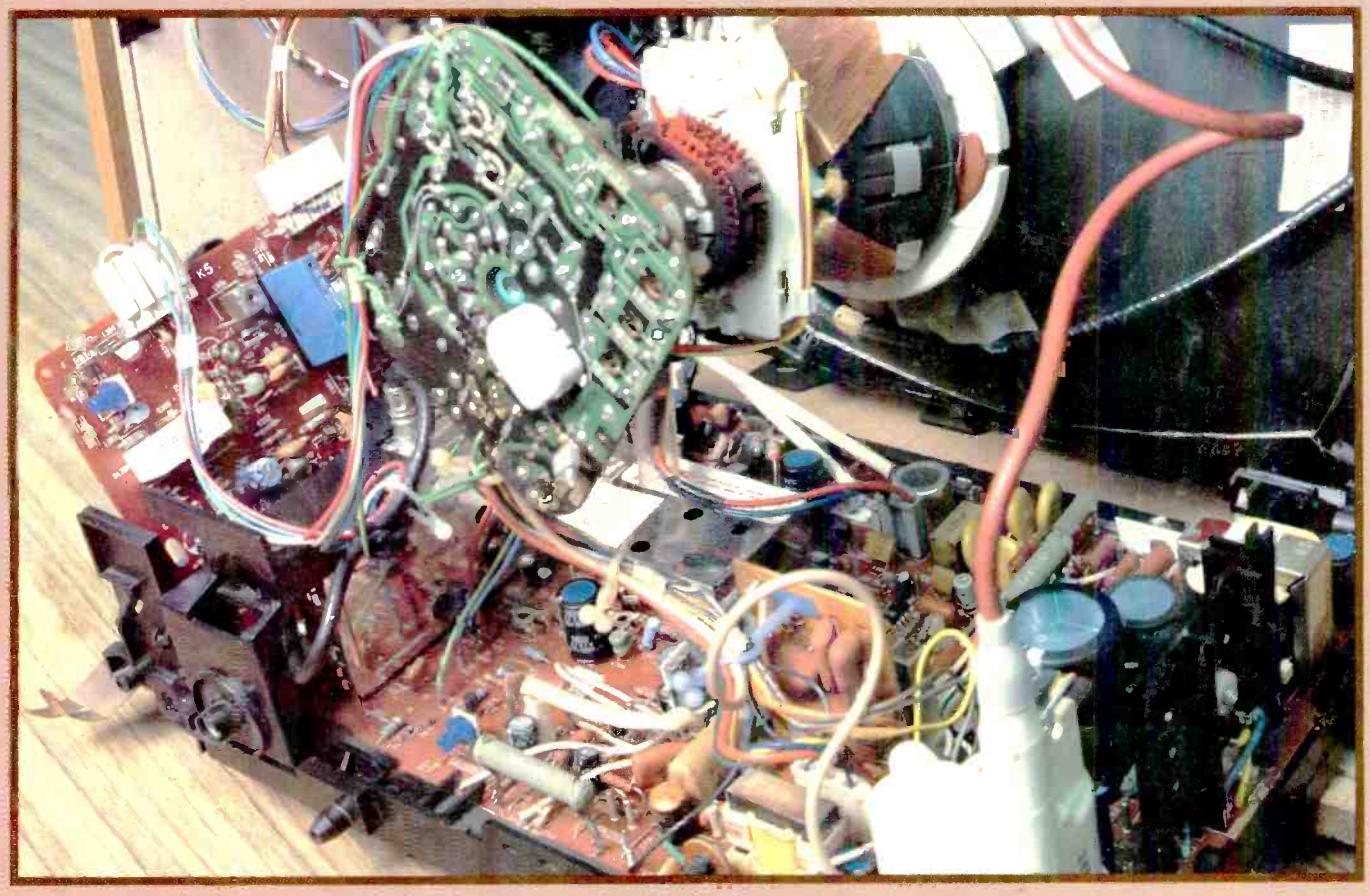
JUNE 1985

Australia $1·30, New Zealand $2·20, Malaysia $5·50 £1·10

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Servicing the Hitachi NP8CQ Chassis
Design of the FS-type Tube
VHS VCR Audio/control Heads
VCR Clinic • TV Fault Finding
Unscrambling Canal Plus • DX-TV
Servicing the Toshiba V9600

SAVE EVEN MORE!

THE TELEVISION FILM SERVICE

So many satisfied customers have been delighted with this award-winning film service that the economies made are now being passed on to you in the form of substantial price reductions. You can now save up to 75p on last year's prices. For 36 successful Superprints you pay only £2.95 inc. VAT. Compare this with last year's £3.70 and with the prices in the shops. Postage and packing is 30p extra as before. Here is the new price range – and remember, Superprints give you 30 per cent more picture area than standard prints at no extra charge.

No. of Superprints	Price (inc. VAT)	
12-15	£1.65	PLUS P/P 30p extra
24	£2.20	
36	£2.95	

RELIABILITY AND QUALITY

All our colour prints are made on Kodak Luxury Lustre paper. Prints have square corners and are borderless to give you maximum picture area. All prints are checked at every processing stage for accurate colour reproduction in a laboratory which is the winner of five recent successive Kodak Gold Awards for Quality. No other processing laboratory has been able to match this record. After allowing for postal and peak-period delays, you should normally expect your prints after seven to ten days.

ALL YOU HAVE TO DO

Send any make of colour print film together with your cheque or postal order inside the Freepost envelope enclosed with this issue. Or fill in the coupon below and send together with your film and remittance in a strong envelope to: Television Film Service, FREEPOST, Watford WD1 8FP. Half-frame films are welcome, and these are charged at double the full-frame price.

PERSONALISED SERVICE

Readers know we care for their prints. If you have any queries, contact our service's ten-line switchboard: (01) 953 9911.

SPECIAL FILM OFFER

Films from the high-resolution emulsion 'ColorFast' range are available to all readers at highly competitive prices. And when you order three, you get another FREE.

110/24, 126/24, 135/24 £1.40 each OR 4 for price of 3 – £4.20. Konica disc £1.60 OR 4 for price of 3 – £4.80. 135/36 £1.80 OR 4 for price of 3 – £5.40.

SPECIAL ALBUM OFFER

An attractive flip-type album, padded in black with gold embossing and holding 100 Supersize prints (in the shops £5.75) is offered to readers for only £3.99 inc. p&p.

All prices are correct at the time of going to press and are for UK readers only.

Approx. sizes of Superprints: 6"x4" (35mm) 5¼"x4" (110, Disc and 135 Half Frame) 4"x4" (126).

USE THIS LABEL IF YOU HAVE NO ENVELOPE, OR PASS TO A FRIEND.

To: Television Film Service, FREEPOST, Watford WD1 8FP.

From: Television Film Service, FREEPOST, Watford WD1 8FP.

*Print my enclosed film _____

*Rush me _____ of 110/24 _____ of 126/24, _____ of 135/24 _____ of 135/36 _____ of Disc/15 film _____

*Rush me _____ album(s) _____

for which I enclose cheque/PO payable to Television Film Service £_____

TVS

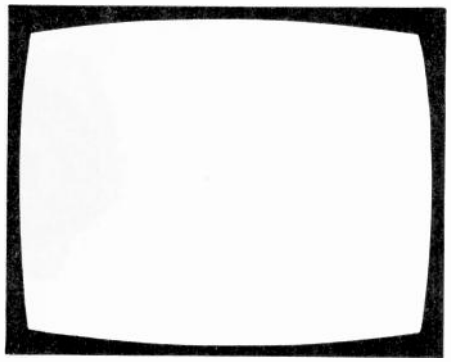
Name _____

Address _____

_____

_____

_____ Post Code _____



TELEVISION

June 1985

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Issue 416

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

SUBSCRIPTIONS
An annual subscription costs £11 in the UK, £12 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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 £1·20p inclusive of postage and packing.

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

this month

OUR NEXT ISSUE DATED JULY WILL BE PUBLISHED ON JUNE 19

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE

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

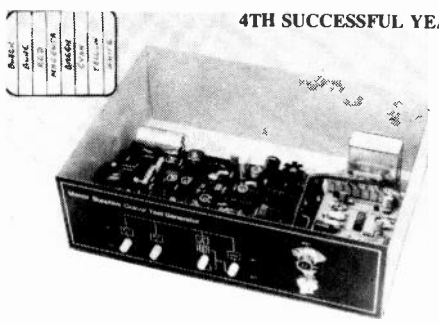
Price of Kit	**£70.00**
Case (10″×6″×2¼″)	**£7.40**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£105.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.50
Add VAT 15% TO ALL PRICES

PAL COLOUR BAR GENERATOR (Mk4)

4TH SUCCESSFUL YEAR



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

PRICE OF MK 4 COLOUR BAR GENERATOR KIT £30.00. CASE £7.40. BATT HOLDERS £2.80. MAINS SUPPLY KIT £4.20 (Combined P&P £2.20).

MK 4 (BATTERY) BUILT & TESTED £58.00 + £2.20 P & P.
MK 4 (MAINS) BUILT & TESTED £68.00 + £2.20 P & P.
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £5.75.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

GEC TELETEXT EXTERNAL ADAPTOR UNIT
Complete & ready for use. Infra-red remote control **£130.00** p.p. £3.00

TELETEXT EXTERNAL ADAPTOR KIT (Less case)
with cable remote control **£120.00** p.p. £3.00

THORN TX10, teletext
Mullard Decorder panel + Interface **£35.00** p.p. £1.80

THORN TX10, PHILIPS G11 PRESTEL
Mullard Units VM 6230, 6330 plus Line Coupler & Interface **£60.00** p.p. £2.50

Goods available if in stock immediately over shop counter (Mail order between 3 days and 1 week from receipt of order). ADD VAT 15%

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

SPECIAL OFFER GEC-Hitachi 2055 Series Colour TV Chassis, New **£38.00** p.p. £3.00
SPECIAL OFFER Philips, Pye KT3 Series infra-red remote control handsets ex rental (untested) Teletext or normal versions available **£2.50** p.p. 80p (5 for **£10** p.p. £1.50).
THORN 9000 Fault Finding Guide **£1.00** p.p. 30p.
SPECIAL OFFER NEW VALVES Branded makes **£1.00** p.p. £80p
PCF80, PY88, PFL200, PCL84 FOUR for **£2.00**. PL504
THORN TX10 Facia Control Panel incl. Infra Red Remote Control receiver **£7.50** p.p. £1.50.
THORN TX10 Series Facia Control Panel with 8 position Channel Selector **£5.00** p.p. £1.50.
PHILIPS UHF Modulator (Audio & Video Input) **£15.00** p.p. £1.00.
SAW FILTER IF AMPLIFIER PLUS TUNER complete and tested for T.V. Sound & Vision. **£28.50** p.p. £1.20.
THORN TX9, TX10 Saw Filter IF Panel. **£7.50** p.p. 80p.
PAL DECODER KIT (Video to RGB) for Monitors **£27.00** p.p. £1.00.
PAL ENCODER KIT (RGB to Video) **£18.50** p.p. £1.30.
TELETEXT DECODERS New & Tested Mullard VM 6101 **£30.00,** Texas XM11 **£40.00** p.p. £1.60
TELETEXT 23 Button De-Luxe Handset with 5 yds Cable. **£2.50** p.p. £1.20.
5V Stab. Power Supply **£3.80** p.p. £1.20.
CROSS HATCH UNIT KIT, Aerial Input type, incl. T.V. sync. and UHF Modulator, Battery Operated, also gives Peak White & Black Levels, can be used for any set. **£12.00** p.p. 80p. (Alum. Case **£2.55,** De Luxe Case **£6.80** p.p. £1.40.) **ADDITIONAL GREY SCALE** Kit **£2.90** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £22.00 (VHF version **£24.00**). Alum. Case **£2.55.** De Luxe Case **£7.40** p.p. £1.80.
CRT TESTER & REACTIVATOR KIT For Colour & Mono with Panel Meter Indicator – can be adapted for latest CRTs **£28.60** p.p. £2.80.
BUSH A823 Convergence, Time Base Panels **£5.00** each. p.p. £1.80.
BUSH Z718 BC6100 series IF Panel **£5.00** p.p. 90p.
BUSH A816 IF Panel (Surplus) **£1.00,** 5 for **£4.00.**
GEC 2040 Convergence Panels, Decoder Panels, **£1.50** p.p. £1.80.
GEC 2110 PANELS Frame **£8.50** p.p. £1.40. Sound **£2.50** p.p. 80p.
GEC 20AX Series Switch Mode Power Supply **£5.00,** IF-Decoder **£12.50** p.p. £1.80.
PYE 691-7 CDA Panels. Makers tested stock. **£6.00** p.p. £1.45.
THORN TX9 Panels ex factory for small spares. Includes I.Cs & Semiconductors etc. **£5.00** p.p. £2.00.
THORN TX9 Panels salvaged ex factory for spares incl. LOPT & Mains Transformers. **£10.00** p.p. £2.80.
THORN TX9 Panels ex factory salvaged complete cond. **£20.00** p.p. £2.80.
THORN TX10 T.B. Panels salvaged ex factory. **£15.00** p.p. £3.00.
THORN TX10 IF/Decoder Panels salvaged ex factory. **£15.00** p.p. £2.00.
THORN 3000/3500 Power supply P.C.B. **£3.50** p.p. £1.00.
THORN 8000/8500 IF/Decoder Panels salvaged **£3.20** p.p. £1.80.
THORN 9000 IF/Decoder Panels Salvaged. **£5.00** p.p. £1.60.
THORN 9000 Series. Long panel facia unit incl. 6 Position Channel Selector & Loudspeaker **£6.00** p.p. £2.00.
PHILIPS G8/G9 IF/Decoder Panels for small spares incl ICs **£2.50** p.p. £1.60.
G11 PANELS, Ex Rental SCAN (incl LOPT) **£28.00** p.p. £2.50.
G11 PANELS, Power, Frame, IF, Decoder, **£18.00** each. p.p. £2.00.
GRUNDIG 8630 Series Varicap Tuners **£5.00** p.p. £1.00.
VARICAP. ELC1043/5 **£7.80** p.p. 80p. Makers Controls PYE CT200 4PSN **£7.50,** BUSH 4PSN **£4.80,** DECCA 4PSN **£5.80,** 6PSN **£6.80** p.p. 80p. etc.
BUSH "TOUCH TUNE" Varicap Control Z179, Z718 types **£3.80** p.p. 95p.
VARICAP UHF-VHF ELC2000S **£9.80,** BUSH **£7.80** p.p. 90p.
VARICAP VHF PHILIPS, £6.90. ELC 1042 **£7.90** p.p. 80p.
UHF/625 TUNERS, many different types in stock. DECCA Bradford 5 position, MULLARD 4 position **£2.50,** JAP Rotary **£4.80** p.p. £1.80.
TV SOUND IF Panels **£6.80** p.p. £1.00.
LOPT TESTER, Service Dept approved **£15.90** p.p. £1.20.
LOPTS New and guar. P/P Mono **£1.35,** Colour **£1.50,** Bobbins **80p.**

BUSH 161 to 186 (twin panel)	£5.90	**R.B.M.** A823	£4.90
BUSH, MURPHY 774 series	£8.50	**R.B.M.** Z179	£9.80
BUSH, MURPHY A816 series	£9.80	**R.B.M.** T20, T22	£9.80
FERG., HMV, MARCONI, ULTRA 1400, 1500, 1590, 1591	£5.90	**R.B.M.** T20, T22 Bobbin	£5.60
THORN 1600, 1615, 1690, 1691	£9.15	**DECCA** Bradford (state Mod No)	£8.80
GEC 2000 to 2038 series	£6.80	**DECCA** 80, 100	£8.80
GEC series 1 & 2	£8.00	**GEC** 2028, 2040, 2100	£5.80
INDESIT 20/24EGB	£7.65	**GEC** 2110 series	£10.60
ITT/KB VC200, 300	£7.65	**ITT** CVC 5 to 9, CVC20	£9.80
MURPHY 1910 to 2414 (twin panel)	£5.90	**ITT** CVC25, CVC30 series	£8.80
PHILIPS 170, 210, 300 series	£7.65	**PYE** 691-697 (state model no.)	£10.00
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	£7.65	**PYE** 713, 715	£6.80
SPECIAL OFFER		**PYE** 725 (90°) 731 to 741	£9.20
DECCA 20/24, 1700, 2000, 2401	£3.80	**PHILIPS** G8	£8.80
GEC 2114J/Junior Fineline	£2.80	**PHILIPS** G9	£10.80
PHILIPS 320	£2.80	**PHILIPS** 570, 571	£6.80
KB VC ELEVEN (003)	£1.75	**PHILIPS** KT3	£9.80
KB VC1	£2.80	**THORN** 3000/3500 SCAN, EHT	£6.90
		THORN 8000, 8500, 8800	£12.80
		THORN 9000 to 9600	£12.90

OTHERS AVAILABLE, PRICES ON REQUEST. ALSO LOPTS.
TRIPLERS Full range available. Mono & Colour.
Special Offer: Thorn 8000 (2 lead) EHT Tray **£2.80** p.p. 80p.
TRANSDUCTORS suitable for G8, A823, Bradford etc. **£1.50** p.p. 60p.
6·3V CRT Boost Transformers for Colour & Mono **£5.40** p.p. £1.20.
THORN TX10 focus control **£8.80** p.p. 80p.
THORN 8000 mains input choke **£6.80** p.p. £1.40.

CALLERS WELCOME AT SHOP PREMISES
THOUSANDS OF ADDITIONAL ITEMS, ENQUIRIES INVITED
LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS
TELEVISION MAGAZINE PROJECT PARTS & REPLACEMENTS STILL AVAILABLE
Telephone 01-794 8751, 794 7346

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172 WEST END LANE, LONDON, N.W.6.

NEAR: W. Hampstead Tube Stn. (Jubilee) Buses 28, 159, C11 pass door
W. Hampstead British Rail Stns. (Richmond, Broad St.) (St. Pancras, Bedford)
W. Hampstead (Brit. Rail) access from all over Greater London.

Mail Order: 64 GOLDERS MANOR DRIVE, LONDON N.W.11.
PLEASE ADD VAT 15% TO ALL PRICES

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Just phone your order through, we do the rest.

Buy with

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Telex: 635562 Griffin G (For P.V.)

SUPPLIERS OF TELEVISION COMPONENTS

TRADE COUNTER OPEN MON-FRI 9 a.m.–5 p.m. SAT 9.30 a.m.–5 p.m. TRADE COUNTER CLOSED WEDNESDAY p.m.

VARICAP TUNERS

ELC1043-05	8.40
ELC1043-06	8.40
ELC2003	16.50
Philips G8/G9	10.50
Philips G11 (U321)	8.50
U322	7.20
U341	9.50
Rank T20	13.00

PUSH BUTTON ASS.

Decca 4 way	6.88
6 way	7.50
GEC 2110 6 way	7.98
GEC Slim 6 way	6.50
GEC/ITT/PYE 7 way	14.50
Pye 4 way (713/15)	9.00
Pye 6 way (207/715)	16.00
Pye 697 repair kit	9.00
Pye 725-735	11.00
Pye 725-735 with tuning head	14.60
Philips G8 (early)	15.50
Philips G8 (late)	13.90
Rank A823	10.75
Rank T20A	9.75
Hitachi 4 way	10.75
Philips G11 unit	26.50
Philips KT3	14.50
Philips KT30	10.30
ITT CVC 8/9 (mod)	12.00
ITT 6 way with VCR	8.90
Thorn 9000 switchback	5.30
Decca 7 way piano key replacement kit	19.50

SERVICE AIDS

SERVISOL Freeze-It	1.14
SUPER SERVISOL	98
SERVISOL Foam Cleanser	96
SERVISOL Plastics Seal	1.08
SERVISOL Silicone Grease	1.20
SERVISOL Tubes Silicone Grease	1.64
SERVISOL Aero Klene	90
SERVISOL Aero Duster	1.20
SERVISOL Excel Polish	92
SERVISOL Video Head Cleanser	86
Super 40	1.62
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Heat Sink Compound 25G	1.08
Silicone Rubber Tube 110G	2.98
Solda Mop standard reel	74

ELECTROLUBE PROOUCTS

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

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Video care kits	3.50
VHS E30 video tape	3.06
VHS E60 video tape	4.00
Scotch E120 video tape	5.00
E180 video tape	4.50
Beta L500 video tape	4.90
Beta L750 video tape	5.80
Philips VCC 240	6.20
Philips VCC 360	8.30
Philips VCC 480	10.21
Philips LVC 1700 1200	15.10

VIDEO HEADS

3HSS VHS	32.50
4HSS VHS	32.80
PS3B Beta/Sony	42.00

VIDEO RECORDER HEADS

Philips V2000	57.00
Philips 1700	57.00
Video lamps	1.30
Video lamp holders	3.30

VIDEO DRIVE BELT KITS

JVC HR3330/3600	4.50
JVC HR3360/3660	4.50
Panasonic NV/300	4.50
Panasonic NV/7000	4.50
Sony SLC7/SLJ7	4.50
Sony SL8000/8080	4.50
Toshiba V7540	4.50
Ferguson HR3330/3600	4.50
Video head cleaner	86

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Stereo playback	4.79
Stereo record/playback	4.99
Stereo record/playback (Dolby)	6.90
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6V MD6515	4.95
9V MD9516	4.95
12V MD12517	4.95

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On/off gen. purpose 4A	75
G8 on/off	1.38
G11 on/off	1.58
G11 on/off remote	1.58
Gen. purpose rotary	66
Thorn Tx 9/10	1.06
GEC 2040	98
Thorn 1591 push on/off	2.90
Rank tuner buttons 1½"×½", 2"×½", 2"×⅜"	35
Rank drive cams	15
GEC 2110 tuner neons	20
Thorn 3500 A1 beam	70
GEC 2110 A1 cont. R/B/G	58
ITT CVC5 on/off	1.24
ITT mains switch + solenoid	4.50
Rank mains switch + solenoid	4.50

EAGLE MULTIMETERS

KEW 7N	6.75	
KEW 14	9.00	
KEW 20	14.50	
EM5	11.95	
EM20A	15.95	
EM10	13.95	
MM50	31.25	Bench
MM100	44.50	Meters
MMT20	21.50	
MM150	75.00	
T1206 intercom	8.50	
MMC100	21.95	Case
TS350	21.95	

ANTEX SOLDERING EQUIPMENT

C15W Iron 240V	6.20
C240 Element	2.75
Bits 102	1.10
106	1.10
820	1.10
821	1.10
CS17W Iron 240V	6.40
CS240 Element	2.75
Bits 1100	1.10
1101	1.10
1106	1.10
XS25W Iron 240V	6.50
XS240 Element	2.75
Bits 50	1.10
51	1.10
Temp. Controlled	
30W Iron CSTC	16.95
40W Iron XSTC	16.95
Unit for above TCSU1	68.95
Stand	2.10
MLXS Auto Repair Kit	8.40

WELLER

Heat gun	12.00
Heat gun tips (pair)	57
3/16" Iron tips 25W (MT5)	57

LABGEAR

CM7261 Power Unit 12V	11.24
CM7262 Reg. Power Unit 12V	12.25
CM7060 MHA 10db 12V W/B	9.86
CM7065 VHF/UHF MHA W/B 12V	14.34
CM7066	13.38
CM7067 UHF 12V MHA (Specify A-B or C/D)	10.72
CM7068 UHF 12V MHA High Gain (Specify A-B or C/D)	15.95
CM7053 Behind Set UHF Amp. (Mains)	13.01
CM7054 Behind Set UHF Amp. (Battery e.g. Caravans)	10.42
CM7043 Second Set Amp. UHF	12.12
CM7093 Behind Set UHF Amp. 3 Sets	15.27
CM7063 Dist. Amp. VHF/UHF 17db/output 12V	22.17
CM7108 VHF/UHF 8+1 Dist. Amp.	43.26
CM9700 27mhz CB Suppress.	4.05
CM6011 Outdoor Splitter (2 way) W/B	7.83
CM9003 Flush Single Outlet	1.47
CM9010 Flush Twin Outlet	1.95
CM9034 UHF Group Filters with DC Through Pass (state A/B/CD)	7.69
CM6006 6 Way Passive Splitter	10.97
CM7042 TV Games Combin.	2.95
CM9009 Flush TV/FM Outlet	3.05
CM7091 Col. Bar Gen.	121.80

STATIONERY

Service Call Pad (100)	1.20
Repair Ticket (100)	3.90
Job Card (100)	2.50
Rental Payment Card (50)	3.50
Rental Agreements (100)	3.50
H.P. Agreements (100)	3.50
Maintenance Agreement (100)	3.50

DID YOU KNOW WE'VE GOT LOTS OF NEW THINGS!

Decca speaker 8R	3.75
B+K tube bases Dynascan	
No. 3 9.50	No. 13 11.11
No. 6 11.08	No. 23 13.86
No. 8 10.08	
L5 7"×3⅝" speaker	4.25
C12 computer cass.	30
C18 computer cass.	33
5¼" floppy disc s/s s/d	1.61
15R fused res. G9	55
G11 line lin coil	2.95
G11 pot G2 R.G.B.	5.30
G11 line scan panel	54.00
G11 power panel	37.50
G11 timebase panel	37.50
G11 bridge trans.	97
G11 EW correc. coil	1.95
G11 final anode lead	1.50
G11 focus unit	5.80
G11 39R 3W resistor	60
G11 RGB 10G diodes	50
Televerta up converta	37.20

SUNORY EQUIPMENT

Test Lead Set	4.20
Degaussing Coil Stick	17.00
Signal Injector	4.00
Elect. Circuit Tester	1.50
5A Choc Bloc (12)	40
Fuse Wire 5A, 15A, 30A	05
4-way 13A Mains Conn.	5.00
Safe Block (mains)	7.00
13A Plug Top (box 10)	4.80
Probes (x10)	10.90
Probes (x1)	10.90
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(2 core)	10.75
(3 core)	13.25
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KT3 posistor	1.50
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Euro decoder panel 1234	46.00
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Hand set 1234	16.00
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Computer to TV	97
7 pin din to 5 pin din	98
5 pin din to 5 pin din	98

IC equivalent booklet £2.25 and transistor equivalent booklet £3.25

SPECIFIC COMPONENTS

Philips G8 knobs sm/lg	50
90° transductor	2.60
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lg	6.20
Thorn 1500 controls	59
390K frame 470K line contrast 1k5	each
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Thorn 9000 focus unit	5.95
Thorn 8500 focus unit	4.75
Thorn Tx10 focus cont.	9.00
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Decca 30 width cont.	50
Decca 2M2 HT cont.	25
Rank T20 focus cont.	2.20
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DIN Plugs 3 pin	22
4 pin	22p
180° 5 pin	20p
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3.5mm Jack Plug	14
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PL259	40
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35m	35	46mm	37	57m	37
66m	39	71m	43	76m	43
90m	43	110m	59		

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74LS20	35	74LS75	65	74LS139	65	74LS194A	75	74LS366	82
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4008B	72	4029B	90	4071B	22	4513B	1.68	4543B	1.12
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4012B	21	4035B	80	4073B	22	4515B	1.88	4553B	2.40
4013B	30	4038B	99	4075B	22	4516B	76	4554B	1.20
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7805	78
7806	78
7808	78
7812	78
7815	78
7818	78
7824	78
78L05	68
78L08	68
78L12	68
78L24	68
7905	98
7906	98
7908	98
7912	98
7915	98
7918	98
7924	98
79L05	72
79L12	72
79L15	72
79L24	72

I.C. SOCKETS DIL to DIL

8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	32
24 way	34
38 way	45
40 way	84

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

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PHILIPS G8/5083 2R2/68R	95
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THORN 1600	1.77
THORN 3500	94
THORN 8000	1.24
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THORN 9800	1.30
DECCA 2R5	96
DECCA 3R9 Modulohm	60

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ECC88	1.35	GY501	1.45	PCL82	1.20	UCH81	2.25
ECF80	1.30	GZ34	3.50	PCL84	1.20	UCL83	1.82
ECF82	88	KT66	8.50	PCL86	92	UY85	1.35
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CQX22	66
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	22mF	28
	47mF	1.03
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35V	0.1mF	13
	0.22mF	13
	0.47mF	13
	1mF	13
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	4.7mF	26
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THORN 1691	9.68
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THORN 8000	5.28
THORN 8500/8800	7.15
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DECCA 100	7.50
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PHILIPS 320 (400/400/200V)	3.02
DECCA 30 (400/400/350V)	3.74
DECCA 80 (400/350V)	4.37
DECCA 100 (800/250V)	
DECCA 1700 (200/200/400/350V)	5.32
PHILIPS G8 (600/300V)	2.53
PHILIPS G9 (600/300V)	2.44
PHILIPS G11 (470/250V)	3.19
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PYE 731 (600/300V)	2.55
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RBM A823 (600/300V)	3.12
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GEC 2040 (300/300/150/100/50)	4.51
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THORN 3500 (1000/63V)	95
THORN 3500 (1000/70V)	95
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PHILIPS 69 2200/63V	1.38
THORN 4700 P/C 25V	1.32
THORN 1591/1691 4700/25V	1.32

CAPACITORS AXIAL

Volts	Mfd	Price			
6V3	33	9	*63V*	1	12
10V	22	10		2.2	12
	47	10		4.7	12
	100	10		10	11
	220	15		15	12
	470	20		22	13
16V	33	11		47	19
	68	11		100	23
	220	16		220	37
	1000	27		470	49
	3300	53		1000	85
25V	10	11	*100V*	2200	1.10
	22	13		10	13
	47	15		22	15
	100	15		47	20
	220	29		100	36
	470	30	*450*	220	70
	1000	55		1	33
	2200	51		4.7	30
	4700	98		10	30
40V	10	10		22	65
	22	10	*500*	33	75
	400	48	*600*	10	32
				0.1	41

MIXED DIELECTRIC CAPS

Volts D.C.

250V	0.91mF	1.15	*1250V*	0.1mF	59
400V	0.22mF	29	*1500V*	0.0047mF	32
600V	0.1mF	38		0.022mF	30
1000V	0.01mF	24		0.033mF	62
	0.047mF	46		0.005mF	65
	0.033mF	33	*2000V*	0.0052mF	1.20
	0.1mF	35	*2500V*	0.0022mF	50
	0.22mF	66			
	0.47mF	98			

CONVERGENCE POTS

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

METRIC CONVERGENCE POTS

PHILIPS G8
5R-10R-15R-20R-50R — 60

FUSES

	Per type	Pack of 10
1¼" QUICK BLOW		
100ma		73
250ma-500ma-750ma-1A		60
1.5A-2A-2.5A-3A-5A		60
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A, 1.5A, 2A		1.70
2.5A, 3A, 5A		2.70
20mm ANTISURGE		
80ma		4.80
100ma		2.50
160ma, 200ma		2.20
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A		1.30
2.5A, 3.15A, 4A, 400ma, 5A		1.90
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A		60
1" MAINS		
2A, 3A, 5A, 10A, 13A		1.00

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18" A47/343X	59.00
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26" A67/120X	65.00
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A66 510	92.00

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19" A49/120X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
25" A63/200X	34.00
26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (410X) 110°	36.00
26" A66/140X (410X) 110°	36.00
20" A51/161X	60.00
22" A56/510X	50.00
A56 540X	89.00
A66 540X	75.00
A66 500X	64.00

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470R-1K-2K2-4K7
10K-47K-470K — 65

SKELETON PRE-SET POTS

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

MIOGET CONTROLS

Insulated Spindle Length 44mm

Log or Lin Without Switch 5K-10K-25K-50K-100K-250K-500K-1M	54p
With D.P.S.T. Switch **Log:** 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M	97p
Dual gang Controls	1.25
16mm Rotary Controls 10K, 22K, 100K, 1M, 10K	39p

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

WIREWOUND RESISTORS*

4W 1R-10K	24p
7W 1R-22K	26p
11W 1R-22K	29p
17W 1R22K	32p
(Preferred values)*	

EVER READY BATTERIES

HP2	26	PP6	82
HP7	12	PP7	82
HP11	24	PP9	84
HP16	13	R6PP	17
PP3	42	R14PP	26
PP3-C	53	1289	45

CARBON RESISTORS*

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

Sold in packs of 10 per type i.e. per value

RECHARGEABLES

EVER READY

RX6 (HP7)	1.10
RX14 (HP11)	1.95
RX20 (HP2)	2.15
RX22 (PP3)	3.75
Universal Charger	7.50

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1640/1	5.00	3V29/30	33.00	G11	3.90
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9800	6.80	80	5.35	KT3	3.90
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AC107	35	BC558	9	BF355	56	OT121	1.91
AC126	30	BCY72	13	BF362	68	R2008B	1.90
AC127	32	BD115	45	BF363	72	R2010B	1.92
AC128	32	BD116A	65	BF371	30	R2265	1.50
AC128K	40	BD124P	79	BF392	35	R2322	62
AC141K	39	BD131	50	BF422	34	R2323	67
AC142K	38	BD132	49	BF423	46	R2461	1.50
AC176	35	BD133	60	BF435	35	R2540	2.80
AC176K	35	BD135	38	BF457	35	RC4558	2.20
AC186	41	BD136	38	BF458	43	RCA16334	90
AC187	38	BD137	38	BF459	43	RCA16029	99
AC187K	38	BD138	35	BF460 = BF462	86	RCA16039	99
AC188	35	BD139	35	BF469	46	RCA16092	99
AC188K	39	BD140	44	BF470	66	RCA16040	96
AD143	62	BD144	1.70	BF597	10	RCA16041	84
AD161	54	BD150	60	BF757	54	RCA16334	90
AD162	54	BD159	65	BF758	54	RCA16335	90
AD161/62 MP	1.15	BD166	52	BFR39	27	RCA16957	2.88
AF106	49	BD179	70	BFR40	30	TIC45	90
AF114	89	BD182	1.20	BFR79	85	TIC46	60
AF118	1.20	BD183	75	BFR90	1.74	TIL32	65
AF121	75	BD201	85	BFT42	39	TIL78	48
AF124	48	BD202	91	BFT43	39	TIP29C	43
AF125	46	BD203	80	BFW10	60	TIP30A	47
AF126	46	BD204	99	BFX29	40	TIP30C	43
AF127	38	BD222	46	BFX84	42	TIP31C	55
AF139	58	BD223	56	BFX85	30	TIP32C	42
AF178	1.54	BD225	47	BFX86	30	TIP33B	75
AF239	60	BD232	68	BFX88	46	TIP34B	1.06
AL102	4.90	BD233	60	BFY50	30	TIP41C	47
AU106	2.50	BD234	63	BFY51	30	TIP42C	50
AU113	5.20	BD235	60	BFY52	24	TIP47	70
BC107	20	BD236	65	BFY90	95	TIP120	65
BC108	20	BD237	57	BR100	34	TIP2955	90
BC109	20	BD238	65	BR101	45	TIP3055	63
BC114	12	BD243	85	BR103	83	TIS91	21
BC115	17	BD244	85	BR303	1.46	TU106/02	1.80
BC116A	16	BD410	79	BRC4443	94	2N696	21
BC117	30	BD434	74	BRC4444	98	2N918	82
BC118	24	BD437	86	BRY39	56	2N2904	51
BC119	36	BD438	94	BRY55	45	2N2905	28
BC139	28	BD507	52	BRY56	57	2N3054	60
BC140	32	BD508	55	BSR59	1.80	2N3055	60
BC141	26	BD509	56	BSV57B	89	2N3702	11
BC142	30	BD510	60	BT100	1.65	2N3703	10
BC143	31	BD278A	81	BT101	1.20	2N3705	10
BC147	13	BD517	60	BT102/500	1.20	2N3706	10
BC148	9	BD520	75	BT106	1.60	2N3708	17
BC149	12	BD535	82	BT108	1.69	2N5294	48
BC157	16	BD536	91	BT109	99	2N5296	48
BC158	16	BD696A	1.49	BT116	1.21	2N5298	69
BC159	15	BD697	1.24	BT119	3.66	2SB337	1.86
BC160	52	BD695	1.39	BT120	3.66	2N5496	53
BC161	28	BD698	1.50	BT151/800	1.20	2N6107	75
BC170B	15	BD707	95	BU104	2.00	2N6109	81
BC171	15	BDX32	2.10	BU105	1.58	2SA715	1.98
BC172	15	BF115	38	BU108	1.80	2SC495	1.10
BC173	12	BF117	36	BU124	1.90	2SC496	1.31
BC174	10	BF125	26	BU126	1.75	2SC643A	1.50
BC177	27	BF127	47	BU204	1.50	2SC1096	1.72
BC178	26	BF154	23	BU205	1.42	2SC1172Y	2.20
BC182L	9	BF158	18	BU206	1.80	2SC1173Y	1.69
BC183L	12	BF160	27	BU208	1.60	2SC1306	2.73
BC184L	14	BF167	24	BU208A	1.65	2SC1307	3.00
BC186	35	BF173	22	BU208D	2.20	2SC1449	1.67
BC187	25	BF177	52	=BU800		2SC1520	68
BC204	10	BF178	46	BU208/02	2.10	2SC1678	2.67
BC208	13	BF179	28	BU326A	1.75	2SC1909	2.90
BC209	10	BF180	39	BU407	1.70	2SC1953	1.44
BC212	9	BF181	39	BU426	3.07	2SC2028	1.82
BC212L	13	BF182	36	BU500	2.30	2SC2029	2.60
BC213	13	BF183	29	BU526	2.46	2SC2078	2.90
BC214	10	BF184	36	BU508	3.20	2SC2091	1.34
BC237	14	BF185	36	BU806	1.40	2SC2166	2.73
BC238	14	BF194/394	16	BU807	2.94	DEC1	2.20
BC251A	18	BF195	16	BUW84	1.45	DEC2	2.20
BC252	12	BF196	16	BUW91A	3.84	THY15/80	2.20
BC261	18	BF197	16	BUX84	1.50	THY15/85	2.20
BC262	18	BF198	18	E1222	40	BUW81A	3.84
BC300	50	BF199	21	MCR101	45	T6006V	1.50
BC301	53	BF200	35	MCR220	1.50	T6021V	90
BC303	33	BF224	25	ME0411	20	T6022V	1.80
BC307	20	BF225	20	MJE340	68	T6026V	90
BC308	25	BF241	25	MJE520	50	T6027V	63
BC323	99	BF256	55	MJ3000	1.98	T6028V	66
BC327	18	BF257	28	MPSA92	35	T6029V	2.50
BC328	18	BF258	25	MR814	45	T6034V	81
BC337	18	BF259	35	MR854	55	T6036V	90
BC338	18	BF262	84	MR475	2.46	T9002V	1.12
BC461	30	BF263	75	MR479	2.60	T9003V	60
BC547	13	BF271	24	ON447	99	Transistor mounting kit T066, T03, T0220AB	30
BC548	13	BF273	24	ON448	99		
BCX32 = BC637	39	BF274	24	OT112	1.91		
BC549	8	BF336	36				
BC550	7	BF337	41				
BC557	8	BF338	41				

INTEGRATED CIRCUITS

AN214Q	3.91	SN76131N	2.00	TCA910	2.20	UPC1197C	1.06
AN240	3.84	SN76226DN	2.00	TCA940	1.95	UPC1198C	84
AN318	3.98	SN76227N	1.18	TDA440	2.20	UPC1200V	1.18
AN262	2.45	SN76533N	1.70	TDA1002	1.95	UPC1211V	2.70
AN301	5.15	SN76033N	2.49	TDA1003A	5.50	UPC1212V	1.34
AN715Q	3.97	SN76544N	2.35	TDA1004A	3.35	UPC1215V	1.66
AN6340	7.85	SN76650N	1.05	TDA1006A	2.50	UPC1216V	1.20
AN6341N	5.10	SN76660N	80	TDA1005	3.60	UPC1217G	1.13
AN6344	7.85	SN76666N	80	TDA1010	1.54	UPC1218H	1.80
BA521	2.80	SN76530A	1.47	TDA1035	4.70	UPC1223C	2.20
BA536	3.00	STK015	6.25	TDA1037	2.95	UPC1225H	2.00
CA555	46	STK032	=	TDA1044	4.37	UPC1226C	1.50
CA556	84	STK078	13.25	TDA1060A	4.44	UPC1227V	1.20
CA741	25	STK043	11.05	TDA1062	1.56	UPC1228H	54
CA748	45	STK433	5.65	TDA1083	1.68	UPC1230H	3.95
CA3065	1.80	STK435	9.06	TDA1170S	3.00	UPC1238V	1.16
HA1151	3.89	STK436	5.50	TDA1190	3.50	UPC1245V	1.35
HA1322	2.65	STK437	7.85	TDA1180	2.91	UPC1350C	4.15
HA1342	2.49	STK439	6.62	TDA1200	2.95	UPC1353C	1.92
HA1306N	2.60	STK459	8.20	TDA1220A	2.12	UPC1365C	6.38
HA1366WR	2.80	STK441	8.10	TDA1270	3.95	UPC1356C2	2.08
HA1392	3.95	STK461=465	9.60	TDA1327	1.70	UPC1367	2.08
HA11219	2.49	STK463	14.30	TDA1352B	1.60	UPC1378H	2.70
HA11244	1.98	SW153	2.74	TDA1412	1.20	UPC1358H	1.88
LA4031P	3.21	TA7050P	95	TDA1415	1.40	UPC1360C	2.20
LA4032P	2.90	TA7051P	95	TDA1470	4.67	UPC1363C	2.16
LA4102	3.37	TA7063P	2.20	TDA1770	5.60	UPC1366C	1.84
LA4400	3.05	TA7074P	1.00	TDA2002	2.80	UPC1368H2	2.15
LA4422	3.28	TA7108P	3.43	TDA2003	1.20	UPC1370C2	2.58
LC7130	5.93	TA7120P	2.43	TDA2004	2.52	UPC1382C	1.08
LC7120	5.87	TA7129AP	3.76	TDA2006	1.78	UPC1384	3.78
LC7137	5.50	TA7130P	1.93	TDA2010	2.00	UPC1447H	58
LM1011	3.25	TA7146P	4.67	TDA2140	5.95	UPC41C	2.80
LM1340T	75	TA7193P	5.67	TDA2150	2.22	UPC5743	38
MB3712	1.95	TA7171P	1.85	TDA2020	4.66	UPC577H	2.46
MC1307	1.99	TA7172P	1.85	TDA2030	2.80	UPC585C	1.28
MC1310P	1.60	TA7173P	1.85	TDA2522	2.40	TDA 1011	4.00
MC1327	1.70	TA7176P	2.50	TDA2523	3.40	11A 4112	75
MC1351P	2.93	TA7202P	4.27	TDA2524	2.25	TAA570	3.98
MC1349	1.99	TA7204P	3.77	TDA2525	4.00		
MC1350	1.50	TA7205AP	3.72	TDA2530	2.70	while stocks last	
MC1352	1.75	TA7208P	3.40	TDA2532	2.56		
MC1358P	1.50	TA7210P	6.60	TDA2540	3.84		
MC1495L	3.00	TA7222	2.42	TDA2541	3.84		
MC14011BCP	66	TA7223P	3.74	TDA2560	3.50		
MC14049UB	43	TA7227P	5.98	TDA2571	2.56		
MC7742	1.35	TA7228P	5.98	TDA2576	3.75		
MC7812	1.35	TA7310P	2.78	TDA2576A	3.75		
ML231 ETTR6016	2.20	TA7609P	4.39	TDA2577	4.50		
ML232	2.20	TA7611AP	2.92	TDA2581	3.30		
ML236	5.35	TAA310	2.83	TDA2582	2.60		
ML237	2.50	TAA320	2.00	TDA2590	3.25		
ML238	6.00	TAA550	55	TDA2591	2.95		
ML239	2.50	TAA630	3.90	TDA2593	2.95		
ML920	4.12	TAA8400S1	1.96	TDA2600	5.30		
ML922	3.29	TAA661B	1.20	TDA2610	3.20		
ML928	2.18	TBA120A (A),(S),(AS),(SA).	88	TDA2611A	1.95		
MM5387ANN	4.15	TBA120B	1.39	TDA2640	2.92		
MRF475	2.50	TBA120SB	1.37	TDA2652	7.31		
MRF477	10.00	TBA120T	95	TDA2653	5.90		
MSN5807	7.87	TBA120U	1.10	TDA2680	3.40		
MS1513L	2.80	TBA395	1.20	TDA2690	1.35		
MS1515L	3.28	TBA396	80	TDA3190	2.00		
SAA1025	4.40	TBA440N (TBA1441)	2.75	TDA3500	6.90		
SAA1124	2.50	TBA440P	2.50	TDA3560	6.00		
SAA1250	3.94	TBA480Q	1.58	TDA3561	6.50		
SAA1251	4.90	TBA510	3.00	TDA3571	3.75		
SAA5000	4.39	TBA520(Q)	1.68	TDA3651A	4.50		
SAA5010	6.30	TBA530(Q)	1.38	TDA4420	4.22		
SAA5012	6.50	TBA540	1.68	TDA4600	2.95		
SAA5020	5.90	TBA5600	1.59	TDA9503	2.50		
SAA5030	8.25	TBA570	1.79	TEA1002	3.50		
SAA5050	8.50	TBA690	1.50	TEA1009	1.37		
SAA3210	2.93	TBA641BX1	3.50	UPC554	1.34		
SAS560S	1.89	TBA673	2.45	UPC566H	2.95		
SAS570S	1.89	TBA700	2.12	UPC575C2	3.40		
SAS660	3.25	TBA720	2.64	UPC576H	1.90		
SAS670	3.25	TBA750	2.98	UPC587C2	1.60		
SAS580	2.90	TBA800	1.62	UPC1025H	2.95		
SAS590	2.90	TBA810AS	1.10	UPC1028H	2.52		
SL901B	5.50	TBA820	1.70	UPC1032H	64		
SL917B	6.50	TBA820M	1.25	UPC1042C	1.56		
SL1310	1.80	TBA890	3.94	UPC1156H	4.26		
SL1327Q	1.20	TBA920(Q)	3.00	UPC1158H	78		
SL1430	1.25	TBA950(2X)	3.25	UPC1163H	98		
SL1432	3.36	TBA970	4.09	UPC1167C2	94		
SL76544	2.05	TBA990	1.90	UPC1168C	1.28		
SN76003N =SN76013N	2.49	TBA14406	2.44	UPC1176C	1.46		
SN76023N	2.00	TCA160	2.50	UPC1177H	1.56		
SN76110N	1.15	TCA760	2.30	UPC1178C	1.28		
SN76115N	2.27	TCA270SQ	2.50	UPC1180C	1.84		
		TCA800	4.50	UPC1181H	1.62		
		TCA830	3.44	UPC1182H	2.95		
		TCA900	2.20	UPC1183H	1.38		
				UPC1185H	3.66		
				UPC1188H	2.20		
				UPC1190G	1.20		

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
BYX55/600	30
BYX71/600	90
DY224	2.00
OA47	9
OA90	10
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	10
IN4007	10
IN4148	5
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	20
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ZTX 313	17
LM1889	87
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Y827	£1.42

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BZX61 Range (1.3W)	20
BZX79 Range (400mV)	10
BZY88 Range (400mV)	10
BZY93, 90 (18V)	1.18

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SG6533	£12.36	Power switch KV1810/20/22 & KV2000	£2.11
Forward Belt C5, C7	23p	Push button switch 2060/1400	£3.00
Capstan Belt C5, C7	87p	Power switch KV2704/2020/2022	£3.66
Capstan Belt SL8000/8080	87p	Slide switch REC	87p
Extension Belt SL8000/8080	£2.11	Slide switch REC/PLAYBACK	£1.26
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P.V.

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AN240P	3.42	SN76530P	1.40	TBA750	2.80	UPC1353C	2.78
AN214Q	3.88	SN76533N	1.60	TBA800	1.60	UPC1356C2	3.40
AN715Q	2.90	SN76650N	1.05	TBA810P	1.10	UPC1365C	8.70
CA3065	1.75	SN76660N	0.75	TBA810S	1.20	UPC1367C	3.40
CA4031P	2.88	SN76666N	0.80	TBA820	1.60	UPC1377C	4.68
CA4102	3.30	STK015	6.50	TBA890	3.88	UPC1382C	1.88
CA4250	3.50	TA7108P	3.20	TBA920/Q	3.00	UPC2002V	2.78
CA4400	2.98	TA7120P	2.20	TBA950/2A	3.05	CA723	0.35
CA4422	3.07	TA7129AP	3.65	TBA970	4.05	CA741	0.35
LC7120	5.33	TA7130P	1.65	TBA990	1.88	**D CONNECTORS**	
LC7130	5.26	TA7172	1.80	TCA160C	3.90	9 way / 15 way / 25 way	
LC7137	5.16	TA7193	5.50	TCA270S	4.00	**Male**	
LM380N	1.65	TA7172P	1.80	TCA270SA	4.02	Solder .75	1.00 / 1.50
LM1303N	2.52	TA7176	2.50	TCA800	3.10	Angle 1.40	2.00 / 2.40
HA1151P	3.12	TA7202P	4.18	TCA940	1.90	**Female**	
MC1307P	1.85	TA7204P	1.86	TDA440	3.80	Solder 1.00	1.45 / 1.85
MC1310P	1.85	TA7205AP	1.50	TDA1002	1.90	Angle 1.50	2.00 / 2.40
MC1312P	2.25	TA7208P	3.27	TDA1003A	5.50	**Covers** 80	80 / 80
MC1327P	1.25	TA7210P	6.50	TDA1006A	2.40		
MC1330P	0.83	TA7222P	2.12	TDA1035S	4.50		
MC1349P	1.85	TA7223P	3.68	TDA1044	4.30		
MC1350P	1.20	TA7227P	5.60	TDA1170S	3.00		
MC1351P	2.50	TA7310P	1.80	TDA1190	3.50		
MC1352P	1.50	TA7609P	4.28	TDA1200	2.98		
MC1357P	2.88	TA7611AP	2.88	TDA1270Q	3.70		
MC1358P	1.30	TAA263	2.46	TDA1327A	1.66		
MC1496L	1.15	TAA310A	2.68	TDA1352A/B	1.56		
ML231B	2.10	TAA550	0.50	TDA1412	1.20		
ML232B	2.10	TAA570	1.99	TDA2002	2.80		
ML237B	2.30	TAA611A12	3.50	TDA2020	4.60		
MRF475	2.50	TAA630S	3.90	TDA2030	2.78		
MRF479	5.20	TAA661B	1.70	TDA2140	5.90		
MRP477	10.00	TAA700	2.80	TDA2521	4.10		
NE555	0.50	TAA840	3.38	TDA2523	3.50		
C-mos 555	0.88	TAD100	2.80	TDA2530	2.70		
NE556	0.80	FM FILTER	1.20	TDA2540	3.80		
SAA1024	5.35	TBA120 AS, S,SA,SB	1.30	TDA2541	3.80		
SAA1025	8.40	Q,T,U,UQ	1.32	TDA2560	3.50		
SAS560A	2.50	TBA120B	1.30	TDA2571A	2.50		
SAS560S	1.85	TBA231	1.45	TDA2581	3.20		
SAS570S	1.85	TBA281	2.65	TDA2590	3.20		
SAS580	2.85	TBA395	1.20	TDA2591	2.98		
SAS590	2.82	TBA480Q	1.50	TDA2593	2.98		
SC9503P	1.10	TBA400	2.30	TDA2610	3.20		
SL432A	4.00	TBA510	2.60	TDA2611A	1.94		
SL901B	5.20	TBA510Q	2.60	TDA2640	2.90		
SL917B	7.25	TBA520/Q	1.60	TDA2680	3.40		
SL1327Q	1.10	TBA530/Q	1.30	TDA2690	3.50		
SN76003N	2.44	TBA540/Q	1.40	TDA3950A/B	2.60		
SN76013N	1.90	TBA550/Q	1.52	UPC554C	1.32		
SN76023ND	2.90	TBA560C	1.70	UPC557H	0.90		
SN76033N	2.45	TBA560CQ	1.60	UPC566H	2.95		
SN76110N	1.12	TBA570	1.50	UPC575C2	3.20		
SN76115N	2.00	TBA641BX1	4.50	UPC1018C	1.10		
SN76131N	1.65	TBA673	2.40	UPC1025H	2.90		
SN76226DN	1.80	TBA700	2.85	UPC1032H	0.90		
SN76227N	1.10			UPC1156H	4.20		
				UPC1158H	0.76		
				UPC1163H	0.98		

ZENER DIODES

400mW Plastic 3V–75V **8p each. 10/75p.**
1.3W Plastic 3V–200V **15p each. 10/£1.40**
1.5W Flange 4.7–47V **£1.26 each**
2.5W Plastic 7.5–75V **64p each**

PLUGS & SOCKETS

Metal Co-ax Plug	0.18
Plastic Co-ax Plug	0.14
Metal Line Socket	0.50
Single Junc Socket	0.80
Plastic Phono	0.15
F.M. Plugs	0.20
PL259 Plugs	0.38
Reducer	0.15
Low loss splitter 1 in, 2 out	1.00

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which) **49.95**
XS25 Watt Iron complete with steel and plug attached 7.20
CS 18W, as above 7.00
Antex 15W iron **5.00**
Antex 18W iron **5.00**
Antex 25W iron **5.20**
Antex elements **2.00**
Antex bits **0.95**
Antex stands **1.90**
Soldersucker **4.50**
Nozzles **0.65**

TERMINAL BLOCKS

2 amp 12 way	0.19
5 amp 12 way	0.20
10 amp 12 way	0.40
15 amp 12 way	0.46
32 amp 12 way	0.90

SONY TV & VIDEO SPARES

Rewind Kits	SLC5-SLC7	A-670-634-8A 4.50
	SLC6	A-670-639-1A 3.50
Video Heads	SLC6-SLC7	A-676-203-8A 48.25
	SLC5	A-676-204-4A 45.60
Motor Kit		X-354-931-41 13.45
Idler Assembly		X-366-331-50 0.95
Cap.Film 0.18mf/1.5Kv		1-129-962-11 1.35
Relay		1-515-323-00 5.10
Switch Power		1-516-390-11 2.30
Switch Push Button		1-552-503-11 3.25
Thyristor SG264A		8-726-420-00 4.00
SG6533		8-765-330-00 13.45
Service Manuel		20.00

Send S.A.E. for our latest Sony Spares list. Over 140 spares now available

13A P/S/U Box with integral Plug. Available In White. **85p each**

50V Ceramic Kit 5 each value 125 per Kit. **£3.50 each**

NI-CAD CHARGER

Universal Ni-Cad charger, charges PP3, AA, C, D
Price **£6.00**

Rechargeable Batteries

AA (HP7)	£0.85 10/ 75p each
C (HP11)	£1.75 10/£1.65 each
D (HP2)	£2.05 10/£1.95 each
PP3	£3.80 10/£3.70 each

Dry Cell Batteries – Button type for Multimeters – set of 3 **£1.50**

CHART RECORDER SPECIAL

Brand new 3 channel pen recorders complete with charts. Full spec. upon request. Once only price **£40 + £10 p&p + VAT.**

TELEPHONE SPECIAL

B.T. Approved. Telephone Plug + 3m Lead **£1.25**
B.T. Approved. Master Socket. Incl. Wiring Inst. **£2.85**
B.T. Approved. Secondary Socket **£1.95**
B.T. Telephone now available.
B.T. 4-way Plug **50p**
10 for **£5.50**

Fuseholders

20mm Panel Mounting	0.28
20mm Chassis Mounting	0.06
1¼" Panel Mounting	0.35
1¼" Chassis Mounting	0.12
Carline 1¼" holder	0.10

FUSES Prices per 10

1¼" Quick Blow. 100, 150, 250mA **£1.30.** 1, 1.25, 1.5, 2, 2.5, 3, 10, 15A **55p.**
1¼" Time Delay. 100mA **£3.50.** 150mA **£2.25.** 250, 300, 500, 600, 750, 850mA **£1.84.** 1, 1.25, 1.5, 1.6, 2A **£1.84.** 2.5A, 3.15, 3, 5A **£2.82. 20mm Quick Blow.** 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA. **£1.00.** 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A **85p. T" Mains.** 2, 3, 5, 7, 10, 13A **85p.**
Manufacturers please note — Very attractive quantity prices available upon request.

REPLACEMENT TV MAINS DROPPERS

GEC2010	8R + 15R + 17R + 70R + 63R + 188R	0.95
GEC 2018	10R + 15R + 19R + 70R + 188R	1.15
Philips G8	2.2R + 68 R	0.80
Philips 70	6R + 124R + 84R	0.68
Philips 300	118R + 148R (with link)	0.85
Philips 300	30R + 125R + 2.85K	1.08
RRI A640	250R + 14R + 156R 50W	1.05
RRI A816	302R + 70R + 6.2R	0.78
Thorn 1500	350R + 20R + 148R + 1.5K + 317R	1.34
Thorn 3000/3500	6R + 1R + 100R Fused	0.93
Thorn 8000	56R + 1K + 47R + 12R	0.95
Thorn 8500	1K5 + 40R + 50R	1.28

MULTISECTION ELECTROLYTICS

THORN	850	100+300+100+16/300V	1.80
	1400	150+100+100+100+150/320V	2.70
	1500	150+150+100/300V	1.50
	3000	1000/63V	0.56
	3500	175/400V+100+100/350V	1.70
	8000	400/350V	2.10
	8000/8500	2500+2500/63V	1.35
	8000	700/250V	2.10
		1000/70V	0.58
	9000	400/400V	2.25
Timer Amp		4700/25V	0.70
DECCA 10/30		400+400/350V	2.45
	1700	200+200+400/350V	3.52
GEC	2047	2048 2083 2084 2104 200+200+150+50/300V	2.32
		600/250V	1.50
ITT/KB		200+200+75+25/350V	2.15
		220/100V	1.95
PHILIPS	G8	600/300V	1.70
	G8 G9	600/300V	1.50
	G11	470/250V	1.50
	G9	2200/63V	1.26
EKCO	T148	125+200+100+32/275V	2.65
	691 Series	200+300/350V	2.15
		600/300V	1.80
		300+300/300V	2.05
RANK	A823	2500+2500/30V	0.98
		220/400V	1.75
		600/300V	1.78

SERVICE AIDS

ALL SERVISOL PRODUCTS		Excel Polish	0.92
		Fire Extinguisher 640g	2.80
Switch Cleaner	0.98	Video Head Cleaner	0.86
Circuit Freezer	1.14	Solda Mop (Std)	0.74
Foam Cleanser	0.96	Solda Mop (L/Gauge)	0.74
Aero Klene	0.90	Solda Mop Heat Sink Comp	1.08
Silicone Grease (Tube)	1.64	Additional P&P on above 30p each	
Antistatic Spray	0.98		
Plastic Seal	1.08		

VDRs, etc.

E295ZZ	
01/	0.28
02/	0.28
E298CD /A258	0.25
E298ED /A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E299DD/P116-P354	all 0.23
E299DH /P230	0.72
VA1015	0.92
VA1033/34/38/ 40/53	39/ all 0.20
VA1056s/56s/66s/ 67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/ 98	all 0.20
VA1103	0.32
VA1104	0.72
VA1108/09/10/ 11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59

Many more types in stock

RESISTORS – CARBON FILM 5%

¼W 1RO to 10M (E12 Range) **2p each. 15p/10. 75p/100**
½W 2R2 to 10M (E24 Range) **2p each. 15p/10. 75p/100**
1W 10R to 2M2 (E12 Range) **7p each. 65p/10. 6.00/100**
2W 10R to 2M2 (E6 Range) **8p each. 70p/10. 6.00/100**

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	5.00
¼W pack 5 each value E12 – 10R to 1M 305 pieces	3.00
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	6.00
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	3.50
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.00

RESISTORS – WIREWOUND. Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.20
4W – 1R0 to 10K – Available in preferred values	0.21
7W – 0.47R to 22K – Available in preferred values	0.25
11W – 1R0 to 22K – Available in preferred values	0.29
17W –1R0 to 22K – Available in preferred values	0.37

VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.95
ECC82	0.65
ECC83	1.10
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.95
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.25
EL84	0.69
EL509	7.85
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	1.36
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.95
PCF801	1.45
PCF802	1.00
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	1.30
PCL86	1.15
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	2.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.90
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.30
AC128	0.30
AC128K	0.34
AC132	0.55
AC141	0.26
AC141K	0.40
AC142	0.26
AC142K	0.48
AC151	0.45
AC152	0.45
AC176	0.28
AC176K	0.46
AC187	0.42
AC187K	0.48
AC188	0.44
AC188K	0.50
ACY40	0.88
AD142	1.10
AD143	1.10
AD149	0.96
AD161	0.42
AD162	0.42
AD161/AD162	0.98
AF106	0.48
AF114	2.10
AF115	2.10
AF116	2.10
AF117	2.10
AF118	0.85
AF121	0.62
AF124	0.48
AF125	0.48
AF126	0.48
AF127	0.48
AF139	0.68
AF178	0.68
AF239	0.68
AF279S	0.75
AL100	2.50
AL102	5.90
AL113	2.20
ASY80	1.75
AU110	1.40
AY102	4.32
BA102	3.34
BA110	0.57
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12
BC108	0.10
A,B or C	0.12
BC113	0.14
BC114	0.12
BC115	0.12
BC116	0.15
BC117	0.22
BC118	0.17
BC119	0.30
BC125	0.12
BC140	0.28
BC141	0.42
BC142	0.30
BC143	0.30
BC147	0.08
BC548	0.12
BC549	0.12
BC550	0.18
BC550C	0.18
BC557	0.12
BC558	0.12
BCX34	0.27
BCY70	0.15
BCY71	0.17
BCY72	0.18
BCZ10	1.68
BCZ11	1.45
BD124P	0.80
BD130Y	0.68
BD131	0.34
BD132	0.34
BD131/BD132	0.95
BD135	0.32
BD136	0.36
BD137	0.36
BD138	0.38
BD139	0.38
BD140	0.38
BD144	1.60
BD145	1.82
BD150A	0.51
BD159	0.65
BD160	1.65
BD165	0.45
BD175	0.60
BD182	1.00
BD183	1.10
BD184	1.20
BD201	0.72
BD202	0.87
BD204	0.80
BD222	0.80
BD225	0.86
BD232	0.45
BD233	0.60
BD234	0.62
BD235	0.63
BD236	0.63
BD237	0.65
BD238	0.56
BD241	0.60
BD243A	0.80
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.54
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.10
BF115	0.32
BF117	0.54
BF119	0.82
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BF160	0.23
BF167	0.30
BF173	0.25
BF177	0.42
BF178	0.30
BF179	0.32
BF180	0.35
BF181	0.35
BF182	0.32
BF183	0.32
BF184	0.32
BF185	0.32
BF194	0.08
BF195	0.10
BF196	0.10
BF197	0.10
BF198	0.14
BF199	0.16
BF200	0.26
BF222	0.48
BF224	0.20
BF224J	0.16
BF240	0.20
BF241	0.20
BF244	0.26
BF244A	0.28
BF244C	0.24
BF245A	0.28
BF254	0.15
BF256	0.40
BF257	0.32
BF258	0.30
BF259	0.32
BF262	0.30
BF263	0.30
BF270	0.30
BF271	0.26
BF273	0.18
BF274	0.32
BF323	0.92
BF336	0.26
BF337	0.26
BF338	0.26
BF355	0.42
BF363	0.82
BF367	0.24
BF371	0.27
BF422	0.38
BF450	0.38
BF457	0.33
BF458	0.36
BF459	0.44
BFR39	0.22
BFR40	0.22
BFR41	0.22
BFR51	0.30
BFR61	0.32
BFR62	0.28
BFR88	0.34
BFR90	1.72
BFX29	0.28
BFX30	0.30
BFX80	3.56
BFX84	0.24
BFX85	0.26
BFX86	0.26
BFX87	0.26
BFX89	0.65
BFY50	0.21
BFY51	0.21
BFY52	0.21
BFY57	0.40
BFY90	0.90
BFY90S	1.34
BR100	0.20
BR101	0.44
BR103	0.58
BRC4443	1.76
BRY39	0.38
BRY56	0.42
BRY61	0.86
BSS17	0.56
BSS27	0.92
BSX19	0.34
BSX20	0.34
BSX59	0.62
BSX76	0.29
BT100A/02	0.94
BT101/300	1.15
BT101/500	1.25
BT102/300	1.35
BT102/500	1.65
BT106	1.50
BT108	1.30
BT109	1.18
BT116	1.25
BT119	3.62
BT120	3.60
BT121	3.02
BT138/600	1.30
BT151/560R	0.90
BT151/300R	1.15
BTY79/400R	2.80
BU100A	2.30
BU104	2.00
BU105	1.20
BU105/02	1.56
BU108	1.80
BU124	1.75
BU126	1.25
BU133	1.80
BU204	1.35
BU205	1.30
BU206	1.70
BU208	1.55
BU208A	1.63
BU208/02	2.05
BU326S	1.75
BU407	1.65
BU407D	1.80
BUX80	3.70
BUY20	1.75
BUY69A	2.60
BUY69B	1.98
BY101	0.48
BY118	1.10
BY122	0.68
BY126	0.12
BY127	0.10
BY133	0.16
BY135	0.25
BY164	0.44
BY179	0.66
BY182	0.87
BY184	0.40
BY187	0.72
BY189	4.75
BY198	0.44
BY199	0.47
BY206	0.24
BY207	0.24
BY210/400	0.25
BY210/600	0.26
BY210/800	0.30
BY223	1.20
BY227	0.26
BY229	0.30
BY238	0.68
BYX10	0.24
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ITT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.48
MJE2955	0.99
MJE3055	0.70
MPSLO1	0.28
MRF475	2.50
MRF479	5.20
MRP477	10.00
OA47	0.10
OA90	0.08
OA91	0.09
OA95	0.18
OA200	0.06
OA202	0.15
OC25	2.10
OC26	1.70
OC28	1.50
OC29	2.47
OC35	1.75
OC36	1.75
OC42	0.72
OC42K	1.40
OC44	0.72
OC45	0.58
OC71	0.50
OC72	0.52
OC81	0.68
OC200	2.46
OC202	2.20
ORP12	0.85
R2008B	1.50
R2010B	1.52
SHG1.5	0.40
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70
TIC106A	0.70
TIP30A	0.46
TIP31C	0.54
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72
TIP41C	0.46
TIP42A	0.52
TIP47	0.60
TIP110	0.88
TIP2955	0.60
TIP3055	0.60
TIS43	0.32
TIS88	0.40
TIS90	0.25
TIS91	0.28
ZTX108	0.12
ZTX109	0.12
ZTX212	0.28
IN4001	0.05
IN4003	0.05
IN4004	0.06
IN4006	0.07
IN4007	0.07
IN4148	0.05
IN5400	0.12
IN5402	0.15
IN5405	0.16
IN5406	0.18
IN5408	0.20
IS920	0.08
2N697	0.55
2N706A	0.33
2N2904	0.28
2N2906	0.24
2N2926G	0.10
2N3053	0.40
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.16
2N3906	0.16
2N5294	0.48
2N6107	0.71
2N6126	0.68
2SB337	1.60
2SC495	0.65
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
2SC1226	0.84
2SC1279	0.50
2SC1306	0.92
2SC1307	1.40
2SC1413A	2.70
2SC1444	1.45
2AC1449	0.63
2SC1507	0.63
2SC1678	1.06
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74
2SC1957	0.76
2SC1969	2.88
2SC2028	0.73
2SC2029	2.10
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
2SC2166	1.20
2SC2314	0.80
2SC2335	1.50
2SC2371	0.90
2SC2749	2.70
2SC2752	0.60
2SD234	0.64
2SD348	3.30
2SD986	0.62
2SJ50	5.20
2SK134	3.80
2SK135	4.60
3N126	1.90
3N211	2.52
3SK45	0.76
3SK88	0.66
3SK135	5.20

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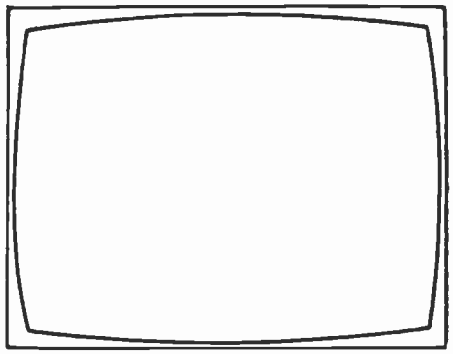

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Please note that the telephone numbers above are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 417.

COVER PHOTO

This month's cover photo shows a rear view (back cover removed) of a set fitted with the Hitachi NP8CQ chassis.

CORRECTIONS

In line 190 of the Spectrum test pattern program (page 379 last month) the graphics bar should have been shown at the top instead of the bottom of the line, i.e. as in similar lines (120, 150, etc.).

Fig. 3(a) on page 372 last month shows the 0·01μF, 200V d.c. capacitor connected to the wrong end of the winding on the field output transformer.

SOVEREIGN TV

We have received several queries relating to Sovereign TV sets, in particular the Model C140 14in. colour portable. They appear to be of Korean manufacture but we have been unable to trace any agents/distributors. Can anyone supply an address for spares etc.?

HELD OVER

Part 3 of "The Lid off Microcomputers" will appear next month.

No Way to run a Broadcasting Service

Not this time a UK matter: instead a look across the ocean at the extraordinary tale of Ted Turner and the Columbia Broadcasting System (CBS).

CBS is America's leading broadcasting network. Its CBS News service is particularly significant in the USA where national newspapers, with the exception of the quirky *Wall Street Journal,* do not exist. But CBS's established position in the news field has led to criticism from the right for its "pro-liberal bias". A group that calls itself Fairness in the Media has been trying to gain control of CBS, a feat that would not be easy – last year CBS made profits of $212m on a turnover of $4·8bn. Enter Ted Turner.

Forty six year old Ted Turner is a controversial character to say the least. His business career started in 1963 when he bought an ailing Savannah billboard company that his father had previously owned. In 1970 he entered the TV broadcasting field when he bought the financially strapped Atlanta TV station WTBS for $2·5m. This was considered to be something of a gamble at the time, but Ted Turner was amongst the first to spot the potential for using satellites to distribute TV programmes/services to cable networks across the USA, where cable TV has been a growth industry during the last decade. Hence the formation of Turner Broadcasting, which in 1980 inaugurated the round-the-clock Cable Network News service (CNN). Turner Broadcasting has expanded rapidly but has not been particularly profitable. In 1984 it made a profit of $10·1m on a turnover of $282m. One of the reasons for the poor profit record is CNN, which is reported to cost $50m a year to run and to be a considerable drain on TBS. It was apparently started as a counter to the US habit of turning to the main networks – CBS, ABC and NBC – for news coverage.

It came as something of a surprise then when TBS announced an offer to acquire a controlling 67 per cent interest in CBS. The offer is a complex one that values CBS at some $155 a share – the pre-bid market price was around $110. How could the comparatively small, heavily indebted TBS finance such an offer? In part through the latest Wall Street fad, "junk bonds", i.e. bonds that offer very high yields and carry correspondingly high risks (if the company flops, the bondholder comes bottom of the list of creditors). It seems that the offer could to some extent be made to work out by doing a bit of asset stripping.

Ted Turner's offer sems cheeky to say the least, and its chances of success are doubtful. TBS is a highly geared company, its ratio of long-term debt to equity capital being $175m to $26·5m. Acquisition of CBS by issuing junk bonds would create a vastly more highly geared operation. It looks like the business economics of the madhouse, but then Ted Turner is on record as feeling that the main US broadcasting networks are "anti-American, materialistic, anti-family, anti-religion and anti-government." He would like to control one and could gain strong backing to do so. To us, this hardly seems the right way to go about running a broadcasting service.

Is there a moral in this for the UK? It's perhaps irrelevant to try to draw conclusions in view of the present wide differences in the broadcasting arrangements in the UK and the USA. But one can say that the story serves as a cautionary tale. Those who would like to dismantle the UK's broadcasting system should beware of chaos this could unleash.

Euro Blues

1984 was not a good year for the European consumer electronics industry. The giants of the industry, Philips and Thomson, failed to make profits in this sector. In the UK, Ferguson is understood to be struggling to break even. Meanwhile on the other side of the globe Matsushita, Japan and the world's largest consumer electronics manufacturer, had another record year. Most other Japanese consumer electronic products manufacturers also reported increased profits.

As mentioned overpage, Thomson's chairman Alain Gomez has called for measures to protect the European industry against foreign competition, particularly against increased competition from Japan. Philips' president Dr. W. Dekker on the other hand, in his foreword to the 1984 Philips annual report, writes: "We consider a free flow of goods on the basis of reciprocity to be of vital importance for the continued development of world trade. Optimum conditions for production and selling can exist only if there is free competition. Protectionist measures aimed at shielding industry are therefore rejected by us." An interesting contrast of views, but then Philips operates on a world-wide basis and Dr. Dekker does emphasize "reciprocity".

For Europe the problems are excessive capacity in relation to local demand, which looks like remaining static for some time to come, while competition from Japan is enhanced by the undervalued Yen. It's hard to see just what can be done to alleviate/improve the situation and interesting to note that at a recent *Financial Times* conference Dr. Dekker talked of the possibility of Philips moving its centre of activities away from Europe. He is reported as saying: "If Europe does not unite, industrial innovation will pass Europe by: multinational companies will then be forced to adjust their geographic priorities . . . If Europe is neither able nor willing to develop its economic structure, then the consequences of that must be drawn."

Teletopics

1984 TRADE FIGURES

Deliveries of TV sets and VCRs in the UK during 1984 are summarised in the following table:

Goods	*Deliveries during 1984 (000s)*	*Percentage change on 1983*
Small-screen CTVs	1,613	+28·4%
Large-screen CTVs	1,959	−12·5%
Teletext-equipped sets	645	−8·8%
Total CTVs	3,572	+2·2%
Monochrome portables	657	−40·8%
VCRs	1,417	−34·4%

The star performance once more came from the small-screen (16in. and smaller) colour TV section of the market, with monochrome portables doing poorly and the VCR market in decline. According to Byron Davies, chairman of the British Radio and Electronic Equipment Manufacturers Association's economics and statistics committee, the UK last year had the highest per capita demand for small-screen CTVs of any large market. The fact that the small-screen CTV has become the standard second set in the UK once more led to an increase in CTV imports. Some 420,000 CTVs worth almost £100m were exported during the year, along with over 250,000 VCRs worth about £70m. Sad to note a further small decline in deliveries of teletext-equipped sets, though the total of over 2·5 million teletext-equipped sets installed in the UK far exceeds that of any other country.

CES LONDON 86

Next year's "under one roof" brown goods trade show will be called the Consumer Electronics Show after the famed annual exhibitions at Chicago and Las Vegas in the USA. The show is being organised by Montbuild Ltd. of 11 Manchester Square, London W1, who organised last year's CETEX, and will be held between April 20th-23rd at Earl's Court, which is to be refurbished with carpeting throughout and the roof draped – there will also be two extra catering areas and a private retailers' lounge and clubroom. The organisers say that the show will be bigger, better and more lavish than any previously organised for the trade in the UK. There will be seven product categories: audio; video; computers; personal (calculators, microwaves, health products, watches, clocks and selected small appliances); communications (telephone equipment and cellular radio); general (aerials, batteries, home security, etc.); and retailer services (specialist shopfitting, in-store security and fire alarm systems, signs etc.). It's intended to have walk-in seminars and business workshops covering all aspects of consumer electronics.

3M's VIDEO TECHNICAL CENTRE

3M, producer of Scotch brand videocassettes and manufacturer of the world's first commercial videotape almost thirty years ago, has completed construction and fitting out of a technical centre at Gorseinon near Swansea. The £2·5m centre has been built alongside 3M's Gorseinon factory, which has been producing videocassettes since 1974, and is equipped to analyse every aspect of videocassette and VCR performance. Three main functions are being undertaken at the centre. First, tests of videocassette performance under normal use conditions. Secondly, detailed physical, chemical and component analysis of videocassette characteristics. Thirdly, a pilot plant enables new videotape formulations to be tried out on a small scale.

The Technical Service Laboratory carries out tests on domestic, professional and broadcast VCRs in all formats. More than 120 VHS, Beta and V2000 machines are linked to computerised dropout measurement and mechanical function controls and are played continuously to allow 3M engineers to monitor the dropout performance of Scotch and other videotapes over thousands of passes, also to check the performance of the mechanical components in a videocassette.

The Product Engineering and Analytical Laboratories contain sophisticated measurement equipment for the analysis of materials and components. Physical measurement equipment includes electron microscope examination of tape and recording head surfaces to a magnification of 180,000, apparatus for measuring the dimensions and surface uniformity of cassette components to tolerances of hundredths of a micron, and equipment to test tapes and components for their friction, abrasivity, static and environmental qualities. Amongst the chemical analysis equipment there's an infra-red spectrophotometer to test surface and material tolerances and check whether new batches of Scotch tape are precisely within formulation specification. Since human nature isn't perfect and someone else's tape stuffed into a similar looking housing is sometimes sold, those engaged in such practices might like to know that the spectrophotometer can "fingerprint" and identify the actual manufacturer of any videotape in 200 secs.

The Gorseinon factory's present production level of 1·75 million videocassettes a month is to be increased to 3·75 million a month in 1987.

A LONG-RUNNING CASE

The case of Thorn EMI Ferguson versus Compagnie Francaise de Television SA (CFT), owners of the patents relating to the SECAM colour television system, has come to an end after fifteen years. On April 2nd the Court of Appeal dismissed CFT's appeal from an earlier High Court decision, which also found in favour of Ferguson, and awarded costs against CFT.

Thorn were originally taken to court as a leading representative of UK TV manufacturers, the case being that manufacturers of PAL colour sets infringed patents relating to the SECAM system – both systems employ a line-duration delay line for signal decoding. Legal and technical argument has long continued over exactly how the patents relating to the use of such a delay line in colour sets should be interpreted. The fact is that the way in which the line is used for PAL and SECAM decoding differs, and this was the crux of the case. Had CFT been successful they might have obtained a multi-million pound settlement in damages: the court's finding removes this threat from Thorn and also from the rest of the UK TV industry, against whom similar suits were pending. A hell of a time to argue over the use of just one component! The legal costs of the case exceeded £1m.

JVC's LATEST VCR

The JVC HRD455 mentioned last month is the first of a new range of machines that will be replacing current models. This month sees the introduction of the HRD140 as a replacement for the HRD120, with a suggested retail price of around £449. Features include "Auto-Power" – it

switches on and off as the cassette is loaded and ejected – remote control, freeze frame, frame advance, nine times shuttle search and auto back-spacing to avoid gaps between recordings. The new range features slim styling – the machines are just 10·5cm high.

EC INTERFERENCE

The European Commission has decided to stick its nose into broadcasting practice. An EEC broadcasting practice Green Paper entitled *Television Without Frontiers* has been published and is expected to be followed by a Commission directive by the end of the year. Amongst the proposals are a maximum advertising time of twenty per cent – the IBA at present has a maximum of ten per cent – and it's thought that this might lead to pressure for more advertising on ITV. The IBA feels that broadcasting standards should be set by the national broadcasting authorities rather than by formal EEC legislation. Quite right. It wasn't so long since that the Commission tried to tell us all what our beer should taste like.

CABLE LATEST

Aberdeen Cable has become the second of the original eleven franchisees selected in November 1983 to begin operations – in the Westhill and Beilside areas of the city. Clyde Cablevision has managed to complete its financing arrangements and is expected to start laying the cable this month: a twenty channel service is expected to start in October. Services in Croydon, Coventry and Westminster are also scheduled to start later this year.

At a speech to the Royal Television Society conference at Birmingham John Butcher, parliamentary under secretary for industry, once again said that the government was not prepared to give cable TV financial backing, commenting that progress would have to depend on consumer response to what the industry had to offer.

PROTECTIONIST PRESSURE FROM THOMSON

Alain Gomez, chairman of the state-owned French consumer electronics group Thomson, has called for protective measures to be adopted to safeguard the European brown goods industry against increased competition from Japan. He pointed out that Japan already controls 80 per cent of the European hi-fi and VCR markets and has a cost advantage of 25 per cent. With the present economic downturn in the USA, where the Japanese have an even greater share of the market, Japanese competition in Europe could well increase. Whether the correct answer is to call for increased EEC duties is debatable however.

MINIATURE SOLDERING STATION

Litesold (Light Soldering Developments Ltd., 97/99 Gloucester Road, Croydon, Surrey CR0 2DN) has introduced a variable temperature miniature soldering station for use on very fine work and sensitive components. The PC478/38 comprises the Model 38 soldering iron which weighs only 7g and handles like a fine pen and the Model PC478 power unit which enables the soldering temperature to be adjusted between approximately 180 and 380°C. Applications include soldering/rework with surface mounted components, calculator and instrument repairs and fine production work.

GEC TO PRODUCE BBC'S DIGITAL PAL DECODER

A digital PAL decoder designed by the BBC is to be manufactured and marketed under licence by GEC-McMichael. The new decoder takes a composite PAL input signal and produces a digital bit-stream of RGB and chrominance/luminance (YUV) information at its output. Other outputs include digitally multiplexed YUV to the EBU parallel interface specification, analogue RGB or YUV and mixed syncs. The use of digital signal processing in this high-quality comb filter PAL decoder achieves a high standard of performance: the separation of chrominance and luminance information is carried out by means of a combined vertical and temporal comb filter, totally suppressing fine cross-colour and giving some attenuation of coarse cross-colour and noise. The new decoder is designed to decode PAL signals for processing in digital video effects equipment and electronic stills stores and could be used in PAL-CMAC conversion. It created great interest at the 1984 IBC and is to be shown at Montreaux this summer.

VIDEO PROCESSING ADC/DACs

Mullard have announced the availability of the video AD converter type PNA7507 and DA converter type PNA7518 mentioned in our feature on chips for tomorrow's sets last month. The two chips are low-power NMOS devices that operate at a sampling rate of 20MHz. The 7-bit PNA7507 has 129 comparators, a reference resistor chain, transcoder stages and TTL output buffers. It requires no external sample and hold, has a high input impedance and is encapsulated in a 24-pin DIL package. The digital output can be selected in twos complement or binary coding. The PNA7518 8-bit DAC has TTL input levels with transparent latch inputs and requires no deglitching circuit. It's encapsulated in a 16-pin DIL package.

IMPROVED VIDEOTAPE FROM JVC

JVC's new Dynarec Titanium Oxide tape is aimed at the VHS hi-fi and AV markets, offering greater durability and improved dropout performance with repeated use. Titanium monoxide is added to the base film resin to make the tape conductive, thus eliminating static dust build up, to darken the tape for improved optical tape motion sensing, and to provide a matt back surface for improved spooling. Removal of three base film additives results in a stronger tape with greater dimensional stability – tape stretching is a major cause of signal loss. Titanium dioxide is added to the coating to act as a dispersant, binder and tape conditioner, replacing three coating constituents. This gives a greater concentration of magnetic material in the coating, improves the magnetic retentivity and increases the toughness of the playing surface.

IN BRIEF

Marconi Communications Systems Ltd. have been awarded a contract to undertake a major re-engineering project at the BBC's Crystal Palace transmitter. The Marconi supplied 40kW klystron transmitters are to be converted to beam-modulated operation to increase their efficiency and reduce station running costs. Marconi will be supplying new 7500 series drives, new vision and sound combiners and other peripheral equipment. The work is due for completion early next year . . . The Japanese watch firm Citizen plans to launch miniature TV sets using liquid-crystal displays in the UK later this year. There will be monochrome and colour pocket models and a "wrist-watch" model. The sets are already on sale in Japan and the USA . . . Seiko is to introduce a "wristwatch"

computer display unit using a two-line, 24-character dot matrix LCD. Listed as Model RC100, the unit is expected to sell for around £110, acts as a watch/calendar in the time mode and has a 2K memory that can store up to 80 "pages" of 24 characters . . . A colour video camera with a solid-state image sensor and mechanical shutter, Model SVC09, has been announced by Prostab International Ltd. of Bracknell. Exposure time is adjustable from 0·1-20msec. The camera is intended for movement analysis, producing sharp images of fast moving action.

TV Fault Finding

Reports from Mick Dutton, Jim Rainey, Malcolm Burrell, A. Davies, Geoff Fardon, Michael Pitt, Philip Blundell, Eng. Tech. and Brian Renforth

Monochrome Portables

Although there are many different portable TV chassis and each set we open up seems to be different we don't often get caught out by awkward faults. Lately however we've had a spate of these small sets that have caused us headaches.

The first was a **Mitsubishi Model BB1204B**, a nice, straightfoward, well laid out chassis. The line output stage was dead so we did the usual checks around the line output transistor and on the rectifiers fed from the line output transformer. Everything seemed o.k. so we moved back to the line driver stage. The voltage at the collector of the transistor seemed about right at approximately 0·6 of the supply rail voltage so we moved back to the line oscillator stage. After a lot of time wasting we got the scope out. This showed that the oscillator was running and that the waveform was reaching the base of the line driver transistor. But there was no waveform at its collector. The set burst into life when a replacement transistor was fitted.

Next a **Bush Ranger, Model BM6714A**. The complaint was no sound. A dab at the input to the sound output stage produced a healthy burp so we moved back to the TBA120SB intercarrier sound chip. Dabbing around here still produced audio noise but there was no off-air noise. We changed the TBA120SB but there was still nothing. We eventually found that C32 (0·02μF) at one of the input pins (pin 13) was faulty.

The next one was a **Sanyo 10-T150H** which was dead with a blown fuse. We replaced the fuse and found that the power supply was heavily loaded down. Disconnecting the supply to the line output transistor restored the correct rail voltage so the fault was clearly in the line output stage. We started by checking diodes etc. then went on to disconnect the output transformer's secondary connections. When the scan coils were disconnected the rail voltage came up and we feared the worst – faulty scan coils – but we decided to try a replacement scan coupling capacitor first. Our luck was in and the set came back to life – we had to order the correct item however due to its large value (C622, 7μF, lacquer type).

The problem with a **GEC 2114** was excessive height with poor linearity. C215 (10μF, 25V) in the field linearity network was open-circuit. **M.D.**

Panasonic TC682GR

The picture on this colour portable suddenly went dark – only slightly dark, which we found we could correct by slight adjustment of the first anode preset. There were several striations down the left-hand side of the screen however. These were similar to what you get when the damping resistor across a line linearity coil goes open-circuit, but in this set the coil is preset and doesn't have a damping resistor. We checked the voltages around the line output stage for a clue and found that the line output transformer derived 190V supply was low at only 155V. The relevant reservoir capacitor C155 (10μF, 250V) was open-circuit. **M.D.**

Nordmende Portable CTV

This set was tripping and a loud knocking noise was coming from the line output stage. When we removed the back the cause of the trouble was obvious. The core of the line output transformer had cracked in half and when the set tried to run the two halves knocked together. We were able to repair the core with Araldite. **M.D.**

Panasonic TC2203 (U1 Chassis)

No results was the complaint with this set. It uses a self-oscillating chopper circuit and we found that while the rectified mains supply was present at the collector of the chopper transistor Q801 there was no voltage at either its emitter or base. The start-up resistor R803 (150kΩ) had gone open-circuit. **M.D.**

Thorn TX10 Chassis

I've had two cases recently where the symptoms were low brightness, the user control having very little effect, and an audible hum from the speaker with the volume control at minimum. In both cases TR654 in the blue output stage was short-circuit base-to-emitter. This transistor forms part of a cascode circuit with its base biased from the 12V line and one can only assume that the symptoms were related to the transistor's effect on the 12V supply. **J.R.**

Thorn 9600 Chassis

This set had a very washed out picture with no colour. The cause was VT115 (BC147) in the decoder short-circuit base-to-emitter. This transistor forms part of the pulse shaping circuit, its failure removing the black-level clamp and burst gate pulses. **J.R.**

Thorn TX90 Chassis

The complaint with this set was "intermittently dead", but it worked perfectly on soak and even a tap around the board failed to produce any trouble. When the board was slipped out for inspection I found that two of the connections to the line output transistor TR112 were dry-jointed. **M.B.**

Intermittent Shut Down

Sometimes a TV set with the complaint that it switches off intermittently comes into the workshop but no amount of soak testing or tapping around will make it go off. As a matter of course these days we give the set a good clean-up around the high-voltage points such as the e.h.t.

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315MA A/S	10 for 50p	750MA	10 for 65p		
500MA	10 for 50p	7A	10 for 50p		
1A	10 for 50p	10A	10 for 50p		
2.5A	10 for 1.00	20A	10 for 50p		
3.15A	10 for 1.00	50A	10 for 50p		

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Thorn Mains TX 8000/8500	10.00
Thorn S.O.P.T. 8000/8500	3.50
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300 Mixed Resistors	1.50
300 Mixed Capacitors	1.50
150 Mixed Electrolytics	2.00
100 W/W Resistors	1.00
20 Mixed Conv Pots	1.00
40 Mixed Pots	1.50
20 Mixed Sliders	1.00
40 Mixed Presets	60p
20 Mixed VDR & Thermistors	1.00
20 Mixed Ferrite Cores	50p
100 Mixed Ceramic Discs	1.00
20 Mixed Valve Bases	1.00

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

AC128	39	BC172	9	BC559	8	BF167	24
AC131	40	BC174B	23	BC595	8	BF173	29
AC138	40	BC177	24	BCX33	22	BF179	32
AC141K	39	BC182LB	12	BCX34	11	BF180	33
AC142K	38	BC183L	12	BD115	49	BF181	30
AC153	39	BC184L	13	BD131	30	BF184	30
AC176	33	BC187	24	BD132	46	BF185	30
AC176K/		BC204	15	BD133	59	BF196	16
AC128K	93	BC208	9	BD139	36	BF197	15
AC188	38	BC212L	9	BD140	38	BF198	19
AD142	1.18	BC213L	12	BD144	1.70	BF199	15
AD143	1.08	BC237	12	BD150	50	BF223	18
AD149	98	BC238B	8	BD163	98	BF224	19
AD161	32	BC238L	8	BD201	74	BF238	20
AD162	32	BC250A	15	BD203	78	BF240	9
AD263	1.05	BC251	8	BD204	99	BF241	21
AF127	45	BC252A	20	BD222	48	BF255	10
AF139	38	BC294	37	BD225	52	BF256S	20
AF239	41	BC301	32	BD232	50	BF257	28
BC107	15	BC303	31	BD233	60	BF259	28
BC108	15	BC307	10	BD234	60	BF271	25
BC109	15	BC308	8	BD237	55	BF274	11
BC115	16	BC309	14	BD238	65	BF337	29
BC117	21	BC327	18	BD241	59	BF338	34
BC125	26	BC328	18	BO244	85	BF355	40
BC126	23	BC337	17	BD278A	81	BF362	50
BC139	27	BC338	17	BD386	88	BF391	21
BC141	34	BC347	8	BD433	71	BF394	16
BC142	30	BC394	8	BD437	83	BF422	47
BC143	31	BC464	8	BD592	1.20	BF423	53
BC147	12	BC455	8	BD589	1.20	BF450	43
BC148	12	BC456	10	BD677G	1.35	BF453	53
BC149	12	BC460	40	BD707	95	BF458	37
BC153	16	BC463	22	BD708	95	BF459	40
BC1540R	16	BC546	8	BDX10	93	BF461	58
BC154YL	16	BC547	12	BDY20	1.09	BF556B	35
BC157	12	BC548	12	BDY82	99	BF596	15
BC158	12	BC549	8	BF137	20	BF694	16
BC159	15	BC557	10	BF153	20	BF757	62
BC171	9	BC558	10	BF154	25	BFR52	31

BFR62	28	NKT276	20				
BFR81	29	NKT453	1.65				
BFR87	25	OT112	1.92				
BFR90	1.74	OT121	2.08				
BFR91	2.08	R1038	80				
BFT42	30	R1039	80				
BFT43	30	R2008B	1.40				
BFX36	40	R2010B	1.10				
BFY50	30	R2030	70				
BFY51	34	R2265	1.30				
BFY52	34	R2305	80				
BRC116	1.50	R2322	50				
BRC1693	1.43	R2443	25				
BU105	1.00	RCA16446	30				
BU126	1.10	RCA16599	1.25				
BU207	1.05	RCA16600	1.40				
BU208	1.15	RCA16799	1.13				
BU208A	1.15	RCA16800	1.42				
BU326A	1.30	RCA16802	1.38				
BU407	1.70	S1299	2.25				
BU408	2.76	S28000	1.25				
BU500	2.30	S6080A/B	3.50				
BU526	2.46	T6050V	1.30				
BU807	2.94	T6052V	1.30				
C1129	9	T9003V	1.25				
C1172B	9	T9010V	1.45				
E5386	54	T9053V	1.30				
E9003	28	T9054V	1.00				
E9005	25	T9039V	1.10				
ME0404	10	TIC45X	50				
ME0412	10	TIC46	48				
ME6002	10	TIC106C	40				
MJ2501	2.36	TIP29	42				
MJ3001	2.21	TIP30	42				
MJE182	47	TIP31	35				
MJE340	50	TIP32	43				
MJE520	50	TIP33	61				
MJE2955	1.40	TIP41	42				
MJE3055	1.50	TIP42	45				
NKT241W	8	TIP110	61				
NKT241G	8	TIS91	25				
NKT241Y	8	ZTX550	30				

INTEGRATED CIRCUITS

BRC1330	1.40	SN76013ND	1.80	TBA530	1.26	TDA2002	2.80
BRC3064	1.00	SN76023N	1.80	TBA540	1.00	TDA2030	2.10
BRC/M/200	1.00	SN76033N	2.00	TBA550Q	1.82	TDA2522	2.10
BRC/M/300	1.00	SN76115	2.00	TBA560C	1.50	TDA2530	2.61
CA3060	1.58	SN76131N	1.58	TBA641	2.05	TDA2540	3.50
LM1303P	1.48	SN76226N	1.25	TBA651	2.50	TDA2560	3.50
ML231B	2.20	SN76227N	1.00	TBA720A	2.49	TDA2581	3.00
ML237B	2.00	SN76530P	1.30	TBA750	2.20	TDA2591	1.96
ML2398	2.86	SN76622N	1.00	TBA800	1.82	TDA2611A	1.95
MC1327AP	1.25	SN76660N	80p	TBA810S	1.00	TDA2640	2.90
MC1358P	1.30	SN76666N	75p	TBA810AS	1.00	TDA2690A	1.50
MC1455P	18p	SN76744	1.92	TBA920	2.08	TDA3580	6.00
MC14516BCP	60p	TA7117P	1.00	TBA950	1.95	TDA9503	2.90
SAA1025	7.20	TA7109AP	2.80	TBA1440	1.92	TCEP100	3.48
SAA1124	4.50	TAA611	1.40	TCA270C	1.95	TEA1009	1.95
SAA5010	6.00	TBA120B	1.20	TCA270CQ	1.05	MC14426P	4.80
SL432A	1.80	TBA120C	1.20	TDA1084A	1.05	MC14429P	4.50
SL1430	2.50	TBA120CQ	70p	TDA1035T	4.00	MC14514	5.00
SN15846N	60p	TBA120S	70p	TDA1037	3.50	UA758PC	2.50
SN74123N	65p	TBA120U	1.00	TDA1200	2.72	UA1008A	2.86
SN74154N	1.40	TBA395	1.00	TDA1270	2.42	ULN2165	1.30
SN76001N	1.40	TBA480Q	1.40	TDA1327	2.76	ULN2216A	1.25
SN76110N	1.14	TBA510	1.90		2.53	SW153	2.50

Thorn 8/8K5 ex equip panels untested		**Thorn 3/3K5 ex equip panels untested**		Thorn 4000 PSU panel ex-factory	2.50
PSU	2.88	PSU	3.75	Thorn 3K5 beam limiter board new	1.75
FTB	3.75	LTB	3.75	Thorn 3K5 PSU bottom board	
Decoder	4.00	Video	2.50	PC206 new	2.75
		Chroma	2.00	Thorn 3K5 IF panel new	3.00
Thorn 9K ex equip panels untested		FTB	2.75	Thorn 3/3K5. EHT & scan TX +	
PSU	12.00	IF	1.75	R2008B on alum chassis ex-equip	1.80
Decoder	5.00	Conv. 3K	3.00	Thorn 8/8K5 damaged FTB for spares	1.25
		Conv. 3K5	3.75	Thorn 8/8K5 damaged decoder for spares	2.25
Thorn 9K6 ex equip panel untested		Autovox Decoder FG/01 new boxed	5.00		
Decoder	5.75	Thorn 4000 Convergence panel ex-factory	3.75		

UHF TV Aerial for portable Indoor Aerial Parabolic Type Reflector to Help Combat Ghosting Problems	50p	Coax Plugs	10 for 1.65
		Band Change Switch Assy, Pye 725	40p
	2.50	Flush Mounting TV/FM Diplexer	1.00
Line Connectors	30p	Switched Flush Fitting Aerial Outlet	1.00

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+ 116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 350+20+148+ 1K5+317	1.40
Thorn 6+1+100	92p
Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

100+150+150	350V 50p	200+200+100	350V 55p
220+47	350V 65p	200+200+75+25	350V 60p
200+150+50	350V 80p	50+50+8	300V 55p
200+200+100	325V 54p	100+50+100	350V 55p
32+32+16	275V 52p	100+150+50	350V 55p
200+200+100+32	350V 70p	2500+2500 (Thorn 8K)	63V 1.20
100+50+150	350V 58p	150+150+100	300V 1.80
400+400	200V 72p	200+47	250V 65p
32+32+16	350V 52p	500+500 175V	
200+32+300+100	350V 70p	Thorn TX9	1.00
225+25	350V 50p	175+100+100	350V
200+200+100	350V 70p	Thorn 3K5	2.25
200+100	325V 65p	400 400V Thorn 9K	2.50
200+100+100+50	350V 60p	470 250V Philips G11	1.50

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 70V Thorn 3K	1.00
50MF 275V	50p	1500MF 100V	1.05
100MF 150V	65p	2000MF 30V	50p
100MF 250V	70p	2200MF 40V Thorn 4K	95p
100MF 450V	75p	2200MF 63V Philips G9	1.25
220MF 400V Thorn 9K	1.30	2500MF 35V	65p
220MF 450V Thorn 4K	1.30	2500MF 40V	65p
400MF 350V Thorn 8K	1.00	3000MF 30V	65p
800MF 250V Print type	80p	3300MF 16V	50p
800MF 250V	70p	3300MF 25V	60p
		4700MF 16V	72p
		4700MF 40V	75p

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC8 On/Off Switch	65p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 500Ω	65p
2.5A Push to make on/off switch	15p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BR303	46p	IN5254B	8p
BT106	1.50	IN5349	14p
BT116	1.00	IN5400	12p
BT119	2.56	IN5401	12p
BT120	2.82	IN5402	14p
BT151 650	1.00	IN5404	12p
BY127	12p	IN5406	16p
BY188	16p	IN5408	16p
BY204	26p	IS025	8p
BY206	16p	IS131	8p
BY207	16p	IS1658	8p
BY208/800	38p	MR854	35p
BY223	95p	SKE1/02	20p
BY225	1.20	MCR106/1	1.00
BY227	28p	MCR406	35p
BY298	22p	2N4444	1.50
BYX22/400	30p	Y827	80p
BYX55/800	30p	Y969	75p
BYX71/350	80p	ZX150	12p
BZV15 C12R	1.16	OA91	5p
BZV15 C24R	1.16	MCR106/7	1.00
IN60	8p	MCR106/8	1.50
IN2070	8p	TD3F800H	2.80
IN4001	4p	TD3F800R	3.00
IN4002	4p	BY255	30p

WE WILL ONLY SUPPLY TOP QUALITY, BRANDED COMPONENTS. REPUTATION COUNTS WITH US

G.G.L.COMPONENTS

108 SCOTLAND ROAD, CARLISLE, CUMBRIA CA3 9EY
PHONE (0228) 20358/39693

BUY WITH

INTEGRATED CIRCUITS

TYPE	PRICE (£)
AN214	1.95
AN301	3.45
AN303	3.45
AN305	3.50
AN7110	1.93
AN7114E	2.33
AN7115	2.37
AN7116	2.35
AN7145	3.25
BA312	1.25
BA511A	1.95
BA521	1.85
BA532	1.95
BA536	2.55
HA1166	2.65
HA1322	2.10
HA1338	2.78
HA1339	2.40
HA1342A	2.20
HA1366 W/WR	1.95
HA1370	2.75
HA1374	2.45
HA1377	3.80
HA1388	4.20
HA1397	3.90
LA1201	1.75
LA1230	2.30
LA1365	2.45
LA3350	1.65
LA4031	2.45
LA4032	2.30
LA4101	1.50
LA4102	1.95
LA4400	2.50
LA4430	2.45
LA4440	3.55
LA4460	2.95
LA4461	2.95
MB3712	2.30
MB3713	2.25
ML231B	2.35
ML232B	2.55
ML237B	2.50
ML238B	4.22
SAA1124	3.45
SAA1125	4.70
SAA1250	3.85
SAA1251	4.95
SAA5010	5.10
SAA5012	5.70
SAF1032P	3.25
SAF1039P	4.55
SAS560S	1.95
SAS570S	1.95
SAS580S	2.40
SAS590S	2.40
SL901	5.65
SL907	7.35
STK0039	6.45
STK0040	5.95
STK0050	7.50
STK077	7.25
STK078	7.45
STK082	9.75
STK415	9.66
STK430	7.75
STK433	6.50
STK435	6.75
STK437	7.25
STK439	7.55
STK441	8.50
STK459	7.35
STK461	7.95
STK463	9.30
STK465	9.95
TA7193P	4.30
TA7202	2.25
TA7203P	2.25
TA7204P	1.90
TA7205AP	1.40
TA7208P	1.95
TA7222AP	1.85
TA7223P	2.85
TA7227P	2.95
TA7310	1.55
TA7313	1.45
TAA550	.43
TBA120AS	.95
TBA120SB	.90
TBA120T	1.25
TBA120U	1.00
TBA520	1.30
TBA530Q	1.00
TBA540	1.37
TBA550	2.45
TBA560	1.60
TBA720A	2.65
TBA750	2.45
TBA800	.80
TBA810	1.35
TBA820	1.40
TBA890	2.95
TBA920	1.50
TBA950	2.65
TCA270	1.55
TCA800	5.45
TCA940	1.55
TDA1002	1.50
TDA1003	2.80
TDA1004A	3.95
TDA1006A	2.95
TDA1035T	2.75
TDA1037	1.95
TDA1044	3.10
TDA1170	1.80
TDA1270	2.20
TDA2002	1.85
TDA2003	2.33
TDA2004	3.15
TDA2006	2.25
TDA2020	2.95
TDA2190M	4.95
TDA2522	1.80
TDA2523	2.25
TDA2530	2.10
TDA2532	2.20
TDA2540	1.95
TDA2560	1.80
TDA2581	2.15
TDA2582	2.20
TDA2591	2.30
TDA2593	2.30
TDA2594	2.95
TDA2600	5.95
TDA2611A	1.50
TDA2640	2.40
TDA3560	5.10
TDA3561A	5.35
TDA3562A	5.50
TDA4600	2.85
TDA9503	2.35
UPC555C	.70
UPC566C	2.10
UPC585C	1.40
UPC1031H	2.95
UPC1032H	.95
UPC1156H	2.45
UPC1181H	2.20
UPC1182H	2.20
UPC1185H	3.30
UPC1230H	3.95
UPC1238H	2.35
UPC1350C	4.50
UPC1353C	2.60
UPC1365C	5.05
UPC1377C	4.60
UPC2002H	1.85

TRANSISTORS

TYPE	PRICE
BC107	.14
BC108	.14
BC109	.14
BC141	.26
BC142	.23
BC143	.25
BC147	.09
BC148	.09
BC157	.10
BC158	.11
BC159	.11
BC182L	.11
BC183L	.11
BC184L	.11
BC212L	.10
BC213L	.10
BC237	.11
BC327	.11
BC328	.12
BC337	.11
BC338	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BD124M	1.05
BD131	.33
BD132	.33
BD201	.80
BD202	.70
BD203	.70
BD204	.83
BD222	.50
BD225	.55
BD232	.50
BD233	.37
BD234	.40
BD235	.32
BD236	.43
BD237	.40
BD238	.39
BD410	.50
BD434	.50
BD437	.70
BD438	.78
BD707	1.05
BF194	.12
BF195	.13
BF196	.11
BF197	.11
BF241	.15
BF256LC	.25
BF258	.25
BF259	.26
BF337	.28
BF338	.30
BF458	.30
BF459	.36
BF757	.75
BFR90	1.60
BR100	.18
BR101	.32
BR103	.55
BT106	1.15
BT116	1.30
BT151/800R	1.10
BU126	1.78
BU205	1.42
BU208A	1.45
BU208D	1.85
BU326A	1.48
BU407	1.12
BU500	1.80
BU508A	1.95
BU526	2.00
BU826A	3.20
R2010B	1.45
R2540	2.35
TIP31C	.46
TIP32C	.47
TIP33	.80
TIP34	.95
TIP41C	.48
TIP42C	.48
TIP47	.75
TIP2955	.70
TIP3055	.70
2N3055	.50
2N3773	3.45
15/80H	2.25
15/85R	2.25
2SA 771	2.35
2SA 835	1.55
2SB 618	2.45
2SC 867A	3.25
2SC 1034	4.85
2SC 1061	1.15
2SC 1114	4.75
2SC 1124	.97
2SC 1316	3.20
2SC 1413A	3.95
2SC 1739	2.45
2SC 1942	2.95
2SC 1962	1.65
2SC 257	2.45
2SD 588A	1.97
2SD 725	3.65

LINE O/P TR.

DECCA 80	7.95
DECCA 100	8.50
ITT CVC 20	7.75
ITT CVC 25/30/32	8.00
ITT CVC 45	8.45
PHILIPS G8	8.75
PHILIPS G11	13.50
PHILIPS KT3	9.95
PHILIPS K30	16.50
RBM T20A	11.50
THORN 1615	9.75
THORN 1690/1	9.65

SONY SPARES

C5/C7 Rewind Kit	4.85
C5/7 Belt Kit	3.50
C6 Rewind Kit	4.35
C7/J7/SLT7 pinch roller	4.85

ANTI-SURGE FUSES

A/S 20MM 80MA	2.75
100, 160, 200MA	1.70
315, 400, 500, 630, 800MA, 1A, 1.25, 1.6, 2A	1.20
2, 3.15, 4, 5A	1.35

VALVES

PCF802	.94
PCL82	.95
PCL85	.98
PCL86	.93
PCL504	1.50
PL508	2.90
PL509/519	5.65
PY500A	1.95

NEW

Sony SG613/6533 ..... 8.70

E.H.T. TRAYS

DECCA 80	7.20
DECCA 100	7.35
ITT CVC 20/30	6.85
PHILIPS G8-550	7.90
PHILIPS KT3	9.75
RBM T20/T22A	7.35
THORN 8500/8800	7.60
THORN 9000	8.70
Universal	5.95

DIODES

TYPE	PRICE
BY127	.10
BY133	.15
BY164	.40
BY179	.65
BY210/800	.30
BY223	.86
BY227M	.23
BY229/600	.87
BY298/400	.24
BY299/800	.25
BYX10	.20
BYX55/600	.26
BYX71/600	.93
SKE4F2/06	.80
SKE5F3/10	1.45
W005	.55
1N4001-7	.07
1N5401-8	.16

CASS MOTORS

6V C/W	5.00
9V C/W	5.00
12V C/W	5.00
13.2V C/W	4.85

SUNDRIES

G8 TRANSDUCTOR	2.25
G8 ON/OFF SW.	1.40
G11 E/W Coil	1.65
G11 Lin Coil	1.80
G11 Bridge Coil	1.35
G11 EHT Lead	2.25
PYE IF Gain MOD	7.85
ITT On/Off SW	1.10
THORN On/Off SW	1.00
CUT OUT 2A	1.95
TX10 FOCUS UNIT	8.95
VCR Pilot Bulb	.70

TV ELECTROLYTICS

DECCA 30(400/400)350V	2.95
DECCA 80-80/100(400)350V (800)250V	3.30
PHILIPS G8(600)300V	2.20
PHILIPS G9(2200)63V	1.15
PHILIPS G11(470)250V	2.15
PYE 691/7(200-300)350V	2.10
RBM A823(2500/2500)30V	1.10
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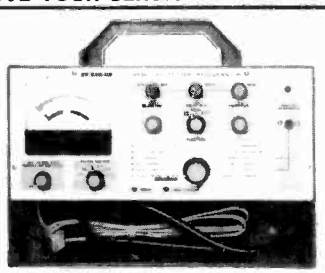

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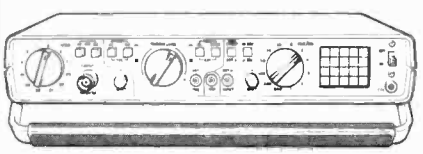

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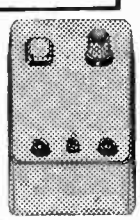

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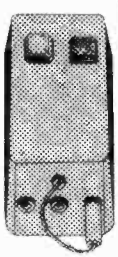

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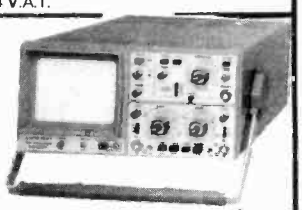

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connector and c.r.t. base. The point of this is that some homes still suffer from condensation in damp weather, but when the set has arrived in the fairly warm, dry workshop the cause of the trouble is no longer present. In fact if you don't find the cause of the problem during a field visit it's worth trying this. Just a single leakage is often sufficient to cause a modern power supply to trip. **M.B.**

Sanyo CTP430

Like the Hitachi CNP190/192 these old Japanese sets seem to soldier on. They give little trouble apart from the odd dry-joint or poor inter-board connection that causes intermittent loss of picture or field collapse. The fault on this set was more elusive however since the raster would partially collapse, leaving about an inch of field scan. Replacing the field driver transistors Q403/4 cured the trouble – BC115s were used as they were the most suitable transistors to hand. **M.B.**

Philips TX Chassis

We had a strange fault with this monochrome portable – it wouldn't switch off! The front mounted switch worked mechanically but not electrically. Now we've all at some time spiked ourselves on the sharp undersides of boards – after all that's how new swear words are invented. The fault was caused by excessive component lead length. Both 2A fuses had blown, but still the set operated! The on-off switch was ineffective in either position, the set coming on and staying on as soon as it was plugged in. Having disconnected the mains supply we removed the plastic board strengthener from under the mains transformer and there was the cause of the problem: two excessively long leads from wirewound resistors were bypassing the fuses and it seemed much else as well. Simplicity itself to put right with a decent pair of side cutters.

The fault on another of these sets was a bright, uncontrollable raster. The cause was the video emitter-follower transistor TS350 (BC558). Note that this is a pnp transistor with its collector connected to chassis. A third problem we encountered in one of these sets was the switch-off spot suppression capacitor C571 (22μF) in need of renewal. **M.P.**

Thorn TX9 Chassis

The problem with one of these sets was field bounce which during investigation gave way to field collapse. Replacing the TDA1170S field timebase i.c. cured the collapse but did nothing for the bounce. The two 0·1μF capacitors C215/6 in the ramp generator circuit were the cause of the bounce.

Purity errors can be a problem with some of these sets fitted with 22in. tubes. It seems that the chassis was not originally intended to drive 22in. tubes and as a result there's a marginal difference in the purity tolerance between 20 and 22in. sets. The problem mainly arises when housewives push the set out of the way to vacuum the lounge – this can result in a call to the tele company!

As many of you may know, the simple T718 ultra-sonic handset can give a bit of trouble. On one occasion recently the sound level would immediately fall to minimum when either of the sound function buttons was released. There were two possibilities for this: either the small circular pressure discs on the handset PCB were short-circuit so that the unit was transmitting all the time, or the MC14029B i.c. on the remote control receiver panel had developed a dislike for sound. It turned out that the i.c. was defective, but it's a good idea to change the three handset pressure disc switches anyway – prevention is better than cure! The newer infra-red T725 handset is vastly superior. **M.P.**

ITT CVC820 Power Board

I've had quite a few sets lately with power supply faults caused by the h.t. smoothing electrolytic C431 (10μF). If it goes slightly low in value the result is cogging on verticals when the set is first switched on. If it goes open-circuit the result is a low h.t. line (80V) with an arcing sound coming from the chopper transformer. **P.B.**

ITT CVC1200 Chassis

If you have a CVC1200 series set with a blown mains fuse as often as not you'll find that the BU508A chopper transistor is short-circuit. Sometimes however it's the 10μF filter capacitor C701 that has gone short-circuit. If the chopper transistor goes short-circuit every couple of days change zener diode D702 (ZPD5·1). **P.B.**

Thorn 1500 Chassis

This 24in. 1500 set came in with the complaint sound but no raster. A new tripler was all it needed, but not having one in stock I decided to try the type used in the earlier 1400 chassis – the 1400 type is similar electronically but fits on the line output transformer horizontally instead of vertically. The set worked well with the 1400 unit fitted and I was about to replace the back cover when I noticed a few horrors. The 20Ω section of the mains dropper had gone open-circuit and been bridged with a 47Ω resistor, while the mains filter capacitor C84 and the h.t. rectifier's protection capacitor C85 were both missing. I assume that the capacitors must have gone short-circuit at some time and simply been snipped out. When these matters had been put right the set was left running on soak. The next thing I noticed was that there was lack of width on the left-hand side. This didn't respond to fitting new valves in the line output stage, and checking components in this area revealed nothing amiss. The scan coils maybe? A Plessey type was fitted and adjusting the line linearity sleeve and the picture centring magnets only made matters worse. Full width was instantly restored when a set of Thorn coils was tried. **B.R.**

Binatone 01/9496

Loss of sync on this monochrome portable was traced to D302 (1N34A) which is in series with the signal feed to the sync separator transistor. There was also sibilant sound due to a dry-joint on C510 which smooths the supply to the audio circuit. **A.D.**

Philips KT3 Chassis

Here's a strange one for you! When the set was tuned to a strong signal the result was a very dark picture with just the highlights showing, colour present and the sound o.k. With a weaker signal there was a near normal picture – except for the graininess to be expected. The cause of the trouble was poor contact (a dry-joint, though it looked perfectly all right) at the focus control pin on the main board – the pin along the track from R1581. **G.F.**

Servicing Notes on the Toshiba V9600

John Coombes

This front-loader is far more prone to mechanical than electronic problems. As with most Beta machines the most common trouble is with rewind – Sanyo seem to have been the only Beta manufacturer to beat this problem. It's a great help in reducing the wear that causes the trouble if the customer uses only L250 or L500 tapes – it's seldom necessary to use a three-hour L-750 tape to record a programme.

Poor Rewind/Playback

For poor rewind/playback first check the upper drum for wear – check for scratches or a highly polished surface with a ridge embedded in the drum. If necessary replace the drum, but be sure to check that the rubber wheel on the clutch idler assembly hasn't been chewed up – replace it if small particles of rubber are present on the surface below the idler assembly.

The next step is to connect a scope to check the playback f.m. envelope at TP101. If the waveform is as shown in Fig. 1 there's no output from one of the heads. Check that both heads are clean and that there's no dust build up due to excessive upper drum wear or maybe the use of poor quality or old tapes. If the problem persists replace the video head disc and set up with an eccentricity gauge – set to within 1μm. When the eccentricity is correct the tracking and picture should be stable and there should be no wow or flutter.

After setting up the head disc check that the back tension is correct – if it's badly out the result will be excessive drum wear. The back tension should be 47-57 grams – if it varies by more than 10 grams from the beginning to the end of the tape replace the band brake.

If the upper drum/disc assembly has been replaced and the picture is noisy instead of clean and crisp, make a recording then play it back while checking the f.m. envelope at TP101. If the output from one head increases while that from the other falls as the tracking control is rotated the playback frequency response controls R150/R151 may need attention – check the condition of the carbon tracks. If the problem persists check the dihedral setting (head height) which can be varied by adjusting the Allan screw on the top of the head. It's very often quicker however to replace the disc instead of working out a graph to set the head height. Adjusting the height can upset the angle of the head.

If after fitting the modified upper drum type 7037-1301 the picture is noisy in parts and the playback f.m. envelope is as shown in Fig. 2 try removing the shims between the upper drum and the support wall. This has proved to be a very successful way of getting the correct waveform (see Fig. 3). If the picture is still noisy the tape path alignment should be set up.

Fig. 1: No output from one head.

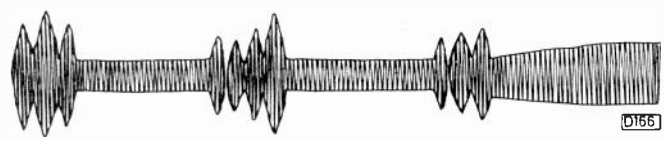


Fig. 2: Distorted f.m. playback envelope.

Fig. 3: Correct f.m. playback envelope.

Loud Howling on Playback

Loud howling on playback can be due to rubbing on the upper drum. Check the flywheel assembly – remove and clean the shaft, put a spot of oil on a cloth and lubricate the shaft then reassemble. This should clear the problem. A very dry shaft can cause sound and picture jitter.

Squealing on Rewind

Squealing on rewind can be caused by a badly worn upper drum but is usually due to worn ceramic rollers on the guide ring. To prove this or effect a temporary cure while awaiting replacement rollers from Toshiba, turn the rollers upside down.

Streaking across Picture

Streaking across the picture is very often caused by incorrect setting of the playback frequency response controls R150/R151. Alternatively the head disc may need replacement or, more likely, IC102 is faulty.

Excessive Picture Jitter

Excessive picture jitter can be caused by poor tapes or a worn clutch idler assembly. Other possible causes are a faulty bearing in the drum unit or a faulty drum motor stator.

Cassette won't Load

If the cassette won't load, check the voltage at pin 37 of IC601 while inserting the cassette in the machine. The voltage should drop from 4V to zero. If this doesn't happen check the cassette in switch S651 and that the switch lever spring hasn't dropped off. The problem can also be caused by a faulty front loading motor – first ensure that l.t. reaches the motor terminal. Also check the condition of the loading belt.

Stops when Record/Playback Selected

If the machine stops when record/playback is selected check the setting of the leaf switch S656 and that the switch lever on the slack detector is operating correctly. It's best to check the leaf switch by replacement. Check the switch lever for being misshaped. If the auto-stop

doesn't operate when adjustment has been completed suspect faulty leaf switch contacts.

Picture Noise/Sound Wow

In the event of noise bands on the picture and/or wow on sound, first check that the 200Hz waveform is present at TP508. If it's missing check for 200Hz at pin 1 of P503. If a 200Hz signal is present here suspect IC502 (TA75902P). Also check whether the capstan belt is dirty or stretched. The capstan motor could be faulty. To eliminate the servo circuitry, check that the voltage at pin 7 of IC501 varies when the capstan motor is slowed.

Drum Motor not Operating

If the drum fails to rotate, try rotating it by hand. If this starts the drum motor the stator is problably at fault. If the motor doesn't start the servo circuit will have to be checked.

Guide to Satellite TV Reception

Part 2

Hugh Cocks

This month we'll take a look at receiver systems. The first point to make is that all satellite TV transmissions use f.m. for the video signal, primarily to reduce the loading on the satellite's power supply.

One of the worst reception problems with a signal of barely sufficient strength (due to rain fade or the use of a small dish for example) is excessive noise on saturated colours. This problem should disappear when the MAC transmission system comes into use – a multiplicity of digital sound channels will be another advantage of the proposed DBS system. The system used at the moment, with a subcarrier for the audio channel, can reduce the overall power level (albeit marginally) from the satellite and can cause patterning on the video together with buzzing from saturated colours if the signal is weak.

At the moment the only MAC transmissions are Norwegian ones via the ECS-2 satellite. The Australian Aussat satellite, which is due to be launched into orbit this August, will be the first satellite to use MAC for DBS transmissions.

Provided the signal is of reasonable strength, which means using a dish with a minimum diameter of 1·2m in the UK for ECS transmissions, none of the problems mentioned above should cause too much aggravation.

Several UK manufacturers already produce satellite TV receivers, mainly for the cable market and for the master aerial market (SMATV – satellite master antenna television – to use the accepted term) that's expected to open up shortly, providing satellite TV signals for blocks of flats, hotels etc. Apart from experimental ones, domestic satellite TV receivers for the UK market are at present something for the future – though let us hope the not too distant future. References in the present article to domestic receivers relate mainly to those used for the US 4GHz band. The indoor part of such receivers is very similar to that required for 11GHz reception, though the input will be at around 500MHz instead of the 800MHz used in Europe.

IF Section

In Europe, the signals in the 10·95-11·7GHz or the future 11·7-12·5GHz band are downconverted at the dish aerial to a standard first i.f. of 950-1,750MHz. Covering 800MHz in one sweep has caused manufacturers great headaches, mainly due to the range the local oscillator has to cover and the r.f. tracking. One enterprising manufacturer has introduced a double-downconverter: 11·45-11·7GHz band signals are converted first to 1,500-1,750MHz and then to 950-1,200MHz. This is a tricky conversion as the unwanted low-band signals from the LNC are still present at 950-1,200MHz and the second harmonic from the 550MHz local oscillator falls within the wanted i.f. range. Nevertheless the unit, which is switched in and out of line by means of switching diodes, works very well.

The second i.f. used varies. 70MHz is rather low as the unwanted image frequency is only 140MHz away. A new choice is around 140MHz: the image frequency at 280MHz is much easier to filter out by means of a tuned r.f. stage preceding the first i.f. mixer.

Another new choice is in the low 400MHz band, just below the 70cm amateur band (432MHz) and well away from local TV transmissions that would cause breakthrough problems. The image frequency at over 800MHz is well above the band of interest, easing problems considerably. A new generation of PLL and quadrature f.m. demodulators has been developed by various manufacturers to detect 400MHz f.m. signals. These will in the fullness of time be complemented by SAW bandpass filters to feed the demodulator i.c. Discrete filters are mainly used at the moment: at 400MHz these consist of several tuned lines in a small metal can. Alignment of the filter is carried out by bending copper tabs adjacent to the lines (similar to the system used with the old rotary u.h.f. tuners).

70MHz SAW bandpass filters are now quite common in the USA, where a large market for C Band "DBS" has developed.

Unfortunately three different i.f. bandwidths, 27, 30 and 36MHz, are at present in use with the ECS and Intelsat V satellites. When we get DBS in Europe 27MHz will be used. Sophisticated cable receivers can switch between these bandwidths (often referred to as deviation frequencies of 18, 20 and 25MHz): if a dedicated receiver is used at the cable head end there's no need for

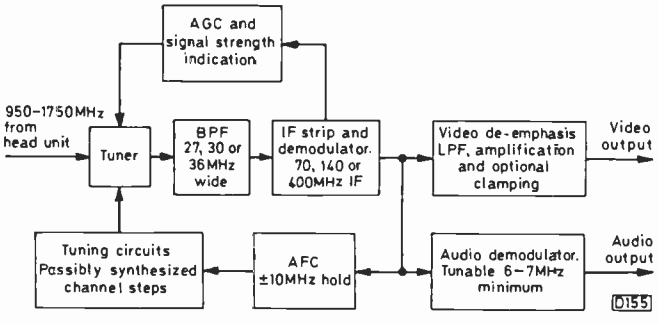


Fig. 1: Block diagram showing the basic features of a satellite TV receiver unit.

switching.

Less complex receivers for domestic/semi-domestic use generally have only a single bandwidth. This can cause problems when all the transmissions available are to be received. Too wide a bandwidth with a narrow-band signal can result in excessive noise on the picture. Too narrow a bandwidth with a wideband signal on the other hand can cause irregular signal distortion which is most noticeable as "sequined" saturated reds. A signal a little below the f.m. threshold (see later) produces a similar effect: saturated reds break into noise when the other colours are o.k. The compromise solution is a bandwidth of around 30MHz, though some receivers with simple alteration of the bandpass filter via the front control panel are becoming available.

Tuning Systems

Normal voltage tuning is used to tune across the first i.f. range. Cable grade receivers generally use synthesised tuning in order to remain on station for a considerable time without adjustment. A.F.C. has to be added with synthesised tuning to cope with the downconverter local oscillator's frequency drift of up to about 5MHz at worst with temperature extremes. Domestic type receivers use either a series of pushbuttons with the tuning voltage stabilised in the conventional manner or just a rotary tuning control with a.f.c. applied to the tuning line to grab the signal once found. Though good, the stability would not be sufficient for very long periods of unattended operation (weeks or months).

A.G.C. is often applied to a meter for dish alignment – or terminals for connection of a remote meter at the dish may be provided. Cable receivers often don't have this feature as it's considered best to align the dish with a spectrum analyser or a specialised signal meter in the first place. Having installed a variety of dishes to date I can say that a receiver signal meter by the dish is by far the easiest method, the peak in dish alignment being very easily seen.

Energy Dispersal

Standard energy dispersal techniques are used with most transmissions, i.e. a 25Hz triangular wave with about 500kHz deviation is added. This results in a flickering picture unless d.c. clamping is used. Some clamps are better than others at removing the dispersal: look for residual flicker in peak white and saturated red (that old bogey) areas of the picture. Residual flicker is often present when a signal is a little below the f.m. threshold.

With encrypted signals using sound in sync the video output from the demodulator has to be unclamped otherwise the decoder (particularly the Oak Orion unit as used by Sky Channel) won't work. Cable receivers have both outputs available at the rear or a front panel switch to disable the clamp.

Audio Standards

A receiver for general use must be able to tune to the various audio subcarrier frequencies employed – 5·5, 6·5, 6·6 and 6·65MHz together with the 7·02/7·2MHz narrow-band stereo frequencies used by Music Box. Encrypted signals generally use sound in syncs, but at least one service (TV5) has clear audio with scrambled video (similar to the Canal Plus system).

Another area that causes problems is audio pre-emphasis. In addition to the standard CCIR system a new standard called CCIT-J17 is used for several transmissions. This has a very high peak-deviation value and results in sibilant hissing with standard CCIR de-emphasis. Special techniques have to be employed to demodulate the audio properly. Needless to say, the French TV5 channel was the first to use this system. Ironically, on their own Telecom satellite they use standard de-emphasis at both 4GHz and 12GHz.

Another problem with certain receivers is that a very high-level 5·5MHz carrier is used to carry out switching operations at cable head ends. With a 6·5MHz audio subcarrier, the 5·5MHz and 6·5MHz signals can beat to produce a 1MHz interference signal that gives bad crosshatching. The cure is to have a proper 36MHz i.f. passband, a linear video amplifier and possibly some notch filtering to remove the beat-frequency interference.

Noise/FM Threshold

The f.m. threshold point is best defined as the point where for every 1dB increase in the carrier-noise ratio (c/n ratio) there's only 1dB increase in the video signal-to-noise ratio. Below this point, down to about 6dB below threshold, every 1dB gives a dramatic increase in signal-to-noise ratio on the picture.

Dish size and the head unit noise figure determine the carrier-noise ratio of the incoming signal at the receiver. With a cable head end, where high-quality signals are a must and space for dishes is not at a premium, systems are designed for at least a 16dB c/n level. On most receivers the threshold point is 8-10dB c/n. This kind of signal level calls for a dish of about 3-3·7m in the UK.

With a domestic/semi-domestic installation where the dish size is all important there's much less margin above threshold. A 2m dish is the largest one is likely to find in use, giving at most a margin of 3-4dB above threshold from some ECS transponders in the UK. Under adverse weather conditions (mainly cloudbursts, where the sky goes very dark) several dBs of signal can be lost. Indeed the writer once noted virtually complete fadeout of ECS signals for two-three minutes during a severe summer thunderstorm using a 2m dish.

When the signal is at the threshold (1·2-1·5m dish, 2·9dB head unit noise figure in the UK) receivers tend to display noise in different ways. Some show "violent hailstones" all over the screen even when the signal is only a fraction below threshold. Others give a softer, finer noise display though these receivers often produce a paler picture when the signal is strong.

Reducing the bandwidth also reduces the threshold point – going from 36MHz to 18MHz gives a 3dB reduction – though this can produce severe distortion on saturated reds and white captions. If a small dish has to be used and the lowest noise figure head unit is obtained, the minimum dish size for the southern UK is 1·2m with offset feedhorn (this gives some improvement in dish efficiency) – the beam centre is off the Kent/Essex coast – but don't look too hard at saturated colour bars in heavy rain.

The new French Telecom-1 satellite has power levels 3dB up on ECS in the 12·5-12·7GHz band (around 50dBW at beam centre near Luxembourg) and can give good pictures with an offset dish as small as 90cm. UK DBS should be 12dB up on Telecom-1 and should produce similar quality pictures with a 22·5cm offset type dish. Allowing for rain fade margins, 30cm should do very well.

Unscrambling Canal Plus

Sotires Elefthériou

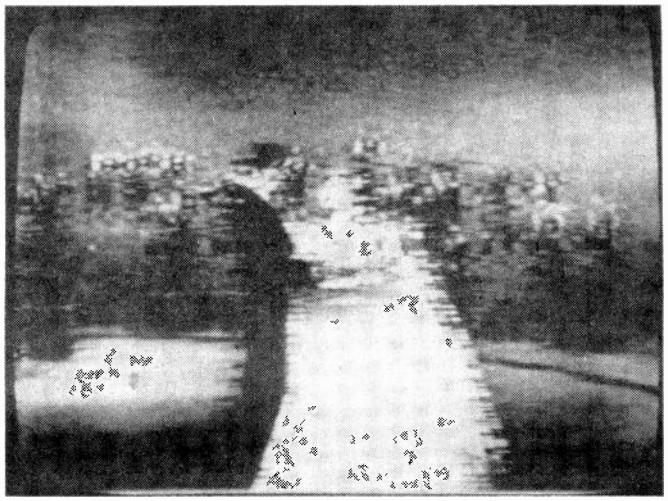
Towards the end of last year Canal Plus, France's new pay-TV channel, had the December issue of the magazine *Radio Plans* seized by a French court to prevent publication of a design for a decoder. The interesting thing about the *Radio Plans'* decoder is that it works on principles quite different from those used by the official decoder and is thus in no way a copy. The complaint against *Radio Plans* was not on technical grounds: it was of "incitation to theft", i.e. that it encouraged readers to receive programmes they had not paid for. The reply from *Radio Plans* was that the design was intended for readers in Belgium, Switzerland and Monaco: while the transmissions can be received in these countries, Canal Plus does not issue decoders to would-be viewers outside France. There was even the case of an enterprising retailer in Switzerland taking out subscriptions for his customers via an accommodation address in France, but a stop was soon put to his initiative.

Canal Plus started operations last November 4th, using SECAM L, both sound and vision scrambling and, for the most part, the old 819-line v.h.f. network. SECAM L has 625 lines, positive-going video, 6·5 MHz vision-sound carrier spacing and a.m. sound modulation. Unscrambled programmes are broadcast between 19.10 and 20.30 each evening. Earlier last year Sylvain Anikini, the Canal Plus man responsible for the choice of a scrambling system, had been widely quoted in the media as saying that the system adopted was completely hacker proof. This made the *Radio Plans* article particularly unwelcome.

Scrambling

Mr. Anikini was confident in his predictions. After all, the official decoder uses specifically manufactured i.c.s and contains a RAM chip powered by a battery – this is used to store essential information that's lost if a tamperer gets to work. Stealing or copying a decoder, or simply keeping one after the end of a subscription to the service, would be no good. Each decoder has a different number stored in its memory chip: the product of this number and the number the viewer has to type in at the beginning of each month gives the correct decoding sequence, i.e. the number of delays given to each line of picture information over a six field cycle (see later). Thus when the sequence is changed at the beginning of the month a new number must be typed into each decoder if it is to produce clear pictures. Canal Plus keeps records of each subscriber's eight-digit number in a computerised data base.

During the first month of operation a simplified code was used, enabling all the official decoders to work



The effect of Canal Plus video scrambling.

whatever number was typed in. But from December 1st you could no longer get the correct code number from your neighbour if you had managed to acquire (or copy) an official decoder without subscribing to the service. Canal Plus had been obliged to find a very secure method of scrambling. Even in the USA, where the public is reputed to respect speed limits and parking restrictions, pay TV stations estimate that they lose 25-30 per cent of their custom to pirates. In a country like France, where fiddling – not to mention failure to respect red traffic lights – is considered to be a national sport, the percentage of those likely to try to get round Canal Plus restrictions was bound to be high.

Canal Plus Reception

The Canal Plus decoder is connected to the SCART socket that's been a legal requirement on every colour set sold in France since 1981. It receives the scrambled composite video and sound signals via the socket and feeds the decoded outputs back to the appropriate socket input pins. A 12V switching signal is applied to pin 8 of the socket to bring this input/output arrangement into operation. This procedure led to all kinds of problems initially. Very few viewers had tried to use the sockets before, and on many sets they weren't up to standard – they couldn't provide the various outputs and inputs at the same time and in many cases the switching function didn't work. In some sets the contrast control was rendered inoperative. And no monochrome sets have a SCART socket. The alternative arrangement consists of a "modulator" – in fact a tuner, vision/sound i.f. strip and u.h.f. modulator: this sold at £100 but supplies dried up.

Decoding the Sound

The scrambled sound is easy enough to decode. Scrambling consists of frequency inversion around 12·8kHz, i.e. single-sideband transmission on a 12·8kHz subcarrier, with 75μsec of pre-emphasis. The SECAM L standard uses a.m. for the sound, but the same kind of scrambling could be employed with an f.m. system as used in the U.K. True single-sideband transmission, i.e. suppressing the a.m. carrier and transmitting only one set of sidebands, wouldn't have been a practical proposition. The use of a.m. precludes the use of an intercarrier sound system – the limiting used to remove vision buzz would also remove the sound modulation. So a crystal-controlled b.f.o. working at 39·2MHz (the standard sound i.f. in France) and a tuner kept stable to within a few Hertz would have been necessary. Even if these requirements could be met, perish the thought of viewing Canal Plus via a VCR in the E-E mode.

The official decoder uses an 8MHz oscillator phase locked to the line frequency (15,625Hz x 512 = 8MHz), the output being divided by 625 (8MHz ÷ 625 = 12·8kHz). The *Radio Plans'* design uses a 3·2768MHz crystal oscillator however (3·2768MHz is a commonly used frequency in computer circles) with a 4020 CMOS i.c. to divide by 256. An MC1496 double balanced mixer and a single transistor active filter to get rid of the ear-splitting 12·8kHz complete the sound section.

Experience has shown that injecting 12·8kHz from an a.f. signal generator into a set's audio section can give barely usable results. A frequency counter must be connected to monitor the frequency, which has to be readjusted every few minutes.

The system has an interesting side effect. While it's perfectly possible to decode a recording of scrambled video the same is not true of the sound. This is because very few VCRs have an audio bandwidth large enough to record the whole of one sideband: on playback and decoding the frequencies below 1kHz are so attenuated that sound is unintelligible.

Video Decoding

Decoding the video is more of a problem. The video on each line is delayed by either zero, 902nsec or 1,804nsec after the blanking and colour burst, the timing of the sync pulses being rigorously maintained. The video delay varies from line to line over a six field sequence. The result, with an undecoded signal, is the ragged effect shown in the accompanying photograph.

The solution adopted by *Radio Plans* is to pass the composite video through two 888nsec delay lines (there is

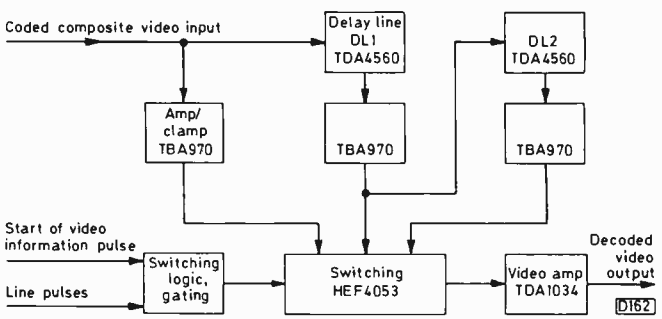


Fig. 1: Block diagram of the video delay system used in the Radio Plans' Canal Plus decoder.

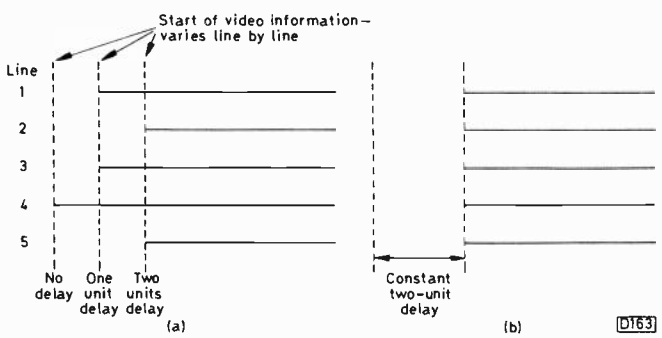


Fig. 2: (a) Coded video with variable delay at the start of each line. (b) Decoded video with the same delay on each line.

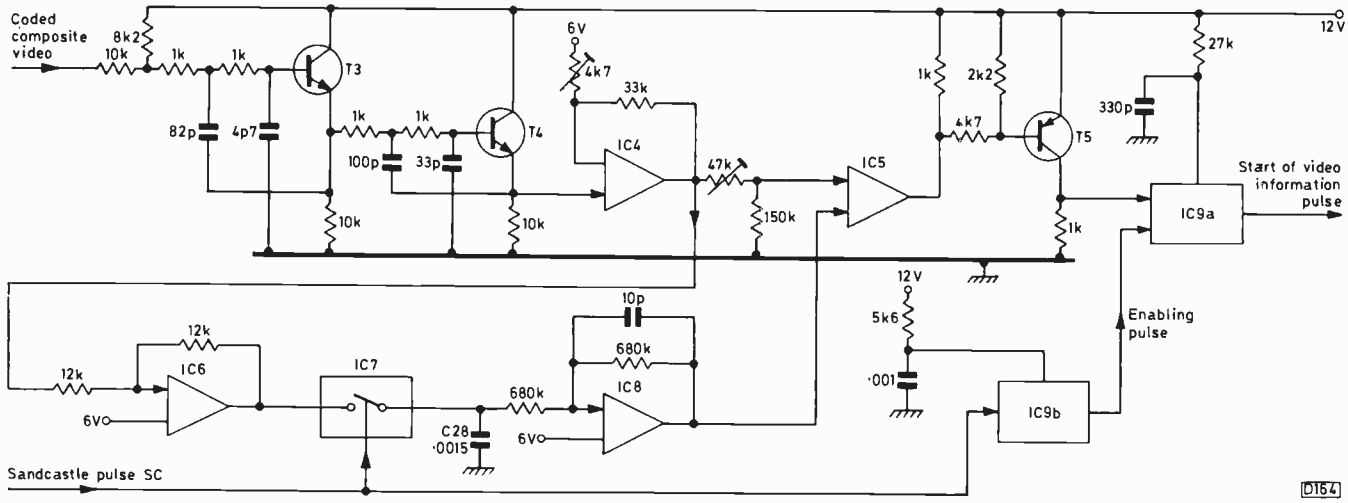


Fig. 3: Start of video detection circuit.

some disagreement as to the exact length of the delay). Each line is separately analysed to determine the delay required. If the video is found to have been delayed by one unit, the output is taken after passing through delay line DL1 (see Fig. 1). If the video is delayed by two units the output prior to the delay lines is used. When the line is not delayed the output from the second delay line is used. A little gating has to be carried out so as not to disturb the sync, blanking and burst in the process. The result of all this is that every line is delayed by two units (see Fig. 2) so that the verticals are once more straight. The dark band on the left-hand side of the screen is not objectionable – and in most cases is lost in the overscan.

The main problem lies in determining whether the video has been delayed once, twice or not at all. For this purpose the *Radio Plans*' decoder detects the signal rise from the blanking level to luminance at the start of each line – in the worst case, with a low-key scene, this rise is about three per cent.

The circuit used is shown in Fig. 3. Transistors T3 and T4 form an active low-pass filter to remove the chrominance information. IC4 then amplifies the resulting luminance only signal five times, which means that we have to detect a rise of 150mV. IC7, a 4016 CMOS switch, samples the luminance signal during the 4μsec sandcastle line blanking pulse (SC), charging C28. The output from IC8 (a buffer) is fed to IC5, an LM360 comparator i.c., which compares the charge on C28 with the video signal from IC4. Transistor T5 changes the output from IC5 to a level suitable for IC9a.

IC9b is connected as a monostable multivibrator which produces a fixed length pulse following the line blanking period (it's triggered by pulse SC). This output pulse is used to enable the other monostable multivibrator IC9a during this period. As a result, the start of video information signal is accepted only during a window of a few microseconds after the end of the blanking period. Two more flip-flops are used to check whether the leading edge of the pulse from IC9a falls within a first, second or third window about 800nsec wide so as to decide which of the video delay periods to use.

Outcome

The *Radio Plans*' circuit went down well with the public. Enough copies leaked out for photocopies to be readily available to anyone who wants them, and only generally available components are used. Component shops in Paris openly sell PCBs – they have to reorder them by the caseful! Fully made up boards are on sale at the flea markets and at technical colleges. Most of the more unusual i.c.s are now in extremely short supply – the TDA2593 sync separator/pulse generator, TDA1034 video amplifier – not to speak of the TDA4560 CCD delay lines. Alternative versions have become available using luminance delay lines instead of the scarce TDA4560s. Rumour has it that electronics engineers in every research establishment in France, including Thomson and the Atomic Energy Commission, spend a large proportion of their time developing new methods of decoding Canal Plus!

The Canal Plus pictures are almost watchable in their scrambled state, particularly when the accompanying sound has been successfully decoded. It has even been said that the erotic films shown on Canal Plus during the early morning hours have a greater effect when seen in the "zig-zag mode". Presumably they leave more to the imagination!

Canal Plus could still counter this illicit decoding. The 902nsec delay periods could be filled with peak white, grey, 1MHz or whatever. But then the hackers will always find a way round whatever is done. Another suggestion has been to store the coding sequence. The number of delays given to each line follows a six field sequence and can be stored in a RAM: the two problems are to determine each month's sequence and provide synchronisation. Canal Plus uses line 310 for synchronisation, but a pseudo-sync signal on a different line could easily be transmitted to confuse the pirates – rather like the pseudo-sync pulses that were used for certain anti-pirate VCR systems. Random sync will give a one in six chance of being right on changing channels: the burden could be taken out of this by using remote control – the viewer switching channels till the picture comes into sync.

Another method that's been suggested for determining the line delay sequence is to use a circuit that produces a movable rectangle on the screen – with monostables and a joystick. The viewer would place this over a contrasty vertical and a comparator of the type previously described would do the rest. The user would have to start again at the beginning of each month of course.

With all this illegal decoding it's perhaps not surprising that Canal Plus has reported heavy losses.

Servicing the Hitachi NP8CQ Chassis

David Botto

This chassis is used in a number of Hitachi sets such as the CTP208, CBP220, CBP222 and CBP226, in the GEC Models C2055H, C2255H, C2057H and C2257H, and in certain Expert sets. The main difference between the GEC "55" and "57" series is that the latter incorporates remote control – an almost identical system is used in some of the Hitachi sets. Since the author is most familiar with the remote control GEC sets this article is based on these. Any minor differences will be noted as we go along.

The C2057H is a 20in. model while the C2257H is the 22in. version. Picture and sound are excellent and the reliability is good. Perplexing faults can occur however, giving mystifying symptoms. There are two power supplies, the main chopper power supply and a stand-by supply on a small printed board labelled PC021 (non-remote control sets omit the stand-by supply). Once the operation of these two power supplies is understood you'll find the receiver straightforward to service. We'll list the most important interconnections between the panels as this can save you hours spent tracing them through to their various destinations.

The a.c. mains supply passes via the on/off switch S901 (see Fig. 1) to pins 1 and 2 of connector PL22 on stand-by

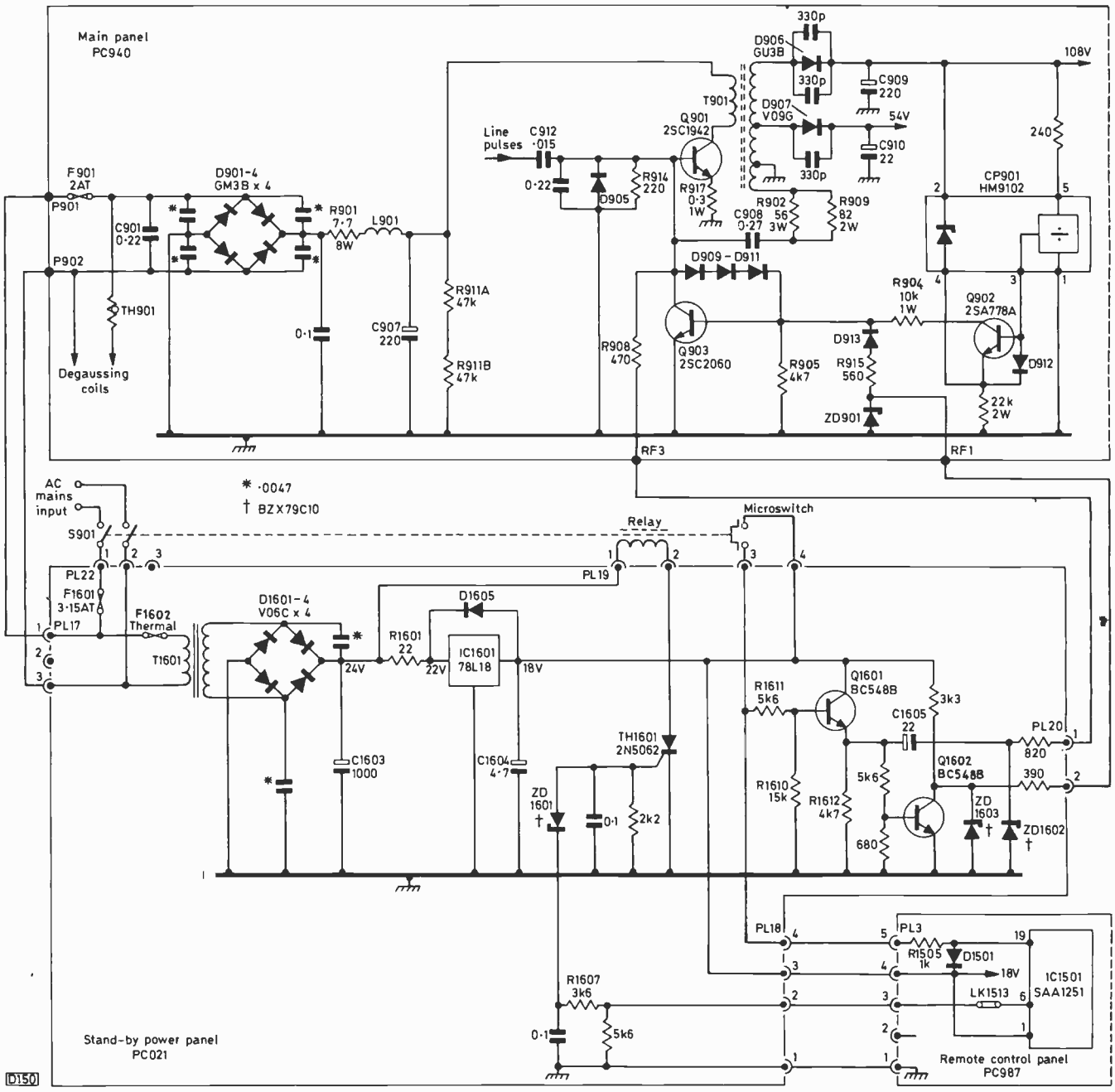


Fig. 1: Power supply arrangements used in the GEC Models C2057H and C2257H.

power board PC021, then via the 3·15AT mains fuse F1601 and thermal fuse F1602 to the primary winding of transformer T1601. A mains feed to the main board is taken off prior to the transformer and its thermal fuse: this goes via PL17-1/3 and P901/2 to fuse F901 (2AT) on the main panel.

The transformer's secondary winding feeds a bridge rectifier which produces 24V across C1603. In addition to feeding the 18V regulator IC1601 the 24V supply is fed via connector PL19-1 to the coil of a relay which can switch S901 off. The other end of the relay's coil is returned to chassis via PL19-2 and thyristor TH1601 whose gate is connected via ZD1601, R1607, PL18-2 and PL3-3 on the remote control/tuning panel (PC987) to pin 6 of the SAA1251 remote control decoder i.c. When pin 6 of this i.c. goes high on receipt of the off command TH1601 is fired and the relay operates to switch off the receiver. Once this occurs the set can be switched on again only by manually operating S901. Note that some of the Hitachi sets with remote control do not have the remote off feature (stand-by power supply panel PC036).

The regulated 18V line powers transistors Q1601/2 and is also fed via PL19-4 to a microswitch which is part of the mains on/off switch assembly S901. When the receiver is switched on, the microswitch closes momentarily, connecting the 18V supply to PL19-3. This point is connected via PL18-4 to PL3-5 on panel PC987 where the supply goes via R1505 (1kΩ) to pin 19 of the SAA1251 remote control i.c. At the same time the base of transistor Q1601 is connected to the 18V line via R1611.

Q1601 produces a positive-going pulse at PL20-1. This goes to connection RF3 on the main chassis, then via R908 to the base of the chopper transistor Q901. The chopper power supply is thus started. Q901 is connected in a blocking oscillator configuration, with feedback from the secondary winding on the transformer to its base via R902/R909 and C908 (0·27μF, 200V polypropylene). The feedback switches Q901 off, after which current reversal in the feedback winding switches Q901 on again. Oscillation is thus sustained.

The microswitch action sets a bistable circuit in the SAA1251, as a result of which pin 19 of this i.c. remains at 18V after the switch has opened. Q1601 and Q1602 are thus held on. A remote stand-by command will reset the bistable in the SAA1251, as a result of which pin 19 goes low. Q1601/2 switch off and the voltage at PL20-2 rises. This voltage is fed via RF1 on the main chassis, then R915 and D913, to the base of the chopper control transistor Q903 which thus turns fully on, shorting the base of the chopper transistor Q901 to chassis. The main power supply then shuts down. When the user selects a channel, Q1601/2 switch on again so that the chopper circuit starts up.

On remote control sets the junction of R911B and R914 is connected to chassis. On non-remote control sets this circuit is rearranged to provide the start-up action, see Fig. 2. In this case the chopper transistor is forward biased at switch-on via R911, R907 and R908. In the event of a short-circuit across the 108V h.t. line D908 switches on, reducing the chopper transistor's base bias to provide protection against excessive dissipation.

Power is taken from the secondary winding on the chopper transformer T901, the two rectifier diodes D906 and D907 producing 108V and 54V respectively across C909 and C910.

The chopper circuit is synchronised to the line timebase by feeding line-frequency trigger pulses from the line

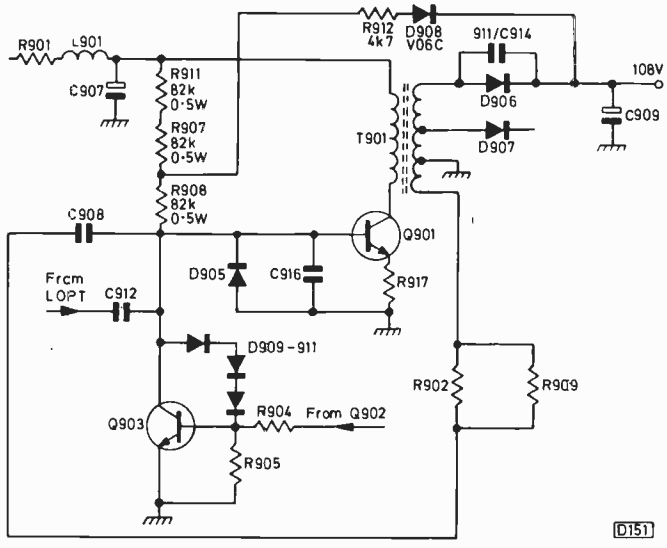


Fig. 2: Chopper circuit differences in non-remote control versions of the chassis.

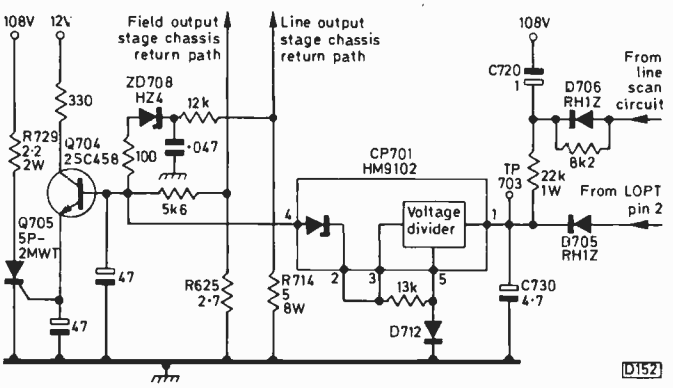


Fig. 3: The excess current/voltage trip circuit.

output transformer to the base of Q901 via C912. Voltage stabilisation is provided by CP901, which samples the 108V line at pin 2, Q902 and Q903. H.T. line voltage variations alter the bias applied to the error amplifier transistor Q902 whose collector voltage thus changes. This adjusts the chopper transistor's base current via the control transistor Q903. Note that there is no h.t. preset control.

Trip Circuit

Comprehensive protection is provided by connecting thyristor Q705 as a crowbar in series with R729 across the 108V line (see Fig. 3). When Q705 is fired the chopper circuit's output is shorted to chassis and the circuit stops oscillating. Q704 fires Q705 under various fault conditions: its base senses the current flowing in the line output stage, though R714 which is in series with the emitter of the line output transistor, the current flowing in the field output stage, via R625 which is in series with the field output transistors, and the voltage conditions in the line output stage. Voltage sensing is done by CP701: pin 1 of this device is connected to C730, the reservoir capacitor for D705 which rectifies the pulses developed at pin 2 of the line output transformer. D706 produces a voltage proportional to the line scan waveform.

Access

To gain access for servicing, remove the back cover by taking out two screws at the bottom and then turning the

four plastic "turnbuckles". When you remove the plastic ties which keep the wiring harness tidy be sure to note their exact positions first. Ease the plastic retainers at the front of the chassis and slide it out. The chassis will turn through 90° and fit into its plastic parking bracket at the bottom left of the cabinet (looking into the reciever from the back).

A parking hook is cunningly concealed at the top of the cabinet: it pulls out to hold the chassis in the parked position. You can now get at the print side of main panel PC940, which should be on the left when the chassis is parked upright. Sadly, your view will be obscured by various hefty chunks of plastic, and to obtain access to some components you'll have to remove the panel from its plastic surround. Unfortunately these always seem to be the parts you want to check!

Dead Set

If you've a completely dead set you may at first get that sinking feeling! Is the fault in the main power supply, the stand-by power supply, or is it due to an overload, probably in the line output stage?

Start by checking F1601 and/or F901. These fuses have been known to die of old age with no sign of blackening. Be careful when handling the stand-by power supply panel as the print easily cracks.

Next remove the line output transistor's collector connection on the line output subpanel PC945, which is mounted on the main panel near the line output transformer. Connect your d.c. meter – preferably a digital one – to the lead you've removed. Connect the a.c. mains supply and switch on. If you get a reading of 108V d.c., the fault is in the line output stage. If there's no voltage, transfer the test lead to the cathode of rectifier D906 to see whether the 108V h.t. is present at this point. If it is, switch off the receiver and check for dry-joints between line output subpanel PC945 and the main chassis. If the 108V is completely absent, experience indicates that one of the power supplies is faulty. Since they both interconnect, how can you decide which power supply has failed?

Connect your d.c. oscilloscope or digital voltmeter to the base of the chopper transistor Q901. Switch the set on and hold the mains switch S901 in. A positive kick-up voltage pulse should be detected. If the pulse is missing, connect the voltmeter to Q901's collector where a reading of about 250V d.c. should be obtained. If 250V is present here but the kick-up pulse is missing you've a fault in the stand-by power supply.

First make sure that the interconnecting plugs are clean and making good contact. Next measure the d.c. voltage at each side of the 78L18 regulator i.c. (IC1601) – 22V and 18V d.c. should be present at the input and output respectively. If the 22V is absent, check R1601, the bridge rectifier diodes D1601-4 and thyristor TH1601. Examine the panel carefully for dry-joints and print breaks. Then check Q1601, Q1602, ZD1602 and ZD1603 in that order.

The fast, reliable way to check these is with a component tester. You can easily check the operation of the microswitch by connecting an ohmmeter (mains disconnected of course) across PL19-3 and PL19-4: press and hold switch S901 and check for a zero reading.

If the kick-start pulse is present at the base of Q901 or there's no 250V d.c. at its collector the fault is in the main power supply. The first suspect is Q901 itself – it's the usual item that fails. Before replacing it, check its emitter resistor R917 (0·3Ω, 1W w.w.). Should Q901 be in order and the 250V supply missing, check the mains bridge rectifier diodes D901-4 and the surge limiting resistor R901 (7·7Ω, 8W w.w.). Although these components seldom fail, they can do so on occasion. A fairly common fault is dry-joint(s) at the chopper transformer's pins. In the non-remote control versions R911, R907 and R908 are prone to failure, with the result that the circuit fails to oscillate. If necessary check Q903, Q902, D909-D912, D905 and ZD901 in that order. It's possible for CP901 to fail: the only sure test is by replacement.

Tackling the Line Timebase

The line generator lives in IC701 (HA11235) along with the sync circuitry and the field generator. It's powered from the 54V rail via R703 and R734 which provide 12·7V at pin 11 in conjunction with an internal stabiliser. The line drive output is at pin 10: it's fed via R710 to the base of the line driver transistor Q701 (2SC1722-BK) which is transformer coupled to the base of the line output transistor Q702 (2SC1942).

Various supplies are produced in the line output stage. D703 and C714 develop 900V for the tube's first anodes. D704 and C719 develop 180V for the RGB output stages. D707 and C729 produce the 12V supply for the low-power stages. Fusible film resistors are incorporated in the 180V and 12V supplies – R713 (2·2Ω) and R717 (1Ω) respectively.

The most common line timebase fault is failure of the output transistor. Before replacing it check D703 (V11N) and the efficiency diode D702 (GH35) – they are on the same panel as Q702.

With Q702 out of circuit, check for line drive at its base connection using the scope with a 10:1 probe. If drive is not present, check at the collector of the driver transistor Q701, then at the junction of R710/R711. See Fig. 4. Don't be in a hurry to condemn IC701: check the associated components and voltages and look for dry-joints first. Other items to check in the line output stage are R714 (5Ω, 8W w.w.), D706 (RH1Z) which is part of the protection circuit, and the fusible resistor R717 which shuts the line output stage down when open-circuit.

The line output transformer T703 is of the diode-split type, and sadly is prone to failure. Substitution is the only reliable test.

Field Faults

As previously mentioned, IC701 produces the field drive waveform. To set the field hold connect a 100kΩ resistor between pins 6 and 8 (TP601/2) and adjust R605. If the field display is unsteady or varying up and down, suspect the thick-film field output module M601 (HM6232).

Tuner and IF Strip

The tuner, Hitachi type ET546, is mounted on the main panel. Its output is fed to the HA11215 i.f. i.c. (IC201) via SAW filter CP201. The 6MHz sound signal is taken from pin 2 of IC201 via ceramic filter MF401 to pin 2 of the HA1124A intercarrier sound i.c. (IC401). The audio output appears at pin 12 of this i.c. and is fed via C415 (10μF) to the audio output transistors Q401/2 (both type 2SD401 or 2SD478). Zener diode ZD401 (HZ11) in the audio coupling network has been known to cause sound

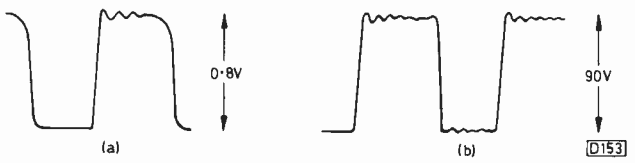


Fig. 4: Line drive waveforms (a) at the junction of R710/1 and (b) at the collector of Q701.

distortion problems. Should the receiver tend to drift off tune, check diodes D054 (1S2076A) and ZD051 (μPC574J). The composite video signal appears at pin 24 of IC201: it's fed via R701 to the sync separator transistor Q703 and via L207 to decoder panel PC942.

Decoder

The video signal arrives at connection B7 on the decoder panel where it's fed via the chroma bandpass filter T501 to the TA7193P decoder i.c. (IC501) and via R301/2 to the first luminance amplifier transistor Q301. You won't have problems with complex colour faults in these sets since virtually all the chroma circuitry is contained in IC501 which is reliable and either works or it doesn't. It has been known to cause green faces however. It's useful to know how to set up the subcarrier oscillator. Connect pin 21 of IC501 (TP504) to chassis via a 22kΩ resistor and link the junction of L501, C506 and C507 (TP503) to chassis. With a colour bar input to the receiver, adjust R514 for correct colours. Normally you won't have to make this adjustment unless the set has been got at by some person unknown.

If you get a raster with a dimly visible picture and uncontrollable brightness, check diodes D303-6 (all type 1S2473H), then zener diodes ZD301, ZD501, ZD502 and ZD503 (all type HZ11) and transistor Q304 (2SC458). Then suspect IC501.

CRT Base Panel

The RGB output transistors are on c.r.t. base panel PC015/PC029. Should you find the 180V supply missing, check R713 and D704 in the line output stage. Some Hitachi models were fitted with an "instant picture" c.r.t. – it had directly heated cathodes. This involved a different base panel with a transformer (T805) to provide the heater supply to the cathodes. The system was not a great success and for replacement purposes modification is recommended (see *Television* December 1982, page 74).

Remote Control

So far we've had no problems with the infra-red remote control signal amplifier panel PC981, nor have we had a faulty remote control handset.

The SAA1251 remote control decoder i.c. (IC1501) lives on panel PC987, just above the loudspeaker. It works hard for its living but we've yet to have one fail. The infra-red commands enter at pin 16 in the form of serial binary data. Commands which override the manual brightness, colour and volume controls emerge at pins 3, 4 and 5. The outgoing information at pins 8–10 serves a dual purpose. It's applied to IC1502 (SN76709AN) on the same panel: this i.c. selects the correct tuning potentiometer for the channel required. It also goes via PL1 to the LM1017 seven-segment display driver i.c. (IC1771) on panel PC018. The FND500 seven-segment LED indicates the channel to which the set is tuned. IC1501 also interprets information from the manual channel selector switches on board PC995.

Should the 4·433MHz crystal XTAL1501 be faulty the clock oscillator in IC1501 will stop and the i.c. will ignore all commands. To check its operation connect a frequency meter or an oscilloscope to pin 23 of the i.c. where the clock frequency of 4·433MHz should be present.

IC1502 is easy to check using a logic probe or digital voltmeter. With a channel selected one of pins 10-13 and 15-18 should be at binary 0 (low) and the rest at binary 1 (high).

If the channels change but the FND500 LED does not indicate the selected channel correctly suspect IC1771 – but first make sure that there is 5V d.c. at pin 16 (from IC1772-78L05A). The FND500 itself is extremely reliable – we've never known one to fail in any piece of equipment.

Soak Test

In conclusion, after repairs have been completed and a thin coat of circuit varnish has been applied to all joints soldered it's best to soak test these sets for at least three hours.

Book Review

Servicing Personal Computers by Michael Tooley, published by Newnes Technical Books (Borough Green, Sevenoaks, Kent TN15 8PH) at £17·95.

As far as we know this is the first book on servicing microcomputers to be published in the UK. Newnes are to be congratulated on its timely appearance. There are now large numbers of microcomputers in homes and offices and their reliability is not too good. It's very likely therefore that a large new servicing market is in the process of opening up. In addition to reliability problems, it's reported that the manuals etc. for many microcomputers leave much to be desired.

This book is not exactly cheap at £17·95 for just over 200 pages (size 234 × 165mm). Is it worth the price? This of course depends on whether or not you really want to get into the subject. If you do, I'd say it's invaluable. Secondly, how much background knowledge do you require to be able to follow the book? I'd say that anyone who reads this magazine will find it remarkably easy to come to grips with the subject through a study of this book. It's not full of obscure logic circuitry but instead treats microcomputers basically in block diagram form, outlining what each section contributes to the microcomputer. This is not to suggest superficiality: the common microprocessor, ROM, RAM etc. chips used in microcomputers are described, with pin connections etc., so that one can have little doubt when looking at a microcomputer board what does what.

The fault diagnosis chapter is detailed and covers everything from simple power supply failures to test procedures for different sections of a microcomputer. This is followed by chapters on tape and disk drives, printers and monitors. The author is Principal Lecturer at the Department of Technology, Brooklands Technical College. All in all I feel that this is a very worthwhile publication. **J.A.R.**

VHS VCR Audio/Control Heads

Derek Snelling

Many of you are probably familiar with the heads used in audio cassette recorders and may have changed one, finding no difficulty with the setting up which usually involves the adjustment of just one screw for azimuth alignment. The audio/control head assemblies used in VHS video recorders are slightly more difficult, with four adjustments that are to some extent interdependent. The purpose of this article is first to show how the two adjustments that may require alteration during the life of a head assembly should be carried out and then to provide, for the more ambitious, some guidelines on replacing an audio/control head assembly.

In the normal course of events the only adjustments required are for azimuth and tilt, to compensate either for head wear, tape wear or the fact that the manufacturer didn't set them up correctly to start with.

Azimuth Adjustment

If the treble response on sound is lacking with prerecorded tapes and those recorded on other machines but is all right with the machine's own recordings the azimuth setting probably needs adjustment. If you have an alignment tape, use the portion with the 3kHz tone and adjust screw A (see Fig. 1) for maximum volume. If you don't have an alignment tape, use a recording made on a known good machine, the newer the better: select a recording with music and a lot of treble (violins are good) and adjust screw A for maximum treble. Note that there is no point in making this adjustment using a tape previously recorded on the machine being adjusted.

Tilt Adjustment

If the problem is varying sound level, usually only on the machine's own recordings and often with certain tapes, the tilt may need adjustment. The cause of the problem here is that the tape is not contacting the top of the head assembly properly. This can be due to low back tension, so check this first if possible. It can also be due to a tape stretching and getting a wavy edge. If the tension is correct and the tapes aren't excessively worn, the cure is to tilt the top of the head assembly slightly forwards to improve its contact with the tape.

To do this, adjust screw B. You'll probably need a jewellers' screwdriver, and may have to clean off some of the sealing paint first. Turn the screw clockwise by no more than one full turn – adjusting any farther than this may cause the bottom edge of the head to lose contact with the tape, and as this is where the control head section is the result could be speed variation problems. To check whether the fault has been cleared, make a recording on a tape which previously showed the fault up. If the fault is still present, try further adjustment, but once a full turn in total has been made no further adjustment should be attempted – a new audio/control head assembly may have to be fitted. After making this adjustment the azimuth should be checked as previously described, with the difference that in this case the adjustment can be made using one of the machine's own previous recordings. Note that the tilt adjustment is not made whilst playing a tape and will not "bring back" the sound on the faulty recordings, only eliminating the problem with future recordings.

Head Assembly Replacement

Now for those brave enough to attempt head assembly replacement. If the machine has a height adjusting nut, e.g. Hitachi and Panasonic machines, removal of the head assembly complete with the base plate is a matter of undoing this and removing the assembly: unhook the spring if fitted. It's best to count the number of turns of the nut to aid refitting at the correct height. After removing the head/base plate assembly, the head assembly must be removed from the base plate by undoing screws A and C. Take care not to lose any springs. Transfer screw B from the old head assembly to the new one, counting the number of turns as you undo it and screwing it in the same number of turns on the new assembly. Refit to the base plate using screws A and C and any springs, screwing the assembly down to approximately the same height. Transfer the head PCB to the new head. Put the whole assembly back in the machine, reconnecting any springs, and screw the height nut down the same number of turns as on removal. Insert a previously recorded cassette in the machine and set it to play. Adjust the height nut for maximum sound while maintaining a locked picture, i.e. no rolling noise bar. Adjust screw A for maximum treble, then recheck the adjustment of the height nut. Screw B should not need adjusting but if necessary refer to the instructions given previously.

If the machine doesn't have a height adjusting nut – Ferguson machines for example – removal means undoing the three screws after which the head assembly can be taken out: in this case the base plate remains in the machine. Before removing it, measure the height of the audio/control head assembly above the base plate to the nearest millimetre to aid refitting. Take care not to lose the springs from under the head assembly. Transfer the head PCB to the new head assembly and fit this in the machine at the same height as previously. To adjust the height on these machines all three screws must be turned the same way a little at a time until maximum sound is

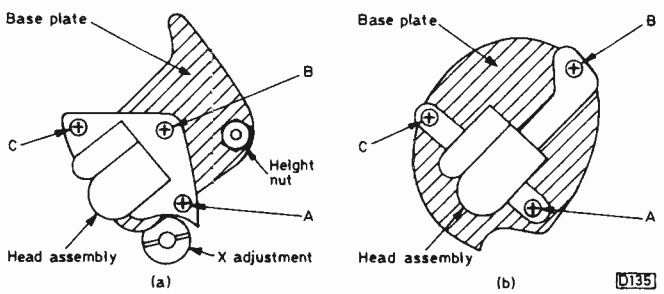


Fig. 1: Typical audio/control head assembly layouts, (a) with height adjustment nut, e.g. Hitachi models, (b) without height adjustment nut, e.g. Ferguson 3V22.

obtained. Azimuth and tilt are then adjusted as before.

The thing to remember when adjusting a new head is that the final alignment will match that of the machine on which the tape used was recorded, so be certain of the alignment of the machine whose tape you use for the purpose.

Finally X adjustment. On some machines this is a conical screw, on others the base plate is mounted via slotted holes. In either case centre the tracking control and adjust for best picture.

Sid's Secret Weapon

Les Lawry-Johns

Our old friend Sid popped in the other day and left a Ferguson 3787 with us for repair. "No hurry Les, I'll be back on Saturday." Since this gave me four days I agreed to have a go, despite my in-built fears of these Nordmende made colour portables that have given me so many hours of torment in the past. I wish an expert on these horrors would write an article for us outlining the pitfalls to be expected when idiots like me try to fumble around in them in the dark. Can you hear me someone out there? . . . help!

I removed the rear shell, loosened the two wing nuts and lowered the chassis. The blue line output transformer at the bottom right caught my eye. It didn't look right. I decided to switch on however to see what would happen. To my surprise the set started up, but in a half-hearted way. I felt the top of the 4·7Ω surge limiting resistor RA05: it was stone cold. When I'd switched off I found that it was open-circuit. The set had been trying to work via the soft-start circuit, which was why RU05 (680Ω) was hot and bothered. So I fitted a new surge limiter and tried again. The sound came on but the tube's heaters didn't glow: the h.t. was correct but all the line output transformer derived voltages were low.

I looked at the transformer again and realised that the top half of the core was missing. I'd a suitable old transformer with a similar core so I stripped it down: the core fitted nicely and I glued it in position. Everything then seemed to be in order. A BBC-1 picture appeared and looked good. It stayed on until I pressed the second button for BBC-2. The set then immediately shut down.

I switched off and tried again after a few minutes. The set came on for a few seconds then shut down. I removed plug II, the feed to the tuner control unit, and tried again. The set now came on,. but without any picture or sound of course. There was plenty of noise however to show that the set was willing. It stayed on like this for an hour. Then I replaced plug II and it immediately shut down. So I removed the tuner control unit and checked just about everything. Finding no faults at all I refitted it and tried once more. The set now came on, but on switch position five – and wouldn't be budged. It seemed as though the SAS590 had taken exception to my probing. After fitting a new one the set came on, on channel 1, and didn't object to changing channels. I felt relieved and left it on for quite some time.

I thought I'd disconnect the aerial and let it play away to itself. The act of disconnecting the aerial resulted in the set shutting down and this made me very angry.

I decided that the set was working in too sensitive a condition and studied the circuit at some length. Perhaps if I adjusted the set-e.h.t. control RZ13? I did so carefully, for 27V at the slider. After doing this the aerial could be removed and channels changed at will. "Why didn't I do that in the first place?" I scolded myself.

The set behaved itself until Sid came to collect it. He phoned yesterday to say that it works o.k. until the aerial is plugged in, then it shuts down. He'll be bringing it back in as soon as he has a chance. Back to square one . . .

The Quiet Life

When the Nordmende had departed life settled down for a few days to a more peaceful run of routine jobs. You know the sort of thing:

"You put a new element in my kettle last week and now it's burnt out. Surely these things are guaranteed?"

"Yes madam, if they are automatic. The one you had wasn't, and you did opt for the cheapest one without a cut-out. If you let it boil dry and cook up you can hardly blame the makers, or me."

The Thorn 9000 which had a new SKE diode (the one in series with the Syclops transistor) fitted six months ago and now has a tripler arcing to the frame. "I thought all work was guaranteed for a year."

Not all customers are unreasonable however. Some are quite understanding. Mainly men, but some women are, especially when you tell them you have a stiff leg (the remainder of this passage is censored – editor).

The Philips CTX-S

We seem to be getting a fair number of Philips sets fitted with the CTX-S chassis in lately. They are nice little sets with only a few common faults. Probably the most common, as with the KT3 etc., is failure of the 4·7Ω surge limiter in the power supply. One came in the other day however with the 300V supply present right up to the collector of the BUX84 chopper transistor.

The chopper drive circuit uses discrete transistors, so fault finding is fairly straightforward. The driver transistor is a BF422, a small 250V npn video type. It had failed. I prefer to fit the more beefy BF337, but it's essential to remember that the base is in the middle with this type, so it must be turned to present the base at one end as marked on the print. Provided this is done and plenty of clearance is left for the body (collector) more reliable operation is assured without the need for a heatsink.

These items, the BUX84 and its drive arrangement, occupy the front right side looking from the rear and are easy to get at as the panel slides out once the rear cover is removed (four screws). Since the lady who'd brought the set in had been told the repair would be difficult and costly she was very happy to have it back in two hours.

Haunted . . .

What a contrast to the Nordmende that continues to haunt me. I'm sure it's only a simple adjustment but I did set it up according to the manual, honest. When it comes back I'll set it up according to me, so there . . .

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

16029	1.58	2SC1061	0.54	2SD898B	2.67	AN320	4.97	BC171	0.10	BD166	0.38	BF137	0.11	BLY49	2.00	BY203/20	0.18
16181	1.13	2SC1096	1.05	40408	0.45	AN322	4.38	BC172	0.09	BD168	0.66	BF152	0.28	BR100	0.20	BY206	0.17
16182	1.13	2SC1104	2.60	40594	1.39	AN331	2.99	BC172B	0.24	BD175	0.39	BF153	0.52	BR101	0.37	BY207	0.22
16334	0.88	2SC1106	4.12	40595	1.39	AN337	3.99	BC173	0.15	BD177	0.39	BF154	0.23	BR103	0.45	BY210-400	0.24
16335	0.72	2SC1114	5.61	40636	0.86	AN340P	1.06	BC174B	0.24	BD179	0.44	BF157	0.23	BR888B	0.58	BY210-600	0.27
16446	0.89	2SC1124	1.10	40871	1.39	AN355	3.36	BC177	0.18	BD181	0.90	BF158	0.16	BRC-M-300	1.58	BY210-800	0.30
16600	1.25	2SC1151A	4.29	40872	1.39	AN362	1.47	BC178	0.23	BD182	0.90	BF159	0.16	BRC116	0.60	BY223	0.85
16799	2.16	2SC1152	4.25	60857	1.10	AN5111	2.34	BC179	0.23	BD183	0.90	BF160	0.28	BRC1330	1.60	BY224-400	0.90
16801	0.86	2SC1157	4.12	74LS132	0.72	AN5132	3.99	BC182	0.08	BD184	1.10	BF167	0.34	BRC300	1.82	BY225-100	0.79
16802	1.03	2SC1162	0.95	74LS138	0.85	AN5250	3.33	BC182B	0.23	BD187	0.48	BF173	0.30	BRC4443	1.12	BY226	0.28
16803	4.81	2SC1172	1.92	74LS157	0.79	AN5435	2.80	BC182L	0.09	BD189	0.35	BF177	0.50	BRC4444	1.12	BY227	0.44
16905	1.35	2SC1195	2.83	74LS161AN	1.18	AN5610	6.75	BC182LB	0.12	BD190	0.59	BF178	0.36	BRC5296	0.70	BY228	0.54
17074	6.00	2SC1213	0.75	74LS196	1.25	AN5613	3.72	BC183	0.09	BD201	0.54	BF179	0.32	BRC6109	0.75	BY255	0.97
17127	3.91	2SC1226	1.32	74LS20	0.25	AN5620X	4.63	BC183L	0.09	BD202	0.54	BF180	0.32	BRC82	0.98	BY298	0.25
17376	1.43	2SC1306	0.85	74LS244	1.65	AN6320N	3.89	BC183LB	0.23	BD203	0.54	BF181	0.29	BRC83	0.98	BY299	0.25
1N4001	0.05	2SC1307	1.35	74LS30	0.29	AN6342	1.36	BC184	0.09	BD204	0.54	BF182	0.30	BRC84	0.98	BY476A	0.76
1N4002	0.05	2SC1316	3.40	74LS367	1.05	AN6344	4.68	BC184L	0.09	BD207	1.00	BF183	0.35	BRX44	0.54	BYW56	0.30
1N4003	0.05	2SC1364	0.49	74LS373	1.55	AN6363	10.20	BC184LB	0.23	BD208	1.00	BF184	0.39	BRX49	0.45	BYX10	0.26
1N4004	0.06	2SC1383	1.39	74LS47	1.05	AN6551	0.56	BC186	0.24	BD222	0.44	BF185	0.35	BRY39	0.50	BYX55-350	0.48
1N4005	0.07	2SC1398	0.51	74LS73	0.39	AN6552	0.52	BC187	0.18	BD225	0.44	BF194	0.15	BRY55	0.60	BYX55-600	0.25
1N4006	0.07	2SC1410	2.17	74LS74	0.39	AN7145	2.04	BC204	0.14	BD228	0.57	BF195	0.12	BRY56	0.38	BYX71-350	0.67
1N4007	0.07	2SC1413	3.68	74LS75	0.52	AN7150	2.22	BC207	0.12	BD229	0.63	BF196	0.15	BSR59	1.17	BYX71-600	0.85
1N4148	0.03	2SC1505	0.56	74LS86	0.49	AN7151	2.05	BC212	0.10	BD231	0.45	BF197	0.14	BSS38	0.30	BYX94	0.18
1N4448	0.12	2SC1578	6.67	74LS90	0.75	AN7156	2.05	BC212B	0.23	BD232	0.44	BF198	0.15	BSTBD1409	2.48	BYY56	1.09
1N5401	0.12	2SC1617	3.35	74LS92	0.75	AN7158	2.34	BC212L	0.09	BD234	0.38	BF199	0.15	BSTBO1405	4.37	BZV15-C12	0.72
1N5402	0.13	2SC1670	2.84	74LS93	0.75	AN7218	1.49	BC212LB	0.23	BD235	0.43	BF200	0.33	BSTC0146	2.25	BZV15-C12R	0.72
1N5403	0.14	2SC1678	1.25	74LS95B	0.85	AP58076	4.25	BC213	0.09	BD236	0.45	BF216	0.32	BSTC0233	2.25	BZV15-C24	0.72
1N5404	0.15	2SC1810	1.40	7805 TO-220	0.63	AS560S	1.43	BC213L	0.09	BD237	0.38	BF218	0.32	BSTC0246	4.51	BZV15-C24R	0.72
1N5408	0.18	2SC1815	0.41	7805 TO-3	1.05	AU106	1.96	BC213LB	0.23	BD238	0.29	BF222	0.50	BSTC1233	3.91	BZV15-C30R	0.72
1N914	0.05	2SC1829	2.01	7806	0.66	AU110	1.96	BC214	0.09	BD239	0.44	BF224	0.15	BSTC3146	0.71	BZX61 Range	0.16
1S44	0.06	2SC1875	4.77	7808	0.54	AU113	2.15	BC214L	0.12	BD240	0.36	BF237	0.59	BSTCC0143	2.79	BZX70-C11	0.54
1S5012A	0.73	2SC1891	3.35	7812 TO-3	0.54	AY102	2.62	BC214LB	0.23	BD240D	0.47	BF240	0.15	BSTC0643	3.06	BZX70-C12	0.54
1S921	0.09	2SC1929	2.25	7812 TO-220	1.05	AY105K	1.89	BC225	0.24	BD241	0.45	BF241	0.15	BSV57B	2.66	BZX70-C15	0.54
2582	1.94	2SC1942	5.70	7815	0.55	AY106	1.98	BC237	0.09	BD242	0.45	BF244	0.23	BSW68	0.38	BZX70-C30	0.54
2N1302	0.24	2SC1945	4.11	7818	0.55	BA102	0.30	BC238	0.09	BD243	0.44	BF245A	0.33	BSX19	0.30	BZX70-C47	0.54
2N1303	0.34	2SC1953	1.75	7824	0.55	BA1310 (IC)	1.72	BC238A	0.11	BD243A	0.50	BF255	0.18	BSX20	0.30	BZX79 Range	0.09
2N2218	0.38	2SC1957	0.86	AC107	0.66	BA1320 (IC)	1.22	BC239B	0.08	BD244	0.44	BF256	0.25	BSX21	0.45	BZY88 Range	0.09
2N2219A	0.29	2SC1959	0.36	AC117	0.39	BA1330 (IC)	1.82	BC251A	0.15	BD244A	0.77	BF256LC	0.38	BSY52	0.45	BZY93-C12	0.99
2N2222	0.34	2SC1962	1.75	AC123K	0.39	BA145	0.17	BC252	0.12	BD245C	0.68	BF257	0.30	BSY79	0.46	BZY93-C18	0.99
2N2646	0.75	2SC1969	2.92	AC128	0.28	BA154	0.08	BC258	0.22	BD246C	0.74	BF258	0.29	BT100A	1.46	BZY93-C24	0.99
2N2904	0.32	2SC2027	2.67	AC138	0.08	BA155-01	0.12	BC261A	0.20	BD253	0.95	BF259	0.30	BT106	1.20	BZY93-C24R	0.99
2N2905	0.39	2SC2028	1.91	AC141	0.26	BA156	0.12	BC262	0.20	BD278A	0.60	BF262	0.51	BT108	1.31	BZY93-C30	0.99
2N2906	0.34	2SC2029	1.49	AC142K	0.39	BA157	0.17	BC287	0.45	BD317	1.96	BF263	0.51	BT109	1.31	BZY93-C47	0.99
2N3053	0.24	2SC2057	1.07	AC151	0.25	BA159	0.12	BC294	0.45	BD318	2.08	BF264	0.33	BT112	2.25	BZY93-C68	0.99
2N3054	0.90	2SC2073	1.40	AC153	0.30	BA182	0.17	BC301	0.36	BD375	0.38	BF271	0.30	BT113	2.25	BZY93-C7V5	0.99
2N3055	0.55	2SC2078	1.25	AC153K	0.36	BA222 (IC)	1.26	BC302	0.30	BD377	0.23	BF273	0.18	BT116	1.52	ZTK33	0.39
2N3055H	0.77	2SC2091	0.59	AC176	0.17	BA284/2	0.15	BC303	0.34	BD379	0.69	BF274	0.18	BT119	1.60	ZX18	2.47
2N3442	1.05	2SC2122A	4.65	AC176K	0.40	BA301 (IC)	0.92	BC307	0.09	BD380	0.69	BF324	0.16	BT120	1.60	C106D	0.46
2N3702	0.12	2SC2141	1.69	AC179	0.25	BA302	0.90	BC307A	0.14	BD410	0.44	BF336	0.27	BT121	2.25	C1129	0.52
2N3703	0.12	2SC2166	1.35	AC183	0.65	BA311 (IC)	1.06	BC308	0.12	BD412	5.70	BF337	0.36	BT122	2.25	CA1310E	2.45
2N3704	0.12	2SC2216	0.62	AC186	0.30	BA312 (IC)	0.98	BC308A	0.09	BD418	0.76	BF338	0.36	BT123	1.80	CA3044	3.18
2N3705	0.12	2SC2233	2.20	AC186K	0.50	BA313 (IC)	1.28	BC309	0.15	BD433	0.33	BF355	0.36	BT125	2.25	CA3046	2.23
2N3706	0.12	2SC2271	3.64	AC187	0.35	BA316	0.07	BC317A	0.11	BD434	0.39	BF362	0.54	BT126	2.25	CA3060	1.50
2N3707	0.14	2SC2278	1.03	AC187-01	0.40	BA317	0.07	BC323	0.92	BD435	0.42	BF363	0.54	BT128	2.25	CA3065	1.17
2N3711	0.14	2SC2335-KIT	7.61	AC187K	0.39	BA318	0.08	BC327	0.15	BD436	0.42	BF371	0.45	BT128P	2.79	CA3089	3.35
2N3771	1.85	2SC2526	1.70	AC188	0.33	BA328 (IC)	0.80	BC328	0.10	BD437	0.41	BF391	0.36	BT129	2.25	CA3089E	1.30
2N3772	1.55	2SC2551	0.95	AC188-01	0.40	BA333 (IC)	1.24	BC337	0.08	BD438	0.44	BF393	0.90	BT151-800R	1.47	CA3090	1.25
2N3773	1.65	2SC2570	1.80	AC188K	0.39	BA401 (IC)	0.58	BC338	0.10	BD441	1.29	BF417	1.20	BT151 500R	1.25	CA3094	2.00
2N3819	0.28	2SC2570A	0.95	AC193K	0.59	BA511 (IC)	1.98	BC360	0.30	BD442	0.56	BF418	1.70	BTT6018	2.20	CA3131EN	2.83
2N3823	1.06	2SC264A	4.38	AC194K	0.59	BA521 (IC)	1.81	BC368	0.23	BD507	0.54	BF422	0.26	BTT6218	2.20	CA3132EN	2.83
2N3904	0.56	2SC2671	1.99	AD140	0.96	BA532 (IC)	1.88	BC440	0.99	BD508	0.54	BF423	0.26	BTT8024	4.02	CAH76023N	6.00
2N3908	0.56	2SC2728	0.95	AD142	0.96	BA536 (IC)	2.72	BC441	0.40	BD509	1.29	BF435	0.49	BTT8124	4.44	CBF16848N-07	1.41
2N4101	1.10	2SC372	1.27	AD143	0.96	BA6304A (IC)	2.65	BC454	0.32	BD510	0.45	BF450	0.30	BTT8214	5.44	CD4001	0.24
2N4240	3.00	2SC373	1.05	AD145	1.45	BA843 (IC)	3.60	BC455	0.32	BD518	1.36	BF451	0.26	BTT8224	2.70	CD4002	0.24
2N4443	1.35	2SC383	1.20	AD149	0.81	BAV10	0.10	BC460	0.38	BD519	1.36	BF457	0.37	BU105	1.66	CD4008	0.96
2N4444	1.12	2SC388	0.45	AD161	0.30	BAV18	0.10	BC461	0.42	BD529	0.38	BF458	0.35	BU106	2.25	CD4011	0.23
2N4914	0.65	2SC41	1.99	AD162	0.30	BAV19	0.10	BC462	0.27	BD530	0.60	BF459	0.35	BU108	1.90	CD4012	0.24
2N5064	0.64	2SC458	0.55	AD262	0.95	BAV20	0.10	BC463	0.58	BD533	0.60	BF460	0.54	BU109S	1.90	CD4013	0.37
2N5293	0.45	2SC495	0.83	AF114	2.24	BAV21	0.17	BC464	0.58	BD534	0.36	BF469	0.27	BU110	2.52	CD4016	0.37
2N5294	0.45	2SC508	3.36	AF115	0.79	BAX12	0.10	BC465	0.58	BD535	0.44	BF470	0.28	BU111Y	3.78	CD4017	0.74
2N5296	0.40	2SC515A	1.28	AF116	0.79	BAX13	0.10	BC477	0.25	BD536	0.55	BF471	0.28	BU124	1.25	CD4020	0.92
2N5297	0.45	2SC537	0.49	AF117	0.75	BAX16	0.10	BC478	0.29	BD537	0.60	BF472	0.28	BU126	1.11	CD4021	0.24
2N5298	0.55	2SC558	3.35	AF118	0.75	BB105B	0.22	BC479	0.29	BD538	0.60	BF479	0.55	BU134S	4.15	CD4023	0.25
2N5490	1.35	2SC605L	1.05	AF121	0.50	BB119	0.15	BC532	0.25	BD544B	0.75	BF480	0.54	BU204	1.29	CD4025	0.54
2N5496	0.45	2SC620	1.32	AF124	0.36	BC107	0.13	BC546	0.15	BD580	1.06	BF495	0.58	BU205	0.98	CD4028	0.76
2N6107	0.53	2SC643A	1.40	AF125	0.36	BC107B	0.14	BC547	0.09	BD590	1.06	BF506	0.39	BU206	1.20	CD4047	0.96
2N6109	1.43	2SC673	1.11	AF126	0.36	BC108	0.12	BC548	0.09	BD598	1.13	BF509	0.37	BU207	1.50	CD4049	0.52
2N6122	1.80	2SC681	4.00	AF127	0.36	BC108A	0.12	BC549	0.09	BD645	3.62	BF523	0.18	BU208	0.98	CD4050	0.50
2N6130	0.65	2SC684	1.50	AF139	0.48	BC108B	0.15	BC550	0.36	BD677	0.55	BF594	0.24	BU208/02	0.98	CD4052	0.68
2N6133	0.57	2SC685A	2.62	AF178	0.75	BC109	0.11	BC556	0.12	BD680	0.69	BF595	0.24	BU208A	0.98	CD4053	0.72
2N6178	0.66	2SC693	0.69	AF179	0.50	BC109B	0.13	BC557	0.09	BD681	1.34	BF596	0.16	BU208D	1.43	CD4069	0.23
2N6180	0.66	2SC710	0.62	AF180	0.50	BC113	0.12	BC558	0.09	BD695	2.09	BF597	0.24	BU209	1.60	CD4081	0.26
2N696	0.39	2SC717	1.92	AF181	0.48	BC114	0.17	BC559	0.09	BD696	2.24	BF617	0.95	BU226	2.08	CD4093	0.72
2N698	0.39	2SC734	1.30	AF182	0.50	BC115	0.14	BC560C	0.10	BD697	3.27	BF618	0.95	BU312	2.16	CD4511	1.00
2N707	0.39	2SC735	1.05	AF186	0.48	BC116	0.20	BC635	0.18	BD698	1.68	BF694	0.20	BU326	0.75	CD4517	1.06
2SA1027	1.15	2SC782	2.24	AF239	0.48	BC116A	0.53	BC636	0.18	BD699	3.17	BF757	0.59	BU326A	1.40	CP5521	16.20
2SA1076	1.78	2SC790	1.15	AF279	0.80	BC117	0.18	BC637	0.18	BD700	3.36	BF758	0.59	BU326S	2.25	CV-12E	2.49
2SA329	0.36	2SC806	10.26	AL100	3.66	BC118	0.18	BC638	0.18	BD702	2.94	BF759	0.30	BU406	1.35	CX034	10.75
2SA351	1.06	2SC814	1.26	AL102	1.75	BC119	0.30	BC639	0.18	BD707	0.55	BF760	0.59	BU407	0.74	CX095D	2.85
2SA489	1.06	2SC828	0.25	AL103	2.43	BC125	0.18	BC640	0.18	BD709	0.72	BF762	0.30	BU407D	1.29	CX104	8.49
2SA490	1.51	2SC867A	2.49	AL113	1.80	BC126	0.18	BC879	0.28	BD710	0.72	BF870	0.27	BU412	4.80	CX108	6.92
2SA493	0.95	2SC926A	1.29	AN208	3.22	BC132	0.12	BC880	0.28	BD807	0.60	BF871	0.84	BU426	1.95	CX109	6.92
2SA628	1.03	2SC930	0.49	AN210	2.07	BC135	0.12	BCX32	0.33	BD809	0.60	BF900	0.68	BU426A	1.67	CX121	10.75
2SA637	1.32	2SC935	3.75	AN214	2.05	BC136	0.15	BCX33	0.24	BD810	0.60	BF907	1.62	BU427	2.67	CX130	4.90
2SA673	1.11	2SC936	1.58	AN214Q	2.05	BC137	0.16	BCX34	0.36	BD879	0.64	BF959	0.38	BU500	1.61	CX131	10.75
2SA683	1.46	2SC937	3.25	AN231	5.56	BC138	0.30	BCX37	0.60	BD880	0.65	BF970	0.55	BU508A	1.33	CX134	10.75
2SA684	1.33	2SC940	4.25	AN234	5.02	BC139	0.32	BCY70	0.27	BD895	1.98	BFR39	0.36	BU526	1.65	CX136	10.75
2SA748	0.68	2SD1138	0.78	AN235	4.84	BC140	0.33	BCY71	0.19	BD899	2.25	BFR52	0.45	BU608D	1.42	CX137	10.75
2SA818	1.65	2SD198	3.51	AN236	3.02	BC141	0.28	BCY72	0.18	BD901	0.55	BFR62	0.36	BU806	1.29	CX139	10.75
2SA835	2.27	2SD234	0.42	AN238	4.98	BC142	0.30	BD115	0.29	BDV64B	1.14	BFR79	0.29	BU806D	1.35	CX157	4.40
2SA940	1.64	2SD235	0.54	AN239	3.95	BC143	0.28	BD116	0.63	BDV65B	1.14	BFR81	0.45	BU807	1.40	CX158	3.44
2SA951	1.23	2SD257	2.67	AN240P	1.88	BC147	0.10	BD124	1.19	BDX32	1.50	BFR86	0.98	BU826A	2.79	CX170	6.92
2SA966-Y	0.54	2SD291	2.67	AN241	1.55	BC147A	0.42	BD124P+KIT	0.62	BDX53	0.80	BFR89	0.39	BUV46	1.13	CX177	5.99
2SB325	3.51	2SD292	2.35	AN245	2.54	BC148	0.11	BD131	0.38	BDX53A	3.68	BFT41	0.27	BUV84	1.12	CX506	8.48
2SB337	1.65	2SD313	2.59	AN247P	2.62	BC148B	0.11	BD132	0.38	BDX54B	2.37	BFT42	0.39	BUN81A	3.15	CX507	6.92
2SB375	3.51	2SD315	2.67	AN252	2.33	BC148C	0.11	BD133	0.48	BDX62A	1.92	BFT43	0.39	BUN84	1.56	CX758	6.92
2SB400	0.36	2SD325D	1.36	AN253	2.70	BC149	0.10	BD135	0.32	BDX63A	1.95	BFT84	0.36	BUX84	1.47	D1693	2.35
2SB407	2.94	2SD350	7.03	AN262	1.58	BC149B	0.11	BD136	0.32	BDX64A	2.37	BFW10	0.79	BY126	0.11	DEC1	1.52
2SB411	3.00	2SD350A	2.08	AN272	5.36	BC153	0.12	BD137	0.32	BDX65A	2.37	BFX29	0.30	BY127	0.11	DEC2	1.52
2SB511	1.48	2SD353	3.25	AN281	5.52	BC154	0.12	BD138	0.41	BDX76	0.53	BFX30	0.59	BY133	0.11	E1222	0.36
2SB54	1.26	2SD389	2.19	AN295	5.01	BC157	0.14	BD139	0.27	BDY20	1.10	BFX84	0.33	BY164	0.50	E5024	0.25
2SB56	1.26	2SD401	1.57	AN301	3.39	BC158	0.09	BD140	0.33	BDY62/01	4.20	BFX85	0.25	BY176	1.38	E5386	0.22
2SB618A	1.40	2SD551	2.20	AN302	3.62	BC159	0.14	BD144	1.30	BDY81	1.07	BFX87	0.50	BY179	1.42	E5529	0.22
2SB681	2.44	2SD588A	1.25	AN303	3.25	BC160	0.36	BD150	1.08	BF115	0.36	BFX88	0.30	BY182	0.95	E8021	1.17
2SB695	1.70	2SD621	8.88	AN305	8.07	BC161	0.36	BD157	0.60	BF117	0.36	BFX89	0.36	BY184	0.42	E9003	0.41
2SB75	0.94	2SD657	2.54	AN313	3.10	BC167	0.32	BD159	0.48	BF118	0.60	BFY50	0.24	BY187	0.70	E9005	0.45
2SB861	0.68	2SD731	1.72	AN315	2.12	BC168	0.32	BD160	1.45	BF121	0.22	BFY51	0.24	BY189	1.20	ER1400	10.12
2SC1034	5.61	2SD811	3.86	AN316	5.58	BC169C	0.14	BD163	0.64	BF123	0.11	BFY52	0.24	BY198	2.38	ESN310BP	3.86
2SC1050	3.66	2SD869	2.40	AN318	4.75	BC170	0.14	BD165	0.56	BF127	0.11	BFY90	0.96	BY201/2	1.36	ESM432C	4.18

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE MODEL LOCATION. REMEMBER TO ADD 0.60p POST & HANDLING. ADD 15% VAT TO TOTAL

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

ESM532C	4.18	LM1303P/N	1.50	MPSU05	0.78	SAA5010	4.90	SN74190	1.81	T6029V	4.41	TBA395	1.35	TDA1230	2.93	TDA9503	2.60
ESM632C	4.18	LM1310P/N	1.25	MPSU10	0.78	SAA5012	6.50	SN7420N	0.30	T6032V	0.89	TBA395Q	1.00	TDA1235	3.52	TDA9513	2.40
ESM732C	4.18	LM3065N	0.77	MPSU55	0.90	SAA5020	5.25	SN7430	0.28	T6033V	0.73	TBA396	1.80	TDA1270	2.64	TE527	1.25
ETT6016	2.65	LM317CKC	1.30	MPSU56	0.30	SAA5030	7.50	SN7440N	0.24	T6035V	0.66	TBA400	2.17	TDA1327A	1.65	TE538	0.36
ETTR6016	2.16	LM339N	0.68	MPSU60	1.20	SAA5040A	14.75	SN7473	0.56	T6036	0.44	TBA440P	1.55	TDA1327B	1.65	TE626	1.35
FND500	5.25	LM3407	1.29	MR510	0.30	SAA5050	8.50	SN7474N	0.72	T6037	1.91	TBA480	1.42	TDA1330	1.60	TEA1002	3.15
FT3055	1.05	LM340T5	0.75	MR812	0.60	SAA661B	1.80	SN7490AN	0.53	T6041V	0.66	TBA480Q	1.67	TDA1365	6.35	TDA1009	0.96
GF758	0.82	LM340T12	0.75	MR914	0.46	SAA700	3.00	SN75110N	0.75	T6044V	0.86	TBA500PQ	4.95	TDA1412	0.95	TEA1020SP	5.34
GF759	1.02	LM340T5	0.75	MSSD7002	0.65	SAB1009B	4.53	SN76001ANQ	2.25	T6045	1.09	TBA510	1.55	TDA1420	1.48	TEA1087	0.46
GF761	0.78	LM342N	0.56	MVS240	0.52	SAB1046P	3.66	SN76003N	2.81	T6049	1.10	TBA510S	6.39	TDA1470	2.63	TIC106C	0.55
GH3F	1.65	LM384N01	1.84	MVS460	0.30	SAB3011	7.34	SN76013N	3.63	T6952V	0.76	TBA520	1.67	TDA1512	2.20	TIC106M	0.55
HA11211	2.30	LM567CN	1.30	MVS460-02	0.55	SAB3012	5.34	SN76013ND	2.25	T6058	0.46	TBA520Q	1.35	TDA1670	3.65	TIC116D	0.80
HA11215	4.60	LM748	1.65	ME545B	2.95	SAB3013	3.28	SN76013NDG	8.07	T6059	1.05	TBA530	0.86	TDA1770	5.56	TIC44	0.65
HA11225	3.90	LM8360	2.78	ME545B	3.80	SAB3021	7.18	SN76023N	2.35	T8001V	1.09	TBA530Q	0.85	TDA1905	1.25	TIC45	0.70
HA11226	7.56	LM8361	2.78	ME5534N	1.48	SAB3022B	12.34	SN76023ND	1.04	T9003V	0.86	TBA540	0.98	TDA1908	2.95	TIC47	0.70
HA11229	2.51	M1024	2.55	ME555	0.34	SAB3023B	11.18	SN76033N	2.33	T9005V	2.16	TBA540Q	1.15	TDA1910	2.38	TIP120	0.96
HA11235	3.60	M1025	4.70	ME556	0.75	SAB3024	4.77	SN76105N	2.36	T9010V	0.87	TBA550	1.95	TDA1940	2.54	TIP110	0.48
HA1124	4.70	M1124	2.54	ME5560N	3.16	SAB3209	6.75	SN76110N	1.13	T9011V	1.27	TBA550Q	2.25	TDA1950	2.54	TIP112	0.80
HA11244	4.32	M1130	4.86	ME565N	1.20	SAB3210	2.93	SN76115AN	1.46	T9013V	5.81	TBA560C	0.86	TDA2002	1.20	TIP117	0.86
HA1125	3.90	M191	5.74	ME645BN	3.80	SAB4209	12.75	SN76131	1.74	T9014V	1.52	TBA560CQ	1.15	TDA2003	1.05	TIP120	0.73
HA11251	3.38	M193	18.55	ME646N	3.80	SAF1031	2.30	SN762260N	1.20	T9016	0.92	TBA570	1.55	TDA2004	2.52	TIP121	1.08
HA1137W	2.57	M51102L	4.02	ME650N	3.94	SAF1032	5.60	SN76227N	0.68	T9022N	0.39	TBA570A	1.55	TDA2006	1.25	TIP126	0.96
HA1138	3.56	M5115P	4.34	ME645BN	3.80	SAF1039	11.66	SN76228N	2.97	T9034V	1.25	TBA570Q	1.35	TDA2010	2.79	TIP127	1.30
HA11414	2.50	M51231P	2.79	MP1106	4.80	SAS5010	7.62	SN76231	2.31	T9035V	1.26	TBA625A	1.97	TDA2020	2.75	TIP2955	0.78
HA1144	6.38	M5124P	4.38	OA200	0.10	SAS560	1.68	SN76242	4.75	T9038V	6.15	TBA625B	1.97	TDA2030	1.65	TIP29A	0.41
HA1156	1.23	M5134-9341	3.75	DA202	0.10	SAS560S	2.97	SN76243	4.75	T9051	2.55	TBA625C	1.97	TDA2140	1.44	TIP29B	0.57
HA11580	7.80	M51394P	6.25	OA47	0.10	SAS560T	2.85	SN76322	2.51	T9053V	1.03	TBA641A12	3.75	TDA2150	5.63	TIP29C	0.40
HA1160	3.45	M5142P	4.38	DA90	0.07	SAS570	1.61	SN76360	1.97	T9054V	0.92	TBA641BX1	2.07	TDA2151	1.75	TIP3055	0.65
HA1166	3.08	M5143P	6.66	OA91	0.08	SAS570S	0.00	SN76390	2.80	T9057V	0.63	TBA651	1.60	TDA2160	3.64	TIP30A	0.41
HA1167	5.13	M5144P	3.42	OA95	0.08	SAS570T	2.50	SN76396	2.63	T9063V	2.94	TBA673	2.35	TDA2161	1.68	TIP30B	0.63
HA11711	16.13	M51513L	2.06	OC28	0.96	SAS580	4.41	SN76510N	0.95	TA5814	1.35	TBA700Q	2.19	TDA2190	3.11	TIP31B	0.35
HA11713	6.70	M51515BL	3.10	OC29	1.95	SAS5800	2.62	SN76530P	1.90	TA7020P	4.36	TBA720	2.85	TDA2510	1.82	TIP31C	0.63
HA11714	7.05	M51516L	3.40	OC35	0.96	SAS590	4.55	SN76532N	1.80	TA7027	4.36	TBA730	1.75	TDA2520	2.15	TIP32B	0.35
HA11715	7.05	M51517L	2.90	OC36	1.16	SAS5900	2.32	SN76533N	1.56	TA7050	1.58	TBA750Q	1.46	TDA2521	2.15	TIP32C	0.66
HA11718	6.79	M5152L	1.00	OC44	0.40	SAS660	2.50	SN76540N	1.80	TA7051	1.58	TBA760	1.55	TDA2522	2.81	TIP33C	1.25
HA11724	15.60	M51522	4.90	OC45	0.40	SAS6600	1.20	SN76544	1.60	TA7080AP	0.60	TBA780	3.00	TDA2523	2.75	TIP34	1.07
HA11725	16.60	M5191P	4.49	OC75	0.40	SAS660S	1.20	SN76545	4.55	TA7061AP	0.78	TBA800	0.00	TDA2524	4.50	TIP41A	0.39
HA1180	4.68	M5192	2.00	ON188	1.70	SAS6610	1.20	SN76546	3.15	TA7069	2.84	TBA810AS	1.46	TDA2525	2.96	TIP41B	0.28
HA1203	1.56	M53273P	0.92	ON236	2.90	SAS670	2.50	SN76546N	3.15	TA7070P	1.52	TBA810S	1.46	TDA2530	2.19	TIP41C	0.44
HA1306	1.74	M53274P	1.20	OT112	0.98	SAS6700	1.20	SN76549	2.35	TA7071	3.35	TBA810T	1.46	TDA2532	2.51	TIP42A	0.39
HA1322	1.74	MA06	0.97	OT121	0.70	SAS670S	1.20	SN76550	0.30	TA7072P	1.35	TBA820	0.83	TDA2533	2.09	TIP42B	0.71
HA1339	1.76	MA8001	0.74	PD144	2.03	SAS6710	1.20	SN76551	1.35	TA7073P	4.05	TBA820M	1.65	TDA2540	1.95	TIP42C	0.44
HA1342	1.80	MB3705	1.62	PT1017	2.43	SAS6800	2.30	SN76570	2.80	TA7074P	1.95	TBA890	1.85	TDA2541	1.95	TIP47	0.65
HA1350	2.97	MB3712	2.65	PT2014	2.76	SAS6810	1.30	SN76600	1.19	TA7076P	4.95	TBA900	2.25	TDA2545Q	3.16	TIP48	0.83
HA1365	3.65	MB3713	1.30	PT6042	1.82	SBA550B	1.95	SN76611	2.35	TA7089N	1.41	TBA920	1.50	TDA2560	1.97	TIP49	3.28
HA1366WR	1.62	MB3730	2.94	R1038	1.99	SBA750	1.46	SN76620	2.35	TA7089P	1.36	TBA920Q	2.10	TDA2571A	2.81	TIS43	1.21
HA1367	3.20	MC13002	4.66	R1039	1.99	SC9488P	1.90	SN76622	1.50	TA7092P	3.85	TBA940	1.70	TDA2575A	2.95	TIS90	0.22
HA1368	1.69	MC1303P	1.96	R2008B	1.20	SC9503	1.50	SN76623	0.62	TA7093P	1.64	TBA950	1.55	TDA2576A	2.58	TIS91	0.26
HA1368R	1.66	MC1307P	1.90	R2009	1.20	SC9504P	1.46	SN76630	2.31	TA7102P	5.34	TBA970	2.08	TDA2577	5.31	TL071CP	2.02
HA1370	2.97	MC1310P	1.25	R2001B	1.20	SC9511P	1.90	SN76640	3.85	TA7108P	1.40	TBA970Q	2.98	TDA2581	1.95	TMS1000NL	10.78
HA1377	2.68	MC1327P	1.20	R2029	1.20	SCR957	1.20	SN76650N	1.24	TA7109	3.37	TBA990	1.65	TDA2582	1.98	TMS3748NS	11.66
HA1389	1.62	MC1330P	1.23	R2030	1.20	SG264A	4.38	SN76651	1.35	TA7120P	0.58	TBA990Q	1.95	TDA2590	2.80	TMS4116	1.87
HA1389R	1.74	MC1349P	1.20	R2257	2.16	SG613	7.88	SN76660N	2.25	TA7122B/P	0.54	TBA231	2.33	TDA2591	2.80	TV106	1.20
HA1392	2.68	MC1350P	1.10	R2265	1.95	SG629	6.82	SN76665N	1.35	TA7124P	2.00	TC4001	1.29	TDA2591Q	2.80	TY6010B	2.70
HA1397	2.97	MC1351P	0.75	R2305	1.07	SG6533	9.37	SN76666N	0.98	TA7130P	1.15	TC4053BP	3.94	TDA2593	2.24	U05G	1.03
HA1398	2.68	MC1352P	1.01	R2306	1.23	SI-1020N	4.76	SN76705	3.38	TA7136AP	1.15	TCA150	1.62	TDA2594	2.80	U143M	2.80
HA1406	1.80	MC1357P	1.95	R2322	1.26	SI-1125HD	10.70	SN76705N	3.99	TA7137P	0.85	TCA160B	1.62	TDA2600	5.00	U3700	0.55
HA17723	5.40	MC1358P	1.55	R2323	1.23	SI-1130N	6.30	SN76707N	3.99	TA7141AP	3.51	TCA270Q	1.55	TDA2610	2.53	U37003	0.44
HBF4030AF	2.25	MC14001	7.15	R2348	1.82	SKB2/08	0.70	SN76709	4.65	TA7146P	8.04	TCA270S	1.95	TDA2611A	1.25	UA723CA	5.02
HD4480	15.60	MC14011	0.23	R2354A	1.82	SKE2F 1/04	1.26	SN76709N	4.95	TA7148P	1.51	TCA270SQ	1.65	TDA2611AQ	2.55	UA758PC	3.06
HD44801A05	15.90	MC14013	0.37	R2354B	1.82	SKE2G 2/04	0.95	SN76730	4.23	TA7149P	2.10	TCA290A	2.05	TDA2612Q	4.25	UA783P3C	1.07
HM6231	8.50	MC14016CP	0.37	R2441	1.23	SKE2G 3/04	0.95	SN76810N	0.62	TA7153P	4.53	TCA420A	1.90	TDA2620	1.96	UAA170	2.14
HM6232	7.71	MC14025	0.54	R2443	0.80	SKE4F 1/02	1.26	SN76920N	2.63	TA7161P	5.66	TCA440	1.65	TDA2630	2.34	UAA180	2.14
HM9102	2.92	MC14049UBC	0.52	R2461	2.10	SKE4F 1/06	0.66	SN94041	3.45	TA7162P	4.25	TCA4500A	1.95	TDA2631	2.48	ULN2165	1.35
HM9104	2.94	MC1438R	0.95	R2477	0.92	SKE4F 2/06	2.10	SN94042	3.95	TA7169	4.80	TCA530	1.80	TDA2640	2.25	ULN2204	7.00
HT4207	15.60	MC14493P	2.56	R2501	1.16	SKE4F 2/08	0.60	SP8385	0.50	TA7171P	2.53	TCA640	2.63	TDA2643	6.93	ULN2216F	1.95
IS689	1.87	MC14510BAL	3.15	R2540	1.80	SKE4G 2/02	0.87	STA441C	2.27	TA7172P	1.28	TCA650	1.85	TDA2651	2.95	UPC1001H	2.50
IS751	1.87	MC14556BCP	3.15	R2540X	3.00	SKE5F 3/10	1.45	STK0029	3.42	TA7176P	2.25	TCA660B	2.63	TDA2652	7.05	UPC1009C	5.74
ITT2003	0.20	MC1712	3.52	R2615	0.60	SL1310	2.85	STK0039	4.00	TA7193P	4.44	TCA730	3.84	TDA2653	2.95	UPC1020H	2.12
K174YP	2.95	MC7724CP	3.17	RC4195NB	1.96	SL1327E	1.20	STK0050	4.96	TA7201P	3.25	TCA740	2.25	TDA2654	2.91	UPC1025H	2.49
KA2101	2.65	MC7818C	1.98	RCA16029	1.82	SL1430	1.25	STK0059	6.48	TA7202P	2.24	TCA750	1.75	TDA2655B	3.15	UPC1026C	1.24
KC581C	5.47	MC7824CP	4.25	RCA16083	4.81	SL1430T	2.10	STK0080	8.32	TA7203P	1.95	TCA760B	2.79	TDA2660	2.24	UPC1028H	0.90
KC582C	3.45	MC78M12	0.75	RCA16334	0.92	SL1432	2.25	STK011	3.86	TA7204P	1.95	TCA800	1.65	TDA2661	2.24	UPC1030H	2.06
KC583C	4.80	MC78M24	0.85	RCA16335	1.23	SL414	3.35	STK013	7.04	TA7205	1.25	TCA800Q	2.25	TDA2670	2.50	UPC1031H	8.05
L129V	1.78	MCR101	0.60	RCA16600	1.25	SL432A	3.12	STK014	7.14	TA7208P	1.95	TCA830S	1.94	TDA2670A	1.76	UPC1031H2	6.00
L200CV	1.68	MCR106/5	1.17	RCA16799	2.16	SL437	6.00	STK015	5.12	TA7210P	3.25	TCA900	1.85	TDA2680	2.30	UPC1032H	0.94
LA1111AP	0.80	MCR220/7	1.34	RCA16801	0.86	SL439	2.25	STK016	4.82	TA7214P	2.90	TCA910	1.50	TDA2690A	2.40	UPC1154H	1.75
LA1201	0.90	ME0402	0.27	RCA16802	0.98	SL480	5.00	STK022	4.77	TA7215P	2.09	TCA940E	1.68	TDA2780AQ	2.18	UPC1156H	1.45
LA1210	1.38	ME0404	0.23	RCA17028	2.25	SL490	1.78	STK025	7.20	TA7217AP	1.36	TCE330	3.53	TDA2790Q	5.92	UPC1181H	1.25
LA1320	1.46	ME0404/2	0.42	RCA17074	6.00	SL901B	6.08	STK040	7.09	TA7222	1.95	TCE527	1.37	TDA2791	2.50	UPC1182H	1.82
LA1352	1.40	ME0411	0.45	RCA17376	1.43	SL917B	7.95	STK043	7.09	TA7227P	1.69	TCE82	0.98	TDA2795	2.95	UPC1185H	2.94
LA1357N	5.90	ME0412	0.21	RCA60857	4.50	SL918A	5.63	STK054	6.48	TA7229P	4.10	TCE83	0.98	TDA2800	6.12	UPC1186H	0.95
LA1364	2.74	ME4102	0.45	RGP10	0.45	SN6848	8.82	STK070	20.28	TA7310P	1.95	TCE84	0.98	TDA3000T	2.31	UPC1212C	0.95
LA1365J	2.79	ME545B	9.10	RT402	1.40	SN16861N-07	1.59	STK077	7.00	TA7313AP	1.36	TCEP100	4.80	TDA3030A	10.44	UPC1213C	0.95
LA1385	1.70	ME6002	0.23	RT905A	2.00	SN16862N-07	1.68	STK078	5.52	TA7314	5.10	TCEP100Q	9.31	TDA3190	1.75	UPC1217C	2.24
LA1387	4.57	ME6102	0.45	S0280	1.94	SN16880N	3.30	STK082	7.54	TA7609	3.00	TD190	0.54	TDA3300B	7.75	UPC1350C	1.75
LA3155	0.90	ME8001	0.26	S0281	1.94	SN16965	8.13	STK086	9.90	TA7611AP	3.54	TD3F700H	6.00	TDA3500	5.95	UPC1351C	1.64
LA3300	1.40	MJ2501	4.95	S041P	1.26	SN16966N	5.49	STK2101	5.74	TA7676P	3.05	TD3F800H	2.25	TDA3501	10.99	UPC1353	6.75
LA3301	1.28	MJ2955	1.34	S042P	1.46	SN29715N	5.49	STK2110	6.66	TAA300	2.99	TD3F800R	3.21	TDA3506	10.12	UPC1360C	4.10
LA3350	1.30	MJ3000	2.15	S1299	4.30	SN29716N	3.32	STK2230	6.66	TAA310A	0.27	TD3F900H	3.78	TDA3510	5.95	UPC1362	7.95
LA3361	1.30	MJ3001	1.30	S175	18.95	SN29717N	6.53	STK415	6.04	TAA320A	1.15	TD3F900R36	3.78	TDA3520	8.82	UPC1365	5.79
LA4030P	2.37	MJ3028	2.40	S2062D	1.88	SN29722	10.65	STK433	9.35	TAA350A	1.62	TDA1001A	2.10	TDA3521	12.17	UPC1366	4.23
LA4031P	3.00	MJ481	1.39	S2800	5.25	SN29723AN	6.95	STK435	5.44	TAA435	1.65	TDA1003A	2.15	TDA3560	6.87	UPC1458	7.87
LA4032P	1.48	MJ802	4.95	S2800D	2.55	SN29744N	2.08	STK436	5.70	TAA550	0.33	TDA1004A	2.15	TDA3561	7.50	UPC2002	1.48
LA4050P	1.42	MJE2955	1.71	S2802	3.15	SN29764AN	3.38	STK437	8.10	TAA570	1.58	TDA1005A	2.15	TDA3571Q	2.25	UPC30C	2.22
LA4051P	1.62	MJE3055	0.78	S3702S	4.73	SN29767	3.61	STK439	6.26	TAA611B12	1.50	TDA1006A	2.15	TDA3571A	5.67	UPC32C	4.49
LA4100	1.62	MJE340	0.44	S3703F	4.73	SN29770AN	2.04	STK441	8.96	TAA621AX1	2.00	TDA1010	2.43	TDA3576	4.76	UPC41C	3.72
LA4101	1.18	MJE520	0.44	S3707	3.92	SN29771BN	4.23	STK443	9.35	TAA630S	3.31	TDA1011	2.60	TDA3950	2.81	UPC554C	1.68
LA4102	2.55	ML231	2.28	S40W	7.99	SN29772BN	4.21	STK459	6.56	TAA640	3.85	TDA1028	2.22	TDA3950B	1.40	UPC558C	3.67
LA4112	4.35	ML232B	3.30	S551	4.12	SN29773	2.28	STK460	5.78	TAA661B	1.59	TDA1029	4.44	TDA4050A	3.15	UPC566H	2.78
LA4125	2.46	ML237B	2.28	S552	4.12	SN29791	1.51	STK461	7.14	TAA700	2.35	TDA1034B	2.20	TDA4180P	1.74	UPC572	3.51
LA4138	2.00	ML238	4.02	S6080B	2.75	SN29798N	3.89	STK463	8.06	TAA840	2.27	TDA1035T	1.83	TDA4260	1.40	UPC575C2	3.72
LA4140	0.80	ML741CS	0.36	S6087AR	4.45	SN29845	2.14	STK465	7.32	TAA930	4.42	TDA1037	1.45	TDA4280	6.45	UPC576H	2.60
LA4192	2.88	ML923	2.18	SAA1020	4.32	SN29848	1.66	STK466	10.70	TAA970	2.57	TDA1041	1.96	TDA4290	4.06	UPC577H	0.64
LA4220	1.34	ML0926	3.25	SAA1021	4.32	SN29861	2.08	STK501	5.74	TAD100	1.91	TDA1044	1.61	TDA4440	1.95	UPC587C2	2.34
LA4400	2.04	MM5314N	3.72	SAA1024	2.55	SN29862	2.08	STK502	5.74	TAG232-600	0.66	TDA1047	2.14	TDA4460	2.06	UPC592H	1.02
LA4420	1.56	MM5316N	3.72	SAA1025	4.70	SN72709	0.40	STR441	6.34	TAG626-600	0.84	TDA1054M	1.10	TDA4470	4.25	UPD1514C	7.56
LA4422	1.56	MM5318N	2.82	SAA1050	3.78	SN7400N	0.24	STR453	6.75	TBA120	0.95	TDA1059B	0.98	TDA4422	5.63	UPD851	14.39
LA4430	1.48	MM5369N	1.82	SAA1051	5.30	SN7401N	0.24	STR6020	7.20	TBA120A	0.95	TDA1060	2.01	TDA4430	4.34	UPX27C	1.98
LA4460	1.92	MM5387AA/N	11.50	SAA1061	3.28	SN7402N	0.59	T6007V	0.69	TBA120AS	0.95	TDA1082	2.65	TDA4431	2.06	X0022CE	3.67
LA4461	2.00	MM5841N	5.90	SAA1075	4.41	SN7404N	0.21	T6007N	0.62	TBA120S	0.95	TDA1104	5.95	TDA4432	2.06	X0035TA	4.35
LA5112N	1.62	MP8112	1.35	SAA1082	8.04	SN7408N	0.24	T6016	0.36	TBA120SB	0.95	TDA1151	0.65	TDA4440	2.52	X0056CE	3.90
LA7020	6.66	MP8113	1.35	SAA1121	4.32	SN7410N	0.24	T6017	0.65	TBA120T	0.95	TDA1170	2.15	TDA4600	2.58	X0062CE	4.95
LA7025	7.31	MP8512	1.23	SAA1124	2.55	SN74121	1.20	T6018V	0.65	TBA120U	0.95	TDA1170S	1.85	TDA4610	2.42	X0065CE	3.48
LA7800	2.12	MPF256C	0.54	SAA1130	4.86	SN74122	0.95	T6021	0.36	TBA120UB	3.47	TDA1180	2.25	TDA4620	4.50	X0109CE	6.10
LA7801	3.60	MPS6570	0.43	SAA1174	5.75	SN7413N	0.33	T6022V	3.56	TBA1440	2.08	TDA1190	1.91	TDA5500	2.48	X1074AF	6.36
LD3120	1.20	MPSA42	0.59	SAA1250	3.78	SN74141	1.41	T6026	0.89	TBA1440G	3.40	TDA1190Z	2.25	TDA5600	2.68	XC9499P	1.20
LM1011N	2.95	MPSA56	0.24	SAA1251	5.30	SN74151AN	1.51	T6027	0.73	TBA1441	1.59	TDA1200A	1.30	TDA5700	2.10	Y730	0.24
LM1017N	1.96	MPSA92	1.11	SAA5000	3.65	SN74154N	1.15	T6028V	0.35	TBA240A	3.42	TDA1220	2.25	TDA9403	2.90	Y969	0.60

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All goods should be delivered within 4 working days

Letters

COMMODORE 64 PROGRAM

Recent letters on microcomputer colour bar programs prompt me to send you the following one for the Commodore 64. It consists of nine lines from line 10 (pokes border to grey) to line 50 in steps of 5.

```
 5 REM TV COLOUR BARS BY D. J. JACKSON
10 POKE53280,11
15 PRINT"s":FORY=0TO24:FORX=0TO4:
   POKE1024+X+40*Y,160:POKE55296+X+40*Y,0:
   NEXTX,Y
20 FORY=0TO24:FORX=5TO9:
   POKE1024+X+40*Y,160:
   POKE55296+X+40*Y,6:NEXTX,Y
25 FORY=0TO24:FORX=10TO14:
   POKE1024+X+40*Y,160:
   POKE55296+X+40*Y,2:NEXTX,Y
30 FORY=0TO24:FORX=15TO19:
   POKE1024+X+40*Y,160:
   POKE55296+X+40*Y,4:NEXTX,Y
35 FORY=0TO24:FORX=20TO24:
   POKE1024+X+40*Y,160:
   POKE55296+X+40*Y,5:NEXTX,Y
40 FORY=0TO24:FORX=25TO29:
   POKE1024+X+40*Y,160:
   POKE55296+X+40*Y,3:NEXTX,Y
45 FORY=0TO24:FORX=30TO34:
   POKE1024+X+40*Y,160:
   POKE55296+X+40*Y,7:NEXTX,Y
50 FORY=0TO24:FORX=35TO39:
   POKE1024+X+40*Y,160:
   POKE55296+X+40*Y,1:NEXTX,Y:GOTO50
```

I hope this will be useful to readers.
D. J. Jackson,
Llanelli, Dyfed.

NOTES ON THE SPECTRUM

I noted Oliver J. Bowry's letter on the use of the Spectrum microcomputer as a TV pattern generator. The idea occurred to me some months ago. As you may know, the Spectrum is limited by using only the central area of the screen as its display. However, I've used the introductory software package Horizons which contains a system called Draw. With this you can create lines, circles, rectangles and squares on the "paper" and fill them in with the colour of your choice or leave them as an outline. When you've completed the pattern you want to use, it's an easy matter to save it on tape with the statement: SAVE "filename" SCREEN$.

To reload, type: LOAD "filename" SCREEN$. Draw is not necessary for reloading.

I found a crosshatch pattern of white lines on a black background very useful for convergence adjustment and a coloured pattern of vertical rectangles (stripes) filled in with white, yellow, cyan, magenta, red, blue and black useful as a colour bar/grey-scale wedge. A concentric pattern of circles (bullseye) is useful for width/linearity adjustments.

After completing convergence adjustments it was necessary to increase the horizontal/vertical separation settings slightly so that the whole screen area is covered. Provided care is exercised, this is fairly straightforward.

It's important to tune the computer's signal in "on the nose". I found that this was achieved when the graphics (black on white) appeared to shimmer with blue and yellow alternately and the sound had just reduced to a minimum.

John P. N. Husband, Marital Electronics (Consultants), Dover, Kent.

BBC MODEL B PROGRAM

I've used the following BBC Model B computer program for the last two years as a workshop tool. It gives a dot, colour bar and grid pattern, the latter being ideal for convergence adjustment.

```
 10 VDU61463;32639;32639;32639;32629;
 20 MODE 2
 30 VDU23;8202;0;0;0
 40 REPEAT
 50 PRINT CHR$12;STRING$(10, CHR$10+
    CHR$10+STRING$(10, "  . "))
 60 IF GET VDU1049;0;1023;1049;0;0;
 70 FOR6%=7 TO 0 STEP-1
 80 VDU18;INT(6%/2)+4*(6%AND1),
    20761;160;1023;20761;0;-1023;
 90 NEXT
100 IF GET VDU4620;1792;1049;1240;-88;
110 FOR c%=1 TO 11
120 VDU25;-1200;100;281;1200;0;
130 NEXT
140 FOR d%=1 TO 13
150 VDU281;0;-1000;25;-100;1000;
160 NEXT
170 VDU5,1049;614;524;240;
180 IF GET=9 MODE7:END ELSE UNTIL 0
```

Any key will take the program on to the next pattern. The program is terminated by pressing the TAB key to end the grid pattern.

J. M. Collick,
Westbury-on-Severn, Glos.

MICROCOMPUTER BLOCK DIAGRAM

I feel that Fig. 1 in The Lid off Microcomputers, Part 1 (page 307, April) is a bit misleading since it suggests that the data and address buses pass through the RAM and ROM and that the ROM has no connection to the control bus (read/write, interrupt, etc. lines). I think that readers not familiar with this subject will find Fig. 1 herewith a little less confusing in this respect.

Also, the comment in the final paragraph seems to forget about data bus buffers, tri-state buffers etc. It's unfortunate that words such as buffer have different

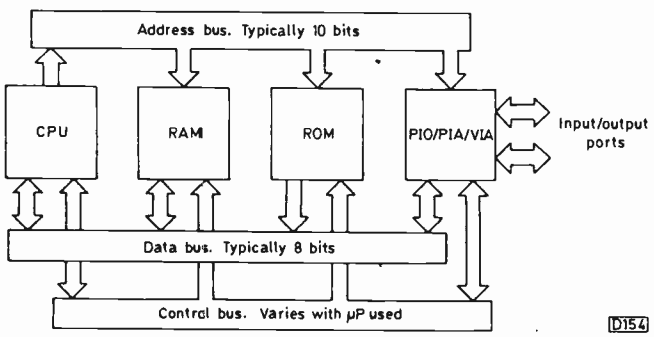

Fig. 1: Basic microcomputer block diagram.

meanings, but I suppose we can't avoid this sort of thing with a living language.
J. Blackwell, Grad.I.E.E.I.E.,
Bakewell, Derbyshire.

SPECTRUM PATTERN PROGRAMS

With reference to Mr. Bowry's letter (March) I've had a Sinclair Spectrum microcomputer test pattern on the market for the last six months. It's suitable for both the 16K and 48K models and as well as colour bars it also generates a crosshatch, dots, a checkerboard, plus red, blue, green, black and white rasters. The only drawback with the Spectrum is its inability to print the crosshatch and dot patterns in the border area. The program is available on cassette from the address below for £3·50 which includes post and packing.
Graham Wells,
Graham Wells TV Service,
1 Eachard Road, Cambridge CB3 0HZ.

Editor's note: Mr. Bowry's letter brought a deluge of Spectrum programs from readers. Our thanks to John Yobec, Ken Bones, Michael A. Harris, Divinder Flora, David Thornton, Geoff Fardon, M. Stevens, Neil Poskett, C. I. Large, John F. Watts and John Hodges. Also to Bill Tillett who kindly lent me a Spectrum to try out. We hope to publish some of the programs sent to us in future issues.

THE SONY KV1810UB

Recent articles and letters on the Sony KV1810UB have interested me greatly. You see my son bought one of these sets some ten years ago and at the time my heart sank in anticipation of the troubles I might be called upon to deal with. After five years of reliable operation the fuse and the two main GCSs blew and I knew that my initial worries were right – a check on all relevant components revealed no faults! Sony were very helpful in suggesting what to check but couldn't be expected to suggest an examination of the power supply panel for dry-joints, using a magnifying glass. When I did this I found a wire loose in the middle of its solder with a minuscule amount of free movement available. So the set had worked for five years with a physically unsoldered joint (as have many sets of many makes over the years). Resoldering this joint and replacing the fuse and GCSs restored reliable operation for another three years.

The only other trouble has been severe flashover in the e.h.t. box, which incorporates the 47MΩ horizontal static convergence potentiometer VR852. The flashovers were accompanied by colour separation and jazzy pictures. Several applications of Plastic-Seal were unsuccessful and when the cost of a replacement box was checked it came to light that this would set us back by almost a three figure sum. Our first reaction was not worth it, in view of the set's age. With nothing to lose however we decided to purchase some Dow Corning Aquaseal, which has a convenient applicator nozzle that can be cut as required. Holes were drilled in the areas adjacent to the e.h.t. output/VR852 (the control was also replaced for good measure) and Aquaseal was injected into them to fill the space between VR852's insulated platform and the potted transformer. The control's top connections were also well covered with Aquaseal. Patience was required next: Aquaseal takes 24 hours per millimetre to cure, an acid

being given off in the process. It's advisable to let this happen in a warm room and, owing to the difficulty in determining the thickness applied (below the platform), to leave it for at least three days. Fortunately the treatment proved to be a complete success, the set giving reliable operation ever since.

This tip may be of interest to other readers. Incidentally a report to Dow Corning brought forth the comment that their other caulk products using silicone rubber should work equally well.

P. R. Atkins,
Southall, Middx.

Design of the FS-type Tube

Eugene Trundle

What does FST stand for? Full Square (Toshiba), Flatter Squarer (ITT), Square Flat (Mitsubishi) and so on. In fact the tube faces are not flat, nor are they square – nor even rectangular. There are very good reasons why they are not.

Surface Loading

Since a picture tube's envelope is evacuated, the full force of atmospheric pressure bears on its outer surface. At sea level the air pressure is about 1kg/sq.cm, so we have a total force of around 1,600kg on the faceplate of a 51cm diagonal tube – over 1½ tons!

If you had to support the weight of a four-door saloon car by means of a tea-tray sized piece of glass held only at its edges, how would you go about it? You would need to specify very thick glass and then dome its surface, following the engineering principle used in bridges and dams to convey the thrust to the edges. Provided the edges were braced strongly the system would work safely. Fig. 1 shows how bridges, dams and picture tubes contain the forces that load them: the curved load-bearing surface conveys the stress to the outer edge where, in the case of a picture tube, it's contained by the combined strength of the glass bowl rim and the rimband.

Consider for a moment a dam (or a picture tube) whose face is dead flat. It's a daunting prospect. In this case the force has to be sustained entirely by the material of the wall, whose intrinsic strength must be much greater than before. We could maybe brace a flat dam or bridge with a series of joists – but we couldn't do this with a tube's faceplate! Only in tubes smaller than about 17cm diagonal (mainly scope and viewfinder tubes) is it practical to provide an optically flat screen surface.

The FS Faceplate

The faceplate of a conventional 51cm (20in.) tube has a glass thickness of 10mm at its centre, the radii of curvature of the inner and outer surfaces being 792 and 820mm respectively – see Fig. 2. With a comparable FS tube (51cmV, 53cm glass diagonal) the thickness at the centre of the faceplate is 12·5mm while the inner and outer radii are 1310 and 1730mm. Thus the FST faceplate thickness is much greater towards the screen edges. This extra glass thickness increases the tube weight by about fifteen per cent.

Next, the problem of square corners. This means in effect the profile of the glass envelope – not only at the four corners of the faceplate, but the whole transition from faceplate to rim, both at the internal and external edges. The question is again one of stress, not so much from atmospheric pressure (a corner is in this respect very strong) but from glass internal and shock- and weight-induced stresses. It's a basic engineering rule that these stresses will be concentrated at the point of an abrupt change in profile or cross-section. For safety, stress must be avoided by providing gentle contours and radii – curvy is safe as well as beautiful. So current FS tubes have slightly curved edges.

Front Screens

The fact that many FST-equipped TV sets have additional "smoked"-glass screens has led to a misconception that additional protection from possible implosion is required as it was in the early days of television. In fact FST type tubes have full BSI approval for direct viewing and

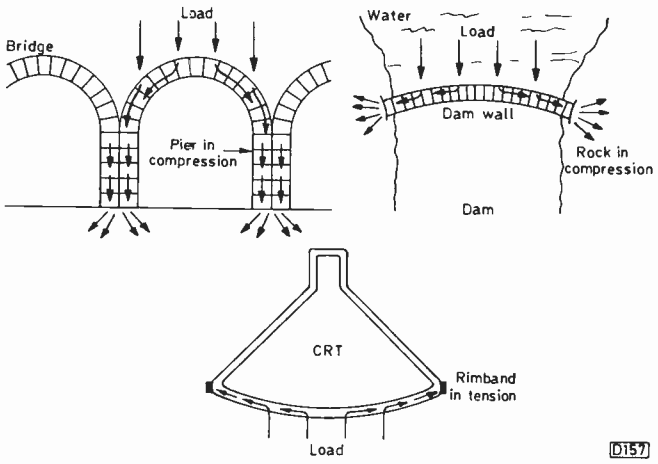

Fig. 1: How a curved load-bearing surface transfers the thrust to its braced edges. The pressure thus tends to "consolidate" the structure. Examples show bridge, dam and c.r.t.

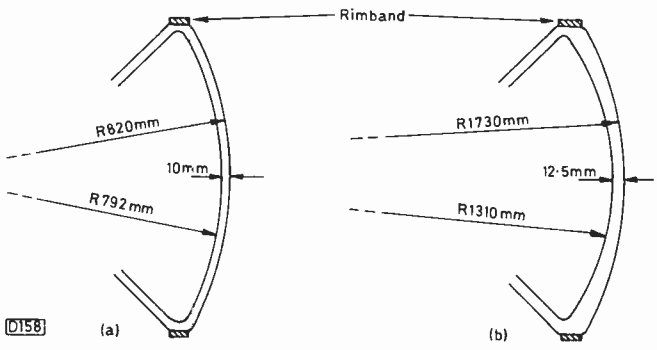

Fig. 2: Picture tube envelope construction – not to scale – illustrating the greater thickness and bracing required in the faceplate of a "flat"-faced tube. (a) Conventional tube; (b) FS-type tube. The radii quoted are in each case for the corner-to-corner profile.

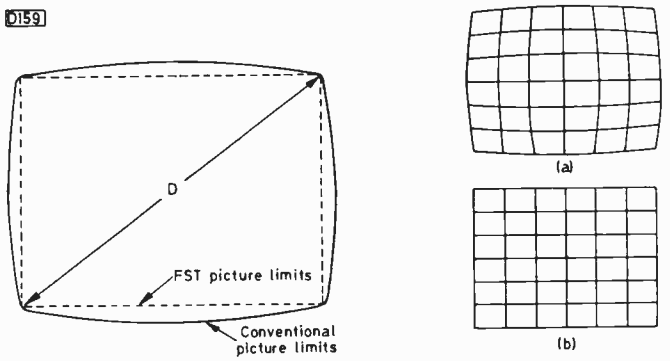

Fig. 3 (left): Comparison of useful screen area based on the visible screen diagonal.

Fig. 4 (right): Comparison between the optical distortion introduced with a curved screen (a) and the true image on a flat faceplate (b), exaggerated for emphasis.

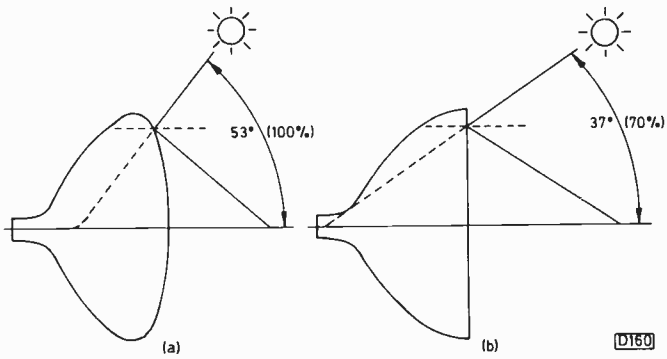

Fig. 5: Screen reflections – (a) conventional tube, (b) FS tube. For an infinite and evenly illuminated viewing area, 30 per cent less light will be reflected from the faceplate of an FS tube.

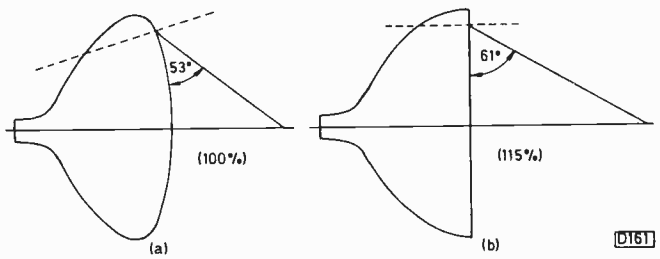

Fig. 6: The FS tube is legible over its entire screen area from wider viewing angles than with an ordinary display tube. (a) Conventional tube; (b) FS tube.

comply with BS415 and equivalent world-wide requirements. What the extra darkened "window" does is to increase the contrast by attenuating ambient light reflection from the internal aluminised tube faceplate. The idea is that reflected light from external sources has to pass twice through the low-transmission glass screen while the phosphor produced light passes only once. The additional screen introduces the disadvantages of reducing the brightness of the display and producing double reflections: for this reason many setmakers provide for its removal if wished.

Advantages

What advantages does the FS tube bring? We are told that the squarer corners result in three per cent more screen area. This must be based on the overall glass diagonal, since as Fig. 3 shows a square display area will actually reduce the size of the displayed picture if the diagonal dimension remains the same. The FS tube gives a definite improvement in terms of optical distortion however, as Fig. 4 shows. When we view a conventional screen we look at a section of a sphere and thus see the distortion shown at (a): the more the faceplate approaches flatness, the less the distortion, as (b) shows.

There's a further advantage with respect to reflection of ambient light. The light "capture area" of a convex reflector is much greater than that of a flat one, as Fig. 5 shows: an FS tube provides a reduction in ambient light reflection of about 30 per cent. If the offending source of light is on or near the tube axis however the reflection will be as great, which is why it's so difficult to take a head-on photograph of a TV set without getting a beautiful superimposition of yourself and your photographic gear! In this respect some very misleading adverts have been produced by a certain setmaker who suggests that on-axis reflections disappear like magic when an FS tube is fitted. The situation does not of course arise when a set is viewed in subdued or zero (as we should!) ambient light.

Light path angles are also relevant to legibility at the corners of the screen and maximum viewing area. Screen edge and corner display legibility are determined by the angle of incidence formed by the tangential plane of the faceplate at the viewing point. A flat faceplate offers fifteen per cent better screen edge legibility in terms of maximum viewing angle – see Fig. 6.

Other Aspects

In other respects FS tubes are similar to conventional ones. The PIL configuration is used, with 90° deflection angle for small tubes and 110° for the larger sizes. Deflection yokes follow normal practice, giving pincushion-distortion free, self-converging displays, while the screen phosphor coating incorporates all the latest features such as black matrixing, pigmented phosphors, etc. Mitsubishi have incorporated their "blue diamond" screen in an FST envelope while a particularly interesting FS type tube has been announced by the pioneers of the technology, Toshiba. This is a 28in. tube, the 66cmV 110° type E6154A, which uses (in common with other FS tubes from the same source) a prestressed shadowmask with ceramic coating on the screen side, an improved electron gun design and screen phosphors with purer primary colours. These and other aspects of modern colour tube technology will be covered in a subsequent article.

Summary

So how do we sum up the advent of the FS tube? The price premium for the receiver is at present about eight per cent. For this you do get a very worthwhile improvement in overall performance. I believe however that some of the claims at present being made for the FS tube are a bit on the lavish side – especially the claim that it represents the most significant development in tube technology since the introduction of colour. That honour has to go to the invention of the in-line, self-converging tube, pioneered by RCA.

As yet, FS tube technology is the exclusive province of the Japanese tube makers. Mullard/Philips are currently sitting on the fence: their stated aim is to develop a "really" square and flat c.r.t. envelope – the next generation of FST? We're informed that much research and investment is at present going into this and that the result could emerge within a year. Watch this space!

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Steve Beeching, T. Eng., Derek Snelling, Michael J. Cousins, T.Eng., Dewi James and C.T. Marden

Sharp VC9700

A fault that's becoming common on this model is tuning drift, with the clock display going dim, as the machine warms up. The tuning and display supplies are both generated on the PWB-E audio board, and we've found the cause of the fault in each case to be thermistor PR6601. It looks like a pulse ceramic capacitor and is fitted on the solder side of the board. **P.B.**

Mitsubishi HS304

A customer's machine would play its own recordings all right but was very poor with library tapes. With the alignment tape in use we found that the f.m. signal at the output from the head amplifier was rounded off at the points corresponding with the drum entry and exit points. When the tape run along the head path was stutied it could be seen to "fall off" the step in a number of places. Attention was turned to the guide rollers which were found to be loose, even though the set screws had not been disturbed. The guides were reset as per the manual and the set screws checked to ensure that they did lock the guides in position before we sealed them with paint. **P.B.**

Ferguson 3V35/JVC HRD120

We've been having quite a few faults caused by the AL and UL switches on these and similar machines, for example the machine goes to stop one second after threading up at switch on, with or without a tape, or the machine rewinds for a couple of seconds then won't accept any further commands. Cleaning the switches has cured these faults, but it's strange to have to clean switches on such new machines.

Have you noticed that the block containing the AL and UL switches has a third switch in later models? It's connected in the cassette lowering motor circuit to prevent the microcomputer i.c. trying to eject the cassette while threaded up if it loses track of what mode it's in. **P.B.**

Tatung VRH8400/JVC HRD120

When the operate button was depressed the operate light just flickered a bit and went out. No functions could be selected. We had visions of a complex system control fault so various checks were made to ascertain the status of the system. All the operate signals were present and correct and the "power on" signal was being passed to the power supply from the system control department. A relay in the power supply switches the supply rails: it had operated but two independent supplies were not available. The cause was the relay contacts, a new relay putting matters right. **S.B.**

Sharp VC9100

The tape would load and the machine would run in play for a few seconds. It would then stop. The screen remained blank as the muting circuits continued to operate. All the signals that should have been present at the microcomputer i.c. were there – drum and reel rotation – and no reason for the failure could be found. So the i.c. was replaced . . . but the fault persisted. After much searching we found that the AL switch was not operating, but unlike other microcomputer i.c. programs forward run was engaged. This unusual condition was misleading. The AL/VS/UL switch assembly had to be repositioned to ensure correct operation of the AL switch. **S.B.**

Ferguson 3V22/JVC HR3320

The trouble started with fuse blowing and the 0·47Ω series resistor in the capstan motor circuit going open-circuit. It was at first thought that the associated electrolytic decoupling capacitor was going short-circuit but after a couple of weeks toing and froing the capstan motor went noisy. The bearings had failed and were going tight intermittently. **S.B.**

JVC HR7200/Ferguson 3V29

The initial fault was that the machine would load the tape and run in play for a few seconds then stop and unlace. A check through the control circuits revealed that the reel rotation signal was missing. This was due to failure of the optocoupler, which was replaced. After completing this repair the machine was given a bench test during which a second fault was discovered: after threading up there were long delays before the pinch roller solenoid operated. This often led to unthreading via the action of the reel rotation detector circuits.

In the threading up process the tape guides are latched on to the end stops and the threading (or loading) motor carries on until the AL switch has operated. In this case however the threading motor was running out of power as the load upon it increased during the later stages of the operation and it couldn't make the final lap to the AL switch. The loading drive belt was slipping, but even after stripping out the loading mechanics and regreasing them the motor couldn't cope, so it had to be replaced. Note that removal of the threading machanics and drum shouldn't be undertaken without due forethought! **S.B.**

Fisher

Fisher VCR's have been known to suffer from a problem relating to the UL switch. The result is overdrive of the unthreading mechanics to such an extent that when play is next selected the machine won't run as the mechanism is jammed. The cure is to adjust the UL switch – which is made difficult by the fact that there's no provision for this! **S.B.**

Sony SLC7

A strange sight this time – the picture pulsating sideways. I had to fetch Andy in to have a look. The left-hand side of the picture was stable but the right-hand side was moving as if the picture was being stretched horizontally.

The drum servo pulses were erratic and the sampling was thus incorrect: the problem was present in both the play and record modes. It was easiest to work in the record mode. There was a 20msec pulse, derived from the field sync pulse, at pin 12 of the drum servo i.c. (IC1) but the output at pin 13 had a duration of 80msec instead of 40msec! Clearly something was dividing by four instead of

by two. The input at pin 12 goes to a delay monostable multivibrator and then to a divide-by-two circuit within the i.c. The multivibrator has an *RC* network connected to it at pin 11 – R11/C11. Across C11 we had a 40msec instead of a 20msec pulse. The cause of the trouble was C11 (0·47μF electrolytic). The monostable multivibrator should by triggered by the field-frequency pulse after which it resets and is then triggered again. The problem was that the reset time was greater than 20msec so that it was missing every other trigger pulse and effectively dividing by two. With a second division by two introduced by the following divider the servo was being incorrectly timed. C11 seemed to be perfectly healthy but a replacement put matters right. **S.B.**

JVC HR7650/Ferguson 3V31

This machine had an unusual fault on playback – an unstable picture, breaking up in a manner similar to a TV set with severe a.g.c. instability. The problem was where to start: most modern VCRs have progressed from mechanical record/playback switches to switching by means of i.c.s controlled by various voltage lines. It transpired that the E-E control line was energised during playback due to an emitter-collector leak in Q103 (2SB643R). This transistor is on the chroma board. **M.J.C.**

Ferguson 3V32/JVC HR7655

This two-speed machine gave excellent results on all manually set recordings. With a timed recording however you'd get no colour on playback to start with though the colour would eventually appear. Experience has taught me that the frequency adjustments in the chroma circuitry are not usually made to a very close tolerance. A check through the various adjustments as per the manual revealed that the a.f.c. adjustment was well out of limits. Resetting R339 for 625 ± 5kHz produced correct colour with timed recordings. **M.J.C.**

JVC HR7350

With the audio selector in the stereo position on playback the sound was accompanied by a regular blipping noise, with the selector set to A there was no sound at all and with the selector set to B there was mono sound with no blip, so the fault was clearly in one channel only. Voltage checks revealed differences between the conditions in the identical stereo sections of IC2 and IC5. We eventually found that C9 (22μF) in the 32dB preamplifier stage of IC2 was going short-circuit intermittently. **M.J.C.**

Sony SLC9

The fault with this stereo machine was low, muffled sound on E-E (and hence on record) with a clicking noise coming through the monitor's speaker. A scope check on the two inputs to the record/playback switching i.c. (IC521) showed that the Ch. 1 signal was of low amplitude with disturbance present. The inputs to the preceding operational amplifier i.c. (IC520, type μPC1458) were in order. A new μPC1458 restored normal operation.

M.J.C.

Ferguson 3V30/JVC HR7300

No playback colour was the fault noted on the label and when the bottom audio/video board was opened up we discovered that liquid had at some time been spilt into the machine. Unfortunately when this happens the board acts as a catchment area: the liquid lays on the component side, where its natural acidity (hopefully just fruit juice) eats through the legs of various components. In this case there were no burst gating pulses going into IC401 (AN6360): they were missing due to L407 having become a single-legged device! Fitting a replacement and cleaning off the offending dried liquid restored normal operation.

M.J.C.

Ferguson 3V00/JVC HR3330

The symptoms with this machine were no fast forward and intermittent picture in the playback mode. When fast forward was selected nothing happened – even the motors didn't turn – yet rewind was perfect. Playback was sometimes perfect, at other times there was a blank raster – not even noise on the screen.

We decided to tackle the fast forward problem first. From previous experience I knew that the drum motor could be operated by one of the microswitches along the front of the machine, behind the keys. Perhaps the capstan motor was switched in this way during fast forward? Fast forward was selected and each switch was tried in turn. Sure enough S4 (operate/stop) started the motor and fast forward operated normally. Careful examination then showed that due to wear on the latching bars if rewind was selected the switch operated normally but if fast forward was selected the operating lever didn't move quite far enough forward to actuate the switch. The play switch, between the other two, sometimes operated S4 and sometimes didn't. In playback this switch doesn't control the capstan motor but one of the voltage lines, via logic circuits on the mechacon board. Hence the blank screen. Luckily the wear was such that slightly bending the arm on the microswitch provided sufficient compensation. Otherwise a long job of stripping down the key mechanism would have been necessary. **D.S.**

Panasonic NV777

In the event of intermittent non-operation of the cassette or tape loading motor replace IC6004 and IC6005 (type BA6029). There was a bad batch of these, so replace both at the same time.

C7512 (4·7μF, 25V) on the timer board can cause various problems – "no lights" on plugging in, time may or may not come on eventually, or the machine might switch itself off after a period of time. **D.J.**

Sharp VC8300

Fast forward and rewind were o.k. but when play was selected the picture was in pause/still – the pause/still LED didn't light up. On investigation I found that the tape was loaded, all the motors ran but the tape was at a standstill. The pinch roller solenoid had operated, but with insufficient force to move the play idler to the engaged position. A further check showed that there was no supply across the pinch roller solenoid. On slitting the solenoid's insulation a thermal cutout was found, marked 250V, 98°C, 2A. It's not shown on the circuit diagram and was open-circuit. A replacement and a dab of Super Glue on the tape solved the problem.

This sort of thing seems to afflict the solenoids used in these Sharp models. The main solenoid is also fitted with a thermal cutout, as previous items in VCR Clinic have mentioned. **C.T.M.**

Long-distance Television

Roger Bunney

After some months of relatively quiet conditions there has at last been some increase in long-distance signal propagation, with Sporadic E becoming active on several occasions during the month to provide sustained colour signals. Hopefully this is an indication of a good SpE season to come: it's perhaps unwise to speculate on the possibilities at this stage, but sustained openings during the second/third weeks of April would give every hope of an excellent season from mid-May onwards. Certainly that was the pattern in the 1960s – mid-April activity followed by a lull and then intense openings from mid-May.

Tropospheric conditions have been quiet, though a small lift occurred on March 8-10th when a high-pressure system over the UK produced enhanced signals from the Benelux countries in central southern UK, London and the midlands. During this event PMR (paging or mobile radio) tones at approximately 180MHz were noted towards the south east of Southampton, consisting of a series of four-second bursts of 3kHz tone at varying intensities: inaudible during flat conditions, they would appear to be a French system – see later under Canal Plus. There have been the usual daily MS pings in Band I, solar conditions have been quiet and no auroras have been reported. The SpE log is as follows:

9/3/85	RAI (Italy) ch. IB.
11/3/85	TVE (Spain) E2.
12/3/85	TSS (USSR) R1.
14/3/85	MTV (Hungary) R1; unidentified ch. E1 and R1 signals.
17/3/85	ARD (W. Germany) E2; RAI IA.
20/3/85	TSS R1, 2 – very strong signals.
22/3/85	CST (Czechoslovakia) R2.
23/3/85	ARD E2; very strong unidentified early morning signals on chs. E3, 4.
24/3/85	CST R1 – very strong mid-morning.
26/3/85	TSS R1; unidentified ch. E2 and R1 signals.

Two reports have been received of CST using the 1956 RETMA monoscope test pattern on ch. R1, with the identification "Ceskoslovensko" in black letters at the top of the circle. This is good news in these days of electronically generated patterns! Canal Plus from further transmitters, including Rouen ch. F7 and Caen ch. F9, was noted during the recent tropospheric lift. The temporary 80m WDR ch. E11 mast is at present transmitting from Teutoburger Wald: the replacement ch. E36 100kW transmitter at Bielefeld carries the identification "Deutches Bundespost Fernsehsender Bielefeld Kanal 36".

The solar cycle has now reached the minimum section: extremely low sunspot counts are expected during the summer and autumn. The absolute minimum is expected to occur next January/February with a predicted low of twelve spots.

My thanks to Tony Privett (Basingstoke), Gareth Foster (Twickenham), Simon Hamer (Powys), Ryn Muntjewerff (Holland) and Reg Roper (Torpoint) for their reports this month.

From our Correspondents . . .

Tony Privett has decided to use a five-element Yagi array with 10dBi gain for 435MHz ATV reception having experienced overloading with wideband Triax grids. He reports reception of G3PZH using a BBC micrographics identification display so the Yagi is working well.

During the tropospheric lift over March 8-10th Reg Roper experienced difficulty with RTE-1 (Eire) reception due to strong French signals coming from the rear of his Yagi array. Adding extra reflector elements 3¼in. above and below the existing one solved the problem. With a ten-element Yagi this would give a 3-4dB improvement in the front/back ratio to perhaps 30dB.

Mike Gaskin has moved to a site some 575ft. a.s.l.

Sporadic E

The arrival of the 1985 Sporadic E season may make new readers wonder what this phenomenon that veteran TV-DXers enthuse over is all about. To recap, the E layer of the ionosphere at 70 miles above the Earth's surface is normally opaque to incident v.h.f. signals which travel straight through it into space. During parts of the year however intense patches of ionisation occur in this layer, the electron density being sufficient to reflect v.h.f. signals. This usually occurs with signals below 100MHz, though reflection at over 200MHz can occur. Band I signals can thus return to Earth at distances of 500-1,500 miles from the transmitter in the case of a single reflection, or up to 2,500 miles with a double reflection – triple reflections have also been experienced but are rare. Unfortunately, Sporadic E propagation cannot be predicted. The SpE season generally lasts from about mid-May to late August/early September. There is also often a

Left: SDR-Stuttgart from the Heidelberg ch. E35 transmitter, received by Ryn Muntjewerff in Holland. Centre: Regional FR3 transmission from the Cherbourg ch. E59 transmitter, received by Ryn Muntjewerff in Holland. Right: Danish local TV (see last month) – the Aarhus Kanal A (ch. E54) test pattern. Photo courtesy of Tele-Audiovision.

mid/late December spell of SpE and in good years you get SpE activity in mid-April. Isolated SpE openings can occur at any time during the year however.

During some openings the ionised patches extend over a wide area, the result being that many signals are reflected and received simultaneously. At other times isolated patches give reception of just one or two signals. Since the patches move about, different transmitters at various distances will be received during an opening. Signals can be very strong – I've measured 3mV on ch. E2 across 75Ω from a dipole mounted at only 7ft. Really distant single-hop signals can resemble weak tropospheric ones, with slow fading: signals from more nearby sources may give multiple imaging.

An opening can occur at any time of the day, but signals will be received only during transmission times of course. In the UK, signals can be received from well into the USSR, from the Middle East down to the Gulf, from Nigeria, Ghana and the Canary Islands and from N. America to the east – all this in addition to the European area. There have been some remarkable loggings of Canadian system M signals in recent years. For further information on this and other propagation modes, see my book "Long-distance Television" published by Babani (BP52)!

News Items

Italy: The government has given the go-ahead for microwave links between private TV stations – previously network coverage was provided by transmitting recorded programmes simultaneously. Several Belgian cable networks now carry RAI-1 via the Eutelsat F1 satellite.

Low Countries: Separate masts may be used for the BRT ch. E25 and RTBF ch. E28 transmissions, 15km and 30km to the south west of Brussels respectively, from late next year. These transmissions were carried by the Wavre mast that collapsed towards the end of last year. From this autumn the Brussels ch. E56 transmitter will provide a local TV service from approximately 1900 nightly prior to the start of the TV5 evening programmes. The projected NOS-3 transmitter at Goes may operate on chs. E35/36 when the Brussels airport radar (at Zaventem) closes at the end of the year.

Sweden: The SBC hopes to start a popular entertainment pay-TV channel towards the middle of next year.

S. Africa: The TV4 service mentioned last month came into operation in the Johannesburg region at the end of March. Its extension to Cape Town is planned.

Uganda: Nippon Electric is to provide new facilities to improve the UTV coverage throughout the country. At present the ch. E5 Kampala transmitter provides a reliable service over a 40-50 mile radius but transmitters elsewhere suffer from technical problems and breakdowns.

Australia: The Aussat satellite due for launch this August will have five spot beams with 42-51dBW e.i.r.p. and two 35-41dBW e.i.r.p. continental beams. The MAC-B transmission system is to be used, with 45MHz channel bandwidth. Interesting to note that a UK estimate for a 1·5m, 12GHz TVRO installation is £700.

New Zealand: Commercial stations are to be set up to expand the TV service. Teletext has proved a success in New Zealand – adverts are to be added.

Canal Plus and Private TV

Unscrambled signals are to be transmitted daily on Canal Plus from 1800-2030, also between 0700-0900 from

Monday-Friday and from 2030-2100 on Wednesdays and Fridays, with general entertainment but no feature films. Dave Shirley (Hastings) reports reception of unscrambled quiz, "Top Fifty" and Rendez-Vous programmes. It's expected that Canal Plus will loose some £40m during its first year. One of the things that's hit Canal Plus is the proposal for private TV in France. Two groups, Teleurop and RVS, have already applied for permission to start services in Paris and Rouen respectively. Channel allocations have to be made by the authorities but enthusiastic "privateers" may jump the gun – the Rouen-based Television Vallee de Seine has already carried out tests at u.h.f. South coast DXers should keep a look out for interesting signals!

Along with the above information comes news that mobile radio (PMR) on Band III frequencies removed from the local TV services is now permitted in the larger French cities. The band used in the Paris area is 192·5-207·5MHz.

IF Preamplifiers

The i.f. selectivity module used in the Philips G8 chassis has been widely adopted for DX-TV reception since it can be easily incorporated between the tuner and i.f. strip and then peaked to reduce the bandwidth and thus improve the selectivity. This is particularly helpful with weak signals or signals on adjacent/overlapping channels (e.g. E2/R1). Switching can be added to give narrow/wideband operation. Unfortunately these modules have been in short supply in recent times. A limited quantity (ex-rental stock) has now been obtained by South West Aerials (11 Kent Road, Parkstone, Poole, Dorset) who can supply them at £2·50 each or two for £4·50 including UK postage and packing. They are brand new and come with screening cans and connection data. G8 vision gain modules are also available at the same price.

An alternative approach is to use the simple n-channel f.e.t. i.f. preamplifier shown in Fig. 1 – the circuit was devised by Paul Barton. It has an untuned coupling to the gate and a double tuned circuit as the drain load. Since the two windings are individually tuned the coils can be stagger peaked to widen the response or tuned to the same frequency for a narrower response. The procedure is to start with the two slugs at the extreme ends of the coil former and screw them in to a point where, Paul says, they "peak beautifully". Paul adds that the performance is similar to that of the G8 unit despite being much simpler. As with any r.f./i.f. circuit care should be taken to adopt a sensible layout with minimal lead lengths. With the preamplifier following the tuner and peaked for a narrow-band response the sound will of course be lost.

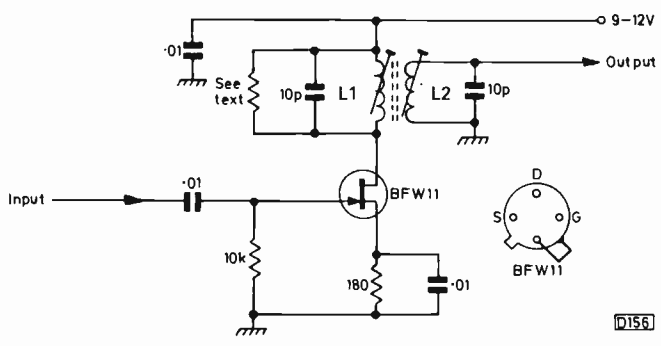

Fig. 1: Simple f.e.t. i.f. preamplifier circuit. L1 and L2 are each 13 turns close spaced, separated by about 10mm on a quarter inch coil former with two slugs. If the output is fed to another biased stage, add an 0·01μF d.c. isolating capacitor.

The circuit was originally developed for use in a TV sound receiver. To widen the response for vision reception a damping resistor is added across the primary winding. Paul suggests using 2·2kΩ. Lower values will widen the response, which with 1kΩ becomes approximately 6MHz. The high-impedance output may need to be matched to the following stage by means of a simple emitter-follower stage which will introduce damping across the secondary winding.

The North American Scene

Radio Shack (Tandy in the UK) is selling a 4GHz TVRO (TV receive only) package in its main Canadian stores, particularly those in the more remote areas. The dish is of the sectional petal type, with aluminium ribs and vacuum formed plastic petals metallic flame-spray coated. The receiver features remote control and stereo sound. Price is in the $2,200 region. At present the package is not being sold on the US market, which is already well catered for.

All's not well at 12GHz in N. America. USCI's narrow-beam scrambled DBS service for the Indianapolis area has met with consumer disinterest. At the beginning of 1985 about eleven 12GHz band channels, including five used for Pay-TV, were available via the Anik C2, C3 and SBS-1 satellites. At 4GHz single satellites such as Galaxy-1 provide twenty or so channels. The marketing and supply of 12GHz equipment has not been all that good and the net result is that for the present satellite TV in N. America means almost entirely the 4GHz band. According to one publication, the 12GHz band is now used primarily for computer interactive services and office/mobile communications. The new Anik C1 satellite, which was due to be launched in February for TV use, has been put up for sale by the Anik operators Telesat Canada. The 4GHz band is favoured in N. America because the satellites in use give wider coverage and the cost of equipment is lower.

As a result of the lack of US interest in 12GHz operation General Instruments are understood to have considerable stocks of unwanted, Japanese made receiving equipment – rumours have it that some 30,000 units were on offer at the end of last year. Global Instruments of Toronto are the distributors and have been allowing interested dealers to sell the units off. Quoted retail price is $1,795. Perhaps a UK surplus TV equipment firm might like to make a phone call to Toronto!

Gateway Rubber of Denver claims to have invented a new material that's 99 per cent reflective and will make possible mass production of low-cost satellite receiver aerials. The company has apparently signed with a large Japanese concern to produce the electronics and with a US manufacturer to produce dishes made of the new material, the result being a low-cost 4GHz system.

Philips, have recently announced ideas for achieving improved picture quality with weak, noisy satellite signals – or alternatively allowing a smaller dish to be used. The proposed system would give acceptable pictures with a carrier-noise ratio as low as 2dB (with current 4GHz receivers a ratio of around 8dB is generally required). The system works by reducing the bandwidth as the noise level rises and employs two PLL filters for the purpose. As with any system that relies on bandwidth reduction, there's loss of definition under weak/noisy signal conditions: as the signal strength rises, the bandwidth is increased to give greater fine detail.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

THORN TX9 CHASSIS

The problem with this set is no colour despite trying two replacement TDA3560 colour decoder chips. Chroma enters at pin 3 and the 8·8MHz signal is present at pin 25 but the output to the delay line circuit at pin 28 is totally wrong. With the brightness and contrast reduced to produce a dim picture very faint, unlocked colour is visible and responds to adjustment of the reference oscillator trimmer CV63. Pin 6 (colour control) doesn't rise above 0·8V as the control is adjusted but the associated components seem to be o.k.

It should be possible to vary the voltage at pin 6 from 0·7-5V. We suggest you apply an external source of 3V at this point. If the colour returns, check the components in the colour control network carefully. If there's still no colour the sandcastle pulse could be of incorrect shape or amplitude. The line-frequency component of this pulse is generated in the TDA9503 sync/line oscillator chip (IC54).

DECCA 100 CHASSIS

The problem is no results. The power supply and the line output stage have been checked without finding anything amiss. The only clue I have is that R317 (6·2kΩ,9W) on the timebase board gets very hot. Replacing the timebase panel clears the fault but I'd like to repair the original panel.

R317 provides the start-up supply for the TBA920 sync/line oscillator chip. Replace it with a 5·1kΩ type and check the associated 12V, 1W zener diode D301. If necessary, replace the TBA920. If there are still no results, the line driver stage is in trouble: start by replacing the BF355 transistor (Tr304).

THORN 1500 CHASSIS

The trouble with this set is ultra-critical setting of the line hold control. I've replaced the sync separator valve and the flywheel sync diodes and checked all the resistors in the sync/line oscillator circuitry, also the flywheel sync d.c. amplifier transistor, but the problem persists.

We suggest checking C51 (1μF) in the flywheel sync filter circuit and the h.t. decoupling capacitor C102 (12μF) by substitution. We once spent many hours on this fault eventually to find that the hold control itself had gone high in value. Check for 470kΩ total, and that the silder end resistance varies smoothly. You'll have to remove the control from the panel to check it.

PHILIPS G8 CHASSIS

We have two of these sets with the same problem, tuning drift. The tuner locks to the selected channel but on return to the selector button after using other channels the station is way off tune and has to be brought back by using the preset tuning potentiometer. After several goes the set will settle down and work all right but at switch on some time later the fault returns. The tuner voltages all seem to be in order and the TAA550 tuning voltage stabiliser and its associated feed and decoupling components have been replaced.

Cleaning and retensioning the contact springs and a clean of the PC pads will sometimes sort the problems out. If this cure doesn't last we suggest you fit the more reliable switch unit available from SEME Ltd.

FERGUSON 3V29

Every time this machine is used for playback it starts with a four inch noise bar that travels from the top to the bottom followed by no sound for a couple of seconds – the no sound period ends up with whistle. This impression is left permanently on the tape played, even with no safety tab. It seems that every time we use the machine for playback it removes a portion of the recording.

It seems that the machine is momentarily going into record at the start of playback. The usual cause of this is the print between the collector and emitter of the rec-9V switching transistor Q105 on the AV board not being etched completely. Also check Q105 for leakage.

HITACHI NP6C CHASSIS

The problem with this set is intermittent variation in the height with slight fluctuation in the brightness. The set can work for several days without the fault appearing. I've soldered the connections on the field output module – this cured the same fault on another of these sets.

We suggest that you monitor the 12V rail with a sensitive voltmeter or scope: any jitter should lead to a check on the 12V rectifier CR705, the connections to pins 1 and 2 on the line output transformer, and the reservoir/smoothing capacitors C735/6. A second possibility is leakage or bad jointing in the blanking line – C641 (10μF) and CR641 are suspect here. Bad joints on the M601 field output module do cause height variations but we've never known these to have any effect on the brightness.

THORN 3500 CHASSIS

The picture is unstable with a blue cast and four rows of coloured dots along the top. R733 on the convergence panel was found to be burnt out. After replacing this and the pincushion potentiometer R781 the width shrank by about an inch at each side and the picture is still unstable.

Burning of R733 is invariably caused by short-circuit turns in the pincushion correction transductor T751 which will have to be replaced. Make sure that you get the correct type – this one is a "special". Changing the value

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of R441 to 5·6kΩ should clear the teletext lines at the top of the screen.

ITT CVC9 CHASSIS

No raster was found to be the result of the boost reservoir capacitor C310 going short-circuit. After replacing this the set had to be retuned to get a picture and there is now a kink in the side of the picture with a hum bar. In addition field lock can be held for only a few seconds despite replacing the PCL805 field timebase valve.

The problems are almost certainly due to hum ripple on the 20V line as a result of leakage in the AD161 stabiliser transistor T46d. Why this fails when C310 shorts we've no idea, but it often happens!

TEST CASE

270

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.

Despite their age many sets fitted with the Philips G8 chassis continue in use. Some of them have managed to double the expected seven-year life span of a TV set, and all credit is due to their design for this achievement. The economic situation as we find it is that servicing and repair of these sets is viable only when the fault is a relatively minor one: if a line output transformer or tube replacement is required we generally advise a customer to replace the set and be grateful for its many years of faithful service.

The last job we had on one of these sets turned out to be a rather long drawn-out affair however. It was initially dealt with on site – the symptom was an intermittently red screen. The owner described this as horizontal red flashing bars and occasional screen flooding with red, especially when the set was warm. As is all too often the case with faults of this type our field technician saw nothing of it when he called, so he checked on the type of chrominance panel fitted (BA12 version) and studied the circuit diagram. He then replaced the BD115 red output transistor with a BF337 and carefully checked for dry-joints on the panel and the c.r.t. base assembly. Not finding any he departed, asking the owner to let him know the outcome of his efforts.

Needless to say the phone rang a couple of days later, the depressing message being "same as before". On the second visit a great deal of tapping and flexing of the PCB failed to instigate the fault, so the red output transistor's 5.1kΩ collector load resistor was replaced – on the assumption that it might be going open-circuit intermittently: a new TBA530 RGB matrixing i.c. was also fitted, along with a replacement for its external red output load resistor (R7326, 39kΩ). Further study of the circuit suggested that R7344 (47kΩ) in the red channel feedback network could be responsible, so in went a new one. For good measure the c.r.t. base pins and socket connections were cleaned and checked. A conscientious and worthy effort in the face of a lot of grumbling and misery from the owner who had yet to pay one penny in service charges!

The trouble bounced within a week of course, and this time the owner was asked to leave his set running for some hours before our technician's late afternoon call. Despite this the colour was correct. In with a loan set, out to the van with the G8 – what a life! Back in the workshop the set was left on soak. At last we saw the fault: after some five hours, the screen started to flash red. The rear cover was removed so that a voltmeter could be hooked to the tube's red cathode pin. This gave a steady reading of about 150V and a nasty red smear on the picture due to its capacitive loading effect – but the red-flood symptom just wouldn't show up with the back removed!

At the suggestion of the RWS (resident workshop sage) a better test was set up, one that would prove conclusively where the fault lay and did not require the set's rear cover to be left off. It was the work of minutes to arrange, and finally led to a definite diagnosis of the faulty item. What was this test procedure, and can you guess the conclusions it led to? Details next month.

ANSWER TO TEST CASE 269 – page 401 last month –

Our problems last month were with a Sony KV2000UB Mk II. To start with we dealt with a line output stage fault. We then had to replace the chopper transistor which went short-circuit at switch on. After doing this we found that the chopper circuit would for some reason shut down after a few tortured seconds despite the fact that the h.t. line was now correct in terms of voltage and of current drain.

The key to the problem lay with the current-sampling resistors R635/6 – to arrive at the required value of 0.55Ω a parallel combination of 1Ω and 1.2Ω is used. The heavy current that flowed when the chopper transistor went short-circuit proved to have been too much for R635, which had promptly gone open-circuit. The voltage developed across R636 on its own by the new chopper transistor was of course excessive. As a result the current limiting transistor Q608 came into operation (causing the squeal effect) and then Q602/3 latched on to remove the chopper transistor's drive. We replaced both resistors on the premise that R636 had probably been subjected to a damaging overload.

How fortunate that R636 had held out. Had it not, the short-circuit current would probably have wrought havoc amongst the delicate resistors and semiconductor devices in the excess current/voltage trip circuitry – there's a lot of energy in the national grid, and with but a 3A fuse and a few ohms between them, well . . .

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AA117	9p	BC337	6p	BF184	20p	BFY57	25p	TIP32A	24p	2N.1131	28p	BY296	20p	7818	35p	PCL805	55p	LA-4461	180p	TBA560	100p	74LS22	24p
AA119	9p	BC338	6p	BF185	20p	BFY64	25p	TIP32C	28p	2N.1132	28p	BY298	26p	7824	35p	PFL200	85p	LA-5112	120p	TBA750	100p	74LS24	47p
AAY32	9p	BC557	6p	BF194	5p	BFY90	45p	TIP33	50p	2N.1613	24p	BY299	28p	7905	35p	PL36	80p	LM301	26p	TBA800	35p	74LS26	24p
AC107	28p	BCY32	150p	BF195	5p	BLY48	85p	TIP34	50p	2N.1711	24p	BY476	90p	7912	40p	PL82	45p	LM311	35p	TBA810S	60p	74LS27	24p
AC126	17p	BCY33	150p	BF196	6p	BLY49	85p	TIP41A	22p	2N.2102	50p	BYX10	15p	7915	40p	PL83	32p	LM324	35p	TBA820	75p	74LS28	24p
AC127	15p	BCY34	150p	BF197	7p	BR100	14p	TIP41C	25p	2N.2160	300p	BYX55/350	30p	7918	40p	PL84	50p	LM325	45p	TBA920	100p	74LS30	24p
AC128	15p	BCY42	20p	BF198	7p	BR101	43p	TIP42A	22p	2N.2218A	24p	BYX55/600	30p	7924	40p	PL95	140p	LM339	40p	TBA950	100p	74LS32	24p
AC128K	23p	BCY56	16p	BF199	6p	BR103	37p	TIP42C	25p	2N.2219	24p	BYX55/800	32p	78L05	28p	PL500	110p	LM348	60p	TBA990	100p	74LS33	26p
AC141K	30p	BCY70	16p	BF200	16p	BSX20	15p	TIP47	40p	2N.2221	23p	BYX70/300	29p	78L12	28p	PL504	95p	LM380	100p	TCA270	40p	74LS37	24p
AC142K	30p	BCY71	16p	BF240	16p	BSX26	18p	TIP48	40p	2N.2222	23p	BYX70/500	32p	78L15	28p	PL508	170p	LM381	150p	TCA800	200p	74LS38	24p
AC153K	23p	BCY72	18p	BF241	10p	BSX29	19p	TIP50	60p	2N.2369	15p	BYX70/800	36p	78L18	28p	PL519	450p	LM382	130p	TCA940	100p	74LS40	24p
AC176	18p	BD115	26p	BF255	12p	BT106	90p	TIP51	120p	2N.2484	20p	BYX71/600	80p	78L24	28p	PY81	70p	LM387	100p	TDA1170	100p	74LS42	48p
AC176K	20p	BD124P	50p	BF256	18p	BT109	90p	TIP52	120p	2N.2646	40p	OA47	6p	79L05	40p	PY88	48p	LM709 DIL	30p	TDA1412	60p	74LS47	78p
AC187	15p	BD124	110p	BF257	18p	BT116	80p	TIP53	120p	2N.2904	20p	OA90	4p	79L12	45p	PY500A	160p	LM723	40p	TDA2002	80p	74LS48	78p
AC187K	20p	BD128	35p	BF258	18p	BT119	100p	TIP54	140p	2N.2905	20p	OA91	4p	79L15	48p	**LINEAR IC'S**		LM741 DIL	18p	TDA2003	150p	74LS51	24p
AC188	17p	BD131	25p	BF259	18p	BT120	100p	TIP105	65p	2N.2906	18p	OA200	7p	LM309K	100p	AN-214P	200p	LM741 MET	45p	TDA2030	140p	74LS54	24p
AC188K	23p	BD132	25p	BF262	25p	BU100A	110p	TIP106	65p	2N.2907	18p	OA202	7p	LM317K	220p	AN-240P	150p	LM747	58p	TDA2522	90p	74LS55	24p
ACY18	48p	BD135	20p	BF263	25p	BU104	100p	TIP107	65p	2N.2926	8p	IN.914	2p	LM317T	180p	AN-360	120p	LM748	35p	TDA2530	100p	74LS73	28p
ACY19	48p	BD136	20p	BF270	18p	BU105	80p	TIP110	47p	2N.3019	28p	IN.4001	4p	LM323K	420p	AN-7110	140p	LM1458	33p	TDA2532	100p	74LS74	33p
AD142	60p	BD137	20p	BF273	15p	BU108	100p	TIP111	50p	2N.3053	18p	IN.4002	4p	LM723	32p	AN-7114	160p	LM3900	30p	TDA2540	100p	74LS75	36p
AD149	45p	BD138	20p	BF311	21p	BU110	110p	TIP112	40p	2N.3054	35p	IN.4003	4p	78HGKC	570p	AN-7115	160p	M-51513L	180p	TDA2560	100p	74LS76	28p
AD161	22p	BD139	20p	BF324	25p	BU111	140p	TIP115	45p	2N.3055	35p	IN.4004	4p	78HOSKC	520p	AN-7120	140p	M-51515BL	270p	TDA2593	100p	74LS78	35p
AD162	22p	BD140	20p	BF336	20p	BU124	60p	TIP116	45p	2N.3055H	50p	IN.4005	4p	78GU1C	190p	AY3-1270	680p	M-51516	280p	TDA2690	100p	74LS83	65p
AF124	25p	BD144	90p	BF337	20p	BU126	70p	TIP117	50p	2N.3440	58p	IN.4006	4p	79GU1C	215p	AY3-1350	300p	M-51517L	280p	UPC-555H	60p	74LS85	75p
AF125	25p	BD150	30p	BF338	20p	BU204	75p	TIP120	43p	2N.3442	85p	IN.4007	5p	79HGKC	670p	AY3-8910	300p	MB3712	150p	UPC-556H	80p	74LS86	32p
AF126	25p	BD157	38p	BF355	28p	BU205	70p	TIP121	46p	2N.3702	9p	IN.4148	2p	**VALVES**		AY3-8912	400p	MB3730	260p	UPC-575C2	100p	74LS90	45p
AF127	25p	BD158	38p	BF362	30p	BU208	75p	TIP122	47p	2N.3703	9p	IN.5400	9p	DAF96	60p	AY5-3600	570p	MB3756	260p	UPC-577H	64p	74LS91	85p
AF139	22p	BD166	30p	BF367	13p	BU208A	80p	TIP125	47p	2N.3704	9p	IN.5401	10p	DF96	50p	CA270	40p	MC1327	70p	UPC-592H2	95p	74LS92	50p
AF239	22p	BD175	30p	BF371	17p	BU208D	100p	TIP126	56p	2N.3705	9p	IN.5402	10p	DL92	47p	CA3046	60p	NE555	20p	UPC-1001H	220p	74LS93	48p
AL112	70p	BD177	30p	BF414	18p	BU325	55p	TIP127	56p	2N.3706	9p	IN.5403	11p	DY86	50p	CA3048	190p	NE556	40p	UPC-1025H	230p	74LS95	60p
AL113	80p	BD179	32p	BF420	16p	BU326	85p	TIP141	90p	2N.3707	9p	IN.5404	11p	DY87	50p	CA3060	280p	SAS560	110p	UPC-1026C	105p	74LS96	80p
ASZ15	100p	BD181	45p	BF421	18p	BU406	85p	TIP142	90p	2N.3708	9p	IN.5405	12p	DY802	45p	CA3080E	70p	SAS570	110p	UPC-1028H	90p	74LS107	39p
ASZ17	100p	BD182	60p	BF422	21p	BU406D	95p	TIP145	65p	2N.3771	85p	IN.5406	13p	EABC80	50p	CA3086	55p	SN76003N	140p	UPC-1031H2		74LS109	39p
AU110	110p	BD183	60p	BF423	15p	BU407	75p	TIP146	90p	2N.3772	90p	IN.5407	13p	EB91	44p	CA3089E	150p	SN76013N	140p		180p	74LS112	40p
AY102	180p	BD187	30p	BF440	16p	BU407D	95p	TIP147	100p	2N.3773	100p	IN.5408	13p	EBF80	45p	CA3090AQ	300p	SN76023N	140p	UPC-1032H	70p	74LS113	32p
AY106	180p	BD201	33p	BF451	17p	BU408	85p	TIP2955	42p	2N.3819	29p	**ZENERS**		EBF89	50p	CA3130E	80p	SN76033N	150p	UPC-1155	200p	74LS114	42p
BA145	10p	BD202	38p	BF455	14p	BU408D	95p	TIP3054	45p	2N.3866	68p	400MV		ECC82	40p	CA3130S	100p	SN76116N	70p	UPC-1156H	140p	74LS122	56p
BA148	10p	BD203	42p	BF458	19p	BU409	95p	TIP3055	42p	2N.3903	11p	BYZ88 Range		ECC83	43p	CA3140E	38p	SN76115	70p	UPC-1181H	115p	74LS123	70p
BA154	6p	BD204	42p	BF459	19p	BU426	120p	TIS43	45p	2N.3904	11p	2V7 to 39V	6p	ECC84	45p	CA3189E	250p	T2800D	52p	UPC-1182H	150p	74LS124	95p
BA157	12p	BD222	31p	BF461	60p	BU500	110p	TIS44	40p	2N.3905	11p	1.3W Zeners		ECC85	40p	CA3240E	90p	TA-7120	55p	UPC-1185H2		74LS125	38p
BB101	13p	BD225	31p	BF462	62p	BU526	80p	TIS61	15p	2N.3906	11p	BZX61 Range		ECH81	49p	HA-1156W	110p	TA-7137P	83p		250p	74LS126	42p
BB103	16p	BD232	31p	BF469	30p	BU801	95p	TIS88A	45p	2N.4031	25p	2V7 to 39V	12p	ECH84	52p	HA-1197	150p	TA-7146P	400p	UPC-1350C	150p	74LS132	53p
BB105B	18p	BD234	32p	BF470	28p	BU806	120p	TIS90	15p	2N.4036	25p	**JAPANESE**		ECL80	57p	HA-1306W	170p	TA-7193P	400p			74LS133	46p
BB205B	24p	BD235	28p	BF471	28p	BU807	95p	TIS91	18p	2N.4037	25p	**TRANSISTORS**		ECL82	59p	HA-1319	250p	TA-7200	200p	**74LS SERIES**		74LS136	35p
BC107	7p	BD236	30p	BF479	30p	C106D	23p	TIS93	20p	2N.4058	13p	2SB324	55p	ECL84	57p	HA-1339	170p	TA-7201	200p	TA-74LS00	24p	74LS138	47p
BC108	7p	BD237	31p	BF493	18p			VK1010	88p	2N.4443	76p	2SB507	68p	ECL85	57p	HA-1342	170p	TA-7203	180p	74LS01	24p	74LS139	45p
BC109	7p	BD238	24p	BF494	18p	MJ2500	100p	VN.10KM	80p	2N.4444	76p	2SB754	80p	ECL86	49p	HA-1366WR		TA-7204	110p	74LS02	24p	74LS145	90p
BC115	10p	BD244	50p	BF595	18p	MJ2501	110p	VN.46AF	88p	2N.5061	20p	2SC495	60p	EF80	31p		160p	TA-7205	80p	74LS03	24p	74LS147	130p
BC118	11p	BD245	50p	BF596	16p	MJ2955	55p	VN.66AF	100p	2N.5294	30p	2SC1060	99p	EF85	34p	HA-1368	160p	TA-7210	200p	74LS04	24p	74LS148	120p
BC140	19p	BD433	28p	BF597	10p	MJ3000	115p	VN.88AF	115p	2N.5296	30p	2SC1061	200p	EF89	43p	HA-1377	220p	TA 72222AP		74LS05	23p	74LS151	45p
BC141	19p	BD434	30p	BF615	30p	MJ3001	115p	VN.89AF	110p	2N.6106	40p	2SC1096	78p	EF183	45p	HA-1389	140p		120p	74LS08	24p	74LS153	60p
BC142	19p	BD435	31p	BF758	41p	MJE29A	30p			2N.6107	40p	2SC1161	110p	EF184	53p	HA-1392	230p	TA-7310P	100p	74LS09	25p	74LS154	180p
BC143	19p	BD437	28p	BF869	22p	MJE30A	30p	ZTX107	11p	2N.6109	40p	2SC1172	150p	EL34	190p	HA-1397	250p	TA-7609	270p	74LS10	25p	74LS155	58p
BC147	6p	BD438	36p	BF870	22p	MJE340	28p	ZTX108	11p	3N.128	65p	2SC1306	90p	EL36	80p	HA-1398	240p	TAA550	18p	74LS11	25p	74LS156	65p
BC148	6p	BD439	40p	BF872	23p	MJE350	80p	ZTX109	12p	3N.143	65p	2SC1307	100p	EL84	50p	LA-1201	85p	TBA120S	45p	74LS12	25p	74LS157	35p
BC149	6p	BD440	40p	BF960	38p	MJE520	30p	ZTX212	27p			2SC1678	120p	EL95	50p	LA-1352	120p	TBA395	60p	74LS13	30p	74LS158	50p
BC157	6p	BD441	40p	BF963	40p	MJE2955K	90p	ZTX300	13p	**DIODES**		2SC1969	130p	EL500	80p	LA-1365	140p	TBA396	60p	74LS14	40p	74LS160	65p
BC159	6p	BD442	40p	BF964	38p	OC28	100p	ZTX301	18p	AA119	9p	2SC2028	75p	EL504	100p	LA-3301	120p	TBA520	100p	74LS15	24p	74LS161	58p
BC182	6p	BD533	50p	BF966	40p	OC29	80p	ZTX302	18p	BY100	40p	2SC2029	120p	EY86	31p	LA-3350	120p	TBA530	100p	74LS20	24p	74LS162	58p
BC182L	6p	BD534	38p	BFR40	25p	OC35	100p	ZTX303	24p	BY103	32p	2SC2078	120p	EY87	31p	LA-3361	115p	TBA540	100p	74LS21	24p	74LS163	60p
BC183	6p	BD535	38p	BFR51	21p	OC36	120p	ZTX304	17p	BY126	6p			EY88	42p	LA-4030	200p						
BC183L	6p	BD536	38p	BFR62	21p	OC45	50p	ZTX320	29p	BY127	8p	**LOW PROFILE**		EZ35	45p	LA-4031	85p						
BC184	6p	BD537	40p	BFR79	25p	OC71	30p	ZTX326	29p	BY133	8p	**SOCKETS**		EZ80	50p	LA-4032	140p						
BC184L	6p	BD538	40p	BFR90	52p	OC72	50p	ZTX500	13p	BY164	40p	8pin	6p	EZ81	55p	LA-4050	130p						
BC212	6p	BD675	40p	BFR91	99p	OC200	180p	ZTX501	13p	BY176	85p	14pin	8p	GZ34	180p	LA-4051	160p						
BC212L	6p	BD676	40p	BFX29	20p			ZTX502	18p	BY179	35p	16pin	9p	PC97	100p	LA-4100	120p						
BC213	6p	BD677	38p	BFX84	20p	R2008B	100p	ZTX503	18p	BY182	32p	18pin	12p	PCC85	42p	LA-4101	100p						
BC213L	6p	BD678	40p	BFX85	20p	R2010B	100p	ZTX504	25p	BY184	32p	20pin	14p	PCF80	58p	LA-4102SK	140p						
BC214	6p	BD679	40p	BFX87	15p			ZTX550	24p	BY187	32p	22pin	16p	PCF200	135p	LA-4112	250p						
BC214L	6p	BD680	40p	BFX88	15p	TAG4443	78p			BY196	20p	24pin	18p	PCF801	110p	LA-4125	210p						
BC237	7p	BD681	45p	BFX89	60p	TAG4444	78p	2N.696	26p	BY206	11p	28pin	20p	PCF802	57p	LA-4140	70p						
BC238	7p	BD682	45p	BFY17	30p	TIP29	15p	2N.697	22p	BY207	11p	40pin	25p	PCF806	115p	LA-4201	120p						
BC300	16p	BDX32	100p	BFY18	40p	TIP29A	22p	2N.698	40p	BY208	16p			PCH200	100p	LA-4220	120p						
BC301	18p	BDX65	80p	BFY41	28p	TIP29C	25p	2N.699	45p	BY210	22p	**VOLTAGE**		PCL81	54p	LA-4400	190p						
BC302	18p	BDY92	100p	BFY50	14p	TIP30	25p	2N.706A	22p	BY223	72p	**REGULATORS**		PCL82	63p	LA-4420	140p						
BC303	18p	BF180	18p	BFY51	14p	TIP30C	30p	2N.708	22p	BY225	120p	7805	35p	PCL84	50p	LA-4422	130p						
BC327	6p	BF181	18p	BFY52	14p	TIP31A	24p	2N.914	28p	BY226	18p	7812	35p	PCL85	55p	LA-4430	130p						
BC328	6p	BF183	20p	BFY56	25p	TIP31C	30p	2N.918	36p	BY227	19p	7815	35p	PCL86	55p	LA-4460	170p						
						TIP32	24p	2N.930	18p	BY228	32p												

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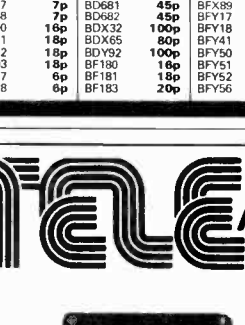
Telegen-1



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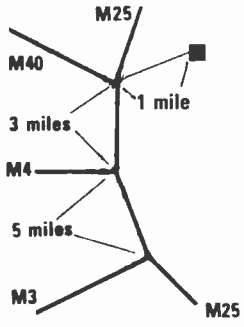

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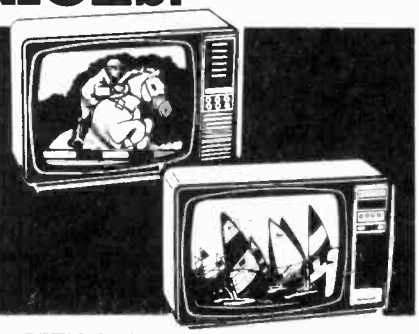

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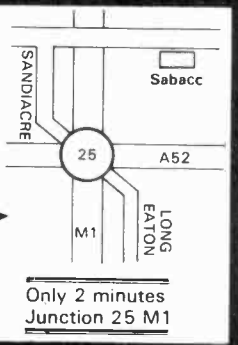

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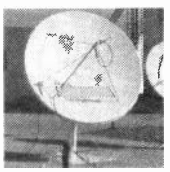

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SENDZ COMPONENTS

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7 Button Unit GEC with Lamps	£7

Mains Droppers

G8 2R2+68R	£1.25
G8 47R 15 watt	75p
Pye 731 3+56+27R	50p
Pye 3R5/15R 45R	50p
Thorn 50/17/1K5	£1.00
120/20/20/48/117	£1.00
270/1006 for Thorn 4000	50p
18/320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ac Socket & Lead GEC, ITT, Philips, Pye	25p
7×3¾ Thorn	£1
Rank Toshiba Tube Bases	30p

Speakers

Pair 25 watt 4Ω speaker & tweeter in cabinet		£15.00
15Ω 12" speaker, 90 watts		£12.00
6×4 GH	25 ohm	£1.00
5½×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
8×5	8 ohm 15 watt	£2
8×5	8 ohm	£1
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6½" dia	4 ohm	£1.50
6½" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
4½" sq	15 ohm	75p
KT3 speaker	K30	75p
3" dia	15 ohm	60p
1690 5×3	12 ohm	£1
K45 Philip	15 ohm	75p
K30 15 watt		£1

KT3-K30

OF-550	E/W.	10p
OF-513	correction	10p
OF-557		50p

Diodes

BY 127	10p
BY 133	10p
BY 134	10p
BY 164	50p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600 4 8A/600k bridge	50p
BY 226	15p
BY 227	15p
BY 229/400	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 602	10p
F 247	10p
XK 3102	50p
XK 3123 THORN	50p

Hitachi 2A/1500V metal case wire end FARST/REC 20p

20.AX

GEC Degaussing Panel 809 with PT37 £1.00

Line Transformers

Hitachi Split Diode and GEC 1981 to 1984	£13
2 I/Pots 3,500 1 off each type	£3.00
G8 Symmetry Coil	£2.00
G8 Trans. Philips	£7.00
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B/W AD5308F + Stik + Lead	£1.50
1690 Thorn EHT over-wind with diode lead & anode cap	£2.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard A1 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono T704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3
Rank L.O.P.T. Z970	£3
CVC 5-8-9	£3.00
CVC20 ITT	£3.50
A12080/15	£5.00
CVC30 ITT	£5.00
CVC32 Line Tran	£4.75
CVC800 Line Trans	£6.00
CVC40 Slip/Diode	£12.00
CVC 45	£5.00
GEC Portable G10T2041	£3.00
GEC Portable G10T2046	£3.00
EHT Split Diode Leads ITT	£1.00
Ex panel "14" Fidelity portable	£5
3500 L.O.P.T. & EHT Trans	each £2
LOPT Rank Z763	£5

Triplers

ITT CVC 5-8-9	£3.50
Rank T25LF Tripler	£2.00
Rank EHTCP A823	£3.50
ITT 25 30k Rank	£3.00
8500 Triplers	£6.50
EHT-Z Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
9000 Thorn	£5
9500 Thorn	£4.50
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
TVK 76/9	£3.00
G8	£4.00
CVC 825 ITT CVC 20/25/30/32	£3.50
Decca 80/100	£4.50
Grundig TVK 52	£2.50
EHTBQ Pye 731	£3.00
EHTHY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 1000/41	£3.25
KT3 BG2000/43	£3.50
Text ultrasonic rec'r panel	£14.00
Video cassette lamps on lead, 12-14V	50p or 3 for £1.00
20 for £5.00	200 for £25.00
GEC 8 touch unit assy complete with all LC's + pots	£4.00
G11 E/W Transformer	50p
G11 E/W coils	£1.00
G11 Transient Suppressors 245V	10 for £1.00
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3/K30 infra-red receiver head	£1
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AF Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye, K30, GEC, etc Pre-mains stand-by switch	£1
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O/P Trans	pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P B U	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans. & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NE5111N	£1.20
LM337M Reg	30p
20 GEC Black Spark Gaps	£1.00
G11 Line Driver Transformer	35p
KT3 Front Panel Control Assy	£2.50
BTW 30/50	50p

TELETEXT DECODER

I.C. SAA 5051	K30
I.C. SAA 5042	
I.C. SAA 5030	
I.C. SAA 5020 etc	£8.00

International Rectifier EHT Diodes G770/HV34 6kV	3 for 8p
6A/600V Stud Diodes	BTW 92/800R £3
6A/1000V Stud Diodes	25A473 PNP C/P 10p

5 Volt Mains Transformer 2 Amp	50p
30V Power Supply 500M/A 4×2¼	£2.50
Pye 731 Power Panel	£13
6 Diode Universal Triplers	£3.25
NEW PYE 725 line O/P panel with L.O.P.T. & Tripler	£10.00
Thorn Mains Isolator unit for 70-80W. Ex-speaker	£2
NEW GEC 20AX Power Supply Switch Mode	£12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI	£10
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPTI	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
Pye 607/205 Line panel with transformer	£10.00
Pye CDA/205 panel	£6.00
GEC portable chassis + LOPTI 2114 New	£4.00
Thorn 1613/1713 chassis	9.75
G9 Line Panel	£12.00
G9 Power Panel	£7.00

NEW MULLARD TELETEX

Decoder Panel (VM6230)	£15.00
Panel 6101	£15.00
Panel 6330	£15.00
G8 Tuner Unit + Panel	£6.00
G8 Convergence Panel (late type)	£12.00
G8 Power Supply	£6.00
G8 6 Sloping PBU	£8.00
G8 IF & Chroma	£10.00
G8 Chroma	£6.00
G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC	
SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz 1 I.C.	
SL437F	£3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s	
TBA1205B TCA2705Q	£2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s	
TBA750+SO950M+ SO950P	£1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead	£5.00
Pye 6 button switch portable	£1.00
GEC V/cap VHF/UHF tuner and IF + sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£6.00
2110 GEC Power Panel	£8.00
GEC Power Supply (Export)	£10.00
G11 dynamic correction panel	£6
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders complete with lamp assy + pots	£14
CVC9 slider pots panel	50p
CVC 5 Mains on/off + 5 pots	£2
Universal Focus. Fits Pye, Thorn and Decca Units	
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
TX10 Focus Units	£6.00
CVC 32 Focus Unit	75p
Peckhity Focus Unit 14R-14S	30p
3500 Thorn Focus Unit	£1.00
ITT Small for use with Split Diode	50p
TV11	50p
Remo TV12SP	50p
TV13	50p
TV14	50p
TV18	60p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p

G7000 Philips Video Games Packs 11 types **£8.00 each**

G11 drawer ASS 3 pots Mains switch and lead	£2.00
Line O/P panel GEC 2217/2218/2213/ 2214/2226/2227/2228	£10

CLOCK DISPLAY

4 SEG ACDM45	£1.00
4000 thick film	£2.00

DISPLAYS

4040 Clock	£1.00
7seg Red LED	50p
2 digit LED 8.8	50p
2 digit LED +1.8 with panel + MC14511	£1.00
4700/63	£1.50

250/64	10p
3300/70	50p
1/100	5p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
2000/100	70p
4700/100	75p
47/160	10p
300/300/300V	80p
400/160	50p
1/250 Pulse	5p
2.2/250v	10p
3n3/250 A.C.	10p
33/250V	20p
39/250V	15p
4n7/250 tested 5KV	25p
91/250	35p
91/400	30p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
GEC 600/250	60p
700/250	£1
300+300 MED 350k	£1.00
800/250	40p
32/300	20p
4/350	5p
8/350	8p
4.7M/350k	10p
33/350	20p
220/350	30p
300/350	40p
400/350	50p
10/375	10p
22/375	15p
220/385	75p
330/385 CVC 820ITT	60p
0.1/400	15p
KT3 E/W 39/400	20p
.56K/400v	20p
4700pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
400/400	40p
394k/400V	20p
220/450	40p
.47/500	25p
0.1/600	15p
.047/600	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
47/1000k	65p
47/250V A.C.	10p
001K 1250	10p
0.0047/1500	10p
005/1500	10p
0.005/1500	10p
1n8/1500	15p
2n0/1500	10p
2n2/1500	15p
.01/1600	15p
G11 8200/2KV	15p
0.1 2K	20p
10n 2KV	15p
3n9/2KV	15p
0.0015/2KV	10p
5n2/2KV	10p
6n2/2KV	15p
2n0/2KV	15p
2n2/2KV	15p
7500pf/2KV	10p
4n7/2KV	15p
8n2/2KV	15p
0.0082/2500	15p
150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
470/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p
47/100V	80p

CVC 20-25-30 Mains Switches	75p
Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Mains Remote Switch 2865 ohm	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	20p
KT3 Mainswitch	£1.00
THORN Rotary Mains Switch	50p
G8 Mains Switch	75p
Thyristor 600/4 amp C106/2	24p
G11 Preh Red LED P/Button for C.H. Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
Mains Switch ITT Long Type Print	75p
Mains Switch Philip Long Type TAG	75p
Mains Switch GEC Long Type TAG	75p
Thorn 12 or 24 volt battery convertor for portable colour T/V	£6.00
Tape Heads R/Play/Back Mono/Stereo	£1.00

Mains Isolation Transformer (R.S. 500V/A Type) in case	£25.00
Rank Secam Decoder Panel UHF & VHF TU5A	£13.00

NEW GRUNDIG SPARE PANELS

Set No. SC4127; SC4337, SC6217, SC6237

GRUNDIG MODULE TYPES

Tuner IF AF TRX I.O.P. TP preamplifier Tuning board, Colour RGB LED Board Deflection Board

From £3 to £8

Multi-Caps

350V 300M + 300M	£1.00
400V 400M	60p
350V 400M	60p
Thorn 3500 175/100/100/350k	£1.00
KTV200/25/25/385v	£1.00
300+300+150+100+50MED 350V	£2
47/220/350k	60p
150/150/100/100/100/320k	£2.00
2500/2500/63v	50p
150/200/200/300k	70p
400/400/200k	£1.70
300/100/100/16/275v	£1.50
100/200/325v	40p
150/150/100/375v	£1.50
300/300/100/32/32/300k	2.00
1500/2000/30k	50p
Jelly pot Thorn 00D4/013	£3
150/150/100/100/320k	£2.00
100/350 + 300/200/100/16/275v	£2.00
225+25/380 GEC	70p
200/100/100/350k	£1.50
500/500/25v	50p
150/150/100/300k	75p
200/150/150/300k	1.00

ITT Panels

CVC 40/2 Chassis, new £30, complete with intrface panel	
CVC 820 Line O/P Panel	
CVC20 Mains Panel	£3.00
ITT 8 & 6 Push Button Unit	£1.00
CVC40/2 New Chroma Panel	£10.00
CMA 10	£2.00
CMA 11	£2.00
CMA 30	£2.00
CMA 40	£1.50
CMC 10/2	£5.00
CMC 16	£4.00
CMC 38	£8.00
CMC 45	£1.50
CMC 47	£1.00
CMC 52	£15
CMC 57	£6.00
CMC 58	£8.00
CMC 59	£8.00
CMC 67	£3.75
CMC 67/2	£4.00
CMC 68	£4.00
CMD 12	£10
CMD 32	£5.00
CMD 33	£5.00
CMD 40	£5.00
CMD 41	£5.00
CMD 800	£10.00
CMF 25	£2.00
CMI 26	£2.00
CMP 10	£2.00
CMP 11	£4.00
CMP 40	£2.00
CMS 11	£2.00
CMS 40	£2.00
CMU 12	£10.00
CMU 14	£8.00
CMU 30	£7.00
CMU 45	£7.00
CMZ 30	£5.00
GMA 90	£5.00
GMC 120	£2.50
GMR 64	£5.00
TMN 2	£2.00
VCA 20	£10
VCA 21	£10.00
VMC 26	£3.00
VMC 34	£5.00
VMC 44 + 45	£4.00
VMC 51	£5.00

Hand Sets

G11 Ultrasonic Teletex Handset	£24.00
8 C H Ultrasonic GEC Full Remote C20/41H/ C2219H	£15.00
New Replacement for G11 Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£24.00
Rank, Infra-red	£10.00
Dynatron Full remote CTV n2, 63, 64	£19.00
Hitachi infra red handset	£18
Philips full remote KT3, 16C928/20C934, 22287324, K12 26C 797/1ST 66K 1826	£12.00
G11, Full remote top button assy	£12.00
G11 Full remote repair service (exchange unit)	£12.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
Philips Key Pad set KT3/K30	£3.00
KT3/K30 T/Text	£15.00
KT3/K30 Full remote	£15.00
KT3 Power supply	£4.00
Hitachi 8 button unit with resistor unit Last year mod	£7.00
GEC infra-red 2236-2026	£4.00
GEC push pad hand set button blobs	10p each
Pye & Philips handset KT3-K30 chassis No RC4001-RC5150-RC5176-RC5171 RC5177	
Special Price	£13.00
ITT Hand Set with TV Teletex VCR	£12.00

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Tuner Units

V/Cap Rank UHF Z776T/Unit	£6
V/Cap Rank VHF Z773T/Unit	£5
NEW G8 Tuner V/Cap	£5.50
I.E.C2000 on Panel	£2.50
G.E.C 6 Push Button Unit	£6
ITT 6 Push Button Unit	£6
DECCA 6 Push Button Unit	£6
GEC or Hitachi 6 push button unit 2110 Conversion	£8
GEC 2110 V/Cap	£5
ELC1043 (Ex Panel)	£3.75
ELC1042 NEW	£5.00
I.E.C2000	£4.00
ELC2004	£10.00
I.E.C2006 NEW	£10.00
G.E.C Tuner V/Cap Hitachi After 1979 ET548, ET547, I.ET451	£10.00
U322 (UHF) ..	£4.00
V314 (VHF) ..	£5.00
V317 (VHF)	£5
V334 (VHF)	£5
U321	£6
U341 UHF	£7.00
U342 (UHF)	£5
U411 UHF	£7.00
U.V. 411 Tuner	£10.00
ELC1043/05 Thorn	£5.90
ELC1043/06 Thorn	£5.00
Small V/Cap Mitsumi UHF ..	£4.00
VHF ..	£3.00
G8 Tuner	£6.00
Portable & rotary Timers Sanyo & Mitsumi UHF	£5.00
NSF-UHF/VHF Varicap (old type)	£8.00
Mosfit UHF/VHF (new type)	£8.00
UF2-B31 Fidelity V/Cap T/Unit	£6.00
Thorn Tuner PANEL with 6×100K pots + cursors NO TUNER	£1.00
HITACHI 20 Turn Pot	30p
U321 on panel	£6.00
Tuner unit VHS Sylvania GTR Videon MTS 900	£2.50
Mullard Video Modulator. Application, video tape recorders, TV cameras, video games, closed circuit T.V., C.C.T.R. system. Data supplied	£10.00
VT100 Sound Tuner Kit. TV Viewsound. The latest design in low noise fitted with DNR, RF output and audio	£30.00
Sylvania UHF E4720B	£6.00
Sylvania VHF 900	£6.00
Small Tuner DX 175-220MHz	
Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00
D.P.D.T. switch Black knob: Chassis or PCB mount	4p
	each or 40 for £1.00

THORN 1400 4P.B. Mech. Tuner	
THORN 1500 4P.B. Mech. Tuner	
THORN 1590 4P.B. Mech. Tuner	
THORN 3500 4P.B. Mech. Tuner	
THORN 8000 4P.B. Mech. Tuner	
THORN 8500 Mech. Tuner	
All new & boxed	£4.00 each

Delay Lines

DL20A 80p	DL600 £1.00
G8 (Old Type)	£1
DL600	£1.00
DL710	£1.00
UDL11	30p
KT3 Luminence	75p
Luminance Delay Line (CVC 45)	
10×6.30ma fuse	25p
10×2A fuse	50p
10×3.15 fuse	50p
10×500mA	80p
10×1 amp	80p
20 3.15 AS Fuses	£1.70
Co-Ax Joint	15p
Co-Ax Belling Lee Plug	12p
Co-Ax Splitter	£1.00
UHF Modulator CCIR	£3.00
Infra Red Emitting Diode	20p
NE2861 Small Neon Lamps GEC & Philips	5p
Mullard 5 Watt Amps LP1162 New	75p

T.V. Tubes

12" A31/300 Hitachi	£10
15" A38/170W Hitachi	£8
18" Hitachi PIL tube with scan coils 470 KCB22-TC03	£25
10" Black and white tube scan coils & line trans	£6.00
12" 90° Tubes Type 310GNB4	£12
14" 110° Tubes Type 310GNB4	£12

Integrated Circuits

AC76003	£1.50
AM25LS23PC	10p
BAV40	40p

BF694	10p	2SK30A	10p	BC456	10p
BF758	30p	BC107	10p	BC460	25p
BF760	30p	BC108	10p	BC462	10p
BFT34	15p	BC109	5p	BC463	10p
BFT43	10p	BC113	10p	BC478	10p
BFT84	8p	BC114	10p	BC527	10p
BFW11	20p	BC115	10p	BC532	10p
BFX29	30p	BC116	10p	BC546	10p
BFX84	25p	BC117	20p	BC547	10p
BFY50	15p	BC119	20p	BC548	10p
BFY52	20p	BC125	10p	BC556	10p
BFY90	25p	BC126	10p	BC557	10p
BLY49	25p	BC139	10p	BC558	10p
BPW41	25p	BC140	30p	BC559	10p
BRC116	25p	BC141	25p	BC635	10p
BRX43	15p	BC143	25p	BCX31	25p
BRX48X	10p	BC147	10p	BCX32/36 Pair	75p
BRY56	30p	BC148	10p	BCX32	25p
BSS68	10p	BC149	10p	BD116	25p
BSY79	10p	BC153	10p	BD124	50p
BSY95a	10p	BC154	10p	BD124 (metal)	60p
BTY80	20p	BC157a	10p	BD130Y	25p
BSX19	17p	BC158	10p	BD131	30p
BSX20	17p	BC159	10p	BD132/238	30p
FT3055	30p	BC160/16	25p	BD135	25p
TCE82	30p	BC171	10p	BD136	30p
2N930	5p	BC172	10p	BD138	30p
2N2221	8p	BC173	10p	BD140	30p
2N2222	8p	BC174	10p	BD176	25p
2N2906	10p	BC183	10p	BD182	£1.00
2N3055	40p	BC184	10p	BD183	70p
2N3566	10p	BC204	10p	BD202	60p
2N3702	10p	BC207	10p	BD204	60p
2N3711	10p	BC212	10p	BD221	20p
2N3583	50p	BC213	10p	BD222	30p
2N3904	15p	BC214	10p	BD228	30p
2N4355	10p	BC237	10p	BD226	20p
2N4442	£1.00	BC238	8p	BD233	30p
2N4444	£1.00	BC239	10p	BD235	30p
2N5296	40p	BC250	8p	BD238	30p
2N5983	30p	BC251	10p	BD239	15p
2N6099	40p	BC252	10p	BD243c	30p
2N6109	40p	BC262	10p	BD244	50p
2N6130	50p	BC263b	20p	BD250a	30p
2N6133	20p	BC294	30p	BD252	20p
2N6348	20p	BC298	10p	BD253B	50p
2N6399	10p	BC300	30p	BD331	20p
2X 2N6099 on heat sink	50p	BC301	30p	BD373b	20p
2SA437	20p	BC303	30p	BD416	25p
2SB407 Sanyo TO3	10p	BC307	7p	BD433	25p
2SB474	30p	BC308	7p	BD437	25p
2SB566	10p	BC309	10p	BD439	50p
2SC381	10p	BC327	10p	BD678	30p
2SC458	50p	BC328	10p	BF761	30p
2SC515	10p	BC328/338 pair	15p	BF858	30p
2SC732	10p	BC337	10p	BF871	30p
2SC733	10p	BC338	10p	BFR39	15p
2SC1030	£1.00	BC349b	10p	BFR52	7p
2SC1546	20p	BC350	20p	BFR79	15p
2SC1725	20p	BC365	10p	BFR81	15p
2SC2068	20p	BC384	10p	BFR87	10p
2SC2073	8p	BC394	10p	BIC660	10p
2SC2122A	£1.00	BC413	10p	BFT42	20p
2SC2229	15p	BC414	10p	MRJ366	20p
2SC7350	15p	BC416	10p	BRC-M-200	40p
2SD180 TO3 80v/6A	15p	BC440	30p	BRC-M-300	50p
2SD200	£2.00	BC454	10p	BRC 1330	75p
		BC455	10p	BRC 3064	£1.00

BTT822	£1.00
BTT6016	£1.20
BTT6018/ML237B	£1.50
BTT6218	£1.50
BTT8124	£1.00
BTT8224	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AF	£1.00
CA1310	50p
CA3065Q	50p
CA3089Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBFH6848	50p
CD4510	30p
DM7492	50p
HA1196	40p
HA1370	£2.00
HA11223	40p
HEF4001	10p
HBF401IAF	10p
HEF4053B	30p
HD38800C	£3.00
K573ID 1001012	£1.00
LA3220	50p
LM101IN	£1.00
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
MC476p	£1.00
MC1307	75p
MC1312	
MC1330	75p
MC1349	50p
MC1352	£1.00
MC1358	£1.00
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14511	50p
MC1748	80p
MEM4956	£1.00
ML231	£2.50
ETT6016	£2.00
ML232	£2.00
ML236E	£1.00
ML237B	£1.00
ML238B	£4.00
ML239	£2.00
MM5387	£1.00
MM5611	£1.00
MM5840	75p
MM5290N-4	75p
MM5308N	£4
MRI366	20p
N64100	£1.00
NE555P	60p
NE555	60p
HD38980C	£3.00
IL-1	20p
OPT600	20p
OPT601	20p
SAA611	50p
SAA661	£1.75
SAA1020	£4.00
SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
SAA1176	£3.00
SAA1250	£3.00
SAA1251	£4.00
SAA1272	£3.00
SAA1276	£3.00
SAA3027P	£4.00
SAA5000A	£1.50
SAB3013	£2.00

Filters

5.5MHz	15p
6MHz	30p
BFU455K	5p

Thyristors

BT151/800R	80p
TDM800	£1.50
BT106 Plastic	30p
BT106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
G11 Thyristor	60p
Decca 80-100	60p
2N4444	£1.00
MCR72 6	25p

Thermistors

G8 Degausing	35p
Philip type VA1104	70p
ITTP766312	15p
PTH451 AOR	15p
PT37P Fits Pye & PT34	20p
Degausing Thermistor (fits most sets)	20p
GEC Double Thermistor	25p

SAB4209	£2.00
TBO0124	£1.00
SAA5000A	£1.50
SAA5012A	£5.00
SAA5020	£3.50
SAA5030	£5.00
SAA5040	£3.50
SAA5040A	£4.40
SAA5050	£3.50
SAF1032p	£2.50
SAF1039	£2.00
SAS560	£2.00
SAS660	£1.00
SAS670	£1.00
SAS580	£1.50
SAS590	£1.50
SL901B	£4.50
SL918	£4.50
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	50p
TAA621	£2.00
TAA661	50p
TAA641	£1.50
TA7108P	£1.00
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7607AP	40p
TA7609P	50p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1441	£1.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA550Q	£1.75
TBA560CQ	£1.00
TBA570	£1.50
TBA625	50p
TBA641	£2.00
TBA651	£2.00
TBA673	£1.00
TBA720A	£1.50
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA890	£1.00
TBA900	£1.50
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 N21 (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2216	75p
UPC566H	£1.00
UPC585C	£1.00
UPC1031H	£2.00
UPC1353C	£1.00
UPC1366C	£1.00
UPC2002	75p
UPD8049HC	£2
SN29848	50p
SN29770BN	£1.00
SN29771BN	£1.00
SN29772BN	£1.00
SN7402N	£1
SN7472N	£1
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76013ND	£1.50
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50

BLY49	50p
I.C. Heat Sink	20 for £1
20×TO5 Heat Sink	£1.00
CVC 9 power supply board	£1.50
CVC 20/2 mains panel	£2.00
ITT Mains Filter .1/250v/	
CVC 20 to 45 chassis	50p
Pots 10 k with Switch	25p
Pots 47 k with Switch	25p
Mullard Surface Wave Filter RW 153P Colour TV Filter	40p
Mullard Surface Wave Filter RW 154 Colour TV Filter	40p
GH Line Scan P.C.B.	£1.00

SN76033	£1.50
SN76110N	£1
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00p
SN76228N	£1.00
SN76270	£1.00
SN76532N	50p
SN76544N	£2.00
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76650	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£1
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA640	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£5.00
TCA830	£1.00
TCEP100	£2.25
TCE120CQ	£1.00
TDA440Q	£1.00
TDA1003A	£1.00
TDA1010	£1.00
TDA1060A	£1.50
TDA1035T	£3.50
TDA1035S	£2.00
TDA1072	£1
TDA1151	30p
TDA1170	£1.00
TDA1190	£1.00
TDA1200	75p
TDA1327A	£1.00
TDA1365	£3.00
TDA1412	50p
TDA2003	80p
TDA2004	£2
TDA2010	£1.00
TDA2140	£3.50
TDA2030	£2.00
TDA2525	£1.00
TDA2640	£2.00
TDA2522	£1.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2571AQ	£2.50
TDA2575A	£1.00
TDA2581	£2.50
TDA2590	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£5.00
TDA26HA	£1.00
TDA2611AQ	£1.00
TDA2653	£4.00
TDA2002	£1.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3560	£4.00
TDA3571Q	£1.50
TDA3710	£3.50
TDA9403	£3.00
TDA3651AQ	£3
UPC1365	£3.00
TDA3300B	£6
SN74LS 125AN	30p
SN74LS 248	50p
SIL451f6	50p
SN1686ING	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
RGP30G	10p
MPSA14	10p
MPSA43	10p
MJ13005	30p
MJE15T	25p
MJE340	28p
MJE660	25p

TV Crystals

4MHz	
4.433-619	
6MHz	
8.867238	
Large or small	50p each
GEC Power Panel	
TV106 Thermistor	
PT34 New	£1.00

NEC 4730312	£3.00
Line Tran Tripler in Case	
Antistatic Isolators	
Disc Type	20p

MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	30p
Sanikron Diode	30p

Philips Cartridges

GP422 (4CH)	£6.00
GP412	£6.00
GP412/11	£6.00
GP406	£6.00

Transistors

A1222	15p
A1223	15p
AC106	15p
AC121	15p
AC124	15p
AC128	15p
AC137	15p
AC151	15p
AC131	15p
AC138	15p
AC152	15p
AC153K	15p
AC142K	15p
AC169	15p
AC176	15p
AC176K	15p
AC178K	15p
AC179	15p
AC186	15p
AC187K	15p
AC188	15p
AC188K	15p
ACY21	25p
AD143	50p
AD149	50p
AD161/162	pair 40p
AF17A	25p
AF139	25p
AF181	£1.00
AF239	25p
AF367	25p
AL102	£1.75
BC161	30p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p
BD646	50p
BD676A	30p
BD678	50p
BD681	25p
BD807	20p
BD826	50p
BD948	30p
BDX75	20p
BDX32	£1.25
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF257	20p
BF258	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF422	15p
BF423	15p
BF448	30p
BF450	20p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	20p
BF480	50p
BF594	10p
BF597	10p

I.C. Holders

DIL – DIL		DIL – QIL	
40 Pin × 4	£1.00	16 Pin × 10	£1.00
42 Pin × 5	£1.00	18 Pin × 10	£1.00
28 Pin × 5	80p	28 Pin × 4	£1.00
16 Pin × 10	70p	8 Pin × 10	50p
24 Pin × 5	75p	16 Pin GH	each 10p
14 Pin × 10	70p	AB Mains Switch	
18 Pin × 10	80p	u/v	30p