at compared to later chassis in the series, where the panel is on the left-hand side. Access is not too bad however, and the panel can be removed once the connecting plugs have been pulled off.

Examination will show that transistor VT701 is at one end and VT702 at the other. VT701 is another MJE340, used this time as the audio output transistor. It's often the cause of no sound. Check its collector feed resistor R703 (1·2kΩ) first as this is often dry-jointed. Diode W701 can go short-circuit to cause the same condition.

VT702 is the 25V series regulator transistor, type MJE520. In the absence of the 25V rail the h.t. circuit cannot start up, so here we have another possible cause of the no results symptom. The supply to the collector of VT702 is derived from the mains transformer via a pair of BY127 rectifier diodes (W801/2), an 800mA fuse (F801) – these three items are mounted on the degaussing panel – and a 51Ω wirewound resistor (R704). VT703 is the error detector transistor in this circuit, working in conjunction with the 6·2V zener diode W702. R706 enables the 25V supply to be set up.

Three transistors are used in the circuit that produces the pulses to trigger the h.t. regulating thyristor. These are VT704/5/6. This circuit is basically reliable and it's the associated components that are most likely to cause trouble – R720 (150kΩ), W705 (1N4005), W706 (1S44), R724 (100kΩ) and C712 (0·47μF). It takes only a moment to check these items and the effort can be most rewarding.

The Tube

The 17in. tube used in these sets has a fairly useful life and can be reactivated without too much trouble. This action should be delayed as long as possible however, as the effect is not likely to be lasting. Whilst postponing the day of reactivation, set the contrast control to as low a level as can be accepted to avoid colour smearing.

Long-distance Television

Roger Bunney

NOW that the festive season has passed and another year has drawn to a close one can sum up the reception of 1982. The verdict must be pretty good. The F2 layer conditions during the autumn were not as good as in the past couple of years, but this shortfall was made good by some excellent Sporadic E openings during the year – unusually, these conditions extended into the early autumn period. There were two good tropospheric openings in mid-September and late October, and an increasing though as yet small number of enthusiasts have been active in the 3·6-4·3GHz band – as equipment, components and practical constructional details have become more readily available. Results have been encouraging, despite the use of relatively small dishes etc. For some, the end of BBC transmissions in Band I has left the spectrum clear for DXing – at least for the next few years!

What will 1983 have to offer? It's unwise to predict, but F2 reception is likely to be only a memory, with perhaps an occasional token appearance in the most southerly part of the UK. We must hope for improved SpE reception. Interference in Band I is likely to increase – apart from the 50-52MHz amateur band (for experimental use outside normal TV hours) there'll be an increase in the use of cordless phones (of both the legal 47MHz and the illegal 49MHz varieties) while yet another CB band is being established commercially on unauthorised frequencies (see later).

I feel that greater emphasis will have to be placed on improved technical standards in the receiving equipment in order to avoid the adjacent frequency interference problems that will arise. The improvements necessary will concern front-end amplification with a wide dynamic range, low noise and perfect linearity, plus optimum filtering for bandpass, bandstop and notching.

This month's log reflects the minimal reception typical of December.

1-4/12/82 Auroral activity in the northern UK on chs. E2 and R1.
5/12/82 RTVE (Spain) chs. E2, 3, 4.
6/12/82 RAI (Italy) ch. IA.
7/12/82 Ch. R1 reception via F2 during the late morning. The MUF across the N. Atlantic rose to 44MHz during the afternoon. A massive aurora was reported during the evening.
10/12/82 Dubai ch. E2 received at 1200-1235 via F2.
11/12/82 RTVE E3; JRT (Yugoslavia) E3; TVR (Rumania) R2.
12/12/82 TSS (USSR) R1 via F2.
13/12/82 Auroral activity in the northern UK with TSS R1 and SR (Sweden) E2, 3 plus unidentified signals and the usual noises, 1800-2100.
14/12/82 Further auroral activity reported from the north, mostly unidentified programmes.
19/12/82 GBC (Ghana) E2 received via mid-day F2. North Atlantic MUF rose to 43·275MHz during the afternoon.

The above reception is via SpE unless otherwise stated.

High-pressure systems settled over the UK during the Christmas period, giving improved tropospheric reception from the 29th to the 31st, mainly from TDF (France) on the 29th and, as the pressure dropped on the 31st (it peaked at 1036mb here at Romsey) there was very good reception of W. German Band III/u.h.f. stations, NOS (Dutch) outlets for approximately two hours in the early morning and, apart from the "usual" French signals, ch. 5 (new French allocations) was noted with Antiope tests on the 625-line system L.

My thanks to Ryn Muntjewerff (Holland), Iain Menzies (Aberdeen), Arthur Milliken (Wigan), Reg Roper (Torpoint), Kevin Jackson (Leeds), Hugh Cocks (E. Sussex) and Graeme Wilson (Middlesbrough) for their reports which supplemented my rather meagre loggings this month.

Following my usual practice, I've not commented on MS reception, which is both fleeting and very common. Suffice it to mention that the Geminids shower in early December produced some good results, particularly on the 6th.

News Items

Citizens' band: Advertisements have appeared recently in CB magazines for an illegal (to use) transceiver that operates over forty channels in the 47·6-47·99MHz spectrum. This is above the recently legalised 47MHz cordless phone allocation and is "currently unused for any other UK service". The units have an output of some 5W and a range of over fifteen miles using unloaded aerials.

Luxembourg: An RTL transmitter is in operation on ch. E24 at Marnach (near Clervaux) beaming just south of west. The 10kW transmitter uses system G PAL and at the time of writing carries colour bars from 0900-1200. It's suggested that it will relay ch. E7 RTL when system B conversion occurs.

W. Germany: New u.h.f. transmitters offering regional variations for the Hamburg area will be Hamburg ch. E28 (500kW), Brockstedt ch. E56 (500kW) and Tarkau ch. E53 (20kW). An authoritative source comments that there are no plans to close any more Band I transmitters – they are too useful in providing coverage extending into E. Germany! French TV is transmitted in W. Berlin using system B/G, primarily for the French forces but also reaching viewers in E. and W. Berlin.

E. Germany: There has been a considerable expansion in TSS-1 transmissions for the Russian forces, using system B. These are generally on ch. E12, but there are variations such as u.h.f. and ch. E4. The programmes have been seen in Berlin, Dessau and Erfurt. Interference is at present being experienced in the Rochlitz (W. Germany) area from a nearby TSS-1 outlet on ch. E4 – the service

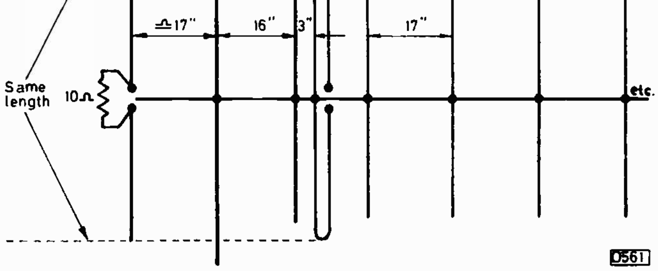


Fig. 1: John Beech's modified Yagi system. The dimensions shown apply to the 144MHz amateur band.

affected is the BR-1 Ochsenkopf outlet on the same channel. The TSS-1 relays generally have outputs of a few mW to a few watts and receive programmes either via direct microwave links through Poland or via the 3·675GHz Gorizont downlink.

Italy: There have been several reports during the past two years or so of f.m. radio stations operating in Band I. The Benelux DX Club comments that the signals are actually from studio to transmitter links – the 50-70MHz band is used where there is no local Band I TV transmitter.

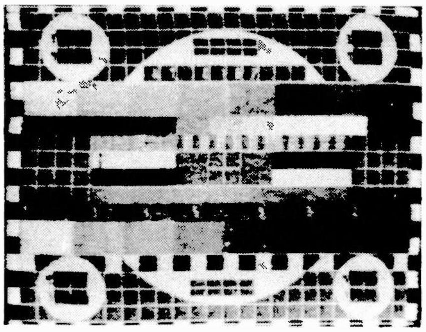
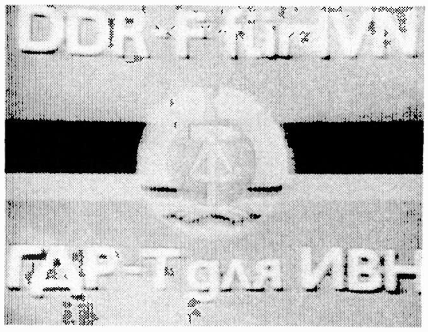
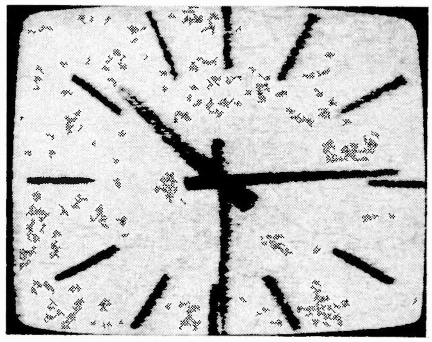
Improved Yagi

Pat Hawker's Technical Topics column in the November issue of the RSGB magazine *Radio Communication* mentioned work carried out by John Beech (G8SEQ) on improving the directional characteristics of the Yagi aerial. A standard 12-element Yagi aerial has a front-to-back ratio of 25-30dB, depending on the design of the reflector system. John's modifications (see Fig. 1) have improved this to achieve a front-back ratio approaching 70dB! The main addition is the "absorber element" mounted behind the reflector. It's cut to the same resonant frequency as the dipole and is isolated from the boom: the terminals are linked by a carbon, i.e. non-inductive, resistor whose value is equal to the element's centre impedance when mounted on the boom. For experimental purposes a 100Ω preset can be used, the element itself being moved along the boom to establish the position that gives optimum results. The sheer size of such an array would be a discouragement to its use in Band I, but it's a practical proposition for use in Band III and above (John's research was carried out in the 144MHz band).

Satellite Update

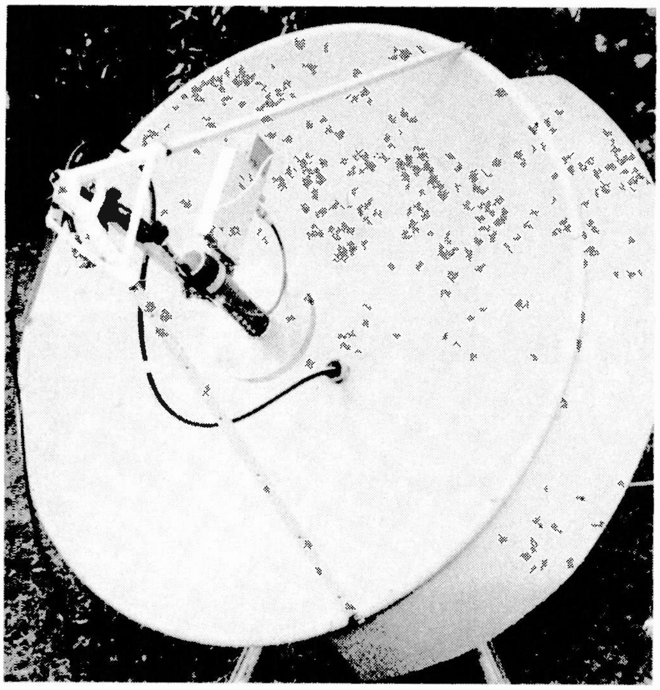
Interest in satellite TV reception has increased considerably over the last twelve months. Cost is unfortunately the major stumbling block when it comes to the main interest of enthusiasts – reception of signals in the 4GHz band. The electronics can cost several hundred pounds and the dish a similar amount. At the time of writing it's possible to buy from the USA a kit for $395 consisting of a single down-coverter system with image rejection giving tunable coverage over 3·7-4·2GHz. A front-end low-noise amplifier, usually a two- or three-stage gallium-arsenide f.e.t. arrangement, would add perhaps $4-500. So for $1,000 it should be possible to purchase the complete electronics for a budget 4GHz package, including the feedhorn, giving remodulated (at v.h.f.) video/audio signals. It may be necessary to add some 25-30% import duty to these prices. Imported systems can be bought in the UK, generally over £1,000.

The alternative approach is to tackle 4GHz reception on a DIY basis – Hugh Cocks can at present offer appropriate components and a PCB. My simple 4GHz converter (featured in the November issue) used imported microwave units, but even this very basic approach, with no amplification prior to the mixer, costs over £100. Apart from the Gorizont 3·675GHz signals, other satellite signals are at a very low level, with the result that a 6ft dish and pre-mixer amplification using a good LNA are essential. Two sources of suitable dishes are Harrison Brothers of Westcliff-on-Sea, Essex – their range of aerials and accessories includes a budget 6ft dish – and Metspin Ltd. of Emsworth, Hants. The Harrison dishes are of petal construction. Metspin can supply spun dishes from 4ft upwards.

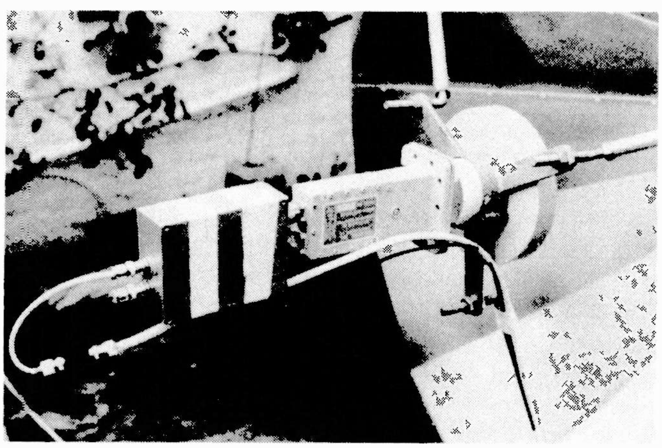
  

Left: Reception of Moscow ch. 1 via the Gorizont satellite at 3·675GHz by Nick Harold, using a 4ft dish. Centre: John Tellick's reception from the Gorizont satellite – a DFF (E. German) transmission. Right: Reception of the TSS-1 clock by T.S. Nanda Kumar in Madras. Transmission via the Ekran satellite at 714MHz.

Several enthusiasts have gone their own way. Nick Harold (Rochford, Essex) is using a 4ft ex-radar dish (9GHz) with a Birkill hybrid feedhorn. A SAM socket with integral quarter-wave stub extracts the signal and feeds it to a two-stage LNA which uses two Mitsubishi MGF1400 gallium-arsenide f.e.t.s. The signal is then converted to u.h.f. by an Aventek mixer and BFR91 local oscillator (working at 3·2GHz) and amplified by a standard Teldis 1450LN head amplifier. The indoor system consists of a Mullard ELC1043/05 tuner (tuning over 430-860MHz gives coverage of 3·63-4·06GHz) followed by two NE592 amplifier chips and an NE564 acting as a video demodulator phase-locked loop. After de-emphasis, a further NE592 provides video amplification with an output at 75Ω. Sound and an a.f.c. feed are also taken from the NE564 – the a.f.c. is essential to remove the 2Hz flutter due to the energy dispersal used with Gorizont. Nick has resolved the usual Gorizont signals, also signals from the Raguda satellite at 35°E, obtaining watchable pictures in both cases. Signals from the three Intelsats at 18·5, 24·5 and 34·5°W can only just be detected with the 4ft dish.



Nick Harold's head unit, with low-noise amplifier, used in conjunction with a 4ft ex-radar dish.



John Tellick's US head unit which is used with a Harrison 2m petal dish.

John Tellick (Surrey) worked in the USA last summer and took the opportunity to purchase a complete system – a receiver, Dexcel LNA and down-converter. To this has been added a 2m Harrison petal dish. Interesting that domestic 4GHz viewing is becoming so widespread in the USA that the equivalent of the UK Comet Warehouses are offering systems at discount prices, while most US enthusiast magazines such as *Radio-Electronics* carry advertisements for cheap 4GHz systems. Once John had sorted out the 120V/240V situation the system was assembled and worked immediately. He can now view Gorizont at 19°W on both channel 1 (European spot beam) and the other two global beam channels. In addition, experimental reception of certain Intelsat downlinks (e.g. Spain, Brazil, Argentina, Morocco etc.) is possible.

Hugh Cocks is now using a 10ft dish obtained surplus from a research establishment. Amongst other things he's been working on the use of a local sync source to phase the local and incoming sync pulses – this technique has proved most helpful with some of the more marginal signals. Experimental reception from Indian and Atlantic Ocean Intelsats has been achieved, perhaps the most exotic reception being an Omani downlink from the 60°E satellite, some 40dB down on the Gorizont European spot beam.

Miscellaneous Matters

The February/March issues of *Ham Radio* contained an excellent article on the theoretical and practical aspects of meteor shower reception, biased towards amateur radio of course. *Satellite TV News* is currently running a series by Hugh Cocks on a 4GHz DIY satellite receiver. Back copies are available (the series has been going for several issues already).

Due to shortage of space, I've had to hold over the letters section till next time.

ITT's Chopper Circuits

THE well-known ITT CVC20-CVC32 range of chassis employed a BU126 chopper transistor with a separate driver stage, the control circuitry being incorporated in a TDA2640 i.c. This i.c. also incorporated over-voltage and excess-current trips. By the time the CVC40 and CVC45 chassis came along in 1978 however the TDA2640 was no longer being supplied for use in new chassis. ITT switched over to the use of a discrete component switch-mode power supply, and in successive chassis have adopted various different approaches. The purpose of the present article is to take a brief look at the operation of these circuits.

Fig. 1 shows the chopper power supply used in the CVC40/CVC45 chassis in block diagram form. The chopper and line timebase circuits operate together, the input drive coming from a TBA920 sync/line oscillator i.c. while the line output transistor is driven by a secondary winding on the chopper transformer. The chopper circuit itself is of the series variety: when the chopper transistor T807 switches on, current flows through the chopper transformer's primary winding; when it's switched off by the drive at

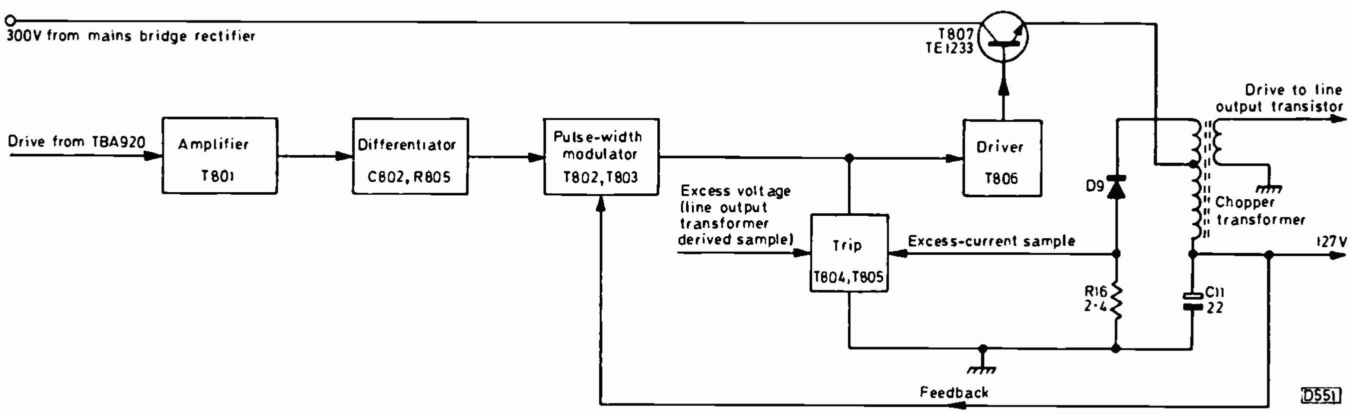


Fig. 1: Block diagram of the chopper power supply used in the CVC40/CVC45 series shassis.

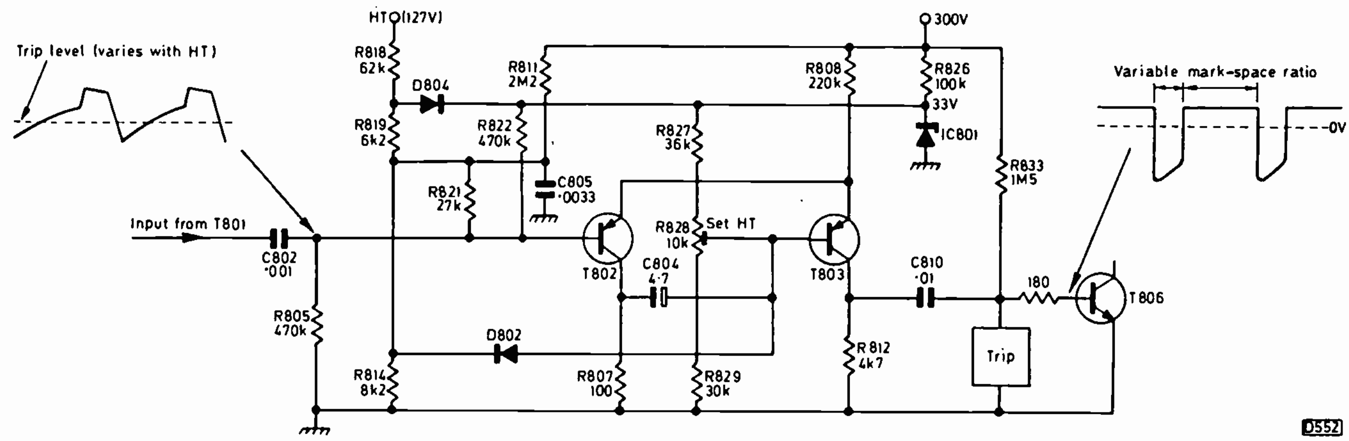


Fig. 2: The pulse-width modulator circuit used in the CVC40/CVC45 series chassis.

its base, the negative pulse that appears at its emitter switches on the "efficiency diode" D9 to maintain the current flow. C11 smooths the 127V regulated output.

Pulse-width Modulator

The circuit as described so far is quite conventional, but a rather unusual pulse-width modulator is used (see Fig. 2). This consists of a pair of pnp transistors, T802/3, in a Schmitt trigger arrangement. The rest condition is with T803 conducting due to the bias applied to its base via the potential divider network R827/8/9, and T802 cut off by the voltage developed across the common emitter resistor R808. The squarewave drive from the TBA920, via the amplifier stage, is differentiated by C802 and R805 and used to switch T802 on and off. When T802 switches on, the positive-going pulse developed at its collector is fed to the base of T803 via C804 with the result that T803 switches off. The point at which T802 switches on and off is controlled by the d.c. bias applied to its base, and as this is derived from the 127V h.t. rail via the potential divider R818/819/814 stabilisation is achieved. The variable mark-space ratio pulse waveform developed at the collector of T803 is fed via C810 to the base of the chopper driver transistor T806, which is switched off by the negative-going pulse excursions. R811, C805 and D802 are included to provide the correct conditions when the set is first switched on. A trip circuit shorts out the drive to T806 in the event of excess-current or excess-voltage conditions.

ITT80/CVC800 Series

The same basic concept was retained in the following ITT80 90° and 110° chassis and the small-screen CVC800/CVC801 chassis. The main changes are shown in Fig. 3. Different component reference numbers are used in the ITT80 and the CVC800 series chassis — we've used the ITT80 reference numbers here. Also the h.t. voltages differ (110V in the CVC800/CVC801, 122V in the ITT80 90° chassis and 148V in the 110° version), and whilst the ITT80 chassis use a TDA9503 sync/line oscillator i.c. the CVC800/801 use a TDA2593.

The first stage in Fig. 3, T611/612, is a complementary astable oscillator. This is free-running at switch on and is subsequently synchronised from the line oscillator chip. Unlike an astable multivibrator, the complementary transistor circuit requires only one time-constant network. Also unlike an astable multivibrator, both transistors are either on or off. Initially T612 will switch on, driving T611 at its emitter. The rising voltage developed across R617 is linked to the base of T612 via C611, with the result that T612 saturates. Base current then charges the upper plate of C611 negatively, and the two transistors switch off. The time-constant of C611 and the associated resistive network determines the point at which T611/2 switch on again.

The following stage T613/4 is again a Schmitt trigger used as a pulse-width modulator, the input to the base of T613 being shaped by C619/R618/R621. This time npn transistors are used, with T614 conducting until T613 is switched on by the positive-going portion of the waveform at its base. When the set is switched on, R643 forward biases the base of the chopper driver transistor T615, whose emitter current provides the 20V rail in conjunction with zener diodes D614 and D619 and the reservoir capacitor C616.

CVC1100 Chassis

With their most recent chassis, the CVC1100, ITT have come up with something quite different. The basic circuit is shown in Fig. 4, and consists of a self-oscillating parallel chopper circuit. It's a similar arrangement to the well known Siemens circuit, but operates at line frequency and uses a transistor (T713) to switch the chopper off. In this chassis the line timebase is independent of the power supply, though the two are synchronised via a winding on the line output transformer.

At switch on C653 and R654 feed 50Hz pulses to the base of the chopper transistor T715 to get the circuit started. During normal operation, T715 is switched on by feedback pulses from tag e on the chopper transformer — these pulses are fed back via a winding on the line output transformer, R722 and C714. With T715 conducting, a sawtooth voltage is developed across its emitter resistor R724 due to the collector circuit's inductive load. This positive-going sawtooth is applied to the base of T711 and appears inverted across its collector resistor R721, i.e. we have a negative-going sawtooth at the base of T713. At some point during the sawtooth T713 will switch on, shorting the base and emitter of the chopper transistor which in consequence switches off.

When T715 switches off the voltage at its collector swings positively and the h.t. rectifier D714 conducts, maintaining a current flow in the primary winding of the chopper transformer. When D714 switches off (voltage across C716 115V), the field around the transformer's primary winding collapses, producing the trigger pulse in the secondary winding to switch T715 on again.

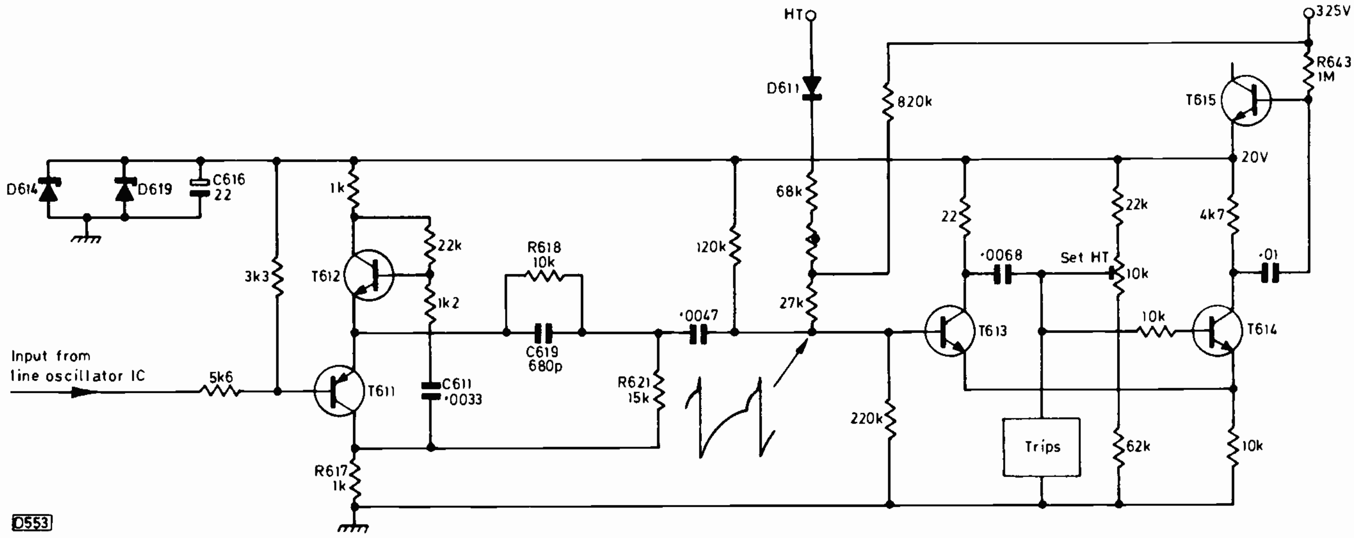


Fig. 3: Chopper control circuitry used in the ITT80 chassis.

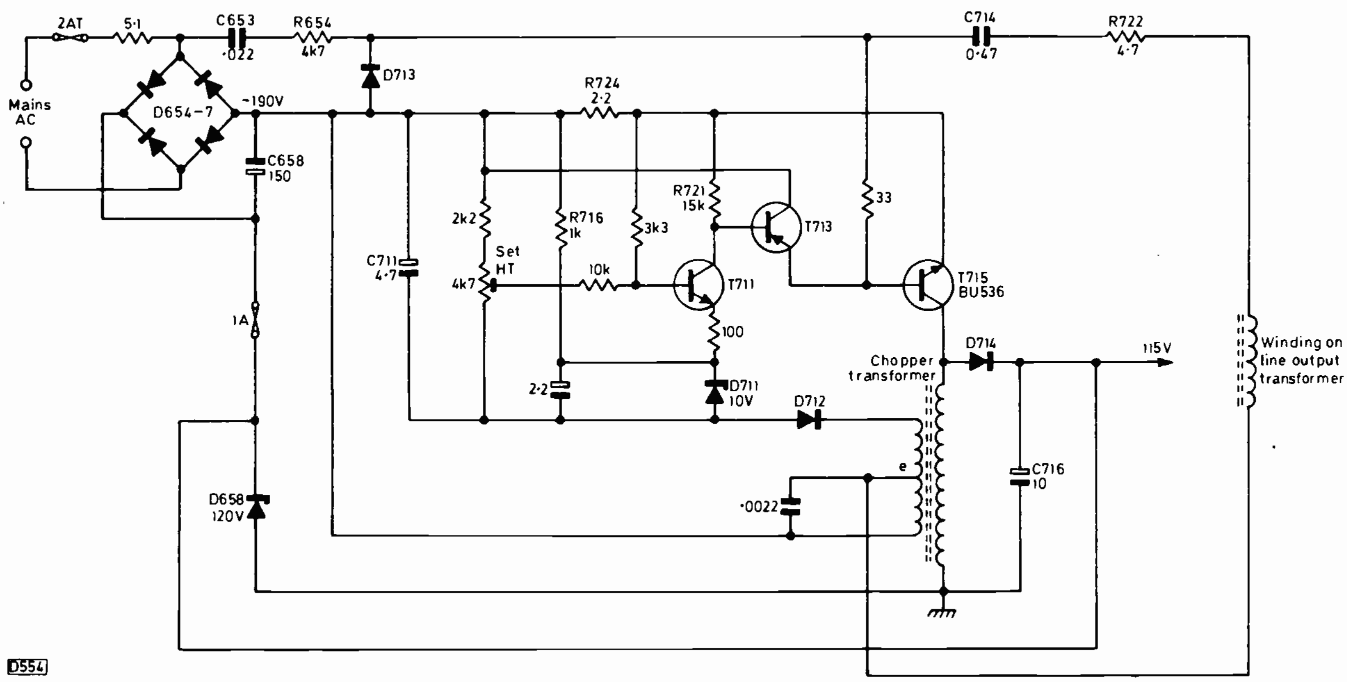


Fig. 4: Chopper power supply circuit (simplified) used in the CVC1100 chassis.

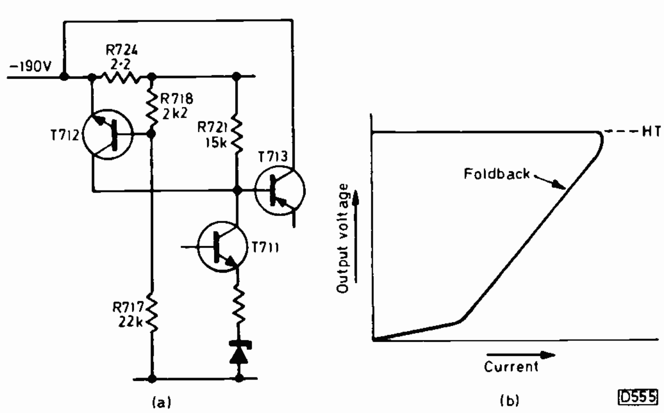


Fig. 5: (a) Excess-current circuit used in the CVC1100 chassis. (b) Foldback voltage characteristic.

The regulatory action is provided by T711 which in addition to acting as an inverter for the sawtooth generated across R724 also sets the d.c. conditions at the base of T713 and thus the point at which T713 switches on. The rectifier circuit D712/C711 produces a voltage proportional to the h.t. output voltage to bias T711. Sensing is carried out at the emitter of T711, across R716.

In order to show the circuit action more clearly, the excess-current trip has been omitted in Fig. 4. The arrangement is shown in Fig. 5(a). Transistor T712 senses at its base the current flowing through R724. It's usually cut off, but in the event of excessive current it will begin to conduct. As a result, the base of T713 will be driven negatively, increasing its on time and thus the off time of the chopper transistor. The net result is a foldback in the output voltage as shown in Fig. 5(b). Over-voltage protection is provided by the 120V zener diode D658.

It's a neat circuit which contributes to the CVC1100's low power consumption (40W under normal operating conditions). The advantage over the standard Siemens circuit is that the frequency remains constant. With the basic Siemens circuit the frequency varies over quite a wide range with the regulatory action: this can cause problems unless care is taken over interference suppression.

Vintage TV: The Pye Model V4

Vivian Capel

THE Pye Model V4, introduced in February 1953, marked a departure from earlier models in several respects. For the service engineer it had many interesting — and frustrating — features. It was fitted with a 14in. tube, type MW36-24 or C36-24, though a 17in. version was to follow later in the year. Subsequent versions incorporated a Band I/III tuner and were designated VT4 and VT7.

Cabinet and Construction

The appearance of these models was quite different from anything seen before. The screen was not masked by the usual overlapping contoured moulding and thus provided the maximum picture size of which the tube was capable. The tube face was surrounded by a wooden frame that was painted matt black, and black cotton material filled the corners. All this was mounted behind a darkened Perspex sheet that served as an implosion shield. The effect was of a darkened window through which the mounting was invisible — even the screen was barely visible when the set was not working.

The darkened shield cut down the illumination from the tube and thus the picture brightness, but had the advantage of improving the contrast. The reason for this was that ambient light had to pass through the screen twice when reflected from the tube face and was thus attenuated to a greater extent than the light from the screen phosphor. The result was really dark blacks and dark greys, even when the set was being viewed under high ambient light conditions. One or two other setmakers produced models with dark screens, but they never seemed to become really popular. Another feature was that the implosion shield was mounted with the top angled forwards to minimise reflections from ceiling and other high light sources.

The lower part of the cabinet front sloped forwards towards the bottom and was fluted to conceal the loudspeaker aperture. There were only two front mounted controls, brightness and volume-on/off. These were edge operated, another unusual feature, and just protruded through a pair of cut-outs in the fluting. The overall effect presented by the cabinet was of a piece of furniture rather than a technological wonder bristling with controls.

The tube was mounted separately from the chassis, being supported by metal struts that ran from the scan coil assembly to the front of the cabinet. The chassis engaged into two studs at the front and was secured by two screws fitted from the top through a backwards lip at the rear. Thus the chassis was easy to remove, not so the tube. There was also an inspection hatch beneath the cabinet.

Screen Cleaning

Which leads to a tale about screen cleaning. This task was necessary from time to time in the sets of the period in order to remove the dirt and dust that accumulated between the implosion shield and the tube face. Depending on the model, varying degrees of dismantling were required. In some sets you had only to remove the chassis and tube together, whilst with others, particularly those with separately mounted tubes, a lot of work was required. The cost varied accordingly, and one would often find owners peering through a hazy pattern of dirt (it was rarely deposited evenly) so that the job could be put off for as long as possible.

We carried out the cleaning on the V4 by first removing the chassis (unsoldering the speaker leads to do so), then removing the tube base, ion trap and can coils, unscrewing the struts and lifting out the tube. All this had to be put back and the tube set up after the cleaning. Definitely one of the longer jobs.

Then one day I was seated at the bench gazing through the hatch of an up-ended V4, stumped by an elusive fault. Idly, I noticed a slot running from side to side of the cabinet bottom just beneath the implosion shield. What was it for? Grooves ran up to the bottom of the tube mounting frame, but the loudspeaker assembly straddled the path. This I discovered could be removed after taking out a single screw. Underneath was a strip of sealing tape, and when this was removed the implosion shield could be slid downwards through the bottom of the cabinet. So cleaning could be carried out in a matter of minutes, without any disturbance to the tube.

Somewhat shamefacedly I consulted the service manual to find out how I'd come to miss this important piece of information. But there was not a single word on the subject — which made me feel a lot better. My colleagues were dumbfounded when I later demonstrated my new technique for cleaning the screens of V4s and V7s, and even years later I encountered engineers who had never discovered it. Goodness only knows how many cleaning operations were carried out the hard way — and charged for. A costly omission from the manual!

Circuit Features

The circuitry used in Pye TV sets had been getting more and more elaborate at the time. Previous models, including the FV2C and FV4C, already had flywheel line sync and a complex line timebase with four preset adjustments in addition to the width and linearity coils. To all this was added in the V4 automatic picture control, a video cathode-follower stage, a video overload diode and a triode interference limiter of the white-spotter type (interference pulses were inverted and fed to the c.r.t.'s grid

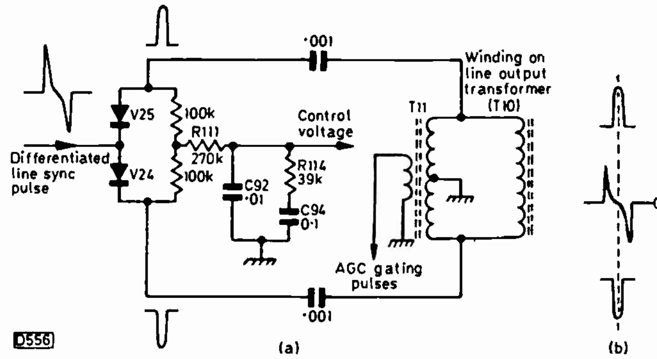


Fig. 1: (a) The flywheel line sync circuit used in the Pye Model V4. (b) Waveforms showing the circuit action.

circuit). In all there were twenty valves, four crystal diodes and five small metal rectifiers.

Flywheel line sync is a familiar enough feature today, but at the time of the V4 it was still something of an innovation. Pye had been using it in their preceding models and it had also appeared in some Ferguson sets. The circuit used in the V4 (see Fig. 1) was quite straightforward, though we didn't think so at the time. In fact Pye didn't go about it in quite the same way that's usual today — after all, they called it the Pye "auto-sync" circuit. We are used to a line flyback pulse being integrated to produce a sawtooth input for the flywheel sync discriminator circuit, the sync pulses being used to gate the circuit in order to sample the sawtooth and thus produce a control voltage. Instead, Pye differentiated the line sync pulse and fed it to the junction of the discriminator diodes V24/5, which were gated on by pulses from a centre-tapped transformer (T11) which was driven in turn by the line output transformer (T10). So the differentiated sync pulse provided the "slope" that resulted in a positive- or negative-going output from the discriminator. This was smoothed in the usual way by the following filter circuit R111/C92/R114/C94 and used to control an ECL80 connected as an astable multivibrator. The circuit action will be apparent from the waveforms shown in Fig. 1. A transformer in the sync separator's anode circuit was used to differentiate the sync pulses (in conjunction with the load resistor) and apply them in the correct polarity to the discriminator circuit. We shall return to the line oscillator itself later.

It was the automatic picture control (a.p.c.) circuit that really put the V4 ahead of its time, as contemporary advertisements emphasized. Other setmakers soon followed with similar circuits however. Hitherto, a.g.c. had been restricted to the sound channel, where arrangements similar to those used in radio receivers were employed. The d.c. nature of the video waveform made it difficult to apply this technique to the vision channel. The V4 was probably the first set in which the video signal was sampled at black level, using a gate so that the a.p.c. detector received its input only during the back porch period following the line sync pulse. Fig. 2 shows the circuit.

V13A provided the gating action: when switched on by a pulse applied to its cathode via C43, the video signal at the cathode of the video cathode-follower valve appeared at the cathode of the a.p.c. amplifier V12B. The gating pulses were obtained from a transformer driven from the line output transformer, delayed by the *RC* network R131/R132/C107 so as to coincide with the back porch period (black level). V12B amplified the video sample at its cathode, the stage gain being set by the contrast control R51. The output at the anode of V12B was coupled to the a.p.c. rectifier diode V13B via C42, and after smoothing was applied to the first vision i.f. amplifier's grid circuit.

The many feeds from the line output stage to other parts of the circuit proved somewhat baffling to engineers who were accustomed to the simple sync and line timebase circuits of the time. Some faults were quite unfamiliar, such as the uncontrollable contrast that could occur when almost any component in the a.p.c. circuit failed, or the wavy line displacement that occurred when one of the filtering capacitors in the flywheel sync circuit went open-circuit. The line output transformer itself frequently failed, and its replacement was a common task.

An overload diode (V7) was connected between the video amplifier's grid circuit and the cathode of the line output valve (see Fig. 3). The purpose of this was to prevent the video amplifier being overloaded in the absence of a.p.c. action, which could not start until the line output stage came into operation. The diode shorted out the video signal during the period when the line output stage valves were warming up (this took about three minutes). Once the line output stage was operative, the positive voltage developed at the cathode of the line output valve biased the diode off. This was all right, but the 25μF capacitor C103 which decoupled the line output valve's cathode sometimes went open-circuit, with the result that a sawtooth waveform was applied to the grid of the video amplifier and the right-hand side of the picture was brighter than the left-hand side.

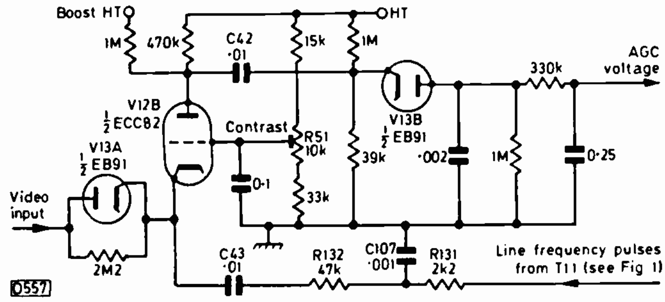


Fig. 2: The vision a.g.c. circuit used in the Pye V4.

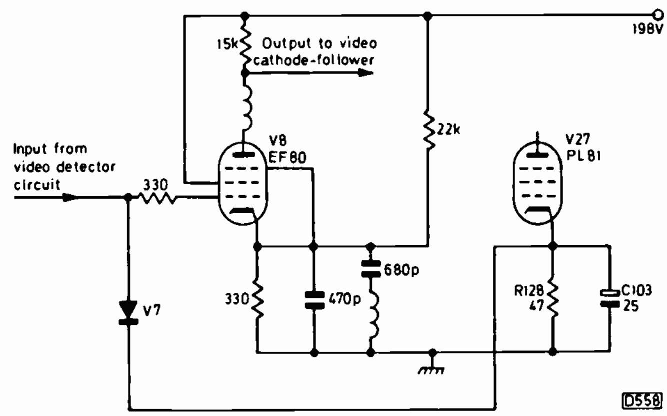


Fig. 3: Video overload diode.

As mentioned earlier, the line oscillator was richly endowed with presets. In addition to the usual line hold control potentiometer, there was a preset line hold trimmer, a line drive control (another trimmer), and a stabilising coil in the ECL80's cathode circuit. The preset line hold control was included to compensate for component tolerances. The drive control was part of a simple series *RC* network which shunted the control grid of the PL81 line output valve: it was set for minimum voltage across the PL81's cathode resistor R128.

The stabilising coil was a factory preset and dire warnings were given about twiddling with it. If the setting was disturbed (by someone else of course) it could be adjusted by switching the set off, connecting an audio generator and valve voltmeter in parallel with it, tuning the generator to 8.5kHz and then adjusting the coil's core for the maximum voltage reading. The frequency of 8.5kHz was chosen for optimum line sync consistent with maximum rejection of noise interference: the effect was to eliminate watery verticals under poor signal-to-noise conditions.

It was perhaps understandable then why a groan went up whenever one of these sets came in with a line timebase problem!

Simple VCR Servicing

Part 2: Jammed and damaged Tapes

Derek Snelling

So the thing that a VCR owner dreads most has happened: a tape has jammed in the machine or come out in pieces. What caused the problem and how can you prevent it happening again? First a jammed tape.

JAMMED TAPES

Provided the tape has not wrapped itself around the capstan/pinch wheel or got stuck to the video head drum, it's possible to remove the tape without damaging it. The first problem is to get the top off the machine. In some cases (the Ferguson 3292, Sanyo VTC9300 and Hitachi models) this is simply a matter of removing the retaining screws and lifting the top off. In other machines however the top can normally be removed only with the cassette housing up. If the cassette lid has two securing screws (Toshiba V5470, Bush BV6900) these can be removed and the lid slid forwards and off. The top can then be removed in the normal manner. If the machine is a Ferguson 3V00, 3V16, 3V22 or the JVC equivalent, you have the problem that the cassette lid retaining screws can be removed only with the top off, which you can't get off until the cassette lid is removed. To get round this, remove the two top screws and lift the top as far as possible: then, with a long cross-head screwdriver, magnetised to prevent the screws falling into the machine, remove the two screws that secure the left side of the cassette lid. This should enable it to be lifted sufficiently for the top to be removed.

Having got the top off, the first thing to do is to examine the tape. If it's still threaded round the head this is why it won't eject – eject is prevented until the tape has been fully wound back into the cassette. Alternatively the tape may be wrapped around the pinch wheel or capstan. If this is tight the cassette housing will be prevented from rising. Or the tape may be stuck to and wrapped around the head drum, though this does not normally stop the eject working. Finally everything may be o.k., the tape wound back fully into the cassette with no tangles, but it just won't eject. We'll take these possibilities separately.

(1) Tape still threaded round head drum

With Betamax machines, pressing the eject button should operate the loading motor so that the tape is

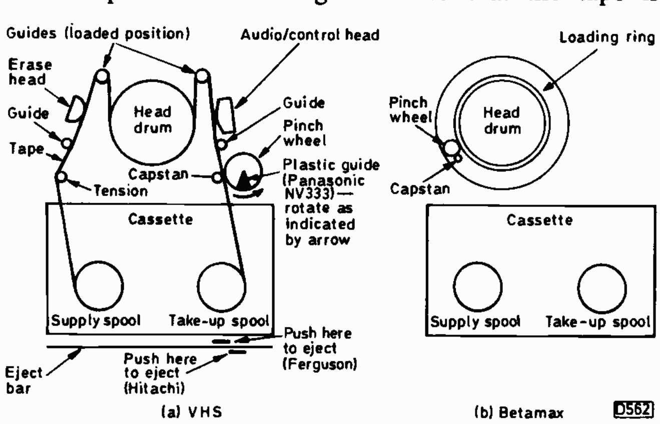


Fig. 1: Basic tape path/loading arrangements.

unthreaded. If this is not happening, check the switch and loading motor circuit, also the loading motor (the latter is a common fault on the Toshiba V5470/Bush BV6900). On the Sanyo VTC9300 there's no separate loading motor, the drive being taken from the main motor to the loading ring via a flywheel and pulley assembly at the centre rear beneath the deck – this has been known to give trouble. If a rented tape is jammed in and you need to get it out quickly in order to return it, you can rotate the loading ring carefully by hand after first pressing the eject button. Depending on the nature of the fault, you may have a loop of slack tape which must be carefully removed from the mechanism and wound back into the cassette.

With VHS machines, pressing the stop button should initiate the unthreading process. This is done by mechanical linkage, and careful study of the manual is necessary in order to sort out the problem. Possible faults are screws falling out, foreign objects preventing the loading arms from coming back, or springs coming off. As failure on these machines is usually a matter of mechanical jamming, removing the tape prior to fixing the fault is not easy and usually involves carefully disentangling it from the loading arms by hand.

(2) Tape stuck to and wrapped around the head drum

In this case the tape (or at least part of it) will be ruined and the easiest thing to do is to cut the tape and disentangle it from the drum. Once the tension had been removed the tape will eject easily. Remember to clean the heads thoroughly afterwards. Unfortunately this fault can sometimes ruin the heads. The only causes are: dirty heads and/or tape, or damp.

(3) Tape wrapped around capstan/pinch wheel

Whether the tape can be saved depends on how much of it is wrapped around the capstan/pinch wheel, but a large section (3-4ft) is normally damaged. Rotating the capstan motor backwards slightly can help to loosen the tape sufficiently for it to be unwrapped. It's sometimes necessary to cut the tape free however. Eject will work normally once the tape is free. Causes of this fault are: dirt on the pinch wheel/capstan; failure of the take-up clutch – this causes the tape to loop and get caught up; and failure of the take-up brake to release properly. If you get this tape tangling problem with a Panasonic NV333, there's a modification (see Fig. 1) which involves turning the white guide fitted to the pinch wheel anticlockwise through 90°.

(4) No apparent fault but the tape won't eject

If the tape appears to be fully wound back into the cassette, the eject mechanism itself may be faulty. A common fault on the Ferguson 3V22 (see *Television* October 1981, page 631) is a loose screw. To get the tape out to examine the mechanism it's possible to trip the eject system on the housing, provided this is not faulty. To do this, push the bar forward on Ferguson and Hitachi models (see Fig. 1). In other makes examination of the eject mechanism will usually reveal how it works.

Electronically controlled VHS machines usually have a separate loading motor. In this case a tape can be unthreaded manually by turning the motor by hand. Do *not* force it: if it seems to be stiff, this usually means that something is jamming the mechanism and the application of force will only cause damage. With most Panasonic machines you'll find a label underneath on one of the pulleys telling you not to rotate it: any attempt to do so is likely to set all the cams and cogs out of line, so don't try manual unthreading with these machines. Possible faults here are the loading motor and drive circuit.

DAMAGED TAPE

If the tape is damaged, the cause is reflected by the type of damage. If the tape is damaged along the edge (not just wavy, which is a sign of wear), the cause could be that the tape is not central on the reels so that it gets damaged by the casing as it leaves the cassette. This can usually be avoided by storing the cassettes upright rather than flat. This type of damage can also be caused by misaligned tape guides or dirt on the guides or capstan. Unless you know that the guides have been touched, it's unlikely that a machine that's previously been working correctly has guide problems. To check the guides, use a torch and mirror: check that the tape is smooth as it passes around the guides. Any wrinkling indicates that the guide is in need of adjustment. Be warned however: adjustment should not be attempted unless you have experience of this sort of thing.

A line along the length of a previously perfect tape can be due to dirt on the guides.

Vertical lines which give rise to sound drop-out on VHS machines, particularly near the beginning of the tape, are caused by the loading arms as they pull the tape from the cassette and are unavoidable.

If there's a loop of tape hanging from the cassette when you remove it, in the case of Betamax machines or VHS machines in the play mode prior to eject, the take-up spool (Betamax) or the supply spool (VHS) is not taking up the slack on eject and the problem should be investigated. Check for belts off or brakes stuck on. In the case of VHS machines in the rewind or fast forward modes prior to eject, check for correct operation of the brakes. Note the modification to Hitachi machines in the VT8000 series for this problem (see *Television* November 1982, page 15).

If the tape is badly damaged, even twisted, in Ferguson 3V29/30 machines, check whether the after load switch is sticking. This keeps the motors running even without a tape in, and inserting a cassette in these circumstances causes damage (see *Television* August 1982, page 519).

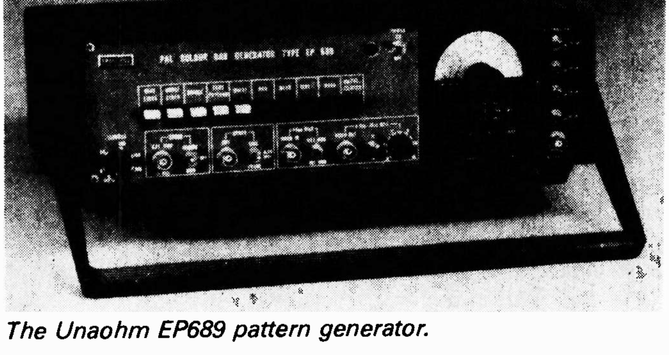
Test Report: Unaohm EP689 Pattern Generator

Eugene Trundle

TV pattern generators fall into two basic categories: miniature and small types costing between say seventy and a hundred pounds, and the all-dancing, all-singing types with prices that range up to around eight hundred pounds. The latter are comprehensive, usually foreign made and offer a wide range of facilities. Of the three I've been able to locate, one is from N. Europe, one is Japanese and the other comes from Italy. Since the first two have price tags approaching £800 and the similar Unaohm is available at about half this figure, I thought I'd investigate it. The EP689 duly arrived and was put through its paces.

Features

The EP689 is intended as a workshop instrument. Four basic monochrome patterns are provided: vertical and horizontal lines, a circle, and a composite pattern consisting of a chequerboard, definition gratings (multiburst) and an eight-section grey scale. The first two or three patterns can be superimposed to provide a crosshatch pattern combined with a circle if required. The five colour patterns are: white raster with colour burst; red and blue rasters at 75 per cent saturation and luminosity; standard colour bars at 75 per cent amplitude, 100 per cent saturation; and an "anti-PAL" chroma signal for setting up decoders. The latter consists of a split-field display with chroma signals on the four main phase axes, i.e. + (R − Y), + (B − Y), − (R − Y) and − (B − Y). The standard colour bars also form part of a split-field display, with a central horizontal white bar one third of screen height. On all the colour patterns the burst amplitude can be varied between 0 and 200 per cent of normal, with a switched reference to the 100 per cent (normal) level.


The Unaohm EP689 pattern generator.

The r.f. output range is very wide, covering the whole of Bands IV and V at u.h.f., the whole of Bands I and III at v.h.f., and reaching down to 36MHz to embrace UK and continental vision intermediate frequencies. The output bands are selected by push-buttons, a calibrated dial with geared drive being provided for tuning. The r.f. output is some 15mV, with four toggle switches providing attenuation from 0-70dB in 10dB steps.

Various signal input and output facilities are available at front panel mounted BNC sockets. Video at 1V/75Ω level can be injected into the r.f. modulator, or the instrument's own composite video signal (positive- or negative-going) can be extracted at a level of between 0 and 2V, 75Ω, set by a front panel control. A sync output socket provides reference signals at line, field and colour subcarrier frequencies, selected by a three-position toggle switch. An audio input socket takes a 1V signal for application to the r.f. modulator, working in conjunction with a three-way toggle switch that gives the following options: unmodulated carrier (external modulation possible); no sound carrier; sound carrier internally modulated with a 1kHz note.

The instrument is impressive in appearance, with a well laid out front panel. All the r.f. controls are grouped together at the right-hand side, with the BNC r.f. output socket. Pattern selection is by push-buttons, white for monochrome displays, red for colour displays. A coloured inset above the push-buttons indicates the pattern selected by each. Grouped below the pattern selection buttons are the sound, sync and video routing switches, together with the associated sockets – in a position where connecting cables will not get in the way. The carrying handle doubles as a prop/stand when the instrument is in operation.

Construction

Inside I found the usual fibreglass panels, two large and one small one. The r.f. department is in a large screened box, a bit reminiscent of the early types of r.f. signal generator – this one is varicap tuned however, with a separately screened diode modulator operating on the final r.f. output. The instrument seems to be well constructed and likely to last. The circuit design is an even mixture of i.c. and discrete component technology, with little use of purpose-designed chips. Transistors are used almost exclusively in the analogue circuit sections, and 74 series i.c.s in the sync and monochrome pattern generator departments. A traditional, perhaps slightly old-fashioned approach, but we've often noticed that in this class of test gear the design does not necessarily follow the latest trends, and there's nothing wrong with that!

Workshop Evaluation

Once I'd checked the main parameters and found them up to specification, the EP689 was put into routine bench service. The instrument was found to be easy and convenient to use, and in the main performed well. The crosshatch of 15 × 11 lines results in squares rather than rectangles, which is useful for linearity checks as well as for convergence appraisal – especially when used in conjunction with the centre circle. This display is particularly useful when no broadcast test pattern is available, though I found it rather difficult physically to lock all three buttons in at once. I missed having a dot pattern, though I find that this is not essential, also the absence of the border castellations offered by some generators. The composite monochrome pattern (chequerboard, multiburst and grey scale) provides a check on many aspects of monochrome and luminance performance, including scanning direction. The multiburst grating frequencies are well chosen at 3, 3·5, 4 and 4·5MHz – only a good monochrome set would resolve them all I found.

Coming to the colour patterns, I found that the white, red and blue fields are very satisfactory while the PAL test field worked well for setting up delay line matrixes and demodulation phases in colour decoders. I was a little less happy with the colour-bar pattern. The bars themselves are fine, but the constant presence of the central horizontal white bar is a mixed blessing, especially on scope displays. It's possible to obtain full-height colour bars by internal adjustment, but the changeover cannot be achieved with a single switch as, for instance, with the Philips PM5519 – if done the modification is really a once-only operation. I would have preferred the final button to have provided a full height colour bar display rather than PAL/NTSC selection (alternating line chroma reversal on/off).

The r.f. modulator is very good. The complete TV band coverage caters for Irish and continental standards as well as direct i.f. injection, and with 15mV available I found I was able to get a long way down the i.f. strip towards the detector! The scale calibration accuracy was found to be better than one per cent – good enough to pretune a set to a distant transmitter (given its channel numbers) and be sure that it would be correctly tuned in on arrival, or at least within the a.f.c. capture range. This was proved in practice. The total 70dB attenuation is just sufficient to extinguish all trace of the picture at about 5μV, and I soon learnt how sets behave at various attenuation settings. The complete u.h.f. coverage enables one to check a tuner throughout the band in order to find any dead or low-gain spots, and the high r.f. output will force a signal through a half dead tuner for alignment or fault diagnosis. At normal output levels of about 1·5mV (20dB attenuation) there was little spurious r.f. output away from the wanted channel.

A certain amount of vision breakthrough on to the sound signal was noticed on the composite monochrome pattern but not on any other. Vision-on-sound is virtually non-existent.

On then to the external signal facilities. The video output has the useful feature of being available with either polarity, which is handy for direct signal injection, particularly with cable receivers if you have no system frequency input facility. The video input was tested with 1V peak-to-peak composite signals, both monochrome and colour, but the result was rather marred by crosstalk from the pattern generator's internal signal; not only this, but crosstalk also occurred from the external video source on normal pattern generator operation until the video input lead was disconnected from the instrument, despite my care in ensuring that the external signal's level and impedance were correct. The crosstalk is particularly noticeable because the external video is not locked to the EP689's sync pulses.

I got clean sound signals on the test set from an external audio source fed via the modulator. The instrument's line sync and colour subcarrier outputs are good, but I found that the field sync output pulses are rather sharp and needle like – to the point where my old oscilloscope could not get a grip on them unless "h.f. sync" was selected. A broader pulse, or preferably a square wave at field rate, would perhaps have been better. The line and field sync pulse outputs are at 5V peak-to-peak, the 4·43MHz subcarrier output being at 0·4V into 100Ω.

Verdict

It's a good instrument with a very professional feel and look. It scores over inexpensive types in the following respects: circle generator; multiburst signal; "anti-PAL" adjustment facilities; comprehensive input/output signal facilities; and in particular the excellent r.f. system, which is one of the best I've come across. It's let down a little by the instruction book, which appears to have been translated literally from the Italian – I had difficulty in keeping a straight face whilst reading it! With a little thought I managed to follow it all however.

None of the criticisms I've made affect the fundamental operation of the unit to any extent, and the current price of £395 plus VAT is very attractive – it's certainly a comprehensive generator for the money. The instrument is available from the UK distributors Advid Electronics, 17A Mill Lane, Welwyn, Hertfordshire AL6 9EU (telephone Welwyn – 0438-832641).

Doing our best

Les Lawry-Johns

WE haven't been at our best lately. As a matter of fact we often wonder if we'll ever be our cheerful, nothing too much trouble, delve a little deeper selves again.

Look at the trouble we had with Mrs. Groaner's set. We'd sold her this nice Philips 20in. set with the KT3 chassis some eighteen months previously – we've sold many others and haven't had the slightest trouble with any of them. But here was Mrs. Groaner on the phone, moaning her head off because she thought she'd be without it for a few hours and perhaps miss the evening programmes in colour (she had a monochrome portable, but said that wasn't the same). So we nipped up in the afternoon and had a quick look.

There was plenty of h.t. up to the BUW84 chopper transistor but no 129V regulated output. So either the BUW84 was out of order or it was not being switched on for some reason. A quick meter check proved that the BUW84 was capable of working, so there was a fault farther down the line. We whipped the set off its frame and assured Mrs. Groaner that it would be back before the evening's viewing got under way. That didn't suit her. She told me to be quick as she wanted to see Blue Peter. So I rushed.

Back on the bench we decided to start by making a few quick checks before switching on. We scored a bull's eye first time: the upper right line output transistor was short-circuit and a new BU205 was fitted in no time at all. We then switched on and there was a nasty flash and bang which frightened the life out of me. The dog ran for his life and Honey Bunch appeared.

"What are you doing to Mrs. Groaner's set? Blowing it to bits isn't going to get it back to her by five o'clock like you promised."

I scowled and kicked the dog, who'd come back to find out whether the fireworks were over.

I withdrew the rectifier panel and examined it closely. The 2A mains fuse was shattered and a check revealed that the 4·7Ω surge limiter resistor R6191 had blown open. "Something must have done that" I diagnosed accurately. But what? Checking the supply line showed no shorts at all, so I assumed there'd been some sort of flashover that wasn't going to reveal itself easily. A new fuse was fitted, and a new 4·7Ω wirewound. I called out to H.B. "you watch the back of the set and see where the flash occurs", averting my eyes so as not to be frightened again. I switched on and there was another nasty flash and bang.

"It came from here" she said, apparently unperturbed by the explosion. She was pointing to the base of the panel.

So I checked carefully between the panel pins and the socket, but found no signs of a flashover. There followed a good half hour of pure farce, during which time several more fuses and resistors were sacrificed. Finally I started to disconnect various items to make a more thorough check. I eventually discovered that there was a fairly high reverse resistance reading through the BUW84, enough to justify removing it completely. All was then revealed. The plastic envelope was blackened and partially decomposed. Here was the source of the flashover that had alarmed the dog so much. It was a good job that one of us had kept cool and remained unruffled.

Mrs. Groaner got her set back before five o'clock, and advanced her own theories about the cause of the trouble. It had to be the aerial or the mains lead as the set itself was so new. We managed to escape without too much aggravation, and made our way back hoping that the next few jobs would be a little easier on our nerves. What a hope!

A Rank T22A

There on the bench was a Rank T22A, with a note saying that it made a funny noise but didn't do anything else. So we accused the tripler and unhitched it from the line output transformer. Bull's eye! The set started up and the tube heaters glowed. So we fitted a new tripler and confidently switched on. The channel indicator said 7 instead of 1, and a BBC-2 programme appeared. It also appeared whichever selector was touched, and we wondered about that for a while.

We reasoned with ourselves. There'd been no mention of tuning troubles, so this must have happened during or after the tripler trouble. Immediately after, if after. So we made sure we had the tripler connected properly from an earth and diode point of view. The chassis connection is made via R13, so we measured the voltage across this resistor. As its value is 330Ω, the voltage across it should not have been too high. It was heavily negative, because R13 was open-circuit. The correct reading was obtained when a new resistor was fitted, but the tuner was still keen on BBC-2 and nothing else.

Over to the touch tuning circuit to make some voltage readings. The two chips (SAS580 and SAS590) receive a stabilised 33V supply at pin 16, but the reading we got was only 10V. Since it was the easiest thing to do, we removed the SAS590 from its holder. The 33V line returned to normal and we could now select channels 1-4 via the SAS580, though without the SAS590 channels 5-8 were unobtainable. We were winning however. We didn't have the required chip, but a frantic phone round produced one from Raymondo who was busy stocking up at the time. Whilst waiting for the chip we had a look at the circuit and noted that the 33V supply is obtained in a rather curious way, from −50V pulses which come from the line output transformer (see Fig. 1). This all seemed to prove that the faulty tripler had had something to do with it.

With the new SAS590 in, all channels could be obtained and we felt quite pleased with our efforts. For a while. A very short while.

Mr. Croaky and the ITTs

I groaned when I saw who was bringing the next set in. We'd seen Mr. Croaky's ITT CVC9 before. Several times before. The last time had been only a week or so ago. It wasn't the set that worried me, it was Mr. Croaky himself.

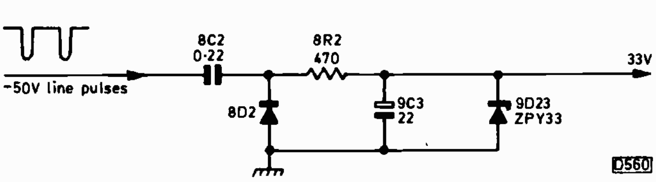


Fig. 1: Circuit used in the Rank T22 chassis to obtain a 33V supply for pin 16 of the touch tuning i.c.s. There's a separate 33V supply for the tuning potentiometers.

Whatever was wrong with the world, Mr. Croaky knew how to put it right. Whatever you did was wrong, and Mr. Croaky knew what you should have done. In short, the sooner you got rid of him the better your nerves would be.

He said that last time there'd been a large gap at the top and bottom of the screen. I'd checked the voltages in the field timebase and found them all in order, and after resoldering all the connections around the PCL805 the height had been restored and no amount of tapping around in this area would make the fault reappear.

Now here he was again, with the same fault. I again checked around the PCL805. Everything was in order. So I tried tapping around at the bottom of the right side line output panel, and found that the fault would come and go almost at will. Making the taps lighter and lighter brought us to the print side of the scan-correction transductor, and resoldering the connections to this produced a lasting cure.

"That's just what I thought it would turn out to be" said Mr. Croaky. "You and your wife should stop smoking you know." He's right but we still do it. We also do a fair bit of drinking, but we didn't tell him about that. How else can you forget about the Mr. Croakies of this world?

We also had a CVC20 that gave us a bad time. Intermittent colour. One tap, it's gone. Another tap and it's back. Whatever part of the decoder panel was touched would either promote the fault or clear it. We eventually gave up trying proper test procedures and resorted to resoldering every joint in the vicinity of the centre section of the panel. It worked and we've had no trouble since.

My Brother's TV

You may recall that we mentioned a spot of bother with my brother's G8. The convergence panel continued to give trouble and he now has a nice new K30 with a 22in. tube and full remote control. It was the only way I could get some peace. I can sleep whilst he plays with the buttons. Just to make sure, I put an alkaline PP3 in the remote control handset. That'll put off his next visit for an extra year or so. Brotherly love they call it.

A Final Moan

A great deal of our working day seems to consist of acting as an unpaid technical adviser. Although my favourite phrase is "I don't know", this strategy seems to have flaws.

As an example, this chap comes in and wants to buy a switch. You ask him what for and he says he wants to run an extra pair of speakers or maybe he wants to fit a master switch to switch off locally his multibank mains supply for his audio separates. You show him a suitable switch, priced at say 50p. How do I fit it? So you draw a diagram for him and he raises all sorts of reasons why his system requires a different layout. You try to accommodate him with a revised drawing. By now about half an hour has elapsed, and you've forgotten the masterstroke you were about to make on the music centre you were half way through repairing.

I know what you'll say. You shouldn't be servicing in the sales area. I've tried the remote approach, secluded in a separate workshop, but the result was even worse. "Les, would you come and explain something to this gentleman. Oh, I forgot you weren't there . . ."

So we continue to sort out odd nuts and bolts to suit queer cartridges, draw pretty diagrams for people who won't follow them anyway, and then find at the end of the day that there's precious little on the till roll.

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling and Michael J. Cousins, T.Eng. (C.E.I.)

Ferguson 3V31

We've noticed that not all 3V31s produce a good still picture without any tracking noise. Some batches are very good, others are not so good. If the tracking noise wanders up and down the screen with the VCR in the slow-motion mode, the drum guides need slight adjustment – the drum exit guide possibly about a quarter of a turn clockwise. If the tracking noise remains in the same position, adjustment of the still picture and slow-motion pulses should be carried out in accordance with the instructions in the manual – except that the noise pulse can be extended from 8msec to 11msec. Another check is to select still picture and see where the noise bar is. If it's at the bottom of the screen, rotate the pinch roller gently a few degrees anticlockwise. This should move the bar down the screen. If further noise is then seen at the top the trouble is due to excessive loss of f.m. carrier during the crossover between the heads. This means that the drum should be replaced as it's out of specification on head tip heights. **S.B.**

JVC HR7200

An Irish tinker came along with this JVC HR7200 (3V29 to those of you who deal with Ferguson machines). "It won't work son" (me "son"?). "Can you fix it – it's worth a drink." Hmmm.

The head drum didn't rotate and the servo output amplifier chip was getting hotter and hotter. The drum trembled a bit if you pushed it, indicating that some power was being applied though not enough to rotate it – or that the power was being applied to rotate the motor in opposite directions at the same time. These machines use direct drive motors, which have two sections, each covering 180° of rotation. There are two sets of drive coils mounted at 90° and two Hall effect switches to control the switching of the drive coils via the motor drive amplifier.

The most common cause of such a fault is failure of the motor drive output stages, in this particular machine a power i.c. So the chip was changed. Wrong again! A scope was then attached to the motor and it was persuaded to rotate, albeit slowly. Both coil drive waveforms were present and in antiphase, though one was of low level. Outputs were also present from the Hall effect switches, but again one was low and distorted. Unfortunately the only course of action now open was to replace the drum motor, which is of course the lower drum assembly, and then go through the tape path alignment checks. All that for a drink, and these days I don't . . . **S.B.**

Colour drop out – Toshiba TVs

This one is about TV sets rather than VCRs, though the problem shows up when the set is used with a VCR. The symptom is intermittent colour drop out, i.e. very brief instants of monochrome. It occurs with Toshiba sets that use the TA7193P single-chip decoder. The colour-killer reservoir capacitor C506 is connected to pin 20 of this chip and has a value of 1μF. It can be discharged very quickly but takes some 150msec to recharge following a colour phase condition that brings the killer into operation. If you encounter this problem, change C506 to 0·1μF. The monochrome period will then last for only a few lines rather than three fields. I first came across this design problem some time ago, and have modified several sets to provide the cure. Toshiba seem to wish to ignore it. **S.B.**

Toshiba V9600 – Hum Problem

We've supplied a lot of Toshiba V9600s – it's a very nice machine that doesn't give much trouble. Unfortunately we received some complaints about a faint line moving within the picture, sometimes upwards and sometimes down. At first Andy and I thought it was due to mains hum being picked up by the machine from the mains supply to the TV set – especially as in one case the latter was a Philips G8 with a thyristor power supply. The customer concerned went as far as to say that it was not the VCR as no line could be seen when he used it at his brother's house. As more complaints were received, we realised that a problem was taking shape.

A telephone call to Toshiba brought no guidance, though they confirmed that field reports identifying the symptom had been coming in. Anyway Andy was checking a machine one day prior to despatch and was at last able to see the fault – very clearly. Hum bars, two of them. Not so much bars, more like thin lines. Tuning had an effect, but nothing was apparent when we checked the input to the tuning circuit. We won't go into the details of our long investigation. The outcome was that the interference was found to be on the tuning line and was caused by pick-up from the mains transformer, which is mounted next to the tuning circuits. The cure is to remove the servo timing module to reveal transistor Q008 on the tuner/i.f. panel, then to connect an 0·1μF capacitor from the base of this transistor to the tuner metalwork. Q008 is mounted on fairly long legs, so it's possible to tap the capacitor on to the base leg with a small blob of solder and then attach the other lead to the tuner can. **S.B.**

Hitachi VT11

We've had several of the new Hitachi VT11 machines in and six have gone wrong, five with the same fault. The problem with these five was either no luminance or no picture on playback, often intermittent, though recording was unaffected. The fault was due to either CP205 or CP206 in the signals circuit. One of these units is a filter, the other a delay line. To check them they must be removed and then bypassed with a wire link, because the problem is due to an internal leak to earth so that simply bypassing them in situ will not show whether the device is faulty. Apparently the problem also occurred on some 9000 series machines, which have a similar signals circuit. Hitachi comment that modified coils have been fitted to overcome it, and as we experienced the problem only with the first batch of machines it would seem that these "got out" before the new coils started to be fitted. We haven't ourselves had the problem with 9000 series machines.

The fault on the sixth VT11 was no playback, no E-to-E operation and no test signal. This turned out to be due to the r.f. converter, which is the same as the one used in the 9000 series. It has the test signal and switch built into it, unlike the ones used in the earlier 8000 series. Another dealer tells me that the r.f. converter is a common failing in the 9000 series, though we've known only one fail ourselves. **D.S**

Hitachi Drum Trouble

In the April 1982 VCR Clinic I mentioned a VT8500 with a faulty lower drum assembly – the symptom had been a line about a quarter of an inch wide across the centre of the picture. I've just had a similar thing with a new VT9500 – a perfect picture apart from a quarter inch wide line about two inches from the top. Replacing the drum assembly once more cured the fault. **D.S.**

Ferguson 3V23

This fault was present on a brand new 3V23 with the revised (January 1982) mechacon board. When a cassette was offered to the front loader it went in at such a speed it nearly took my hand as well! If play was then selected, the tape was drawn through at such a pace that it seemed faster than fast forward. The link between the cassette and reel motors is the regulator transistor Q1 (X1 on the board, type 2SD313) which turned out to be short-circuit collector to emitter, putting some 22V instead of 12V on the supply to the motor control stages. Luckily nothing else was damaged. **M.J.C.**

Ferguson 3V00

One of these machines came into the workshop recently with the complaint that it "throws out keys". This is usually caused by the mechacon board not receiving one of the sensor inputs, i.e. cassette lamp, take-up spool rotating, etc. On this occasion the pulses from the drum were correct at TP6 on the servo panel (0·6V negative-going peaks) but the following drum servo i.c. (IC2, AN318) which generates the drum FF pulses was defective.

It's quite common for the drum flywheel to slip down the shaft, producing strange faults. On test the negative peaks of the drum pulses can go as low as 250mV, still producing the 25Hz FF pulses to the mechacon board, but the 1:1 mark-space ratio changes, resulting in incorrect head switching and drum servo problems. **M.J.C.**

JVC HR7300

The fault on this machine was no fast forward or rewind. When fast forward was selected the machine would start and then stop. Play, fast forward search and rewind search were perfectly normal, eliminating many of the components in the reel motor control circuit. Understanding the operating sequence enabled us to locate the fault without much difficulty. On selecting fast forward, the reel motor is given a loading command for a second until the fast forward command comes through via D17. This diode was open-circuit. So the motor stopped after loading, removing the reel sensor input to the mechacon board with the result that the machine stopped working. **M.J.C.**

Ferguson 3V22

A customer brought in a 3V22 and commented "there was a puff of smoke in rewind and the machine went dead". Inspection revealed that the 3·15A fuse had blown, and when we replaced this and tested the machine we found that the fuse blew only when a motor function was selected, not in the E-to-E mode. Resistance checks in the servo department then revealed that the drum drive control transistor X1 was short-circuit collector to emitter.

Replacing X1 solved the fuse blowing, but it was impossible to set up the drum servo. Further checks led us to R80, 0·6Ω, which is a wire-wound resistor on a coil former. It's in series with X1, acting as the drum current sensor for the servo, and had overheated when X1 failed, developing shorted turns. Replacing R80 and setting up the servo produced a stable picture with a fast lock-in time. **M.J.C.**

Ferguson 3V29/3V30

These machines, being very popular, have been sold and rented in large numbers. Consequently they produce a fair proportion of the VCR faults we encounter. A fault that's occurred on quite a few occasions is an erratic increase in the capstan motor's speed due to the absence of the 126Hz capstan servo sample signal. This fault is due to a weakness in the board design. There's a hole through the left-hand corner of the servo board, and the print for the 126Hz signal from connections 61/2 runs to the right alongside this hole: these tracks are prone to hair-line cracks, hence the absence of the 126Hz signal.

If the print to the left of the hole is cracked another obscure fault occurs – periodic drift due to absence of the drum servo playback reference signal. The cracked print in this case results in the earth connection to IC5 (M54519P) going open-circuit; in consequence a low voltage appears at pin 10 of the servo i.c. (IC3), cutting off the phasing monostable multivibrator in this i.c.

The problem we had with one of these machines was no sound in the E-to-E mode and the function lights showing rewind and audio dub even though there was no tape in the machine. These symptoms led us to suspect the latch i.c. on the mechacon board – IC4, type TMS1025N2LL. A replacement restored the sound and the function indicators to normal. **M.J.C.**

Fault Report

Notes on TV faults from Mick Dutton and George Wilding

Bush Model BC6318

The customer's complaint with a Bush Model BC6318 – A823A chassis with remote control – was that the sound kept going off. It was possible to restore the sound by tapping the top of the cabinet. We removed the back and prodded around the audio output stage, but couldn't find anything wrong. So the set was taken back to the workshop for a soak test. We then found that when the fault was present the remote control system didn't work either. This was checked and the 18V supply to 8Z1 on the remote receiver panel was found to be missing – due to a dry-joint on the wire from 1Z7 where it connects to the customer control unit. Resoldering this cured the problem – the sound was being muted in the fault condition by the remote receiver muting circuit.

An earlier model fitted with the two-chip Z584 decoder panel suffered from colour drop out, leaving vertical purple and green striations right across the picture. This was traced to a faulty 4·43MHz crystal. **M.D.**

Siemens Model FC365

No colour was the fault on a Siemens Model FC365, and a new decoder panel didn't help matters. The first two chroma amplifier stages are on the i.f. panel however, and on making voltage checks we discovered that the base of the first chroma amplifier transistor V245 was deprived of bias due to C244 (10μF) which smooths the a.c.c. supply being short-circuit. **M.D.**

Philips KT3 Chassis

The problem with a set fitted with the Philips KT3 chassis was no red. This wasn't surprising, since the red was switched off at the c.r.t. base. When the switch was turned on, the problem I was confronted with was a heavily red shaded picture with red flyback lines. The three background controls and two drive controls had been adjusted to their end stops by the customer, so I adjusted all these to mid-position and started making voltage checks to find the cause of the excessive red.

As I didn't have the circuit with me, I had to compare the voltages in the R, G and B channels. This revealed that the base and emitter voltages of the red output transistor were about 3V high, though everything else seemed right. The semiconductor devices were next checked out of circuit, but still no fault could be found. I finally resorted to comparing the resistance measurements across different components, and this revealed that the feedback resistor R4428 in the red channel was a different value to its opposite numbers. Replacing this cured the problem, and after setting up the grey-scale we'd an excellent picture. A point to note is that Philips' orange paint looks like brown – R4428 appeared to be 560Ω but is in fact 56kΩ.

Rank Z718 Chassis

Tuning drift was the problem we had with a Bush Model BC6111 (Z718 chassis). The drift was quite marked, well outside the a.f.c. circuit's pull-in range. The stability of the TAA550 33V regulator i.c. was checked and found to be perfect, but a digital meter connected across the tuning voltage line showed quite a fluctuation. The voltages around the tuning presets were found to be stable, and the problem was eventually traced to dirty plug/socket connections at pin 2 of 9Z1 – the pin carrying the control voltage to the tuner. **M.D.**

ITT FT110 Chassis

We've had a couple of capacitor problems recently on sets fitted with the ITT FT110 chassis. On the first set there were red/green convergence errors on the left-hand side of the screen: R651 didn't do anything and R652 had only a limited effect. The problem was that C653 (0·047μF) had gone open-circuit.

The level of the B – Y signal in the second set would vary – the fault was very intermittent. Sometimes there was complete loss of the B – Y signal, at others just a slight reduction in the picture's blue content. We found that the voltages around the B – Y emitter-follower T802 would vary when the fault was present, but attempts to make accurate measurements would clear the fault. Use of a hairdryer and can of freezer didn't help, so we had to resort to changing components one by one. The fault cleared when C818 (0·022μF), a coupling capacitor in the delay line matrix circuit, was replaced. It couldn't be faulted on a capacitance tester. **M.D.**

GEC 20AX Models

Two GEC sets fitted with the 20AX tube have come our way recently for repair. The complaint with the first one was lack of brightness with no colour. It seemed likely that the problem lay somewhere on the decoder panel, so we started by taking voltage readings here and found that everything was low, including the 12V supply rail. This comes from a three-leg regulator chip (IC502) on the switch-mode power supply panel. There was 20V input to the chip but only 8V output, a replacement curing the fault.

The problem with the second set was that the power supply fuse had blown due to a short-circuit chopper transistor. This was replaced and as no other faults could be found we fitted a new fuse and tried again. Once more we had an open-circuit fuse and dead BU126 transistor. This time we consulted GEC, whose helpful technical adviser suggested that we check R515 in the chopper driver transistor's base bias network as it was becoming a common occurrence for it to go high in value. He was quite right – it had risen from 150kΩ to nearly 2MΩ. When this happens the chopper transistor's drive waveform is incorrect and it's turned on for too long, leading to its instant demise. A similar problem can occur with the ITT CVC20 series chassis, which uses a similar chopper circuit. **M.D.**

Körting Hybrid CTVs

The problem we had with a Körting hybrid colour set was sound but only an unmodulated, not too bright raster, the brightness control having no effect. These sets use colour-difference tube drive but are rather unusual in that the luminance drive to the cathodes comes from an emitter-follower transistor. So if this fails to pass current there will be a raster but no luminance. On dropping the hinged chassis the first thing we noticed was that the fusible resistor R608 was open-circuit. Since this is in series with the supply to the luminance output transistor and emitter-follower we had the first clue. A resistance check at its output end produced a low reading to chassis, so all that remained was to find the short. Obvious suspects were the h.t. smoothing electrolytics, but whilst I've often come across dried up or partially dried up h.t. electrolytics I can't recall when I last came across one that was short-circuit. Low-voltage ones with heavy leaks or shorts yes, but not high-voltage types.

The h.t. line concerned also supplies the chrominance unit, which includes the transistor colour-difference output stages. As this panel plugs in and the whole success of rapid fault location is based on making the minimum number of disconnections we removed it, clearing the short in the process. A careful study of the relevant part of the circuit showed that there's an h.t. decoupler here, C751 (0·047μF), which turned out to be dead short. Replacing this and resoldering the fusible resistor restored normal vision. **G.W.**

Junking for Joy

Bob Walker

EVERY laboratory and workshop gathers a hoard of disused or defunct equipment that takes up a lot of useful space and gives little in return. Two courses of action are possible: either you throw it all out, or you dismantle the equipment and keep the bits that may be of value. A third possible course is to do nothing about it until the stuff overflows and engulfs you, but let's not indulge in negative thinking. To the professional time is money and to the amateur it's precious, but it's no waste to devote some time to the disposal of junk, thus gaining valuable space and a stock of useful items. It can also be an instructive exercise, particularly for newcomers to electronics.

If you've never done the job, dismantling say a TV set may seem to be a protracted business. This is not so. In about half an hour you can be left with neat piles of resistors, capacitors, coils, transformers, nuts, bolts, brackets, etc. Older cabinets can provide useful timber, woodscrews, clips and so on. If the tube is any good it can be kept for a time, say until it's ten years old, then scrapped. If you don't like your dustbin men put it out intact: otherwise it's judicious to stand it face down, cover it with sacking or other stout material and tap the socket end gently until the air hisses in. This method has proved successful with all sizes of tube over a number of years, and as the tube doesn't disintegrate there's little mess to clear up.

One of the interesting aspects of the dismantling operation is the discovery of inherent faults. It's a bit like doing a post-mortem. As part of his former police duties my brother attended many post-mortems and I recall him saying how often they revealed disorders that had apparently never been reported or recorded. This also applies to electronic equipment. Throughout the years I've discovered many dry or unsoldered joints, incorrect valves, wrong connections, wrongly printed circuits, reverse connected components, open- and short-circuits where they shouldn't be and so on. It's extremely instructive to keep your eyes open when doing this sort of thing, as you learn about things to look for when fault finding on operational equipment.

Component Assessment

The end products of the dismantling operation – the neat piles of component parts – require sorting out and assessing as to their potential for future use. Some items can be ceremoniously cast out, but others merit further consideration.

Capacitors: The casualty rate for these is high. Cracked casings and short or loose leads earn the thumbs down. Electrolytics, even though they may read well enough on test, tend to deteriorate rapidly when not in use and low-voltage types have a short lifetime. Subminiature types also have little left to offer as a rule. Mixed dielectric, polypropylene, polyester, polystyrene, polycarbonate, mica and ceramic varieties, especially those encapsulated in epoxy resin or plastic, usually repay the trouble of being tested. I've a soft spot for the more highly rated types of capacitor such as those that may be salvaged from defunct triplers or line timebase panels. In all cases however it's good practice to derate the nominal working voltages of reclaimed capacitors when considering them for reuse.

Resistors: These are generally not worth bothering with, but beginners may want to select certain values. Discard all resistors with short leads and any that are discoloured or have been used in heavy current circuits, e.g. h.t. smoothing resistors and potential dividers, etc. Select resistors of good appearance and accurate values when tested.

Potentiometers: Many are well used and have worn tracks. These should be discarded. Volume controls combined with on/off switches fall into this category. Others which are usually adjusted and left alone and don't carry a hefty current can be checked out for reuse. Convergence controls usually lead a hard life and are best discarded.

Coils: Generally not worth keeping, but a number of tuning cores of various sizes should be carefully removed and kept for spares. Heavier gauge coils can be used for winding low-voltage transformer secondaries, but enamelled wire is not suitable for reuse as the insulation tends to crack.

Deflection coils: These can be thoroughly cleaned and retained with the c.r.t. until it's disposed of as suggested earlier.

Transformers: Field and line output transformers can be retained for possible use as spares or test items for similar models. They should be marked with the make and model number of the set from which they've been removed. Audio output transformers are handy to have and if well constructed and insulated can be used as low-voltage mains transformers. Power transformers should be checked for voltage outputs and insulation and have the tags labelled appropriately. Mark them with the set's make and model number and retain them as spares or for other uses.

Tuners: V.H.F. types can be discarded unless you are a DX buff. U.H.F. tuners are worth holding on to. Keep them in plastic bags with circuit details and of course the set's make and model number.

Semiconductors: Discard those with short leads. Remove others carefully, using shunts and the minimum application of heat. Test for condition and retain those with satisfactory characteristics.

Valves: The use of valves in domestic electronics has declined greatly, but the best of each type may be worth keeping for a while.

Loudspeakers: A range of sizes and impedances is worth retaining. Examine for free movement, lack of rust and good cone condition, mounting and stability.

Other items: Switches, knobs, plugs and sockets, clamps, clips, nuts and bolts, screws, thermistors, VDRs, tube sockets, e.h.t. caps, delay lines, choke triplers and focus units are useful items that should be retained unless in doubtful condition, with identification where necessary.

Panels: Where a set uses self-contained panels or modules it's a matter of discretion whether to keep these intact or to dismantle them. It depends on the age of the set and the likelihood of the units being required as replacements. I.F. panels can sometimes be interchanged with some alterations, and audio amplifiers are capable of other uses. It's also possible to convert part of a TV set for use as a sound only receiver.

So where does the joy come in? To a Scot (and an Aberdonian to boot) like myself there's the joy of being economical. There's also the pleasure, perverse or childish though it may be, of taking things apart. There's the subsequent joy of discovering that your foresight in storing away some scarce item enables you to put right an old piece of equipment for which the parts are no longer available. The real amateur can also derive much pleasure from the instructive aspects of checking out the various assemblies and components and finding out how the passage of time has affected their efficiency. Last but not least is the discovery of faults, both pre- and post-natal, that contributed to the demise of the equipment in question.

One warning – this pastime can become addictive! You can all too easily become prone to gathering up all sorts of abandoned equipment just for the pleasure of taking it to bits. Living in a city where international oil companies are thick on the ground, I've recently been blessed with everything from chargers to oscilloscopes, including inter-com sets, emergency transmitter-receivers, etc. which have become surplus to requirements or out-dated. Who's complaining? I enjoy it enormously, but for space reasons must learn to say no at least once in a while.

Ah-hah! – I see that one of the advertisers in the December issue has reintroduced TV bargain parcels. . .

Service Bureau

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

ITT CVC5 CHASSIS

There's a good picture for the first quarter of an hour after switching on from cold. The colour then starts to break up from the left-hand side, giving an intermittent green and yellow tone, eventually finishing up as a vertical red and green band about half an inch wide hovering about the centre of an otherwise monochrome picture. Correct colour is restored after about an hour.

This fault is usually due to trouble with the line pulse feed to the decoder. The most common cause is a dry-joint around the line output transformer, either between the transformer and its subpanel or between the latter and the main board.

THORN 1500 CHASSIS

The picture is sometimes very noisy, at other times quite acceptable, changing from one extreme to the other for no apparent reason. The aerial connections have been checked and the tuner replaced, and the voltages in the i.f. and a.g.c. stages are all about correct.

If the aerial itself is o.k., check the condition of the tuner gain preset control R74, the connections in the tuner plug/socket P1, and the ceramic capacitor C8 (0·01μF) which decouples the emitter of the first i.f. transistor VT4.

GRUNDIG 7200

There's a width problem with this set. The raster is in at each side by approximately two inches and is concave. The voltages are o.k. other than those in the EW module. A full raster was obtained by replacing C506, but the replacement failed after only three days.

If replacing C506 cured the problem it's likely that the replacement component was not of the correct type. This capacitor is one of the line output stage tuning capacitors and takes a heavy ripple current – only a Grundig supplied component will do. If the trouble persists when a new C506 of the correct type has been fitted, the simplest course would be to obtain an exchange EW module – Grundig operate an inexpensive exchange service.

THORN TX10 CHASSIS

The chopper transistor has failed on three occasions, going open-circuit. Some circuits show this as type BU208A, others as type BU208B, and I'm not sure whether I've used the correct replacement.

The latest type recommended by Thorn is the S518T – this is best obtained through a dealer or direct from Thorn. It would be worth replacing the efficiency diode D704 (BY228) and the tuning capacitor C712 (0·0105μF, Thorn special) at the same time. Also check the chopper driver supply decoupler C723 (0·22μF) and the over-voltage trip circuit resistor R810 (150kΩ).

REDIFFUSION Mk. III CHASSIS

This set trips at switch on. The start-up supply is present and the line oscillator operates (waveform checked) but it's difficult to check anything else because of the tripping. The trip thyristor 6THY1 seems to be all right and unloading the line output stage has failed to reveal anything amiss here.

If the flyback thyristor 5THY1 and its parallel diode 5D3 (these may share a common encapsulation) are o.k., concentrate on the power supply panel. Replace 6R3 in the start-up circuit – it will probably be burnt – then check the following items in the regulating thyristor drive circuit: 6R17 (68Ω), the 22V zener diode 6D7, the 6·2V zener diode 6D6 and if necessary transistors 6TR1/2.

GEC C2110 SERIES

The problem is a line, composed of dots, the whole width of the picture. This moves from the bottom of the picture to the top and back again. I've tried swapping panels with another set but the problem remains.

The nature of the effect suggests that it's due to continuous arcing or sparking at 50Hz. If the mains wall socket and plug are o.k., suspect the mains switch, the mains filter capacitor C751, the degaussing components (withdraw PL36 to check), the mains input choke L57 and the snubber network components C58/R69 (if fitted). A remote possibility is that the aerial socket is electrically leaky.

KÖRTING 51763 SERIES

The original problem on this hybrid set was no colour. It was traced to the pulse shaping transistor T725 in the decoder. Replacing this restored the colour, but whilst carrying out the repair the colour-killer preset R876 was disturbed. Since readjusting this the colour has been good except that red is now mauve.

This sounds like lack of the B − Y signal, in which case blue will appear desaturated as well. Since the fault developed after the colour-killer was adjusted it's probable that the d.c. levels in the colour-difference output stages are incorrect – the killer works on the TAA630 i.c. which in turn drives the output stages to saturation. There should be 140V, 70V and 120V at the collectors of the B − Y, G − Y and R − Y output transistors respectively, on a colour transmission with the front colour control turned off. Adjust with the three marked presets at the front of the decoder, adjusting the B − Y control first. If the voltages cannot be brought within 20V of the correct figure, the TAA630 is probably faulty.

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TELEVISION MARCH 1983

TEST CASE

243

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.

What initially looks like a routine repair can sometimes turn into something quite nasty – when what appears to be a simple thirty minute job develops into a two hour session with the scope, circuit description and goodness knows what else. Dry-joints often provide problems of this sort, but the fault to be described this time turned out to be due to a faulty component.

The patient was a Pye colour set fitted with the well-known Philips G11 chassis. The service record showed that a replacement TDA2600 field timebase chip had been fitted a few weeks ago, and now here it was on the bench with a blown h.t. fuse and a dead short BU208A line output transistor. As is fairly well known, the line output transistor in this chassis can be killed by internal arcing in the h.t. reservoir electrolytic capacitor C4029. So in went a new one, along with a replacement BU208A and fuse. The set worked at switch on, but there was a slight ripple to the vertical edges of the raster, betraying hum on the h.t. line. Two bulges were present at each side of the picture, so the hum was at 100Hz. Plainly the mains bridge rectifier circuit was behaving itself and the problem was down to the h.t. smoothing. Our first reaction was that the new reservoir capacitor was faulty, but fitting another replacement made no difference to the symptom. Time to get out the scope and the circuit diagram.

The ripple across the reservoir capacitor was found to be normal, as per the manual. The ripple at the h.t. fuse F4037 was excessive however, which would account for the symptom. The G11 chassis uses an active h.t. filter circuit, which follows the reservoir capacitor and precedes the fuse (see Fig. 1). Obviously the fault was in this department. The circuit is known to us here as a muf-multiplier: it consists of a pair of transistors, Tr4032/Tr4033, which provide dynamic smoothing by in effect amplifying the action of the electrolytic capacitor C4034 (10μF) in Tr4033's base circuit. Perhaps C4034 was open-circuit? We switched off, hooked another across it, and tried again. There was no change in the ripple on the h.t. line. Leakage in either of the two transistors could be responsible we reasoned, but ohmmeter checks cleared both transistors of suspicion.

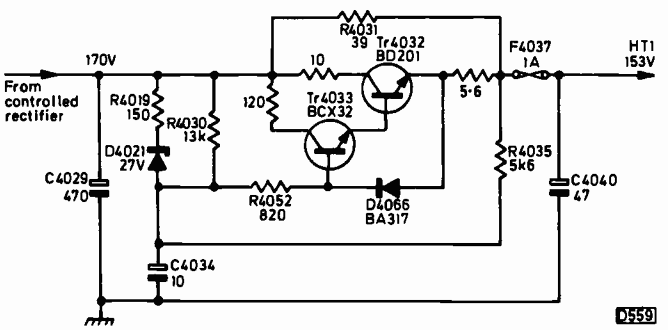

Fig. 1: The h.t. smoothing circuit used in the Philips G11 chassis. C4029 is the h.t. reservoir capacitor. The following circuit consists of an active filter: the potential divider R4030/R4035 with C4034 provide a smoothed bias for the base of Tr4033 which drives the emitter-follower Tr4032.

Thought was next given to more subtle possibilities. The earthing of both C4029 and C4034 was found to be satisfactory, and a check on the h.t. current flowing through the fuse showed no excessive consumption. Could there be anything funny about the new BU208A? No. The fuse is followed by another electrolytic, C4040 (47μF), which is included to provide decoupling rather than smoothing. The voltage at C4040 was slightly high, and for want of anything better to do we went on to check C4040 itself and then try another BD201 in the Tr4032 position. These slightly reduced the breathing effect on the raster, but by no means cleared it. When the culprit was eventually discovered it seemed likely that the damage had been done at the time of the demise of the original line output transistor or maybe the reservoir capacitor. What did we replace? See next month for the answer.

ANSWER TO TEST CASE 242
– page 213 last month –

The problem described last month concerned a fault in the colour recording system in a Ferguson 3V24 VCR – or did it? We found that some recordings made on the machine were marred by unresolved, floating colour, whilst playback of prerecorded tapes was satisfactory. What was happening in fact was that the full-width erase head was not working, so that with a defective recording we were looking at the residual chrominance on the tape from previous recordings! You will recall that recordings were perfectly o.k. provided a new tape was being used. The result of the last test we described – recording a red raster over previously recorded colour bars – was that reasonably recognisable vestiges of the colour-bar formation could be seen behind the red raster.

In cases like this the luminance comes out almost unscathed because of the "erasing" effect of the f.m. signal being recorded. The fault may well have gone undetected with recordings of monochrome programmes in fact. Lack of an erase signal is often betrayed by sound distortion and sound crosstalk from any previous recording – because the oscillator that provides the erase signal also provides the sound recording bias. The 3V24 uses this arrangement, and as the sound was all right it was clear that the oscillator was working but the full-width erase head was not being energised. In fact the head was dry-jointed at its connecting PC panel.

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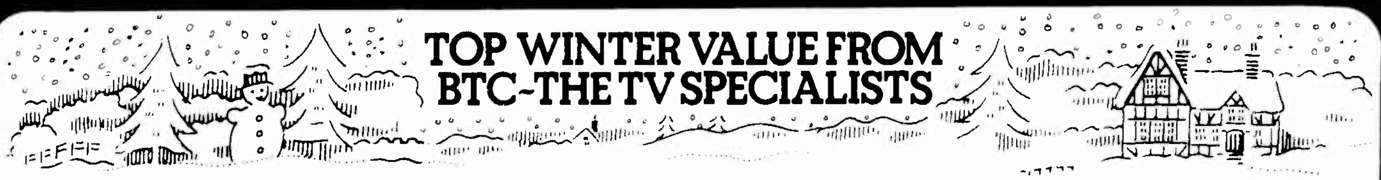

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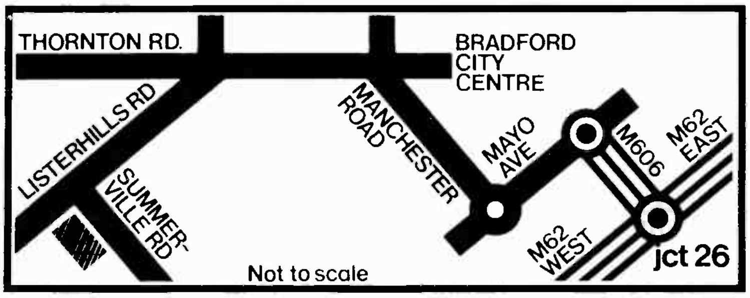

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Delivery arranged.

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SETS & COMPONENTS

The VINTAGE WIRELESS COMPANY

NOSTALGIA-COLLECTING
1900-1950s
Publishers of 'The Antique Wireless Newsheet'
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Suppliers of:
- Valve Radio sets & Amplifiers
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- Repairs & Restorations
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The complete service for the collector and enthusiast of Vintage Radio.

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Repair/sale service by ex-RR1 experts. Same day return with 3 months guarantee. Genuine RBM technology at your service.
Monday to Saturday 9am to 7pm.

T. K PANELS SERVICE
Tel: (0438 61567
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JAPANESE COLOUR TVs, Hitachi, Sony, Panasonic, Mitsubishi, Toshiba, Sharp. Colourland TV. Trade Only. 0484 863489.

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Contains at least £50 worth of T.V. service components and accessories. Loads of hard to obtain T.V. spares and components. Ideal for the service engineer. Only £12.50, carr. £2.50. Ref. Guar. HAVE YOU SEEN THE GREEN CAT? 1000s of new components, T.V., radio, and electronic items at unbelievably low prices. Probably the cheapest in the country. Send 40p for GREEN CAT and reserve FREE RECORD SPEED INDICATOR.
MYERS ELECTRONICS, Dept. TV2,
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Next to Union Jack Clothing Store, Leeds LS2 7EA.
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Open 9 to 5 Mon to Sat. Tel. 452045.

EX RENTAL C.T.V.'s & REGUN TUBES

RBM, THORN, DECCA, PYE GEC, GRUNDIG, ITT, PHILIPS G8, G9, G11, JAPANESE
From £10
Also all modules from **£4** untested.

STARLITE ELECTRONICS,
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Telephone Romford 752537
London Code 3.

TELEVISION

TRADE COLOUR TV'S

MOST MAKES & SIZES
FROM £10. DISCOUNTS
5% & 10% OFF FOR 5+ & 10+.
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For the best quality at the cheapest prices in Nottingham.

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100s of ex-rental sets in stock.
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SPECIALIST DISTRIBUTORS TO THE TRADE OF T.V. & VIDEO SPARES.
WE STOCK A FULL RANGE OF PARTS & COMPONENTS INCLUDING C.R.T's
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Good quality working colour televisions (from £35 plus VAT) straight from our retail shelves, (with good tubes & cabinets). Available at all times – delivery available anywhere.

Contact John, Dave or Steve on Cambridge 69215 or Ely 61462

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COMPLETE NON WORKERS
PHILIPS G8 £14 THORN £14
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PHILIPS G8 £30 THORN £25
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I.T.T., PYE, GEC & JAPANESE also available. Ex equipment panels (lots of G8) from £3.
Now open Thurs. & Fri. nights until 9.00 pm.
Quantity rates & delivery service.

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UHF T.V. Pattern Generators
Crosshatch & 4 patterns £17.25
As above but with Greyscale £18.50
Prices include P&P and VAT.
Also available:
PAL COLOUR BAR GENERATOR
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TRANSISTOR TESTER
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The above items are not kits
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52/54 Worcester St., Wolverhampton WV2 4LL
Tel. (0902) 23916

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ANY PUBLISHED, full-sized service sheet by return £2 + L.s.a.e. CTV/Music centres £3. Repair data with all circuits, layouts, etc. Your named TV or Video £8.50. Free 50p mag. all orders, queries: TIS (TV), 76 Churches, Larkhall, Lanarkshire.

SERVICES

VIDEO, HI FI, TELEVISION Servicing by highly experienced engineers. Trade contracts required. Capital Electronics 01-675 2508.

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(Cheques and Postal Orders should be crossed Lloyds Bank Ltd and made payable to Television)

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Rate
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MAR 83

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Any quantity.

Top Prices Paid.

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This will assist advertisers in processing and despatching orders with the minimum of delay.

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Regular supplies required
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MANUAL/CIRCUIT WANTED. Hunts capacitance resistance analyser type. CRB serial 1213. 67, Osborne Gardens, Herne Bay.

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THORN 2000 chassis complete untested offers? G.E.C. 4022H stereo working, no speakers £25. 021-360 7208.

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SPECIAL CLEARANCE

Colour TV's, Good working order £25 each, any quantities, most makes and sizes available. Complete non-workers £10 each. Mono sets £2 each. Spare parts available.

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FULLY INTERLACED

Only 3" × 3" × 6", better than 450 line resolution, including 16mm lens. **Only £160 inc p&p.**
24" Monitor **£190** plus delivery.

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T.V. Repair
Tool Kits

T.V.L. 47×38×10cm. 4 X Nutspinners B.A., 6", 4" screwdrivers, inspection mirror, 5" cutters & pliers, soldering iron, 6" crosspoint, large comp box. *With tools* **£62.00**. *Without tools* **£36.00** *plus comp box.*

T.V.M. 43×32×9cm. 4 X Nutspinners metric, 6", 2½" crosspoints, 5" cutters and pliers, 4", 6" screwdrivers, comp box. *With tools* **£41.00**.

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T.V.S. 39×28×7cm. (Ideal for I.Cs.) small round and snipe nose pliers, small cutters, 4", 2½" screwdrivers, 4" 2½" crosspoints, mini soldering iron, inspection mirror. *With tools only* **£49.00**.

PLEASE ADD £2.50 p&p. (Money refunded if disatisfied.)

KITRONICS, 7 The Meadows, Berwick-upon-Tweed.

SERVICE SHEETS

TECHNICAL INFORMATION SERVICE

SERVICE SHEETS: full size by return – radio, mono, etc. £2 + large sae. CTVs & Music Centres from £3.
SERVICE MANUALS: Sole suppliers most obsolete equipment. Everything stocked to latest releases. Fantastic stocks CTVs/Videos. E.g. A823 £6.50; Autovox (early) £6.50. Tyne 5000/6000 Series £7.50.
COMPREHENSIVE TV REPAIR COURSE – Complete data almost every fault. – Huge beginners section. – Only £8.50.
TV REPAIR MANUALS – All 12 for £75. – Mono portables (new) £6.50. – Early VCR, £10.50.
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SAVE £12 – BRITISH CTV ONLY £60 – LIMITED TIME; Complete integrated TV Repair System £160.
Quotations/free 50p magazine/price lists/etc for large sae.
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PHONE 0698 883334 FOR FAST QUOTES – Open 4-6 daily, 11-1 weekends.
T.I.S., 76 CHURCH ST., LARKHALL, LANARKSHIRE ML9 1HE.

30,000 SERVICE SHEETS IN STOCK. COLOUR MANUALS ALSO AVAILABLE

TV Monos, Radios, **£2.00.** Tuners **£2.00.** Tape Recorders, Record Players **£2.00.** Transistors, Stereograms & Music Centres **£2.00** + SAE. Also Colour Available. Car Radios **£3.00** + SAE. All Radiograms **£2.00.** State if Circuit will do if sheets are not in stock. All TV Sheets are full-length 24×12, not in Bits & Pieces. All other Data full-lengths.
All sheets from **£2.00** except Colour. OLD VALVE Radios **£3.00** + SAE 9" × 3". **MAIL ORDER S.A.E.**
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SANDHURST PUBLICATIONS
Television Service Sheet Specialists
Workshop Manuals, large selection of Japanese and European TV Sheets. Callers 5.30-7.00 pm. Upper Floor. Send S.A.E. for Catalogue and Enquiries:
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BELL'S TELEVISION SERVICES for service sheets on Radio, TV, etc. £1.25 plus SAE. Colour TV Service Manuals on request. SAE with enquiries to B.T.S., 190 Kings Road, Harrogate, N. Yorkshire. Tel. (0423) 55885.

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AERIALS & ACCESSORIES

QUALITY components at competitive prices. UHF 10 element from **£1.10**. 18 element from **£2.20**. FM2 from **£2.40**. FM4 from **£4.95**. Lashing Kits from **£1.20**. Wall Bkts. from **85p**. Masts available 2' to 20'. Aluminium coax plugs from **10p**. Coax cable from **£9.30**. Full range of Accessories and Amplification Equipment available.
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14 Tanners Crescent,
Hertford, Herts. SG13 8DS
Tel: 0992 50478

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CAMPBELL ELECTRONICS LTD.

Distributors of specialist spares to radio and television service depts.

We stock semiconductors, I/Cs, special T.V. and audio spares, service aids, rebuilt CRTs etc.

Fast off the shelf delivery of stock items.

Send S.A.E. or telephone for full catalogue and price list.

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Unit 5, Heath Hill Estate,
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Telephone Telford (0952) 502422.

Tel: Northwood (Middx) 27019 — 01-845 2036

RETACH LTD. Rear 78 High St., Northwood, Middx.

COLOUR TV's Complete Set

Philips G8 .... £18 each.
Bush A283's .... £10 each.

REBUILT COLOUR TUBES

20" .... £29.00 2 year Guarantee.
22" .... £33.00 2 year Guarantee.
26" .... £35.00 2 year Guarantee.

All price + VAT — Callers by Appointment

SECOND HAND COLOUR TV spares and tubes, most makes. Telephone Southport (0704) 74411. Anytime.

CASED ISOLATION TRANSFORMERS 500w max, suitable TV work £8.00 + £2.85. Working test equipment, Meters, P.S.U's etc. S.A.E. lists. S.H.E. 5, St Joseph's Park, Ballycruttle, Downpatrick BT30 7EN.

TELEVISION TUNER REPAIRS ALL TYPES

BRITISH, EUROPEAN JAPANESE ETC.

MEN-TU ELECTRONICS LTD.
SALTERNS LANE,
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TEL: 0329-235116

RE-GUNNED
TUBES
2 YEAR GUARANTEE
A56 X120
£30 Inclusive

ALSO AT £30
A51-110, A49-191, A44-271, A47×342, A47-343.

A66 × 120
A67 × 120 **£35** inclusive

SLIGHTLY USED TUBES

A56 × 120	£15.00
A66 × 120	£19.00
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Prices inclusive with 3 month guarantee. All Jig tested.

No need to spend £5 returning old glass if you buy from us.

Delivery only a few days from receipt of cheque.

£5 delivery per tube, 2 for £9 including Scotland and N. Ireland.

Discounts for more than 2.

All tubes fully insured by us.

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Open 7 days — **Callers ring first.**
½ mile off M18 Junction 2.

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No other consumer magazine in the country can reach so effectively those readers who are wholly engaged in the television and affiliated electronic industries. They have a need to know of your products and services.
The prepaid rate for semi display setting £5.64 per single column centimetre (minimum 2.5 cms). Classified advertisements 33p per word

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214 Purley Way, Croydon, Surrey.
Tel: 01-686 7951/2/3/4

SUPPLIERS OF MONO AND COLOUR TUBES TO MAJOR RENTAL COMPANIES.

ALL COLOUR TUBES HOT PUMPED AT 385c AND REBANDED TO BRITISH STANDARD. 415 1972 CLAUSE 18-2.

19" and 22" TUBES APPROVED. OTHER TYPES PENDING.

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TURN YOUR SURPLUS capacitors, transistors, etc., into cash. Contact COLES-HARDING & CO, 103 South Brink, Wisbech, Cambs. 0945 584188. Immediate settlement.

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SOLID STATE GRUNDIG, Nordmende, reconditioned panels. Also complete sets circuits. 0785 814643.

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PHILIPS · GRUNDIG
TELEVIEW 01-994 5537
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Thorn 3000/3500
Thorn 9000
UNIVERSAL
1 year guarantee

TRIPLERS £4.50 inc. p.p.

The UNIVERSAL TRIPLERcan be used in most G.E.C., I.T.T., Pye, Rank, Decca & Continental sets.
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LARGE QUANTITY OF GOOD CLASS
COLOUR TELEVISIONS
BUSH, PYE, GEC, THORN, PHILIPS ETC.
Excellent Cabinet Condition.
Genuine Change Over TV's and Repossessions.

LARGE QUANTITY SOLID STATE BUSH £10 Each
(Minimum quantity 5)

GEC HYBRID	PYE HYBRID	MONO
£5	£5	£3

100's to choose from!!

We export large quantities of TV's weekly. Can we help you?
Discount on Quantity Orders.
OVER 1,000 MONO TV's IN STOCK FROM £3.
100's colour tubes suitable for reconditioning. Working colour TV's to order ie. Bush 20"/22" 21.C. excellent picture, ready to sell. Only £39.
CALL AND SEE OUR SELECTION

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All types of Washing machines, Vacs, Fridges, Cookers, etc. Hoover Auto's, Servis, Hotpoint, Hoover Uprights, Vacs. 500 always in stock. Fully reconditioned Hoover Twin Tubs and Upright Vacs, all models. Phone for details.
PAY US A VISIT AND YOU WILL NOT BE DISAPPOINTED.

N.W. ELECTRONICS

BOLINGBROOKE STREET (PICKFORD BUILDINGS), BRADFORD 5.
3 minutes from Motorways. Telephone 0484 714413.

SERVICE PAGES

(minimum 12 words), box number 60p extra. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television Room 2612, IPC Magazines Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5846).

DIODES

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IN 60	5p
IN 541	5p
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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 10	10p
ZF 11	10p
ZF 12	10p
ZF 15	10p
ZF 33	10p
ZF 43	10p
ZF 47	10p
ZF 82	10p
ZF 310	10p
ZPD 3.9	10p
ZPD 4.7	10p
ZPD 5.6	10p
ZPD 10	10p
ZPD 47	10p
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ZPY 12	10p
ZPY 16	10p
ZPY 24	10p
ZPY 43	10p
ZPY 47	10p
ZPY 56	10p
ZTE 2	10p
ZTX 22	10p
ZTX 33	10p
ZTX 33a	10p
ZTX 102c	10p
ZTX 107	10p
ZTX 108c	10p
ZTX 109k	5p
ZTX 213	5p
ZTX 341	10p
ZTX 342	10p
ZTX 550	10p
ZW 27	10p
ZW 43	10p
ZW 310	10p
ZY 47	10p
ZY 72	10p
AA 112	10p
AA 113	10p
AA 143	10p
AA 144	10p
BA 102c	10p
BA 157	8p
BA 158	8p
BA 159	8p
BA 173	8p
BA 182	8p
BA 201	8p
BA 202	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 61c110	6p
BZX 61c15	6p
BZX 70c33	8p
BZX 79c4v7	8p
BZX 79c5v6	8p
BZX 79c6v2	8p
BZX 79c6v8	8p
BZX 79c8v2	8p
BZX 79c12	8p
BZX 79c22	8p
BZX 79c30	8p
BZX 79c43	8p
BZX 79c47	8p
BZX 83c4v3	10p
BZX 83c7v5	10p
BZX 83c5v6	10p
BZX 83c8v2	10p
BZX 83b12	10p
BZX 83c13	10p
BZX 83c20	10p
BZX 83c27	10p
BZX 83c33	10p
BZX 84c6v8	30p
BZX 85c8v2	10p
BZY 88c0v7	10p
BZY 88c3v9	10p
BZY 88c4v7	10p
BZY 88 6.8v	20p
BZY 88 6v2	20p
BZY 88c12	20p
BZY 88c22	20p

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All diodes at 10p in this list 20 of one type **£1.00**
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R 1038	50p
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R 2008b	£1
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R 2040	£1
R 2210	60p
R 2257	60p
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	60p
R 3018	60p
R 3019	60p
BU 105	75p
BU 105/04	80p
BU 108	£1
BU 124	50p
BU 126	80p
BU 137	50p
BU 180a	65p
BU 202	50p
BU 204	60p
BU 205	£1
BU 206	£1
BU 207	£1
BU 208	60p
BU 208a	£1
BU 326	£1
BU 407	60p
BU 426V	60p
BU 500	£1
BU 526	75p
BUX 84	50p
BUW 94	30p
BUY 71	£1
BSX 19	17p
BSX 20	17p
CV 8617	10p
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 29C/A	20p
TIP 30	30p
TIP 31A/B	40p
TIP 32	25p
TIP 33	50p
TIP 34	50p
TIP 35	50p
TIP 36	50p
TIP 41	30p
TIP 41c	40p
TIP 42	30p
TIP 47	40p
TIP 49	30p
TIP 100	30p
TIP 112	30p
TIP 120	30p
TIP 130	30p
TIP 131	30p
TIP 136	30p
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2SC 2073	20p
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2SB566	10p
F247	10p
MJE 1300S	30p
MJE 2955C3	30p

MV 2209	10p
SP 8385	25p
UA 79M08CKC	30p
TIS 90	30p
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TIS 92	30p

Integrated circuits

SAA 5012	£2.50
SAA 5020	£2.50
SAA 5030	£3.50
SAA 5050	£3.50
TDA 2575a	£2
U 14727	15p
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 36/600	50p
BYX 38/300	25p
BYX 38/600	50p
BYX 55/350	10p
BYX 71/350	20p
BYX 71/600	30p
BYX 72/300	20p
BYV 95	8p
BYV 96D	10p
BYZ 106	10p
BPW 41	15p
BUW 94	30p
BFY 50	15p
BFY 90	20p
BYW 56 2A/1000v	8p
BF 960	30p
BFR 81	15p
1.52 diode	10p
XK 3123	50p
BZY 93	50p
BZV 15/12	30p
BZV 15/18	30p
BZV 15/30	30p
BZW 70c6v2	10p
1A/1600v diode	10p
A1 diode	10p
TDA 2532	£1
TDA 1010	£1
Mitsumi tape motor	75p
Sankyo tape motor	75p
20 mixed led red/yellow/green	£1.25
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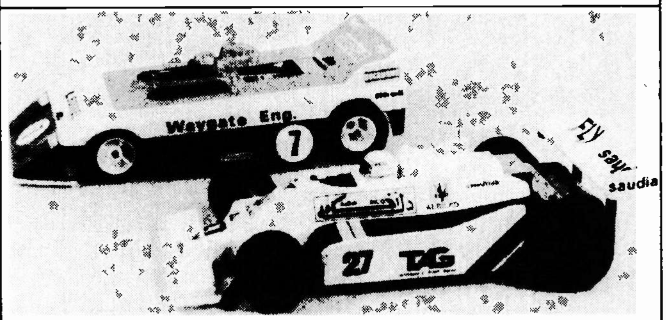

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BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF167	20p
BF178	25p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF185	20p
BF194	20p
BF195	10p
BF196	10p
BF198	10p
BF199	10p
BF200	20p
BF238	20p
BF240	20p
BF245b	20p
BF257	20p
BF258	25p
BF259	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF301	10p
BF324	25p
BF336	30p
BF337	25p
BF338	25p
BF355	30p
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BC149	10p
BC154	10p
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BC158	10p
BC160	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC182L	10p
BC183	10p
BC184	10p
BC187	10p
BC204	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC245	8p
BC250	8p
BC251	10p
BC252	10p
BC257	30p
BC263	10p
BC298	10p

BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC337	10p
BC338	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC413	10p
BC414	10p
BC440	30p
BC447	10p
BC454	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC558	10p

BC559	10p
BC635	10p
BD116	25p
BD124	50p
BD130Y	25p
BD131	30p
BD132	30p
BD135	30p
BD136	30p
BD140	30p
BD202	60p
BD204	60p
BD207	30p
BD221	20p
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