MAY 1986

Australia $2, New Zealand $2·50, Malaysia $5·75 £1·20

TELEVISION

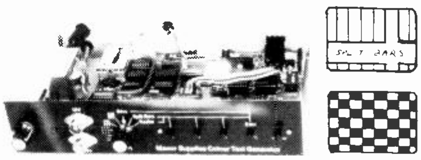
SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Servicing Sinclair Computers
Tuners and IF Arrangements
TV Fault Finding • DX-TV
VHF Sound Receiver
VCR Clinic • Trade News
Simple CRT Tester/booster

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE



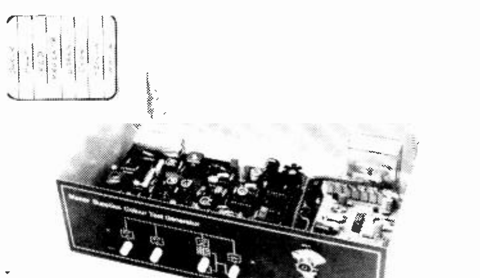
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ 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″) app.	**£8.60**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£108.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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

PAL COLOUR BAR GENERATOR (Mk4)



- ★ 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 £8.60. BATT HOLDERS £4.20. 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.

ADD VAT 15%

THORN TX9 MK2/3, TX10, teletext
Mullard Decorder panel + Interface **£35.00** p.p. £1.80
THORN TX10, PHILIPS G11 PRESTEL, TELETEXT
Mullard Units VM 6230, 6330 plus Line Coupler & Interface **£38.00** p.p. £2.50
EXTERNAL TELETEXT ADAPTOR
(RADOFIN) with cable remote control. Fully tested. **£150.00** p.p. £3.00.
SPECIAL OFFER (shop customers only).
SURPLUS 'AYR' TELETEXT EXTERNAL ADAPTOR UNITS.
Ideal for experimental use **£50.00.**

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

SPECIAL OFFER Mullard/Philips quality UHF modulator (audio & video input) ex new equipment **£5.00** p.p. £1.00.
PHILIPS G11 PANELS (tested).
Power, frame, IF, decoder **£18.00** each p.p. £2.00. Scan Panel **£28.00** p.p. £2.80.
PHILIPS G11 PANELS ex rental (untested).
Power, frame, IF, decoder **£10.00** each p.p. £2.00.
PHILIPS HANDSETS ex rental (untested) CTX, K4, K35 etc. Teletext + Video **£5.00** p.p. 80p.
THORN 9000 Fault Finding Guide **£1.00** p.p. 30p.
THORN REMOTE CONTROL HANDSETS
8800/9800 (2-button) **£10.00; TX9 ULTRASONIC** (3-button) **£15.00; TX9, TX10** Infra red **£18.00; TX9, TX10** Infra red Teletext **£20.00,** p.p. £1.20.
TX10 Remote & Tuning control panel (1515) **£9.40** p.p. £1.50
TX9/TX10 Teletext interface panel (1524) **£5.00** p.p. 80p.
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 **£6.50** p.p. £1.50
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. **£5.00** 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,** KT3 Tested **£30.00,** Untested **£5.00** p.p. £1.60
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 **£2.90,** 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 **£2.90.** De Luxe Case **£8.60** p.p. £1.80.
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, 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** p.p. 90p, 5 for **£4.00** p.p. £1.40.
GEC 2040 Decoder Panels, **£1.50** p.p. £1.80.
GEC 2110 PANELS Frame **£8.50** p.p. £1.40. Sound **£2.50** (tested) p.p. 80p.
GEC 20AX Line Time Base **£18.00.** IF-Decoder **£12.50** p.p. £2.00.
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. **£3.00** p.p. £1.80.
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 3000/3500 Power supply P.C.B. **£3.50** p.p. £1.00.
THORN 8000, 8500, 8800 IF Decoder Panels Tested **£10.00** p.p. £2.30.
THORN 8000/8500 IF/Decoder Panels salvaged **£3.20** p.p. £1.80.
THORN 9000 IF/Decoder Panels Salvaged. For spares **£2.50** p.p. £1.80.
THORN 9000 Frame Time Base **£8.50** p.p. £1.80.
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 (tested).
G11 PANELS, Power, Frame, IF, Decoder, **£18.00** each. p.p. £2.00 (tested).
GRUNDIG 8630 Series Varicap Tuners **£5.00** p.p. £1.00.
U321. 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 Z585, 710 **£3.80** p.p. £1.00.
VARICAP UHF-VHF ELC 2000S **£9.80** p.p. £1.00.
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, MURPHY 774 series	**£9.80**	**R.B.M.** T20, T22	**£9.80**
BUSH, MURPHY A816 series	**£9.80**	**R.B.M.** T20, T22 Bobbin	**£5.60**
FERG., HMV, MARCONI, ULTRA		**DECCA** Bradford (state Mod No)	**£8.80**
1500,1590,1591,1612,1613,1712	**£4.80**	**DECCA** 80, 100	**£8.80**
THORN 1600, 1615, 1690, 1691	**£9.15**	**FIDELITY** ZX2000, 3000	**£16.00**
GEC series 1 & 2	**£8.00**	**GEC** 2110 series	**£10.60**
INDESIT 20/24EGB	**£7.65**	**ITT** CVC 5 to 9, CVC20	**£9.80**
ITT/KB VC200, 300	**£7.90**	**ITT** CVC25, CVC30 series	**£8.80**
PHILIPS 170, 210, 300 series	**£7.65**	**ITT** CVC45	**£9.80**
PYE, INVICTA, EKCO.		**PYE** 691-697 (state model no)	**£10.00**
368, 169, 569, 769 series	**£7.65**	**PYE** 725 (90°) 731 to 741	**£9.20**
SPECIAL OFFER		**PHILIPS** G8	**£8.80**
DECCA 1700, 2001, 2020, 2401, 2420	**£3.80**	**PHILIPS** G9	**£9.80**
GEC 2114J/Junior Fineline	**£2.80**	**PHILIPS** KT3	**£9.80**
PHILIPS 320	**£2.80**	**THORN** 3000/3500 SCAN, EHT	**£6.90**
RBM A823	**£4.80**	**THORN** 8000, 8500, 8800	**£12.80**
GEC 2028, 2040, 2100	**£4.80**	**THORN** 9000 to 9600	**£12.90**
PYE 713, 715	**£6.80**	**THORN** 9800	**£19.80**
PHILIPS 570, 571	**£6.80**	**THORN** TX9	**£14.80**

OTHERS AVAILABLE, PRICES ON REQUEST.
TRIPLERS Full range available. Mono & Colour.
Special Offer: THORN 3000/3500 EHT Tripler **£2.50** p.p. £1.30.
THORN 8000 EHT TRAY (2 lead) **£2.80** p.p. £1.00
6·3V CRT Boost Transformers for Colour & Mono **£5.90** p.p. £1.40.
THORN TX10 focus control **£8.80** p.p. 80p.

CALLERS WELCOME AT SHOP PREMISES
THOUSANDS OF ADDITIONAL ITEMS, ENQUIRIES INVITED
LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS

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

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PLEASE ADD VAT 15% TO ALL PRICES INCL P+P

TELEVISION

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

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An annual subscription costs £14 in the UK, £17 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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Send orders for binders (£4·50) and indexes (75p) to the Editorial Office, Television, IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS. Prices include VAT and postage. Add 60p for overseas orders.

BACK NUMBERS
Some back issues published during the last six months are available from the Editorial Office at £1·40 inclusive of postage and packing. Address as above.

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 JUNE WILL BE PUBLISHED ON MAY 21

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3600 DECCA 100 7.95
3601 DECCA 110 9.80
3604 DECCA 1730/1830 8.50
3599 DECCA 80 7.22
3727 DECCA MS1700-2420 10.13
3729 FIDELITY FTV12/TVR120 5.50
5529 FIDELITY ZX3000 22" 13.95
3808 FIDELITY ZX2000/3000 13.95
3731 GEC 2100/2040 5.58
3732 GEC 2114 9.72
3734 GEC 3133 3.00
3733 GEC M1201/M1501H 12.00
3614 GRUNGIG 5010/6010ETC 12.95
3755 INDESIT 24EGB 11.25
3617 ITT CVC30 7.95
3619 ITT CVC45 9.75
3615 ITT CVC5-8 10.25
3620 KORTING A21100 90° HYBRID 14.95
4508 PHILIPS E2 CHASS 10.00
2861 PHILIPS G8 7.00
2862 PHILIPS G9 9.95
5305 PYE 691 WIRED 5.00
3628 PYE 725 90° 9.25
3629 PYE 731 110° 8.95
3632 RANK A823 5.50
3634 RANK T16A 8.95
3636 RANK T20A 12.95
3726 RANK T26A 15.50
3637 RANK Z179 11.95
3639 RANK Z718 22" 21.75
3770 REDIFUSION MK1 CHAS 9.38
3771 REDIFUSION MK3 CHAS 12.00
3775 SANYO CTP5101 15.50
3643 THORN 1400 SERIES 5.95
3644 THORN 1500 20" 5.95
3645 THORN 1500 24" 5.95
3646 THORN 1590 SERIES 10.85
3647 THORN 1600 SERIES 10.85
3648 THORN 1615 SERIES 10.94
3649 THORN 1690/91 SERIES 10.42
3713 THORN 1790 8.95
3714 THORN 3787 15.23
3652 THORN 3K 3K5 EHT TX 8.95
3651 THORN 3K 3K5 8.56
6172 PHILIPS G8 SPECIAL 7.85
2868 PHILIPS KT3 10.95

EHT TRAYS

5400 BG1895-641 7.50
5403 BG1897-642 7.50
5404 BG2097-642/333 7.50
3663 DECCA 100 7.25
3665 DECCA 1830 3.00
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3667 GEC 1028/CS108 3.50
3677 ITT CVC45 7.95
3675 ITT CVC5/9 3.50
3678 KORTING HYBRID 7.95
3683 PHILIPS 550 G8 6.50
3681 PHILIPS 570 (5 LEAD) 9.00
3684 PHILIPS G9 4.00
3685 PHILIPS KT3 9.95
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3688 PYE 725/731/741 6.95
5395 SEIMANS TVK186/5 8.50
5393 SEIMANS TVK52 8.50
4696 SEIMENS TVK196/17 11.95
5406 TCE 1400 LARGE SCRN 4.95
3696 TCE 1500 17"-19" 5.65
3697 TCE 1500 23"&24" 4.95
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3700 TCE 4000 4.50
3703 TCE 9000 7.85
3699 TCE3000/3500 7.75
3706 TV11 EHT STICK 2.95
3709 TV20 EHT STICK 0.95
5275 TV45 EHT STICK 2.45
3705 UNIVERSAL EHT TRAY U.K. 4.95

TV ELECTROLYTICS

3547 DECCA 10/30 400X2/350V 2.90
3549 DECCA 100 400+800 350/250V 2.90
3548 DECCA 80/100CHAS 100/400V 2.90
5304 FIDELITY ZX2000 330 385V 3.98
5303 FIDELITY ZX3000 220 385V 3.98
3557 ITT CVC20/RRI T20 220/400 1.20
3556 ITT CVC5/9 200X2+25+75ETC 2.60
3560 PHILIPS G11 470UF/250V 1.85
3559 PHILIPS G9 2200/63V 1.55
3561 PHILIPS KT3 200+25X2/385V 1.95
3554 PHILIPS G8/GEC 2110 600/300V 1.90
3558 PHILIPS G9/PYE 731 600/300 PC 3.16
3565 PYE 725/731 800/250V 1.90
3564 PYE 691/697 200+300/350V 2.00
3576 RRI AB23 2500X2/25V 1.48
3588 TCE 3000/3500 1000/70V 0.89
3585 TCE1500 150X2+100/300V 1.90
3587 TCE3000 200+100X2/350V 2.86

MIXED DIALECTRIC CAPACITORS

4270 0.01 600V X5 0.75
4272 0.022 1KV X5 1.40
4273 0.033 1KV 1.40
4274 0.047 600V X5 0.85
4275 0.047 1KV X5 1.80
4276 0.1 600V X5 1.20
4277 0.1 1KV X5 1.90
4278 0.1 1250V X5 0.44
4279 0.1 2KV X1 0.75
4280 0.22 600V X5 1.45
4281 0.22 1KV X1 0.74
4282 0.47 1KV X1 1.82
4283 4700PF 1.5KV X5 1.50
4271 0.01 1KV X5 1.60

SLIDE CONTROLS

4883 100K LIN STD TV 0.55
4884 150K LIN STD TV 0.55
4874 1K LIN STD TV 0.55
4880 22K LIN STD TV 0.55
4881 22K LOG STD TV 0.55
4875 3K3 SEMI LOG STD 0.55
4885 470K LOG STD TV 0.55
4720 470R LG STD 0.99
4719 470R LM STD TV 0.99
4876 4K7 LIN STD TV 0.55
4877 4K7 LOG STD TV 0.55

PRESETS

STANDARD RANGES
VERTICAL STANDARD X 5 0.60
HORIZONTAL STANDARD X 5 0.60
VERTICAL MINI X 5 0.60
HORIXONTAL MINI X 5 0.60

TUNER UNITS

4662 DECCA 30 SERIES MECHANICAL 4.95
4664 ELC 1043/05 EXCH TUNER 6.00
4663 ELC 1043/05 NEW TUNER 8.25
4666 ELC 1043/06 EXCH TUNER 6.00
4665 ELC 1043/06 NEW TUNER 8.25
4972 ELC 2003 EXCH TUNER 12.50
5534 GEC 2100 TYPE REPAIR CHGE 10.25
4675 PHILIPS G8 EXCHANGE TUNER 7.25
4679 RRI RANGERI/2 EXCH TUNER 8.75
4680 RRI 720 NEW TUNER 10.25
4678 RRI RANGER2/3 NEW TUNER 11.25
4668 U321 EXCH TUNER 6.50
4667 U321 TUNER NEW 7.95
4670 U322 EXCHANGE TUNER 6.50
4669 U322 NEW TUNER 7.95
4673 U341 EXCHANGE TUNER 7.25

VALVES

3883 DY802 VALVE 0.89
3932 PCF802 VALVE 0.95
3938 PCL805 1.08
3935 PCL82 VALVE 0.95
3936 PCL84 VALVE 0.85
3937 PCL86 VALVE 0.95
3940 PFL200 VALVE 1.20
3943 PL504 VALVE 1.40
3944 PL508 VALVE 2.06
3945 PL509 VALVE 5.95
3946 PL519 5.95
4870 PL802 VALVE 4.95
3950 PY500A VALVE 2.25
3951 PY801 VALVE 0.95

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2897 T1590 MAINS TRANSFORMER 9.80
2920 TX10 FOCUS UNIT 7.54
4590 T1600 MAINS TX 7.92
5430 T1600 MAINS TRANSFORMER 9.80
4973 T1690 SLOW MOT. TUN. POT 3.99
2906 T3000/3500 A1 SWITCH 1.15
2904 T3000/3500 MAINS TX 5.00
2908 T3000/3500 METAL CUT OUT 2.34
4587 T3500 100R CONVERG POT 0.85
3277 T3500 200R CONVERG POT 0.56
3278 T3500 500R CONVERG POT 0.56
4585 T3500 50R CONVERG POT 0.65
2905 T3500 5MEG A1 POT 1.17
4589 T3500 SPARK GAP ,1/1500 0.51
2907 T3500 THICK FILM VID LOAD 1.40
4563 T38000 MAINS ON/OFF SW. 3.10
4412 T4000 FOCUS CONTROL UNIT 7.80
3273 T6818 220K BRIGHT CTRL 2.18
2909 T8500 FOCUS CONTROL UNIT 2.56
2911 T8500 MAINS CHOKE 17.45
4415 T8500 MAINS TX 12.75
2910 T8500 PLASTIC CUT OUT 3.72
2918 T9000 FOCUS UNIT 3.95
4556 T9000 FR1 THICK FILM 1.65
2919 T9000 OVER VOLT THICK FILM 3.95
4555 T9000 T701 CHOPPER TX. 13.75
4982 T9600 0.33 2KV CAP 2.35
2914 T9600 CHOPPER TX T512 17.65
2916 T9600 FOCUS UNIT 2.95
2913 T9600 SWITCH MODE TX T511 9.98
2917 T9800 FOCUS UNIT 5.93
4429 T9800 MAINS CHOKE 0.80
4437 TX10 .0022 2KV 0.27
4658 TX10 100K TUNING POT 0.64
2938 TX10 CHOPPER DRIVER TX 3.27
5427 TX10 SW NONREM CONT. 2.32
2922 TX10 TUNER DRAWER ASSY 1.95
4859 TX9 4" RND 15R SPEAKER 3.56
2937 TX9 INPUT CHOKE L65 12.05
2936 TX9 L64 BILIFAR CHOKE 4.25

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4616 DECCA 100 0.01 2KV CAP 0.98
2933 DECCA 100 BEDIGE TX 2.65
2932 DECCA 100 FOCUS CONTROL 2.65
4615 DECCA 100 LINE DRIVE TX 2.25
2928 DECCA 10SER 470K SH+VOL 2.15
4603 DECCA 2230 10R FUSIBLE 0.65
2930 DECCA 2233 PSH PSH SH 5.14
2931 DECCA 2263 PSH PSH SH 4.20
2926 DECCA 30 SER 3R9 RESIS. 0.50
2924 DECCA 30 SER MAINS TX 11.18
2929 DECCA 30 SER 47K SH+VOL 2.43
2939 DECCA 80 470R SH+VOL 2.45

RESISTORS

CARBON
STANDARD RANGES
1/4 WATT X 10 0.29
1/2 WATT X 10 0.29
1 WATT X 10 0.45
2 WATT X 10 0.80
SAFETY CERAMIC
STANDARD RANGES
5 WATT X 5 0.70
7 WATT X 5 0.80
11 WATT X 5 0.95
17 WATT X 5 1.15

OTHER RESISTORS

3279 2M2 H/V FOCUS RESISTOR 0.43
3280 22M H/V FOCUS RESISTOR 1.50
3281 33M H/V FOCUS RESISTOR 1.50
3282 47M H/V FOCUS RESISTOR 1.50
3283 56M H/V FOCUS RESISTOR 1.50

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3025 MAINS DROPPER RANK A640 1.20
3013 MAINS DROPPER DECCA 80/100 1.68
3016 MAINS DROPPER GEC 2010 0.98
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3030 MAINS DROPPER THORN 1600 1.45
4910 MAINS DROPPER DECCA 100 2R5 0.82
3034 MAINS DROPPER THORN 9800 1.48
3027 MAINS DROPPER THORN 1400 1.45
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3028 MAINS DROPPER THORN 1300 1.80
3029 MAINS DROPPER THORN 1500 1.63
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3022 MAINS DROPPER PYE 725/731 1.40
3017 MAINS DROPPER PHILIPS 210 0.98
3019 MAINS DROPPER PHILIPS G8 47R 0.48
3033 MAINS DROPPER THORN 8500/8800 0.98
5385 MAINS DROPPER DECCA 80 2.97
5386 MAINS DROPPER DECCA 100 1.80
5533 PYE CT200 PHILIPS 579 DROPPER 3.45

UNIVERSAL CONVERGENCE POTS

5R, 10R, 22R, 20R, 25R, 50R, 75R, 100R, 200R, 250R, 500R 0.48

FIDELITY SPARES

2940 CHOPPER TX FIDELITY CTV14R 4.58
2942 DRIVER TX FIDELITY CTV14R 2.25
2941 FOCUS UNIT FIDELITY CTV14R 8.50
5408 MAINS INPUT CHOKE ZX2000 3.45
5504 MAINS FILTER TX CTV14R 2.95
5505 DRIVER TX ZX3000 404387 2.95
6162 ON/OFF SH FIDELITY CTV14R 3.85
6163 ON/OFF SH FIDELITY CTV14S 1.85

GEC SPARES

2965 GEC 1401 CHOPPER TX 16.56
2964 GEC 1401 INPUT CHOKE 9.63
5531 GEC 1501 MAINS TX 5.25
4758 GEC 2100 3R FUSIBLE RES 1.45
4759 GEC 2110 SH2 2KV CAPS 2.39
4760 GEC 2100 ETC FOCUS VDR 1.60
2959 GEC 2100 THERMAL CUT OUT 0.97
2962 GEC 2110 10K CONTRAST CTRL 3.95
2961 GEC 2110 1K BRIGHT CTRL 2.25
4760 GEC 2110 FOCUS CONTROL 5.98
4771 GEC 2110 LUM. DELAY LINE 1.83
4728 GEC 2110 MAINS CHOKE 7.85
4996 GEC 2110 NEONS 0.20
4751 GEC 2114 VOL+SWITCH CONT 1.98
4656 GEC 22K MULTI TURN POT 0.64

GRUNDIG SPARES

2949 GRUNDIG 5010 FOCUS VDR 3.25
4633 GRUNDIG 5010 CONTROL TX 4.76
2948 GRUNDIG 5010 FOCUS UNIT 3.75
4865 GRUNDIG 5010 L515 CHOKE 1.63
4744 GRUNDIG 5010/6010 LID 2.62
4745 GRUNDIG 5011 LID 2.59
4637 GRUNDIG 5011 SH+SLIDERS 11.69
2952 GRUNDIG 6010 MIXIE MOD 22.50
4630 GRUNDIG 6011 MAINS SH 3.00
4631 GRUNDIG 6110 MAINS SH 4.86
2947 GRUNDIG A6400 MAINS SH 4.95

REMOTE CONTROL UNITS

PLEASE STATE MODEL NUMBER
4311 DECCA 100 NONTEXT RCU 20.78
4314 DECCA 100 (TEST+PREST) RCU 20.78
4310 DECCA 80/100 SERIES RCU 19.20
4315 DECCA 90/100 N/TXT RCU 20.78
4324 GEC 2 FUNCTION RCU 18.45
4325 GEC C2057H/2067H RCU 19.20
4326 GEC TELEMASTER 12 RCU 20.03
4327 GEC TELEMASTER 16 RCU 20.03
4328 GEC TELEMASTER 8 RCU 22.13
4332 GRUNDIG TELEPILOT 12 RCU 26.25
4333 GRUNDIG TELEPILOT 16 RCU 25.85
2955 GRUNDIG TELEPILOT 7 29.95
4334 GRUNDIG TELEPILOT 8 RCU 20.03
4357 KORTING 12 CHANNEL RCU 22.13
4358 KORTING 16 CHANNEL RCU 22.50
4380 PHILIPS G11 NONTEXT RCU 19.20
4378 PHILIPS G11 T/TEXT 8CH RCU 20.78
5409 PHILIPS G11 T/TEXT U/SONIC 24.50
5453 PHILIPS KT3 REMOTE RC4001 16.00
4379 PHILIPS/PYE G11 2 FUNC RCU 18.90
4359 PHILIPS/PYE KT3/KT30 16.13
4385 RBM 16CH NONTEXT RCU 19.20
4386 RBM 8CH NONTEXT RCU 19.20
4387 RBM TEXT&V/DATA RCU 20.78
2980 REMOTE CTRL UNIT PHILIPS G9 8.97
4389 TCE 9000CHAS 2 FUNC RCU 20.24
4398 TCE TX10(9653)+TEXT RCU 20.78
4400 TCE TX10(9670)+PREST RCU 20.78
4397 TCE TX9/TX10 19.20

PUSH BUTTON UNITS

2870 4 WAY DECCA ETC 7.50
2871 6 WAY DECCA 9.40
2873 4 WAY HITACHI ETC 8.94
2875 4 WAY PYE/TCE 10.87
2877 6 WAY GEC 2110 11.25
2878 7 WAY GEC 2112 12.95
2879 6 WAY T3500 2.75
2880 6 WAY PYE 713 15.30
2881 6 WAY T9000 3.95
2882 4 WAY BUSH A823 10.65
2884 6 WAY MOD CVC9 12.85
2885 6 WAY 520 PHILIPS 16.46
2886 6 WAY PHILIPS 550 14.98
2887 T1P SWITCH UNIT PHILIPS G11 24.95
2888 6 WAY PHILIPS G11 6.95
2889 PIANO KEY MOD DECCA 2631 22.48
4935 7 WAY ITT CVC5 12.90
5278 GEC 2136 TAPERED 10.95
5279 ITT 6 WAY +VCR 10.70
5280 6 WAY BUSH T20 11.50

ITT SPARES

2972 ITT CP340 PB ASSY 31.50
4501 ITT CP340 SLIDER ASSY 7.50
4683 ITT CV40 FOCUS UNIT 1.95
5543 ITT CVC20 LINE DRIVE TX 3.05
4571 ITT CVC20 MAINS SWITCH 1.36
4787 ITT CVC25 6N2 2KV CAP 1.35
4786 ITT CVC25 8N2 2KV CAPS 2.15
2970 ITT CVC25 BRIDGE COIL 3.95
4789 ITT CVC25 E/W LOAD COIL 1.92
4567 ITT CVC25/30 MAINS SW. 6.89
2969 ITT CVC32 DRIVER TX 2.55
4568 ITT CVC32 REMOTE MAIN SH 6.84
2971 ITT CVC32 SH MODE TX 6.35
4795 ITT CVC45 ON/OFF SWITCH 2.69
3286 ITT CVC5 1MFD 250V CAP 0.40
4569 ITT CVC5 MAINS SWITCH 2.83
4781 ITT CVC5 SHIFT POT 25R 1.82
4780 ITT CVC5 SLIDER BANK 7.41
2967 ITT CVC5-9 MAINS TX 8.48
4570 ITT CVC9 MAINS SWITCH 5.61

FUSES

STANDARD RANGES
20MM Q/B FUSE X 10 0.50
20MM A/S FUSE X 10
63MA - 160MA 1.00
200MA - 5A 1.20
1.25" Q/B FUSE X10
250MA - 800MA 0.95
1A - 5A 0.70
1.25" A/S FUSE X 10
250MA - 2A 1.50
2.5A - 5A 2.30
PLUG TO P FUSE X 10
2, 3, 5, 7, 10, 13A 0.95

SERVICE MANUALS

5011 DECCA 101/100 6.00
5047 DECCA 80 CHASIS 4.50
5442 DECCA/TATUNG 120 7.80
5022 GEC C2055H-C2255H 6.80
5023 GEC C2065H-C2265H 4.95
5026 GEC C2110-C2149 6.80
5068 HITACHI CPT2024 3.00
5074 HITACHI CPT2234 3.00
5094 ITT CVC20 2.00
5095 ITT CVC25+30 9.80
5096 ITT CVC40 5.00
5097 ITT CVC45/1 4.75
5513 ITT CVC800/801 3.00
5093 ITT CVC9 4.00
5123 MITSUBISHI CT2008 1.50
5627 PANASONIC TC2205 4.00
5116 PANASONIC TX2234 3.00
5127 PHILIPS G11 CHASSIS 4.00
5126 PHILIPS G8 CHASSIS 6.00
4515 PHILIPS KT3 SERV. 5.00
5135 PHILIPS T8-E 1.00
5136 PHILIPS TX 2.00
5143 PYE 725 731 SER 4.00
5145 REDIFFUSION MK1 3.00
5146 REDIFFUSION MK3 9.90
5147 REDIFFUSION MK4 4.00
5148 REDIFFUSION MK5 3.00
5167 THORN 1500 1.50
5168 THORN 1600 1.50
5171 THORN 1615 3.00
5172 THORN 1690-1691 3.00
5184 THORN 38030 2.00
5187 THORN 3V01 12.00
5188 THORN 3V16 12.00
5178 THORN 9000 6.00
5182 THORN 9800 10.80

RANK RADIO SPARES

4650 RRI T20 SPEAKER 2.36
5524 RRI T24E ON/OFF + VOL SH 2.35
4842 RRI 1122 SH+VOL 22K PULL 3.10
4843 RRI A823 100K TUNER POT 1.78
4847 RRI A823 FOCUS ASSEMBLY 6.83
2998 RRI A823 PLASTIC CAM 0.46
5300 RRI A823ETC RING SPK GAP 0.55
4988 RRI T20 (TYPE) FOCUS ASY 0.60
3001 RRI T20 3K3 SH+VOL CTRL 2.67
4852 RRI T20 9N1 2KV CAP. 1.98
4853 RRI T20 CONTRAST+AFC POT 3.23
3003 RRI T20 E/W CORR. COIL 3.41
3000 RRI T20 FOCUS ASSY 4.95
3004 RRI T20 SH MODE TX 11.20
4849 RRI 2718 3K3 SH+VOLUME 3.15

PHILIPS PYE SPARES

4969 PHILIPS 128711 4K7 VOL+SH 3.23
3288 PHILIPS 300 470L VOL+SWITCH 2.87
4449 PHILIPS 570/713 IF MODULE 7.00
5425 PHILIPS CTX-S EHT LEAD 0.95
5418 PHILIPS CTX-S FOCUS UNIT 4.04
4655 PHILIPS G11 100K TUNER POT 0.64
2983 PHILIPS G11 CVC32 B/COIL 2.31
2984 PHILIPS G11 E/W CORR COIL 1.92
2985 PHILIPS G11 FILTER COIL 8.89
2986 PHILIPS G11 FOCUS UNIT 8.48
2987 PHILIPS G11 G2 CONTROL ASSY 7.98
4575 PHILIPS G11 RNO SHAFT SH. 2.32
4576 PHILIPS G11 SQ SHAFT SWITCH 2.32
4645 PHILIPS G11 TDA2600 HOLDER 0.65
5284 PHILIPS G8 100K TUN P/SET 0.84
2977 PHILIPS G8 10K COLOUR CTRL 0.98
4525 PHILIPS G8 10K CON POT (550) 0.87
4524 PHILIPS G8 15R CON POT (550) 1.07
2975 PHILIPS G8 2K2 BRIGHT CONTL 0.85
4526 PHILIPS G8 2H A1 POT (550) 3.80
4522 PHILIPS G8 5N1 1500V CAP. 1.88
4523 PHILIPS G8 5R CONV POT (550) 0.64
4858 PHILIPS G8 6×4" 70R SPKR 5.98
2979 PHILIPS G8 EQUALIS. COIL 2.25
4503 PHILIPS G8 METAL SH 1.72
2978 PHILIPS G8 RED/GRW SYM COIL 3.33
4504 PHILIPS G8/G11 NON REM SH 1.72
5307 PHILIPS K12 THICK FILM UNIT 12.96
4649 PHILIPS KT3 4X4 SPEAKER 2.85
4566 PHILIPS KT3 MAINS SWITCH 8.60
4907 PHILIPS KT4 THICK FILM UNIT 10.29
4564 PHILIPS T173 MAINS SWITCH 3.45
4648 PHILIPS G11 6X4 SPEAKER 2.85
2992 PYE 169 LINE OSC COIL 3.45
4839 PYE 731 3R3 50W RESISTOR 1.29
4535 PYE 731 47K VOL. SWITCH 3.11
2992 PYE 731 FOCUS UNIT 4.05
5545 PYE 731 L/H 3X 100K PSET 3.20
5546 PYE 731 R/H 3X 100K PSET 3.20
2994 PYE 731 THICK FILM ASSY 1.55
4938 PYE KT2 FOCUS UNIT 2.85
4864 PYE T194/6 SPEAKER 5.05
5556 PHILIPS G11 SHORT SHAFT SH 1.98

THORN VIDEO SPARES (OVER 450 PARTS)

QUOTE THORN PART NUMBER IF POSSIBLE
5561 T3292 BOOSTER 44.62
5562 T3292 CAPSTAN BELT 3.48
5563 T3292 CAPSTAN MOTOR 51.16
5568 T3292 CASSETTE LAMP 1.62
5569 T3292 COUNTER BELT1 0.60
5571 T3292 COUNTER BELT2 0.60
5575 T3292 DRUM MOTOR 47.70
5577 T3292 F/F IDLER 2.02
5582 T3292 GUIDE ROLL ASSY 11.40
5585 T3292 LOWER DRUM ASY 80.48
5587 T3292 PINCH ROLL ASSY 9.84
5591 T3292 REWIND IDLER ASSY 7.84
5592 T3292 REWIND RUBBER TYRE 0.60
5621 T3292 UNLOADING BELT 0.60
5622 T3292 UNLOADING IDL ASSY 6.43
5624 T3292 UPP/DRUM KIT+MOD 35.94
5629 T3V00 CAPS. MOTOR BELT 0.60
5635 T3V00 COUNTER BELT 1 0.60
5637 T3V00 DRUM MOTOR 49.38
5646 T3V00 PINCH ROLLER ASSY. 7.31
5648 T3V00 RECORDING LAMP 2.00
5650 T3V00 SERVICE MANUAL 17.51
5655 T3V00 T/U IDLER ASSY 5.58
5657 T3V00 UPPER DRUM+MOD KIT 35.94
5663 T3V16 PINCH ROLLER ASSY 7.31
5666 T3V00 CAPSTAN MOTOR 51.16
5688 T3V00 TENSION BAND 1.86
5689 T3V00 TIMING GEAR 4.12
5692 T3V00 UNLOADING IDLER ASSY 6.43
5710 T3V01 TENSION BAND 1.86
5716 T3V16 CAPSTAN BENT 3.48
5720 T3V16 CASSETTE LAMP 1.62
5721 T3V16 CHANGE GEAR 0.86
5726 T3V16 DIODE STACK 3.41
5727 T3V16 DRIVE ARM ASSY 4.50
5750 T3V16 SERVICE MANUAL 26.24
5758 T3V16 T/U IDLER ASSY 5.58
5759 T3V16 T/U IDLER ASSY (LA) 7.55
5765 T3V16 UNLOADING IDLER 6.43
5772 T3V22 CAPSTAN MOTOR 51.16
5773 T3V22 CAPSTAN MOTOR BAND 0.60
5774 T3V22 CAPSTAN BELT 3.48
5790 T3V22 F/F IDLER 1.74
5803 T3V22 GUIDE ROLLER ASSY 8.39
5807 T3V22 MICRO SWITCH 4.25
5809 T3V22 PINCH ROLLER ASSY 7.31
5814 T3V22 REWIND IDLER ASSY 7.84
5822 T3V22 SUPP SPOOL CARRIER 4.88
5824 T3V22 TAKE UP IDLER SMALL 5.58
5825 T3V22 TAKE UP IDLER LARGE 7.55
5828 T3V22 TENSION BAND 1.86
5834 T3V22 UPPER DRUM ASSY 35.94
5840 T3V23 BOOSTER 24.71
5844 T3V23 CAPSTAN MOTOR 55.83
5852 T3V23 CONNECT GEAR ASSY 6.56
5856 T3V23 GUIDE ROLLER TYRE 0.60
5862 T3V23 PINCH ROLLER ARM AS 4.10
5868 T3V23 REEL IDLER ASSY 2.47
5869 T3V23 REEL MOTOR ASSY 32.81
5879 T3V23 T/U REEL DISK ASSY 5.17
5880 T3V23 TAKE UP REEL ASSY 2.58
5882 T3V23 UPPER DRUM ASSY 35.94
5885 T3V23 WORM GEAR SPINDLE 5.95
5886 T3V23 WORM GEAR SPROCKET 1.63
5888 T3V24 BRAKE SHOE 0.60
5896 T3V24 CASSETTE LAMP 1.62
5899 T3V24 DEW SENSOR ASSY 9.05
5902 T3V24 F/ERASE HEAD ASSY 10.41
5908 T3V24 LOADING GEAR ASSY 28.91
5909 T3V24 LOADING MOTOR 8.57
5912 T3V24 PINCH RLR LVR ASSY 0.62
5920 T3V24 SERVICE MANUAL 28.50
5945 T3V29/30 BOOSTER 24.71
5946 T3V29/30 BRAKE SHOE 0.67
5951 T3V29/30 CAPSTAN BELT 1.74
5952 T3V29/30 CAPSTAN MOTOR ASSY 27.32
5957 T3V29/30 CASSETTE LAMP 1.48
5962 T3V29/30 EJECT LCK ARM 0.60
5974 T3V29/30 LOADING MOTOR 0.60
5976 T3V29/30 LOHR DRUM ASSY 78.72
5980 T3V29/30 PINCH RLLR ASSY 8.66
5981 T3V29/30 PINCH RLLR SLND 8.26
5985 T3V29/30 REEL MTR ASSY 34.66
5990 T3V29 SERVICE MANUAL 25.85
5991 T3V30 SERVICE MANUAL 15.75
5998 T3V29/30 TAKE UP CLUTCH 0.60
5999 T3V29/30 T/U CLUTCH ASSY 2.36
6001 T3V29/30 T/U LDG RING ASSY 2.73
6003 T3V29/30 T/U SPL IDLER 2.25
6012 T3V31 BOOSTER 32.37
6016 T3V31 CAPSTAN BELT 1.74
6017 T3V31 CASSETTE LAMP 1.71
6027 T3V31 LOADING GEAR ASSY 6.60
6028 T3V31 LONG TRIMMING TOOL 0.93
6030 T3V31 PINCH ROLLER ASSY 8.66
6033 T3V31 SERVICE MANUAL 27.31
6034 T3V31 SERVO TEST JIG 49.94
6038 T3V31 TAKE UP CLUTCH ASSY 2.36
6039 T3V31 T/U LOAD/RING ASSY 2.73
6042 T3V31 UPPER DRUM ASSY 35.49
6044 T3V32 BOOSTER 32.37
6048 T3V32 CAPSTAN BELT 1.74
6053 T3V32 CASS MOTOR ASSY 9.45
6066 T3V32 LOADING GEAR ASSY 6.60
6068 T3V32 PINCH ROLLER ASSY 8.66
6071 T3V32 SERVICE MANUAL 18.50
6072 T3V32 SUPP/LDG RING ASSY 2.58
6081 T3V32 UPPER DRUM ASSY 35.94
6085 T3V35/6 BRAKE PAD X2 0.67
6086 T3V35/6 BRAKE SHOE 0.67
6087 T3V35/6 BRUSH ASSY 2.07
6090 T3V35/6 CAPSTAN MOTOR 23.91
6091 T3V35/6 CASSETTE MOTOR 6.93
6103 T3V35/6 PINCH ROLLER 9.84
6105 T3V35 REMOTE CONTROL 19.43
6107 T3V35/6 SERVICE MANUAL 27.00
6117 T3V35/6 TENSION BRAKE 0.60
6118 T3V35/6 UPPER DRUM ASSY 35.94
6119 T3V40 SERVICE MANUAL 12.00
6158 T3V29/30 UPPER ORM ASSY 35.94

SONY VIDEO

6133 SONY 8000UB FORWARD BELT 1.20
6136 SONY C6UB THREADING BELT 1.20
6138 SONY C6UB CAPSTAN BELT 1.77
6145 SONY C7UB BRAKE ASSEMBLY 1.77
6150 SONY C5UB CAPSTAN MOTOR 38.75
6152 SONY C6UB MK2 REEL MTR 23.00
6154 SONY C7 DC MTR (BHF/1100) 38.75
6155 SONY C7UB REMOTE CONTROL 43.75
6156 SONY C5UB REMOTE CONTROL 20.63
6157 SONY C6UB REMOTE CONTROL 18.13
4953 SONY C5/7 REWIND KIT 5.40
4954 SONY C6 REWIND KIT 5.40
4948 SONY SL-7/SL-T7 BELT KIT 4.00
4944 SONY SLC7/SLJ7 BELT KIT 5.50
4949 SONY SLT 9ME/J9 BELT KIT 4.50

GEC

6173 V4000H UPPER CYLINDER 34.66
6174 V4000H RELAY 2.81
6175 V4000H PINCH ROLLER 0.00
6178 V4000H CAPSTAN MOTOR 32.63
6181 V4000H TAPE SENSOR LAMP 0.68
6185 V4001H PINCH ROLLER 0.00
6192 V4002H UPPER CYLINDER 34.66
6204 V4004 CLUTCH ASSY 9.51
6212 V4100 AUDIO CONTROL 28.13
6253 V4000H SERVICE MANUAL 7.08
6254 V4001H SERVICE MANUAL 7.08
6255 V4002H SERVICE MANUAL 9.45
6256 V4004 SERVICE MANUAL 7.85
6257 V4100 SERVICE MANUAL 7.08

HITACHI VIDEO SPARES

6214 8000 UPPER CYLINDER 38.99
6218 8000 AUDIO CONTROL 20.33
6220 8000 F/FWD REWIND ASSY 0.59
6224 9300E RELAY 2.81
6230 9300E TAPE SENSOR LAMP 0.95
6231 9300E TUNER 15.53
6240 VT33E UPPER CYLINDER 38.99
6244 VT33E CAPSTAN MOTOR 23.63
6249 VT11E F/FWD REWIND ARM 3.26
6252 VT11E CAPSTAN MOTOR 23.63

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6259 BETA – B VIDEO HEAD 40.50
6265 VHS – A VIDEO HEAD 32.50
6266 VHS – B VIDEO HEAD 32.50
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6275 PHILIPS H1700/2 VIDEO HEAD 51.00
6276 PHILIPS 2020/2 VIDEO HEAD 53.77
6277 PHILIPS 2030 VIDEO HEAD 53.90

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4999 ANTEX BIT 1/8" DIAMETER 1.45
5000 ANTEX BIT 3/16" DIAMETER 1.45
4452 ATTENUATOR 12DB 1.46
4469 ATTENUATOR 18DB 1.55
4451 ATTENUATOR 6DB 1.46
5419 COLOUR CRYSTAL 8.86MHz 0.60
4659 HEAT SINK COMPOUND 1.08
5001 QUICK TEST MAINS CONN. 6.99
4700 SERVISOL FOAM CLEANER 0.95
4453 SERVISOL FREEZE-IT 1.13
4724 SERVISOL SW CLEANER 0.98
4516 SERVISOL VIDEO HEAD CLEANER 0.85
4976 SOLDER 0.5 KILO REEL 7.02
4466 SUPER WICK 2MMX1.6M 0.75
4970 TV LOOP AERIAL 0.55
4998 WELLER INST. HEAT GUN TIP 0.59

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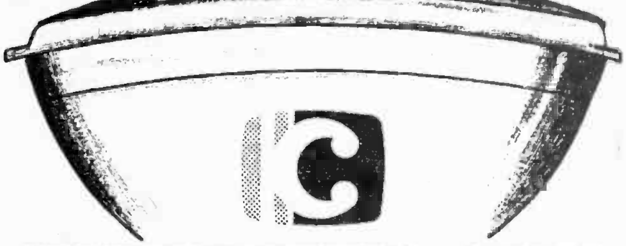

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510 VSB	£60
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560 DYB-560 DTB	£62
560 EGB	£62
560 CGB	£62
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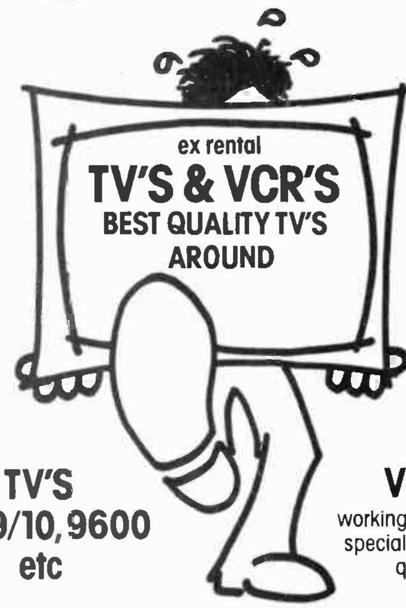

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1 × B.T. Approved SECONDARY SOCKET	£1.95
1 × LINE JACK CORD with PLUG	£1.25
	£6.05
THE WHOLE PACKAGE FOR + VAT	**£4.95**

1 KIT available with any order of £10.00 and over.

SERVICE AIDS

Switch Cleaner	1.24
Circuit Freezer	1.40
Foam Cleanser	1.22
Aero Klene	1.14
Plastic Seal	1.34
Excel Polish	1.16
Antistat Spray	1.24
Aero Duster	1.48
Super 40	1.86
Video Head Cleaner	1.10
Fire Extinguisher	3.28
Silicone Grease Aero	1.50
Ditto Tube	1.66
Heat Sink Compound	1.10
Solda Mop 0.12mm	0.74
Ditto 0.06mm	0.76
Industrial Reel 0.12mm length 10m	£2.90

VOLTAGE REGULATORS

78L05/08/12/15	0.30
7805/08/12/15/18/24	0.45
7905/12/15/18/24	0.50
LMC17K	2.40
LMC17T	1.25
LM723	0.65

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	67.95
XS25 W Iron kit/complete with steel & plug attached	10.00
CS 18W, as above	9.90
Antex 15W iron	5.25
Antex 18W iron	5.50
Antex 25W Iron	5.75
Antex elements	2.75
Antex bits	0.90
Antex stands	2.10
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

NI-CAD CHARGER

Universal Ni-Cad charger, charges PP3, AA, C, D
Price £5.17

Rechargeable Batteries

AA (HP7)	95p	10/ 85p each
C (HP11)	£2.14	10/£1.98 each
D (HP2)	£2.30	10/£2.10 each
PP3	£3.75	10/£3.65 each

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

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	2.00
	3000	1000/63V	0.74
	3500	175/400V+100+100/350V	2.56
	8000	400/350V	2.10
	8000/8500	2500+2500/63V	1.99
	8000	700/250V	2.15
		1000/70V	0.80
	9000	400/400V	3.00
Timer Amp		4700/25V	0.95
DECCA 10/30		400+400/350V	3.20
	1700	200+200+400/350V	3.75
GEC	2047	2048 2083 2084 2104 200+200+150+50/300V	2.50
		600/250V	1.85
ITT/KB		200+200+75+25/350V	2.90
		220/100V	1.95
PHILIPS	G8	600/300V	2.20
	G8 G9	600/300V	2.10
	G11	470/250V	1.80
	G9	2200/63V	1.25
EKCO	T148	125+200+100+32/275V	2.65
	691 Series	200+300/350V	2.50
		600/300V	2.20
RANK		300+300/300V	1.75
	A823	2500+2500/30V	1.50
		220/400V	1.85
		600/300V	2.25

INTEGRATED CIRCUITS. (£) EACH

709	0.35	SN76666NO	1.40
741	0.25	STK015	6.20
747	0.70	TA7146P	4.60
AN214Q	3.80	TA7203P	2.76
AN240P	3.42	TA7204P	1.50
BTT6218	1.98	TA7205AP	1.30
CA301AT	2.88	TA7222P	2.32
CA358	0.66	TAA550	0.50
CA801CM	1.20	TAA611A12	3.50
CA3020	2.10	TAD100	2.90
CA3065	1.60	TDA120A	0.80
CA3080E	0.68	AS/S/SB/T/U	0.80
CA3140	0.45	TDA120B	1.30
HA1366W	1.59	SA/SQ/UQ	1.30
LA4422	3.20	TBA520	1.50
LC7131	4.90	TBA530	1.20
LC7137	5.40	TBA540	1.64
LM324N	0.48	TDA560C	1.50
LM380N8-P	1.15	TDA800	0.80
LM380N14-P	1.80	TBA810S	1.20
LM1011N	3.20	TBA950/2A	3.05
LM1488N	0.98	TCA270SA	4.02
LM3900N	0.85	TDA1003A	5.50
M51513L	3.18	TDA1006A	2.45
M51515L	3.18	TDA1035S	2.20
MC1307P	1.99	TDA1170S	1.99
MC1327P	1.50	TDA1352A	1.80
MC1330P	1.60	TDA2002	1.80
ML23213	2.10	TDA2020	4.00
ML23713	2.30	TDA2030	1.90
NE555	0.25	TDA2140	2.90
SAA1025	4.00	TDA2160	2.50
SAS560	2.50	TDA2522	2.75
SAS570	1.85	TDA2530	2.20
SAS580	2.85	TDA2532	2.80
SN76131N	1.99	TDA2560	3.20
SN76226DN	1.70	TDA2561	4.65
SN76227N	1.10	UPC57562	1.48
SN7666ON	0.75	UPC741G	0.92
		UPC1156H	2.75
		UPC1182H	2.75
		UPC1218H	1.80
		UPC1370C2	2.50
		UPC2002H	2.78
		UPC2002V	2.78

RESISTORS – CARBON FILM 5%

1/4W 1RO to 10M (E12 Range)	2p each. 15p/10. 75p/100
1/2W 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

1/4W pack 10 each value E12 – 10R to 1M 610 pieces	5.75
1/4W pack 5 each value E12 – 10R to 1M 305 pieces	3.35
1/2W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.95
1/2W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.75
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.50

RESISTORS – WIREWOUND. Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.15
4W – 1R0 to 10K – Available in preferred values	0.18
7W – 0.47R to 22K – Available in preferred values	0.15
11W – 1R0 to 22K – Available in preferred values	0.18
17W – 1R0 to 22K – Available in preferred values	0.24

TELEPHONE SPECIAL

BT App Telephone Plug + 3m Lead	£1.25
BT App Master Socket inc Wiring instrns	£2.85
BT App Secondary Socket	£1.95
4-way plug	30p each
BT 4-Core Cable per metre	15p/m £12.00/100m
Cable clips for above	100/75p

SONY T.V. & VIDEO SPARES

Idler Kit SLC5.SLC7 (Rewind Kit)	A-670-634-8A	£4.80
SLC6 (Rewind Kit)	A-670-639-1A	£3.06
Video Head SLC9UB	A-676-208-8A	£45.05
SLC5/C6/C7	A-676-212-9A	£43.05
Motor Kit MT General	X-354-931-41	£14.44
Limiter Assembly SLC7UB	X-365-331-00	£2.45
Power Switch KV General	1-554-820-11	£5.50

Diodes ICs Thyristors Belts Transistors Switches Remote Controls Instruction & Service Manuals

FUSES Prices per 10

20mm Quick Blow. 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. 40p. 20mm Time Delay. 100, 125, 160, 200mA £1.80. 250, 315, 400, 500, 630, 800mA. £1.00. 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A 85p. 1" Mains. 2, 3, 5, 7, 10, 13A 85p.

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	£1.25 each*
2.5W Plastic	7.5–75V	64p each*
20W Stud	7.5–75V	£1.35 each*

*Only available while stocks last

HV Disc Ceramic (†)

1kV 1.5nF 18p
8kV 10, 47, 56, 82, 100, 120, 150, 180 30p

POTENTIOMETERS

Carbon Track Rotary 0.25W Log & 1 in values. All 1/4in Spindle 20ml body dia Shaft 2" long

4K7.2M2 Single Gang Log	.40	10/3.50
1K – 2M2 Single Gang Lin	.30	10/3.50
5K – 2M2 Single Gang DP Switch Log	1.05	10/9.50
5K – 2M2 Double Gang Log & Lin	1.25	10/10.50

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
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

Plus Many More. Please enquire.

ZENER DIODE PACK

400mW – 5 each value – 11 values – individually marked and packed – 55 Zener Diodes. Price £3.50 each.

All prices are subject to change without notice

VALVES

Enquiries are welcomed for any other valve not listed here.

Type	Price (£)
AZ31	4.50
AZ41	1.98
DAF96	1.00
DF96	0.75
DK96	2.65
DM71	2.95
DY86/87	0.66
DY802	0.95
CV850	2.50
CV4015	2.80
E180F	6.50
EABC80	0.98
EAF42	1.50
EB91	1.30
EBC41	2.00
EBF80	0.75
ECC81	1.00
ECC82	0.90
ECC83	1.00
ECC84	0.80
ECC85	0.95
ECC86	2.80
ECC88	1.25
ECC189	0.85
ECF80	1.20
ECF82	0.85
ECF83	1.90
ECF86	1.70
ECH35	3.75
ECH81	1.40
ECH84	1.50
ECL85	0.75
ECL86	1.75
EF80	0.75
EF86	1.80
EF91	2.00
EF95	1.68
EF183	0.90
EF184	1.00
EH90	0.98
EL34	3.25
EL36	1.96
EL81	6.95
EL84	1.00
EL85	4.75
EL86	0.90
EL509	7.86
EL519	7.95
EM80	0.86
EM84	1.75
EM87	2.56
EY51	0.90
EY86/87	0.65
EY88	0.75
EY500A	2.50
EZ41	2.80
EZ81	0.80
GY501	1.40
GZ32	1.20
KT66(G.E.C.)	18.00
KT77	11.50
KT88(G.E.C.)	19.00
PC88	1.40
PC92	3.00
PC900	1.40
PCC88	0.80
PCC89	0.75
PCC189	0.85
PCF80	0.95
PCF82	0.95
PCF84	0.75
PCF86	1.25
PCF87	0.50
PCF200	1.95
PCF201	1.95
PCF800	1.20
PCF801	1.05
PCF802	1.05
PCF805	1.60
PCF806	1.20
PCF808	1.60
PCL82	1.00
PCL83	2.50
PCL84	1.00
PCL86	0.90
PCL88	2.50
PCL805	1.05
PD500	2.90
PFL200	1.85
PL33	1.50
PL36	1.75
PL82	0.75
PL95	2.00
PL504	1.40
PL508	2.70
PL519/509	5.25
PL802	5.50
PY81/800	1.10
PY82	1.75
PY88	0.80
PY500A	2.20
PY801	0.68
UABC80	0.85
UAF42	1.25
UBC41	3.00
UBC81	1.50
UCC85	0.75
UCF80	1.20
UCH42	2.50
UCH81	2.00
UCL82	1.80
UCL83	1.80
UF41	1.25
UF89	2.50
UL84	1.25
UY85	1.15
2D21	1.60
6AT6	1.25
6AV6	1.50
6C4	1.00
6GH8A	1.20
6J5GT	2.50
6K7G	2.50
6K8G	2.75
6KD6	5.50
12AU6	2.00
30FL2	1.70
30FL12	1.60

TRANSISTORS – DIODES

Type	Price (£)	Type	Price (£)
AC127	0.28	BC118	0.16
AC128	0.30	BC119	0.28
AC128K	0.34	BC125	14
AC141	0.58	BC140	0.27
AC141K	0.38	BC141	0.24
AC142	0.56	BC142	0.24
AC142K	0.38	BC143	0.26
AC151	0.45	BC147	0.18
AC152	0.45	BC147B	0.14
AC153	0.57	BC148	0.10
AC153K	0.46	BC148B	0.12
AC176	0.30	BC149	0.10
AC176K	0.38	BC149C	0.14
AC187	0.28	BC157	0.10
AC187K	0.38	BC158	0.12
AC188	0.28	BC159	0.12
AC188K	0.38	B/C	0.14
ACY22	1.50	BC160	0.30
AD142	0.88	BC161	0.30
AD143	1.10	BC168B	0.20
AD149	0.72	BC169C	0.12
AD161/162	1.20	BC170A/B/C	0.16
AD162	0.52	BC171A/B	0.10
AF114	1.20	BC172/B/C	0.10
AF115	2.10	BC177A/B/C	0.24
AF116	2.10	BC182A/B/C	0.10
AF121	0.56	BC182L	0.12
AF124	0.42	LA LD LC	0.10
AF125	0.58	BC183A/B/C	0.10
AF126	0.58	BC183L	0.10
AF127	0.38	LA LB LC	0.10
AF139	0.40	BC184	0.10
AF178	2.28	A B CL LC LB	0.10
AF239	0.50	BC207	0.15
AF279S	1.40	BC212A/B/C	0.10
AL100	5.40	BC212L	0.09
AL102	4.40	LA LB	0.10
ASY80	5.20	BC213A/B/C	0.10
ASZ17	2.00	BC213L	0.10
AU110	2.80	LA LB LC	0.10
AY102	4.40	BC237	0.11
B40C200	1.03	BC238	0.12
BA110	0.68	BC251A/B	0.14
BA115	0.14	BC262	0.20
BA121	0.40	A B	0.28
BA129	0.38	BC301	0.30
BA148	0.16	BC302	0.30
BA155	0.12	BC303	0.30
BA157	0.28	BC307A	0.18
BB105B	0.30	BC317A	0.12
BB105G	0.48	BC323	0.90
BB110B	0.42	BC327	0.16
BC107	0.10	BC328	0.16
A or B	0.12	BC337	0.12
BC108	0.10	BC338	0.12
A,B or C	0.13	BC350A	0.24
BC109	0.10	BC351	0.16
A,B or C	0.14	BC440	0.36
BC115	0.12	BC441	0.40
BC116	0.12	BC461	0.58
BC117	0.22	BC478	0.24

Type	Price (£)	Type	Price (£)
BC516	0.48	BF178	0.26
BC547	0.12	BF180	0.27
A or B	0.10	BF181	0.27
BC548	0.12	BF182	0.32
A B or C	0.10	BF183	0.32
BC549	0.10	BF184	0.30
A or B	0.10	BF185	0.28
BC550	0.10	BF194A	0.15
A or B	0.10	BF195	0.12
BC557	0.10	BF224J	0.20
BC558A	0.10	BF240	0.30
BCY70	0.16	BF241	0.30
BCZ10	3.21	BF244A	0.30
BCZ11	2.80	BF257	0.22
BD124P	0.70	BF258	0.26
BD129	0.90	BF259	0.30
BD130Y	0.68	BF262	0.34
BD131	0.36	BF263	0.38
BD132	0.36	BF270	0.30
BD135	0.26	BF271	0.28
BD136	0.26	BF273	0.22
BD137	0.28	BF274	0.34
BD138	0.30	BF294	0.46
BD139	0.30	BF336	0.32
BD140	0.28	BF337	0.28
BD142	1.26	BF338	0.28
BD145	1.82	BF355	0.37
BD150A	0.72	BF371	0.27
BD160	1.58	BF450	0.38
BD165	0.45	BF457	0.36
BD183	0.70	BFR51	0.36
BD201	0.52	BFR61	0.32
BD202	0.57	BFR90	0.86
BD204	0.50	BFT41	0.68
BD222	0.80	BFT43	0.86
BD225	0.40	BFY50	0.22
BD232	0.45	BFY51	0.22
BD234	0.30	BFY52	0.22
BD235	0.30	BFY90	0.80
BD236	0.38	BFY90S	1.34
BD237	0.38	BR100	0.25
BD410	0.76	BR101	0.40
BD434	0.58	BR103	0.50
BD438	0.58	BR303	2.75
BD439	0.85	BRY39	0.50
BD441	1.00	BRY56	0.42
BD507	1.00	BSX20	0.30
BD520	1.20	BSY52	0.30
BD687	0.88	BSY95A	0.25
BD707	0.88	BT100A/02	0.90
BDX18	1.00	BT101/300	2.75
BDX32	1.48	BT101/500	3.25
BF115	0.32	BT102/300	3.60
BF117	0.50	BT106	1.15
BF119	0.82	BT116	1.20
BF120	0.38	BT119	3.30
BF125	0.42	BT138/600	1.30
BF127	0.41	BT151/560R	6.00
BF154	0.14	BU104	1.80
BF157	0.46	BU105	1.20
BF160	0.23	BU108	1.75
BF167	0.32	BU124AE	0.98
BF177	0.42		

Type	Price (£)	Type	Price (£)
BU126	1.40	ORP12	0.85
BU133	1.90	R2008B	1.20
BU204	1.30	R2010B	1.20
BU205	1.30	R2540	2.71
BU206	1.50	TIP30A	0.32
BU208A	1.40	TIP31C	0.39
BU326S	1.75	TIP32	0.35
BU407	1.10	TIP33A	0.55
BUX80	3.70	TIP34A	0.70
BUY20	2.75	TIP41C	0.42
BUY69A	2.60	TIP42	0.44
BUY69B	1.98	TIP47	0.42
BY100	0.80	TIP121	0.63
BY103	0.50	TIP2955	0.70
BY122	0.60	TIP3055	0.58
BY126	0.10	TIS88	0.50
BY127	0.08	TIS90	0.27
BY133	0.06	Y728	0.14
BY135	0.35	Y969	2.80
BY164	0.45	IN4001	0.04
BY179	0.56	IN4003	0.05
BY182	0.80	IN4004	0.05
BY184	0.38	IN4006/7	0.07
BY187	0.65	IN4148	0.04
BY189	6.75	IN5400	0.12
BY198	0.64	IN5402	0.13
BY199	0.72	IN5405	0.16
BY206	0.14	IN5406	0.17
BY207	0.16	IN5408	0.19
BY210/400	0.21	2N2122A	0.34
BY210/600	0.24	2N2222	0.30
BY210/800	0.28	2N2904A	0.48
BY227	0.22	2N2926G	0.14
BY228	0.46	2N3053	0.30
BY238	0.65	2N3054	0.60
BYX10	0.20	2N3055	0.65
BYX36/150	0.40	2N3703	0.10
BYX36/600	0.48	2N3773	2.80
BYX48/300	0.70	2SB337	1.80
BYX55/600	0.30	2SC1098	0.84
BYX71/600	1.18	2SC1172Y	1.70
C106D (400V)	0.48	2SC1173Y	0.88
E1222	0.30	2SC1279	0.50
E5024	0.30	2SC1306	0.92
MCR106/5	1.20	2SC1413A	2.70
ME0413	0.70	2AC1449	0.60
ME6002	0.28	2SC1507	0.60
MEU21	0.62	2SC1678	1.00
MJ400	0.45	2SC1758	0.68
MJ2955	1.00	2SC1909	1.20
MJ3000	1.80	2SC1923	0.30
MJE340	0.46	2SC1945	2.88
MJE520	0.44	2SC21953	0.70
MJE2955	1.60	2SC1957	0.70
MJE3055	1.40	2SC1969	2.80
MPSA05	0.30	2SC2028	0.73
MPSA12	0.30	2SC2029	2.70
MPSLO1	0.34	2SC2078	1.05
MPSUO5	1.05	2SC2091	0.70
MPSUO6	1.18	2SC2098	2.90
MR502	0.40	2SC2122A	3.20
MR854	0.88	2SC2314	0.80
OA91	0.07	2SC2335	1.50

74LS

74LS00	0.24	74LS123	1.00
74LS01	0.24	74LS124	1.15
74LS02	0.24	74LS126	0.50
74LS03	0.24	74LS132	0.60
74LS04	0.24	74LS135	0.26
74LS05	0.24	74LS136	0.42
74LS08	0.24	74LS138	0.44
74LS09	0.24	74LS139	0.58
74LS10	0.24	74LS145	0.93
74LS11	0.24	74LS147	1.64
74LS12	0.24	74LS148	1.28
74LS13	0.33	74LS151	0.70
74LS14	0.48	74LS153	0.70
74LS15	0.24	74LS155	0.55
74LS19	0.44	74LS157	0.45
74LS20	0.24	74LS158	0.58
74LS21	0.24	74LS160	0.62
74LS22	0.24	74LS161	0.68
74LS24	0.28	74LS162	0.70
74LS26	0.24	74LS163	0.68
74LS27	0.24	74LS164	0.74
74LS28	0.24	74LS165	1.10
74LS30	0.24	74LS166	1.50
74LS32	0.24	74LS168	1.48
74LS33	0.24	74LS170	1.40
74LS37	0.24	74LS173	0.98
74LS38	0.24	74LS174	0.75
74LS40	0.24	74LS175	0.70
74LS42	0.50	74LS190	0.82
74LS47	0.79	74LS192	0.98
74LS48	0.85	74LS193	0.98
74LS51	0.24	74LS194	0.75
74LS55	0.24	74LS195	0.74
74LS73	0.30	74LS196	0.84
74LS74	0.33	74LS197	0.96
74LS75	0.44	74LS221	0.85
74LS76	0.38	74LS240	0.80
74LS83	0.88	74LS241	0.80
74LS85	0.82	74LS242	0.94
74LS86	0.35	74LS243	0.94
74LS90	0.48	74LS244	0.80
74LS91	0.90	74LS245	1.20
74LS92	0.54	74LS247	1.00
74LS93	0.54	74LS251	0.75
74LS95	0.60	74LS257	0.73
74LS96	1.20	74LS258	0.75
74LS107	0.40	74LS259	1.20
74LS109	0.44	74LS266	0.55
74LS112	0.44	74LS237	1.20
74LS113	0.40	74LS279	0.70
74LS114	0.39	74LS283	0.80
74LS122	0.68	74LS353	1.10
		74LS365	0.50
		74LS366	0.50
		74LS367	0.50
		74LS368	0.50
		74LS373	1.00
		74LS374	1.00
		74LS375	0.70

CMOS

4000	0.19	4072	0.24
4001	0.24	4073	0.24
4002	0.24	4075	0.24
4006	0.68	4076	0.68
4007	0.24	4077	0.24
4008	0.59	4078	0.24
4009	0.44	4081	0.24
4010	0.39	4082	0.24
4011	0.23	4085	0.58
4012	0.24	4086	0.58
4013	0.35	4089	1.22
4014	0.58	4093	0.37
4015	0.58	4094	0.70
4016	0.38	4095	0.93
4017	0.54	4096	0.98
4018	0.59	4097	2.65
4019	0.59	4098	0.78
4020	0.78	4099	0.75
4021	0.58	4161	0.96
4022	0.68	4162	0.96
4023	0.30	4163	0.96
4024	0.49	4174	0.96
4025	0.24	4175	1.00
4026	0.89	4195	0.99
4027	0.44	4501	0.38
4028	0.44	4502	0.58
4029	0.73	4503	0.38
4030	0.33	4507	0.45
4031	1.28	4508	1.28
4033	1.25	4510	0.54
4034	1.40	4511	0.54
4035	0.68	4512	0.54
4036	2.48	4514	1.10
4038	0.73	4515	1.20
4039A	2.70	4516	0.60
4040	0.58	4517	2.70
4042	0.48	4518	0.48
4043	0.42	4520	0.05
4044	0.48	4521	1.10
4049	0.38	4522	1.20
4050	0.34	4526	0.58
4051	0.68	4527	0.64
4052	0.58	4528	0.68
4053	0.58	4531	1.20
4066	0.44	4532	0.64
4068	0.24	4536	2.50
4069	0.24		
4070	0.24		
4071	0.24		

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TELEVISION

What a business to be in!

The pioneer firms in the early days of radio were often set up by technically gifted individuals who wanted to develop innovatory designs. One wonders what they would make of the situation today. It's certainly a very long time since we last saw a new name with a new product in our industry, which despite continuing innovation must now be classified as "mature". Quite apart from the fact that to develop and put into production new consumer electronics goods is an horrendously expensive business, there's very little incentive for anyone to try to break into the industry. Why? Simply because it's so unprofitable.

Let's consider some examples. Our one major UK consumer electronics manufacturer Ferguson has been struggling for some time to achieve profitability. While Thorn has traditionally been a profitable business the basis of this has been the cash flow from the rental side, which continues to make good profits. It seems that in the past Thorn paid less attention than now to the profitability of the various sections of the company. Sets were required and the plants were there: the costs of the manufacturing side were covered by the overall profitability of the business. Ferguson is understood to have broken even in recent months, but it's been a trying time.

What about Amstrad you might say? Surely this company shows that profitability is not impossible? The firm has indeed produced impressive figures in recent years, but its position is rather unusual – it's largely a one-product company. By concentrating on particular market sections in succession it has been able to achieve profits that would probably have eluded it had it attempted to offer an across the board range of consumer electronics goods.

Philips recently announced reduced earnings for the year 1985 despite turnover up by twelve per cent. The main problems were in the semiconductor business and disappointing sales and earnings in the USA. Philips has been setting itself higher targets but is finding these hard to achieve. The company's wide spread of activities across the world emphasize the difficulty of trading profitably in today's electronics markets.

What about the famed Japanese electronics industry? Over the last few years most Japanese consumer electronics manufacturers have managed to achieve sometimes spectacular earnings growth. They've been helped by operating under favourable economic conditions. If you can hold down your costs and inflation is not a problem you can be very competitive. Even more so if your currency is relatively undervalued. Japanese success has been almost the mirror image of US problems. For two years the value of the dollar soared despite horrendous trade deficits. This strange situation arose because the US government's growing deficits were financed by sucking in loose cash from around the world. By offering high real interest rates the US government was able to balance its books. But that sort of situation cannot last indefinitely, especially in view of the international economic distortions it introduces. Last September the US government and the other main trading nations decided to take action on the overvalued dollar. Unusually – it's said that governments can't control free markets – the move has been highly successful. The key dollar/yen exchange rate fell from Y240 to around Y180.

The effect of this on the earnings of the traditionally prosperous Japanese manufacturers has been profound. Matsushita increased profits by three per cent in the year to last November 20th but expects a decline of 20 per cent this year. Hitachi is expecting a profit downturn of 34 per cent, with export earnings falling for the first time in nineteen years. Mitsubishi anticipates a fall in profits of 40 per cent while Toshiba is expecting a decline of 45 per cent. At NEC the expected fall in earnings is put at 16 per cent. Sony has already announced a sharp fall in first quarter earnings. In all cases the problem has been put down to the fall in the value of the yen and difficult market conditions, i.e. it's harder to sell anything at a profit.

In the past Japanese success has continued despite awkward market conditions. The key to this has been product innovation. If you can produce goods that people want to buy, at a price they can afford, you've got it made. But what happens when markets become saturated? The VCR has made the main contribution to the profitability of Japanese consumer electronics manufacturers over the last three years but it seems that this market, though still a major one, is now no longer in an expansionary phase. What next? There are still plenty of "goodies" on offer – the compact disc player, new lightweight camcorders and satellite TV equipment for example. But with the exception of the CD player it's hard top see these items producing the sort of output/profits growth we've been used to seeing.

The CD player market is a particularly interesting one. Traditionally a new product is offered at a relatively high price: it's regarded as a high-margin item till the mass market/mass production phase occurs. But the price of CD players has already fallen substantially, at an early stage in the product's life. Recently the £200 barrier has been breached, which brings us back to Philips. The company has been taking a certain amount of flak in the trade over its CD pricing policy and the profit margins offered. It seems that Philips hopes to use the CD player as a means of gaining a significant increase in its share of the international consumer electronics market. That's fair enough in view of Philips' role in the development of the compact disc, and one can't help but admire Philips' efforts to lead a resurgence of the European consumer electronics industry. But we're back with the problem of low manufacturing – and retailing – profitability.

The consumer benefits from all this competitive activity, but if you were looking for an industry that offers an easy life you'd certainly not choose consumer electronics.

FRONT COVER

This month's front cover photograph shows a Sinclair ZX Spectrum microcomputer on the workbench with a scope monitoring digital waveforms.

TELETEXT SERVICING

Publication of the next instalment in Mike Phelan's series will be delayed. Mike is at present in hospital with a back injury: we wish him a speedy recovery.

Servicing Sinclair Microcomputers

Part 1

Ken Taylor

Mike Phelan's series "The Lid off Microcomputers" last year evoked considerable interest among readers. It's clear that many of you are keen to get to grips with these devices which seem to be taking over the electronics world. They come in quite a lot of different types and forms. The single-chip types used in VCRs, washing machines and cars are special-purpose devices: they are not ideal subjects for an initial assault even if the wife would let you at them. So forget these and Head Office's IBM main-frame computer. In this series we're going to deal with some of Sir Clive's products, which happen to be among the cheapest, simplest and most abundant to have been put on the market. They have the added advantage that spares are readily available, which must appeal to anyone used to the problems of the TV servicing trade.

Servicing Equipment

One of the first thoughts that will probably cross your mind is the cost of the servicing equipment required. Perhaps, like me, you've wandered round the exhibitions looking at £2,000 plus scopes and sneaking envious glances at the logic analysers – "no self-respecting computer repair organisation should be without one". I often wonder whether I'd have the time to learn how to use one of these even if I could afford it. But fear not. The most I recommend, in addition to the usual TV servicing equipment (scope, multimeter, bench PSU etc.), is a logic probe. Even this could be made from one of the many circuits that have been published if you wish to keep the initial expenditure down.

In some ways a logic probe duplicates a scope, which can be used instead. It's very much quicker and easier however to use a device with an in-built indicator when checking for pulses along the pins of an i.c.: you don't have to look up and check each response on the scope. The signals you'll be looking at are generally TTL ones (0-5V), so if you use a scope for the purpose its sensitivity need be no greater than that required for TV work, though the essential high-impedance probe does reduce the signal a bit. The crystal oscillator used in a microcomputer often runs at about 14MHz, i.e. rather higher than the basic frequencies encountered in a TV set, but there's rarely need to study waveforms at this frequency and the more critical system clock frequency is in the 2-4MHz range.

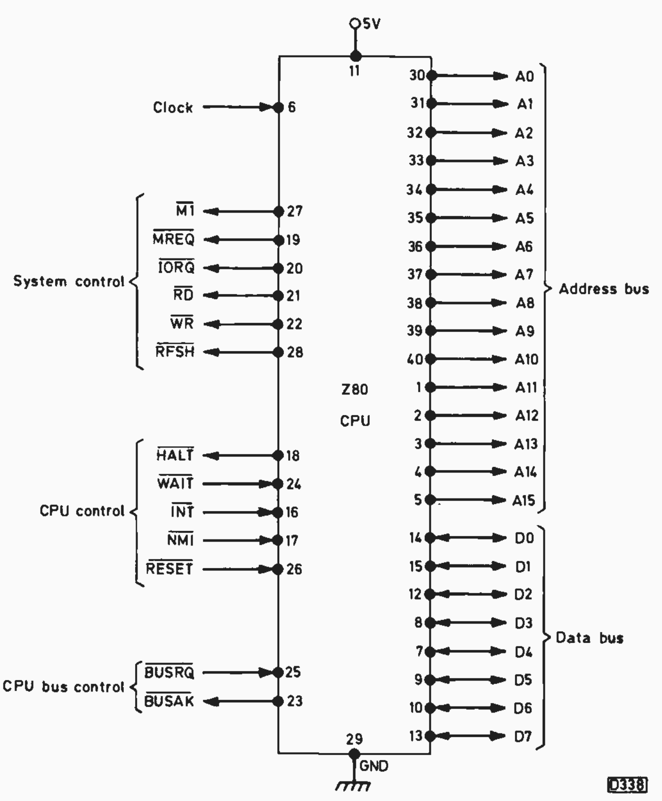


Fig. 1: Z80 CPU (microprocessor) pin connections.

The Central Processing Unit

The system clock frequency just mentioned depends on the type of central processing unit (CPU, i.e. microprocessor) used in the microcomputer. Sinclair use the Z80 family: the Z80 runs at a clock frequency of 2MHz, the Z80A at 4MHz and the Z80B at 8MHz. The Z80A, which is used in all the microcomputers we'll be considering, is housed in a 40-pin package – Fig. 1 shows the connections. Some of the names used may be new to you, so we'll briefly run through the pins and their functions.

Note that the address and data bus lines are the only "active high" ones: all the rest go low (to 0V) when operative and should thus be written as $\overline{\text{RESET}}$ for example (= not reset when high, i.e. 5V).

Designation	*Function*
5V, GND	Chip's 5V supply and chassis connections.
A0-A15	Address bus outputs which are tri-state, active high; i.e. either high (active) = 5V, low = 0V, or open-circuit (high impedance) – this latter state allows other devices to control the line without loading problems. A0 is the least significant bit. These 16 lines can address 64K binary addresses (65,536 in decimal as 1K = 1,024 decimal, i.e. 64 × 1,024).
D0-D7	Data bus lines (in/out), again tri-state, active high. D0 is the least significant bit. These eight lines carry the data to and from the CPU. They represent 1 byte in binary (256 decimal).

The CPU generates signals on the following six lines to inform and control the other devices in the system. When the lines carry signals from the rest of the system the CPU output is tri-state.

$\overline{\text{M1}}$	Machine cycle one, active low. Used by the CPU to signal that a particular loading cycle is being carried out.
$\overline{\text{MREQ}}$	Memory request, active low, tri-state. Indicates that the address bus holds a valid

address for a memory read or write operation.

$\overline{\text{IORQ}}$ Input/output request, active low, tri-state. Indicates that the lower half of the address bus holds an address for use by an input/output device.

$\overline{\text{RD}}$ Memory read, active low, tri-state. Signals read to a memory or input/output device.

$\overline{\text{WR}}$ Memory write, active low, tri-state. Signals write to a memory or input/output device.

$\overline{\text{RFSH}}$ Refresh, active low. Indicates that memory refresh is taking place. Every address in a dynamic memory has to be refreshed at 2msec intervals. This line signals that a refresh is taking place. More on this when we come to memories.

The remaining lines are used by the system to initiate action or to indicate that action has been taken.

$\overline{\text{HALT}}$ Halt output, active low. CPU output signal indicating that it has obeyed a software halt instruction.

$\overline{\text{WAIT}}$ Wait input, active low. Allows external devices to halt the CPU. Must be of short duration because refresh is stopped.

$\overline{\text{NMI}}$ Non-maskable interrupt input, active low. Allows an external device to interrupt the CPU and make it carry out a special software program.

$\overline{\text{INT}}$ Interrupt request input, active low. Similar to $\overline{\text{NMI}}$ but disregarded when instructed by the program running.

$\overline{\text{RESET}}$ Reset input, active low. Resets the CPU to the start address (0000 Hex). Takes place automatically at switch on. Refresh stops and dynamic memory is cleared.

Clock System clock input. This signal controls the speed of the system and all the CPU's operations are synchronised to it. The frequency depends on the CPU but is usually 2-4MHz.

$\overline{\text{BUSRQ}}$ Bus request input, active low. This line is activated by an external device when it requires control of the system. The CPU outputs other than $\overline{\text{BUSAK}}$ go to the open-circuit state and refresh ceases.

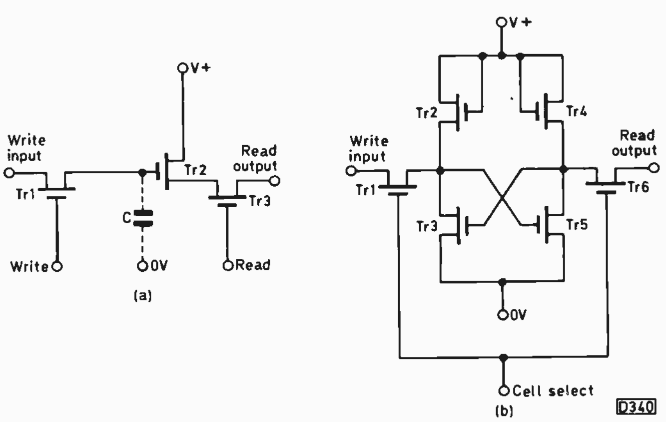


Fig. 2: Examples of basic MOS dynamic RAM (a) and static RAM (b) memory cells. In the DRAM cell the data bit is stored as an electrical charge by the capacitor shown as C – in practice this is Tr2's input capacitance. The SRAM cell uses a bistable circuit for storage (Tr3/5, with Tr2/4 as loads): the cell selection line enables data to be written in or read out. The DRAM memory cell is much simpler, giving greater storage per square area of silicon chip, but requires refreshing every 2msec.

$\overline{\text{BUSAK}}$ Bus acknowledge output, active low. Reply signal to $\overline{\text{BUSRQ}}$.

It's not necessary to worry too much about the precise function of each of the above lines: the important thing is whether a high, low or a dynamic signal is to be expected. For instance the $\overline{\text{RESET}}$ line has to be high (except at switch on) or the CPU ceases to function. Many other lines, particularly the address and data lines, are continually changing even when the computer is apparently doing nothing. At all times the refresh system is putting out addresses and indicating their presence via the $\overline{\text{RFSH}}$ line. Although this dynamic action is rarely cyclic and often produces a meaningless pattern on an oscilloscope we shall see later that it can be turned to advantage when fault finding.

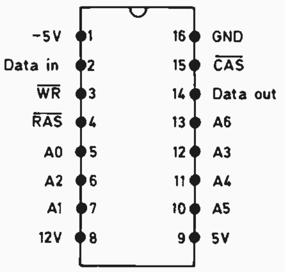
Programming Knowledge

After dismissing the need for a detailed knowledge of the operation of the CPU this is perhaps an appropriate time to stress the need for some knowledge of programming. Unlike other electronic systems the computer is controlled by the software program and the program resident in the ROM. To expect to be able to carry out fault diagnosis without an understanding of how to program the machine is naive, and a knowledge of how the system is designed and functions can be a great help. Most home computer handbooks give instructions on programming – usually in the "universal" BASIC (Beginners' All-purpose Symbolic Instruction Code) language. Unfortunately however there are different BASIC systems. Sinclair BASIC is one of the most way-out, and although devotees swear by it the differences between it and others are considerable. So too are the computer start-up sequences, and it's a great help if one knows what ought to happen when the machine is switched on. To sum up, I'd not advise anyone to attempt repairing a machine before obtaining practice and experience of its operation. More on this when we come to the ZX81 next month.

Memory Chips

While discussing the CPU we mentioned dynamic memories. We'd better next look at the memory family. As you probably know by now there are two basic types of memory, ROM (read only memory) and RAM (random access memory). The former are preprogrammed and non-volatile, i.e. they contain the manufacturer's program for operating the machine/system: this program is permanent and unchangeable. The memory in a RAM can be changed however and is used to store the data produced by the computer system. It's volatile in that all the data is lost if the supply voltage fails, but some RAMs are even more vulnerable. These are the dynamic memories (DRAMs) that require constant refreshing. With these each binary bit of every data word is stored as an electrical charge at the input of a high input-impedance transistor. This charge leaks away in about 2msec. So each bit – and there may be as many as 64K bits – has to be recharged every 2msec. A daunting task you may think.

It's not quite as bad as it looks however since another feature of the dynamic RAM helps. We said earlier that sixteen address lines are required to count up to 64K. So a DRAM is going to be a multi-pin device with probably



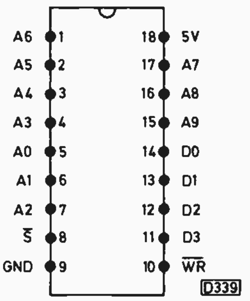


Fig. 3 (left): 4116 dynamic RAM pin connections.
Fig. 4 (right): 2114 static RAM pin connections.

over twenty pins. In fact it has sixteen. This is achieved by matrixing the address lines. The address matrix is formed of rows and columns and a system built into the chip switches eight of the pins first to one and then the other. Externally the sixteen address lines are also switched, first to one set of eight addresses then to the remaining eight. Both these switching operations are synchronised by the CPU: the data appears on the data bus at a precise time and is read by the CPU or the memory in sync with the switching.

Back to our refresh problem. The internal circuitry that does the row/column switching also assists with the refresh by recharging all the column bits each time a row is addressed. It's necessary to refresh only the rows therefore to refresh the memory completely. The number of refresh operations is thus reduced from 64K to less than 256.

Fig. 3 shows the pin connections for the 4116 DRAM. The $\overline{RAS}$ (row address strobe) and $\overline{CAS}$ (column address strobe) pins are used to synchronise the switching. This is a 16K by one bit (serial bits enter at pin 2 and leave at pin 14) memory. Despite requiring three voltage supplies (12V at pin 8, 5V at pin 9 and −5V at pin 1) it's still only a 16-pin device. Seven lines (A0-A6) are used for the addresses. The other pins are chassis (16) and $\overline{WR}$ (3) – read/write select. Compare this with the 2114 static RAM – see Fig. 4. Static RAMs use flip-flops to store the bits. This device has only one supply and has a 1K by four bit memory, i.e. it can store 1,024 four-bit numbers. Its storage capacity is a quarter of that of the 4116, yet 18 pins are required.

The Z80 is an eight-bit microprocessor, these eight bits being known as one byte. It connects with an eight-line data bus and when it addresses a memory location it expects to receive an eight-bit instruction to direct its operation. The memory chips are arranged to meet this requirement: in the case of the 4116 eight of these devices would be used, providing a 16Kbyte memory; as the 2114 is a four-bit memory two of these would provide a 1Kbyte memory.

When memories are assembled in this way the address lines are common to all the memory chips. If there is more than one memory group with the same address pins confusion would exist if they all unloaded their data together. To overcome this problem memories are generally provided with chip select (CS or S) or chip enable (CE) pins – often more than one. These switch the memory on only when they are active.

Suppose for example that four 2114 memories are paralleled on the address bus to provide 2K × 8 bits of memory. If an address in the 0-1K range is required the first two memories will be enabled whereas for an address in the 1-2K range the decoder detects the higher number (usually the next binary address line) and enables only the second memory pair. The data pins are tri-state and remain in the high-impedance state until the memory is enabled.

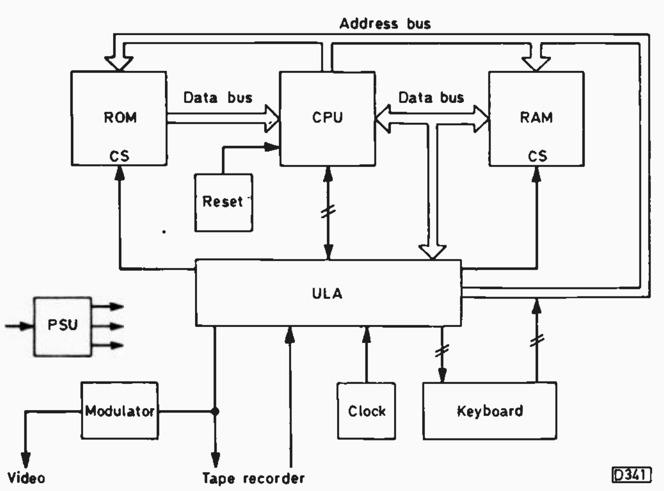


Fig. 5: Simple microcomputer block diagram.

Complete Microcomputer System

It's time to look at the computer system as a whole. Fig. 5 shows a block diagram for a simple computer using the absolute minimum of components. We've already dealt with most of the important items – in fact the only major item remaining is the ULA (Uncommitted Logic Array). This is a collection of logic circuits assembled to the computer manufacturer's specification, replacing the many standard and special logic chips that would otherwise be required. In this example it would provide the address decoding, produce the clock pulses, decode the keyboard, condition the analogue tape input signals and control the output of data to the tape recorder and video modulator. Some of these tasks are carried out by the ULA alone, some are controlled by the CPU.

The clock oscillator for example is driven and divided automatically and the chip select signals are continually produced by the ULA logic alone. The output to the video modulator however is a complex signal consisting of screen character pixels and sync signals: the CPU is needed to sequence these correctly. The CPU and ULA also combine to carry out the keyboard decoding. Electrically the keyboard is organised in matrix form, one set of contact connections running from top to bottom and the other along the rows of keys. Signals are sequenced in the vertical lines via the ULA, a key producing a pulse on the address line. This pulse can then be decoded in a time sequence to find the key pressed.

We've now covered the major components in this simple example of a microcomputer. But we haven't finished with Fig. 5 because it's not a fictitious example. In fact it's a block diagram of the ZX81, the simplest Sinclair computer produced. Because of its many limitations this model has become obsolete and has little marketable value. As a result ZX81s can be purchased second-hand for as little as £10. They make ideal initial practice machines. Anyone contemplating microcomputer servicing would, if he doesn't already have a machine, be well advised to buy one of these for both the software and hardware experience.

Next month we'll look at the ZX81 in detail and start to establish a fault-finding procedure.

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Sanyo LOPT AM-WM-4	7.30
Philips LOPT G8	7.80
Sanyo LOPT (CW21) 4-2751-44700	5.00
ITT LOPT CVC5-9	9.60
ITT LOPT CVC30	8.75
ITT LOPT CVC45	9.75
Baird 8750	10.25
Baird 8752	10.25
Thorn Line Drive TX. TX9 (T2)	3.00
Thorn Line Drive TX. 8K etc. (T402)	1.85
Thorn Line Drive TX. 9K (T705)	2.00
Thorn Switch Mode TX. 9K6 (T511)	3.75
Thorn Input Choke TX9 (L64)	4.00
Thorn Choke TX90 (L120)	2.95

300 Mixed Resistors	1.50	10 Spark Gaps	1.00
300 Mixed Capacitors	1.50	10–16 pin Quil IC Socket	90p
150 Mixed Electrolytics	2.00	20 Assorted TV Knobs	1.00
100 W/W Resistors	1.00	10–16 pin Quil to Dil IC Socket	90p
20 Mixed Conv Pots	1.00	100 Mixed Diodes	1.00
40 Mixed Pots	1.50	50 Mixed Mica Washers	65p
20 Mixed Sliders	1.00	300 Mixed Resistors & Capacitors	1.50
40 Mixed Presets	60p	10–16 pin Dil to Dil IC Socket	1.00
20 Mixed VDR & Thermistors	1.00	50 Electrolytics & 50 Capacitors	1.00
100 Mixed Ceramic Discs	1.00	50 Mixed Poly Capacitors	1.00
20 Mixed Valve Bases	1.00	20 Mixed Valve Bases	1.00

						BF154	25	BFR52	31	NKT276	20
						BF167	24	BFR62	28	NKT453	1.65
AC128	39	BC174B	23	BCX33	22	BF173	29	BFR81	29	OT112	1.92
AC131	40	BC177	24	BCX34	11	BF179	32	BFR87	25	OT121	2.08
AC138	40	BC182LB	12	BD115	49	BF180	33	BFR90	1.74	R1038	80
AC141K	39	BC183L	12	BD131	30	BF181	30	BFR91	2.08	R1039	80
AC142K	38	BC184L	13	BD132	46	BF184	30	BFT42	30	R2008B	1.40
AC153	39	BC187	24	BD133	59	BF185	30	BFT43	30	R2010B	1.10
AC176	33	BC204	15	BD139	36	BF194	16	BFX38	40	R2030	70
AC176K/		BC208	9	BD140	38	BF195	16	BFY50	30	R2265	1.30
AC128K	93	BC212L	9	BD144	1.70	BF196	16	BFY51	34	R2305	80
AC188	38	BC213L	12	BD150	50	BF197	16	BFY52	34	R2322	50
AD142	1.18	BC237	12	BD163	98	BF198	19	BRC116	1.50	R2443	25
AD143	1.08	BC238B	8	BD201	74	BF199	15	BRC1693	1.43	RCA16446	30
AD149	98	BC238L	8	BD203	78	BF223	18	BU105	1.00	RCA16598	1.25
AD161	32	BC250A	15	BD204	99	BF224	19	BU126	1.10	RCA16600	1.40
AD162	32	BC251	8	BD222	48	BF238	20	BU207	1.05	RCA16799	1.13
AD263	1.05	BC252A	20	BD225	52	BF240	9	BU208	1.15	RCA16800	1.42
AF127	45	BC294	37	BD232	50	BF241	21	BU208A	1.15	RCA16802	1.38
AF139	38	BC301	32	BD233	60	BF255	10	BU326A	1.30	RCA16815	1.20
AF239	41	BC303	31	BD234	60	BF256LB	38	BU407	1.70	SP8385	2.65
BC107	15	BC307	10	BD237	55	BF256S	20	BU408	2.76	S1299	2.25
BC108	15	BC308	8	BD238	65	BF257	28	BU500	2.30	S28000	1.25
BC109	15	BC309	14	BD241	59	BF259	28	BU526	2.46	T6050V	1.30
BC115	16	BC327	18	BD244	85	BF271	25	BU806	1.80	T6052V	1.30
BC117	21	BC328	18	BD278A	81	BF274	11	BU807	2.94	T9003V	1.25
BC125	26	BC337	17	BD386	68	BF337	29	C1129	9	T9010V	1.45
BC126	23	BC338	17	BD433	71	BF338	34	C1172B	9	T9053V	1.30
BC139	27	BC347	8	BD437	83	BF355	40	E5386	54	T9054V	1.00
BC141	34	BC394	8	BD592	1.20	BF362	50	E9003	28	T9039V	1.10
BC142	30	BC454	8	BD589	1.20	BF391	21	E9005	25	TIC45X	50
BC143	31	BC455	8	BD677G	1.35	BF394	16	ME0404	10	TIC46	48
BC147	12	BC456	10	BD679	1.42	BF422	47	ME0412	10	TIC106C	40
BC148	12	BC460	40	BD701	1.04	BF423	53	ME6002	10	TIP29	42
BC149	12	BC463	22	BD702	1.12	BF450	43	MJ2501	2.36	TIP30	42
BC153	16	BC546	8	BD707	95	BF453	53	MJ3001	2.21	TIP31	35
BC1540R	16	BC547	12	BD708	95	BF458	37	MJE340	50	TIP32	43
BC154YL	16	BC548	12	BD839	1.30	BF459	40	MJE520	50	TIP33	61
BC157	12	BC549	8	BOX10	93	BF461	59	MJE2955	1.40	TIP41	42
BC158	12	BC557	10	BOY20	1.09	BF556B	35	MJE3055	1.50	TIP42	45
BC159	15	BC558	10	BDY82	99	BF596	15	NKT241W	8	TIP110	61
BC171	9	BC559	8	BF137	20	BF694	16	NKT241G	8	TIS91	25
BC172	9	BC595	8	BF153	20	BF757	62	NKT241Y	8	ZTX550	30

INTEGRATED CIRCUITS

				TBA530	1.26	TDA2030	2.10
BRC1330	1.40	SN76013ND	1.80	TBA540	1.00	TDA2522	2.10
BRC3064	1.00	SN76023N	1.80	TBA550Q	1.82	TDA2530	2.61
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.50	TDA2540	3.50
BRC/M/300	1.00	SN76115	2.00	TBA641	2.05	TDA2560	3.50
CA3060	1.58	SN76131N	1.58	TBA651	2.50	TDA2581	3.00
LM1303P	1.48	SN76226N	1.25	TBA720A	2.49	TDA2591	1.96
ML231B	2.20	SN76227N	1.00	TBA750	2.20	TDA2611A	1.95
ML237B	2.00	SN76530P	1.30	TBA800	1.62	TDA2640	2.90
ML239B	2.86	SN76622N	1.00	TBA810S	1.00	TDA2690A	1.50
MC1327AP	1.25	SN76660N	80p	TBA810AS	1.00	TDA3560	6.00
MC1358P	1.30	SN76666N	75p	TBA920	2.08	TDA4500	5.40
MC1455P	18p	SN76744	1.92	TBA950	2.54	TDA9503	2.90
MC14516BCP	60p	SY153A	2.50	TBA1440	1.92	TCEP100	3.48
SAA1025	7.20	TA7117P	1.00	TCA270SA	1.05	TEA1009	1.95
SAA1124	4.50	TA7109AP	2.80	TCA270C	1.05	MC14426P	4.80
SAA5010	6.00	TAA611	1.40	TCA270CQ	1.05	MC14429P	4.50
SL432A	1.80	TBA120B	1.20	TDA1035T	3.50	MC14514	5.00
SL1430	2.50	TBA120C	1.20	TDA1037	2.72	UA758PC	2.50
SL1432	2.50	TBA120CQ	70p	TDA1170	2.15	UAA1008A	2.66
SN15846N	60p	TBA120S	70p	TDA1170S	1.76	ULN2165	1.30
SN74123N	65p	TBA120U	1.00	TDA1200	2.42	ULN2216A	1.25
SN74154N	1.40	TBA395	1.00	TDA1270	2.76	UPC1365C	5.75
SN76001N	1.40	TBA480Q	1.40	TDA1327	2.53	SC9488P	1.40
SN76110N	1.14	TBA510	1.90	TDA2002	2.80	SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested
PSU 2.88
FTB 3.75
Decoder 4.00

Thorn 9K ex equip panels untested
PSU 12.00
Decoder 5.00

Thorn 9K6 ex equip panel untested
Decoder 5.75

Thorn 3/3K5 ex equip panels untested
PSU 3.75
LTB 3.75
Video 2.50
Chroma 2.00
FTB 2.75
IF 1.75
Conv. 3K 3.00
Conv. 3K5 3.75
Autovox Decoder FG/01 new boxed 5.00

Thorn 4000 Convergence panel ex-factory 3.75
Thorn 4000 PSU panel ex-factory 2.50
Thorn 3K5 beam limiter board new 1.75
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip 1.80
Thorn 8/8K5 damaged FTB for spares 1.25
Thorn 8/8K5 damaged decoder for spares 2.25

UHF TV Aerial for portable	50p	Coax Plugs	10 for 1.65
Indoor Aerial With Reflector		Band Change Switch Assy, Pye 725	40p
to Help Combat Ghosting Problems	2.50	Coax Cable Low Loss	per Metre 22p
Line Connectors	38p	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 6+1+100	92p
Thermal Cut-Out Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	4.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Thorn 1500 3 stick	2.40
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

220+47	350V	65p	200+200+100	350V	55p
200+150+50	350V	60p	200+200+75+25	350V	60p
200+200+100	325V	54p	50+50+8	300V	55p
32+32+16	275V	52p	100+50+100	350V	55p
200+200+100+32	350V	70p	100+150+50	350V	55p
100+50+150	350V	58p	2500+2500 (Thorn 8K)	63V	1.20
400+400	200V	72p	150+150+100	300V	1.80
32+32+16	350V	52p	200+47	250V	65p
200+32+300+100	350V	70p	500+500 175V Thorn TX9		1.00
225+25	350V	50p	175+100+100 350V Thorn 3K5		2.25
200+200+100	350V	70p	400 400V Thorn 9K		2.50
200+100	325V	65p	470 250V Weldel Type Philips G11		1.71
200+100+100+50	350V	60p			

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 100V	1.05
50MF 275V	50p	2000MF 30V	50p
100MF 150V	65p	2200MF 40V Thorn 4K	95p
100MF 250V	70p	2200MF 63V Philips G9	1.25
220MF 450V Thorn 4K	1.30	2500MF 35V	65p
400MF 350V Thorn 8K	1.00	2500MF 40V	65p
400MF 400V Thorn 9K	2.95	3000MF 30V	65p
800MF 250V	70p	3300MF 16V	50p
1000MF 100V Thorn TX90	2.90	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 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 50Ω	65p
2.5A Push to make on/off switch	15p
Thorn TX90 On/Off Switch	1.85
10K Lin Pot. TX9/TX90	75p

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
BT106	1.50	IN5254B	8p
BT116	1.00	IN5349	14p
BT119	2.56	IN5400	12p
BT120	2.82	IN5401	12p
BT151 650	1.00	IN5402	14p
BY127	12p	IN5404	12p
BY188	16p	IN5406	16p
BY204	26p	IN5408	16p
BY206	16p	IS025	8p
BY207	16p	IS131	8p
BY208/800	38p	IS1658	8p
BY223	95p	MR854	35p
BY225	1.20	SKE1/02	20p
BY227	28p	MCR106/1	1.00
BY298	22p	MCR406	35p
BYX22/400	30p	2N4444	1.50
BYX55/600	30p	Y827	80p
BYX71/350	80p	Y969	75p
BZV15 C12R	1.16	ZX150	12p
BZV15 C24R	1.16	OA91	5p
IN60	8p	MCR106/7	1.00
IN2070	8p	MCR106/8	1.50
IN4001	4p	BY255	30p
IN4002	4p		

VHF/UHF Sound Receiver

Paul Barton

A DX-TV enthusiast wishing to use a standard UK TV set to monitor foreign TV sound channels has a considerable problem: the set will be designed to operate with the UK system I sound-vision spacing of 6MHz and will thus not respond to the system M, B/G and D/K sound-vision spacings of 4·5MHz, 5·5MHz and 6·5MHz respectively. An imported set could be used, but this would have a wide vision bandwidth, as a result of which unwanted signals will "spread" on to adjacent channels – the narrow i.f. bandwidths often used by DX enthusiasts enable much weaker signals to be seen, but the sound is obviously lost.

This article describes a totally separate, self-contained radio receiver with a very wide frequency range (depending on the tuner unit used). Fig. 1 shows the receiver in block diagram form. The 36MHz output from the varicap tuner unit is converted to 10·7MHz by a second mixer so that narrow bandwidth ceramic filters can be used. The initial i.f. amplifier has a low noise figure and when a low-noise tuner is used excellent performance is achieved.

Circuit Description

Fig. 5 show the circuit of the receiver. To avoid shortwave breakthrough, the input from the aerial is fed to the varicap tuner via a high-pass filter. Several different types of tuner can be used. The tuner's i.f. output, at approximately 37·7MHz, is capacitively coupled to the gate of the BFW10 i.f. amplifier transistor whose double-tuned drain load provides some selectivity at this frequency. The original prototype receiver used two Philips U800 (G8) selectivity modules in this position, but these are now very hard to obtain. With the tuner's output connected directly to the 40673 MOSFET mixer transistor it was found that each station appeared at more than one tuning position, probably due to signals at 43·3MHz, present at the tuner's output, mixing with the second harmonic of the 2N3819 oscillator's output. Fortunately the combination BFW10/L3 was found to work well. Constructional details for L3 are shown in Fig. 2: note that if only 12·7mm dust cores are available these can easily be shortened using sidecutters.

The second frequency-changer stage employs a 40673 MOSFET. The 2N3819 f.e.t. local oscillator provides an output at 27MHz, i.e. 37·7 – 10·7MHz. The signal is converted from 37·7MHz to 10·7MHz so that readily available ceramic filters can be used. This approach provides a narrow bandwidth without the problems of coil alignment: with the specified filters the bandwidth is 150kHz at the −6dB points. L6 is specified as a MAXI-Q type. If this is too large physically it may be possible to use a Toko coil though it would be necessary to experiment with the connections. Similarly L4 is specified as a Toko coil but a number of other 10·7MHz transformers may be suitable, such as the MAXI-Q type IFT15.

A TBA120AS i.c. provides the main i.f. gain and f.m. demodulation. The d.c. volume control facility (pin 5) is not used since it's useful to have a tape recorder socket which calls for a constant audio level. Audio amplification is provided by a TBA800 i.c.

A simple power supply circuit is shown. This provides a 33V tuning supply and 12V at 0·5A. The transformer secondary voltages need not be exactly as shown but use the nearest available. Mount the regulator i.c.s on small heatsinks, isolated from the chassis.

Most of the receiver can be built on a PCB. Keep the tracks around the i.f. stages and the TBA120 i.c. short and construct the oscillator in a well-screened case (there's some harmonic radiation which can be picked up by the aerial wiring).

With a little ingenuity a cord drive can be operated from the tuning potentiometer (ten-turn potentiometers are available from Cirkit). The completed receiver should be housed in a metal case to prevent signals at the i.f. (10·7MHz) breaking through – alternatively the i.f. stages can be built in tinplate boxes.

Tuners

As previously mentioned several different types of varicap tuner can be used: the choice depends on availability and the frequency coverage required. The original prototype receiver used the early NSF non-MOSFET type tuner which covers 43-104MHz and 110-240MHz at v.h.f. plus the normal u.h.f. bands. Better performance and a slightly greater frequency range can be obtained using the ET021 NSF MOSFET tuner, though these no longer seem to be available. Both these tuners also cover Band II (f.m.) which may be an advantage when DX conditions are quiet. The Mullard ELC2000 series tuners also work satisfactorily: the ELC2000M for example covers approximately 45-90MHz, 110-240MHz and u.h.f. with fair sensitivity. I'm at present using a GEC-Hitachi ET547 part-MOSFET tuner which covers the TV bands only. Although the frequency coverage is restricted (43-70MHz, 150-230MHz plus u.h.f.) the performance is excellent: it should suit Band I SpE enthusiasts – u.h.f. performance seems to be about average.

Alignment

Alignment is simplified if you have access to a shortwave receiver covering approximately 10-30MHz and a signal generator. Alignment can be done without these but is a little less precise and more time consuming.

First set the oscillator coil L6 to about 27MHz. This can be done using a shortwave radio. If you have a TV set with Band I coverage the oscillator's second harmonic at

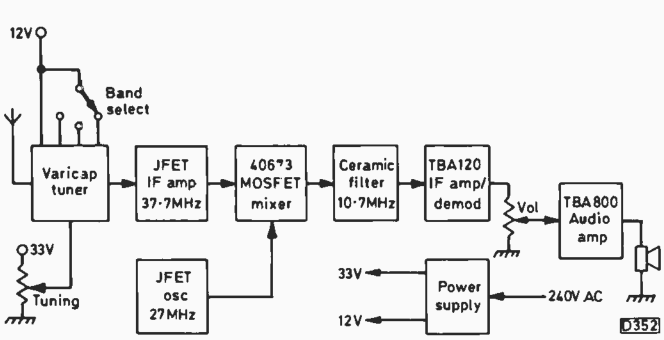

Fig. 1: Block diagram of the receiver.

about 54MHz should be found if a lead from the set's aerial socket is passed close to the oscillator.

Inject a 10·7MHz signal at the mixer transistor's drain – or attempt to tune in a station. Adjust L4 and L5 for maximum output/least background noise – L5 requires the most care in setting up. Tune to a semi-distant f.m. signal with slight background hiss (either u.h.f. TV sound or a Band II radio station is suitable). Adjust L5 carefully to minimise this hiss, using a plastic (not bronze) tool. Finally adjust L3 (both cores) then L4 and L5 for least background noise.

If the receiver isn't working the individual sections can be checked with the generator and/or the shortwave receiver.

It may be found that with the receiver in use the oscillator's second harmonic can be detected on the tuning range in Band I. In this event, ensure that it doesn't interfere with either ch. E2 sound (53·75MHz) or ch. E3 vision (55·25MHz). If it does, adjust the oscillator slightly so that the harmonic falls into a gap between these channels. Changing the oscillator's setting also moves the positions at which stations are tuned in on the dial but the harmonic will move relative to these stations, enabling a

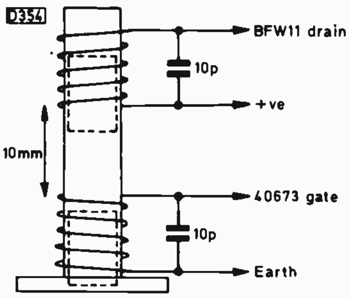

Fig. 2: Details of L3. Both coils 13 turns of 26-28 s.w.g. close spaced on an 0·3in (7mm) former with two 6 × 9mm long dust cores. Mount in a screening can.

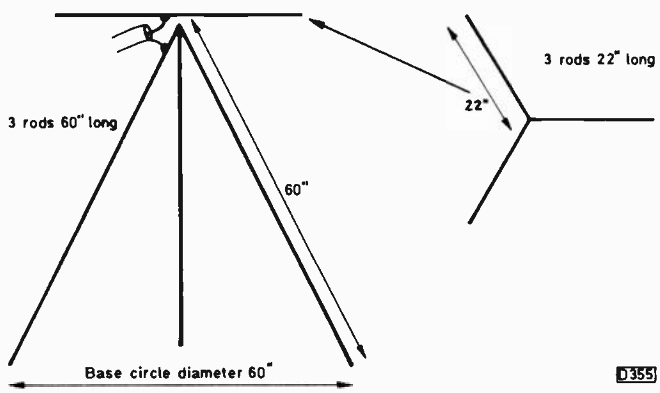

Fig. 3: Simple discone aerial design.

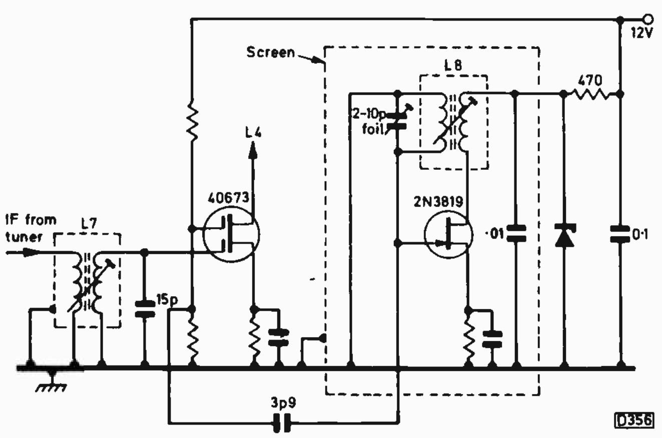

Fig. 4: Modified circuitry used in the miniature portable version. L7 is Toko type KANK3335R, L8 Toko type KANK3428R.

clear spot to be found. If the pick-up is excessive, try additional screening of the oscillator and aerial wiring. There's every possibility that the harmonic pick-up will be inaudible (it will appear as a blank carrier, possibly with hum, if present).

Finally the tuning scale can be marked. If a v.h.f. signal generator isn't available it will be necessary to wait for signals to appear to calibrate Bands I and III.

Tuning drift is normally very slight. Any abnormal drift will usually be due to the tuning supply, though the oscillator could obviously cause problems. I did come across a faulty batch of 33V regulators which produced random up and down drifting of the output voltage. The prototype receiver uses a ZTK33 regulator which gives excellent results – once the receiver has been switched on for a minute or so it will stay on tune for hours. A TAA550 is shown in the circuit diagram since this is more readily available.

Performance

Good results can be obtained using a telescopic aerial, with clear reception of quite distant local f.m. radio stations. Audio quality is excellent. For fixed operation the use of a discone aerial is suggested: this has a very wide frequency coverage (40-700MHz or so) with predominantly vertical polarisation – a simple design is shown in Fig. 3.

A.M. signals can be resolved by tuning the receiver slightly to one side of the signal. This method gives reception of a wide variety of mobile stations, public services, aircraft and so on which use a.m.

The receiver is ideal for monitoring DX conditions since Band I can be checked in an instant without having to wait for the main TV receiver to warm up (I use a Bush TV183D, which is a hybrid set). It's proved invaluable for monitoring DX-TV sound signals – it enabled CBHT, Halifax, Nova Scotia ch. A3 to be logged in June 1984.

Alternative Arrangements

More recently I decided to build a miniature, portable receiver using the same basic circuit. A miniature, double-tuned i.f. transformer is not available commercially however and is difficult to wind by hand. As a result, an adequate level of pre-mixer selectivity couldn't be achieved. To overcome the problem I decided to use just a single-tuned i.f. transformer prior to the mixer and an oscillator working at about 47MHz (36MHz plus 10·7MHz). The circuit changes are shown in Fig. 4. This approach also eliminates the previously mentioned problem of unwanted signals due to the oscillator's second harmonic, and enables the whole of the oscillator and mixer circuitry to fit on to a PCB measuring just 2 by 1¼in. It's necessary to keep the tracks associated with the tuned circuits to 1cm or less in length, and to screen the oscillator circuitry from the rest of the set.

Remove the tuning slug from the oscillator coil and set the trimmer near minimum. Signals should be received, and can be peaked using the core of the input coil.

Receiver sensitivity with this simplified arrangement is still high.

In its present form the reciever doesn't resolve a.m. signals too well. A TDA4420/4421 i.c. could be used instead of the TBA120 (for details of this i.c. see "System L-I Converter", *Television* February 1983). This should enable both f.m. and a.m. signals to be resolved at

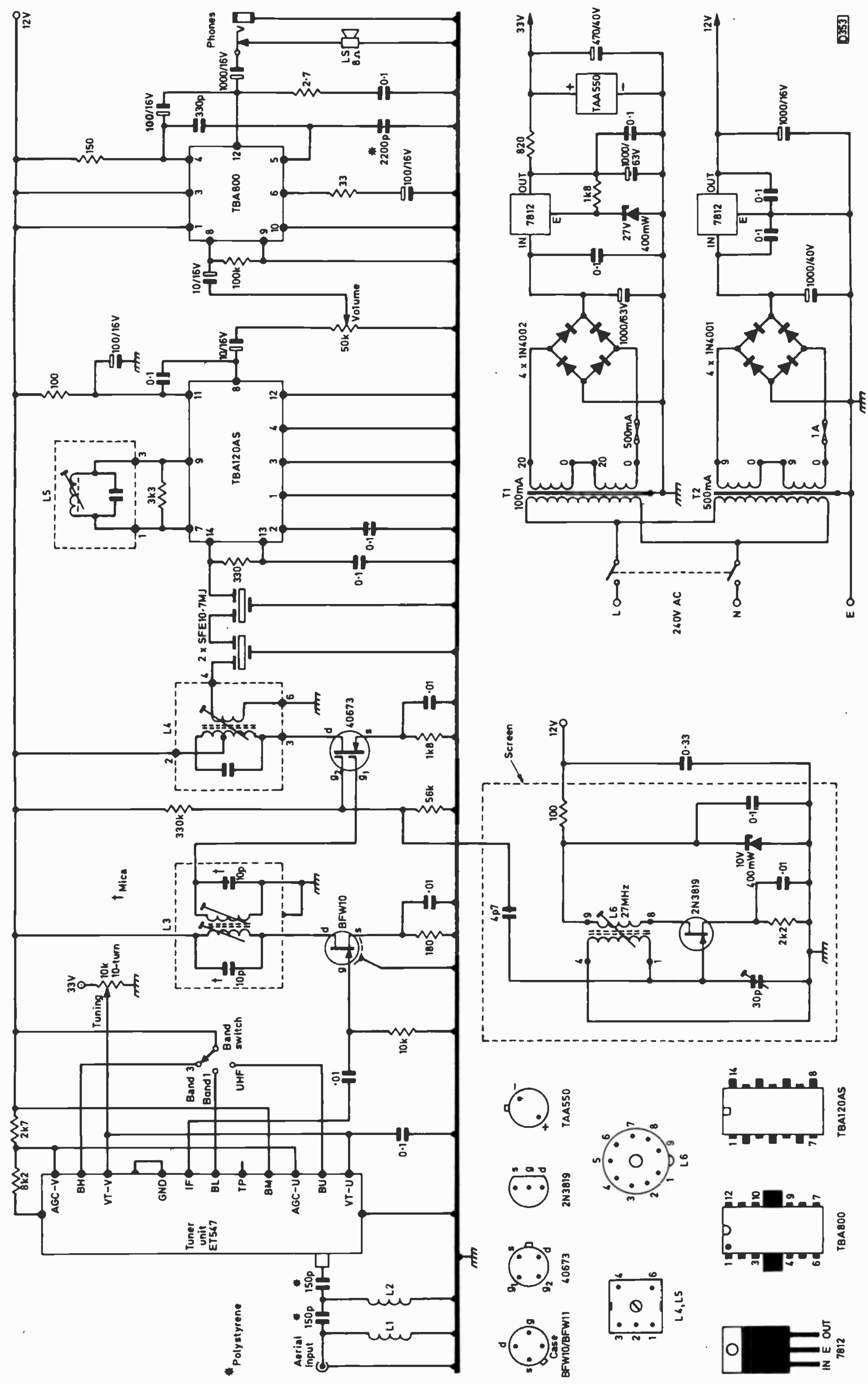

Fig. 5: Circuit diagram of the receiver. L1 and L2 consist of ten turns of 28 s.w.g., 2·5mm in diameter, close spaced and air cored. L4 and L5 are Toko type KALSA4520A coils – base on left viewed from below. L6 is a MAXI-Q R4T (white) coil, base also viewed from below. The JUGFET i.f. amplifier transistor can be type BFW10 or BFW11.

optimum quality, and would also provide a.g.c. to drive both the tuner and a signal strength meter. Switchable wide/narrow band i.f. filters would improve the results on the 2m amateur band, and would allow the use of a stereo decoder. . .

Component Sources

Ceramic filters and Toko coils can be obtained from Cirkit Holdings plc, Park Lane, Broxbourne, Herts EN10 7NQ. L4 and L5 (KALSA4520A, order code 35-45200) cost 67p each while the SFE10·7MJ (order code 16-10756) ceramic filters cost 55p each. Various other filters are listed. A 10kΩ, ten-turn potentiometer (48-10310) costs £4·45. Add VAT then 60p postage – note that the minimum order is £5.

L6 is available from G. and P. Powles, Unit 8, Brunel Road, Gorse Lane Industrial Estate, Clacton-on-Sea, Essex CO15 4LU. Specify White range R4T (for transistor use). Cost is £1·45 each. The IFT15 is a double-tuned 10·7MHz type costing £1·37 each. Add postage at 25p up to £2 order value, 7p on each additional £1 or part thereof. Then add VAT.

Tuner unit type ET547 is available from Sendz Components (see advertisement on back pages) who also list various other types of tuner.

The VPS VCR Switching System

James Fletcher

Surveys have shown that the vast majority of VCRs are used primarily to record programmes off-air for playback later at a time more convenient to the user. The one thing that the new VCR owner soon discovers however is that it won't provide more hours per day for TV watching: I wonder how many of these timed recordings are in fact subsequently watched. It's also interesting to speculate on how many people can actually understand the instructions that come with their recorders. Many modern machines offer very sophisticated timed recording facilities, often allowing the user to record different programmes at different times over a period of up to a year, or to have individual episodes of their favourite serials recorded each night for a week. Unfortunately most users never take the trouble to learn how to make full use of the timer facilities, restricting themselves to being able to record just one programme and finding this adequate for everyday purposes.

Another major problem with timed recordings is that the broadcasters don't always keep to their published schedules, leading to disappointment when a programme you've been planning to record doesn't appear on the tape, or when the film doesn't start until after the time shown in *Radio Times* so that you lose the last ten minutes and don't know who dunnit!

Such problems are not restricted to our own shores of course. To help overcome them the Germans have developed a much simpler way of controlling timed recording sessions. The system is know as VPS – video programming system – and has been developed by the W. German broadcasting organisations in conjunction with their version of BREMA, the ZVEI. It's been in operation since the autumn of last year.

With VPS each programme carries a teletext-like coded signal on line 16 of each picture. When the transmitted signal on line 16 matches information previously put into the recorder by the user, and not before, the programme will be recorded. At the end of the programme the recorder switches off – until it recognises another line 16 signal for a programme it has been asked to record. The actual time at which the programme is transmitted is unimportant therefore, since the machine won't spring into action till it recognises the appropriate signal at the start of the wanted programme. If the broadcasters would co-operate by leaving the advertisements uncoded films could be recorded without the "natural breaks", but there are presumably commercial reasons for not doing this.

For some years now the W. German broadcasters have been carrying bi-phase coded data at a rate of 2·5Mbit/s on line 16 of each TV picture, one of the so-called insertion data lines. This data is used for source information, remote control of the network, identification of stereo sound channels and the transmission of test measurement results. The VPS signals that identify each programme item use four previously spare bytes of data on line 16 – bytes 11-14, see Fig. 1. The comparator in the domestic VCR continuously checks whether information decoded from bytes 11-14 on this line matches information

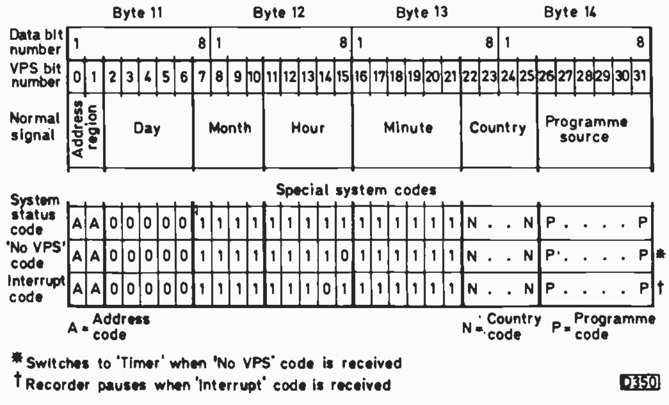

Fig. 1: Format of the VPS data transmitted on line 16.

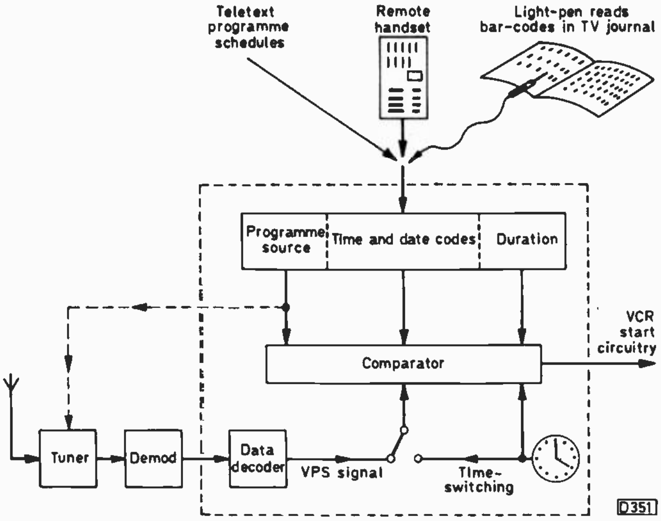

Fig. 2: Block diagram of the VPS VCR switching system.

programmed into it by the user. The system – see Fig. 2 – allows for automatic selection of VPS-controlled or timer-controlled operation of the VCR (to cope with programmes not VPS coded) and the timer can be used so that the VCR responds to VPS codes only during particular time slots, perhaps half an hour before and after the expected transmission time, thus minimising power consumption.

Feeding instructions into the machine to tell it which programmes to record can be done in several ways. Since the identification signals contain the month, date, hour and minute of the programme source, it's simple to use a remote control handset to insert the required information when prompted by a message on the screen. It's even easier to wipe a simple "light-pen" over the bar codes printed in programme timetable magazines: merely passing the pen over the codes for all the programmes you want to record sets up the required comparison signals without any further action.

Many engineers may wonder why the Germans don't make use of the standard teletext transmissions for VCR switching purposes – the IBA demonstrated that such a scheme was practical in the late seventies. The intention at that time was to use automatic teletext-controlled switching to allow UK schools' broadcasts to be transmitted and recorded at night. The UK teletext standard, on which the German one is based, actually contains a pseudo row address in magazine eight specifically for this purpose.

When asked about this the German engineers say that the lower VPS data rate of 2·5Mbit/s (compared to 6·9375Mbit/s for teletext) gives a better error rate, with simpler error detection and clock regeneration, i.e. a more reliable system. This sounds fine in theory until you recall that the teletext system was not adopted by the W. Germans until a large numbers of tests had shown that the 6·9Mbit/s transmissions were reliable over a wide range of different terrains, including that of Bavaria. It also seems strange to introduce yet another decoder circuit now that millions of sets are equipped for teletext reception. A more plausible explanation for not using a teletext-based system is that with the federal structure of broadcasting in W. Germany each region has its own programming but not necessarily its own teletext service. The Germans say that to multiplex teletext signals from a central service with locally generated VCR switching signals would be extremely expensive. All regions already made use of the existing data transmissions on line 16, so it's a fairly simple matter to introduce the VCR switching bytes in each region. In the UK line 16 is used for teletext transmissions.

Grundig are now making VPS equipped VCRs, several W. German networks are transmitting the VPS switching signals, and both Austria and Switzerland have announced that they will be adopting the system shortly.

It looks as though this W. German initiative is set for considerable success, thanks to the broadcasters and manufacturers working together. In fact the VPS system could well become standard throughout Europe. The chances for an alternative, teletext-based switching system don't look too good, especially when you consider that the earlier IBA ideas were never taken up. The bar-code system of programme identification was demonstrated by the BBC several years ago, for use in conjunction with radio recorders. It was claimed however that the printers couldn't print accurate bar codes on the type of paper used for the *Radio Times*!

TV Fault Finding

Reports from Philip Blundell, Eng., Tech., Leonard Allsopp, Steve Leatherbarrow, Roger Burchett and Steve Illidge

Finlux 1000 Series

The complaint was a blue screen. Now these sets have a tendency to produce a coloured raster if the first anode preset is incorrectly set, but with this receiver it was very difficult to find the correct setting. We also noticed that with a test card there was a slight green tint to the white sections of the picture and a blue ghost to the right of any vertical line. The semiconductor devices in the red and blue channels were swapped over one by one but the fault persisted. A burst of resistance checks finally revealed that Rb47 (1·8kΩ) in the coupling to the blue output stage was high in value.

Field collapse can be a difficult fault to trace in these sets. If the sound is working you've probably got a run-of-the-mill field fault such as a defective TDA3652 field output chip or loss of the 26V supply due to Rzll and Rz12 (1Ω) being open-circuit – modified types are available from Finlux. There's one trap for the unwary however. Parts of the field timebase are in two different chips, the TDA3652 output chip and the TDA2578A sync processor/timebase oscillator i.c. The driver stage in the latter chip monitors the feedback from the output stage and if this is wrong the driver shuts down. So a fault in the output stage, open-circuit print or failure of resistors Rk17/18/19 in the feedback network can be responsible for lack of drive from the TDA2578A. The fun really starts when the fault is field collapse and no sound. You could have a TDA2578A supply problem. Check the voltage at the cathode of D21 in the 11·5V regulator circuit on the video/i.f. board – the reading should be 11·5V. If this voltage is missing fusible resistor Ra3 is probably open-circuit. If o.k. check the voltage at pin 10 of the TDA2578A. A low voltage here, at some 6V instead of 10·7V, should lead to a check on the associated circuitry including transistors Th6/7 etc. Diode Dh7 (1N4148) in this circuit can be responsible for this when leaky.

E.H.T. but no sound or vision was the complaint with one of these sets. Turning up the first anode preset produced a coloured raster – so it wasn't a field fault this time! The interstation muting was disabled by disconnecting pin 13 of the TDA2578A i.c. This produced sound, so out came the scope. The video signal was present at the output of the TDA3541 i.f. chip but was missing at pin 19 of the scart connector. Ri20 (100Ω) turned out to be open-circuit – it fell apart when unsoldered from the board! **P.B.**

Tatung 160 Series Chassis

This set, actually a GEC 2296, was only a month old when the top of the picture began to fold over. All the voltages around the TDA3651 field output chip were low, including the 25V supply. This was due to the h.t. line being low. After many d.c. and resistance checks in the switch-mode power supply we discovered that the h.t. control itself, R813, had gone low in value. **P.B.**

Philips KT4 with VST

This set was dead – stuck in standby. An initial check on the power supply revealed that the VST module wasn't giving the on command. The momentary contact on the power switch was working and the supplies to the microcomputer i.c. were normal, but the voltage at pin 7 (reset) was low at 2V. C2121 was leaky. **P.B**

Panasonic TC48G/TC862G

The trouble with this set was line hold drift. All the voltages in the line generator department were within tolerance and the flywheel sync discriminator diodes were o.k. Use of freezer eventually identified C505 (1μF, 50V) as the cause of the trouble. This electrolytic couples the feedback pulse from the line output stage to the discriminator circuit: it measured all right but a replacement did the trick. **L.A.**

Hitachi NP8CQ Chassis

This set wouldn't start up. There was h.t. at the collector of the 2SC1942 chopper transistor but precious little else. After a check on the three high-value start-up resistors R907/8/11 the chopper transistor's base lead was disconnected to that a resistance check could be made. We discovered that there was base-emitter leakage, but when the lead was touched back on with the power still applied the set sprang to life. Fitting a new chopper transistor restored normal operation. **S.L.**

Rank T20 Chassis

The symptom here was a vertical scan covering only a third of the screen but perfectly linear. Adjustment of the height control made matters worse! Its 470kΩ feed resistor checked out perfectly but when the height control was removed from the panel some sort of substance could be seen between the pins. Dismantling and cleaning the track and metal case solved the problem. One of those "suitable for TV" type aerosols had been used in the past. There had then been a build up of conductive gunge which ate up the height circuit volts. **S.L.**

Fidelity ZX3000 Chassis

We had fitted a new tube to this receiver and had just completed the setting up procedure when we noticed that black lines appeared across the screen at low beam current levels and that if the brightness control was used quickly to darken the picture the black level sort of floated around with picture content. Our fault of course: we'd left off the aquadag earth tag at the tube base. **S.L.**

Philips KT4 Chassis

No picture but normal sound was the problem here. With the set on and the back off horrible dry-joints and nasty blue sparks were seen around the connections to the line output transformer. Set off, joints resoldered, switch on and no blue sparks – but no picture either. Turning up the first anode preset on the tube base panel gave us a new symptom – field collapse. Checks around the field timebase chip at the top right of the board gave hope – there were no voltages anywhere. Moving back to the line output transformer derived 26V supply was a short step and we soon found that the 3·9Ω surge limiter resistor was open-circuit. Replacing this and resetting the first anode supply gave good results. The blanking circuit within the TDA3650 field timebase chip had presumably removed the raster. **S.L.**

Fidelity AV System

Whilst removing the back cover on one of these units I hoped I was going to find something recognisable inside. Amongst the jumble of wires I could just make out a ZX3000 chassis. Not too bad really, but a glance at the audio side shows that it leaves a lot to be desired regarding accessibility. Anyway, the TV side was dead. Not totally dead, as the power supply was delivering a "quiet" 112V to the line output transistor. No line drive maybe? The TDA8180 "do all" sync/timebase oscillator i.c. was getting its 25V supply from the chopper transformer but not doing a lot with it. Replacing this chip along with the BF460 line driver transistor produced line drive but then the set tripped. After many fruitless checks in and around the line output stage we discovered that the h.t. supply was low. Resetting it gave good results – apart from the usual vicious geared-down tuning arrangement. Maybe the set interpreted low h.t. as excessive current flow? **S.L.**

Decca 100 Series Chassis

This set was brought in off rental when it blew a 3·15A mains fuse for the second time in three weeks. Suspecting a problem in the crowbar circuit we connected a 60W bulb in series with the thyristor and left the set on test. Sure enough after a couple of days the bulb lit, indicating that the thyristor had fired. As a first go the thyristor and the transistors in its trigger circuit were changed. Result: perfect operation till it did the same thing again! Replacing the 186V over-voltage sensing zener diode D617 finally cured the fault. **S.L.**

Thorn 9000 Chassis

After a number of complaints about muffled sound on this set I consulted a friend at R*** R***. He suggested a check on the soldering of the coil (L712) that lives at the left-hand front corner of the Syclops panel, viewed from the back. The fault was present next time I called and tapping under the board here cured it: resoldering the coil provided a permanent cure. The chassis connection for the audio circuit is made via this coil. **R.B.**

Philips TX Chassis

A common fault with these sets as they age is no field scan with uncontrollable brightness. The cause is a break in the 95V line just behind the aerial socket bracket. This disconnects the supply to the video output transistor and the field driver transistor.

Line collapse to a vertical bar about half an inch wide was caused by the line scan coupling capacitor C455 (47μF) leaking. Fortunately there's nothing too close to get corroded, and as the panel is horizontal the gunge doesn't spread. **R.B.**

Philips G11 Chassis

I've come across several cases recently of dry-joint trouble at the lower end of the line flyback tuning capacitor C3131. In one set it had burnt a large hole in the panel, breaking the print and disconnecting the line output transistor from the transformer: C3131 was a misshapen mess and the smell must have been pungent, but still they used the set!

Difficulty in setting up the EW and width controls (you can almost get it right) is due to one of the EW modulator diodes (D3132, type BYX55-600) being leaky. **R.B.**

Decca 10/30 Series Chassis

A fault that's becoming more common as these sets age is low, sometimes varying contrast, with a noticeable difference in contrast between channels. The culprit is the a.g.c. smoothing capacitor C60 (22μF). **R.B.**

Hitachi CPT2248 (NP83CQ Chassis)

The fault with this set was no channel change, just a blank raster with the green video light illuminated. The 12V rail was low and the 2Ω resistor R716 which feeds the 12V regulator transistor Q703 was found to be high in value. Replacing this didn't cure the problem however: the 12V rail was still low and Q703 ran hot. The cause was found to be Q1454 on the CITAC board assembly. This transistor is used as a 5V regulator, fed from the 12V rail. It was short-circuit. **S.I.**

Sony KV2207UB

The complaint with this set was dark pictures. A check on the voltages at the tube base revealed that the focus voltage was low. The feed resistor R724 (1MΩ) had gone high in value. **S.I.**

Teletopics

EURO DBS

Plans for the services to be broadcast via the French TDF-1 TV satellite keep changing. In the January issue we reported that Robert Maxwell had signed a contract to run one of the channels. Since then Mr. Maxwell has entered into an agreement with four partners to form a European satellite television broadcasting corporation (Consortium Européen pour la Télévision Commerciale) which will be providing the programmes on two of TDF-1's five channels. Mr. Maxwell is the president of the Corporation whose other members, all with equal shares, are Sylvio Berlusconi's Italian Fininvest company, Jerome Seydoux's French Channel Five group, Leon Kirch's W. German Taurus Films group and a so far unnamed Spanish company. The Corporation will be paying an annual rental of some £10 million for the two channels and the deal is to last for eight years initially. One channel will provide English-language programmes while the other will be multilingual – mainly Italian. The service area includes the UK and Ireland to the west, across Europe as far east as central Poland. There will be eighteen hours of broadcasting daily, paid for by advertising. Of the other five TDF-1 channels one has been assigned to a French cultural programme (Channel Seven), one is to be run by the French Channel Five group while an option on the fifth has been offered to the Luxembourg broadcasting organisation CLT. TDF-1, which is due to be launched in November, is a high-power satellite which will operate in the 12·5GHz band.

Mr. Berlusconi's TV interests continue to expand: he's a partner with Jerome Seydoux in Channel Five and also runs three Italian private TV networks. The TDF-1 programme, which was started in 1981, has received substantial government aid.

Meanwhile a new report from CIT (Communications and Information Technology) Research considers that the potential European market for domestic satellite TV equipment has been much overrated. It suggests that there will be only some 400,000 domestic installations in use by 1990 and warns that it would be misleading to base forecasts on the situation in the USA where the rapid rise in TVRO use has been mainly in rural areas. One would be inclined to go along with this if the European services continued to be primarily from the low/medium-power Eutelsat and Intelsat birds, but it could be a different matter if the TDF-1 services catch on. Patrick Whitten, managing director of CIT Research, points out that none of the European satellite TV channels are at present making a profit. It will be interesting in this respect to see how Mr. Maxwell's Corporation fares and what effect it will have on his cable/satellite TV interests.

The European Telecommunications Satellite Organisation has issued an official statement on the performance of two of the transponders on Eutelsat I-F1 (one of these is used by Sky Channel). It points out that the transponders continue to provide the nominal transmitter power without degradation of the quality of the signals received and that the launch of an additional ECS flight will not be necessary. ECS-4 is due for launch in July 1986 and ECS-5 in March 1987. Sky Channel has renewed its Eutelsat transponder lease contract. A new generation of Eutelsat birds is planned for launch starting in late 1989.

LITIGATION

As forecast last month the IBA decided to block the Rank Organisation's proposed £753m bid for the Granada Group. The IBA's action upset Rank who promptly decided upon legal action. Once the men of law got in on the act things became decidedly complex, as is inclined to happen. The case came up before the High Court and was dismissed on the grounds that the IBA, in making its decision not to grant Rank permission to exercise more than five per cent of the voting rights in Granada (it already had an eight per cent stake) under Granada's articles of association, had been exercising an adjudicatory power conferred upon it by those articles and had not been exercising a power given to it by the 1981 Broadcasting Act. Well now you couldn't get much clearer than that, could you? Not good enough said Rank who immediately took the case to the Court of Appeal which agreed with the High Court's ruling. Rank is now considering an appeal to the House of Lords.

PHILIPS SERVICE POLICY CHANGE

As a result of continuing product reliability improvement and following general acceptance of the warranty claim form policy introduced last June Philips Service is changing the way in which it will in future operate. A comprehensive network of Approved Service Dealers is being appointed. These will have the support of a specialist team of Philips technical liaison officers. Consumer electronics repair facilities, both field and workshop, will cease to operate at the present eight Philips Service branches on May 1st. In addition all branch trade spares counters apart from Waddon (Croydon) will be closed from the same date. Spares will continue to be available from Central Stores, Waddon. In many cases spares will be available locally only from the Approved Service Dealers – a directory of these is to be made available shortly. The existing major appliance field service system will continue to be available using the network of telephone numbers currently in use and the repairs service for small domestic appliances will remain unchanged.

SMALLEST CAMCORDER

A new lightweight camcorder (Model GRC7) weighing only 1·3kg with cassette has been launched by JVC on the Japanese market. It's expected to be available in the UK this summer at a price of around £1,300. The new camcorder is a full-feature model with ×6 power zoom, electronic viewfinder, auto white balance and fade, backlight compensation and one-button fully automatic or manual operation. A half speed setting gives a recording time of up to an hour. The size is 121 × 165 × 223mm with the detachable viewfinder retracted – size reduction has been aided by using a CCD image sensor instead of a pickup tube.

BUSH TAKEN OVER

Bush Radio, a USM listed company which acquired the rights to the Bush brand name from the Rank Organisation in 1981, has been taken over by the video distribution group Prestwich Holdings in an agreed bid that values Bush Radio at £15·5m. Paul Levinson, chairman of Prestwich, intends to extend the range of products handled by the group. Bush Radio's technical and purchasing office in Hong Kong will give the combined group access to Far Eastern suppliers.

TV/VCR SPARES GUIDE

In presenting our spares guide last month we mentioned the rapid changes at present taking place in the industry. Already a correction is required. Spares for Rank produced sets are now handled by HRS Electronics Ltd., Great Barr Street, Birmingham B9 4BB (021 771 2525) who have taken over the total stock of components previously held by Mastercare Ltd. The agreement between the two companies assigns to HRS sole distribution rights for Rank Radio International service components. Orders should now go to HRS quoting the same part numbers as previously used.

One brand that was accidentally omitted from our list was Metz. Spares for Metz receivers can be ordered from Kolbyco Ltd., 65 Valleyfield Road, London SW16 2HS (01 677 6224).

MULLARD'S SLIMSCREEN TUBE

Mullard have developed a new tube which is believed to be a "world first" in flat TV tube technology. Known as the Slimscreen the new tube is 50mm deep with a screen diagonal of 19cm. It's described as a high-technology, folded-optics c.r.t. with a conventional 4:3 aspect ratio, offering high resolution, good brightness and excellent contrast. The tube has been shown in a working demonstration and is primarily intended for military and avionic applications where space is at a premium. We assume that it stems from the design described in this column last November (page 39). The currently available tube is a monochrome one though colour versions are being developed.

AVOMETERS RECALLED

Certain Model 1000 and 1001 Avometers are being recalled by Thorn EMI Instruments for modification. The meters concerned have serial numbers with the second letter C or D or adjoining letters AE, BE, CE or DE. The problem is on the 1kV range. Meters should be returned to the Thorn EMI Instruments Parts and Service Centre at Archcliffe Road, Dover, Kent CT17 9EN marked "for modification".

35mm SLIDE CONVERTER

OpTex (22-26 Victoria Road, New Barnet, Herts EN4 9PF) have introduced the simple to use Duplikin III 35mm slide to 2/3in. video converter. Transferring slides to video is achieved by inserting either mounted or unmounted slides into the converter, which attaches to the camera's lens port, and pointing the assembly at a constant light source. Slides are focused by moving the lens barrel back and forth: the barrel is then fixed in position by four screws. Duplikin III sells at £575 plus VAT and can be used with the following cameras: Sony 330 and BVW3P; Hitachi SK97/91/81; JVC KY310/320/900/950.

PHILIPS' PROJECTION TV SYSTEM

Philips is to introduce a new projection TV receiver later this year at a price of around £2,000. It provides a 37in. colour display using back projection, the cabinet dimensions being remarkably compact – 41in. high, 33in. wide and 20·5in. deep. Performance is said to be excellent, with high resolution and good focusing, colour rendition and contrast. Two techniques have been adopted to get sufficient contrast for viewing under bright ambient light conditions. First there is liquid coupling between the three tubes and the objective lens. Secondly the projection screen consists of a PMMA plastic structure arranged like a Fresnel lens – this is in effect an optical equivalent to a black-stripe c.r.t. Four speakers mounted beneath the screen provide high-quality stereo sound and the set has remote control, teletext and various connectors including two scart sockets.

MULTISTANDARD CTV

Toshiba's new 26in. FST Model 289X4M is a multistandard, multivoltage receiver with midband cable capability – it can handle eleven different broadcasting standards including PAL, SECAM and NTSC colour. The suggested price is £800. Other features include 23-button remote control and AV input/output sockets. For further details contact Toshiba (UK) Ltd. at Toshiba House, Frimley Road, Frimley, Camberley, Surrey GU16 5JJ.

NESAT PRODUCTION MOVE

Manufacture of NEC's NESAT satellite TV receiver system has been moved from the company's Fuchu plant in Tokyo to a mass production facility at the Fukushima factory in N. Japan. Sales of the system, which is tailored specifically to the requirements of the European market, are said to have surpassed all initial projections. Production is now running at up to 100 a day.

NEW MULLARD TV CHIPS

The latest addition to be Mullard TDA4500 series of chips, which incorporate the i.f./a.g.c./sync/timebase generator sections of a receiver, is the TDA4505 which features an external connection between the video amplifier and sync separator. Since the i.c. can synchronise signals from an external source manufacturers using it can produce sets able to display teletext, VCR and video camera inputs. It can also be used in surveillance monitors etc.

The original TDA4500 was followed by the TDA4503 which has improved crosstalk suppression. The TDA4501 reduced the external component count further by incorporating a sandcastle pulse generator. The new TDA4505 has the same features as the TDA4501 plus the additional external video connection. These chips also provide sound signal processing. The TDA4502 is a version of the TDA4501 witout the sound processing but with an internal video switch. A further version, the TDA4504, was originally developed for the French market and will be available later this year: it's pin-compatible with the TDA4502 and can handle both negative and positive video modulation.

The new TDA3566 colour decoder chip is a higher performance version of the TDA3562A and can handle both PAL and NTSC signals.

DIGITALLY ASSISTED TV

BBC research engineers have proposed a new technique called Digitally Assisted Television (DATV). With this system on analogue picture signal is transmitted along with high data rate digital signals that carry control or supplementary information about the picture. One application could be for bandwidth reduction with a high-definition TV signal to enable it to be accommodated within a single DBS channel designed for a 625-line signal. DATV is basically a bandwidth compression technique: the role of the digital component of the transmitted signal is to provide the receiver with control information to enable it to reconstruct the picture without significant degradation compared to the original. One example of the use of the DATV digital component is to carry information about which parts of the picture are moving and which parts are stationary – several bandwidth reduction techniques rely upon this information being made available to the receiver. Another example is to carry data to help reconstruct a sequentially scanned picture which, to save transmission bandwidth, has been converted from sequential to interlaced scanning.

Early results of experiments at the BBC's Kingswood Warren Research Department indicate that the DATV technique can provide HDTV quality even where the signal bandwidth has been reduced by a factor between two and four. DATV can also be used to improve the performance of 625-line systems with associated digital capacity such as the MAC/packet family of transmission standards. The BBC's deputy director of engineering Charles Sandbank sees DATV as "a powerful technique to squeeze HDTV signals through the bottleneck of transmission channels using the sort of technology that will be in our homes in the 1990s".

Hush My Mouth

Les Lawry-Johns

If you remember, a couple of months ago I bragged about Mrs. Furnace's set: a Philips G6 which I'd sold to them some sixteen years ago. I mentioned how good the picture was. Well, she phoned the other day to say that the picture had gone into lines. So I packed my bag with care, taking with me in particular a PCF802 and a PFL200, the latter in case it was rolling too. In these sets you see the luminance output valve is a PFL200, the second pentode section being the sync separator.

We arrived at the house and switched the set on. When it had warmed up, the picture was in lines and I could see that it was also rolling over. So I decided to fit the new PFL200. As I did so I noticed that a small nearby resistor looked the worse for wear. It was one of the sync separator's anode load resistors, R2121 (68kΩ – it's a single-standard G6). Just to be sure I measured it and found that in fact it wasn't too far out. To be safe I replaced it, then tried the set again. This time the picture looked fine: I left Mrs. Furnace with her praise ringing in my ears. "Don't retire yet Les."

Next Day

Next day she was on the phone again. "The picture's all white with no picture but the sound sounds fine." I didn't doubt what had happened. The glass of the PFL200 had cracked when I'd put it in. It's happened before to ham-fisted idiots like me. So off I went again, this time with three PFL200s just in case.

The valve hadn't cracked, but I noticed a resistor laying in the bottom of the rear edge. It was the luminance output pentode's screen grid feed resistor R2111. My lightning sharp (what?) mind immediately pointed out that an open-circuit screen grid feed resistor would have caused the valve's anode voltage to rise, not fall, thus blacking out the screen. But I checked the resistor's value, which was correct at 2·7kΩ. So I refitted it and to be on the safe side checked the resistance to chassis (in case the decoupling capacitor was short-circuit, which it wasn't) and fitted another PFL200. The picture was now as poor as it could be. There was plenty of colour but no luminance. I decided to try the previous PFL200. There was a puff of smoke from R2111 and it fell off its tags again, this time damaged beyond salvation. I kicked myself hard, then fitted a new PFL200 and a new resistor. We were now back to the lack of luminance.

I looked askance at the BC148 black-level clamp transistor in the luminance PFL200's control grid circuit: if the previous valve had gone short-circuit between its screen and control grids the transistor would have been dealt a mortal blow. I looked twice at the chassis and decided to remove the panel (three screws at the top). This done it was a simple matter to replace the BC148 – except that I didn't have one with me. I did however find a BC147, and decided to fit that. It worked fine and once more we had a lovely picture. I tottered out into the snow and managed to find my way to the nearest off-licence – I never drink at work but make up for it in the evening.

Mrs. Furnace phoned later that night, after I'd downed a few whiskeys, to say that her picture was rolling. "If you look at the back of the set you'll see that a knob sticks out at the lower rear centre. Turn it slightly, looking at the picture through a mirror: get the picture to roll down, then turn the control so that the picture rolls up and clicks into lock. O.K.?" I presume that when I refitted the rear cover the last time I'd moved the control slightly without realising it. She hasn't phoned back, so it's either all right or she's called in a more able engineer who's not thinking about retiring.

A Handy Tip

Here's a handy tip that's been passed on to me. Apparently lots of 20in. Philips sets fitted with the KT3 chassis are suffering from loss of blue and green to leave a predominantly red picture. The cause is loss of emission in the blue and green guns – the heaters are slightly underrun and the cathodes become contaminated. The tip is to short out the heater chokes on the tube base. Put a link across one of the two chokes and note the difference after a day or two. If there's no improvement, put a link across the other choke as well and leave the set working in this way for a day or so. When full emission has been restored, remove the links to leave the set in the original condition (chokes in circuit). I haven't tried this yet myself but we've a couple of KT3s that could do with it.

Reggie's Mum

Reg Butcher is in fact our butcher. He's an important person since he supplies Zeb with his weekly bones as well as our meat. When H.B. called into his shop last Friday Reg told her that his mother was in dire straights with her TV set. Would Uncle Les put in an urgent call?

So Les paid her a visit. She opened the door and I said "I've called about the TV". She told me my visit wasn't necessary as it had been fixed. I was a bit taken aback because I knew they wouldn't call in anyone else and Reg always paid the bill. I told her that Reg had asked me to call.

"My Reg? Oh, you must mean the TV. I thought you were the telephone man. Come in." I went in and switched on the Thorn 8800. There was no green. She was talking away ten to the dozen about her ailments and the weather and what not whilst I tried to listen and answer, at the same time checking the voltages around the three top transistors. The voltage at the collector of the green output transistor was a lot higher than the voltages at the collectors of the other two output transistors. "What's wrong? Something gone has it? I suppose you'll have to order it and I'll have to wait as usual." I didn't answer as I was searching in my bag for a BF337. I found one, fitted it and the picture was then green. So I set the controls and wrapped the job up. "Oh you've done it then. I suppose they give you all those things in case you need them."

"No dear I have to buy them in case you need them."

"What happens if no one needs them?"

"I just have to keep them till they are needed."

"Oh, well. Never mind. Give my love to my Reg."

So off I went to present him with my bill.

"Thanks Uncle Les."

A Smashing Time

Later that day I called to a customer who said the set was too big to bring in. It turned out to be a Ferguson set fitted with the TX10 chassis – a 26in. model that lived quietly in a corner of the room, under a shelf on which were displayed many china articles which I presumed to be Ming or something.

I pulled the set out and removed the rear cover. The fuse under the right side red cover had failed so I looked suspiciously at the focus control. "There was a spark and then the set went off altogether." That confirmed my suspicion. I replaced the fuse and rummaged in my bag for a focus unit (the long type with improved insulation). I found one and took it out of the box. "Oh" said the lady of the house, "look at the pretty elephants on that box." So I had to tell them what Stan had told me months ago, about Small Elephants and Mammoth Elephants. I could see they didn't believe me and I don't blame them.

As I was fitting the unit my shoulder caught against the shelf. There was a resounding crash as the china descended into the fireplace. I managed to catch one lovely plate in its plastic holder and handed it over to the lady. As I did so the plate toppled out and joined the others in pieces in the fireplace. "Oh, I'm so sorry" I mumbled, expecting to be attacked at any moment. "Don't worry" was the surprising reply, "they were only raffle prizes." Well I never. Most other people would have done their nuts, raffle or not. I fixed the focus unit and refitted the red cover. When I switched on a good picture appeared. We watched it for a few minutes to make sure, then I took my leave.

Smoke and Moans

A chap was waiting when I got back to the shop. He was tapping his foot and moaning his head off. "You repaired this set for me a few months ago, now it's smoking."

"It's not good for it you know."

"It's not good for me either" he groaned. "Paying out all this money. I paid you ten pounds for this set only six months ago."

"No you didn't. You paid me ten pounds for an e.h.t. unit to save replacing the line output transformer which would have cost a lot more." The set was a Ferguson Model 3840 (1690 chassis) which has an e.h.t. rectifier buried inside the transformer. We fix an external, shrouded diode in series with the e.h.t. lead and this restores normal working. It was the lead from the transformer to the diode that was smoking, running a bit too close to the heatsink. I unsoldered it and slipped a used solder mop cover over it. This held it away from the heatsink. Soldered it up again and the job was done, i.e. no more smoke.

"There you are sir. You can stop moaning now. Good afternoon. May you have many more male children and don't let them smoke." As I rolled myself a cigarette.

Second-hand VCRs

Derek Snelling

In the November 1983 issue of *Television* I wrote an article on checking over second-hand VCRs. Since then some of the more modern machines have started to appear on the second-hand market. While everything said in the previous article still holds, certain extra points need to be borne in mind. So here's a short up-date on what to look for.

In the previous article the problem of pulsing with the Ferguson 3V22 was mentioned – the picture or colour moving from side to side when playing back a recording of a stationary picture. The most common cause of this at the moment is a worn pinch roller.

When checking in the picture search mode the presence of extra wide noise bars may be the first indication of head wear. The problem can also be caused by the fast forward/rewind idler slipping – this results in varying tension, particularly in reverse search. It applies of course only to machines fitted with this type of idler.

With the newer machines it's best to find out as much as possible about the model before you go to inspect it – in particular what it's supposed to be able to do and how many motors it has. For example, is the pause supposed to have a noise bar or not? Is the timer a one event or several type? Knowing the number of motors can have a bearing on such problems as poor rewind: if this is done by the same motor used for fast forward then a clean or a new idler is probably all that's required, but if each turntable is directly driven by its own motor the problem could well be due to a faulty motor.

Another point concerning motors. In some machines a noisy capstan motor is a precursor to wow on sound. If the machine you're checking seems noisy in the playback mode, press pause: if the noise goes away it's coming from the capstan motor; if it remains the lower cylinder could be worn.

Finally, most of the more recent machines have remote control. Don't forget to check its operation. Faulty wired remote control systems are usually easy to repair but beware of the type with multipin plugs. If the machine has an infra-red remote control system try to arm yourself with a set of batteries to counter any claim that "it's all right – just needs some new batteries".

Armed with the above notes and the previous article you should be able to avoid most of the pitfalls of buying a second-hand VCR.

Long-distance Television

Roger Bunney

The reception talking point during February 1986 was the intense aurora that started on the 7th and produced dramatic results on the 8th. Major solar storms across the Sun's surface during the first week of February produced large flare disturbances resulting in a collapse of the ionosphere, with resultant high levels of noise and very low m.u.f.s. The magnetic storms that followed produced dramatic auroral displays (Northern lights) and v.h.f. signal reflection from the auroral sheets. Minor signal reflection occurred during the first phase in the late afternoon and the later phase at midnight on the 7th. The following day produced the most intense aurora for several years, again with the first phase during the afternoon from late lunchtime to 1800 and the second phase from around 2100 to well past midnight. Fortunately the 8th was a Saturday, allowing many enthusiasts to experience the aurora. Reports from both DX-TVers and radio amateurs show that signals from across Europe were received via the northerly reflections. Unusually, signals from the lower latitudes were well received – from Yugoslavia and Hungary for example as well as from Czechoslovakia, Poland, Russia, Germany, the Benelux countries, Scandinavia and the UK itself. Signals from France, Switzerland, Austria and Ireland were also logged. The optimum direction for reflection seemed to be around 20-55° from north.

As usual Scotland did well with auroral reception throughout Band I, though the characteristic fading/hum effects caused some difficulties with signal identification. Ian Menzies (Aberdeen) logged many Band I signals from SR (Sweden) and NRK (Norway): TSS (USSR) was logged up to ch. R4. An unusual identified reception was that of Radio Kent at 104·2MHz. Cyril Willis (Downham) noted signals throughout Band I and into the lower part of Band III, though none of the latter could be identified. On the east coast Tim Anderson received signals up to ch. E3 with reasonable quality, though they consisted of unidentified programmes. Following the solar storms and disrupted ionosphere the E and F layers gradually returned to a more normal state. The intensity of this aurora suggests however that a repeat performance will occur after the next solar rotation (27 days).

There was little SpE propagation during the month, though short periods were noted during the daytime – particularly signals from Scandinavia. The 5th produced CST (Czechoslovakia) ch. R1, RAI (Italy) IA and TVP (Poland) R1; the 9th TVP R1 and ORF (Austria) E2a. Signals from JRT (Yugoslavia) were seen during the early morning on March 2nd – on chs. E3 and E4.

There was a slight tropospheric lift on February 27/28th with reception in eastern England of the nearer Benelux/French u.h.f. transmitters, also RTL (Luxembourg) ch. E7. A further lift occurred on March 3rd. Improved tropospheric conditions on February 22nd produced French fifth network signals (Bouvigny ch. E51 and Lille town ch. E65), also the Bouvigny sixth network transmitter (ch. E54), in Brussels.

Ryn Muntjewerff (Holland) probably received MTV-2 (Hungary) on ch. R37, a 20W relay at Vamosmikola, during the tropospheric opening on October 27th last year. SpE reception in Australia during February produced many signals in Band I, also signals in the 88-108MHz f.m. band.

An Interesting Band I Aerial

Various wideband Band I aerials have been featured in these pages in the past. One particularly interesting design, by Ian Beckitt (Buckingham), is shown in Fig. 1. It features an active dipole with two tightly coupled passive resonators – not unlike the Antiference Tru-Match design, though that had a single passive element tightly coupled to the dipole. Ian's design has proved to be surprisingly effective – one memorable reception was of a prolonged, multiple-hop SpE signal from Ghana on ch. E2. The design is shown here to enable other enthusiasts to experiment with it: coverage is basically 45-62·3MHz but I feel that an improvement at the top end of the band to give coverage of ch. E4 would be obtained by decreasing the length of the forward passive resonator from 90in. to 83in. This step plus reduction of the reflector length from 124in. to 117in. would change the coverage to 48-68MHz, i.e. chs. E2/3/4. Many DXers use a single element cut to the centre of the band, say 55MHz, which means that a lot of signals are missed. If there are other interesting designs "out there" we would appreciate hearing about them.

DX Converter Unit

In the February-April 1982 issues we featured an outboard DX-TV system incorporating an up-converter so that the output could be fed to the aerial input socket of a standard system I TV set. The system gave full coverage of the v.h.f./u.h.f. bands with switchable i.f. bandwidth facilities for weak signal working. A commercial unit, type D100, is now available from HS Publications, 7 Epping Close, Derby DE3 4HR. The single box includes a v.h.f./u.h.f. tuner, variable bandwidth arrangement plus gain and tuning controls and costs £73 plus £1·99 post and packing.

Transmitter Listings

The latest EBU supplement mentions that the e.r.p. of the French (SSR) ch. E32 and Italian (TSI) service transmitters in Switzerland has been increased from 70kW to 130kW.

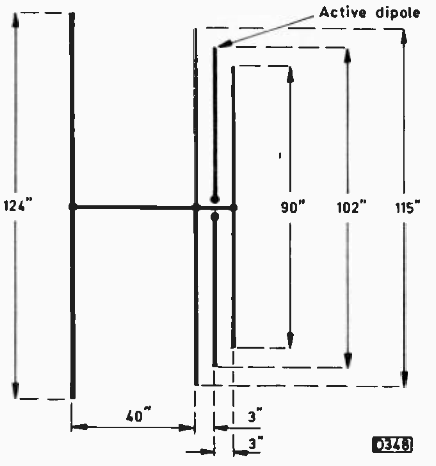

Fig. 1: Ian Beckett's wideband Band I aerial design. Boom 1in. OD. Elements ½in. OD. (OD = outside diameter.) Connect coaxial feeder to the active dipole, terminated at 75Ω unbalanced.

The latest issue of the *World Radio/TV Handbook* (1986) – the fortieth anniversary issue – lists Soviet forces transmitters in various E. European countries. Czechoslovakia is shown as having eleven relays including one that uses ch. R2 – Krupka, 100W. E. Germany has fifteen relays operating in Band III and at u.h.f. The GDR is well received during good tropospheric openings – look for Cottbus ch. R8, Karl-Marx-Stadt ch. R27 and Dresden ch. R32 (all with horizontal polarisation). No e.r.p.s are given for the E. German relays. The eight relays in Hungary all operate in Band III. SpE possibilities from Poland are Legnica ch. R2 and Szczecin ch. R3 – there are also two Band III relays. Bulgaria has one relay, Sofia ch. R31, Rumania none. The network relayed is TSS-1, via Gorizont at 14°W (Euro spot beam), so programme times relate to the USSR. It's understood that some very local news insertions are made. In general, identification of any transmitter carrying the TSS-1 service will be extremely difficult.

The timetable for extending the coverage of the French fifth TV network is as follows:

In operation

Besancon/Bregille	ch.45	Nancy/Malzeville	ch.55
Bordeau/Boullac	ch.56	Nevers	ch.41
Cannes	ch.63	Nimes (town)	ch.31
Dijon (town)	ch.46	Paris (Tour Eiffel)	ch.30
La Rochelle	ch.48	Saint-Nazaire	ch.55
Lens-Bouvigny (Lille)	ch.51	Saint-Quentin	ch.30
Lille	ch.65	St. Etienne	ch.65
Lyon/Fourviere	ch.28	Toulon	ch.57
Marseilles/Gd Etoile	ch.32	Toulouse	ch.32
Maubeuge	ch.32		

End June

Ales	ch.62	Lorient	ch.62
Amiens-Dury	ch.49	Mantes	ch.53
Angers-Rochefort	ch.50	Marseille/Pomegues	ch.54
Avignon	ch.47	Montlucon	ch.49
Bayonne	ch.56	Nantes	ch.21
Bourg-en-Brasse	ch.38	Orleans	ch.52
Caen-Chu	ch.38	Poitiers	ch.41
Clermont-Ferrand	ch.58	Tours	ch.57
Dunkerque	ch.59	Valence	ch.53
Le Creusot	ch.38	Valenciennes	ch.49
Le Havre	ch.53		

End September

Angouleme	ch.31	Niort	ch.38
Belfort	ch.30	Pau	ch.29
Bourges	ch.21	Rouen	ch.59
La Baule	ch.38	Vannes	ch.58
Limoges	ch.38		

Mid-December

Beauvais	ch.49	Reims	ch.53
Brest	ch.34	Rennes	ch.34
Chartres	ch.47	Troyes	ch.39
Cherbourg	ch.35		

News Items

Scrambling: CNN (Cable News Network) has been noted via Intelsat V-F2 at 1°W experimenting with various types of scrambling including MAC and random line displacement with digital sound in syncs. Nick Harrold presumes evaluation is in progress prior to CNN adopting scrambling in June. Teleclub has also been conducting tests, during the early morning, using – according to the test pattern caption inlay – "carrier remote switching".

France: The fifth network is now partially in operation and the identification on the PM5544 test pattern has been changed to "RES 5" – the programming also carries an inlay identification at the lower right-hand corner, a small square with a dominant figure five and "La Cinq" above this. The sixth network officially opened on March 1st: both Paris ch. E33 and Bouvigny ch. E54 have been received in Belgium. The sixth network Paris transmitters (chs. E30 and E33) operate at 3kW (not e.r.p.): this will be increased to 50kW. There are apparently no plans for Band I stations.

From our Correspondents. . .

Ian White (Waterford) is replacing his u.h.f. aerial system with a twin stacked bowtie Triax grid array. He comments that there's great difficulty in many parts of the u.h.f. band in his part of the Republic due to the use of active reflectors. Many are illegal. Others with low engineering standards drive up to five amplifiers in cascade, with serious cross-modulation spreading on to adjacent channels. The Presely, West Pembrook group B transmitter is favoured as a programme source, usually being up-converted to group C.

Jean Dubler recently visited Malaysia and sent us a shot of the local test pattern. The first and second networks provide nationwide services: the coverage of the third service is more limited but with stereo/dual sound tests in the mornings and afternoons using the German system. Teletext, known locally as "Beriteks", is carried by the third network in both English and Malay and is operated by a company independent of TV3.

TEL 0902 712083 TELEX 338490

HA1374	4.80
HA1377	3.96
HA1389R	2.05
HA1389	2.39
HA1392	3.90
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HBF4030AF	2.48
HD14538	2.07
HD38702-A2	7.45
HD38750A53	8.71
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	17.49
HEF4001BP	0.67
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	8.89
HM6251	5.70
HM7103	2.46
HM9032	3.22
HM9012	3.22
HM9015	3.24
HT4207	17.16
HT4208	18.25
IN5401	0.11
IR2403	4.25
IR2C05	4.25
IR3P06	2.25
IR3P08	4.95
IR94558	6.25
IS751	2.85
ITT425	0.18
IZ0003GE	5.37
IZ0020GE	5.93
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	5.54
L200CV	1.69
LA1201	1.02
LA1210	1.56
LA1230	2.87
LA1320	2.87
LA1352	1.75
LA1357N	11.07
LA1363	7.25
LA1364	3.02
LA1365J	3.44
LA1385	1.94
LA1387	7.60
LA3155	1.25
LA3301	1.41
LA3350	1.43
LA3361	1.23
LA3365	3.98
LA3390	4.25
LA4030P	4.20
LA4031P	3.20
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	4.83
LA4125	2.25
LA4138	3.38
LA4140	1.15
LA4192	3.65
LA4220	1.62
LA4250	6.75
LA4400	2.25
LA4420	1.72
LA4422	1.72
LA4430	1.47
LA4440	4.95
LA4445	7.25
LA4460	2.32
LA4461	2.95
LA4505	5.94
LA5112N	2.65
LA7020	7.33
LA7025	8.05
LA7027	9.35
LA7040	9.20
LA7042	4.25
LA7800	2.65
LA7801	4.15
LB1274	3.08
LC7800	9.20
LD3120	1.13
LD3150	2.25
LM1017N	4.29
LM1877	10.92
LM224	1.75
LM2808	5.94
LM2877	4.93
LM317CKC	1.38
LM324N	0.75
LM339N	0.80
LM340K	11.85
LM342P	1.62
LM342P	1.62
LM342P	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	1.82
LM8360	3.22
LM8361	3.57
LR2612	11.95

LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	4.95
LU03112	12.37
M193	12.75
M21C	1.00
M23C	0.83
M293	9.15
M51102L	6.35
M5115P	5.24
M51203L	3.15
M51231P	3.04
M5134-9341	4.13
M51353P	5.25
M51381P	4.50
M51393AP	7.78
M51394P	11.97
M5142P	5.49
M5144P	4.25
M51513L	2.55
M51515BL	3.23
M51517L	3.71
M5192	2.20
M5194AP	5.74
M5231L	1.95
M53274P	1.33
M54532P	2.15
M54544L	4.75
M58478P	6.75
M58485P	10.74
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	3.25
MC13002	4.50
MC13002	4.50
MC1310P	2.25
MC1327P	1.33
MC1330P	1.69
MC1350P	1.61
MC1351P	3.96
MC1352P	1.98
MC1357P	2.15
MC1358P	1.30
MC14001	2.40
MC14013	0.41
MC14493P	3.44
MC14494P	2.15
MC14497	14.99
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.70
MC1712	3.88
MC5192	13.50
MC7724CP	3.49
MC7818C	2.18
MCR100/7	1.65
MCR106-5/6	0.85
MCR220/7	2.28
ME0402	0.17
ME0404/2	0.47
ME0411	0.28
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.69
MJ481	1.53
MJ802	5.45
MJE2955	1.89
MJE3055	1.65
MJE340	0.49
MJE520	0.49
ML231	3.33
ML232B	2.15
ML237B	2.51
ML238	5.77
ML923	3.30
ML926	3.58
MM5314N	4.02
MM5316N	4.25
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.49
MN1400VL	9.96
MN1405	9.52
MN1435VX	10.62
MN6016A	20.56
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.45
MPSU05	0.86
MPSU10	1.56
MPSU56	0.60
MPSU60	1.33
MR818	0.33
MR854	0.72
MR914	1.20
MSM5816RS	17.35
MSM5840H	9.15
MVS460-02	0.61
NE542	2.35
NE545B	4.33
NE555	0.38
NE556	0.95

NE565N	1.33
NE645BN	3.35
NP1106	5.61
OA202	0.11
OA47	0.14
OA91	0.09
OA95	0.09
OC28	2.95
OC29	2.15
OC36	1.28
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.95
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	1.33
R2029	1.33
R2030	1.33
R2257	2.38
R2265	1.49
R2305	1.18
R2322	0.59
R2323	0.76
R2354A	2.01
R2354B	2.01
R2443	0.88
R2461	1.50
R2540	2.31
R2540X	3.30
R2615	0.67
RCA16029	2.01
RCA16600	1.38
RCA16802	1.08
RCA17074	6.60
RCA17376	1.58
RCA17524	0.83
RCA17523	0.83
RCA2060	2.00
RGP01-15	0.70
RGP10	0.50
RGP30M	0.59
RT402	1.58
RT905A	2.38
S1299	5.74
S175	31.48
S2062D	2.07
S2800D	5.54
S2802	3.47
S2818	4.05
S3702S	6.15
S40W	10.89
S6080B	8.80
SA8063	5.17
SAA1006	1.75
SAA1020	4.76
SAA1025	4.40
SAA1024	2.81
SAA1075	6.25
SAA1121	4.43
SAA1124	3.25
SAA1130	4.99
SAA1174	7.77
SAA1250	3.96
SAA1251	9.85
SAA11351	4.95
SAA3027P	10.03
SAA5000	2.95
SAA5010	5.39
SAA5012	4.15
SAA5020	5.78
SAA5030	8.25
SAA5050	7.74
SAB1009B	6.81
SAB3011	7.34
SAB3013	5.61
SAB3021	7.90
SAB3024	6.36
SAB3209	5.82
SAB3210	3.49
SAF1032P	6.50
SAF1039	3.35
SAS5010	8.39
SAS560S	2.26
SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
SAS580	2.85
SAS6600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	1.33
SBA750	1.61
SC84203	18.98
SC9504P	1.95
SDA2006	18.95
SDA2112/2	12.50
SG264A	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI-1020H	10.89
SI-1125HD	17.63
SI1125H	7.50
SI1225HD	17.73
SI1630HD	17.85
SI6900	12.00
SKE1/02	1.85
SKE2F1/04	1.39
SKE2G3/04	1.05
SKE4F1/06	0.73

SKE4F2/08	1.24
SKE4F2/06	0.85
SKE4F2/10	1.24
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	2.31
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	3.28
SL480	3.14
SL490	2.37
SL901B	8.32
SL918A	9.07
SN16861AN0	4.95
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SN16966N	10.25
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SN29723AN	7.65
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SN29791	1.67
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SN2709	0.44
SN7400N	0.34
SN7401N	0.36
SN7402N	0.65
SN7404N	0.24
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
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SN74LS26N	0.53
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SN76023N	5.15
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SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
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SN76707N	4.39
SN76705N	1.34
SN76730	5.36
SN76810N	0.60
SN76832N	3.25
SN94041	5.54
SN94042	4.35
SP8385	0.55
SPS5384	1.98
ST1702L	0.99
STA401	6.76
STA441C	2.75
STA471C	6.76
STK0029	5.54
STK0039	5.35
STK0040	12.00
STK0050	7.67
STK0080	9.16
STK011	3.96
STK013	9.25
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STK015	7.75
STK016	6.91
STK022	5.25
STK025	12.50
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STK058	18.25
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STK080	16.50
STK082	11.86
STK086	13.59
STK1039	5.75
STK2110	7.33
STK2145	16.25
STK2230	7.70
STK2240	14.40
STK2250	18.95

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STK3044	5.75
STK4019	4.50
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STK435	5.94
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STK436	7.21
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STK439	8.31
STK441	11.28
STK443	10.29
STK457	13.45
STK460	10.75
STK461	9.68
STK463	11.53
STK466	11.77
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STK502	5.74
STK5314	9.48
STK5730	3.95
STK7216	12.67
STK772	6.95
STR1096	4.50
STR4090	11.75
STR440	7.85
STR441	9.45
STR451	4.95
STR453	8.16
STR454	7.50
STR6020	8.31
T6029V	5.75
T6035V	0.73
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T6037	2.11
T6044V	0.95
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T6052V	0.87
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T6059	0.65
T9003V	1.25
T9005V	2.38
T9011V	0.49
T9013V	7.96
T9014V	2.60
T9016	1.02
T9019W	1.98
T9034V	1.38
T9035V	1.39
T9051	4.29
T9054V	1.15
T9057V	0.70
T9062V	0.49
T9064	1.51
TA6002	4.35
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	1.27
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TA7072P	2.57
TA7073P	5.86
TA7074P	1.98
TA7076P	7.50
TA7089P	1.50
TA7092P	6.84
TA7093P	3.99
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TA7152P	1.52
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TA7161P	5.45
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TA7169	9.54
TA7172P	1.41
TA7176P	2.48
TA7193AP	6.67
TA7193P	5.50
TA7201P	2.71
TA7203P	2.18
TA7204P	2.16
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TA7215P	2.58
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TA7227P	2.81
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TA7232P	6.60
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TA7240AP	7.83
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TA7270	6.75
TA7310P	2.15

TA7312P	2.45
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TA7323P	3.15
TA7325P	1.15
TA7339P	1.35
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TA7607AP	13.90
TA7609	3.28
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TAG626-600	1.06
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TDA2576A	2.85
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TDA2591Q	0.83
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TDA2680	3.20
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TMS1024NLL	6.86
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UPD4066B	4.95
UPD553-164	19.25
UPD8049C-1	10.14
X0007TA	4.68
X0022CE	5.75
X0029CE	4.95
X0031CE	4.95
X0035TA	5.11
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	5.11
X0057GE	6.00
X0062CE	6.52
X0065CE	5.75
X0074GE	10.00
X0077GE	12.95
X0079CE	4.95
X0092CE	4.95
X0096CE	4.29
X0109CE	9.90
X0113CE	2.07
X0195CE	4.00
X0204CE	8.74
X0261CE	8.75
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Letters

MICROCOMPUTER SERVICING

I've been servicing microcomputers – mainly Sinclair machines – for a couple of years now and notice that information on this subject is beginning to appear in *Television*. The following notes may be of interest to your readers: they are based on practical, often hard-won, experience.

Commodore VIC20: Intermittent non-initialisation (rubbish sometimes appears at switch on) has on a few occasions been traced to the ROM i.c.s. Intermittent program crashing and/or lines (looks like no line lock), usually when the machine has warmed up, is generally due to the 6560 microprocessor i.c.

Commodore 64: For no cassette motor drive check whether diode CR2 (type Y068, part no. 900941-01) is short-circuit. Will not load from the cassette – check i.c. U2 (6526).

Commodore cassette recorders: Head realignment has been necessary on dozens of these, even when the adjusting screw has not been disturbed. The case is usually full of cat's hairs etc. and orange squash appears to be the favourite tipple!

Sinclair Spectrum: With any Spectrum the first check is to listen for coil buzz from the inverter. If there's no buzz and pin 1 of IC6 is not at −5V change TR4 (ZTX650). Switch on with a finger on TR4 to monitor its temperature. If you're lucky there'll be coil buzz and the machine will initialise. There may however be faulty RAMs (see later). If you're unlucky, TR4 will heat up and go short-circuit again. In this case change TR5 (ZTX213) and replace TR4. If you've been wise enough to get in a bulk supply of ZTX650s you can switch on again. This may be enough, but if TR4 immediately burns your finger again replace TR4, TR5 and the coil. This should bring success. If you're short of ZTX650s change the coil first.

Once a cool-running TR4 and a −5V supply have been established it may be necessary to look for faulty RAMs. A shorted RAM often shows itself up by getting very hot. Open-circuit RAMs can be found by "piggy-backing" good ones on top (if the originals are soldered in). Don't forget to count up to five slowly after each test and powering down, before removing any such test i.c., and be prepared for more than one RAM to be faulty. Fit new RAMs in holders for future convenience (you'll be glad you did).

On issue 1 and 2 machines modify the inverter circuit as follows: change R60 from 100Ω to 270Ω and add a 4·7μF capacitor with the positive side to the positive end of C34 (emitter of TR5) and the negative side to R58 (base of TR5).

So far we've considered the 16K RAM machines. Faults do occur with 32K versions. A memory test may indicate loss of memory space. Again, piggy-backing will often locate a faulty, open-circuit RAM. Short-circuit RAMs do happen, sometimes getting warm. Occasionally an address chip fails. A scope will indicate the faulty device – a logic probe is useful too. IC25 and IC26 both fail (type 74LS157): I've never yet had IC23/4 fail.

Returning to power supplies, I should point out that no buzz can be caused by the 5V regulator being open-circuit. Heatsinks are often loose and inefficient and the regulator frequently fails because of this – also for more obvious reasons like the legs twisting when the screw is tightened during assembly, often breaking off at the bottom or coming away from the print. The remedy is obvious – replace the regulator and take care to improve the heatsinking.

The ULA chips often fail – this usually starts as an "intermittent when warm" fault. Heatsinking can be tried, but it's usually too late.

Check for poor holder contact when replacing i.c.s. Some holders had tarnished pins from the start – this seems to apply mostly to the microprocessor chip. The result is that odd intermittent faults appear later. Tapping and flexing the board shows this up. Cut the faulty holder out and replace it.

These are the main faults we've had within these machines. I can't stress too much that all the leads and add-ons should be brought in for checking. More on this later. First some odd faults.

A machine tested with interface and microdrive and passed o.k. by the test tape came back as it refused to work with a modem. This proved to be due to dirty edge connectors. So, as a final precaution before reassembly, clean the edge connectors. Also replace any missing feet: these are there to allow cool air to circulate.

I've twice been caught by faulty clock crystals: flicking them with a finger proved their guilt.

In Spectrum Pluses and some later Spectrums a Texas colour modulator chip (SN prefix) was used instead of an LM1889. These tend to fail and we sent dozens back to the wholesalers. Some machines will escape the net but the remedy is simple – change to an LM1889.

Now for customer induced faults. Loose add-ons cause havoc, destroying microprocessor and ULA chips and sometimes the ROM as well. The customer often suspects that something is wrong and "waggles it to see". Kemston interfaces appear to be the worst. Too quick switching on and off often destroys the odd RAM at least. I know, I've done it myself.

The dirtiest deeds are done in the power supply however. Considering the cost of some of the equipment on sale today (VCRs etc.) the quality of the mains plug and wiring used is often abysmal. Even reputable dealers often fit cheap, imported plugs – or a customer may fit a plug liberated from say a defunct toaster. I remove these, fit an MK plug and lecture the owner on his folly. If the mains supply is suspect, either because the customer lives in the country with overhead lines or uses multiple adaptors, sharing with a vacuum cleaner etc., I advise either a "power cleaner" plug (expensive) or a mains transient suppressor. I fit the type used in the Philips G11 chassis – for the simple reason that I keep these handy to fit to Thorn TX9s (the early ones).

The d.c. power plug is also liable to attack. Replacement leads are available from Sinclair agents but the 2·2mm plug is generally available – from tape recorder spares stockists for example.

A few odd "loading" and "saving" faults occur when the leads are used a lot. If the machine is frequently used it's worth making up new leads, using quality plugs with strain-relief sleeves. The same applies to the TV lead. These leads are o.k. but basic.

Finally, spares. CPC of Preston are Sinclair agents and are very helpful. Service manuals are available and all components seem reasonably easy and quick to obtain.

Microvitec Cub Monitors (1441 etc.): The first anode supplies have been a problem, with R933 burning out and the preset VR932 suffering as well. Recommended modi-

fications are as follows. Remove wire link R236 (on the main board, adjacent to the line output transformer) and fit a 150kΩ, 1W resistor in this position. Remove R933 and fit a 150kΩ, 1W resistor. Replace VR932 if damaged – use a 2·2MΩ, 1W preset. Remove R934 and fit a 220kΩ, 1W resistor. Then set up the first anode supply as follows. Turn the contrast to minimum. Turn up VR932 for a just visible raster, then extinguish it. Turn up the contrast and if necessary adjust the focus control.
Roger Burchett,
Hythe, Kent.

CASSETTE BULB TIP

The cassette bulb in the Ferguson 3V00 VCR – and similar machines – is not the most reliable of components. Neither is it cheap at £2 plus VAT etc., especially if you are unemployed. This prompted me to look for something cheaper. After all there's nothing very special about a filament bulb operated from a 12V supply. A check on the current consumption revealed that this was about 50mA. I found something suitable in the Maplin catalogue – bulb type WQ13P, which sells for about 30p. To fit it the lighthouse holder must be drilled out to 6·2mm or a quarter of an inch. It's plastic and can be drilled by hand – clamp the drill in a vice and turn the fitting by hand. The wire ends are short but soldering on a length of hook-up stranded wire and sleeving this overcomes the problem. It's a great saving.
Ian Ruddock,
Stanstead Abbotts, Herts.

PYE 697 CHASSIS

These sets are getting on now but can still give very good results. The problem of lines at the top of the screen is usually caused by the underrated preset control RV41 on the convergence panel, but in a recent case the problem was traced to the e.h.t. lead from the line output transformer to the tripler. This runs very close to the transformer's shield: corona discharge between the lead and the shield was cured by moving the lead away and wrapping a couple of turns of insulating tape around the "hot spot".
B. L. Trainor,
North Ormesby, Middlesbrough.

WORD OF WARNING

We recently purchased a number of ex-rental sets fitted with the Rank T20/22 chassis. A few had power supply faults, the remainder the usual stock faults – 5R8 in the line output stage, the line oscillator start-up capacitor 4C19, 4R16 in the 12V regulator circuit, etc. The sets in which the power supplies were working all needed new h.t. reservoir capacitors (7C13 220μF and 7C2 100μF).

Out came the first power supply unit and 7C2/13 were replaced. It was noted that a lot of work had previously been carried out on the unit by the rental boys. Both thyristors had been replaced, along with the BU326 chopper transistor and the bridge rectifier diodes. The PSU was set up on the bench, loaded with a 100W bulb and with a digital meter to monitor the output. On test we found that the output could be wound up to well over 200V without the over-voltage trip operating. The reason for this was that 7R15 (8·2Ω), which is in series with the crowbar thyristor, was open-circuit. It seems that the crowbar had operated and the faulty components had been changed but 7R15 had not been checked: it's essential to check this item after carrying out any repair in this area – if the fuses have blown, check 7R15 to ensure continued protection and safety. We found that with the other PSUs that had to be tested in every case components had been replaced but 7R15 had been left open-circuit.
Michael Dranfield,
Dranfield and Harrop TV Repairs,
Buxton, Derbyshire.

VERY SMEARY PICTURE

The following fault had me baffled for some hours, so perhaps this report on it will help others. The set was a Sony KV1612UK and the symptoms were a very smeary picture with something of the appearance of a clamp or d.c. restoration fault: the colour was correct though weak. Oscilloscope checks in the luminance stages provided what appeared to be correct waveforms up to the RGB output stages on the tube base. The voltages at the collectors of the RGB output transistors seemed to be about right but were extra sensitive to either the meter or scope probe, causing even more severe loss of h.f. response. The h.t. supply to these three transistors comes via a small choke, L701 (270μH): the meter showed a difference of 20V across this item which, when measured, turned out to be open-circuit. Fitting a replacement restored a perfect picture. Mystery: where were the output transistors getting their h.t. supply from?
Laurie Watkinson, Telesonic Services,
Holsworthy, Devon.

TELETEXT TROUBLES

I've been following the correspondence on teletext decoding faults with interest and believe, like Mr. Sears, that Mr. Beard's problem is probably caused by reception difficulties. The Texas XM11 decoder is capable of coping with the extra teletext lines on Ch. 4: mine gives perfect results.

I've been experiencing problems since just before Christmas however on BBC-2 and occasionally on ITV. Prior to this time I'd no problems on any channel and the results were consistently good. The BBC-2 fault is always the same: rows of text are missing – usually every fifth row at the time of writing, earlier it was every fourth row.

The local BBC tell me that everything is o.k. at their end and occasionally BBC-2 text is o.k. – every few days. When BBC-2 text is really troublesome bits of another page appear to fill the gaps in the page called up! During the times when this happens BBC-1 and Ch. 4 text are perfect. When BBC-2 is at its worst ITV gets twitchy and it needs two goes to get a page right.

I've spent quite a lot of time on this problem. Text transitions look good on the scope. The only difference between BBC-2 and the other signals is the level after the clock run-in – this is about fifteen per cent down.

Adjustment of the video signal level is not very critical on BBC-1 and Ch. 4 and the "window" of satisfactory signal levels is about 2:1. ITV is more critical while nothing seems to help BBC-2. I've tried another aerial at this site and the resuls are just the same. So far I've not taken the set to a different site to try it there.

Another experiment involved the introduction of a passive *LC* network to alter the group delay characteristics. Any adjustment away from the normal situation caused eyeheight reduction however, with errors appearing on the good channels. Consequently this approach was abandoned! I came to the conclusion that as nothing in the receiver and decoder had changed the problem must lie either in the transmission or short-term echoes – so short that they don't show up on a normal picture.

So what could cause the change? One thought is the loss of foliage on nearby trees. To prove this theory (or otherwise!) will mean waiting till later in the year. We have docks and containers only a few degrees off beam but two or three miles away. Varying reflections due to movement of large objects in this area could be responsible. Perhaps an aerial with very narrow beamwidth would help. Investigations continue, but the evidence to date leads me to believe that what Mr. Beard and I are seeing is probably the result of short-term echoes. Hamming correction is inadequate on certain rows which consequently don't get loaded into the memory and thus appear blank.

Keith Cummins,
Southampton.

The comment about Ch. 4 text problems north of Leeds in my previous letter (March issue) was not correct, though it was based on information given to me when I phoned the IBA office in Leeds to report the fault. I've since been told by John Rogers of Yorkshire Television that faults in Leeds can affect only local transmitters directly served by YTV. He also mentioned that the decoding errors I described, i.e. call page 597 and get page 598, were due to page 597 programming errors and not a data bridge fault. I used page 597 as an example however – the same trouble occurred with other pages. Decoding of Ch. 4 pages has been correct for some time now so the fault, if there was one, has been cured or has "gone away". The BBC-1 opt-out clockcracker page fault has also been corrected. When the BBC first increased the number of data lines and changed some of the transmission parameters certain decoders wouldn't function correctly on subtitles and newsflashes. This fault has also now been corrected.

L. D. Sears, Chief Engineer,
Hepworth and England Ltd.,
Batley, W. Yorks.

Open- and Short-circuit Checks

S. Simon

According to theory only two basic faults can occur in an electrical circuit – either an open-circuit or a short-circuit. Complication is added by the fault's degree. For example, a resistor can go high in value – a partial open-circuit. Or a capacitor can leak – a partial short. Thus the faults that blight our daily lives are only variants on a very old theme. Let's look at some examples.

Ticking Thorn 9800

You have a set fitted with the Thorn 9800 chassis in for service. It just ticks and does nothing else. You apply an external 25V d.c. source to pin 5 of plug 4 on the decoder panel, negative to chassis, and the set then works with sound and a picture. This means that the 25V supply is absent of course. It's derived from the 48V supply generated in the line output stage, via a series stabiliser circuit in the power supply. So you check the left side power supply panel, in particular the series regulator transistor VT702 and the driver/error detector transistor VT703. Without the external supply you find that the supply from the line output transformer is pulsing up but that nothing is reaching the base of VT702. When R708 is removed, or isolated at one end, it's found to be open-circuit. Fitting a new 1·8kΩ resistor restores normal operation. We mention this as an example of an open-circuit fault because it's becoming extremely common, and can be puzzling when first encountered.

It's most helpful to have available a source of 25V d.c. when handling these sets. Pin 5 of plug 4 on the decoder panel is the mauve lead at the bottom right. Plug 4 is at the centre of the board, almost.

Severely Reduced LT Supply

A small Ferguson portable, Model 3845 (1690 chassis), is received suffering from severely reduced l.t. supply: the sound is very low and the tube's heater barely lights. Removal of the e.h.t. lead from the tube restores normal supplies, i.e. the e.h.t. rectifier has gone short-circuit. Snag: it's located within the line output transformer. You have two options: replace the transformer, or fit an external stick rectifier (well insulated in its own housing) in series, i.e. if the internal diode is short-circuit you fit another suitable diode in series with it. This will restore normal operation.

If removing the e.h.t. cap makes no difference, check to see whether the 95V supply rectifier is overheating. If it is, disconnect one end and check for leakage – you should get a low reading one way round, infinity the other way round. If the diode is without fault, check the associated reservoir capacitor which may have shorted.

These nice little sets often show signs of poor smoothing, i.e. a background hum and a badly distorted picture. This tends to direct attention to the 4,700μF reservoir capacitor or perhaps the series regulator transistor, either of which could be at fault. All too often however the cause of the trouble turns out to be an improper clip contact on the front right feed from the mains transformer, i.e. the full-wave mains rectifier has become a half-wave circuit due to an open-circuit connection. The cause may be at the transformer itself, where the centre tap may not be securely soldered.

No Line Drive

On many imported portables the supply to the line driver transistor passes via a small resistor raised on insulated legs. This resistor often goes open-circuit, depriving the line output transistor of its drive (sound o.k., no picture). It's always worthwhile to check the driver transistor's collector voltage as a start.

No LT Supply

A fairly large Murphy Acoustic De Luxe (Rank A823 chassis) was brought in with the complaint "no results". The mains lead and plug were in a dangerous condition and were changed, but still no results. Voltage checks showed that h.t. was present at the top fuse and that a.c. l.t. was present at the fuse that supplies the bridge rectifier, but there was no l.t. output from the bridge. Since this provides the supply for the line oscillator and driver stages (amongst other things) the absence of e.h.t. as well as sound was explained. In this case the bridge consisted of four BY126 diodes, two of which were open-circuit.

Primary and Secondary Faults

It's often the case that a primary fault will cause a secondary one that's more obvious. Here's a simple example. No results again, this time with a Fidelity CTV14R colour portable. An initial check found the obvious bit: the h.t. filter resistor R828 (10Ω, 2W) was open-circuit. There was a low-reading to chassis at one end and a lower one at R901 (4·7Ω, 5W) which feeds the line output stage. The line output transistor was suspected but proved to be blameless, as did the BY127 efficiency diode in parallel with it. Further checks brought us to the primary fault, the line output transformer – as so often in these sets. The replacement and more reliable transformer has built in focus and first anode supply presets – the originals on the tube base have to be removed. The new transformer also has different pin connections: an adaptor board is supplied to enable it to be married into the main board.

One Thing Leading to Another

The Philips G8 chassis often gives us an example of a short causing an open-circuit. If the right side 800mA h.t. fuse in the line timebase is found to be open-circuit, examine the top winding on the line output transformer. If this is scorched, cut the wires to it and keep them clear. Wire an insulated link from the lower to the upper tag and fit another fuse. Try again. In many cases the fuse will hold and the set will function normally. If a spark is seen in the lower winding you've no option but to replace the transformer – if this is in fact the cause of the trouble. There are several other possible causes, for example faulty line output transistors or perhaps a shorted line shift control: it's prudent to check these possibilities before replacing the transformer.

If the left side mains fuse has failed a check for shorts must be made, starting with the thyristor h.t. rectifier, but often there's no fault and a new fuse will restore normal operation. Another open-circuit that's frequently encountered with this chassis occurs in the front, vertical dropper, where the 2·2Ω lower section often goes open-circuit to remove the supply to the thyristor. If the upper section (h.t. filter) goes open-circuit one tag will be left charged due to the 600μF h.t. reservoir electrolytic having nowhere to discharge itself – except perhaps through you. Shunt this section with a resistor to discharge the capacitor before handling.

In Conclusion

The short or open-circuit rule holds good for most parts of a set but doesn't take into account such things as phase errors in the decoder or incorrect alignment. For the vast majority of faults however the theory holds good.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Derek Snelling and Steve Beeching, T. Eng.

Hitachi VT8000

It's finally happened – my own video went faulty! I have an Hitachi VT8000 and the other night I inserted a cassette, pressed play and after a few seconds the machine switched off. A closer look showed that after pressing play the tape laced up and the capstan and take-up spool rotated as normal though the picture, which is blanked out during lace-up, did not appear during the few seconds that the machine operated. Removing the cassette and looking inside showed that the drum was rotating, so although the machine appeared to be operating correctly, at least from the mechanical point of view, it must have thought otherwise. On trying another cassette the take-up spool refused to rotate and upon selecting stop no other function would work. Ejecting the cassette and reinserting it brought back the original fault.

Perhaps the microcomputer chip was confused – always a good standby this when you're stuck for an answer. When I unplugged the machine however and counted to ten before switching on again it went into the rewind mode without a cassette in and the only way to stop it was to unplug it again. At this point I decided to take it into the workshop next day and look at it there. In the workshop the machine reverted to its original fault condition of switching off after a few seconds in play, and it was while I was debating whether to look for the fault logically by discovering why it switched off or whether to change the microcomputer i.c. that the machine started to work normally. Whilst trying to persuade it to go faulty again I noticed a peculiar thing: if the mains was switched on with the cassette housing in the down position all was well, but if the mains was connected with the cassette housing in the up position the machine went into the rewind mode and only unplugging would stop it. At this point I decided to change the microcomputer chip (IC901, type HD44801A05). This cured the problem. I've known this i.c. to fail on at least three previous occasions, each time with obscure fault symptoms. **D.S.**

Mitsubishi HS306 and HS318

The problem we've had with several HS306s, and the newer HS318s, is failure to load correctly. It's a mechanical problem. The front loading mechanism consists of a cassette carrier which is raised and lowered along grooves formed by two metal plates at each side. It's held in these grooves by two white nylon pieces and what happens is, that one or both of these jump out of the groove for no apparent reason. They're a bit tricky to refit but once back the problem does not seem to recur. Perhaps it's caused by the customer inserting the cassette incorrectly. **D.S.**

Hitachi VT11

I had to go out to see this machine, the complaint being intermittent tracking and sound. When I got there I discovered that the picture was all right at first. Then a rolling noise bar appeared, accompanied by fading sound – as if the audio/control head was way out of alignment. A check in this area showed that the tape was riding down the head and that the pinch roller seemed to be crooked. In fact the pinch roller wobbled all over the place as the inner brass ring had come adrift. A replacement roller cured the problem. **D.S.**

Toshiba V65B

We've had several of these machines come in with the complaint of intermittent sound recording, with the old sound track left on the tape. This appears to be another case of erase head plug and socket trouble – several other models by different manufacturers have suffered from this problem. Certainly removing the plug and socket and soldering directly to the head appears to have cured the problem. **D.S.**

Ferguson 3V29

This machine came in with no clock display. Investigation revealed that the 315mA fuse had blown, and a replacement lasted only a few seconds. The 22·3V zener diode D13 and transistor Q5 (2SB642Q) turned out to be faulty – these items supply the −22V rail for the fluorescent display. **D.S.**

Mitsubishi HS318

We've recently had two instances, both with HS318s, where the customer has managed to get two cassettes into the machine at once. How they manage this I don't know as there's a metal piece that comes up after a cassette has been inserted to prevent another one being put in. This of course makes it very difficult to get the extra cassette out afterwards. Luckily no damage was done to the machine in either case – in fact one customer said that the first cassette would play quite happily despite the presence of the second one. **D.S.**

Mitsubishi HS700

The HS700 is prone to a customer induced fault which is rather misleading. The symptom is that the machine stops playing after a few seconds although it appears to be operating correctly. Before scoping various pulses check the still frame adjustment potentiometer. This is adjustable through the back of the machine and you'll probably find that it's been broken by over-enthusiastic use of a screwdriver by the customer. To be fair to the customer, making this a subminiature preset for customers to adjust was probably asking for trouble. We've had half a dozen cases of this fault. **D.S.**

Panasonic NV333

The complaint with this machine was permanent eject. Normally the machine goes buzz, buzz as the loading motor overtravels to unlock the cassette carrier for eject, then reverses back to a rest position. In the rest position the cassette carrier will lock down – but not in this case as the loading motor had stopped in the unlocking position. It was not too easy at first to spot precisely what was happening – it seemed probable that the loading motor was revolving in only one direction. Attention was directed to the loading motor and the VCR was switched on to reset and eject: the negative terminal then went high and the positive terminal went low, the motor turned then both terminals went high! The motor stopped in the eject position. A few more resets later it could be seen that Q6028 was being turned on by Q6025 but its collector voltage stayed high. Replacing Q6028 restored normal operation. **S.B.**

Sharp VC482

After inserting the cassette and selecting play this machine would enter the forward visual search mode. Selecting play for a second time would produce the play mode, but without a picture. At first the video heads were suspected, but the machine's recordings (played back on a test machine) were fine. We then found that the record 9V line was still active in the playback mode. Q803 was at first suspected of being short-circuit or leaky but we then found that it was being turned on by a low output at pin 12 of IC802. The corresponding input pin 5 should have been at 0V instead of the 3V that was recorded here. So was the microcomputer chip IC801 faulty, producing a rogue output, or was IC802's input circuit at fault? It turned out to be IC802. **S.B.**

Sony SLC7

There was no servo lock in record. This one was a bit more difficult since the reference (pin 19) and feedback (pin 20) signals were both present at IC2 and the servo locking was good in playback. We slowed down the capstan flywheel in record to check the reaction of the pulses but there wasn't any. As the pulses, or the ramp on pin 20, are derived from the capstan flywheel the pulse period should have increased. When the input signal was unplugged the pulses went away. This proved that they were derived from the incoming sync pulses and not from the capstan flywheel as they should have been. The fault was traced to the switching transistor Q25 which had an open-circuit emitter, allowing the record control pulses back to the capstan servo. When Q25 is properly switched on D15 is reverse biased and the input to the capstan servo consists of FG pulses via D16. **S.B.**

JVC HRD120/Ferguson 3V35

Dead easy this one – no colour due to the VXO crystal block XB401 being non-operational. **S.B.**

JVC HRD565

There was no hi-fi muting in visual search. The muting signal from the mechacon PCB is sent to the muting i.c. via R330. This is mounted on the print side and is stuck with the glue which somehow becomes conductive. It prevented pin 9 of IC208 going low because of current leakage from a higher voltage source. Removing the glue also removed the fault. **S.B.**

Sanyo VTC5000

The problem with this machine was poor capstan servo lock when replaying its own recordings. A replacement audio/sync head improved matters but the performance was still unsatisfactory. A small servo PCB mounted on the main servo panel contains the control track record/replay circuit. Full drive from the CTL record logic was available at the head but the replay was only about two thirds the level of the pulses obtained with a test tape. The unstable results could be seen as an intermittent interruption of the squarewave output at pin 2 of IC4501. This sent the servo off lock. I eventually got fed up trying to find out why the level was low and got over the problem by adding a 390Ω resistor in parallel with R4515, the preamplifier transistor's emitter resistor. **S.B.**

Akai VS5

"Breakdown" it flashed. Damn nuisance that word: it's obvious that the machine has broken down since it doesn't work – we don't need to be told as well. The light had gone out, the rewind didn't rewind and there was a crackle on sound. The first two were easy: the third is down to the record/playback signal path relay RL1. It responds to a quick squirt on its contacts. **S.B.**

Grundig VS180

This little note comes care of Grundig Pete. Very occasionally on a small number of these machines one of the reel motors fails to stop when requested, with loud squeals from the reel brakes. The logic level FKT is low and the motor drive amplifiers should be off: in some cases however capacitor C301 or C305 has been found to be leaky. The leakage is low – some 10MΩ or so – but is sufficient to prevent the amplifier turning off by biasing the inverting input. In each case C301 and C305 have been the round black disc types. **S.B.**

Sharp VC381

An easy one for a change. The clock couldn't be reset, cured by replacing the MP2812 microcomputer chip. It's hidden beneath the display panel. **S.B.**

Sharp VC390

This machine wasn't erasing the vision or recording the sound. We found that the erase oscillator transistor wasn't being switched on as Q602 (oscillator control) was held on because Q603 (2SC2001) was leaky. **P.B.**

Sony SLC6

The problem with this machine was no reel functions. This was soon traced to R061 (1Ω, 1W) which supplies the collector of the upper reel motor drive transistor being open-circuit, but when this resistor was replaced the machine wouldn't thread up after accepting a cassette. After a happy hour spent chasing around the microcomputer control chip we found that the threading end switch was wrongly adjusted – the phantom fiddler had been there before us! **P.B.**

Sharp VC381

This machine appears to use the same black electrolytics that cause so many troubles in ITT TV sets. Problems have so far shown up as faults that occur from cold – thank goodness a dash of freezer reveals the faulty component otherwise a long session with the scope would be required. Faults up to now have been in the Y/C module, common ones being C438 or C439 defective resulting in E-E luminance problems. **P.B.**

Modern Receiver Circuitry

Part 2: Tuners and IF Arrangements

J. LeJeune

With the total shift to u.h.f. transmission for TV in the UK easy selection of the input frequency has become imperative: for a number of years now the familiar "tuner box" has made this possible with a good level of reliability. The Mullard ELC1043 and Thorn SC4 are excellent examples of mass-produced u.h.f. tuners.

Tuners

The purpose of the u.h.f. tuner is to select and amplify the off-air signals available at the aerial socket and convert the required signal to a fixed intermediate frequency (i.f.). Most u.h.f. tuners employ some pre-mixer selectivity to reduce image or "second channel" interference due to an input signal whose frequency equals the sum of the local oscillator and intermediate frequencies. The local oscillator frequency is always above the required input signal frequency, so both inputs will produce the same i.f. and thus interfere with each other. The preselectivity or r.f. stage in the tuner provides some gain. Its input is designed for optimum low-noise performance rather than an accurate match to the aerial and feeder.

Early u.h.f. tuners used ganged rotary capacitors for tuning, with bandpass circuits at the input and to couple the two stages (r.f. amplifier and self-oscillating mixer). They were of sturdy mechanical construction. The very earliest types used valves and had poor long-term stability – as the valves aged their internal capacitances altered and the tuning drifted. Subsequent transistor versions provided better stability: heat was less of a problem and transistors do not age in the way that valves do.

The adoption of varicap diodes for tuning brought about a minor revolution in u.h.f. tuner design. A.F.C. was easy to apply and an even response was obtained right across the u.h.f. TV bands. But the main feature of the varicap tuner is tuning by means of an adjustable voltage, making preset tuning very easy to provide in the receiver. In essence however the basic circuit configuration remains the same.

The r.f. amplifier or preselectivity stage employs a transistor in the grounded-base mode. Fig. 1 shows a typical circuit, with untuned coupling between the aerial input and the emitter of the transistor. C2 and C3 are feedthrough ceramic decoupling capacitors. C3 is particularly important: in a grounded-base stage the base connection is common to both the input and output circuits, and as there's no signal inversion in such a stage any appreciable impedance in the base lead will provide a coupling between the input and output – the ideal conditions for oscillation. It's essential therefore to achieve efficient decoupling of the base connection, with the decoupling component as close to the transistor as practical.

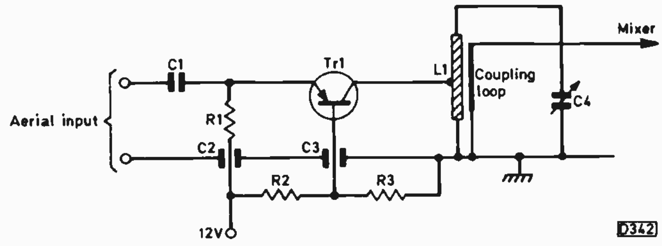

Fig. 1: Grounded-base r.f. amplifier stage.

The mechanical tuner circuit shown in Fig. 2 uses pnp transistors with the collectors returned to chassis. This was a common arrangement with older tuners. It was convenient for two reasons. First the tuned lines could be grounded directly to the tuner's body. Secondly the preferred transistors at the time for u.h.f. use were germanium pnp types – the most common being the AF139 and AF239 – that required the collector to be negative with respect to the base and emitter. Varicap tuners ushered in some changes. Silicon npn transistors with improved gain and lower noise figures had by then become available, and a move was made to the use of printed-circuit tuned lines. The compartmentalised box that forms the body of the tuner was retained to provide screening between stages and to keep the whole assembly stable.

The grounded-base stage is ideal for use as an r.f. amplifier in a u.h.f. tuner. The gain is principally the result of the large change in impedance, from a low input impedance of typically 25Ω to a high output impedance of the order of 5kΩ. Although the input impedance is not a correct match to the aerial and feeder the degree of mismatch is not too serious and the design of the stage is optimised for low noise performance rather than a low voltage standing wave ratio at the input. The output impedance is such that tapping too far down the collector tuned line to achieve critical damping of the bandpass-coupled interstage circuit is not required.

Various types of mixer circuits are to be found in UK made and imported receivers. Most UK made receivers employ a self-oscillating mixer. An alternative approach is to use a diode mixer followed by an i.f. amplifier to make up the loss. Use of a Schottky diode as the mixer gives improved results since the cross-modulation performance is better.

The self-oscillating mixer is essentially a grounded-base amplifier stage with positive feedback to make it oscillate at a frequency determined by a tuned line in the collector circuit. Common-mode feedback, i.e. via the base circuit, is not used as this is unreliable and does not provide stable operation across the u.h.f. bands. Two other methods are used, providing positive feedback between the collector and emitter. One is to incorporate a "window" in the screening wall between the oscillator and input sections so that the emitter coupling line receives some of the oscillator signal: the other is inductive or capacitive coupling between the emitter and collector circuits. The latter has become the general practice. The window method has the virtue that it can be adjusted to give the optimum degree of feedback to maintain an even response throughout the tuner's range: it requires skilled setting up however, which is not possible under modern production-line conditions. The window technique is used in the circuit shown in Fig. 2, with a.f.c. applied to a varicap diode to "pull" the oscillator to the correct frequency – the diode is inductively coupled to the oscillator tuned line.

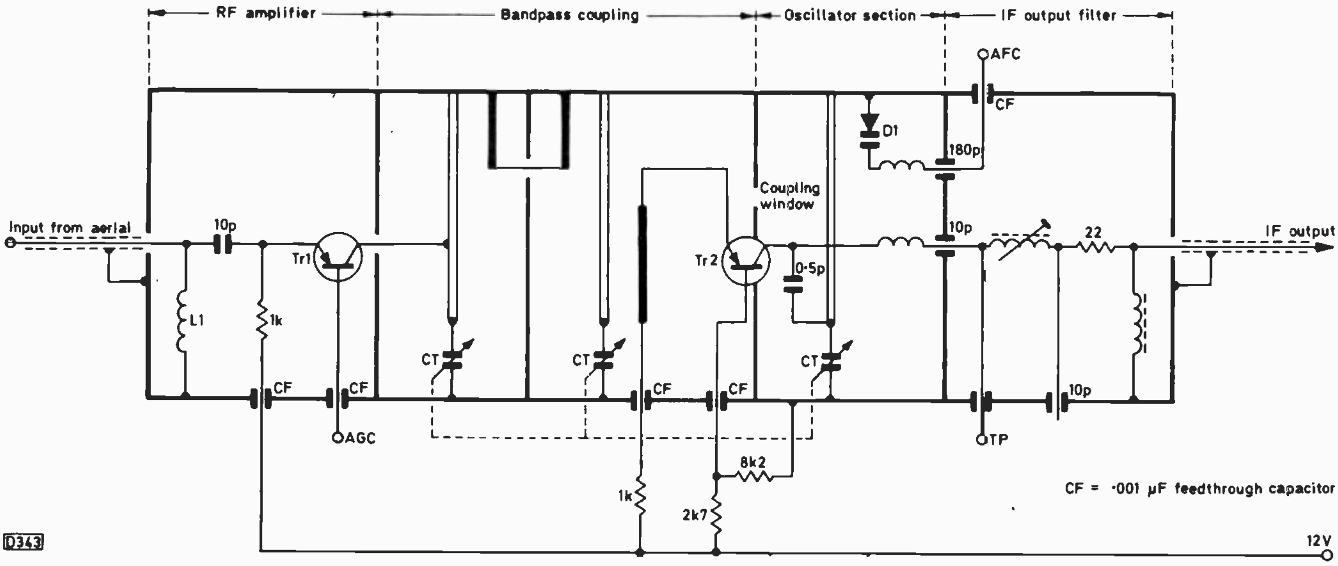

Fig. 2: Typical mechanical tuner circuit, with a.f.c. applied via varicap diode D1.

The mixer transistor's collector current will contain input and oscillator signal components and, because of the non-linearity of the device, the sum and difference products of the two frequencies. Since the oscillator frequency is always at a fixed difference above the input frequency, the difference frequency is constant across the unit's tuning range. This difference frequency is maintained by "tracking": in mechanically tuned units this is done by adjusting the split outer rotor vanes of the variable tuning capacitor; with varicap tuners it's done either by a tracking capacitor in series with the varicap diode or by using a dedicated varicap diode formulated for the purpose.

The standard vision and sound i.f. carrier frequencies in the UK are 39·5MHz and 33·5MHz respectively. The mixer's output circuit contains an adjustable pi filter whose response is centred between these frequencies: the tuning is broad to cover them without much loss. Frequencies present in the tuner's i.f. output range from about 33MHz to 40·75MHz, i.e. the sound and vision carriers and their sidebands. With teletext there's another carrier at 32·6MHz, the clock signal.

The IF Strip

The bulk of the amplification occurs in the i.f. strip where the signal is raised to a suitable level for detection. Until five or six years ago the i.f. amplifier section would consist of three-four transistor stages with tuned interstage coupling. Forward a.g.c. was applied to the first or the first two stages. The a.g.c. detector operated on the sync tips which represent peak signal level with negative-going vision: gating the detector so that it operates only during the sync pulse period reduces the influence of noise.

Current practice has moved on to the use of i.c. amplifiers with, generally, a surface acoustic-wave filter (SAWF) at the input to determine the passband. Fig. 3 illustrates a typical integrated circuit i.f. amplifier/detector arrangement. IC1 is a preamplifier stage which serves a dual purpose: it provides enough gain to compensate for the loss in the SAWF and also gives a balanced output to drive the SAWF correctly. Some designs use a discrete transistor preamplifier and do not provide a balanced drive for the SAWF, but a glance at Fig. 4 will show that this is essentially a balanced device. The loss introduced by the SAWF is typically 20dB: the preamplifier's gain will be a little higher – some 26dB. Some preamplifier i.c.s provide an a.g.c. output to control the tuner.

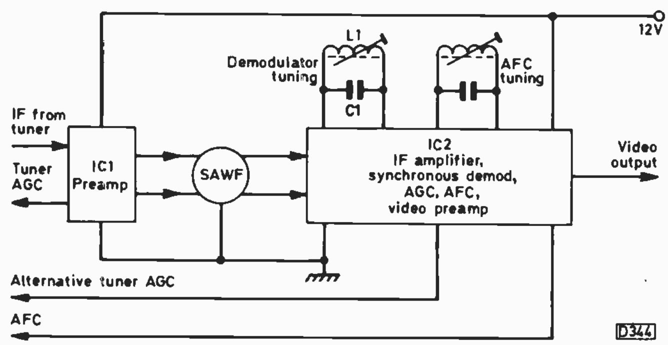

Fig. 3: Block diagram of a modern i.f. strip.

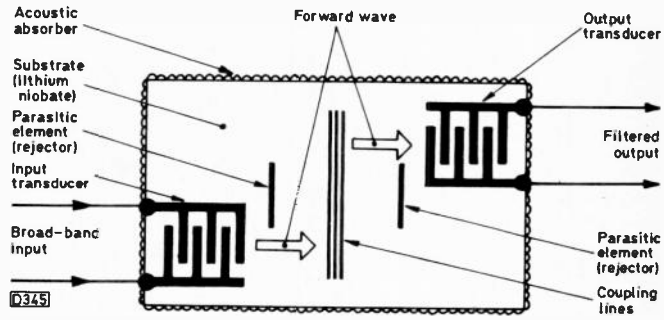

Fig. 4: Principle of the surface acoustic-wave filter.

Fig. 4 shows an idealised SAWF arrangement. The filter's substrate is a slab of piezoelectric material –lithium niobate. The filter elements are deposited on the surface of the substrate so that in some ways it resembles a printed circuit. The relatively broadband tuner output is amplified and fed to the input transducer which produces an electrical field between its interleaved fingers. This field in turn induces mechanical vibrations in the substrate. The resultant wave-like motion passes both forwards and backwards: only the forward wave is used, the back wave being absorbed at the edge of the substrate by the acoustic absorber. This is necessary since without the absorber the wave would be reflected by the edge of the substrate back into the filter – but with a time delay. The loss of the backward wave does however contribute to the filter's high through loss.

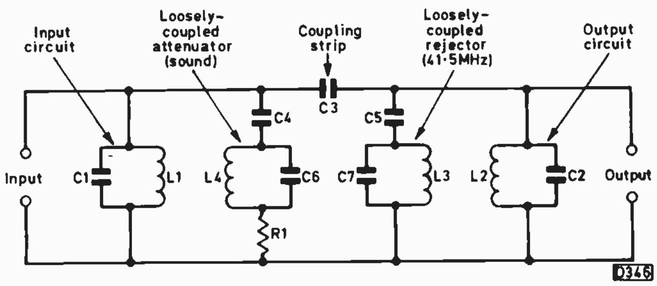

Fig. 5: Electrical analogue of a SAWF.

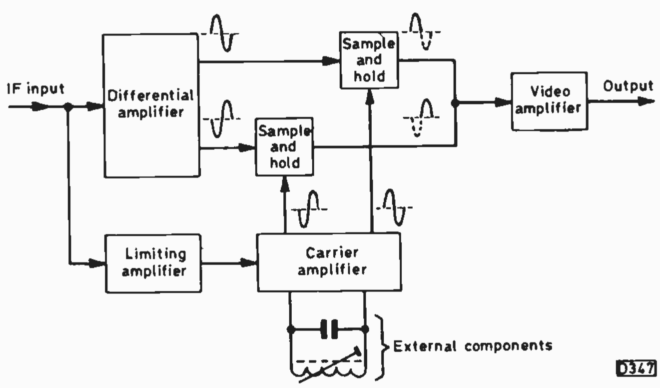

Fig. 6: Principle of the i.c. synchronous demodulator.

The forward wave travels across the output transducer and is then similarly absorbed at the edge of the substrate: without absorption here the wave would bounce back towards the output transducer and produce a second, delayed signal. On its path from the input to the output transducer the forward wave encounters some tuned, parasitic elements which lie partially in its path. These behave as loosely coupled rejectors: one is the sound attenuator, which introduces a loss of 20-26dB at the sound carrier frequency; the other is the lower adjacent sound carrier rejector. The dimensions of the parasitic elements are such that they are resonant at the required frequency: the extent to which they intrude into the path of the forward wave determines the attenuation provided. The ouput transducer produces a filtered electrical signal between its interleaved fingers. The coupling lines shown provide broad-band resonant coupling across the required i.f. range. Fig. 5 shows an electrical analogue of the SAWF.

The output signal from the SAWF passes to IC2 where it's amplified to a suitable level for application to the integrated synchronous demodulator. An internal gated a.g.c. system holds the signal level constant. The vision i.f. chip nowadays usually incorporates an a.f.c. circuit, white-spot limiter and video preamplifier. The use of synchronous demodulation gives improved results compared to the use of a diode detector, with virtually no odd-harmonic distortion.

The basic principle of a TV synchronous demodulator is shown in Fig. 6. The i.f. signal is fed to a differential amplifier which acts as a phase splitter and to a limiting amplifier which strips off any a.m. The latter is followed by a carrier amplifier which produces sinewave outputs at 39·5MHz. The external tank circuit – L1/C1 in Fig. 3 – is used to adjust the phase of the carriers – correct adjustment of this gives the excellent odd-harmonic suppression of which the system is capable. The carriers are used to control a pair of sample-and-hold circuits which switch on at the peaks of the carriers. As a result, the hold circuits are charged to the peaks of the incoming, modulated i.f. signal. The detected outputs are combined and fed to the following video amplifier, whose output will contain the luminance signal, the chrominance signal on its 4·43MHz subcarrier and the 6MHz intercarrier sound signal. There are differences in the way in which synchronous detection can be carried out but the basic idea, as indicated, is to use a carrier to control switching circuits that sample the incoming i.f. signal – the switching circuits sample alternate half cycles of the i.f. signal, thus providing demodulation.

Simple CRT Tester/Booster

Jim Littler

This c.r.t. tester/reactivator unit is simple to use and cheap to make – the mains transformer is one taken from a scrap Decca Bradford chassis, though two separate transformers could be used to provide the heater and first anode supplies required. It's based on an earlier design that appeared in the November 1984 issue of *Television* and has been built by a number of readers. The earlier design was suitable for use with delta-gun tubes only however: the present circuit (see Fig. 1) has been rearranged so that PIL tubes can also be handled.

In the test mode the grid of the gun being checked is connected to chassis, about 75V is applied to the first anode and the cathode is connected to chassis via meter M1 (0-0·5 or 0-1mA f.s.d.). For a good gun a cathode current reading of around 0·1mA should be recorded.

In the reactivate mode h.t. is applied between the relevant grid and cathode, the boost current cleaning up the cathode. The pygmy bulb lights to indicate current flow. Do not reactivate for more than five seconds – check the outcome by switching to the test position. Don't try a second reactivation.

The electrolytics are RS type 105-240.

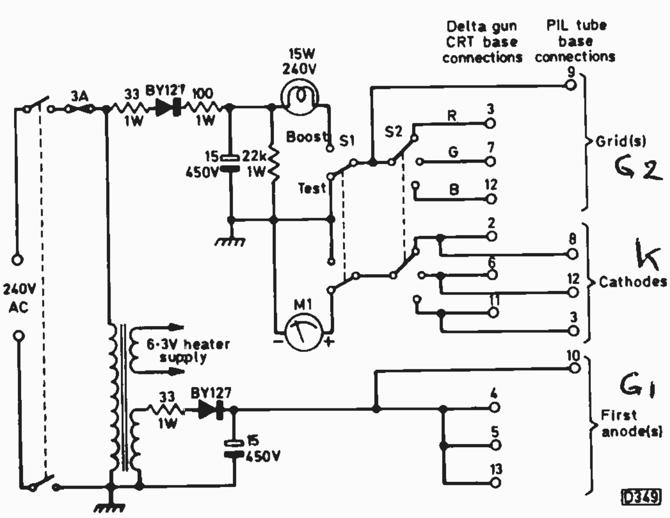

Fig. 1: Circuit diagram of the c.r.t. tester/booster.

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PANASONIC U1 CHASSIS

After three-five minutes the field starts to jitter, sometimes becoming a momentary field collapse. The set may settle to give normal operation for say half an hour then the jitter will return. The transistors and electrolytics in the field output stage have been checked by replacement but the fault persists.

A very common cause of this fault is a defective bias diode, D403, in the field output stage. The correct type must be used. Check also the safety resistor R442 which must be type ERQ12HJ1R0. The fault can damage the field driver and output transistors. If necessary check the scan coupling capacitor C415 (2,200μF) and for dry-joints in the deflection coil circuit.

SANYO VTC9300

On playing back one of the machine's own recordings there's breakup of one line only about a third of the way down the screen – the line appears to "twinkle". The problem does not arise with prerecorded tapes and the machine works satisfactorily in all other respects. At first the fault was only occasional, now it's present all the time.

Since one TV field is recorded across the tape per head scan the twinkling line must be due to a longitudinal fault in the tape. Close examination of an affected tape will probably show a crease or defect running along it. The usual cause is an abrasive particle or scratch on the surfaces encountered by the tape during its path across the deck. Clean and inspect the tape heads, guides, poles etc.

SONY KV1340UB

The mains fuses blew without warning. Checks showed that Q601, Q603 and Q604 in the power supply and the line output transistor Q802 were all short-circuit. Replacing these items restored normal operation for about a week, then they all blew again.

The power supply is unusual in employing a switching circuit to reduce the mains input to 144V at the series regulator. Q601 is the switching transistor, Q604 the series regulator and Q603 its driver. It's essential that these critical components, also the line output transistor, are approved, Sony supplied types. Use of alternatives will lead to premature failure. Other possibilities for early failure are the line output transistor's base feed resistor R802 – the value of this component depends on the Sony hFE number shown on the output transistor – and D601, which is in series with Q601, being defective. The other diodes in the mains input circuit – D602/3/4 – are worth replacing just in case. Before restoring power check the power supply and line timebase panels carefully for dry-joints.

AMSTRAD 7000 VCR

This machine won't load. When a cassette is inserted the machine will lace up then unload and stop. It appears that the right-hand spool is not taking up the slack tape.

Check that the loading gear is being driven far enough to engage the pinch wheel – if not, suspect the drum pickup head next to the flywheel of being open-circuit, therefore no drum flip-flop pulses. If the loading gear is going right home but the reel motor doesn't appear to be driving the idler, clean the nylon pulley and the idler with alcohol. Replace the idler if necessary. To do this the cassette lift must be removed: when replacing it the flat spring goes above the little arm, not in the slot in the end of the arm – otherwise eject will not operate.

ITT CVC20

The width suddenly decreased by one and half inches on each side – the picture is otherwise perfect. Transistor T903 on the EW modulator board was found to be short-circuit collector-to-emitter – removing this panel leaves a perfect picture.

T903 commonly goes short-circuit as a result of failure of the EW modulator driver transistor T17 (BD233) on the main panel. After replacing both transistors it's worth checking modulator diode D24 (BYX71), filter capacitor C72 (4·7μF) and the modulator transformer L33/34 – check this for signs of overheating.

SONY C5

This machine will no longer play back its own recordings though these play back perfectly on another machine. Playback of its own recordings produces a blank screen, with no sounds or noise except on fast forward/rewind and freeze frame when a perfect picture is obtained – in monochrome of course. When fast forward/rewind or freeze frame are released the picture starts to colour up, then goes blank. Playback of prerecorded tapes is all right.

What you are seeing is the effect of the muting circuit which monitors the level of the off-tape control track pulses. Their level has dropped due to a problem with the control head. It may be dirty but is probably badly worn. Ideally a new one should be fitted, but the assembly is expensive and not easy to fit. To stave off the evil day the following modification can be carried out on audio/servo board AS-6: replace D30 with a 180Ω resistor and change R123 to 2·7kΩ. Clean the head first of course!

REDIFFUSION Mk. 4 CHASSIS

This set works perfectly for an hour or so then the power supply trips and doesn't restart. Fusible resistor 4R2 in the start-up circuit then opens. By resoldering 4R2 and waiting about ten minutes normal operation resumes but the set

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trips again after half an hour to an hour. No obvious faults can be found but the intermittent nature of the trouble makes testing difficult.

Failure of the fusible resistor 4R2 indicates that the start-up circuit is being called upon to deliver sustained energy. This will be because winding G-A on the chopper transformer 4T1 is failing to provide the 12V necessary to maintain zener diode 4D5 in conduction. Check 4D6 (BA157) and 4C6 (1,000μF) in the 12V power supply then the chopper transformer 4T1 for dry-joints. The TDA1060 chopper control chip could be faulty.

TEST CASE

281

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

Unlike most domestic electronic equipment, VCRs contain a lot of precision mechanical components. VCR technology has improved so much that failure rates are now very low, and when troubles do crop up there's a very good chance that their cause will lie in the mechanical sections where wear, dirt and corrosion are amongst the causes of faults. The fact that the electronic circuits in a VCR operate at low signal and power levels greatly increases their reliability.

Not all problems are down to the mechanics however! An interesting case came our way recently and provided an object lesson in logical diagnosis. It concerned an Hitachi VT33, and the typically vague and unhelpful shop assistant's entry in the job card's fault box read "picture rolls". It took some considerable time to establish that playback was faultless, but that on playback of the machine's own recordings a wiggly, 1cm high bar occasionally travelled up the picture, followed shortly after by a few seconds' loss of field hold and a burst of snow over the picture. A further symptom was a lateral picture wobble. For those not too familiar with VCR servicing the story so far forms a mini test case: what do the symptoms imply? But to continue the saga.

Most of you will probably have recognised the symptoms as loss of drum servo lock during record. So did the technician, and his reaction was to check the setting of the drum servo circuit. This is easy to do thanks to the diagnostic pins so thoughtfully provided by Hitachi in their machines. With the shorting link in place between pins 2 and 7 of PG601 the disparity in frequency between the sampling and tacho pulses was very small: only a tiny tweak to preset RT604 (cylinder free speed) was needed to bring them into line.

Needless to say the problem of intermittent drum lock in the record mode was still present. Had the problem been in the servo circuit itself it would have shown up on playback of a known good tape of course. Accordingly our intrepid technician transferred his scope to check the field sync pulse input to the drum servo chip, at pin 16 of IC602. There should be sharp positive spikes of 1·5V amplitude here, derived from the off-air field sync pulses. In this machine the pulses at this point were erratic, misshapen spikes of no more than 500mV amplitude, wavering like corn stalks in a wind and varying in shape with picture content. Closer examination of the field sync input to the drum servo section confirmed that all was not well with the separated sync pulses coming from IC202 in the Y/chroma section. The waveform at pin 27 of this chip was of adequate amplitude – 0·8V peak-to-peak – but strange things were happening during the field sync pulses, especially during commercial breaks in ITV programmes and at scene changes in other programmes. A quick check confirmed that the chip was receiving the correct level of off-air video signal, so the chip was condemned and a new one was ordered.

This i.c. is not an integrated circuit in the usual sense of these words – it's a hybrid thick-film assembly. When the replacement was fitted the performance was no better. In fact in spite of its distorted output the original chip was not faulty. Now for the questions. What simple recording test would have established where the fault lay more precisely? And where in fact did the real cause of this "video nasty" lie? Clue: a long way from the servo circuit! Answer next month.

ANSWER TO TEST CASE 280
– page 388 last month –

If there was one thing that last month's puzzler brought home it was the need to consider all the fault symptoms present. They usually stem from a common cause and a little careful thought will generally save much time in arriving at a diagnosis. So, in the case of the Philips TX chassis reported last month, the two coincident fault symptoms were excessive brightness and field collapse. The common denominator here is the 95V supply provided by the line output transformer in conjunction with a simple rectifier circuit. It's used by the video output transistor and the field driver transistor. Hence the excessive brightness (tube cathode at zero volts) and the field collapse.

The 95V supply was missing of course. The pulses at pin 7 of the line output transformer are rectified by D453 which charges reservoir capacitor C452. The transformer winding is connected between pins 7 and 8, the latter being connected to chassis. Meter checks showed that D453 and C452 were in order, as was the surge limiter resistor R450. There was no measurable short-circuit across the 95V line, and in any case if there had been R450 would have burnt up. There was no measurable continuity from pin 7 of the transformer to chassis either! In fact pin 8 was found to be dry-jointed to the print land.

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ZTX502	18p
ZTX503	18p
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2N.3055	35p
2N.3055H	50p
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2N.3703	9p
2N.3704	9p
2N.3705	9p
2N.3706	9p
2N.3707	9p
2N.3708	9p
2N.3771	85p
2N.3772	90p
2N.3773	100p
2N.3819	29p
2N.3866	68p
2N.3903	11p
2N.3904	11p
2N.3905	11p
2N.3906	11p
2N.4031	26p
2N.4036	26p
2N.4037	25p
2N.4058	13p
2N.4443	76p
2N.4444	76p
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2N.5294	30p
2N.5296	30p
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AA119	9p
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BY127	8p
BY133	8p
BY164	40p
BY176	85p
BY179	35p
BY182	32p
BY184	32p
BY187	32p
BY196	20p
BY206	11p
BY207	11p
BY208	18p
BY210	22p
BY223	72p
BY225	120p
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BYX70/500	32p
BYX70/800	36p
BYX71/600	80p
OA47	6p
OA90	4p
OA91	4p
OA200	7p
OA202	7p
IN.914	2p
IN.4001	4p
IN.4002	4p
IN.4003	4p
IN.4004	4p
IN.4005	4p
IN.4006	4p
IN.4007	5p
IN.4148	2p
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7812	35p
7815	35p

7818	35p
7824	35p
7905	35p
7912	40p
7915	40p
7918	40p
7924	40p
78L05	28p
78L12	28p
78L15	28p
78L18	28p
78L24	28p
79L05	40p
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DL92	47p
DY86	50p
DY87	50p
DY802	45p
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E891	44p
EBF80	45p
EBF89	50p
ECC82	40p
ECC83	43p
ECC84	40p
ECC85	40p
ECH81	49p
ECH84	62p
ECL80	57p
ECL82	59p
ECL84	67p
ECL85	57p
ECL86	49p
EF80	31p
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EF183	45p
EF184	53p
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CA3086	55p
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CA3130S	100p
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CA3189E	250p
CA3240E	90p
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HA-1319	250p
HA-1339	170p
HA-1342	170p
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LA-3301	120p
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LM382	130p
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LM709DIL	30p
LM723	40p
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LM741 MET	45p
LM747	58p
LM748	35p
LM1458	33p
LM3900	30p
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M-51515BL	270p
M-51516	280p
M-51517L	280p
MB3712	150p
MB3730	260p
MB3756	260p
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74LS10	17p
74S11	17p
74S12	17p
74S13	26p
74S14	30p
74S15	17p
74LS20	17p
74LS21	17p

74LS22	17p
74LS24	38p
74LS26	17p
74LS27	17p
74LS28	17p
74LS30	17p
74LS32	17p
74LS33	17p
74LS37	17p
74LS38	17p
74LS40	17p
74LS42	39p
74LS47	70p
74LS48	60p
74LS51	17p
74LS54	17p
74LS55	17p
74LS73	28p
74LS74	26p
74LS75	32p
74LS76	28p
74LS78	34p
74LS83	46p
74LS85	50p
74LS86	30p
74LS90	39p
74LS91	75p
74LS92	46p
74LS93	40p
74LS95	52p
74LS96	63p
74LS107	35p
74LS109	36p
74LS112	38p
74LS113	32p
74LS114	38p
74LS122	44p
74LS123	50p
74LS124	85p
74LS125	36p
74LS126	42p
74LS132	44p
74LS133	34p
74LS136	35p
74LS138	38p
74LS139	40p
74LS145	83p
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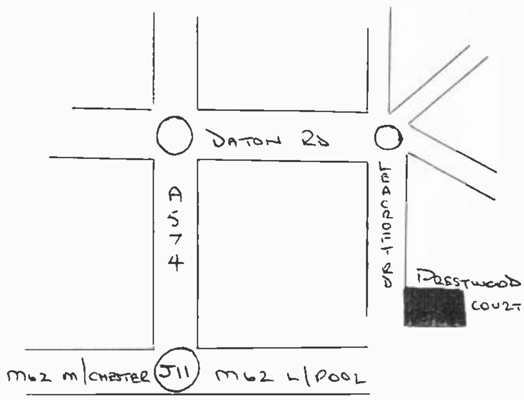

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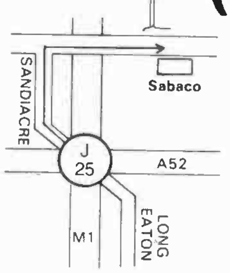

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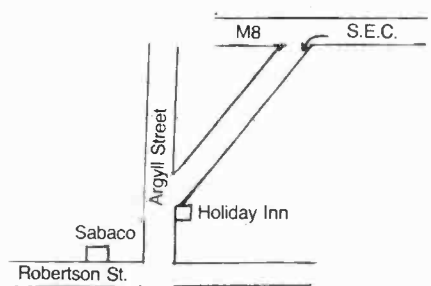

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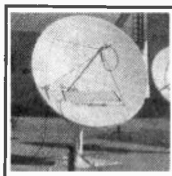

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45 watts 50p

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BU205	10 for £8.00
BU105	10 for £6.00
2SC2122A	10 for £8.00
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Thorn 50-40R-1K5 50p
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8×5 8 ohm 50p
5×3 8 ohm 70p
7×3 16 ohm £1.00
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5" dia 8 ohm £1.50
6½" dia 4 ohm £1.50
6½" dia 3 ohm £1.50
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3" dia 8 ohm 75p
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3" dia 15 ohm 60p
1690 5×3 12 ohm £1
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K30 15 watt £1

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OF-550 E.W. 10p
OF-513 correction 10p
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BY 127 10p
BY 133 10p
BY 134 10p
BY 164 50p
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BY 187 10p
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BY 206 8p
BY 208/800 8p
BY 210/400 5p
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BY 224/600: 4 8A/600V bridge 50p
BY 226 10p
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Triplers
KT3-30 BG 200/43 £6.00
ITT CVC 5-8-9 £3.50
Rank T25LE Tripler £2.00
Rank HTCP A823 £3.50
TU 25 30K Rank £3.00
II TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
9000 Thorn £6
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
HTBQ Pye 731 £3.00
II TIIY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
T/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 IC's + pots £4.00
GII E.W Transformer 50p
GII L.W coils £1.00
GII Transient Suppressors 245V 10 for £1.00
GII Scan Coils £5.00
GII 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 AE 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
GII 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 NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
GII Line Driver Transformer 35p
KT3 Front Panel Control Assy. £2.50
BTW 30/50 50p

TELETEX DECODER
I.C. SAA 5051 K30
I.C. SAA 5042
I.C. SAA 5030
I.C. SAA 5020 etc. £8.00
BTW 92/800R £3
25A473 PNP C/P 10p

NEW Pack THORN 17 off Manual £5.00
NEW 1617 THORN Chassis with IC's & AU113 £5.00
30V Power Supply 500M/A 4×2¼ £2.50
Pye 731 Power Panel £13
6 Diode Universal Triplers £4.00
NEW PYE 725 line O/P panel with L.O.P.T. & Tripler £10.00
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 205 T/unit £3.90
Pye 205 Line op panel £7.50
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 CDA/205 panel £6.00
GEC portable chassis + LOPTI 2114 New £4.00
Thorn 1613/1713 chassis 9.75
G9 Power Panel £6.00
Mono RANK Chassis 127A NEW £10.00
NEW G9 Frame Panel £10.00
NEW GII IF Panel £7.00

G8 Tuner Unit + Panel £4.00
G8 Power Supply £5.00
G8 6 Sloping PBU £8.00
G8 IF & Chroma £6.00
G8 Chroma £3.00

GII IF Detector £3.00
GII Selector gain module £3
Complete CVC 825 Chassis (both panels) £40.00
AFC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz I.C. SL437F £3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q £2.50
K35 IF £6.00
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P £1.50
Pye GII 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
GII 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 £9.00
CVC9 slider pots panel 50p
CVC 5 Mains on/off + 5 pots £2
Universal Focus. Fits Pye, Thorn and Decca Units
T147 Rank tube base on panel £1.00
Z718 Focus Unit £1.50
120 Focus Unit £1.00
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
K30 Tube base on panel £1.00
TX10 Focus Units £7.00
CVC 32 Focus Unit 75p
Feddity Focus Unit 14R-14S 30p
3500 Thorn Focus Unit £1.00
ITT Small for use with Split
Z718 Bush Focus £2.00
Diode 50p
TV11 50p
Remo TV12SP 50p
1600 Thorn EHT Rec and Lead 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 rec stick 5p

.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
800/160 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
22/250 15p
47/250 10p
100/250 20p
GII 470/250V £1.75
GEC600/250 60p
700/250 £1
300+300 MFD 350v £1.00
800/250 40p
32/300 20p
4/350 5p
8/350 8p
4.7M/350v 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 820HT 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
0.1/1200V wire end 20p
0.1/450 A/C wire end 20p
047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
47/1000v 65p
47/250V A.C 10p
.001K/1250 10p
0.0047/1500 10p
005/1500 10p
0105/1500 10p
1n8/1500 15p
2n0/1500 10p
2n2/1500 15p
01/1600 15p
GII 8200/2KV 15p
0.1/2KV 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
3000PF/3000V 10p
4n7/2KV 15p
8n2/2KV 15p
0.0082/2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 10p
47/100V 80p

GII drawer ASS 3 pots Mains switch and lead £2.00

K30 Drawer Ass with pots cable forme £1.00

Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228 £10

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

CVC 20-25-30 Mains Switches 75p
Infra Red and Ultrasonic GII 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
GII Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
THORN Rotary Mains Switch 50p
G8 Mains Switch 75p
Thyristor 600/4 amp C106/2 24p
GII Prch 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

Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF T115A £13.00

Multi-Caps
4,700/75 6 amp Rip £2.00
350V 300M + 300M £1.00
400V 400M 60p
350V 400M 60p
Thorn 3500
175/100/100/350v £1.00
KT3/200/25/25/385v £1.00
300+300+150+100+50MFD
350V £2
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
150/200/200/300v 70p
400/400/200v £1.70
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
Jelly pot Thorn 00D4013 £3
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
225+25/380 GEC 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT 8 and 6 Push Button £1.00
Pye 725 LOPTs £6.00
Pye 731 LOPTs £6.00
Thorn 8500-8800 LOPTs £5.00

CMD 800 Chassis No tuner £20.00

TAG 226/600 50p
BD 650 50p
UPC 574 30p
BSS 38 30p

WT 456 £1.00

LM 317T 30p

AF 114 50p

FET Power VN88AF 50p

PHILIPS SBC 469 Stereo Microphone £23.00
Meters Hills 520 £17.00
Meters Hills 420 £15.00
Infra-red Tester Handset £12.00

Infra Red Hanset Tester
Works at 24 feet – Sound repeater
Works off 9 volt battery £8.00
Fits in top pocket.

Repaired Handsets
Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £9.00

GEC Full Remote Infra-red, 1983 models £15.00

Timers, 60 mins, small £1.00

GII Ultrasonic Teletext Handset £24.00
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for GII Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
GII Infra-red full teletext £24.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18
Philips full remote K13, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
GII, Full remote top button assy. £12.00
GII, 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
K35
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 each 10p
Pye & Philips handset KT3-K30 chassis No RC5150-RC5176-RC5171-RC5177 **Special Price** £13.00
ITT Hand Set with TV-Teletex-VCR £12.00
RC4001 KT3 and Teletex £14.00
Philips Tops for Teletext & Full Remote KT3-K30 £9.75