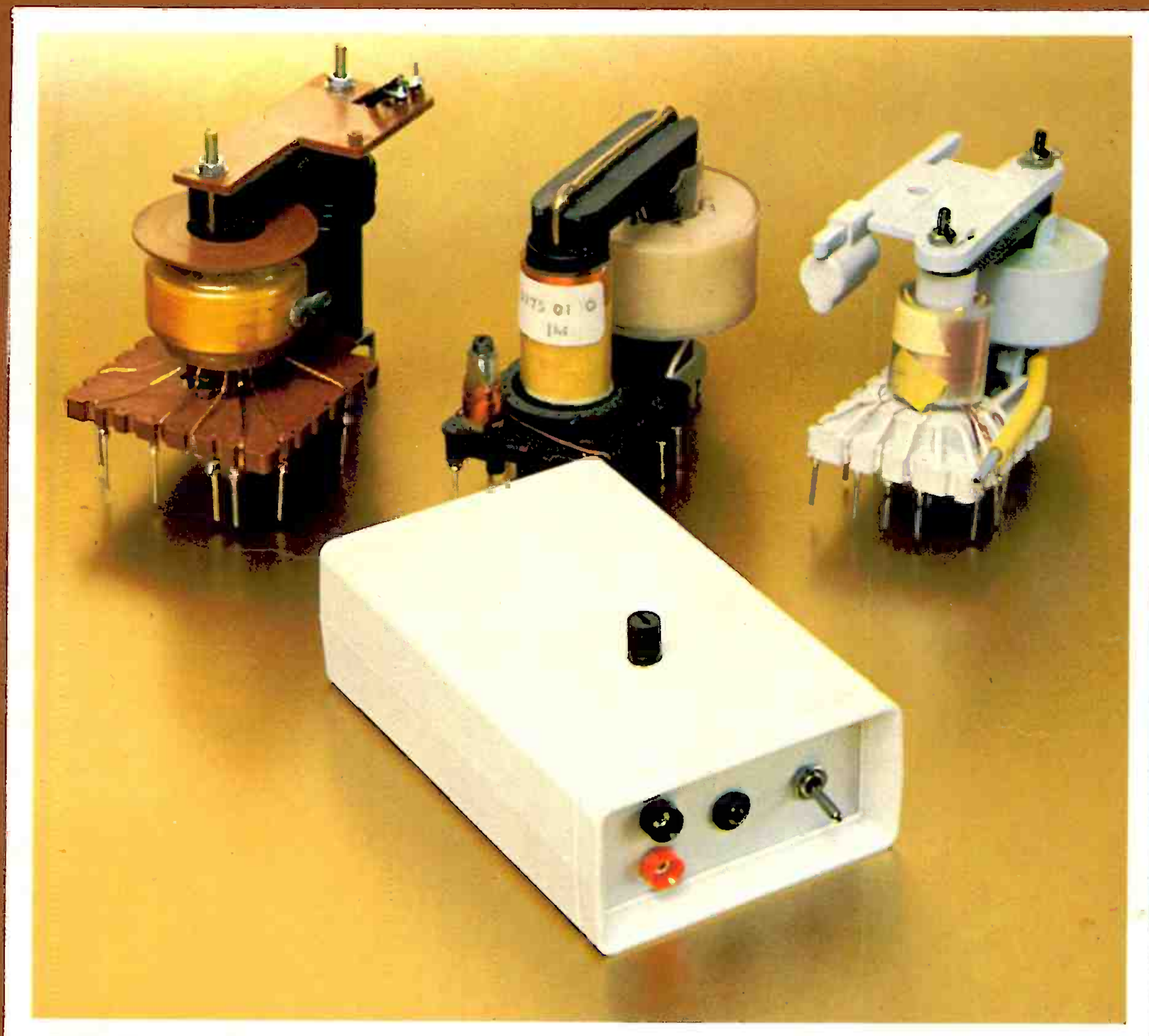
MAY 1982

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

80p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



LOPT TESTER

TV-VCR COMPATIBILITY

FAULT REPORT

SIMPLE VHF PREAMPLIFIER

CHECKS ON THE DECCA BRADFORD CHASSIS

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

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

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

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

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

TELEVISION

May 1982 **Vol. 32, No. 7 Issue 379**

this month

OUR NEXT ISSUE DATED JUNE WILL BE PUBLISHED ON MAY 19

MANOR SUPPLIES

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

TEST DEMONSTRATIONS AT 172 WEST END LANE

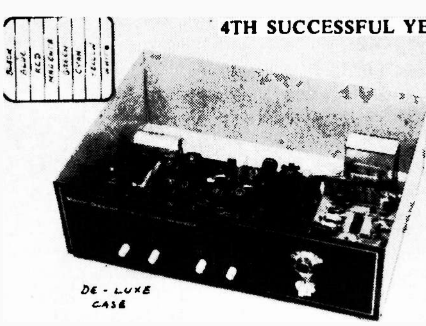
★ 40 different patterns and variations.
★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
★ Chequerboard.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

PRICE OF KIT £80.50.
DE LUXE CASE (10"×6¾"×2¼") £8.50
Post/Packing £2.00.

ALL ABOVE PRICE INCLUDE VAT 15%.

PAL COLOUR BAR GENERATOR (Mk 4)

4TH SUCCESSFUL YEAR



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

PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £40.25 P&P £1.20. DE-LUXE CASE £5.95. ALUMINIUM CASE £3.30, P&P £1.20, BATT HOLDERS £1.70 P&P 85p, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55 (Combined P&P £1.80).

MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.80 P & P.
MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.80 P & P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £4.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

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

Goods available if in stock immediately over shop counter (Mail order between 3 days and 2 weeks according to method of payment).

TELEVISION PROJECTS & SERVICE SPARES

SPECIAL OFFER Leading makers Tuner-Timer in De Luxe Case. 12 station touch tune UHF-VHF + IF amp. Video Audio Outputs, Digital Clock etc. Less than half original trade price **£74.75** p-p £3.50.

"TELEVISION" NEW COLOUR PORTABLE PROJECT (Parts available) **SWITCH MODE POWER SUPPLY KIT £26.00** p.p. £1.60. **SIG BOARD KIT** (Incl. ALT. SAW IF) **£70.00** p.p. £1.60. **TIME BASE £44.80** p.p. £1.60. **CRT BASE £2.60** p.p. 60p. **CONTROL UNIT PACK £3.90** p.p. 80p. (PHONE, CALL, SEND FOR LIST). WORKING MODEL & PANEL TEST SERVICE AT 172 WEST END LANE.
"TELEVISION" TV PATTERN GEN. (Parts available) Pack Price **£34.00** p.p. £1.40.
"TELEVISION" MONITOR PARTS AVAILABLE.
"TELEVISION" MONO PORTABLE RECEIVER PARTS AVAILABLE. WORKING MODEL & PANEL TEST SERVICE.
"TELEVISION" COLOUR RECEIVER (LARGE SCREEN) PROJECT ALL PARTS AVAILABLE. SEND OR PHONE FOR LIST. WORKING MODEL ON SHOW WITH TELETEXT. (PANEL TEST SERVICE)
SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND TESTED FOR T.V. SOUND & VISION **£32.80** p.p. £1.20 (SUITABLE FOR USE WITH TELEVISION SIGNAL BOARDS).
SPECIAL OFFER TEXAS XMII TELETEXT MODULE NEW & TESTED, AT REDUCED PRICE **£57.50** p.p. £1.60.
TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£7.80** p.p. £1.20. XMII INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 60p. (ALUM CASE **£2.60** DE LUXE CASE **£5.50** p.p. £1.20.) ADDITIONAL GREY SCALE KIT **£3.35** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £21.60 (VHF version also available). ALUM CASE **£2.00** DE LUXE CASE **£8.50** p.p. £1.80.
CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO **£29.40** p.p. £2.00.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 90p.
DECCA "Bradford" IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
DECCA 80, SERIES, IF FRAME TB **£5.75 each** p.p. £1.40.
GEC SERIES I MONO PANELS **£2.10** p.p. £1.30.
GEC 2110 Decoder, RGB panels (ex rental) **£5.75 each** p.p. £1.00.
GEC 2040 DECODER PANEL **£2.88** p.p. £1.60.
GEC 2040 IF PANEL **£3.22** p.p. £1.40.
GEC 2040 (SERIES) CDA PANEL **£2.88** p.p. £1.40.
PYE 713/715 Convergence **£5.75 each** p.p. £1.40.
THORN 3000 BEAM LIMITER PANEL **£1.72** p.p. 80p.
THORN 3000 VID, IF, DEC, Ex Rental **£5.75 each** p.p. £1.30.
THORN 8500 Series channel selector & front control unit **£4.37** p.p. £1.80
THORN 8000/8500 IF/DECODER PANELS salvaged **£5.52** p.p. £1.80.
THORN 8000/8500 FRAME T.B. PANELS salvaged **£5.52** p.p. £1.40.
THORN 9000 LINE T.B. (incl. Lopt etc.), Salv., spares **£8.62** p.p. £2.00.
THORN 9000 SERIES TOUCH TUNE REMOTE CONTROL UNIT PLUS ULTRASONIC TRANSMITTER HANDSET **£19.32** p.p. £1.84.
THORN 9000 IF/DECODER PANELS Salvaged **£8.90** p.p. £1.60.
PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 80p.
PHILIPS G8/G9 IF/DECODER Panels for small spares **£4.80** p.p. £1.40.
G8 IF Panels for small spares **£1.75** p.p. 95p.
G8 Decoder panels salvaged **£4.25.** Decoder panels for spares **£2.00** p.p. £1.40.
VARICAP, U321, U322, ELC 1043/06 ELC 1043/05 **£7.82** p.p. 80p; G.I. type (equiv. 1043/05) **£4.00** p.p. 60p. Control units, 3PSN **£1.40,** 4PSN **£1.75,** 5PSN **£2.00,** 6PSN **£4.00** p.p. 60p. Others available.
BUSH "Touch Tune" and Varicap Control Unit **£4.40** p.p. 95p.
VARICAP UHF-VHF ELC 2000S **£9.80.** BUSH TYPE **£8.60** p.p. 85p.
VARICAP VHF MULLARD ELC 1042 **£7.95** p.p. 80p.
UHF/625 Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, Mullard 4 position push button **£4.80** p.p. £1.50.
TRANSISTORISED 625 IF for T.V., sound, tested. **£7.82** p.p. £1.00.
MULLARD EP9000 Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
LINE OUTPUT TRANSFORMERS. New guar. p.p. £1.25.

BUSH 145 to 186SS series	£9.20
BUSH, MURPHY A816 series	£9.80
DECCA 20/24, 1700, 2000, 2401	£8.80
FERG., HMV, MARCONI, ULTRA 850 to 1580	£6.80
THORN 1690, 1691	£10.50
GEC 2000 to 2038 series	£7.80
GEC series 1 & 2	£9.20
INDESIT 20/24EGB	£8.80
ITT/KB VC1 200, 300	£8.80
MURPHY 1910 to 2417 series	£8.80
PHILIPS 19TG 170, 210, 300	£8.80
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	£8.80

SPECIAL OFFER

GEC 2114J/FINELINE	£5.50
PYE 40, 67	£2.00
THORN 1590/1591	£5.50
KB VC ELEVEN (003)	£2.00

COLOUR LOPTS p.p. £1.40 Bobbins 80p

R.B.M. A823	£5.60
R.B.M. Z179	£6.70
R.B.M. Z718	£16.60
R.B.M. T20, T22 Bobbin	£6.44
DECCA Bradford (state Model No.)	£10.15
DECCA 80, 100	£9.50
GEC 2028	£5.60
GEC 2040	£6.70
GEC 2110 Series	£12.20
ITT CVC 5 to 9	£11.30
ITT CVC 30 Series	£10.15
PYE 691-697	£14.80
PYE 713-715	£7.85
PYE 731 to 741	£7.85
PHILIPS G8, G9	£10.15
PHILIPS 570	£7.85
THORN 3000/3500 SCAN, EHT	£7.85
THORN 8000/8500/8800	£14.80
THORN 9000 to 9600	£10.15

OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.
TRANSDUCTORS Suitable for G8, A823, Bradford etc. **£1.72** p.p. 60p.
THORN 1400 5 Stick EHT Tray **£1.72** p.p. 65p. Full range available.
THORN 3000/3500, 8000, 8500, MAINS TRANSF. **£10.15** p.p. £1.80
6·3V CRT Boost Transformers **£5.80,** Auto Type **£3.20,** p.p. £1.20.

CALLERS WELCOME AT SHOP PREMISES Telephone 01-794 8751/7346
THOUSANDS OF ADDITIONAL ITEMS AVAILABLE, ENQUIRIES INVITED
LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS

MANOR SUPPLIES
172 WEST END LANE, LONDON, N.W.6.
NEAR: W. Hampstead Tube Stn. (Jubilee) Buses 28, 159, C11 pass door
W. Hampstead British Rail Stns. (Richmond, Broad St.) (St. Pancras, Bedford)
W. Hampstead (Brit. Rail) access from all over Greater London.
Mail Order: 64 GOLDERS MANOR DRIVE, LONDON N.W.11.
ALL PRICES INCLUDE VAT AT 15%

P. V. TUBES

Telephone: Accrington (0254) 36521

REPLACEMENT ELECTROLYTICS

DECCA 30 (400/400/350V)	2.86
DECCA 80 (400/350V)	3.15
DECCA 100 (800/250V)	3.15
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.21
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.39
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.28
RBM A823 (600/300V)	2.30
RBM Z146 (300/300/350V)	3.15
RR1 T20A (200/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.47
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.01
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.46
THORN 3500 (1000/63V)	65
THORN 3500 (1000/70V)	84
THORN 8000/8500 (2500/2500/63V)	1.64
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.05

MIXED DIELECTRIC CAPACITORS

Volts DC		
250V	0.91 MF (Philips)	84
400V	0.022 MF	15
600V	0.1 mFd	38
1000V	0.01 mFd	20
	0.047 mFd	29
	0.1 mFd	32
	0.22 mFd	48
	0.47 mFd	75
1250V	0.1 mFd	45
1500V	0.0022 mFd	19
	k0.0047 mFd	20
	0.022 mFd	24
	0.033 mFd	59

CAPACITORS

AXIAL TYPE

Volt	MF	price	Volt	MF	Price
10	22	7	63	10	9
	47	7		22	11
	100	8		47	16
	220	11		100	19
	470	18		220	30
16	1000	20		470	38
				1000	53
25	10	7		2200	85
	22	7	100	10	12
	47	9		22	14
	100	10		47	19
	220	17		100	28
	470	22		220	35
	1000	38	300	12	30
	2200	46			
	4700	80	450	1	23
40	22	9		4.7	28
50	500	38		10	28
63	1	7		22	56
	2.2	7		33	82
	4.7	7	500V	1	30

DISC CERAMIC CAPACITORS

High Voltage

6KV d.c.-12KV d.c.	30	180pF	30
39 pF	30	200pF	30
140pF	30	220pF	30
150pF	30	250pF	30

TEST EQUIPMENT

Portable Oscilloscope	150.00
Probes × 10	£10.90
TF200 Frequency Metre	155.00
CRT Tester/Rejuvenator	172.00
Degausing Coil (stick type)	15.50
KHP 30N Measuring Probe (30KV) EHT	29.95

WIREWOUND RESISTORS

PREFERRED VALUES

		price each
4W/5W	1R 1K5	20
	2K2-3K3	20
	4K7-6K8	20
	10K	25
7W	1R-4K7	21
	5K6-12K	21
	15K-22K	21
11W	1R-6K8	24
	10K 15K	24
	22K	24
17W	IR-10KO	28
	15K 22K	28

RESISTORS

A range of the following at Preferred Values

		Price per 10 pack
0.25W		20p
0.5W	3R3 to 8M2	20p
1W	10R to 10M	38p
2W	10R to 10M	62p

SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

MINIATURE price each 14
100R-220R-470R-1K0-2K2 4K7-10K-22K-47K-100K 220K-470K-1M0

STANDARD price each 14
100R-220R-470R-1K0-2K2-4K7-10K-22K-47K 100K-220K-470K-1M0-2M2-4M7

'MIDGET' CONTROLS

Insulated spindle length 44mm.

LESS SWITCH 38p
Log or Lin
5K 10K 25K-50K-100K-250K-500K-1M

WITH D.P.S.T. SWITCH
Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M 81p

SLIDER POTENTIOMETERS

Lin or Log

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

MULTITURN POTENTIOMETERS

100K
GEC/TCE	55p
PHILIPS G8	55p
DECCA/RANK	55p

THICK FILM RESISTOR NETWORKS

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

CONVERGENCE PRE-SET POTS

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

METRIC CONVERGENCE POTS

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

EAGLE PRODUCTS

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

SE500 Headphones		3.75
SE540 Headphones with Volume Control		5.50
SE600 Lightweight Headphones		7.95
Multimeters		
KEW 7N	2,000 opv	6.25
EM5	5,000 opv	8.95
EM10	10,000 opv	11.50
EM50	50,000 opv	19.95
EMC321 Carrying Case for above		2.25
Digital Meter TS1000		44.50
MM20 20,000 O.P.V		21.95
MM50 50,000 O.P.V		25.85
MM100 100,000 O.P.V		38.50
Case for MM100		15.95
T1206 2 Station Intercom.		8.95

DATA BOOKS (No VAT)

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

ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	7.80
Mullard ELC1043/06	7.80
4 P/B DECCA/GEC/ITT	5.80
6 P/B DECCA/GEC/ITT	7.00
4 P/B PYE	9.00
6 P/B PYE	10.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass. (Square/Early)	13.50
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.75
U321 UHF Tuner	7.50
THORN 8800 SELECTOR (HMV Model 2725/6 way round button)	7.50
THORN 9000 SELECTOR	11.40
U322	7.20
HITACHI 4 way Chan. Selector	8.00
RR1 T20A 6 way Chan Selector	8.75

SUNDRY TUNER ACCESSORIES

RANK Tuner Push Button 1¼" × ½" dia.	35p
RANK Tuner Push Button 2" long ⅜ dia	35p
GEC Tuner Neons 2110 chassis.	14p
Drive Cams	each 10p

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/push	82
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/off	82
A1 Beam Switch (THORN 3500)	50
A1 Controls 5m (THORN 3500)	69
GEC 2110 A1 Control IMS (Red, Blue, Green)	each 58p
GEC 2040 On/Off Switch	each 88p
On/Off Switch G11/G12	1.56
On/Off Switch GEC 2040/TCE TX9-10	1.06

THERMAL CUT OUT

THORN 3000 2A Metal	1.80
THORN 8500 2.5 Plastic	1.80
GEC 2040 Metal	2.50

PYE LABGEAR

CM6040/WB UHF Masthead (ch21-68)	18.98
CM7025 UHF High Gain M.H.A. 24V (specify group A, B or CD)	15.66
CM7061 Power Unit (12V)	11.38
CM7065/WB VHF/UHF M.H.Amp (12V)	13.44
CM7073 VHF/UHF Dist Amp (8+1)	38.85
CM7053 'Behind the set' UHF Amp. (mains)	11.27
CM7043 'Behind the set' 2nd Set Amp. (UHF-2 outputs)	10.56
CM6006 UHF 6 way Passive Splitter	11.26
CM7042 TV Games Combiner	3.48
CM9003 Flush Mount Single Outlet Isolated	1.84
CM9009 Flush TV/FM Diplex Outlet Isolated	3.15
CM7069 Tri Star Amplified Set Top Aerial (ch21-68) UHF	18.38
CM6038 VHF/UHF 625 TV Patt Generator	102.38
CM6052 UHF/VHF Pal Colour Bar Generator	225.75
7056 **TELETEXT ADAPTOR** (Converts any set to remote)	210.30
AMPLIFIED CARAVAN AERIAL (All Channels)	19.43

FUSES

	Pack of 10
1¼" QUICK BLOW	
100ma	73
250ma-500ma-750ma-1A	54
1.5A-2A-2.5A-3A 5A	45
1¼" ANTISURGE	
250ma, 500ma 600ma, 630ma, 750ma 850ma, 1A, 1.25A	
1.5A, 2A	1.80
2.5A, 3A, 5A	2.48
20m ANTISURGE	
80ma	3.43
100ma	2.30
160ma, 200ma	2.08
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A	1.18
2.5A, 3.15A	1.58
20mm QUICK BLOW	
100ma, 250ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	81 / 40
1" MAINS	
2A, 3A, 5A, 10A, 13A	91

MAINS DROPPERS

DECCA 20	2.20
DECCA 2R5	50
DECCA 27R/47R	75
DECCA 56R/6R8	75
R.B.M. A823	88
R.B.M. 161	82
GEC 2000/2018	70
GEC27840	84
PYE 713/15 3R5/15/45R	1.70
PYE 725/31 3R0/56R/27R	1.18
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2k85	1.75
PHILIPS 210/5051 -/118R/148R	93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	65
THORN 1400	1.15
THORN 1500	1.32
THORN 1600	1.80
THORN 3500	94
THORN 8000	96
THORN 8500	88

SUNDRIES

ANTIFERENCE Super Set Top	8.80
ANTIFERENCE Car antenna	7.80
Triangular Splitter	1.20
Surface Mounting Splitter	1.70
Delay Lines DL60	2.20
Delay Lines DL700	2.20
G8 Knobs small/large	50
Surface Mounting Aerial Outlets	80
Cable Clips per 100	1.18
Transductor 90°	2.08
EHT Final Anode Cap	53
Delay Line CTAV 82/DL50/50L141	2.20
EHT Cable 30kV	25p per mtr.
Coax Plugs pack of 10	1.80
Focus control GEC/THORN	1.83
PVC Tape	35
FM Plugs	25
PL259 Plugs	40
DECCA 30 Series width control	50
DECCA 3.9R Modulohm	80
DECCA Height Control 2M2	25
THORN 1500 Frame Hold 390K	32
THORN 1500 Line Hold 470K	32
THORN 1500 Contrast 1K5	32
Line Connectors	35
6.3V CRT boost trans	4.35
ANTIFERENCE XG8 High Gain Aerial (State Channel)	17.00
Reducers for PL259	16
13A Plug Tops box of 12	4.80
T.V. Filter 50db rejection 27MHZ	2.10
Quick Set Adhesive	78
Attenuators 6db, 12db, 18db	each 1.00
Moulded Plastic Hex. 8mm Trim Tools	10
Trim Tools Moulded Double Ended 4mm/6mm	20
Thorn 1591 Loudspeakers 4¾ × 2¾	3.45
Thorn 1591 Loudspeakers 5¾ × 2¾	3.95
Focus Rod	1.25
Holder	2.00
Cassette Drive Belts 46mm per pack of 5	1.65
58mm	1.68
66mm	1.71
77mm	1.80
89mm	1.90
Key nector at	5.50

N.B. We have a full range of aerials and accessories available from the trade counter.

SOLDERING EQUIPMENT

WELLER Iron 15W	4.31
WELLER Iron 25W	4.31
WELLER 3/16" Single Flat Tips	51
MIN Soldering Iron	5.00
WELLER Heat Gun Kit	14.30
(Pair) Tips for Gun	42
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	4.98
Solder Remover Sucker	6.50
Solda Mop	72
500G Reel Solder	7.00
DIY Type Solder	43
250G Solder	3.50

SERVICE AIDS

SERVISOL Freeze-It	92 plus VAT
SUPER SERVISOL	84 "
SERVISOL Foam Cleanser	82 "
SERVISOL Plastic Seal	85 "
SERVISOL Silicone Grease	98 "
SERVISOL Tubes Silicone Grease	1.56 "
SERVISOL Aero Klene	72 "
SERVISOL Aero Duster	90 "
SERVISOL Excel Polish	74 "
Penetrating Fluid	70 "
Fire Extinguisher 640G	2.80 "
Heat Sink Compound 25G	1.05 "
Silicone Rubber Tube 1106	2.98 "
Solda Mop standard reel	72 "

ELECTROLUBE PRODUCTS

Electro-Mech lubricant	1.39
Elect. cleaning solvent	1.50
Freezer	1.39
Foam cleanser	1.00
Heat transfer compound	1.07
Silicone compound	1.81
Special contact fluid (Snorkel)	2.07
Permagard	1.43
Elec. mech. lubricant pen	89

HOW TO ORDER

ADD 15% VAT to **ALL** prices.

All orders **ADD** 65p per order Post/Packing – U.K. ONLY

Orders which contain aerosols or degaussing coil **PLEASE ADD** 30p extra per can/coil (these are very heavy!)

FIRST CLASS Mail is used whenever possible

ALL enquiries S.A.E. please

VAT Invoice on request

Goods are despatched on the day we receive your order. If for any reason beyond our control we are out of stock, we will try to inform you as quickly as possible. We try our best to give a speedy, fair, and efficient service.

As our regular customers know, orders telephoned in before 4.0p.m. will be despatched the same day. Give us a ring – we'll give you service.

TELEVISION

Satellites and Cables

The subject of TV/video has certainly been hitting the headlines of late. Video discs are to be launched on the UK market this month – the long awaited Philips LaserVision system, which we'll be considering in greater detail next month. The things that have caused the greatest stir however have been the authorisation of a satellite TV service for the UK, due to start in 1986, and the government's announcement that the future of cable TV is to be considered as a matter of urgency.

The BBC has been given the task of providing the initial satellite TV services – using two of the five channels allocated to the UK for satellite TV broadcasting. One channel will be used for feature films, cultural programmes and live sports transmissions, on a subscription basis at an envisaged charge of some £10 a month. The second channel will be used for repeats of BBC material and programmes from other sources world wide, and will initially be financed by a small addition to the normal licence fee. There will also be three satellite radio channels. The IBA has expressed its firm wish to participate in satellite broadcasting. This will require legislation however, since the IBA is at present restricted to two TV services and local radio. In addition, the ITV system is for the time being engaged in establishing the channel 4 and breakfast TV services.

The link between satellite and cable services arises from reception problems. Satellite reception is strictly line-of-site. As the satellite will be at 31°W above the equator, there'll be shadowing problems in hilly and built up areas. Quite how extensive these will be remains to be seen, but the solution will lie in cable distribution from a suitable receiving site.

Now to cable itself. The Home Secretary announced in the House of Commons on March 22nd that, following a report on cable systems from the Cabinet Office's Information Technology Advisory Panel, an urgent enquiry is to be set up to decide on technical standards and methods of controlling such services, to report by the autumn.

The history of cable TV goes back almost as far as TV broadcasting itself. The earliest systems were tagged on to audio distribution networks. For a long time now however cable TV has been something of a backwater. Pay TV services, local TV and so on have been authorised and tried out on several occasions (there are pilot pay TV trials in operation at present), but successive governments have been unable to make up their minds on the possibilities that cable distribution offers (basically more channels and services than can be provided off air). This has been a pity in many ways, but traditionally cable has never been regarded as a matter of any great urgency – until now!

So here we are with a panel asked to report back in a matter of months. Has someone panicked; has the fashionable notion of the information revolution once more got out of hand; or are political considerations paramount – there's been no effort to disguise the hope of getting a new cable system started before the next general election, in order to avoid uncertainty? Whatever the reason, it's hard to see why the subject of cable TV should at this precise moment be one of such overriding urgency. Technically, there would appear to be good reason to wait awhile. Why go to all the trouble of installing a coaxial cable system, as proposed, when optical-fibre cables are clearly the thing of the future? The technological history of TV shows over and over again that those who jump in first don't necessarily come off best in the long run. One thinks for example of the N1500 VCR system, the NTSC colour system, and the 405-line TV system. Whenever a technology is going through a period of rapid change, it usually pays to hold back and see how things develop. The link between cable and satellite TV seems in this connection to be a bit of a red herring: much of the shadowing is likely to be most easily dealt with by on-the-spot aerial distribution installations.

The non-technical problems are even more difficult to assess. It's important for a start to ensure that the principle of public broadcasting services is preserved, i.e. that the established broadcasting services with their overall coverage are not allowed to become second-class services. The economic facts also require careful consideration – after all we're talking about expenditure of hundreds of millions of pounds, whoever provides the funds. Cable TV has been very successful in the USA over the last few years – but maybe that's been due to the poor fare offered by the US broadcast networks. The current experimental cable pay TV services in the UK on the other hand have not turned out to be all that successful – maybe people prefer to rent video tapes. One has also to consider the effects of an expanded cable system on the other media. These are not the sorts of problems that can be satisfactorily considered under a tight time schedule.

Finally, there seems to be considerable confusion about what sorts of services could eventually be provided by different sorts of cable. Would some of the proposed services simply duplicate what teletext or Prestel can do? Which would be cheaper? And to what extent do people want or need access to information via a home computer terminal? In this latter connection it's interesting to note the results so far from the pilot test (in Paris) of the French Télétel interactive videotex system. According to a recent report, an average of two calls a week are made from each terminal, while much of the information called up could as easily be provided by other means.

All in all, caution would seem to be the appropriate stance for the present.

Teletopics

VIDEO DISCS ARE HERE

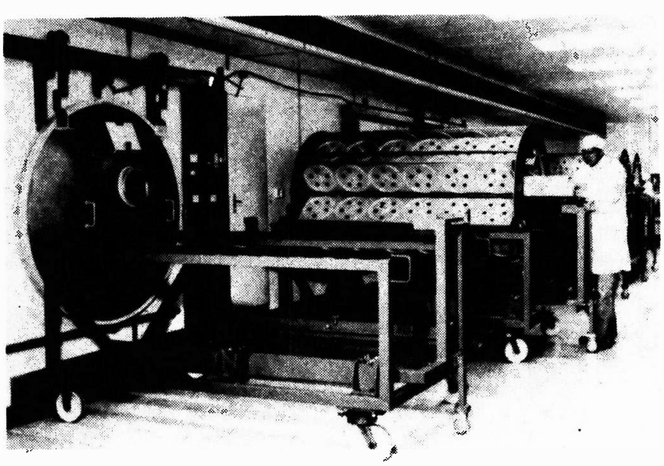
The Philips LaserVision disc system is to be launched on the UK market at the end of the month. The players and discs will initially be on sale in the Greater London and surrounding Home Counties area, through a restricted number of outlets including high-street multiples, independent retailers and specialist rental shops. The plan is to progressively increase the number of outlets through the other major conurbations until nationwide distribution is reached at the earliest opportunity. The initial disc catalogue will contain over 100 titles, of which at least 75 will be available for sale on the launch date. The balance of the titles will become available shortly afterwards, followed by further new releases to expand the catalogue substantially by the end of the year. Philips will be backing the launch with a strong advertising and promotional campaign aimed at both the trade and the consumer. It will emphasize that the system is a new and unique source of home entertainment and information, using an easy to operate, damage proof player and tough coated discs of lasting quality. In parallel with this, Philips are devoting substantial resources to developing the interactive use of the LaserVision system for industrial, commercial and educational purposes.

The LaserVision launch date coincides with the CETEX consumer electronics exhibition at Earl's Court – this replaces the traditional May trade shows. The JVC/Thorn VHD video disc system will also be on show to the trade at the exhibition, though the public launch will not be till September – only a couple of months behind the original schedule.

Meanwhile in the US RCA have decided to reduce the price of their Selectavision disc players by about £80 to some £190 in an effort to stimulate demand. The players have been moving slowly, though sales of the discs themselves have been up to expectations and the disc pressing capacity has been increased to seven million units. RCA made a loss of $106·8 on the system in 1981, and puts this down to a premature launch.

SATELLITE TV IN '86

The BBC has been given the go-ahead to start satellite TV broadcasting. The service is expected to start in 1986 and will be on two channels. One will offer programmes from abroad plus repeats of BBC material: viewers will pay a supplementary licence fee which is expected to be levied when the required receiving equipment is acquired. The other service, which the BBC expects to be the main attraction, will offer feature films shown within weeks of their release plus full length cultural programmes (concerts, operas, plays etc.) and sports coverage. This will be a subscription service, with scrambled transmissions: only subscribers will be able to obtain the required decoder. The price of a suitable dish aerial is expected to be around £250 initially, though this could fall considerably as production increases.



General view of the metallisation room at the Blackburn LaserVision disc pressing plant.

MINI-VCR SYSTEMS

The fact that agreement has been reached on a common international standard for compact camcorder cassette systems doesn't seem to have put a brake on the development of various other systems. Grundig are developing a system which they refer to as VBC (video baby cassette). This is a camcorder which uses a cassette only marginally larger than an audio one. The cassette is compatible with V2000 system machines, with half inch tape, and has a playing time of an hour. Meanwhile JVC are developing a miniature cassette which, you guessed it, is compatible with the standard VHS system. This again uses half-inch tape with a playing time of an hour, but will be used in conjunction with a very compact portable VCR weighing only some 5·5lb (the Funai/Technicolor Microvideo VCR weighs 7lb, but is already on the market).

TELETEXT US STYLE

A curious situation has arisen in the USA where the Federal Communications Commission has refused to specify a single teletext standard for use by broadcasters. It will go only as far as saying which lines of the field blanking period are to be used. Despite opposition from the National Association of Broadcasters, the Commission has left it up to individual stations/networks to decide which system (Teletext/Antiope/Telidon) to adopt. This "free market" approach would seem to be neither in the interests of broadcasters (the FCC has reserved the right to review the situation at a later date) nor those who buy receivers with videotext facilities.

EURO SATELLITE TV EXPERIMENT

Experimental satellite TV transmissions will be conducted on May 24-30th (five hours per day) by the IBA and thirteen other European and N. African broadcasting organisations within the EBU. The aim is to assess the feasibility of a full-scale European service. The transmissions will be sent via the IBA's mobile dish transmitter to the European Space Agency's OTS satellite and will be received on closed circuit. To prevent unauthorised use the signals will be scrambled.

VIDEO HICCUP?

Production of VCRs in Japan in 1981 reached a total of 9·5 million units, an increase of 114% on 1980. Japanese CTV production in 1981 was 4·9 million sets. The main Japanese VCR markets were the USA (2·4 million), the EEC (2·9 million) and the Japanese home market (1·6 million). The closing months of 1981 saw a slump in the US VCR market however. It's not clear to what extent this is due to the US recession and/or market saturation, but there are understood to be around half a million unsold machines in the US and some price cutting has been noted. The Japanese industry has revised its 1982 production predictions downwards.

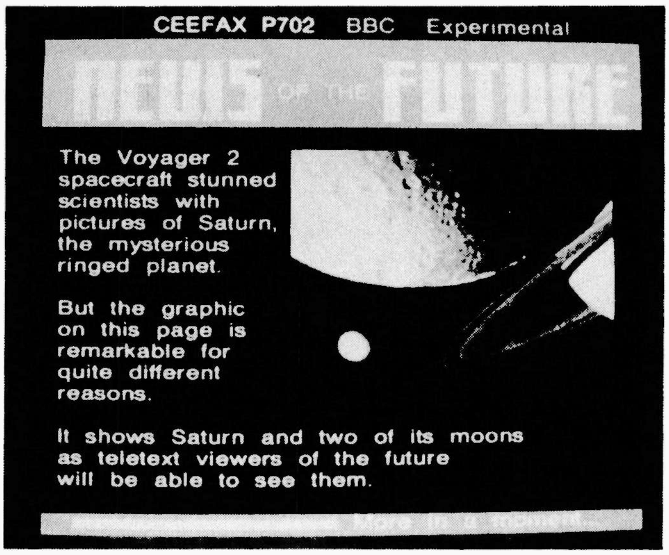
STEREO TVs LAUNCHED

Both Tandberg and Grundig have launched TV sets featuring stereo sound on the UK market. You might think that this is a bit premature, since there are at present no stereo transmissions (or even plans for them), but as Grundig point out the sets can provide stereo reproduction from stereo VCRs and disc players while in the case of mono broadcast transmissions the signals are processed to give a stereo effect – basically by separating the treble and bass components of the audio signal and feeding them to speakers with a reasonable spacial separation. The Grundig sets will be adaptable for stereo reception when transmissions become available by replacing a plug-in board.

HIGH QUALITY CEEFAX STILLS

The BBC has transmitted high quality still pictures via the teletext system in demonstrations for the IEE and an EBU technical committee. Other teletext enhancements demonstrated by the BBC include improved graphics, redefinable character sets, more readable characters, linked pages and broadcast telesoftware. The photo used for the still picture demonstration consisted of a montage of pictures of Saturn taken by the Voyager-2 spacecraft. It was fed from a conventional 35mm slide scanner into a digital picture store. After sampling at 13MHz, the signal was sent to a microcomputer and data generator to sort the information into a form suitable for transmission. The special equipment used in the demonstration temporarily replaced two of the conventional four-line BBC-2 teletext signals.

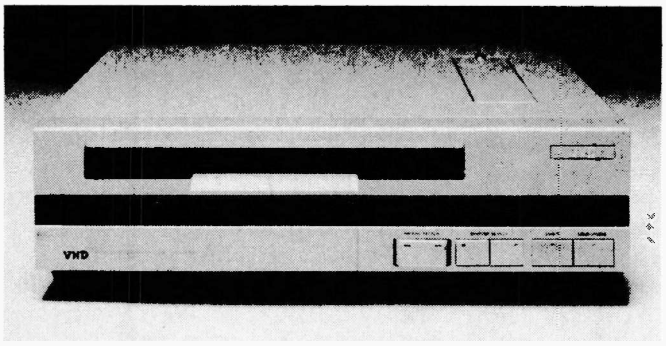
Most of the enhancements require additional memory in the receiver's decoder, but all are compatible with existing decoders. Thus a viewer selecting a page that included the picture information would be able to display the text but not the picture with a present generation decoder.



BBC experimental transmission of a high quality still picture via the Ceefax teletext system.

NEW NAMES, OLD NAMES AND MORE TVs

More brand names to get used to. Tatung have now introduced a range of eight colour TV sets under their own name – 14, 20, 22 and 26in. models in standard and remote-control versions. The Tatung sets will be distributed through independent retailers and will use the same 120/130 series chassis as the complementary Deccacolour range (see *Television* November 1981 and subsequent issues). The chassis seems to be collecting some new names along the way – System 25 and Micro 25. Monochrome sets and a VHS VCR are to be added to the range.



A prototype of the JVC Model HD5500 VHD video disc player.

Meanwhile the return of a brand name that hasn't been used on TV sets for many a year – Ambassador. The name is being used by Stereosound Products (successors to Ambassador Radio and Television Ltd.) for some luxury sets which are fitted with the Rediffusion Mark IV chassis.

Two new CTVs have been announced by Fidelity, the 20in. Model CTV20R and a second-generation 14in. portable, Model CTV14S. Both use the same basic chassis as the popular CTV14R, which was introduced a year ago. The new models come with a comprehensive infra-red remote control system and feature numerical LEDs to indicate channel selection. An order for Secam versions has been received from a French distributor.

The dominant position of Philips in the European TV field has been increased with the takeover of Luxor AB, Sweden.

IMPROVED PICTURE QUALITY

Both the BBC and the IBA are working on new TV standards to give improved picture quality. The idea is to take advantage of the wider bandwidth possible with satellite transmission and cable distribution. The BBC have proposed a system in which the higher frequency luminance signal components (above 3·5MHz) are filtered off and up-converted to a higher band (8MHz upwards), then transmitted along with the original low-frequency luminance signal components and the chroma signal. The advantages are the avoidance of chroma-luminance interference (cross-colour – those annoying flashes of false colour on striped shirts and suits for example) and the fact that the luminance signal bandwidth can be increased to give finer detail. The BBC have demonstrated experimental coders/decoders using the principle, and have passed extended bandwidth signals with associated digital sound channels through an r.f. link simulating a satellite channel. The results were "very satisfactory", and showed that the proposed system is entirely compatible with the continuing use of present-day receivers.

The IBA report that practical work on their MAC system (multiplexed analogue component – see *Teletopics* February 1982, page 187) has indicated that the initial theoretical claims are being validated. This system does not appear to be compatible with current receivers, but does overcome the problem of incompatibility between

The centre of the video world? – Steve Beeching's Newark Video Centre.

the PAL and Secam colour systems. It would give a clearer picture than present systems and, according to the IBA, would ultimately provide as an option a picture of much improved resolution suitable for the large-screen displays that are expected to become available during the 1990s.

LATEST VCRs

A Beta VCR with a four-head drum for high-quality stills has been introduced by General/Teleton. Model VG200B has a full range of facilities including cable-linked remote control.

The latest VCR from Panasonic is the NV2010. This is a "basic" machine to replace the NV2000, and has a recommended price of £522.

A portable VHS machine has been added to the Akai range – Model VP77. The machine is manufactured by JVC and has similar specifications to the equivalent JVC and Ferguson machines.

Cap Ten Industries have introduced a video system – camera, recorder, tuner/timer and a.c. adaptor – from NEC. The complete system has a price tag of around £1,395.

405-LINE CLOSURES

The BBC and IBA have announced the timetable for Band I/III transmitter closures during 1983-4. The list is as follows:

First quarter 1983: Bath, Weymouth, Ridge Hill, Manningtree, Wensleydale, Richmond (N. Yorks), Weardale, Llangollen, Newry.

Second quarter 1983: Barnstaple, Thrumster, Orkney, Bressay, Grantown, Kingussie, Ammanford, Kilvey Hill, Llanidloes, Huntshaw Cross, Rumster Forest, Aviemore.

Third quarter 1983: Douglas, Ballater, Toward, Lochgilphead, Rosneath, Millburn Muir, Richmond Hill, Whitehaven, Rothesay, Rosneath.

Fourth quarter 1983: Larne, Whitby.

1984: Les Platons, Tacolneston, Peterborough, Sandale, Llanddona, Holyhead, Pitlochry, Forfar, Oban, Dolgellau, Machynlleth, Swingate, Eastbourne, Hastings, Rye, Folkestone, Brighton, Sidmouth, Fremont Point, Mendlesham, Sandy Heath, Arfon, Angus, Bala, Dover.

SERVICE BRIEF – PHILIPS

Philips have carried out an investigation into repeated failure for no apparent reason of the BU208A line output transistor and/or TDA2600 field timebase chip in the G11 chassis. The cause is intermittent h.t. surges due to the h.t. reservoir capacitor C4029 developing a high resistance at its terminations. Replacement electrolytics should be DALY/ITT types (Philips code number 124 47056).

VCR STANDARDS CONVERTER

A US company (Instant Replay, 2980 McFarlane Road, Coconut Grove, Florida 33133) has introduced an "image translator" to enable NTSC tapes to be replayed via a PAL VCR/TV receiver combination or PAL tapes via an NTSC VCR/TV receiver combination (depending on model). No receiver modifications are required.

3-D TV

Various experimental 3-D TV transmissions in W. Germany, Holland and the UK seem to have produced rather rude comments. It appears that the system offers little more than the 3-D films of the 50s – and those were in colour, the TV display being in monochrome whilst requiring a colour set. As with the films, the viewer has to wear cardboard spectacles with one red and one green lens. Apparently the pictures are poorly focused and give viewers a mild headache. Focusing problems occur because of the double-lens system used in the camera.

PORTABLE PRESTEL

Tandata Marketing (Clyde House, Reform Road, Maidenhead SL6 8BU) have announced a portable "briefcase viewdata" system that enables users to link up with Prestel wherever they have a standard telephone and television set available, say for example in a hotel room. The system employs an adaptor with an acoustic coupler to provide the connection instead of a conventional jackpoint. It's housed in a briefcase, weighing only about 5lb, and has a price tag of £449 plus VAT.

THE VIDEO REVOLUTION – SYMPOSIUM

A symposium entitled "The Video Revolution" is to be held at the University of Reading on July 12-15th. The symposium is residential, and has been organised by the Society of Electronic and Radio Technicians to deal with future developments in television transmission and reception, plus video recording and playback technology. There will be five sessions, with papers on the following subjects: the video disc; new generation VCRs; TV chassis design; display devices, telesoftware and videotext; satellite and cable TV. Copies of the provisional programme and registration details are available from: The Conference Organiser, S.E.R.T., 57-61 Newington Causeway, London SE1 6BL (telephone 01-403 2351).

STATION OPENINGS

The following relay transmitters are now in operation:

Banbury (Oxfordshire) BBC-2 ch. 48, Central Independent Television ch. 55, BBC-1 ch. 65, TV4 (future) ch. 67.

Coleford (Gloucestershire) TV4 (future) ch. 39, BBC-1 ch. 42, HTV-West ch. 45, BBC-2 ch. 52.

Humshaugh (Northumberland) BBC-1 ch. 39, TV4 (future) ch. 42, BBC-2 ch. 45, Tyne-Tees Television ch. 49.

Langley Park (Co. Durham) BBC-1 ch. 39, TV4 (future) ch. 42, BBC-2 ch. 45, Tyne-Tees Television ch. 49.

West Wycombe (Bucks) BBC-1 ch. 40, Thames/London Weekend Television ch. 43, BBC-2 ch. 46, TV4 (future) ch. 67. Aerial group E (wideband).

The above transmissions are all vertically polarised.

Simple VHF Preamplifier

Roger Bunney

THE need arose for a wideband, Band I preamplifier using the minimum number of components and with a low noise figure. The various circuits and data sheets available were consulted and the BFY90 (BFX89) transistor seemed to be a suitable choice. After some experimentation the circuit shown in Fig. 1, with high-pass filtering at the input, was adopted. This was found to have good gain and a low noise performance over the ch. E2-4 spectrum, with zero response to short-wave radio signals. Subsequent measurements (see Fig. 2) established that the Band I performance was indeed good, and that it extended with only slightly reduced gain across Band II and with reduced though still useful gain through Band III. The noise figure is fairly level over this wide bandwidth. The results shown in Fig. 2 compare favourably with the data sheet for the BFY90.

The input circuit is a compromise to get a reasonable v.h.f. coverage: hence the rise in the noise figure to 4·2dB at the extreme l.f. end of the bandwidth. Increasing the values of the capacitors in the filter network from 82pF to say 250pF would reduce the noise figure at this lower end of the bandwidth, but the performance at the h.f. end would begin to deteriorate at a lower frequency. Fig. 3 shows alternative input and output circuits using Ambit r.f. toroids – this is a more "upmarket" approach. The high-pass filtering ensures that no s.w. radio breakthrough will occur (unless you live next to the back fence of the Daventry World Service or a CB operator using a wideband linear amplifier). Such breakthrough is often experienced with home built amplifiers of this type.

The unit can be operated from a 9-12V supply providing approximately 4·5mA. The BFY90 transistor is a rather dated device, which the Ambit catalogue calls a "golden oldie". Hence its low price. I'd suggest however that you buy a branded transistor from a specialist dealer such as Ambit, Watford Electronics or Modular Electronics – unmarked or unbranded devices are often inferior in both performance and reliability.

Construction is very simple – the circuit can be built up on a small square of 1⅛ in. copper laminate. Drill a small hole for the transistor to sit in – provided small resistors are used, most of the circuit is self-supporting. The two prototypes were housed in the smallest available RS Components diecast boxes, using 4BA solder tags soldered to the copper laminate to support the board via the nuts/bolts holding the coaxial input/output sockets.

The performance is excellent. The two prototypes have been tried by several DXers, whose comments suggest that the amplifier is a vast improvement on the commercial Band I types they'd been using. Several Band II (f.m. radio) enthusiasts have also tried them, and have found that IBA signals down in the noise are lifted above the noise while previously monophonic only signals give acceptable stereo. Assuming that new components are used, the cost of one of these amplifiers should be around £2-2.50. My thanks to Paul Gardiner of the IBA who arranged for the noise performance to be checked.

As a footnote, one of the prototypes suffered damage during a thunder storm whilst on test at Swanage last summer – the transistor went short-circuit collector-base-emitter when a lightning flash struck the cliff top some thirty yards away (the unit had been left connected to a Band I aerial). This is perhaps an unreasonable test, so protection diodes have not been fitted at the input. The diode in series with the positive supply feed is included to give reverse polarity protection.

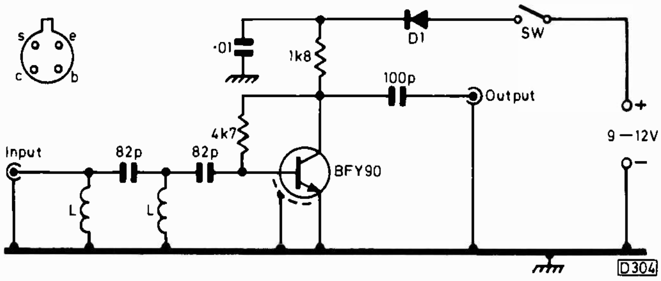


Fig. 1: Circuit diagram. The coils marked L consist of ten turns each of 28g wire, close spaced at 1/10in. diameter. Use 100V ceramic coupling capacitors and 1/8 or 1/3W carbon film resistors. Any silicon diode can be used in position D1, e.g. type 1N4002 etc.

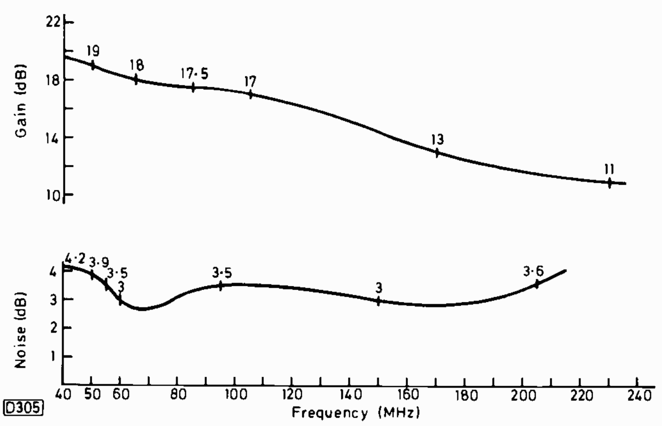


Fig. 2: Gain and noise characteristics, measured with 75Ω input/output and a 9V, 4mA supply.

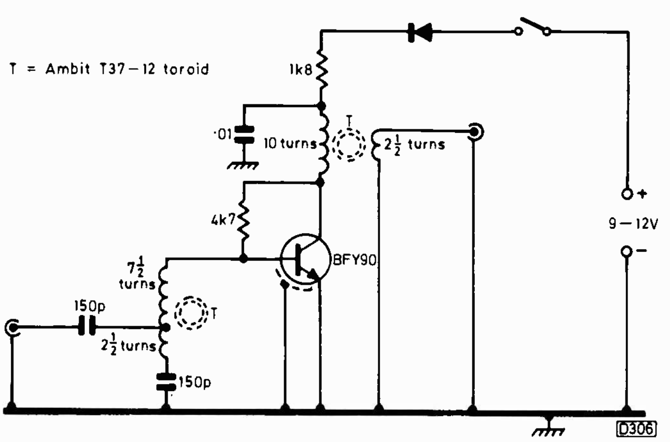


Fig. 3: Alternative input/output arrangements using Ambit r.f. toroids.

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.), Mike Phelan and Mike Sarre

One question consistently crops up during the course of the lectures I regularly make at various venues: what sort of scope do I recommend for VCR servicing? I normally answer to the effect that the scope should have a 10-15MHz bandwidth and be a true dual-beam type. This is based on the many years' faithful service I've had from my Philips PM3232 oscilloscope. The true dual-beam operation provides two independent vertical signal displays (if required) controlled by the one timebase, with none of the interaction that with beam switching, i.e. one beam giving two "chopped" displays, can give the impression that more pulses than those in the actual signal are present. The PDA tube in the PM3232 is operated at 10kV, maintaining the brightness and focus at the highest timebase speeds. In practice the scope will display the line pulses within the field flyback blanking period whilst locked to the field sync pulses without too much loss of brightness and focus. The cost of today's equivalent, the PM3233, is £863.

I kept to the PM3232 for a long time. There didn't seem to be much point in buying a new scope since what was available wasn't sufficiently exciting to make it worthwhile. Then the PM3217 was launched. A quick call to Pye Unicam and a PM3217 came along the following day for us to play with and put through its paces.

The screen is 8cm high and 10cm wide, the display being a pretty blue (P31 phosphor). As with the PM3232, the PDA tube is operated at 10kV, giving crisp and bright signal displays.

The facilities provided by the PM3217 are astonishing. My main worry, that it's a dual-beam scope using chopped or alternate sweeps rather than a true dual-beam type, was quickly put to rest. I soon managed to get the hang of this and use the mode of operation that suits the signal to be displayed best. A selection of A or B channel is possible, with both in the chopped or alternate mode, also A plus B – and the B channel signal can be inverted. The sensitivity is 2mV per division to 10V per division with ± 3% accuracy, and the chop rate is 500kHz. The frequency response – never disappointing in these instruments – is d.c. to 50MHz.

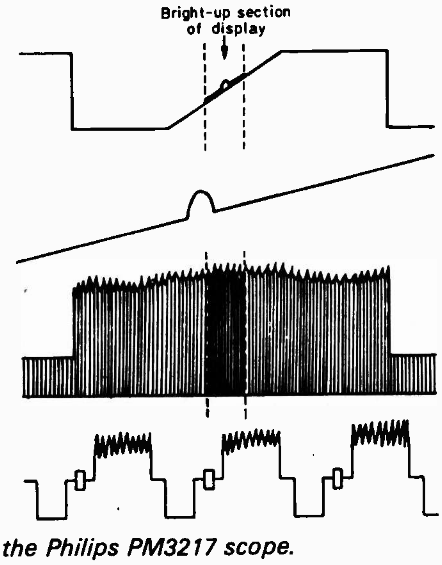


Fig. 1: Displays on the Philips PM3217 scope.

The PM3217 has two timebases, main and delayed. The main timebase has scan speeds from 0·5 seconds per division to 100 nanoseconds per division, and can be triggered from either the A or B inputs or externally. The trigger modes are selectable – a.c. or d.c., TV line or TV field, automatic or manually by means of a slope level control with positive- or negative-going slope selection. The X position control also has a times ten magnification facility.

There are two aspects to the delayed timebase operation. The scan can be delayed from either an input signal or the main timebase via a variable delay time control. Once the scan has been triggered, the speed can be varied from one second per division to 100 nanoseconds per division, enabling the user to pick out a section of the main A display and have this section displayed separately. A bright-up section is added to the main display and can be moved across it by the delay time control and altered in width by the delayed scan speed control.

The delayed timebase operates on both the A and B inputs, giving a possible total of four display waveforms at once. An example is shown in Fig. 1. In this, main beam A is triggered from a VCR drum servo in the record mode, the delayed A display being the sample pulse sitting on the ramp. Main beam B is displaying the input (or output) video signal. The delayed B display consists of a few TV lines that occur during the scan period selected on the delayed A timebase display. The stability of the drum servo compared to just a few input lines can be readily proved in this way.

All very well you may say, but what is the usefulness above and beyond that of an ordinary oscilloscope? The answer is in dealing with microprocessor controlled VCR control systems. If you've ever tried to display the Io and Ii ports of the microprocessor used in the HR7700 on a cheap scope for example, or to compare the inputs and outputs of the data selectors, you will know of the triggering problems. Trying to trigger my own PM3232 on non-symmetrical data waveforms proved to be nearly impossible. With the PM3217 it's no problem at all. It's incredible the way it locks, giving a clear, stable display.

To sum up then I'd say that the PM3217 is a scope of scopes for VCR servicing and setting up. I ordered my demonstration one without hesitation. The next point of course is price! Very reasonable at £888. There's also a rechargeable battery option that brings the price up to £1,135. If anyone has difficulty in obtaining one of these scopes or would like to see one, you can get in touch with me at the Newark Video Centre (108 London Road, Balderton, Newark) and I'll do what I can to help. **S.B.**

Ferguson 3V00

Our first patient this month was a Ferguson 3V00 which would not record in colour. We tried it on playback with a prerecorded tape and all was well. Subsequent checks revealed that the 5·06MHz carrier was very low in amplitude – on both record and playback. There was plenty of 5·06MHz carrier signal at the input to bandpass filter BPF203, which selects the 5·06MHz output from one mixer stage and passes it on to the other one, so we replaced it. All was then well – strange that the fault had shown up on record only. **M.P.**

Sanyo VTC9300

The Sanyo VTC9300 is a robust and trouble-free (albeit heavy) machine. Up to now most of our troubles have been due to the 12V regulator in the power supply going-open circuit, but this time we had a machine in which the clock's third digit was twice as bright as the other digits. The display is of the green flourescent type which works like a valve (remember them?). There's an emissive filament, and the grids and anodes are matrixed – one grid per digit and one anode for the same segment in all digits. The grids are returned to a −23V supply via 100kΩ resistors (see Fig. 2). Voltage measurements showed −3V on G2 and −23V or −18V on the other grids. Bridging the relevant 100kΩ resistor with another one made no difference – the TMS1070 clock i.c. was the culprit. **M.P.**

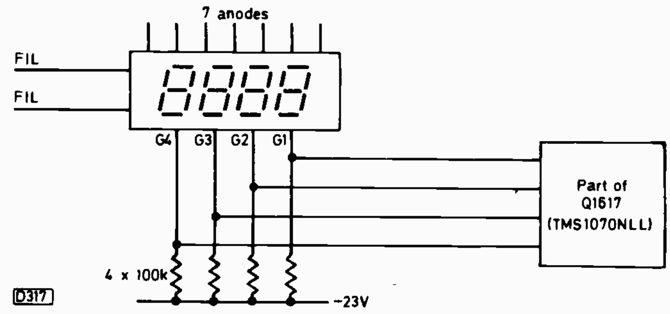


Fig. 2: Clock display, Sanyo Model VTC9300.

Baird 8930

We've had a few minor problems with the Baird 8930 machine. The most spectacular was the one we had recently where the tape speed in fast search was about twice that in normal fast wind – it looked as though the spools were about to take off. The reel motor is driven by a bridge amplifier circuit (see Fig. 3) in IC12 (10VT05) so that it can be reversed. The supply for IC12 comes from Q2 which in the search and unload modes is controlled by IC6 (1458) on the servo board. On fast wind Q2 is turned fully on: in all modes the direction is controlled by four inputs from the microprocessor IC2 (μPD553C-164). The fault turned out to be due to the dual operational amplifier IC6, whose output was shorted to the positive supply rail. **M.P.**

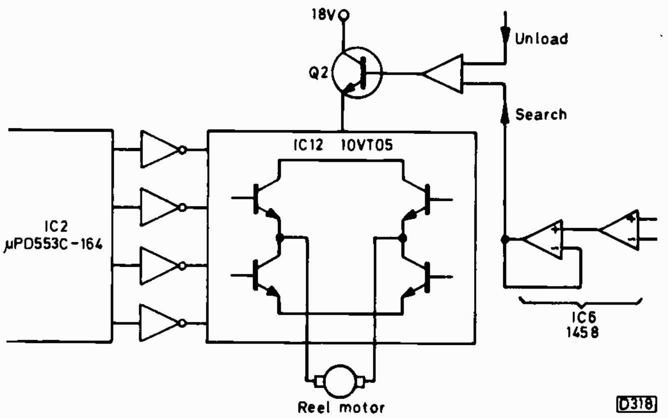


Fig. 3: Reel motor drive, Baird Model 8930.

Ferguson 3V22

Here's the "naked truth" about late versions of the 3V22 jamming up when stop is pressed. What happens is this. The machine is in either the record or playback mode and the stop button is pressed. The machine starts to unthread, but the arms move only a small way and the belt slips or comes off. Reason – the mechanism has been modified, mainly to provide a more reliable take-up clutch and different brake operation. When stop is selected from play or record, maximum resistance is met by the capstan motor in lifting the roller on the timing gear out of its notch. At the same time the "memory plate" slides, operating the brake. Any stiffness here causes the mechanism to stall and the belt slips.

One picture speaks volumes, so here are two (pictures, not volumes, see Figs. 4 and 5). First lubricate, next check for burrs, then either stretch the spring slightly or replace with the modified type available from Thorn. **M.P.**

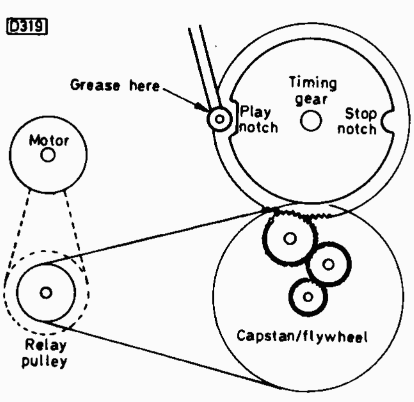
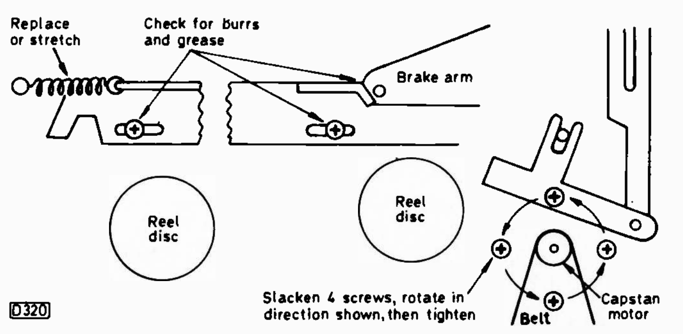


Fig. 4 (left): Stop mechanism, bottom view.
Fig. 5 (right): Stop mechanism, top view.



Philips VR2020

A Philips VR2020 machine was brought to us with the complaint that "it stops after a few minutes" – and indeed it did. With a tape being played back, the machine went to stop after a short while. This was found to be due to the video head drum slowing down and stopping. The drum seemed to be rather stiff to turn, and as there was nothing to loose by stripping the motor down we removed the bottom end plate. The stiffness then went. In the bottom centre of the motor there's an Allen screw: slackening this a quarter of a turn cured the problem. **M.P.**

Grundig 2 × 4 Super

We've had a number of Grundig 2 × 4 Super machines in with tuner drift problems. The cause is tuning voltage leakage within the tuner unit, the usual symptoms being either inability to tune in the higher channels (the sweep tuning operates, as shown by the indicating digit on the display, but the tuning voltage flattens out at some 15-20V instead of rising to just above 30V), or if the leak is severe the station going off when the store button is depressed. Otherwise these machines are very good: the picture is excellent, there's noise-free fast search and stop frame, and the simple mechanism that provides cassette loading and tape threading with a single motor is a masterpiece of ingenuity. **M.P.**

Sony C7

The problem we had with a Sony C7 was that the tape would thread but would not play. Fast forward would not operate either. If the end alarm switch was on, it would sound and the tape would rewind. Having had the problem of auto-stop on the Bush BV6900, I went immediately to the forward oscillator circuit, hoping to find an adjustment. There isn't one on this machine however. Circuit checks were then made and we discovered that the voltage coming from pin 8 of the sensor oscillator i.c. (IC8 on the SY11 system control board) was incorrect at 10V. The circuit is basically a metal detector, so I checked the sensing coil. The resistance was the same in both cases, but when checked back to the board was 35Ω instead of 2·5Ω. This turned out to be due to a build up of oxide deposit on connector CN4013. All was restored to normal after cleaning. **M.S.**

Sony C5

The fault with a Sony C5 was a line drifting down the screen, on record only. Playback with a test tape was o.k., and on looking at the fault it was clearly due to the head switching point shifting. RV3 on the AS6 board was found to work but was not able to compensate for the problem.

While making a recording and checking with a scope I changed channels. The servo reference pulse didn't attempt to lock in at all, and on tracing the pulse back towards the video signal I found some minor discrepancies between the board diagram and the circuit diagram, in the sync switching between record and playback. It appears that the block diagram had been taken from the C7 manual. On checking around this section I found that D27 was connected to C403, but neither were connected to pin 4 of IC12 (internal switch for record/playback reference). Making this connection removed the fault.

There was also a voltage discrepancy at Q69. Perhaps a corrected diagram should be issued. **M.S.**

Philips VR2020

Here are a couple of symptoms we've had with Philips VR2020 head faults. The first was playback of pre-recorded tapes o.k. but a tracking error on record. One of the actuators that moves the heads up and down had failed. The other symptom looked very much like open chicken netting, affecting the chrominance only. A new head drum cured the problem. **M.S.**

Ferguson 3V30

A Ferguson 3V30 we had in recently would thread up and produce a static picture but wouldn't run. Rewind and fast forward were o.k., but once the tape threaded up the usual clunk, i.e. the pinch roller engaging, was not heard. On removing the cover we saw that the pinch roller was indeed disengaged. I then threaded up the tape and found that the roller would hold in if pushed towards the capstan. There are two transistors in the control circuit, Q4 and Q5. The latter is fed with a pulse at the end of threading up, to supply enough power to pull the solenoid in, and was open-circuit base-to-collector. **M.S.**

Philips N1700

The fault we had on a Philips N1700 looked like the line hold being out on playback only. The servos were all locked rock solid to the reference signal, and after changing the servo panels the fault was still present. I was wondering what to do next when I noticed that the 50Hz reference signal was not synchronised to the 50Hz mains (generated from my hands holding the scope lead). The cause of the trouble was a break in the wire that carries the 50Hz mains signal to the servo board. **M.S.**

Raising the Dead

Les Lawry-Johns

A LITTLE while ago a chappie came into the shop and asked whether we'd be interested in buying a colour set for which he'd no further use. We cautiously asked what make of set it was? Philips was the reply. "Does the sound come on as soon as you switch the set on?" "Yes." So it was probably a G8 and thus a viable proposition to fill the role of a loan set, of which we had a need. A deal was struck, and later that afternoon I climbed six flights of stairs to the top flat, where the set lived. Narrow stairs I noted.

He showed me the set working, and whilst the cabinet was in good condition the picture appeared to be a bright cyan, with not a trace of red in sight. Even so I thought it was worth taking a chance, so I paid him and removed the screws which secured the set to its stand. Then came the task of carrying the set down to ground level. He offered to do this for me, but seeing that the set was now my property I declined the offer and asked if he'd be kind enough to bring the stand down for me?

Return to the Ranch

So I picked my way down the stairs, carrying the 22in. set at an awkward angle. Now I'm well aware of what you're hoping or at least expecting me to tell you next. Well, there were a few moments when I thought it might happen – the set tumbling down with me tumbling after it – but don't forget that I always put my socks on standing up. I was as sure footed as a mountain goat on those difficult bends where the right foot had plenty of space but the left foot had only an inch to feel for. Huffing and puffing, we eventually made it out to the front of the house, just in time to see a traffic warden taking notes just because there were these double yellow lines.

"Oh it's you" she said, putting her pad away.

"Don't just stand there" I wailed, "open the back up before I drop this thing."

She did as she was told, as all women should, and muttered in my ear "one of these days I'll catch you when there are lines on the pavement as well."

"One of these days I'll catch you when you haven't that uniform on" I said, "then I'll have my wicked way."

"Who would help you then?" she said.

At this point I remembered the stand. "Keep an eye on the van love, something's missing."

I nipped back in to find him laying at the foot of the stairs with the stand around his neck, mumbling something to the effect that the stairs would one day be the death of him. Apparently he'd stopped to have a word with someone on the first floor, and by the time he started down again I was out at the van. Which was why I hadn't heard the crash. What a good job he'd not been carrying the set. Oh yes: was he hurt? Well I don't think he suffered any lasting injury, and the stand was still in one piece. So, wishing everyone the best of good luck, I departed for the shop to make sure that everything there was going according to plan. I found Honey Bunch listening patiently to a customer who was describing what was wrong with his set.

It was a portable, and apparently wouldn't go unless turned over and slapped on the bottom. Honey Bunch seemed to find this very interesting. "I see. It won't go until you smack its bottom. Fancy that! Well I never!"

It transpired that the line output transistor was bolted to the bottom panel on a heatsink and that the nut was loose. A jolt was necessary to complete the path to the collector of the transistor. A turn with the pliers was all that was required. This made the customer happy, but Honey Bunch kept on about it. Her comments were interrupted by a loud noise outside.

The Wheelbarrow

We were somewhat surprised to see a large iron wheelbarrow being humped up on to the pavement by two chaps. In the barrow was an object covered by a piece of black plastic sheeting that was secured by a number of house bricks. They brought the barrow over to the shop door and proceeded to remove the bricks, dropping them on the ground. Eventually the object was uncovered. It was a Decca 30 series set (Bradford chassis) which they then carried into the shop. They were apparently father and son, and father did the talking.

"I came in last Saturday and told you the sound had gone off on my TV. I asked you which valve it was and you said it could be the PCL82 or something that carried the juice to it – perhaps both." He talked on without a pause. "The valve I paid you one pound sixty five for hasn't done the job so we've brought the set along. We live at Meopham (about six miles away) and I know you'd charge if you came out. Can't see me paying through the nose if I can bring the thing in myself, so here it is. Picture's lovely – isn't it son? Sound's gone off, that's all."

Six miles. Through rain and wind. What courage! What fortitude! What an idiot! The poor old set must have been shaken out of its life after all that way on an uncushioned metal barrow.

With some misgivings I took the back off and plugged it in. The valves warmed up but there was little other sign of life.

"Where's that lovely picture you mentioned?" I asked.

"Something must have happened on the way" he moaned. "Anyway, here's the valve I paid you for. If you give us the money back me and the boy will go and get ourselves a cup of tea while you do the set." I wondered about the import of this statement, but gave him his one sixty five and off they went.

Pulling the chassis back I was able to reach the h.t. fuse which had failed. With a new fuse fitted the e.h.t. rustled up once the valves had warmed, but there was no sound. The 1·8kΩ resistor that supplies the h.t. supply to the PCL82 audio amplifier/output valve was open-circuit. It had died a natural death rather than being killed by the PCL82, so we wrapped the job up and found a nice piece of packing for the set to travel on more comfortably.

A little later the owners returned from their refreshment. They didn't argue about the service charge (much to my surprise), so apparently they hadn't needed the one sixty five to pay for the tea.

Red is Dead

At last I could investigate the newly acquired G8. Voltage checks on the base revealed that all three guns were receiving equal voltages, but there was no sign of red. So we asked the tube tester for help. It said blue gun good, green gun good, red gun nothing. We then employed the tester's reactivation section. Still nothing.

So we brought into action the reactivator we built from the *Television* design published back in April 1978. With a meter in series with the red cathode and boost applied to the heaters we got a reading of only a few microamps. Left for a bit the needle climbed a couple of microamps and then fell back again. Clearly the red gun was buggered. We would have to fit a new tube, but meanwhile we could hardly hurt this one so we decided to carry out a couple of experiments. The normal heater supply from the tester is 6·3V, the boosted supply 8V. How about some more? We've a bench supply for checking car radios, cassette recorders, etc. This normally supplies 12V at 1A, but can provide more – up to about 15V.

With nothing to lose we applied 12V to the heater pins, with the red grid and cathode still connected to the reactivator via the meter. After a few seconds the heaters glowed very brightly. A few seconds later a nice spluttering came from the red cathode and the meter's needle swung over to 60mA, with the lamp lighting just to add fun to the proceedings. We immediately removed the 12V supply and reconnected the reactivator's heater supply. The heaters dimmed nicely, but the needle still maintained the full reading and the lamp remained alight to show that the red cathode was alive indeed, as were our hopes. The set is still giving a reasonable picture in fact, and we hope it will continue to do so for a while.

Thus encouraged, we decided to try the process out on another duff tube – one whose green and blue guns had both gone. This time the results were not as hoped for, and we realised that our first experiment had been a lucky one.

Finally, if you try this excess heater volts lark don't blame us if the heaters fail on you. Do it only if you've nothing to lose.

Footnote (ha ha!)

Oh yes, and Honey Bunch says if he's as sure footed as a mountain goat how come he falls over a snow flake and rips his sheepskin?

TV-VCR Compatibility

Eugene Trundle

A RECENT Test Case item (number 229) highlighted the problems of incompatibility between TV sets and VCRs – in that case a JVC VCR and a Philips G8 chassis, the problem relating to the effect of noise on the black-level clamping in the TV set. I've had several instances of compatibility problems of one sort or another recently, not only with TV sets that didn't like particular types of VCR, but also home computers that are fussy about the type of receiver used for the display, TV games that produce rolling football fields (Kevin Keegan himself would have trouble on such a pitch), and sets in which colour drop-out occurs when they are fed from an h.f. distribution system with substandard burst and chroma levels.

These problems all arise from the fact that the signals presented to the set are substandard in some way compared to a broadcast signal. Often the receiver is not faulty at all, and as different receiver designs vary in their tolerance of non-standard signals the situation arises where certain combinations of receiver and signal source are incompatible. In many cases something can be done to improve the situation – occasionally at the signal source, but more often at the receiver, where a modification may be possible to increase its tolerance of non-standard input signals.

We suspect that this sort of situation is becoming more common as time passes and more types of peripheral equipment become available. The purpose of this article is to suggest ways of overcoming the problems. It's surprising how much can be done in this direction with careful thought.

Initial Servicing

The first step is to ensure that all equipment is in good order and working correctly. A decoder which is out of alignment for example may well give reasonably acceptable colour on a broadcast transmission but poor or no colour on a locally generated signal. A sync separator transistor starved of base bias due to a high-resistance or open-circuit bias resistor may cause only a momentary field slip on certain captions with a broadcast programme, but uncontrollable picture rolling might well occur with this VCR but not that one! We remember a case where severe vision buzz almost blotted out the sound from a sophisticated TV games console, whereas broadcast TV reception was quite tolerable: fitting a 6MHz ceramic filter, followed by careful adjustment of the intercarrier and sound detector circuits in the set, rendered both the off-air and TV-game sound crystal clear.

Possible Modifications

Once you've confirmed that there are no faults in the receiver, the next step is to try to establish which characteristic of the local signal is different from the broadcast standard, so that the area of the set requiring attention can be identified. Many TV games for example have a single long field sync pulse instead of the broadcast standard of five short ones. In this case experimentation with the time-constant of the field sync pulse integrating circuit may improve matters. Where the locally generated signal has a colour burst timing error that causes colour drop-out and locking problems, the receiver's burst gate "open" time can be widened by modifying the gate's timing components. And so on. In cases like this, a working knowledge of the receiver's circuitry and an oscilloscope are essential.

Unless the receiver is to be used to display the locally generated signal only, it's important that any modifications do not affect off-air reception. In some cases a switch will be needed to remove the modification with a broadcast signal.

Problems Encountered

Some of the compatibility problems we've encountered are listed below, along with some indications of the line of approach to take in each case.

Sound buzz: Check the video input level and the setting of the 6MHz generator in the generating equipment's r.f. modulator. Fit a ceramic filter in place of, or in addition to, the intercarrier sound tuned circuits in the receiver. Carefully align the receiver's 6MHz f.m. demodulator circuit.

Poor reference oscillator locking due to a mistimed burst: Realign or modify the burst gate timing in the receiver to accommodate the local and broadcast signals.

Colour drop-out due to reduced chrominance level: Increase the chroma gain prior to the burst gate.

Field rolling or jitter due to poor picture/sync ratios: Increase the video drive to the sync separator.

Line pulling at the top of the picture due to a "simple" field sync pulse: Check the action of the line sync differentiator; try changing the time-constant of the flywheel sync filter circuit.

Crossmodulation due to r.f./i.f. overloading: Fit an attenuator at the aerial input.

A.F.C. lock-out with a double-sideband r.f. signal: Fit an a.f.c. disabling switch or disable the a.f.c. on the channel used for the local signal.

Spurious patterns due to digital signal generating equipment (i.e. computer or TV game) with output pulses having very fast rise times: Wind the coaxial lead to the TV set around a ferrite ring – about twelve turns toroidal.

Bright-ups superimposed on the picture due to spurious signals during the field flyback blanking period: Speed up the field flyback or fit/modify the field flyback blanking circuit.

Flutter due to noise in the back porch period (e.g. test case 229): Increase the time-constant of the TV set's black-level clamp.

Most of the above suggestions apply mainly to older sets. In all cases it's wise to consult the manufacturer's service department before diving in with the side cutters. Very often you'll find that the setmaker's service department has encountered and solved the same problem and can suggest a proven modification – some of these are listed later.

Mechanical Jitter

Mechanical jitter is the greatest cause of difficulties, i.e. the use of a TV set for playing back video tapes or discs. It's well known that some sets require modification to the line sync circuit – let's spend a few minutes examining the reason for this.

In any recording system where mechanical movement of the recording medium is involved, minute imperfections in bearings, friction surfaces and tape guides, along with the elasticity of the tape itself, mean that there will be tiny variations in the timing of the signal being read off the tape. Dirt build up and lack of lubrication also contribute to the problem. It's important therefore to ensure that a VCR or disc player is in good mechanical condition and that it's regularly cleaned.

The degree of mechanical jitter we're talking about is very small indeed, quite unnoticeable in audio reproduction. At the television line rate however such minuscule timing variations become quite significant. Even high-quality professional video equipment is subject to these problems, but in this case the played back signal can be passed through an electronic timebase corrector. This expensive device is in effect a very fast-acting variable signal delay which cancels jitter by applying an equal and opposite correction factor. Cost precludes the use of such exotic techniques with domestic and semiprofessional equipment however.

The problem would not arise if the line oscillator was directly triggered by the off-tape sync pulses. Flywheel line sync is the order of the day with TV sets however, and has been for many years. The effect of flywheel line sync is to average the influence of the incoming line sync signal over a period of several lines. This is fine for TV reception, especially in noisy or fringe area conditions. The time-constant of the flywheel line sync filter is generally too long for VCR operation however – it makes the line sync circuit too sluggish to be able to follow the short-term timing variations in the off-tape signal. So while the timebase produces a smooth, average-rate scan, the picture twitches laterally in time with the signal jitter. Thus even with a VCR in good condition it may be necessary to reduce the set's flywheel sync time-constant to enable the line oscillator to follow the rapid fluctuations in the timing of the off-tape signal and thus straighten up the picture. As a rule, the time-constant needs to be reduced to about one third of its original value – this rule of thumb can be applied in cases where modifiction details for a particular model are not available.

Old and New TVs

All current TV sets and those produced in recent years are designed for VCR operation. Selection of the last tuning button, (extreme bottom or right-hand side of the selector band), or the one marked VCR or AV, is all that's necessary. Some Pye-Ekco colour sets have a VCR switch mounted at the rear, whilst almost all Japanese TV sets are designed with a short flywheel time-constant and thus need no modification.

Some older sets do not like VCRs at all – for example my old Rank A823 took violent exception to the Philips N1500 machine I acquired. In general it's not a good idea to use an old set with a VCR, not only because of sync problems but because the general performance standard is likely to be low – and the errors will be cumulative. Also, a VCR replay signal will never be as good as an off-air one. A customer of ours recently bought almost six hundred pounds worth of all-singing, all-dancing remotely controlled VCR and uses it with a seven-year old set. After the appropriate modifications were carried out to the set, reasonable pictures were produced on playback. I'm not convinced that the customer is getting his six hundred pounds worth however!

Most VCRs have video and audio output sockets, and several enlightened TV manufacturers are fitting AV sockets on their latest models. Where playback can be done at video/audio frequencies rather than passing the

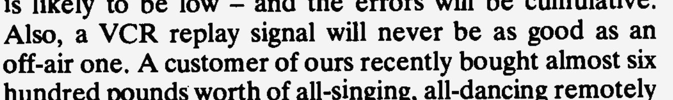


Fig. 1: Field blanking modification for the B and O 3400 chassis. Both resistors should be 0·5W types.

signals through the VCR's modulator and the set's tuner etc. this has much to recommend it – something to bear in mind when purchasing new equipment. The era of the TV receiver-monitor is upon us!

Before listing specific modification details, let's consider one or two other aspects of harnessing TV sets and VCRs together.

Interference Problems

Many peculiar effects, from patterning through vertical striations to loss of colour, are due to mutual interference by radiation between the two. This can be proved easily enough by physical separation. The precise effects depend very much on the TV and VCR models involved. Very often the problem can be eliminated by interposing an earthing screen (maybe wire mesh or aluminium foil) between the two (earth it if necessary). I've found this to work in several cases where the VCR resides on a shelf below the TV set.

Black-level Clamping

Another occasional problem area is the TV set's black-level clamping arrangements. Any locally generated signal with a lot of noise during the back porch period is liable to confuse the clamp if this has a short sampling time. Sets vary greatly in their clamp circuits and time-constants. The situation described in test case 229 concerned a Philips G8 chassis with the BA00 combined decoder/signals panel, the effect being fluttery horizontal bars. It was cured by increasing the value of the clamp circuit's reservoir capacitor C224 from 0·15μF to 1μF. In a more recent case I came across the set was a GEC Model 2233H. In this chassis the black-level clamping is done within a TDA2560 luminance/chrominance chip, and severe brightness flutter on replay was cured by increasing the value of the clamp reservoir capacitor C208 from 0·47μF to 4·7μF: a tantalum capacitor was used, any value above 4·7μF producing picture shading.

Sound Crackle and Buzz

Sound crackle and buzz on replayed video is another problem we sometimes encounter, generally on older sets that don't use a quadrature f.m. sound detector (much depends on the type of VCR). Sometimes the set needs modification or alignment as already described, but where the VCR is a JVC HR3330 or HR3660 or the Ferguson equivalents 3V00 and 3V16 respectively, improvement can usually be obtained by adjusting the video modulation level and balance controls VR1 and VR2. These need careful setting to maintain performance (for full details see page 546 of the August 1980 issue and page 296 of the April 1980 issue).

Field Bounce

Field bounce or judder is sometimes encountered with certain equipment combinations. The most common offenders are dealt with below: setmakers' service departments are usually happy to discuss specific cases and suggest cures. Field judder on still frame is rather different. On some machines this effect can be minimised by adjusting a hidden preset (V-lock) at the rear of the VCR. This needs setting up to match the receiver in use, and usually works beautifully. Examples are the National

NV8610 and JVC HR3660/Ferguson 3V16. The ideal frozen frame on which to adjust this preset is one with a clearly defined horizontal edge. If the frozen frame is part of a fast-moving scene, a degree of judder will be present anyway due to the movement between successive fields. A test card is ideal for this adjustment.

Modification Details

A lot of information on flywheel sync and other modifications has been generated over the years by setmakers, VCR manufacturers (notably Philips) and lonesome bench engineers beavering away in corners of workshops. What follows is a set by set list of modifications, mainly to the flywheel line sync department of each chassis concerned, but also as much information as I have been able to gather concerning other compatibility modifications. Few Japanese sets appear in the list, and recent chassis from most manufacturers are fairly thin on the ground since TV design has for a long time taken VCR operation into account. If a particular chassis does not appear below, it's probably suitable for use without modification.

With the exception of GEC sets, any chassis using a TBA920 sync/line oscillator i.c. may be adapted by connecting pin 10 of this chip to chassis.This can tend to upset the line sync performance in fringe areas or situations where there is a lot of interference. In this case it may be necessary to fit a switch to restore the original circuit conditions for off-air reception. In my own (very poor reception) patch, I've sometimes found it necessary to fit a toggle switch on the back of some Decca 100 chassis for this reason. With time and effort (and perhaps a microswitch) this can be arranged to take place via the last tuner button on some receivers.

Where the modifications given below are in graduated form as it were, go only as far as is necessary to clear line jitter etc. on the replayed picture, otherwise the off-air pictures will be impaired. This applies particularly to B and O and Philips hybrids, some ITT solid-state chassis, and the Pye/Philips G11 chassis. Any further modifications or comments from readers are cordially invited!

Bang and Olufsen

2600-3200 hybrid chassis: Change C423 to 680pF, C428 to 0·01μF and C421 to 0·1-0·2μF for best results. If necessary, replace R422 with a 50kΩ potentiometer and adjust for best results.
3400 hybrid chassis: No flywheel sync modifications necessary, but field flyback too slow for some applications. Blanking modification shown in Fig. 1.
3502, 4402, 6002 etc.: To prevent possible field bounce, change 2R1 to 5·6MΩ.
4000-5000 chassis (early models): Change 5C5 to 0·1μF. Fit an 0·1μF capacitor between pins 4 and 12 of 5IC1 (TBA950), with a 680Ω resistor from pin 9 to chassis. Short-circuit 5R7. Fit a 4·7kΩ resistor in series with 5R4 on the earthy side, and a 14kΩ resistor from pin 3 of 5IC1 to the junction of the new 4·7kΩ resistor and 5R4.
5500, 8000, 8800: To prevent possible field bounce, change 2R4 to 5·6MΩ.

Decca

10 and 30 series hybrid chassis: Change R434 to 680kΩ, C419 to 2μF and C421 to 0·47μF.
80, 88, 100 chassis: Where no provision is made in the channel switchbank, earth pin 10 of the TBA920 i.c.

Alternatively, in the 80 chassis change R314 to 100kΩ, C307 to 0·01μF with a 4·7kΩ resistor in series, and R301 to 2·2MΩ.

The same applies to the 100 chassis, but the component reference numbers are R311, C312 and R302 respectively.

Where field sync problems occur, fit a series combination consisting of a 680Ω resistor and 0·22μF capacitor from pin 12 of IC300 (TBA920) to chassis. Fit a 220Ω resistor in series with pin 10 of IC102 (TCA270) – close to the chip. If necessary, adjust the tank coil L107 to minimise field jitter.

70 and 90 series: Press buttons 1 and 2 *together* and tune the VCR in on the "varitune" knob.

Doric (Rediffusion)

Mark III colour chassis: Numerous recommendations as follows:

Flywheel sync: Connect pin 9 of 4IC2 to the 12V rail if no provision already made.

Field flyback lines visible with TV games: Fit improved TDA9400 chip (part number 38326). Change 4R14 to 10kΩ and remove any 33kΩ resistor on the print side of the timebase panel.

Field jitter on VCR freeze frame: Change TDA9400 as above. Check that 4C22 (0·22μF) is 2% tolerance, i.e. black letter G on body. Change 4R14 to 1MΩ with a 1N4148 diode in parallel, cathode to 4C4.

Line pulling on freeze frame: Change 4R27 to 1·2MΩ and add a parallel combination of 33kΩ and 0·033μF in series with 4C11 at the 4IC2 end. If necessary unsolder the tuner end of 0R13, remove the PVC covered lead from the junction 0R13/0C4 and reconnect it to the freed end of 0R13, then fit a wire link between the two holes thus vacated.

Poor sync where the signal's sync/video ratio is low: Change 4R25 to 1kΩ and 4C10 to 270pF.

CB breakthrough on audio: Fit an 0·0022μF capacitor between the base and emitter of 0TR6.

Colour drop out on an h.f. distribution system with low chroma levels: Change 2R2 to 120Ω.

Mark IV chassis: For field jitter on early models change 0R26 and 0R27 to 150Ω, 3R21 to 82kΩ and 3C11 to 3·3μF. Short-circuit 3R22.

A complete range of video/audio connecting leads for use with the Mk IV chassis and many types of VCR/disc players is available from Doric Radio Ltd.

Finlux

Peacock: Interchange C5102 and C5103 (0·0027μF/0.0033μF). Change C5104 to 0·68μF, C5105 to 0·0033μF, R5105 to 330Ω and R5108 to 8·2kΩ.

GEC

Hybrid colour chassis: No modifictions necessary.

C2110 solid-state series: Do not earth pin 10 of the TBA920 chip as the result will be jagged verticals. A short time-constant is used as standard. In models with a six-button tuner, change R414 to 12kΩ. In models with an eight-button selector use channel eight.

Grundig

Hybrid CTV chassis: Change R606 and R607 to 220kΩ, C608 to 0·056μF and replace R609 with a 100kΩ potentiometer – set to maximum resistance, then back off until horizontal jitter *just* disappears on tape replay.

5010-6010: Use tuner position seven. If necessary, fit a series combination consisting of 1kΩ and a 1N4148 diode, anode of the diode to pin 12 of the horizontal module, resistor to pin Z9 of the "electronic" module – the diode (Di417) may already be fitted in the horizontal module.

1510, 1613, 6632 series: Change C421 to 0·15μF, C423 to 0·015μF, R421 to 4·7kΩ and R422 to 5·6kΩ in horizontal module 29301-008·05.

Super-Colour receivers: If pulsating colour occurs, proceed as follows:

Chroma module 7247·072·00 replace R831 with ZPD4·3V zener diode.

Chroma module 29301.024.01 short-circuit R822 and change C821 to 5·6μF, C822 to 0·015μF and C833 to 0·33μF.

Chroma module 29301.024.20 (PAL/Secam) change C1647 to 15μF.

New and exchanged modules will have been modified by Grundig UK.

GSC100 and GSC200 chassis: Use last channel button marked VCR.

Hitachi

PAL-2 chassis (Models CAP160, CEP180, CNP190 etc.): Change C705 and C706 to 0·022μF, R713 to 33Ω and R710 to 12kΩ. Short-circuit C736 and fit a 390pF capacitor across R709.

ITT

Hybrid colour chassis (CVC5 etc.): Change C288 to 820pF, C290 to 0·1μF and R395 to 47kΩ.

CVC25/30/32 chassis: To reduce vertical line wiggle, remove WL32 (adjacent to L35) and replace with a 100μH choke (part number 06496). Fit a 22μF, 63V electrolytic from the cathode of D26 to the adjacent earth lug.

See module notes below, **applicable to CVC20 to CVC45 chassis.**

Module CMS11: To reduce l.f. line jitter, change R702 to 2·2MΩ, R707 to 3·3kΩ and remove earth link from video button.* To reduce h.f. line jitter change R708 to 68kΩ and C710 to 0·068μF. If this results in l.f. line jitter, implement modifications listed above.

Module CMS30: For field jitter change R713 to 3·3kΩ and R702 to 2·2MΩ. Add an 0·01μF capacitor in position C714. Replace WL3 with an 0·1μF capacitor (C715). Add a 100kΩ resistor in position R714. Change R702 to 2·2MΩ. Module becomes type CMS32. For l.f. line jitter change R707 to 3·3kΩ. For h.f. line jitter change R708 to 82kΩ and C710 to 0·068μF. Remove earth link from video button.*

Module CMS32: Line jitter – change R707 to 3·3kΩ, R708 to 82kΩ and C710 to 0·068μF. Remove earth link from video button.*

Module CMS40: Change R706 to 3·3kΩ. Remove earth link from video button.*

Modules CMF25 and CMF30: Change R2008 to 300kΩ, short-circuit R2001 and remove C2002 to improve field sync. Modules become types CMF26/CMF31.

Up-dated modules CMS32 and CMF26/31 give better performance on substandard sync pulses from h.f. distribution systems and TV games.

*This can cause slight impairment of fringe-area performance – all buttons are made available for VCR use.

Luxor

110° hybrid CTV chassis: Change R738 to 1·8kΩ.

NordMende

90° CTV chassis: Change R440 to 680kΩ, C440 to 15μF and C439 to 0·001μF.
110° TV chassis: As for the 90° chassis but the component reference numbers are R448, C448 and C449 respectively.

If difficulty is experienced with either chassis, fit a 1MΩ potentiometer in place of R440/R448 and adjust for best results.

Philips

G6 chassis: Change R4076 to 82kΩ, C4012 to 0·22μF and replace R4078 with a 47kΩ preset – turn to maximum resistance, then back off until replayed signal just becomes stable.
K7/K70 chassis: Change R1170 to 82kΩ and C785 to 0·22μF. Replace R1172 with a 47kΩ preset – adjust as above.
G8 chassis (earlier versions): On timebase panel, change R4495 to 47Ω and C4496 to 10μF. Delete C4498. Panel becomes type BA14. On i.f. panel, remove R2167 and R2181. Change R2180 to 10kΩ and connect it between pin 3 of IC2001 and the 12V line. Panel becomes type BA17.
G8/9 with combined i.f./decoder panel type BA00: Flutter with some VCRs can be removed by changing C224 to 1μF.
G11 chassis: To remove field jumping on VCR operation change C2039 to 0·0039μF/100V. If necessary, reduce R2003 to 1·8MΩ or possibly 1·5MΩ (keep value as high as possible for best off-air results). Consult National Panasonic technical department if these modifications don't cure field bounce with the National VCR Model NV7000.
KT3 chassis: Remove R8374 from sync module and connect a series combination consisting of a 2·2μF capacitor (observer polarity) and a 1·5kΩ resistor between pin 9 of IC8367 and chassis.
T4 monochrome chassis: Change R758 to 680Ω, C570 to 0·001μF, C567 to 15μF and C572 to 3·3μF. Short-circuit R757. Connect junction of C566/R756 to chassis. Adjust coil U464 for optimum playback.
TS7 monochrome chassis: Connect a 390Ω resistor across R215. Short-circuit R240. Connect an 0·082μF/50V capacitor across C197 and a series combination consisting of 10kΩ/22μF (observe polarity) across R213. Open-circuit the print between pin 5 of U4 and the junction of R240/R241. Connect a 4·7kΩ resistor from pin 5 of U4 to chassis. Fit a screened lead, with the braid to chassis and the core to the junction S37/C224. Connect a series combination of 1kΩ and 0·068μF/250V from pin 5 of U4 to the lead's core: leave braiding at this end disconnected.

Pye

691/693/697 chassis: Change R36 to 15kΩ, C203 to 180pF and C202 to 820pF.
713 chassis: Short-circuit R621 by linking points Y1 and Y2.
725/735/741 chassis: VCR compatible with TBA920 fitted. Check VCR switching arrangements in individual models.

See also G11, KT3, T4 and TS7 chassis in Philips section.

Rank

A823 series with A803 scan drive panel: Change 5C12 to 0·01μF and 5C13 to 680pF.
A823 series with Z504 or Z968 scan drive panel: Remove 5C12. Change 5C10 to 1·5μF and 5R15 to 4·7kΩ. If jitter ensues on off-air reception, change 5C15 to 0·068μF.
Z179 chassis: Connect pin 10 of 4SIC1 to chassis. For single-button VCR operation, use kit 215, part number 9500-4622.
Z718 chassis: Connect pin 8 of 4SIC1 (TBA950) to the 12V rail by linking pins 1 and 2 of 3Z9 (on decoder panel).

Saba

E series: Change R504 to 47kΩ, C503 to 0·0022μF and C504 to 0·033μF.
F and G series: Change R633 to 47kΩ, C633 to 0·0022μF and C634 to 0·033μF.

Sony

KV2020/2022/2204/2206/2207UB: To cure intermittent colour drop-out, change R308 to 1·5kΩ and L301 to 15mH (part number 1-408-160-11). Check and adjust a.p.c. loop. If touble persists, change IC301 (type μPC1365C). This trouble can also occur on broadcast transmissions.
KV2704UB: As above. Component reference numbers R308, L305 and IC301 respectively.

Tandberg

CTV1 chassis: Modified sync/line oscillator module available from Farnell-Tandberg (Leeds). Current cost about £40.
CTV2 chassis: Use last button.

Telefunken

708 chassis: Add a 100kΩ resistor across R434, a 120kΩ resistor across R440 and an 0·01μF capacitor across C434.
709 and 710 chassis: Add a 27kΩ resistor across R452, a 3·9kΩ resistor across R453 and an 0·01μF capacitor across C453.

See also Decca section – many Telefunken sets have Decca chassis.

Thorn

2000 chassis: Change C7 to 4·7μF.
3000/3500 chassis: Change C506 to 4·7μF.
4000 chassis: Change C316 to 0·15μF and remove R327. Add lead to VCR switch S301, using tag behind braid connection to existing screened lead. On signals processing module, add a 680Ω resistor in series with R193 (680Ω) and connect the new lead from the VCR switch to the junction of these two 680Ω resistors so that the junction is taken to chassis when the VCR switch is depressed. If the U702 remote control is in use, break the link across connector 3A pins 1 and 2.
8000, 8000A, 8500, 8800 chassis: Change C423 to 2μF.
9000 chassis: Change C419 to 3·3μF and C421 to 1μF.
9800 chassis: If no AV switch fitted, change C423 to 2μF.
1500 monochrome chassis: Change C51 to 0·047μF and R57 to 47kΩ.

Components and Safety

Unless otherwise stated, capacitors should be 25V or above and resistors ¼W or above. Ensure that modifications do not infringe BEAB and BS415 requirements.

Routine TV Receiver Tests: Decca 10 and 30 Series CTVs

S. Simon

IN OUR article last month we considered a couple of well-known chassis from the Bush-Murphy stable. Both were solid-state. This month we turn to a hybrid colour chassis to illustrate the different approach called for. Of the various hybrid colour chassis, probably one of the most commonly encountered after the Pye ones is the Decca Bradford, which was used in models such as the CS1910, CS2213, CS2030, CS2230, CS2630 and so on. The later 30 series were very similar to the initial 10 series sets, though there were some differences and we must be forgiven if some of the tips given in the following notes do not apply to all models.

For example, the types and positions of the fuses varied. Some models had a thermal cutout with a reset button, some had touch tuners in place of the press-button type, and the later 30 series had a somewhat different decoder with an MC1327P i.c. for colour demodulation and matrixing etc. Also some of the smaller screen sets omitted the raster correction circuitry. By and large however the basic chassis concept remained the same in all models. An initial visual check is first required to verify the presence of a thermal cutout, the position of the fuses, etc.

Some Disguises

It's also worth bearing in mind that large numbers of these sets carried banners other than Decca. Large quantities of ex-rental Rediffusion sets are still in circulation, and names such as Classic are to be found. You will also find the chassis in some Telefunken models, and a slightly modified version was produced by Telpro. Carnival and Tristar are other names that spring to mind.

Tuner Troubles

Most of these sets employ a tuner with four push-buttons and a fifth that's the tuner. Inaccurate channel selection, where it's necessary to retune the fifth knob each time any button is pressed, is a very common complaint. If the control panel is removed and the cover taken off the tuner, you will see that each end of the tuning spindle is secured by a semi-circular bracket fixed by two screws. It's usual for the screws to loosen or come out altogether, with the result that the spindle flaps about a bit. Hence the inaccurate channel selection. The screws will normally be found inside the tuner, with the bracket, and can be refitted without trouble to restore normal operation.

Dead Set

If the set is dead on arrival, one should assume that a fault has caused the cutout/mains fuse or an h.t. fuse to go open, or perhaps a valve heater to fail, leaving the h.t. very much in evidence to the careless hand or tool. One proceeds with a certain amount of caution therefore, first checking the a.c. input to the cutout or fuse or checking for the presence of h.t. at the main smoothing electrolytic or some other convenient point.

If the h.t. is present at this point, the chances are that a valve heater is open-circuit, and although any one of them could be at fault the place to start is not actually with the valves at all. Since the h.t. cannot reach the top caps of the two valves (PL509 and PY500) in the line output stage until they are heated, a resistance check should be made from either top cap to chassis. A low reading immediately rings warning bells to the effect that a fault which could damage a new valve fitted in the PY500 position is present.

The reason for the low reading is very often that the boost capacitor C436 (0·22μF, 1kV) at the lower right is short-circuit. Note the flylead which comes down from the line output transformer. This is the link between the transformer and the boost capacitor and the width circuit. The capacitor (normally white or blue/white) so regularly shorts that it's the first thing the writer checks when one of these sets comes in with a "no raster" or "no results" complaint. A quick ohmmeter check across it will often save some time checking elsewhere to find the cause of the fuse failure. On occasions a direct short-circuit across the capacitor may not mean that the capacitor itself is shorted. So disconnect one end and repeat the check. If the short-circuit is still present, the boost capacitor is cleared of suspicion and the next items to check are the PY500 (lift the top cap) and the fifth harmonic tuning capacitor C435 (150pF or 220pF) which is mounted on the transformer. Once in a while the transformer itself may be at fault, with a short between windings, but this is far less common. The ohmmeter check can be made from the top cap of the PL509 or PY500 to chassis if you wish: the correct reading is something in the order of 200kΩ.

If a short is found and cleared, the result of it will still be present – usually in the form of a blown h.t. fuse. The situation of the fuse will vary according to the model. In some it will be found on the right-hand side, behind the line output valves, and of course the chassis will have to be released and rolled back to gain access. In others it will be found on the lower power supply section, near the shift controls. In some sets the extra current flowing as a result of the short-circuit may have proved too much for the large cement-covered h.t. surge limiting resistor which is in series with the h.t. rectifier diode on the left-hand side of this horizontal panel. It's R603, value 3·9Ω. A standard 3·3Ω section rated at over 10W is a suitable replacement.

This resistor is often responsible for lack of h.t. and could in fact be the only cause of the no results symptom. No results might not be a completely true description, even though there's no h.t. This may come as a surprise to some, since the sound output is provided by a PCL82 valve which is supplied from the h.t. line: the fact that

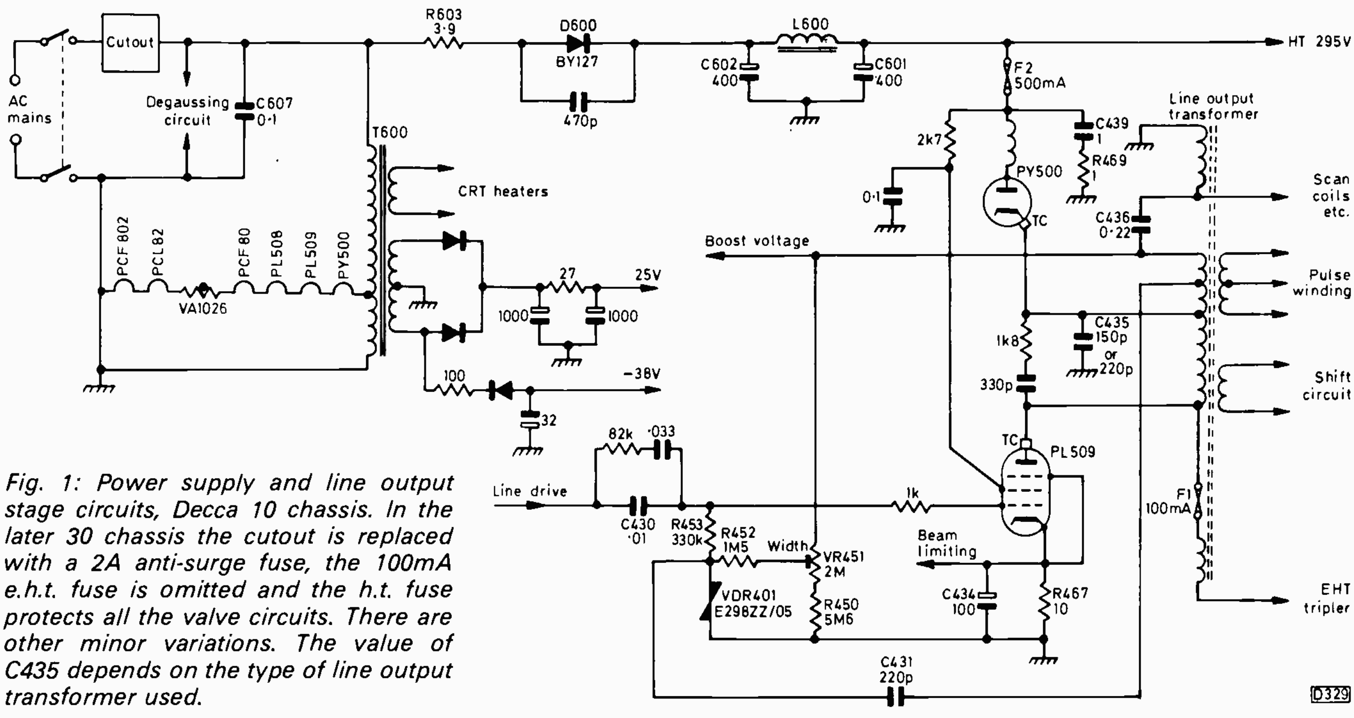


Fig. 1: Power supply and line output stage circuits, Decca 10 chassis. In the later 30 chassis the cutout is replaced with a 2A anti-surge fuse, the 100mA e.h.t. fuse is omitted and the h.t. fuse protects all the valve circuits. There are other minor variations. The value of C435 depends on the type of line output transformer used.

there is no h.t. should result in no sound at all from the speaker, but faint signs of life may still be heard and may lead one to believe that the h.t. is present though there's none at all.

Access is improved by removing the lower left i.f. panel or both this and the timebase panel – remove the connection plugs, then release the spring clips. The power supply panel can then be removed or the set upended to enable work to be carried out on the panel and the PCL82 audio department which is often in need of attention.

More often the no h.t. fault leaves the valves glowing and there is thus less doubt about what's gone wrong. Where the valve heaters are not glowing it should be assumed that the h.t. is present until a check reveals its absence.

Heater Chain

We have tended to suggest that if the valve heaters are not glowing the PY500 is responsible, and this is so. It often transpires however that the PY500's heater is intact and that the fault is further along the heater chain. The PCL82 should not be overlooked as a possible culprit, but due to its awkward position it's easier to check the other valves first (PL508 etc.). Simply remove them and check between pins 4 and 5 with the ohmmeter. Where the PY500's heater is found to be open-circuit and there's no short-circuit to chassis from the top cap, there's a possibility that the PL509 may have a heater-cathode short. This will have ruined the PL509 of course and taken the PY500 with it, so the rule is that if the PY500 is replaced and the PL509 has not been checked, keep a hand on the off switch just in case the PY500 lights up like a 100W bulb.

The Width Circuit

If the complaint is lack of width, it's worthwhile first to check the slider of the width control (bottom right), as this often develops poor contact with the track. In this event slight movement may be all that's required to restore normal working. If this is not the trouble, check the PL509 and PY500 valves and the width circuit resistors. A very common offender here is R453 (330kΩ), and the symptoms may be misleading. This is because the beam limiter circuit's sensing point is the cathode of the PL509, so that incorrect line output valve biasing will affect the brightness/contrast levels. It can also lead to the early failure of the PL509, and to intermittent fuse failure. Another resistor whose value is worth checking is R444 (33kΩ). This is the line oscillator valve's anode load resistor.

Grey Scale Problems

If the grey scale is disturbed and varies, attention should be paid to the upper left preset controls which tend to develop poor contact, thus altering the grey-scale setting so that good black and white cannot be relied upon. Occasionally the cause will be a dry-joint either on the controls or at the bases of the RGB output transistors. A few moments with a soldering iron and cored solder will often pay dividends. The transistors themselves give trouble, but not all that often – probably due to the efficient heatsinks employed. The BF337 is recommended as a replacement for the BF179.

Summary

All in all the Decca Bradford is a reliable chassis. The sets you will come across will already have given quite a few years' service. The faults they are prone to are fairly easy to recognise and trace once one has become used to their habits.

The weak points are the usual mains filter capacitor (C607, 0·1μF) failure; distorted or no sound, pointing to the PCL82 valve, the wirewound h.t. feed resistor and/or occasional poor contacts around the valve base due to heat over a period; and short-circuit capacitors, faulty valves and changed value resistors in the line output stage. A final word or warning. If the receiver is to be turned on its side with the chassis withdrawn, make sure that the nylon wheels are in their runners and locked at the end. Nasty things can happen.

LOPT Tester

Hamit I. Mustafa, T.Eng.

LINE output transformer failure is a common enough fault, on some chassis more than others. It's not always easy to be sure that the transformer is defective however without going to the trouble of fitting a replacement. Hence the usefulness of a tester. Open-circuit windings present no difficulty of course: the problem arises with shorted turns. The circuit presented here can be used to detect shorted turns in the primary winding. We've been using it now for over four years, and during this time it's given us reliable checks.

Circuit Details

The full circuit is shown in Fig. 1. Transistors Tr1 and Tr2 form a simple *RC* sinewave oscillator circuit – actually an emitter-coupled Wien-bridge oscillator. In Fig. 2 the oscillator circuit has been redrawn to show the bridge network. The principle of this type of oscillator is the use of negative feedback and frequency-selective positive feedback. Tr1 is the oscillator transistor, whose output is developed across R1 and fed to the base of Tr2. The output is taken from the collector of Tr2, whilst the feedback is taken from its emitter.

Negative feedback is applied to the base of Tr1 via the potential divider network R4/R3. The positive feedback is applied to its emitter via the Wien network comprising VR1/VR2/C4/R2/C3. The values of these components set the oscillator's frequency: at frequencies other than the resonant frequency, the negative feedback exceeds the positive feedback with the result that there is no output.

Returning to the full circuit, the line output transformer's primary winding is connected across the parallel tuning network R2/C3 via the d.c. blocking capacitor C2. A winding with shorted turns will load the circuit sufficiently to prevent oscillation.

The output developed across R5 is rectified by D1, charging its reservoir capacitor C5. This voltage is applied to the inverting input of the comparator i.c. (IC1), which compares it with the fixed voltage fed to the non-inverting input via R9 from VR3. When the voltage at the inverting input is sufficient, the output at pin 6 turns on

★ Components list

Resistors:
R1 22k
R2 2·2k
R3 2·2k
R4 4·7k
R5 4·7k
R6 100k
R7 1k
R8 1M
R9 100k
R10 68k
All ¼W carbon film

Capacitors:
C1 47μF 16V electrolytic
C2 0·1μF polyester
C3 0·022μF polyester
C4 0·022μF polyester
C5 0·22μF polyester

Potentiometers:
VR1 1k linear midget
VR2 2·4k linear subminiature preset
VR3 47k linear subminiature preset

Semiconductors:
Tr1 BC182L
Tr2 BC182L
IC1 301A (RS 307-244)
LED1 RS 586-475

Miscellaneous:
PCB D099
Case RS 508-560
PP3 battery with connector
Toggle switch (SPST)
2mm plugs and sockets, leads, miniature insulated crocodile clips.

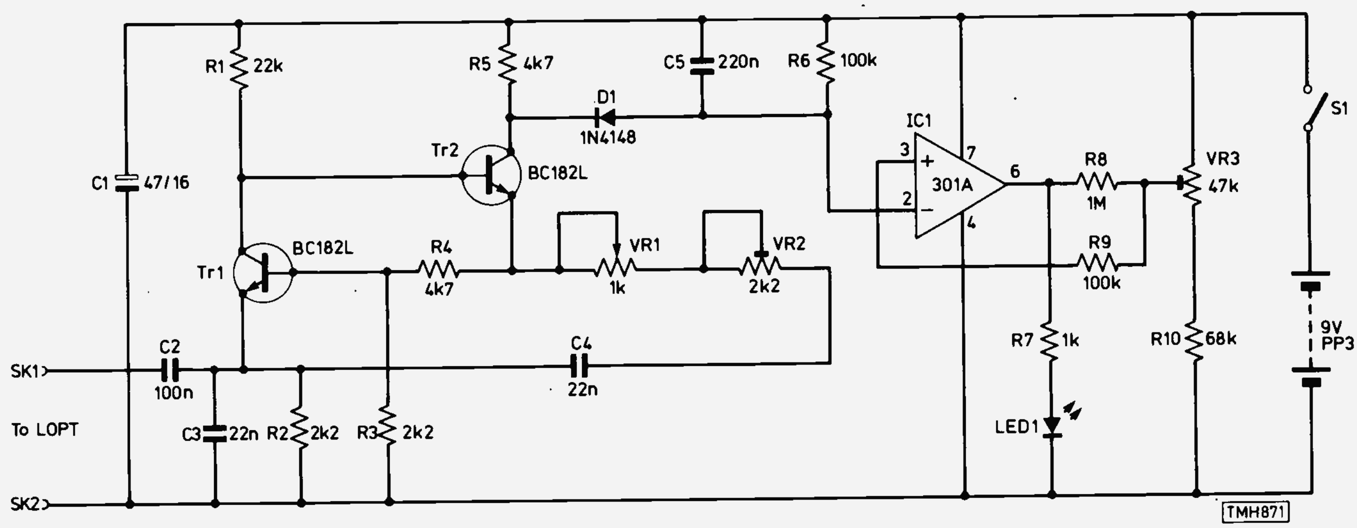


Fig. 1: Circuit of the line output transformer tester.

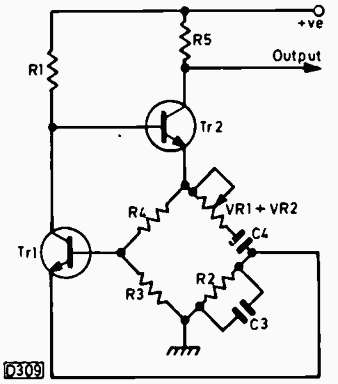


Fig. 2: The oscillator circuit redrawn to show the bridge circuit, with Wien network for positive feedback.

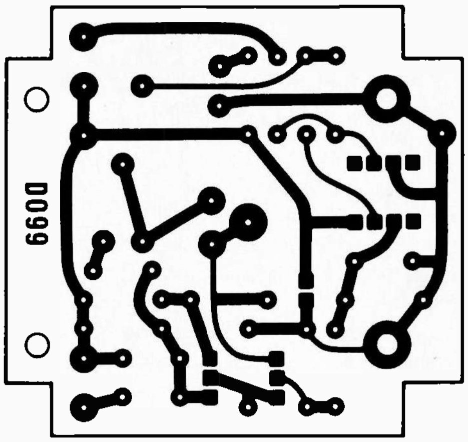


Fig. 3: PCB print pattern.

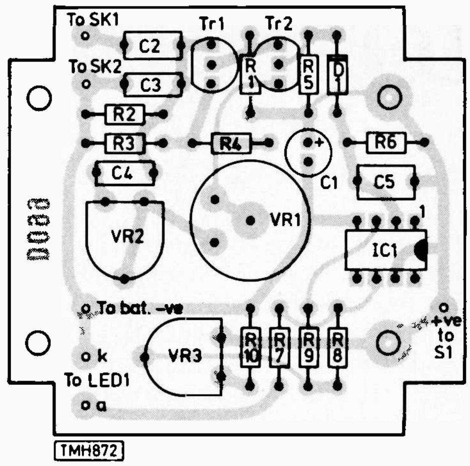


Fig. 4: Component layout.

the light-emitting diode LED1. Thus a good line output transformer primary winding will be indicated by an illuminated LED. A winding with shorted turns will stop the oscillator and the LED will fail to light up.

Setting Up

To set the unit up initially with a new 9V (PP3) battery, short together the probes to ensure that the oscillator does not run, then adjust VR3 until the LED turns on. Back off VR3 slightly until the LED goes off again. Remove the short, turn VR1 to the mid-position, then adjust VR2 to the crossover point. The tester is now ready for use – VR2 and VR3 should need no further adjustment.

Use

To use the tester, adjust VR1 till the LED just turns on, then connect the probes to the line output transformer's primary winding. If the LED goes off, indicating that the oscillator has stopped, the winding has a shorted turn. A good winding will start the oscillator even though VR1 is set before the turn-on point.

The tester has certainly proved its usefulness for us. I hope it will be as helpful to other readers.

Test Report: CED CRT Tester

Ian C. Beckett

ANYONE engaged in TV servicing knows how useful a good c.r.t. tester/reactivator can be. For some time now we've been using a CED Model 4A, and as the results have been good the following brief report may be of interest to other readers.

Description

The unit is housed in a metal case with a sturdy carrying handle and a black front panel with white lettering. It's designed for 220/250V a.c. mains operation and measures 280 × 125 × 130 mm. The facilities provided are emission testing, interelectrode leakage and short-circuit tests, heater current measurement and a very effective boost facility. The large meter on the front panel is easy to read and clearly marked. There are two scales. The top one is calibrated 0-1 for emission: the red section 0-·4 indicates low emission, the green section ·6-1 normal emission. The lower scale is for the leakage tests and is calibrated from zero to infinity.

There are four switches: a rocker type for power on/off, with a neon indicator to show power on, and three rotary switches. The gun switch has red, green, blue and monochrome positions. The leakage switch has grid-anode, grid-cathode and heater-cathode positions, with a fourth position for use when making emission tests. The mode switch has heater current, emission and two reactivate positions. A pair of terminals is provided on the front panel for heater current measurement in conjunction with an external meter. For reactivation, up to 400V at 100mA is applied between the grid and cathode.

Results Achieved

We've reactivated a large number of monochrome tubes with readings as low as ·02-·2 in the red over a considerable period of time, boosting them to give readings of ·8-·9. With colour tubes it seems that the red gun usually looses its emission first, i.e. one often finds readings of about ·7 with the green and blue guns and ·4 with the red gun. We've reactivated many colour tubes to give readings of ·9 or better on all guns. Some colour tubes that have given a zero red gun reading have been successfully reactivated to give equal readings on all three guns and are still holding up well after a long period of time. A large percentage of the monochrome tubes we've reactivated have been checked and found to be performing well after a considerable time.

Recommendation

In conclusion, we've found this instrument to be both efficient and reliable and helpful on the bench and in the field. It's available from Willow Vale Electronics, Old Hall Works, Arborfield Road, Shinfield, Reading, Berks RG2 9DP (telephone 0734 884444) at £82.50 plus VAT.

Inside the Philips VR2020

Part 2

Brian Dempster

THE heart of the Philips/Grundig V2000 VCR system is the way in which the video heads are kept aligned with the recorded tracks during playback. The technique is called dynamic track following – the positions of the heads are continuously adjusted to maintain correct tracking. This ensures optimum signal-to-noise on playback and intermachine compatibility. To operate the system, pilot tones (DTF signals) are laid down on the tape. They are of relatively low frequency, slotting into the l.f. end of the recorded signal spectrum as shown in Fig. 4 last month.

Four different frequencies are used, f1 102kHz, f2 117kHz, f3 149kHz and f4 164kHz. These are laid down on alternate tracks as shown in Fig. 12. Let's take track C, which is recorded by head K1. Since the azimuth angle of the head has no effect at such low frequencies, head K1 will pick up mainly 164kHz on playback. It will also however pick up some 149kHz signal from track D and some 117kHz from track B, i.e. from the two adjacent tracks. If the position of the head is a little too high, it will pick up more of the 149kHz signal from track D than the 117kHz signal from track B – the converse occurs if the head's position is too low. If the tracking is correct, the signals picked up from the adjacent tracks will be of equal amplitude.

It will be seen that beat frequencies (difference frequencies) are produced – because the pilot tones from the adjacent tracks mix with the track's own pilot frequency. The difference-frequency signal produced by mixing the C and D track signals is 15kHz, the C and B track signals producing a 47kHz difference frequency. If these difference frequencies are rectified, we have voltages which give us information about the position of the head. The predominant mistracking frequencies are: head K1 high 15kHz, low 47kHz; and conversely head K2 high 47kHz, low 15kHz. Since the error voltages are in the opposite sense for each head, an inverter must be used in the control circuitry for one of the heads, and a switch must be used to direct the control voltage to the appropriate head.

The video heads are mounted on piezoelectric actuators (see Fig. 13) which when subjected to a potential difference move to give the control action. The direction and degree of movement depend on the polarity and value of the applied voltage. A total movement of some 80 microns is possible, and since the width of the recorded track is only 22·5 microns the control range is more than adequate.

When one of the video heads is in contact with the tape its vertical position is being continuously controlled as just explained. When the control voltage is removed however the actuators exhibit a degree of hysteresis, i.e. they don't always return to the same position. Since the dynamic control voltage is removed from an actuator whenever its head leaves the tape, this hysteresis could mean that when the head again contacts the tape (at the start of the following track) it would not necessarily be in the correct position. For this reason, the control voltage is sampled for about 2·5msec at the beginning of each track, the average value being held in a sample-and-hold circuit. This voltage is switched to the appropriate actuator as its head leaves the tape, ensuring that the starting position for the next track is correct. The sampled voltage is known as the "track starting value". Fig. 14 shows the track following discriminator in block diagram form.

Head Control on Record

The hysteresis problem means that it's not possible simply to remove all control voltages from the actuators when recording. If we did, we would have no guarantee that the tracks recorded by one head would not overlap the tracks recorded by the other head.

To overcome this difficulty a short burst of another frequency (f5, 223kHz) is recorded shortly after the start of each track (see Fig. 15). When this is read back, an indication of the proximity of the track to the adjacent one is obtained. The width of the track and the angle at which the tracks are laid down results in a 1·5 line period offset, i.e. if f5 is written (recorded) for 1·5 lines and then read for 1·5 lines, the read period for one track lies adjacent to the write period for the previous track. Thus the amplitude of f5 read back will increase if the track being recorded moves closer to the previous track and vice versa.

It's necessary to control only one head in this way, actuator one being used. The control voltage produced is sampled for a short time (13μsec) at the end of the f5 read period and held for the rest of that track.

DTF System Summary

Summarising the DTF system so far then, the video heads are mounted on piezoelectric actuators which provide a degree of vertical movement: the vertical positions of the two video heads can be varied independently by altering the polarity and magnitude of the control voltage applied to each actuator. Track following signals are laid down in a four-track sequence when recording, and a fifth signal (f5) is recorded for just 1·5 lines on each track,

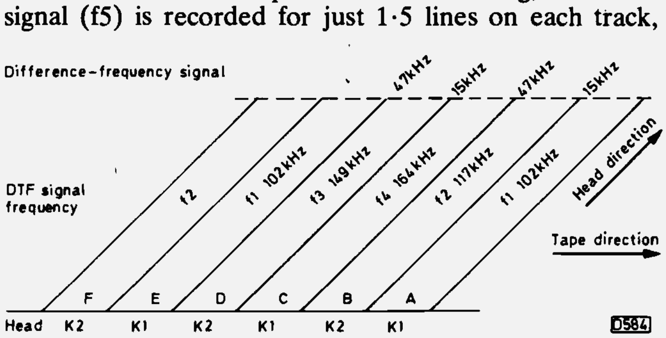


Fig 12: Arrangement of the DTF signals on the tracks.

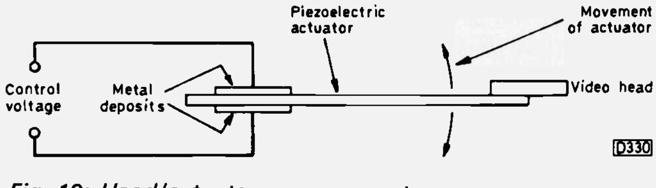


Fig. 13: Head/actuator arrangement.

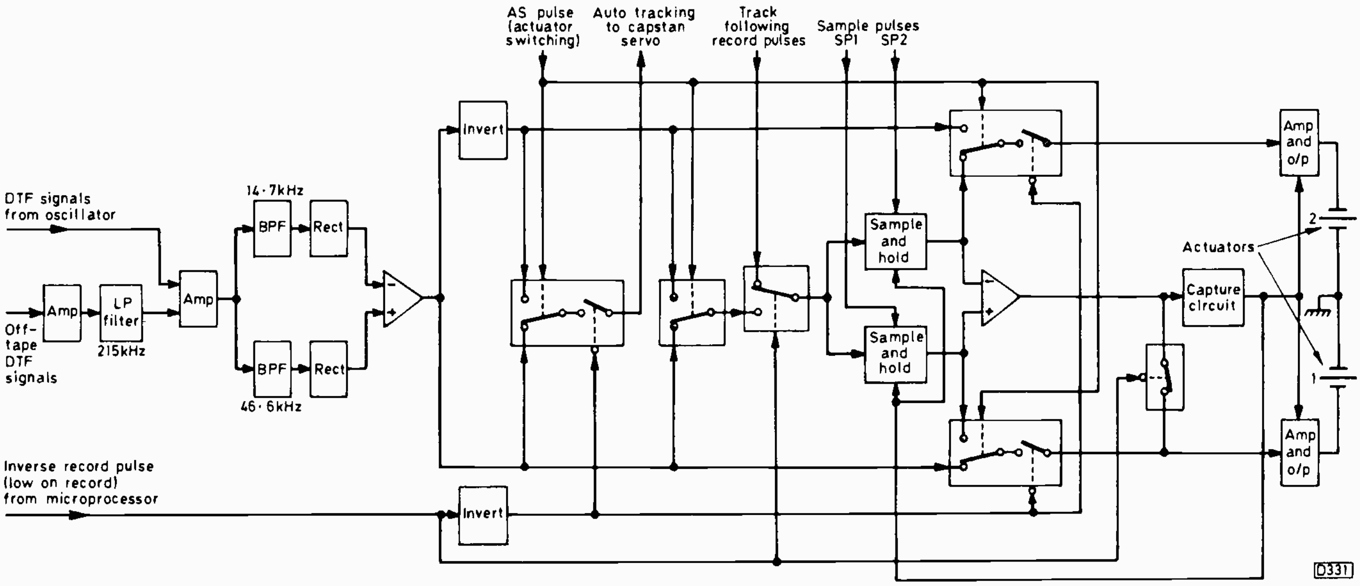


Fig. 14: Block diagram of the actuator control system.

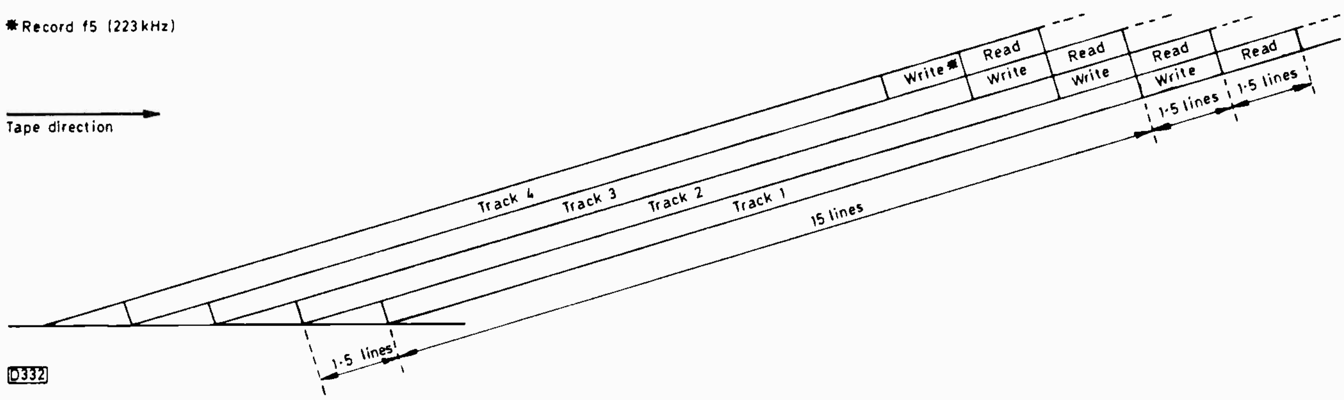


Fig. 15: Extra signals (f5) are laid down to control the heads on record.

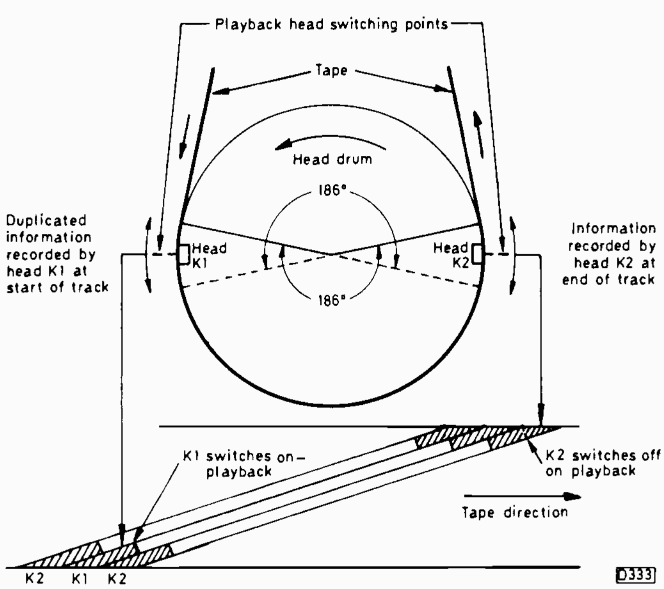


Fig. 16: Head switching.

starting 15 lines from the beginning of the track. An f5 read period of 1·5 lines follows the f5 record period, some of the f5 signal from the previous track then being picked up. The amplitude of this picked-up signal is sampled for 13μsec and used as information indicating the proximity of one track to the next one: this information controls the position of actuator one whilst recording. The track-following signals (f1-f4) are blanked during the f5 read and write periods.

During playback the beat signals produced by crosstalk between tracks are filtered and rectified, their relative amplitudes producing the voltages to control the actuators. The dynamic control voltage is applied to the actuator whose head is in contact with the tape, this action being controlled by a switching signal known as AS (actuator switching). The dynamic control voltage is also sampled for about 2·5msec just after the start of a track by the SP (sample pulse) signals 1 and 2. SP1 occurs when head K1 is in contact with the tape and SP2 when head K2 is in contact with the tape. This sampled control voltage is stored and applied to the relevant actuator (switched by the AS signal) when its head leaves the tape, so that when the head comes into contact with the tape again it's in the correct position to start its next track.

Due to the use of a tape wrap of 186° (see Fig. 16), there's a small amount of duplication of the information recorded at the end and at the beginning of consecutive tracks. Head switching on playback – this is controlled by the HP (head pulse) signal – occurs about 11 lines before the field sync pulse (see Fig. 17). This ensures that the playback field sync pulses occur at the beginning of each track.

Timing

Fig. 2 last month showed the location of the head posi-

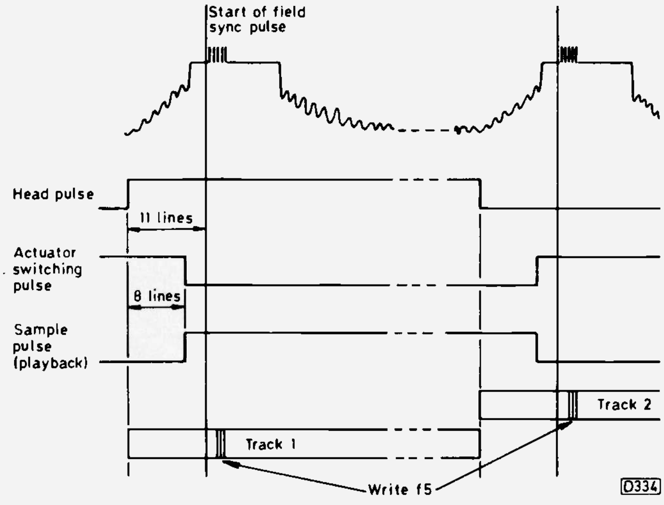


Fig. 17: HP, AS and SP1/2 pulse timing relative to the field sync pulse.

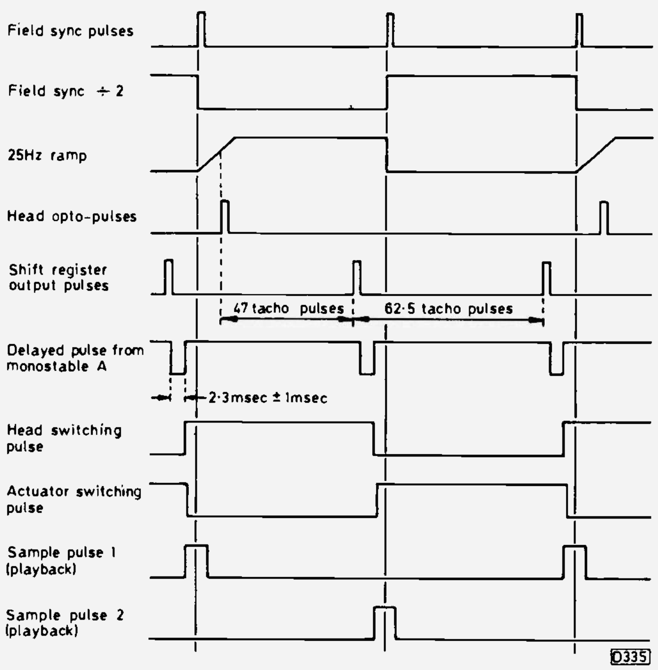


Fig. 18: Timing of the various control pulses.

tion indicator. This is a metal projection that interrupts a beam of light normally incident on a phototransistor. When sharpened and inverted, the pulse produced in this way gives an indication of the position of the K1 head relative to the tape. The pulse frequency is 25Hz. This pulse and the field sync (divided by two) are applied to a discriminator which produces a phase control voltage for the head motor (see Fig. 18): phase lock normally occurs when the head opto-pulse arrives half way up the 25Hz ramp produced from the divided-by-two field pulse.

The head motor is also coupled to a tachogenerator which produces 125 pulses per revolution of the head drum, i.e. 62·5 pulses per head/tape contact. By using the opto-pulse as a reset pulse, these tacho-pulses can be counted in order to produce an HP switching pulse after each tacho-pulse count of 62·5. The HP pulse occurs a little before the field sync pulse however, so something less than 62·5 pulses must be counted after the first opto-pulse to bring us almost to the next field sync pulse. It's also desirable to have a degree of adjustment to allow us to position the head switching accurately. A monostable multivibrator is used for this purpose. After each HP cycle the opto-pulse resets the pulse counter (shift register). Once generated, the HP pulse can be used, after a short delay (eight lines), to produce the AS pulse and the playback sample pulses.

The time relationship between these various pulses is shown in Figs. 17 and 18.

Pulse Generation

Fig. 19 shows the complete pulse generating department in block diagram form. We'll now take a closer look at this.

The output from the shift register, after the preset delay of 2·3msec provided by monostable A, triggers bistable E whose outputs are used as the head (HP) pulses. The other output from monostable A triggers bistable D, whose outputs change the shift register count from 47 to 62 and vice versa. The reset input to the shift register comes via a NAND gate whose inputs are the head opto-pulses and the inverted-Q output from monostable A. These inputs are both normally high, so that the shift register is reset by either an opto-pulse or its own output pulse. The head tachogenerator pulse train is phase inverted when the shift register is set to count 62. This has the effect of extending the count by one half of the period between the pulses, thus giving a count after 62·5 tacho-pulses. The opto-pulse also resets bistable D, ensuring that count 47 occurs first. The sequence is thus as follows:

The head drum opto-pulse resets bistable D (ensuring that the shift register is set to count to 47) and also resets (or "empties") the shift register. The head tachogenerator produces 62·5 pulses per head/tape contact (125 pulses per revolution of the head). Thus after 47 tacho-pulses we are some substantial distance along the tape track. At this point an output pulse from the shift register triggers monostable A, starting a 2·3msec (±1msec) delay. The output from this monostable gets us to 11 lines or so before the field sync pulse (see Fig. 17). Its output then triggers bistable E to produce the head pulses.

The inverted-Q output from monostable A also triggers bistable C (via monostable B), whose outputs pass via time-delay circuits to produce a train of 2·5msec pulses. These are the sample pulses, which are directed to the appropriate sample and hold circuit (Fig. 14) by one of the head pulses during playback. In the record mode these pulses are shortened to 13μsec.

The f5 write (WR), read (RE) and write plus read (WRE) pulses are initiated by the field sync during record. Now the HP pulse occurs some 11 lines before the field sync pulse (see Fig. 17), and WR occurs some 15 lines later. Thus WR occurs some four lines after the field sync pulse. The necessary delay is introduced by monostable F. The duration of the WR pulse (about 1·5 lines) is set by monostable G. The falling edge of this pulse starts monostable H, producing the RE pulse. The addition of these two gives us the WRE pulse.

Monostable J is also started by the falling edge of the WR pulse. It has a duration of 80μsec. The time difference between the pulse generated by monostable H (93μsec) and that produced by monostable J (80μsec) gives us the f5 sample pulse (13μsec). This is used to modify the sample pulse (SP) from 2·5msec during playback to 13μsec on record. The inverse record pulse from the microprocessor panel selects which to use, acting via monostable B.

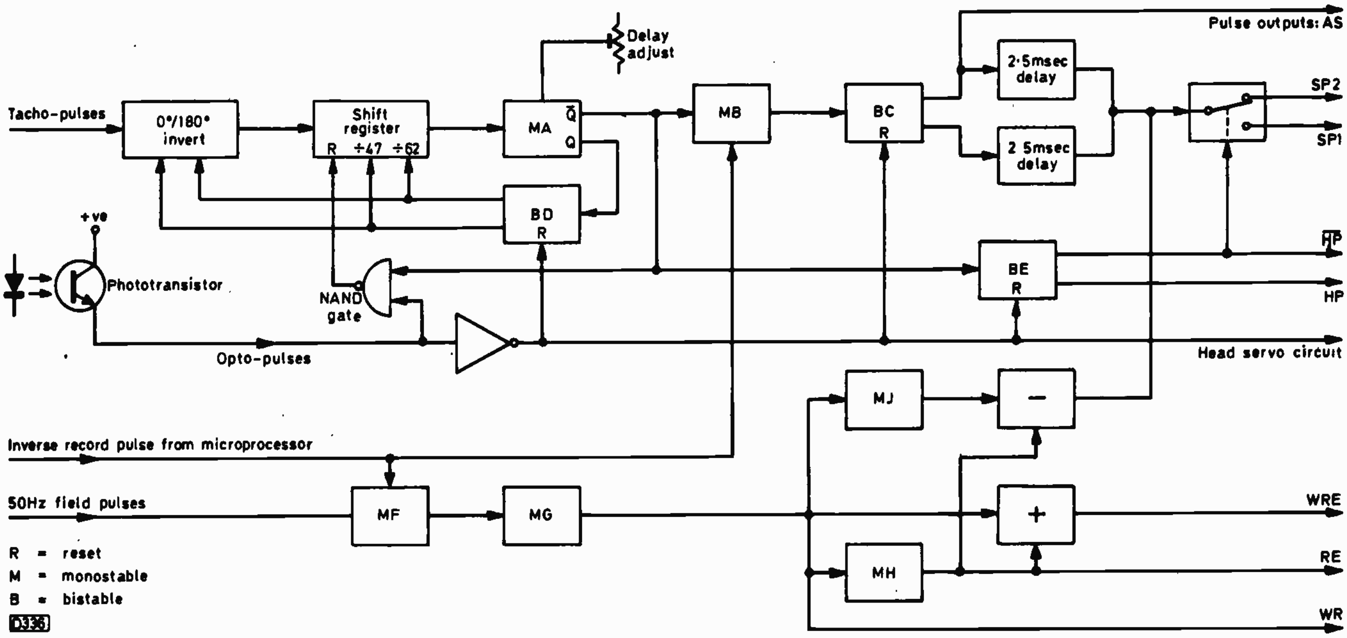


Fig. 19: Generating the control pulses.

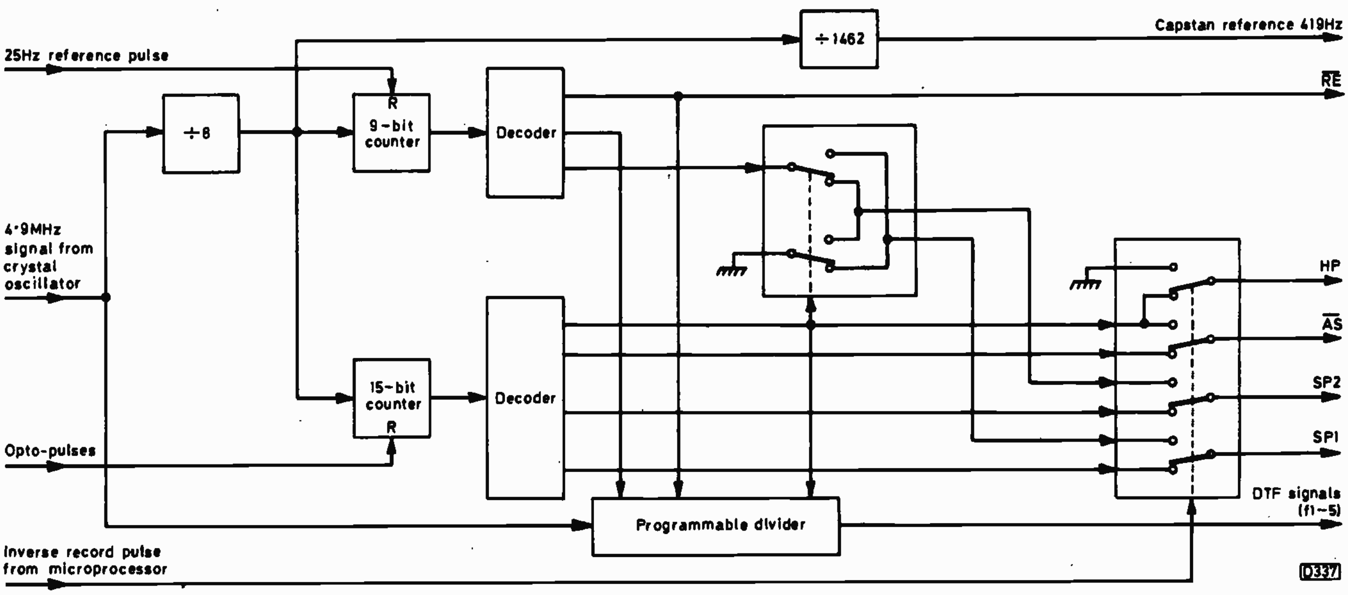


Fig. 20: Later system in which all the control signals are counted down from the output of a 4·9MHz crystal oscillator.

So much for the original version. Most machines use the later version however. The requirements remain the same of course (f1-5, HP, SP1/2, AS etc.) and the timing of these relative to the field sync is the same. In this version however all these items are obtained by counting down from the 4·9MHz oscillator in the SAA1085P i.c. (in the original version this oscillator was used only to generate f1-5 and the capstan reference on record).

The track-following frequencies (DTF pilot tones) are produced by a programmable divider from the 4·9MHz oscillator, the divider being programmed by field rate signals which are also derived from the 4·9MHz oscillator, via counters (see Fig. 20). Two kinds of control signal are required, both at field rate: one to initiate the change from f1 to f2 etc. and the other, occurring about four lines from the field sync pulse, to allow f5 to be recorded. These signals are generated by binary counters.

The arrangement used is shown in Fig. 20. The 4·9MHz signal is first divided by eight to get 612·5kHz. The lowest frequency needed is 25Hz (HP), and for this purpose a fifteen-bit counter is required. This generates the actuator switching, head switching and playback sample pulses. These functions are all timed relative to the head opto-pulse, which is used to reset the 15-bit counter.

A separate nine-bit counter, reset by a 25Hz field sync-locked reference signal, is used to count the correct interval for the f5 read and write pulses. This counter also generates the 16μsec sample pulse on record – the pulse is directed to the appropriate output (SP1 or SP2) by the 25Hz HP signal from the 15-bit counter (this HP signal is not otherwise used when recording).

In early machines the "track-sensing oscillator panel" was designated U240 and the pulse generator (on the head servo panel) U200. In the later machines the track-sensing oscillator and pulse generator are incorporated within the SAA1085P i.c. and live on the head servo panel (type U280). The later panel plugs into the same location on the mother board, but is not interchangeable with the U200 panel.

In Part 3 we'll be considering the servo systems.

Fault Report

From Richard Blenheim, Keith Hamer, Garry Smith and Mick Dutton

Thorn 1690 Chassis

No line sync in one of these sets led us to make a check on the flywheel line sync discriminator diodes. These were o.k., so we tried setting up the line oscillator coil. Lock was achieved, just, but the fault was obviously still present. It was subsequently traced to R102 (6·8kΩ) in the reference pulse feedback path – the resistor had risen substantially in value. We've had the same problem with R418 (10kΩ) in the Thorn 8000/8500/8800 chassis. ***R.B.***

Thorn 9600 Chassis

The problem we had with a colour set fitted with the Thorn 9600 chassis was sound but no vision (blank raster). This one took quite a time to track down since it meant checking around the i.c.s on the i.f./decoder panel.We eventually found that there were no black-level clamp pulses at pin 5 of the SN76226ND luminance i.c., due to failure of VT115 (BC147) in the pulse shaping/phasing circuit. No signs of colour either since the same circuitry provides the burst gate pulses for the TBA395 chroma i.c. ***R.B.***

Rank A816 Chassis

We've had a couple of faults recently in sets fitted with the Rank A816 chassis (the large-screen solid-state monochrome one). The problem with the first was lack of height with bottom cramping. After checking the field charging and scan coupling capacitors 3C29 and 3C31 we started to check (by substitution) the transistors in the field timebase. The problem was solved when 3VT11 (BC207), the npn transistor in the complementary-symmetry driver stage, was replaced.

The other set was suffering from tuning drift. This was cleared by replacing 3C13 (1μF) which decouples the tuner's tuning voltage pin. ***R.B.***

Thorn 3000/3500 Chassis

We sometimes find R609 on the top of the power supply panel in the Thorn 3000/3500 chassis open-circuit without any apparent cause. It's a special type of resistor (so don't fit any old one) and is connected in series with the h.t. feed to the chopper transistor (see Fig. 1). The cause is usually a defective cut-out which is jammed or welded internally so that it fails to operate when an overload occurs. As a test, press the cutout's reset button: if the cutout is working the set should cease to function until the button is released. It's easy enough to make this test, which may prevent more serious trouble developing.

The crowbar trip thyristor W621 can operate intermittently, operating the cutout, and is worth replacing if suspect. Make sure that the set e.h.t. control is correctly set for 60V at the h.t. fuse F603. Other causes of intermittent cutout operation are the chopper transistor VT604 and C618. The latter is present to prevent short-term flashovers operating the crowbar trip. ***K.H.-G.S.***

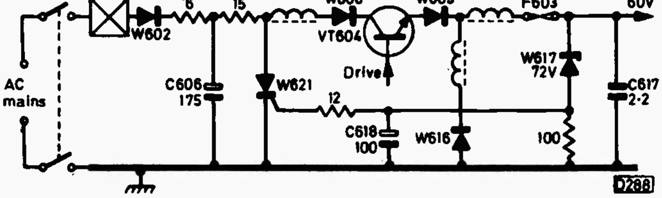


Fig. 1: Chopper feed circuit, Thorn 3000/3500 chassis.

Hitachi PAL-2 Chassis

No colour on early Hitachi colour sets, e.g. Models CAP160, CEP180, CNP190 and CNP192, is often due to failure of C533 (0·001μF) which couples the ripple output from the burst detector to the two-stage ident section of the decoder. ***R.B.***

Ferguson 3787

A Ferguson 3787 colour portable was brought in with the complaint "set dead". When we carried out checks we found that the start-up circuit seemed to be doing its stuff but the soft-start/protection thyristor DU04, which provides the h.t. feed during normal running, was failing to come into operation. The cause was lack of pulses at its gate, due to RU16 (82Ω) in the pulse feed circuit having gone high in value. ***R.B.***

Pye 713 Chassis

A fault we've had on several of these sets is an intermittent reduction of height – by about an inch at the top and bottom. The cause has in each case been a dry-joint on the wiper connection to the height control R719. So before starting to change components, check this connection. ***K.H.-G.S.***

ITT CVC20 Chassis

Another preset we had trouble with recently was the line hold control (R710) on the sync/line oscillator subpanel in the ITT CVC20 chassis – the fault was loss of line lock and colour after the set had been on for some three hours. Gently prodding the control enabled us to produce the symptoms complained about.

Intermittent colour with the CVC20 chassis, especially on early versions, is often due to poor soldering between the print and the metal cross-members of the decoder panel, via which pin 16 of the TBA540 i.c. is earthed. Sometimes an intermittent dry-joint on the burst phase coil's leadout wires (L508) is responsible. ***K.H.-G.S.***

Hitachi CBP260

A new Hitachi set (Model CBP260 with 30AX tube, equivalent to the GEC C2659H) was unpacked for display in the shop. When it was switched on, there was a very narrow picture and a plume of smoke from the back. On investigation, R756 (30Ω, 1W) was found to have burnt up – it's between the EW driver and diode modulator circuits. There didn't seem to be any suggestion of a short-circuit, so a new resistor was fitted and the set was switched on again. Still the narrow picture, and still a very warm resistor. Close inspection of the panel then showed up a dry-joint on one leg of C751 (0·33μF), and on resoldering this a full width picture with no overheating was obtained – it's one of the scan-correction capacitors (there are four of them, connected in series-parallel. ***M.D.***

Pye Hybrid CTV Chassis

The problem with a Dynatron set fitted with the Pye hybrid colour chassis was excessive brightness. I've had this problem on many occasions in the past, often due to a faulty PL802 luminance output pentode or its 2·7kΩ anode load resistor R354 going open-circuit – another possibility is R397 (8·2kΩ) in the CDA clamp voltage potential divider network going open-circuit.

In this case the brightness control had no effect at all, and the beam limiter preset would reduce the brightness only very slightly, at one end of its track. The beam limiter circuit acts via the brightness control in these sets. As a first step, voltage readings were taken at the beam limiter transistor VT35. These all seemed to be in order, so I moved over to the brightness control network. There was a reasonable voltage difference across the control, and I then noticed that the slider is decoupled to chassis by a 12·5μF non-polarised electrolytic (C201). This turned out to have a very heavy leak, replacement curing the fault. ***M.D.***

TV Sound Receiver

Part 2

Luke Theodossiou

CONSTRUCTION of the receiver using the PCB designed for the project is very easy and should not present any difficulties. The circuit is so simple in fact that the use of a PCB is not essential – the original prototype performed extremely well when built up on a piece of Veroboard. The only section that's slightly critical is the preamplifier (Tr1 etc.). This should be constructed with care, using short lead lengths. In particular, keep the connection from the i.f. output as short as possible.

For those using the PCB, Fig. 1 shows the component layout. We suggest that the components mounted on the front panel are connected to the board before final installation, so that alignment can be carried out.

To set the receiver up, connect a good aerial to the unit and feed the output to an amplifier. Although the *Q* of the quadrature detector coil L2 is high, it should allow the selection of a signal at virtually any setting of its core. Tune to a station, then adjust the coil for maximum audio output consistent with minimum distortion. This is easy enough to do by ear, but those with the necessary test equipment can inject a 6MHz f.m. signal at the input to the ceramic filter and set up the coil before tuning to a station.

The tuner's i.f. output coil has little, if any, effect. It can be set up by inserting an 18dB (or greater if necessary) attenuator in the aerial lead, then adjusting the coil for the minimum background noise.

The unit works well with a moderate signal level, but for optimum performance a reasonably strong signal is necessary.

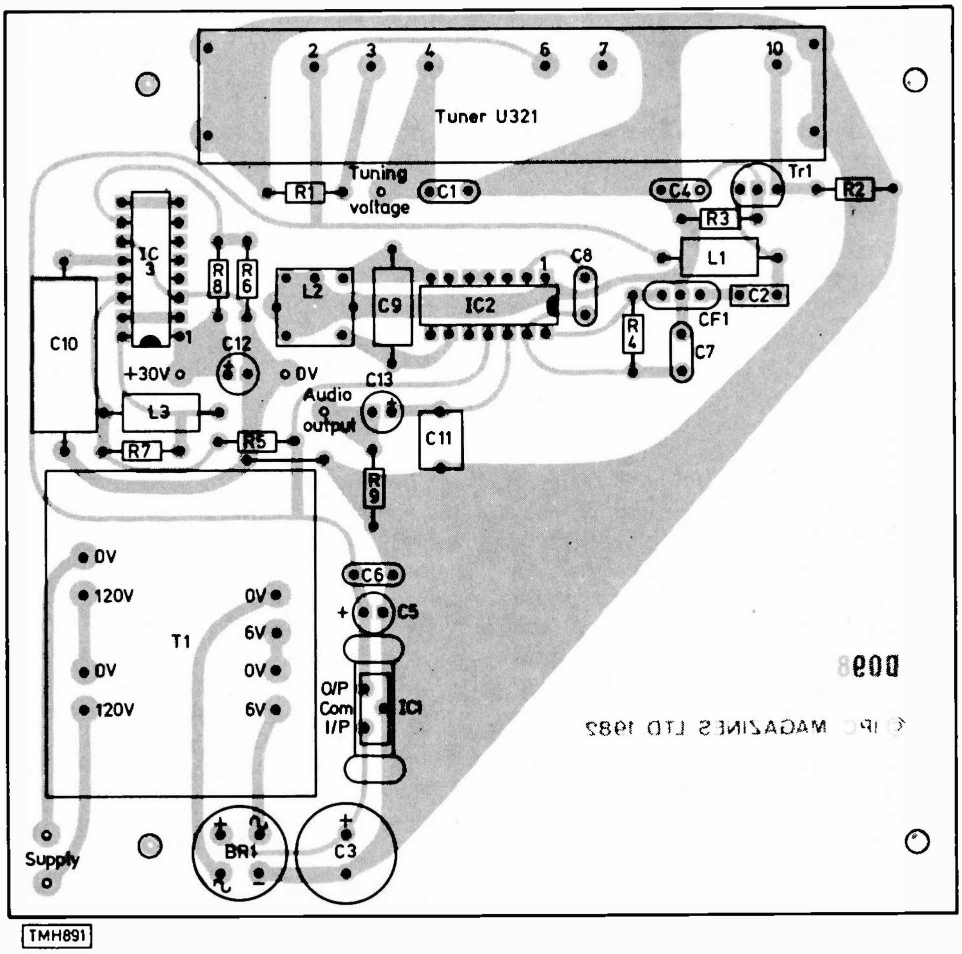


Fig. 1: TV sound receiver PCB component layout.

Letters

VHS COLOUR SYSTEM

I am finding Mike Phelan's articles on *VCR Servicing* extremely interesting and helpful. He is to be congratulated on tackling such a complex and at present ill-documented subject. I must however point out an error that occurred in the January instalment and was repeated in the February issue.

As I understand the VHS recording process and its chrominance crosstalk cancellation system, the "channel 1" recorded chroma signals merely have the normal PAL phase alternations while the "channel 2" chroma signal is in addition successively phase retarded by −90° line by line.

On playback the phase shift applied to the "channel 2" signal is also −90° line by line. In other words, the 627kHz off-tape "channel 2" chroma signal carries the successive −90° phase shifts placed upon it during record, and for correct up-conversion the 5·06MHz carrier must also be shifted by −90° in step. This gives a correctly phased 4·43MHz chroma signal.

I hope this helps clarify the situation. I can well appreciate how the confusion arose, since the information from the manufacturers themselves is often erroneous.

D. A. Peck, T.Eng. (C.E.I.), F.S.E.R.T.,
Senior Lecturer, Electronics Servicing Courses,
Southampton Technical College.

Mike Phelan writes: Right on both counts! The "channel 1/2" error started with Fig. 30 in the January issue. For "ch. 1" read "ch. 2" and vice versa in this figure and the relevant text.

As regards the chroma phase-shift paradox, the 5·06MHz carrier is indeed phase retarded on both record and playback on the "channel 2" tracks (contrary to what the JVC and Ferguson manuals say!). The phase-shifted carrier is subtractively mixed with the 4·43MHz chroma signal on record, so that the "ch. 2" 627kHz signal goes on to the tape phase shifted by −90° line by line. On playback we must advance the phase of the 627kHz signal to compensate. This is done by *retarding* the phase of the 5·06MHz carrier so that, when it is subtractively mixed with the off-tape 627kHz chroma signal, we get the correct 4·43MHz difference signal. As the two signals are phase shifted in the same direction, the relative phase between them is constant, i.e. the 4·43MHz signal remains of constant phase (apart from the PAL switching and the chroma modulation itself of course). A look at the circuit will show that the MN6061A i.c. which does the phase shifting cannot distinguish between record and playback.

Fig. 32 remains a valid depiction of the principle of chroma crosstalk cancellation in the VHS system.

RANK T20 CHASSIS

With reference to Mick Dutton's *Fault Report* (March), I've recently had the same trouble with a Rank T20 chassis, i.e. a dead set due to 4R16 being open-circuit. This seems to be a regular trouble spot – it was also noted by John Coombes in his article on the chassis in the June 1981 issue. We found some discolouration of the panel around the resistor, though the resistor itself looked sound enough. There's some 23V across 4R16, resulting in a dissipation of about 0·6W. This could account for its early failure. As the value (910Ω) is from the E24 range and not always available, I fitted two 1·8kΩ resistors in parallel, stacked one above the other: using 0·5W types reduces the dissipation in each, and should improve the reliability.

The circuit is in fact not a very good regulator. Better results can be obtained by using a 7812 regulator i.c., but this would require substantial modification.

M. A. Priestley,
Edinburgh.

CAPACITOR TROUBLES

Reading Mick Dutton's *Fault Report* (March), I was particularly interested in the comment "the fault was eventually traced to C710 (0·01μF) . . . which read perfectly on a capacitance bridge!" Such comments have occurred regularly in past editions of the magazine.

One is occasionally troubled by components (generally ceramic or electrolytic capacitors) that give a satisfactory indication on "normal" test equipment but refuse to perform correctly in the circuit being checked. This can cause much loss of time. It would be interesting to get some "in depth" case histories of components that fail to perform as requested in particular circuits. This would certainly help the service engineer, by possibly reducing the amount of time that has to be spent in the "grope" method of fault diagnosis.

J. O. N. Burrows,
Havant, Hants.

Editorial comment: We suspect that the component concerned had an intermittent high-resistance internal connection, which would not show up on a test of capacitance. Component reliability has been greatly increased in recent years of course, but hard-to-explain failures still occur to confuse all and sundry. We'd be interested to hear from any readers with experience in the component manufacturing/testing fields.

USEFUL GRIPPER

Here's a simple gadget that costs nothing to make and can be used instead of tweezers to retrieve screws, nuts and other small items from inaccessible parts of the innards of chassis. It can also be used to grip a small piece of foam or lint-free cloth for cleaning purposes.

Use an empty ball-point pen of the retractable kind. Any type will do, but for optimum usefulness it should be as long as possible and have a reasonably wide bore

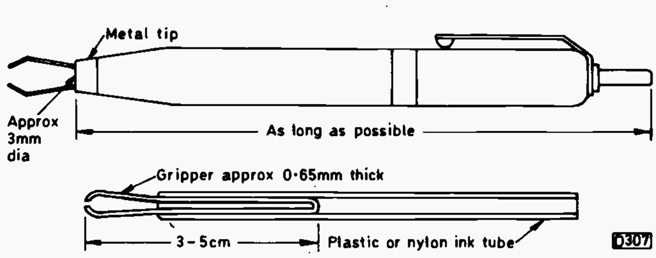


Fig. 1: Victor Rizzo's nut and bolt retriever.

at the tip (say 3mm). Bend in two a piece of chromium or nickel steel or even phosphor-bronze wire, about 6-10cm long and 0·65mm thick, shape it as shown in Fig. 1 and press it down the plastic or nylon ink tube after removing the writing tip. Reassemble the pen: if necessary, find the best position for the steel gripper by forcing it in or out of the tube.

Victor Rizzo,
Msida, Malta.

EMPLOYMENT CONDITIONS

After reading your interesting comments in the March leader I'd like to air my views on the subject of well trained engineers, salaries, etc.

My first point is not only that radio and television servicing is lowly paid – it's one of the lowest, according to a survey of salaries in the field of electronics carried out by the Electronic Engineering Institutions last year. I wonder how many engineers would agree that once you're trained in this relatively narrow field of electronics it's very difficult to obtain employment in any other branch of electronics? This is a point well noted by many employers when discontent about salaries, conditions, holidays etc. arises in the workshop.

The second point I'd like to make is about trade unions. As you said, most TV engineers tend to be "independely minded".

Good training with constant up-dating on new technology plus a fair salary, conditions etc. should ensure a continuous flow of "specialist" people from the colleges and so on who would enter and *stay* in this important field of electronics. The discontent many engineers feel would give way to a better working relationship between employer and employee, with all the benefits this would bring to both.

P. G. Dixon, T.Eng. (C.E.I.), A.F.S.E.R.T.,
Crawley, W. Sussex.

TESTER MODIFICATION

I built Mike Phelan's simple in-situ transistor tester (March 1981 issue) but used a different method of construction. The low-voltage secondary winding of a small 240V transformer was used as the oscillator coil, adding the 20 plus 20 tapped winding (see Fig. 2). The results are very good – I would not expect better using the original type of transformer. My main reason for writing however is to mention a slight modification which increases the usefulness of the device. This is the extra probe, marked X, which is connected via a current limiting resistor (R2) to the same point as the collector probe.

The idea is to connect probe X to one side of the circuit/device under test, then tap the other side with the emitter probe E. The pulses thus produced should make the neon flash momentarily. These flashes may be a bit dull at times, but with practice you will be able to judge them. Without the current limiting resistor R2 the flashes would be bright but the current drain would exceed 300mA. The current drain between X and E should be around 50-60mA. If it's higher, increase the value of R2. If you don't know the current drain, don't use a value less than 39Ω: try increasing the value a few ohms at a time, keeping the value as high as possible without losing the neon flash. The current drain varies for the different tests, from below 30mA to 50-60mA.

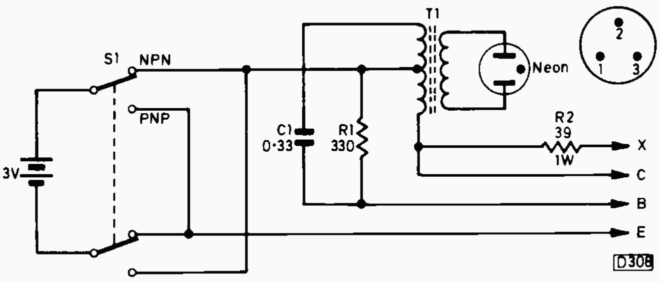


Fig. 2: Modified version of Mike Phelan's in-situ transistor tester devised by Walter Spencer, with an extra lead for additional tests. Walter reports using an 0·22μF capacitor in the C1 position and a 560Ω resistor in the R1 position – the values of these components are not critical.

Use the CBE probes for transistor testing (to check whether the transistor oscillates, lighting the neon). For all other tests (transistor base and polarity, continuity, diode and LED) use the X and E probes.

As an example of determining the base and polarity of an unknown transistor, refer to the numbered base shown on the right in Fig. 2. Connect any of the leads, say 2, to probe X, then tap the other two leads with the E probe. If the neon flashes when the E probe is connected to leads 1 and 3, the lead connected to probe X is the base and the polarity of the transistor is the same as that of the polarity switch S1. If the results differ, you could have the wrong polarity setting or probe X is not connected to the base.

Either polarity setting can be used when making continuity checks, but use the same one, say npn, for all tests. Connect probe X to one point and tap the other point with probe E. If the neon doesn't flash, the circuit is high-resistance or open. It's an idea to make some tests to get an idea of the results. The continuity of leads, fuses, light bulbs, toasters, irons etc. can be checked.

To check a diode, connect one end to probe X and tap the other end with probe E. A good diode will produce a flash with the probes one way round only.

A LED will light if correctly connected, the neon flashing when it goes out. If you use a red LED, you can with a bit of practice judge the condition of the tester's batteries.

Walter Spencer,
Brisbane, Australia.

SPARES AND ADVICE

Chris Avis (*Letters,* February) asks whether there are "kindred spirits out there?" Here's one, about four and a half light years away at Sedgley, West Midlands – which is maybe why my reply has been delayed a bit.

To overcome the manufacturer problem, you have to try to ensure that whoever is going to handle your request is first jerked out of the rigidity and boredom of their job and actually thinks. Give them a chance first, by sending a readable and concise message – with maybe a comment at the end expressing your delight at the splendid design of the thing for which you want the bit. If this fails, seal the second try in an envelope with the following written on the outside: "Please don't open this immediately: hand it, together with a cup of tea or coffee, to some responsible, technical person who will read it all and think about it before doing anything. Thank you for your help." It needs two envelopes of course, but always seems to work – though it might not if you overdo the exercise. As a recent example, I received a detailed reply in verse from the ladies (Jeannie and Grace) in the Sales Office at Rank-Rotel! Another approach is to send a case of whisky with the first order.

You mention the problems of a one man business. Yes, but it's very satisfying, isn't it? You feel needed. You have to be professional: let the job be perfect then, when it's finished, scrub it all over with hot water, using a one inch paint brush and some Daz. Pay attention to the tube surround, the corners and the grooves in the knobs. Apply teak oil if it's wood, and if it's a portable Brasso that miserable loop aerial at the back. When the owner's seen that the job is perfect, present him with a printed invoice made out in detail – and don't apologise for the charge. Don't tell him that you're honest and the bee's knees either – let them find out for themselves!

Although I work alone, I couldn't keep it up without my highly skilled staff. They sit on a shelf, keep quiet, don't ask for a teabreak or pilfer the stock – and I pay them, so gladly, 80p a month. I won't mention their names in case I accidentally miss anyone out. But one I will mention. When I've spent maybe hours on an intermittent fault, this obviously competent man, smiling at his own imagined idiocies, restores my soul: live for ever L.L.J!

R. S. Daynes,
Sedgley, Dudley.

VCR Servicing

Part 8

Mike Phelan

In Part 7 we discussed aerial amplifier, tuner and i.f. faults. We will now press on with other faults in the signal-handling parts of the machine.

Those new to VCR servicing often find difficulty in interpreting the fault symptoms, i.e. in distinguishing between mechanical and electronic faults and, with the latter, deciding in which part of the circuit the fault is likely to lie. Assuming some experience of TV servicing, one can say for a start that symptoms which are the same as those in a TV set will usually be due to the same fault, e.g. as we saw last month a faulty r.f. amplifier transistor in the VCR's tuner will produce a snowy picture. Things like lack of contrast will be caused by a fault, or maladjustment, in the luminance circuitry – but only in the part of the circuit where the luminance is not handled as an f.m. signal. It's important to ascertain whether the fault is on record, playback, or both – this will save a lot of unnecessary work.

Since a VCR does not contain timebases or a PAL decoder, there are a lot of things that cannot happen. This is a great consolation, but what we are getting at is that if we have something like line slip for example we can't say that the VCR's line oscillator is running at the wrong speed, because it doesn't have one. Just a minute though, it's the line oscillator in our TV set that's running at the wrong speed, so why? Because we are trying to get more – or less – than 312·5 lines into each field. In fact the head speed must be incorrect. If we get a fluorescent light on the bench and strobe the rotating head it should appear nearly stationary. A mark made with a black felt pen helps – but not on the head's working surface, please. Such mistakes are expensive.

We'll return later to servo faults. For now we'll concentrate on the signal circuits, especially the luminance channel. As most of this handles the signal in f.m. form, it's fair to say that if the fault lies in this area the symptoms will not bear any resemblance to typical TV faults. This is a useful but not hard and fast rule.

Heads and Preamplifiers

Since the video heads cause more problems than the rest of the circuit we'll start with these. At the first available opportunity it's a good idea to see what the picture looks like when replayed by a machine with only one head working – simply disconnect one of the head leads. On playing a prerecorded tape, the working head will provide a picture. It will be covered with noise from the head that isn't working however. This noise will not be like r.f. snow. It will consist of short, horizontal dashes of varying length: this is noise after it has been f.m. demodulated. The picture will probably be in monochrome as well, because the set will not like chroma on alternate fields only.

If the VCR is a basic JVC/Ferguson VHS machine, the waveform at TP7 on the pre-rec board will be as shown in Fig. 34. There will probably be noise on the sound too, as some of the noise components will fall within the passband of the sound carrier. Output from one head only means that either the head itself is defective or dirty or that one head preamplifier is not functioning. A quick check is to leave the scope connected to TP7 and place a wet finger lightly on the rotating head connections (the small PCB in the head). If the preamplifier is working, noise will appear in the blank field on the scope's display (see Fig. 35). If it doesn't, the preamplifier isn't working. Fault-finding shouldn't present much of a problem, as a screwdriver placed on various points in sequence should produce some effect on the screen – use the other preamplifier for comparison if necessary. You will probably have to unsolder the screening can. Pay particular attention to the switching transistors, both those for record/playback switching and those for alternate head switching. Also look at the rotary transformer's connections.

It is more than likely that the preamplifier is working and that the head itself is the cause of the trouble. It's possible on the other hand to have a fault that results in only one head recording a signal. The effect of course will be exactly like one head not working. To check, use a known good tape from a known good machine. There should not be much difficulty in tracing the cause of this

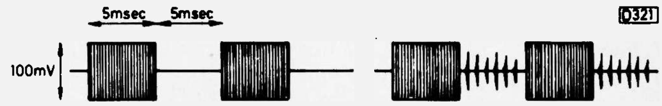


Fig. 34 (left): Output from one head only.
Fig. 35 (right): Noise test for head/preamplifier checking.

particular type of fault, since most of the record current amplifier is common to both channels. Again, don't forget the switching transistors – if one is not working, signal will be present on three out of the four head connections as one is not being earthed. Typical record signal level is 2 or 3V peak-to-peak of f.m. The chroma signal is about 100mV and rides on the edge of the f.m. carrier.

Head Troubles

The video heads can cause problems either through wear, damage or a build up of tape oxide. As far as VHS machines are concerned, the heads do not need cleaning in the normal course of events – the tape itself does this. If a machine is switched on when it is cold or damp however, or if the tape is damp, then either the tape will stick to the rotating head and get tangled up in the machine or oxide will be removed from the tape and will stick to the head (see Fig. 36). A piece of oxide of the size shown is enough to prevent any output from the head. If both heads are affected in the same way there'll be no picture, just "f.m. noise" as we'll call it.

We've found that the best way to clean the heads (this should fill the magazine's postbag!) is to put the machine into play and press a finger lightly against the part of the tape that's wrapped around the head drum. Do this until the picture clears, then stop the machine and examine the drum surface for oxide – especially near the slots in which the heads reside. Clean with tissue or chamois-leather moistened with alcohol or methylated spirit, and allow to dry for a few minutes before use. Be careful not to apply any pressure to the video heads – it's best to avoid touching them if possible – as the ferrite cracks very easily.

Worn heads give a rather different effect, mainly due to the fact that the change in shape alters the resonance. As both heads will usually be worn equally, the picture will show a rather poor l.f. response with no detail in the highlights – something like a flat c.r.t. without the defocusing. There will also be noise in the half-tones – this type of noise is caused by the head output falling off at the higher frequencies, and looks like grains of rice rather than snow. There will probably be inversion of whites, i.e. black streaks following a light object. This happens when the amount of noise entering the playback limiter is greater than the limiter can cope with, or if the f.m. output is excessive.

The best way to prove the point is to remove the head and examine it under a magnifying glass with a magnification factor of about ×12. The sort we use is a watchmaker's loupe, giving ×12 or ×3 magnification if the front part is unscrewed. With a new head, the ferrite

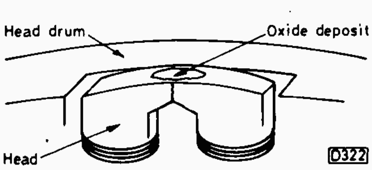


Fig. 36: An oxide deposit of the size shown will prevent any output from the head.

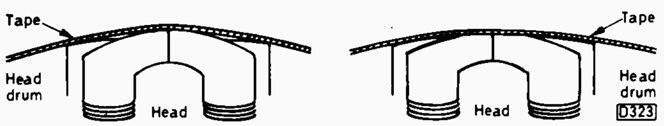


Fig. 37 (left): With a new head there's tape penetration.
Fig. 38 (right): Head worn to the same radius as the drum.

projects above the surface of the drum, so that a certain amount of tape penetration occurs (see Fig. 37). When worn, the curved part of the ferrite wears down to the larger radius of the drum (see Fig. 38) so that contact with the tape is erratic, giving a low and noisy f.m. signal output. On some machines, due to the shape of the head, the gap also becomes wider. As with audio, this causes poor h.f. response – but remember that it's f.m. we're dealing with, the highest carrier frequency corresponding with the picture highlights. This means that the bright parts of the picture become noisy and lacking in detail, due to the low f.m. carrier.

How much you allow the heads to wear before changing the drum is like the similar situation with a c.r.t. – it depends on the viewer's tolerance. The job of changing the drum is fairly simple with most machines – the Toshiba V5470 is a little involved however and requires the use of a dial gauge to adjust the eccentricity. The heads on this machine are in a narrow drum that rotates between two stationary drums. Cleaning is sometimes required as the tape pressure on the rotating part is less. The later Toshiba V8600 and the Sanyo VTC9300 have the ferrite parts of the heads projecting through a gap in a stationary cylinder, so there's no rotating metal part to get dirty. The V8600 has four video heads (more on this later) and gives a superb still frame – it also rewinds at a terrific speed!

Adjustments

A few adjustments have to be made after changing a video head drum, mainly due to the differing output and frequency response. On a VHS machine of the sort we've discussed earlier in this series there's a gain ("Q") and resonance adjustment for each head, also colour and f.m. balance and f.m. level controls. The last three must be adjusted using a good prerecorded tape – preferably the alignment tape. The two Q adjustments are best turned to the end of their travel giving the maximum signal at TP7 – turn to the other end and you'll get inversion (black streaks). To adjust the two resonance trimmers, choose a stationary picture with plenty of mid-grey (a test card is ideal), turn the colour off if necessary, and adjust for minimum " rice" on grey areas. A sharp null which also gives minimum black-after-white (ringing) will be found. I maintain that this method is as accurate as using the r.f. sweep on the alignment tape.

Adjust the controls for colour and f.m. balance and f.m. level as per the manual. It's instructive to turn the f.m. level control to maximum and then slowly reduce it to zero while observing the picture. The correct output for a Ferguson 3V00 is 400-500mV at TP7. Excessive output gives inversion, "rice" on grey areas and fringeing on edges. As the output is reduced the picture improves, with little change down to about 80mV. Noise then appears very suddenly and obliterates the whole picture.

If the colour balance is badly out of adjustment the colour will flicker and maybe break up into horizontal bars – depending on the tolerance of the TV set's decoder to alternate fields with no chroma signal!

Precaution

One last thing on the subject of heads: it's preferable to handle the working surfaces with cotton gloves to avoid fingermarks.

Next month we'll turn our attention to servicing the f.m. and chroma sections of the machine.

Long-distance Television

Roger Bunney

FEBRUARY was very active for the time of year, with Sporadic E, tropospheric, F2/TE and MS reception all being reported. At the start of the month Band III tropospheric signals from SR (Sweden), DR (Denmark) and NRK (Norway) were received in eastern England while Band I (chs. E3/4) and Band III (ch. E11) signals from RTVE (Spain) arrived in the south. More prolonged openings occurred over February 9-10th, with widespread reception in the south/east/midlands from TDF (France), NOS (Holland), BRT/RTB (Belgium) and both East and West Germany in Band III and at u.h.f. Nicholas Brown (Rugby) reported noise-free reception of French f.m. stereo radio transmissions in Band II: various u.h.f. TV signals were somewhat less stable. Reg Roper (Torpoint) had good French reception, using his home-constructed short-backfire aerial. There were more tropospheric signals on the 17-19th, mainly from the north/north east – Cyril Willis (Ely) received NRK on all Band III channels!

SpE reception occurred on various dates during the month, including the following:

30/1/82 RTVE chs. E2, 3, 4.
7/2/82 RTVE E2, 3, 4; RTP (Portugal) E2, 3; NRK E2, 3, 4.
13/2/82 NRK E2, 3.
14/2/82 RTVE E2, 3.
23/2/82 MTV-1 (Hungary) R1; also an unidentified ch. E4 signal at 2310 with the caption "Godthab-Lokal TV" (?).

Sunspot activity increased, improving the F2/TE conditions. The following reception was reported:

29/1/82 TSS (USSR) R1.
7-9/2/82 GBC (Ghana) E2.
14/2/82 ZTV (Zimbabwe) Gwelo E2 (F2, later TE).
16/2/82 ZTV E2; Dubai E2 (PM5544 pattern with identification "testing" at the bottom).
19/2/82 ZTV E2 1115-1245 GMT (PM5544 pattern with identification "ZTV" at the top and a digital time insert at centre right-hand).

The improved tropospheric conditions produced more reports of the new IBA TV4 transmitters being on test – Hannington ch. 66 has been on the air here locally. Hugh Cocks reports reception of several BFBS (British Forces) signals on the 9-10th, including chs. E23, 33 and 44 with vertical polarisation, also DFF (E. Germany) ch. E34.

During the SpE opening on the 7th, RTVE was noted with teletext signals in the field blanking interval (Antiope?). Following our report that TSS had been seen using the "Orbita III" identification with the "Vostok" network, "Orbita IV" has also been seen. Orbita III signals direct from the Stat-T satellite (at 754MHz) have been seen in Turkey and India – a computer readout from Arthur Milliken puts the craft's output at some 14·3° over the London horizon.

My thanks to the following who sent in reports this month: Hugh Cocks (Sussex), Arthur Milliken (Wigan), Nicholas Brown (Rugby), Mark Baldwin (Canterbury), Sam Faulkner (Burton-on-Trent), Cyril Willis (Ely), Ryn Muntjewerff (Holland), Reg Roper (Torpoint), David Moller (Eastbourne) and Garry Smith (Derby).

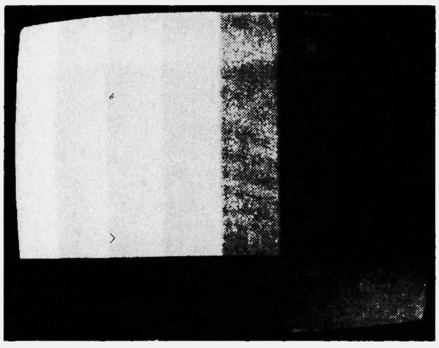
49MHz Walkie-talkies

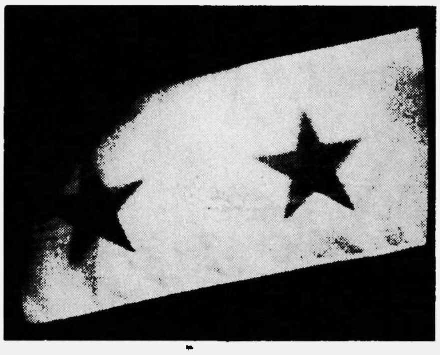
Following the statement from the Home Office quoted last month, I understand that a bill making it unlawful to sell "illegal to use" equipment has been "laid on the table" in Parliament. This procedure allows discussion of the bill by interested parties prior to first and second readings after which, assuming that there are no strong objections, the bill passes into law.

News Items

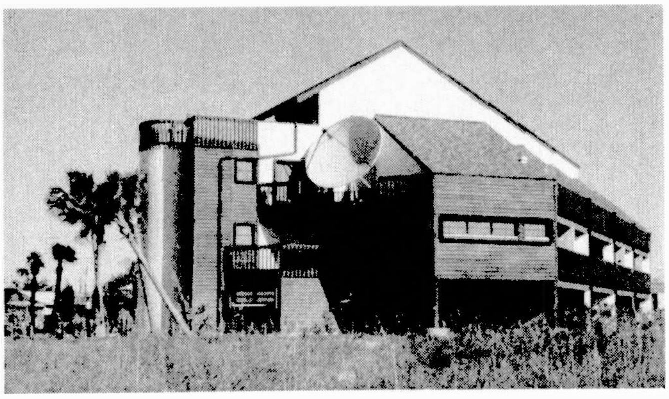
Syria: Thanks to Petri Pöppönen and a relation of his working in Syria we can provide up to date information on the Syrian TV broadcasting situation. There is a ch. E3 transmitter in operation, with considerable power, and the colour system is PAL. Subtitling is in very thick script, and a tape recorded in Syria has confirmed reception of Syria by at least two DXers (previously thought to be Jordan, which also uses ch. E3). Commercials are carried for many products, and during pauses in programmes slides of flowers are shown. The evening news is at 1830 GMT, and a colour-bar test pattern is used. The Syrian flag is shown, with anthem, and the reader from the Koran is shown seated at a table (unlike Dubai, whose reader is shown in close up with captions of the script in between). The news announcer is shown against a background with globe, which may appear on either side of the frame. According to other European loggings now confirmed, the ch. E3 station has been on air for at least two years.

W. Germany: Alexander Wiese reports that decoders for stereo TV sound are now on sale. There are two designs, one from ITT and the other from Körting. Both are priced at around DM500. The ITT unit incorporates a TV tuner with seven pretuned buttons and can be used to feed a stereo amplifier or headphones (a low-power amplifier is





The test pattern, flag and news announcer, Syrian TV ch. E3.



Holiday apartments with a three metre 4GHz dish aerial in position at St. Petersburg, Florida.

incorporated). The Körting unit has to be connected to a TV set but has a hi-fi stereo amplifier with bass and treble controls etc.

In brief: A new RTBF transmitter is in operation at Tournai, on ch. E63 with 20kW e.r.p. (vertical polarisation) . . . There is a report of reception of Greece in Holland last August via SpE: the PM5544 pattern with "EPT" identification in the top panel and a digital clock insertion slightly to the right of dead centre was seen.

Correction

Due to an editorial misunderstanding, there was an error in the item on the improved varicap notch filter (see March column). It's not the Grade 901 ferrite core that has a circular tag ring – it's the company (Denco) that stock circular tag rings (useful for carrying components atop a coil former!).

From our Correspondents . . .

Tony Harris (Fareham) has been on holiday recently in Florida and has sent in some interesting photos. One of them shows a 4GHz dish aerial on the balcony of a holiday apartment building, for the reception signals from one of the US TV satellites.

Sam Faulkner (Burton-on-Trent) reports mystery reception of the Irish RTE-1 ch. A (45·75MHz) using the PM5544 test pattern (hence the positive identification). He first noted the signal on August 14th last, at 1230 GMT, and subsequently saw it on August 30th at 0900. The same pattern was seen during good tropospheric conditions in November, with an aerial heading of 270°W. The mystery is that there is no listing of such a transmitter – and RTE are puzzled! Can any reader in Eire/N. Ireland throw any light on this? In parts of the country signals are taken off air and retransmitted on other channels (e.g. Presely Group B being down converted to Band III!), but this is the first instance of retransmission of RTE-1 by persons unknown at powers sufficient to reach the UK during good conditions. Anonymity will be observed if requested! During the excellent early/mid-December F2 conditions Sam logged several ch. A2 signals at good strengths, including the "AM" breakfast programme from CBC.

Mark Baldwin has been on holiday in Greece. He reports that the PM5544 pattern is used (see News Items above) by EPT and YENED. In the latter case there's a blank for a digital clock but the clock itself is not present. Test transmissions start at approximately 1500-1600, with programmes starting at 1600-1700. The continuity is very poor, with abrupt cuts into and out of programmes (no

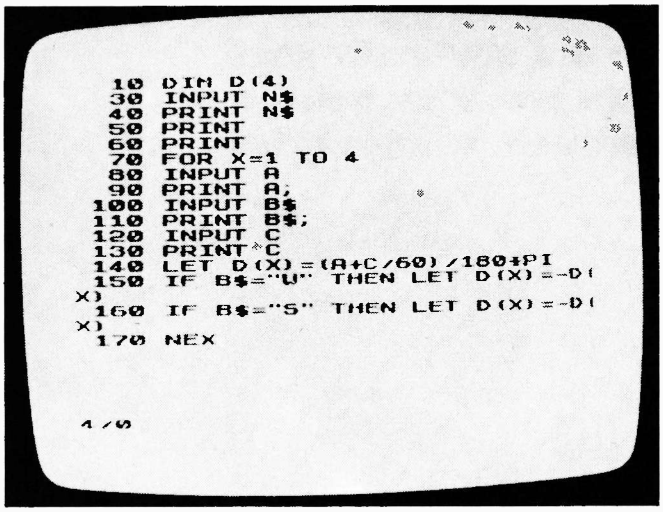


Photo 1: Part 1 of the programme (lines 10-160).

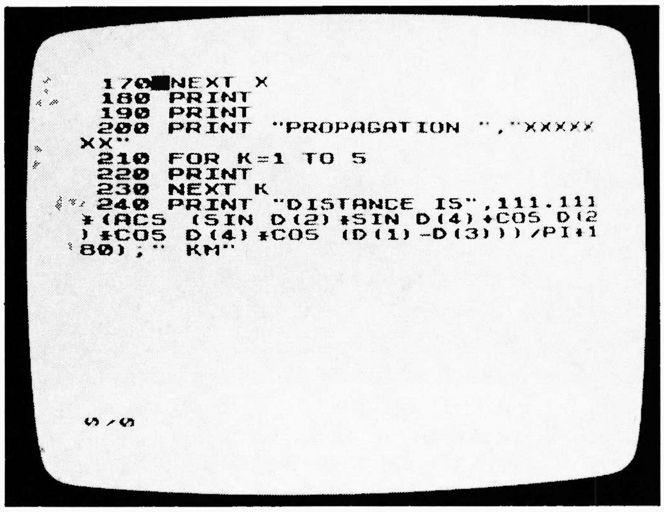


Photo 2: Part 2 of the programme (lines 170-240).

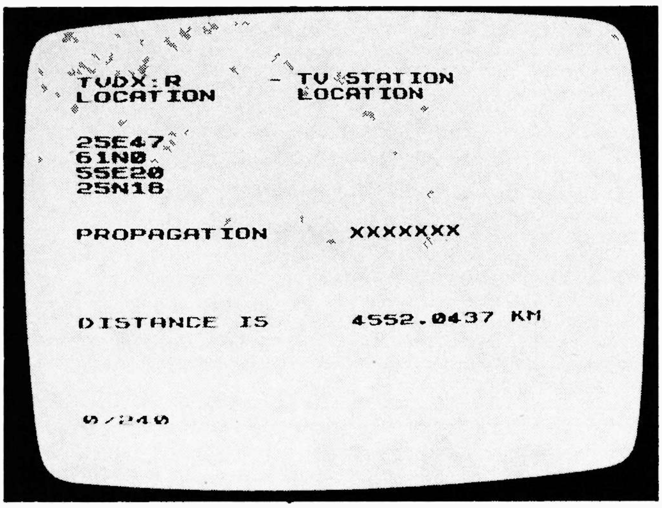


Photo 3: How the programme gives its results.

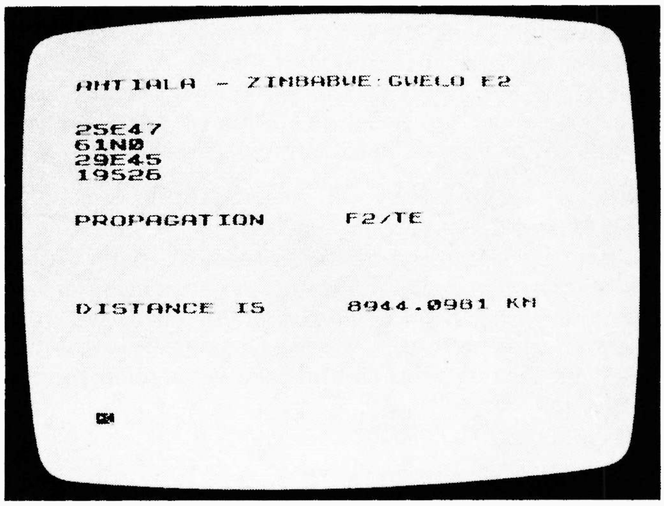


Photo 4: An example.

nice fades). Local programming often starts straight off with few captions and no music. Adjacent channels are used by YENED and EPT in the Athens area: this is a stiff test for any receiver's selectivity, and results in floating pictures. There are no signs of Band I aerials from Thessaloniki to Athens.

David Moller (Eastbourne) found all the u.h.f. channels swamped with French u.h.f. transmissions during the 9-10th period. He uses a modified Sony monochrome portable and a Philips teletext colour receiver in conjunction with an XG21W aerial and head amplifier. Apparently Boulogne is a constant high-level signal at Eastbourne, be it fine or wet!

Sinclair ZX81 Computer Programme

Petri Pöppönen has sent us a computer programme that enables the DXer to calculate the distance between his receiving site and a distant transmitter. The computer programme language used is BASIC. With some modifications, the programme might also work with other home computers. I'd be interested in hearing from anyone else who's been experimenting along these lines.

Variable N is the DXer's location and the TV station's location (write in via the keyboard when the programme has started). Variable A is the coordinate in degrees, variable B is S, E, N or W and variable C the coordinate in minutes. After propagation on line 200 there appears "XXXXXXX". The propagation type (SpE, MS, F2, tropospheric etc.) can be written here instead.

The programme goes like this:

(A) Write the whole programme (lines 10 to 240) into the ZX81's memory via the keyboard (see photos 1 and 2). Press RUN and 1 and 0 (RUN 10).
Press "new line" key. Cursor L appears on the screen.

(B) Write the names of the two places between which the distance is to be calculated.
Press new line key. Cursor K appears on the screen.

(C) Write east or west degrees of first place.
Press new line key. Cursor L appears on the screen.
Write letter E or W (east or west).
Press new line key. Cursor K appears on the screen.
Write east or west minutes of first place.
Pess new line key. Cursor K appears on the screen.
Write north or south degrees of first place then press new line key.
Write N or S then press new line key.
Write north or south minutes of first place.

(D) Press new line key and repeat all lines from (C) with coordinates of second place.

(E) Press new line key. Computer will show result on the screen.

The location coordinates of TV stations can be found in publications such as the EBU list of television stations (European broadcasting area).

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 381 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

THORN 3000 CHASSIS

The sound is distorted and the picture only just fills the screen, i.e. the performance is generally down. The h.t. line is o.k. at 61V, but the 30V supply line is low at 25V. Assuming that this was the cause of the trouble I replaced the two electrolytics C607/9 in the 30V regulator circuit. This produced no improvement so I decided to replace the SP8385 30V regulator transistor. The problem is that I can't get one! Would a BF458 do?

The SP8385 is available from Thorn and should be in stock at workshops where these chassis are dealt with. The BF458 won't do, but the readily available 2N5296 can be used. The transistor is probably o.k. however – the trouble is much more likely to be due to the 30V zener diode W605 (Texas Y969 or ITT Z3B300CF).

PHILIPS 320 CHASSIS

All I can get is a small picture about five inches square in the centre of the screen, with teletext and flyback lines at the top and a thin white line across the centre.

It's likely that the h.t. voltage at TP15 is way below its correct value (the circuit shows 163V, but a little below 160V gives improved reliability). If this is so, check the control stage in the thyristor regulated h.t. circuit. Suspect items are the 7·5V zener diode D5603, the BC147 transistor Tr5602, the BA154 diode D5608, and the resistors in the potential divider chain – R5630, R5631, R5632 and R5637.

TELEFUNKEN 709 CHASSIS

When the set is switched on the boost voltage rises to an excessive level, the set boost control R476 having no effect. Other voltages in the line output stage are wrong, for example the PL509's control grid voltage being a bit on the low side at −50V, and the waveforms are of low amplitude. Just about everything that could affect the boost voltage, in both the line output and the line oscillator stage, has been replaced without curing the problem. The odd thing is that after a time the boost voltage becomes normal, the PL509's control grid voltage rising to −90V.

As the boost voltage is high at switch on the line drive must be adequate – a voltage in the region of −50V at the PL509's control grid is a reasonable one to obtain using a universal meter. The VDR in the width circuit can cause unusual effects, and should not be overlooked. Another point worth attention is the fact that the print is very thin, so that it's possible for a break to cause trouble. A wire link from the VDR connects with a long section of print that terminates at pin 8 of the line output transformer. Check this section for continuity, as a hair line crack that's invisible to the naked eye often develops here. The high-value resistors in the width circuit are unlikely to be suspect as they usually go open-circuit in this chassis, causing low boost voltage.

NATIONAL TC85G

The trouble with this set is complete loss of colour. What steps would you advise?

The decoder in these sets is usually very reliable, so we can only suggest that you check through the circuits in logical sequence. First override the colour killer by turning R616 fully anticlockwise: this will enable the true nature of the fault to be seen. If there's still no colour, check that the 12V supply is present at pin 13 of the chroma i.c. (IC601). If not, check the 12V zener diode D604 – it has a habit of going short-circuit, pulling the line down to zero and making its feed resistor R628 get rather hot. If the 12V supply is present, check that the reference oscillator is working – there should be a 1·3V peak-to-peak 4·43MHz sinwave at pin 13 of IC602. If this is absent, suspect the i.c. If present, move back to the chroma signal path.

The chroma signal leaves IC601 at pin 3, passing via TR601 and the delay line to the MC1327 demodulator chip (IC603). Check that the chroma signal is present at the base of TR601 (test point B9). If not, suspect IC601. If the chroma signal is present, check TR201 (2SC1012A) and the MC1327 i.c.

If unsynchronised colour appears when the colour killer control is turned fully anticlockwise, check for the presence of the burst signal at test point B2. Absence of the burst signal means that either IC601 is faulty or the burst gate pulse (2·5V peak-to-peak) is not present at pin 16. If the burst is present, adjust the a.p.c. control R623 to lock the colour.

THORN 8000 CHASSIS

The problem started as flaring of the red to the right of any bright areas of the picture. This got worse, to the extent that the only way to get rid of it is to reduce the brightness, contrast or colour control settings. Increasing the brightness or contrast makes the picture flare to the extent that the picture disappears, leaving only a bright white raster.

This sort of thing is usually caused by incorrect d.c. levels in the RGB output stages. Check that the preset brightness control R205 is of the correct value and in good condition. Adjust it to eliminate the effect, compensating for any lack of brightness by adjusting the first anode controls on the c.r.t. base. If necessary, check the beam limiter diodes W601 and W602 – these are also on the c.r.t. base (the tube's grid voltages should not exceed 27V).

AUTOVOX 2684

The initial fault was the tube heaters alight but no sound or raster, with no a.c. feed from the mains input/degaussing board L to the power supply board S. This was traced to a defective stand-by switch (faulty spring!). Though there's now a.c. at the mains bridge rectifier and the two thyristors, I still get no results.

It seems that the thyristors are not being fired, and it's likely that the trigger pulse is missing. Confirm this then check back.

Feedback: Quite right! The BR101 SCS which fires to produce the trigger pulses had failed.

GEC 3133

The 18Ω resistor R203 in the supply to the TAA621 field output i.c. on panel PC602 keeps overheating. The only fault I could find was that the field flyback switching transistor TR201 was short-circuit emitter-to-collector. This was replaced, also the panel and C201 which decouples R203, but the overheating persists.

The main suspect is the TAA621 (IC252) – it's always been the cause when we've had this trouble. The only other possibilities we can think of are D206, which is in parallel with TR201, and the field scan coupling capacitor C211. It would be worth checking with an ohmmeter to ensure that there are no solder blobs or similar faults in the area of the field timebase.

INDESIT TC26LGB

The thyristor (D911) in the h.t. supply has failed. The type number is given as 2N4101, but this doesn't seem to be available. Can you suggest an alternative? The case doesn't matter as I can make a suitable heatsink.

The thyristor in this hybrid colour set is one of the elements in a regulated voltage doubler circuit, providing 270V, 260V and 245V h.t. lines. An alternative "three-legged" type is the 2N4444. A BT106 can be used if a stud type is preferred.

ITT VC200 CHASSIS

The initial problem was a faulty line output transformer. This was replaced and the set worked perfectly for about ten minutes. The sound and picture then faded out, leaving a blank raster. I've ascertained that the tuner is o.k., that the 20V supply to the signal circuits is correct, and that the voltages in the circuits following the vision detector are correct (within reasonable limits). Access to the transistors in the vision i.f. strip is not easy however.

The problem – failure of one of the transistors in the vision i.f. strip – occurs fairly regularly on this chassis. We suggest you replace all three transistors, using BF196s in the TX3 and TX4 positions and a BF197 in the TX5 position: the leadout connections will be correct if you insert the lockfit replacements ignoring the screen lead hole (fourth, to chassis) for the original disc-type transistors.

THORN 2000 CHASSIS

The line driver and the two line output transistors in this set have failed. The original types no longer seem to be available. Any suggestions?

The R2008B, used as the line output device in the 3500 chassis, can be used in these positions.

BEOVISION 3400

There's no raster and distorted sound. The upper 400mA fuse, in the h.t. feed to the main line output stage, was found to be open-circuit, also the fusible resistor 5R18 in the feed to the field output stage. A burnt paxolin smell was traced to an intermittent printed circuit fault where one of the line linearity coil damping resistors enters the board. When the upper 400mA fuse is removed, the sound returns to normal and the lower 400mA fuse holds.

The fact that 5R18 is open is probably due to the associated rectifier diode 5D2 being short-circuit – replace it if necessary with a BY127. Next check the PY500, PY88 and the two PL509 valves in the dual line output stage. Replace the top fuse with a 500mA anti-surge type (instead of 400mA), and the lower one with a new 400mA anti-surge type. This should get the set working. The line linearity control can then be adjusted for a somewhat wider picture – this will reduce the dissipation in the two damping resistors. If the top fuse continues to blow, the 8014039 line output/e.h.t. transformer is suspect.

THORN 1500 CHASSIS

The line and field hold became unstable, and I found that the preset line hold control R63 was getting very hot. The PCL805 field timebase and 30FL2 sync/line oscillator valves were replaced as they were found to be faulty when tested, but now the picture trips after about thirty seconds.

The usual cause of sync problems in this chassis is the sync separator's screen grid feed resistor R44 (47kΩ). Replace this and the associated resistor R47 (22kΩ) if necessary, also R63. The following components in the video output stage are also worth checking: the collector load resistors R40 and R41, and the h.t. supply decoupling capacitor C38 (12μF).

GRUNDIG 6011

The trouble with this set is that the brightness and colour controls are inoperative. A new luminance panel has been fitted, and the first anode presets can be adjusted to get red, blue or green pictures.

It seems likely that there's a fault in the beam limiter circuit, as a result of which the output from the TBA970 luminance i.c. is being turned down. The beam current is sensed by R521 (680Ω, 1W) with Di521 in parallel. Check these components and the coupling resistor R383 (3·9kΩ). There should be 0·5V at pin 8 of the TBA970. Also check fuse Si521 (50mAT) associated with the tripler.

THORN 8500 CHASSIS

There's a temperature-sensitive field fault on this set – after about two hours the picture creeps up from the bottom by about three inches.

The most likely cause of the trouble is thermal drift in one of the three transistors VT409/10/11 – the driver and output pair. The 10Ω output stage emitter resistors R457/8, and the bootstrap and scan coupling capacitors C438 (10μF) and C439 (160μF), are not above suspicion.

DECCA 30 SERIES CHASSIS

The trouble is light blue horizontal bands which flash intermittently across the screen. The effect may take the form of several thin blue bands, or sometimes half the screen becoming blue – or occasionally the whole screen. The fault occurs when the set has been on for an hour or so, and gets progressively worse. If the set is then switched off for a few minutes, it's o.k. again on switching back on. Sometimes the set works for a few days without the fault putting in an appearance.

This sort of thing is difficult to track down. We've often found the cause to be the blue output transistor TR215 (BF337). Check that the two presets VR316 and VR320 in the blue output stage work smoothly, then return them to their original positions. We assume that you've tapped and probed for dry-joints around TR215. If the fault persists, the MC1327P demodulator/matrixing i.c. could be responsible, or if you are very unlucky the c.r.t. could have an intermittent short-circuit in the blue gun.

PHILIPS G11 CHASSIS

Normal reception may last for up to two days, after which the set goes off tune. The set can then be retuned, but after half an hour or so the tuning reverts to the original position and has to be reset.

There's probably a dry-joint on the control panel – it doesn't take long to resolder them all. Also check that the 33V line at the stabiliser (TAA550 or equivalent) does not vary.

TEST CASE

233

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

We've been servicing ITT colour sets for over ten years now, and certainly thought we knew all the habits and failings of the hybrid chassis (CVC5-CVC9). One that came our way recently shook our complacency somewhat however. The tale is as follows.

The set was an early example of the breed, a 22in. Model CK601, fitted with the CVC5 chassis and in excellent condition – as most of these sets still are. The fault reported to us was a cramped and rolling picture. A new PCL805 field timebase valve will normally cure this one, along with a new pentode cathode decoupling capacitor C247f (250μF) if it's dried up or of the black type with silver markings. These components were replaced at the site. There was some improvement, but the fault was by no means cured. So it was that the set joined the queue for workshop attention.

When it's turn came we switched on and watched the test card as the set warmed up. The picture was rolling from the start, but by adjustment of the field hold control could be made to just hover. This revealed that the *top* of the picture was cramped – very unusual! As the set warmed up, we found that reasonable field linearity could be achieved by adjusting the linearity presets (the main linearity potentiometer had to be at one end), but the field hold control had very little range of adjustment, suggesting weak sync. After some deliberation we decided to put the set on one side to run on test: when it was thoroughly warm, we noticed cramping at the bottom of the picture.

We felt that these troubles must all stem from a common cause in the field timebase, but it was difficult to think of a single component that could be responsible for the three diverse symptoms along with the temperature-sensitive factor. Another valve was tried, and another 250μF decoupling electrolytic. The pentode's cathode bias resistor R351f (390Ω) was checked and found to be of the correct value. The afflictions remained.

As top cramp is rather unusual in this type of valve timebase, and when it does occur is in our experience usually due to the field output transformer, we next replaced this item. This operation is not one that's undertaken lightly, as the beastie has twelve connections. At the end of the operation the symptoms were virtually unchanged!

We began to have suspicions again about the biasing of the valve. The pentode's cathode current was checked, and found to be reasonably correct at about 47mA. This test exonerated many suspect components, but after checking the screen grid and h.t. voltages there was nothing left to do but start changing the many peripheral components around the valve. None of this made any difference . . .

The problem was finally solved with one snip of the sidecutters and no necessity for component replacement. What evil forces were at work here? Had the valve cooked its own goose? We'll leak the full story to you next month.

ANSWER TO TEST CASE 232
– page 322 last month –

A jittering h.t. line was our poser last month, the patient being a little Sony Model KV1300UB. As you'll recall, we'd established that the cause of the trouble lay in the switch-mode power supply. We'd made some initial but abortive tests on the error detector/amplifier transistor Q604 and some of its peripheral components.

Now normal h.t. line fluctuations will be taken care of by the fact that the chopper transistor and the error transistor form part of a closed control loop. It seemed likely therefore that the trouble was somewhere in the error-detector stage. We subsequently established that when the h.t. voltage fell Q604's base voltage rose. The root of all this evil was found to be the little temperature-compensating thermistor Th601 – it's a small bead-type component, and its resistance was fluctuating to the point where it would "talk" to us when connected to an ohmmeter! A new thermistor (type S-4700) restored a steady and stable picture.

We're thinking of starting a little black museum: this mini green monster would be a good candidate for display!

QUERY COUPON

Available until 19th May, 1982. One coupon, plus a £1·00 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 379.

TELEVISION MAY 1982

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

MAIL ORDER ADVERTISING

British Code of Advertising Practice
Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfill orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

Mail Order Protection Scheme
If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

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

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

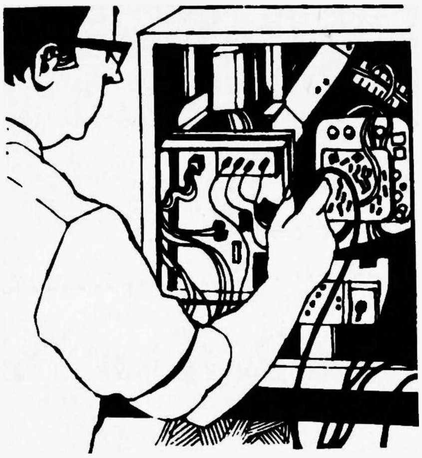
This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example, payment made in response to catalogues etc., received as a result of answering such advertisements. Classified advertisements are excluded."

SMALL ADS

The prepaid rate for classified advertisements is 29p per word (minimum 12 words), box number 60p extra. Semi-display setting £5.64 per single column centimetre (minimum 2·5 cms) All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television, Room 2612, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

NOTICE TO READERS

Whilst prices of goods shown in classified advertisements are correct at the time of closing for press, readers are advised to check with the advertiser to check both prices and availability of goods before ordering from non-current issues of the magazine.



SETS & COMPONENTS

TRADE TELEVISIONS. Decca, I.T.T., Korting, Thorn E.T.C. Colour/mono. Best prices, best sets. (070682) 3845.

COLOUR T.V.s

PHILIPS G8 COMPLETE

22" £45 26" £55

DISCOUNT FOR BULK BUYERS

TEL: 965 1230 & 961 3997

SMITH ELECTRONICS

43–43A, PARK PARADE, HARLESDEN, LONDON N.W.10.

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

UPCONVERTERS

Wideband VHF to UHF Converter 12 volt supply required. Simple connection. Ideal Eire, overseas use **£11.90** inc. p.p.
TVDX Equipment Amplifiers filters. Special DX Upconverter.
SAE Data, lists:
H. Cocks, Cripps Corner, Robertsbridge, Sussex. Tel. 058083 317.

SUFFOLK TUBES LIMITED

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

SUPPLIERS OF MONO AND COLOUR TUBES TO MAJOR RENTAL COMPANIES.

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

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

BRITAINS LARGEST INDEPENDENT REBUILDER FOR 21 YEARS.

T.V. SPARES, PANELS AND MANUALS
PHILIPS · GRUNDIG

TELEVIEW 01-994 5537
194, Acton Lane, London W.4.

A1 TUBES. High quality rebuilt Tubes. 18 month guarantee. From £22. Please phone 0706 523415 Monday-Saturday.

COLOUR AND MONO TV's

	Comp with tested CRT	Comp untested
Thorn 8/8½K, G8, Grundig etc.	**£30**	**£25**
Bush, Telpro, Decca	**£25**	**£20**
Pye & GEC Hybrid	**£14**	**£9**
Korting, A' Bush	**£15**	**£10**

Good working Decca Bradford **£30** each. Good working single standard mono **£9** each. Untested **10p,** slots **£2** each. Thousands of panels @ **50p** each. Fully tested tubes – any standard size **£10.** Tested colour valves – Output valves **50p** each; Small valves **20p** each

LAVITE LTD.
Viaduct Mills, Market Street, Milnsbridge, Huddersfield. Tel. 0484 643273.
(Callers by prior appointment).

Tel: Northwood 27019 01-845 2036
RETACH LTD. Rear 78 High St, Northwood, Middx.
COLOUR SET RANK & THORN.............from £20
COLOUR TUBES REBUILT 2yr guar.......from £28
RANK PANEL (TESTED OK)

DECODER	£11	POWER SUPPLY	£6
TIME BASE	£11	CONVERGENCE	£6
IF	£9	TUNERS	£5

ALL PRICE + VAT

CLEARANCE SALE OF SERVICE SHEETS, 1p each. S.A.E. for details. Hamiltons, 47, Bohemia Road, St. Leonards, Sussex.

CAMPBELL ELECTRONICS LTD.
Distributors of specialist spares to radio and television service depts.

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

Fast off the shelf delivery of stock items.

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

CAMPBELL ELECTRONICS LTD., Unit 5, Heath Hill Estate, Dawley, Telford, Shropshire. Telephone Telford (0952) 502422.

T.V.s FOR EXPORT

We have a selection of Bush and Ferguson colour T.V.s in good working order.

VHF/UHF suitable for countries using PAL system. We also supply The Home Market.

Write:
Tele Spares Ltd.,
7 Walkinstown Road,
Dublin 12, Ireland.
Tel: Dublin 520485.

When replying to Television Classified Advertisements please ensure:

(A) That you have clearly stated your requirements.
(B) That you have enclosed the right remittance.
(C) That your name and address is written in block capitals, and
(D) That your letter is correctly addressed to the advertiser.

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

CAMPBELL ELECTRONICS LTD.
COLOUR T.V. PANEL EXCHANGE/ REPAIR SERVICE

THORN, RANK, PHILIPS, GEC, DECCA, TELPRO, GRUNDIG etc.

90 Day Guarantee on all repairs – same day postal service.

Telephone Telford (0952) 502422
for catalogue and price list.

CAMPBELL ELECTRONICS LTD.,
Unit 5, Heath Hill Estate, Dawley, Telford, Shropshire.

TURN YOUR SURPLUS capacitors, transistors, etc., into cash. Contact Coles-Harding & Co., 103 South Brink, Wisbech, Cambs. 0945 4188. Immediate settlement.

TELFURB T.V. LTD.,

PHILIPS G8, 570. ITT. PYE 262, CT200. BUSH. THORN 8800, 8500, 3500. GEC 2110. DECCA VARI. TOSHIBA & MONO. PLUS REFURBISHED SETS TO ORDER.

RING:

WHEATLEY, OXFORD
086-77-3849

PYE 205's reconditioned with all mod's, ready for sale, good cabinets £46.00. Free delivery, five or over. (0827) 874007. A. T. SERVICES, 27, Laburnum, Kingsbury, North Wark's. Callers by Appointment.

GRUNDIG, NORDMENDE, small quantities complete sets, also panels (tested). Telephone 0785 814643.

TV DX SPECIAL OFFER!

Schrader, tunable masthead amplifiers.

UHF. RB45-M4 ch. 21-65. Gain 22-26dB. Noise ratio 3.5dB. Bandwidth 10-15mHz. max. overload 10Mv. incl. power/tuning supply VR12/01 **£34.50.**

UHF. RB45A-M4 (incl. amateurband) ch. 17-65. incl. power/tuning supply VR12/01 **£39.50.**

VHF. RB3. ch. 5-11. Gain 26-30dB. Noise ratio 2.5dB. Bandwidth 10-15mHz. max. overload 10mV. incl. power/tuning supply VR12/01 **£44.50.**

Extra for power/tuning supply incl. 6 presets **£13.50.**

VHF UHF P.S. incl. set side VV1/01 2×6dB. **£7.50.** VV1 2×12dB. **£9.50.**

CRT reactivator. excluding CRT socket. Works beautifully **£20.00.**

Prices incl. P&P. Send SAE for catalogue.

REYSTRONICS,
28 Pemberton Road, East Molesey, Surrey. Phone 01-979 7380.

CASED ISOLATION TRANSFORMERS 500W max suitable TV work £8.00 + £2.85. Good Working Test Equipment P.S.U.s List Tel. (0396) 841631, or write S.H.E. 5, St. Joseph's Park, Ballycruttle, Downpatrick BT30 7EN.

QUALITY REBUILT TUBES

HIGH TEMPERATURE PUMPING

COLOUR (2 year Guarantee)

90° up to 19"	**£33**
90° 20" – 22"	**£35**
90° 25" – 26"	**£36**
110° and PIL	**£40**

MONO (including thin necks) from **£14.**

All prices + VAT

Delivery UK Mainland £6.

4 year Optional Guarantee

Send or phone for full list and terms.

WELTECH PICTURE TUBES
Unit 3-10 Wembley Commercial Centre, East Lane, Wembley, Middx. 01-908-1816

RANK BUSH MURPHY
TV Panels Repair,

By ex RRI expert engineers. Same day return with 100 days guarantee. 823, Z718, 179, T20, T26 chassis covered. Contact for price list & economise.

T.K. Panels Service,
31 Leaves Spring, Stevenage, Herts. Tel: 0438 61567.

COLOUR TUBES £25

2 for £46 – 22" (A56) 20" (A51) re-gunned to a high standard with one year guarantee. Guaranteed slightly used 20"-22" tubes £15 each. 2 for £28 with 3 month guarantee. All jig tested.

Prices inclusive, plus £6 delivery per tube (UK mainland). No need to spend £6 returning old tube if you buy from us.

CASH & CARRY ONLY

17", 18", 19" £29. 20", 22" £25. 26" £35. In line tubes re-built. New mono tubes £14.

Callers Ring First

U-VIEW (TUBES)
29 Warmsworth Rd., Doncaster Yorkshire DN4 0RP
Tel: (0302) 855017 (Open 7 days)

VETERAN & VINTAGE

VARIOUS 1940s, 1950s TELEVISION and Radio Sets, parts, oddments. Shrewsbury 64187 for list.

"SOUNDS VINTAGE"

The only magazine for all vintage sound enthusiasts packed with articles by top writers, covering gramophones, phonographs, 78s, wireless, news, history, reviews, etc.

All back numbers to No. 1 available. Send 75p for sample copy.

28 Chestwood Close, Billericay, Essex

SERVICE SHEETS

Thousands of different full size service sheets Thousands of different manuals of all kinds in stock.
(Many of above are unique to us and obtainable nowhere else.) Any published single service sheet still only £1 + s.a.e.
British CTV circuit/layouts from dual to latest from Decca, G.E.C., ITT, Philips, Pye, Rank, Thorn, etc.
Continually updated – 3 giant binders only **£39.50** – latest update includes Thorn 9200 to 9800.
Revised foreign C.T.V. Repair System in 2 huge binders plus 3 Repair Manuals for £39.50.
Contains chassis from Grundig, Hitachi, Korting, Kuba, Luxor, Mitsubishi, National P., Nordmende, Sharp, Skantic, Toshiba, Zanussi.
Any Repair Manual only £6.50 for the first – £6 each thereafter.
Save £6.50 on complete set of 11 unique TV repair manuals – only £60. Mono +colour from dual standards to recent sets, McCourt & Tunbridge.
***NEW* Tunbridge Portable Mono TV Repair Manual – Pre Publishing Offer at £5.50 each (save £1).**
***NEW* Full details HOW TO BUILD YOUR OWN TRANSISTOR/DIODE TESTER – price £1.50 post free.**
S.A.E. any quotation, also price lists, newsletter, bargain offers, details of our unique TV repair systems. Service sheets and all stock manuals by return of post.
Phone: 0698 883334, anytime. Callers 4–6 pm. weekdays, Saturdays 11 am.–1pm only.

G.T. TECHNICAL INFORMATION SERVICE
76 CHURCH ST., LARKHALL, LANARKSHIRE ML9 1HE.

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

TV Monos, Radios, **£2.00.** Tuners **£2.00.** Tape Recorders, Record Players **£2.00.** Transistors, Stereograms & Music Centres **£2.00** + SAE. Also Colour Available. Car Radios **£3.00** + SAE. All Radiograms **£2.00.** State if Circuit will do if sheets are not in stock. All TV Sheets are full-length 24×12, not in Bits & Pieces. All other Data full-lengths.
TV Catalogue with order. All Sheets **£2.00** except Colour. Old Valve Radios
C. CARANNA, 71 BEAUFORT PARK, LONDON NW11 6BX. 01-458 4882 **MAIL ORDER S.A.E.**

SANDHURST PUBLICATIONS
Television Service Sheet Specialists

Workshop Manuals, large selection of Japanese and European TV Sheets. Callers 5.30-7.00 pm. Send S.A.E. for Catalogue and Enquiries:

49C Yorktown Road, Sandhurst, Camberley, Surrey GU17 7AG.

CLEARANCE SALE OF SERVICE SHEETS, 1p each. S.A.E. for details. Hamiltons, 47, Bohemia Road, St. Leonards, Sussex.

SERVICE SHEETS, Radio, TV, etc., 10,000 models. Catalogue 25p plus SAE with orders-enquiries. Telray, 5 Henderson Street, Preston PR1 7XP.

COURSES

VIDEORECORDER TRAINING COURSE. Yet another super technical training course for TV engineers who want to learn about videorecorders. Saturday and Sunday 24th and 25th April 1982. For details contact Mrs. Beeching, Newark Video Centre, 108 London Road, Balderton, Newark, Notts. Tel. (0636) 71475.

BOOKS & PUBLICATIONS

ANY PUBLISHED SERVICE SHEET £1 + S.A.E. Thousands different repair/service manuals/sheets in stock. Repair data your named TV £6.50 (with circuits £8.50). S.A.E. Newsletter, price lists, quotations. AUST, 76 Church Street, Larkhall, Lanarkshire. (0698 883334).

PERSONAL

FREELANCE Colour Service Engineer available for Contract work in West/South Yorkshire. Own w/shop and equipment. Mr. Pearson. 0484-863489.

EDUCATIONAL

TELEVISION COMPUTER RADIOCOMMUNICATIONS & RADAR SERVICING

2⅓ YEAR full-time Modular Diploma course to include a high percentage of practical work.

- ELECTRONIC PRINCIPLES
- MONO TV & CCTV
- COLOUR TV & VCR
- MICROELECTRONICS & DIGITAL TECHNIQUES
- MICROPROCESSORS & COMPUTERS
- RADIOCOMMUNICATIONS & RADAR

Each of the above Modules are 13 weeks in duration. Individual Modules can be arranged for applicants with suitable electronics background.

Subject to approval, students will be awarded a TEC Diploma in Electronics & Communication Engineering on Completion of the full course.

Next session starts April 19th.

Prospectus from:

LONDON ELECTRONICS COLLEGE

Dept: PP, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.

MISCELLANEOUS

C.E.D. C.R.T. Tester reactivator suitable for most types of colour and mono including P.I.L., 20AX, Jap narrow neck, and Toshiba in line types, tests emission, checks and measures inter electrode leakage, incorporates a highly effective reactivation facility. Not a kit but a much praised professional instrument. £89.70 inc. VAT 12 months guarantee, and comes with a 10 day money back assurance. C.E. Developments, 54 Baronsmead Road, High Wycombe, Bucks HP12 3PG. Tel. High Wycombe 30307.

SECOND HAND COLOUR TV SPARES AND TUBES
MOST MAKES
Telephone:
Southport (0704) 74411
anytime

CENTURION BURGLAR ALARM EQUIPMENT. Send SAE for free list or a cheque/PO for £11.50 for our special offer of a full sized signwritten bell cover, to: Centurion Dept. T.E.L., 265 Wakefield Road, Huddersfield, W. Yorkshire. Access & Barclaycard telephone orders on 0484-35527.

CTV2. Tubular Degausser as supplied to Colleges and rental companies only 11″×1½″ 200-240v, £15.00 + £1.90 P&P. I.T.S., 97 Marton Drive, Blackpool, Lancs. Tel. 0253 65089.

BURGLAR ALARM EQUIPMENT. Latest Discount catalogue out now. Phone C.W.A.S. Alarm. 0274 682674.

BRISTOL WHOLESALE TELEVISION Mono T.V.'s from £5. Colour T.V.'s Pye, GEC, Philips, RBM, ITT, from £25. Phone Bristol (0272) 556735. 47 West Street, Old Market, Bristol.

TOOL KITS

For the engineer who's into I.C's Show your customer you have the tools for the job by using our executive style case and tools.

Each contains:
Pen and paper folder, Mini soldering iron 240v, Mini cutters, round nose pliers, snipe nose pliers, solder pump, 6″ plain inspection mirror, 3″ cross point, 4″ screwdriver, 2½″ screwdriver, 2½″ cross point, component box and spare side space. Case 395×280mm. Complete case **£52.50.** p&p £2.50. (Minus tools, case plus comp box £20.00.) (Money refund if disatisfied.)

KITONICS
7 The Meadows, Berwick-Upon-Tweed.

FOR SALE

RANK A823 Series Service Jig. As New. £150 or exchange VCR or Test Equipment. Tel. Cardiff (0222) 617245.

OSCILLOSCOPES. Marconi TD2200 Dual Delay Timebase. Marconi TF1330 Dual Beam. Solartron CD1400 Dual Beam. Telephone (0376) 22567.

"TELEVISION" January 1970 to February 1980. Less 8 issues, CVC5 manual, Radio Valve Data, 8th edition, WRTH 1971. Offers 0568 3727.

RADIO AND TELEVISION servicing 1956-69. Good condition. £40. Tel. Torquay (0803) 34691.

PHILIPS G9. 26″ touch tuner TV with unused Philips remote control teletext kit plus manual. £155.00. 01-540 9553.

FERGUSSON, BUSH. Complete sets and spares too much to list. Private sale. Reading 724002.

£15,000 PLUS VAT buys 100 TV Rentals Realising £10,000 Gross P.A. Scope for expansion. Bristol area. Box TV 168.

TELEVISION MAGAZINES January 1970 to March 1982 – £35. Telepart colour bar generator as new – £25. Newark 71873.

MAIL ORDER T.V.'s, Pye 205's, good tubes and cabinets, all modifications, reconditioned, £46.00 and £12.00 P&P. A. T. SERVICES, 27 Laburnum, Kingsbury, North Wark's. (0827) 874007. Callers by appointment.

WANTED

"TELEVISION" Sept. 1972 and Nov. 1973. EADE, West Gerinish, South Uist, Western Isles, Scotland PA81 5RW. 0870 5239.

WANTED! Tube Regunning Plant complete system with full training. Yosipovich, 106 Morkel Road, Lyndhurst 2192 JHB, South Africa.

WANTED S/HAND Double Beam Oscilloscope in good working order. Phone Rochdale 54983

WANTED. Test Gear, Servicing Books, Diagrams. Phone Bacup, Lancashire 876779 or write 30, Oakenclough Road, Bacup.

DISPLAY ELECTRONICS

LEADERS IN TUBE TECHNOLOGY SINCE THE 60's.

REGUNNED COLOUR TUBES
2 YEAR GUARANTEE

Up to 19″ **£33.00**
22″ **£36.00**
26″ **£39.00**

The above prices are for standard 38mm Delta Gun Types. Add £3 Gun surcharge for 20AX Types. Other in-line & P.I.L. Types, prices on application.

MONO TUBES
2 YEAR GUARANTEE

20″ **£12.00**
24″ **£14.00**

BUDGET CORNER

Buy any 5 mixed types Cash 'n Collect – Take 20% discount.

PRICES EXCLUDE VAT

CALLERS WELCOME

Late night Thursdays until 8pm Saturdays until midday.

N.B. Customers intending to collect orders are requested to telephone in advance:— even popular types may be out of stock for short periods.

WATERLOO ROAD, UXBRIDGE, MIDDLESEX

Telephone: Uxbridge 55800

TUNERS

THORN 1043	£5.00
ELC 1042	£5.00
ELC 2000	£7.00
ELC 2004	£7.00
ELC 2060	£7.00
NSF AEG UHF/VHF	£4.50
NSF 1043 on Panel	£5.00
MULLARD U314	£5.00
MULLARD U321	£6.00
MULLARD U322	£6.00
G8 Tuners	£7.00
GEC Rotary Tuner	£2.50
MOSS FIT UHF/VHF DXT Tuner Unit	£9.00
Small DX Tuner V/capp 175-220MHz auto changeover	£5.00
V/capp Tuner 50-300MHz auto changeover	£4.00
V/capp Sylvania T/units VHF/ UHF	£4.00
V/capp Sylvania T/units VHF	£3.00
F6013 Rank Set	
DECCA Bradford Tuner 5 button	£2.75
SONY KV 1400 Tuner Unit	£4.00
VHF Modulator CCIR	£3.00
THORN 9000 Tuner on Panel	£7.00
9000 Frame Panel	£7.00
SANYO Rotary Tuner	£4.00

MODULES

LP1173 10 watt Seconds	£1.00
LP1173 10 watt New	£2.00
LP1170 Seconds	50p
LP1179 Seconds	50p
LP1162 New PYE OUTPUT STAGE	£1.50

TRIPLES

GEC 2028 Tripler	£2.50
GEC 2040 Tripler	£2.50
DECCA 80 Tripler	£2.50
PYE TBQ	£1.50
DECCA 80	£4.00
TBZ fits GEC 1028, 2028, 1040, 1060, CS108	£4.00
G9	£4.00
CVC 20/25/30	£3.50
THORN 9000	£4.50
THORN 9500	£3.50
GEC 2110	£3.50
LP1194	£3.50
GEC 2100	£3.00
LP1174/NC	£3.50
GRUNDIG TVK52	£3.50
ITT BG 100/41	£3.00
BG 100/61	£3.00
TBW fits Autovox, Saba, Grundig, Tanberg	£4.00
TCZ	£2.50
TAU	£1.25

FOCUS UNITS

THORN 8500	£1.00
THORN 3500	£1.00
DECCA Large	£1.00
DECCA Small	£1.00
ITT CVC 40	60p

MAINS DROPPERS

PYE 69-161	40p
PYE 731 3+56+27R	50p
THORN 50R-40R-1K5	50p
Mains Dropper 50R-17R-1K5	50p
Coax Plugs	12p
De-solder Pumps	£4.00
Aerial Socket and Lead	35p
Pye, Thorn, ITT, Thyristor, Philips G11 G122	60p
RANK TOSHIBA Tube Bases	30p

SPEAKERS

6×4 G11	25 ohm	£1.00
5½×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
5×3	15 ohm	80p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
8×5	16 ohm	£1.50

MULTI-CAPS

2500/2500/63V	50p
470/470/250V	50p
150/200/200/300V	70p
100/200/325V	40p
400/200/200/350V	£1.50
800/250V	40p
700/350V	50p
600/300V Pye, Bush, GEC	£1.00
200/200/100/300V	60p
200/200/100/32 325V	£1.00
100M+300M+200+100M+16M 350V	£2.00
400/400V	40p
220/450V	40p
4700/25V	25p

CONDENSERS

15M/63	5p
750/50V	10p
470/25V	5p
220/40V	5p
4/350V	5p
8/350V	5p
8/300V	8p
680/40V and 25V	5p
47/250V	10p
33/450V	15p
2200/25V	10p
·1/800	10p
·1/1000V	10p
·1/200V	15p
·47/1000	30p
·01/1000V	10p
22/375V	15p
·047/1250V	10p
·0047/1500V	10p
1N8-1500V	10p
1500M 35V	7p
32 MFD 300V	10p
2N2-1500V	10p
8N2-1500V	10p
6N2-2000V	10p
ITT CV5 7 Push Button Unit	£7.00

PYE 6 P/B Unit	£6.00
PYE 731 6 P/B Unit	£2.00
4 Push Button Unit	50p
THORN 1400/1500 4 P/B Unit Mech	£7.00
GEC 8 Channel Touch Tune Unit	£4.50
XK3123 4000 THORN Diode	50p
FT3055	20p
BD116	25p
A1 Dioder 3500	10p
BU137T	£1.00
BUY69 (RCA 1693)	80p
THORN Transductor	£1.00
Transductor AT404/41	50p
Front End Music Centre VHF/MW/LW Size 13×3½	£5.00
Output stage for music centre	£5.00
Sony 1400kV Chroma Panel	£6.00
Tuner Unit Sony	£3.50
Touch Button Sony	£3.50
ORP 12	40p
AD 161/162	60p pair
BY212	10p
NPN PNP 660/661	20p
5·5MHz Filters	15p
6MHz Filters	25p
TV 11 EHT REC	25p
TV 12 EHT REC	30p
TV 13 EHT REC	25p
TV 14 EHT REC	40p
TV 18 EHT REC	40p
100K 40 Turn Pots G9-G11 Thorn	20p
3500 6 Push Button	£1.00
NE 2B6H Small Neon Lamps, GEC	5p
20 small LEDs	£1.00
TV XTALs 4·433-619KHz	50p
TV XTALs 8867-238KHz	40p
6MHz Crystal	50p
Infra Red Emitting Diodes TIL 30P	20p

THERMISTORS

VA 1104	35p
ITT PT266 3W12	15p
PTH 451A or B	10p
PT37P fits Pye, Bush etc.	20p
MR 501 3 amp 100V	7p
MR 508 3 amp 800V	12p
Philips Snips	£1.50
B9A Print V/Holder	5p
PYE 697 Long V/Holder	15p
12" TV Tube Hitachi A31/300	£12.00
Line OP Lopt CVC20	£4.00
V/U Meter	45p
Convergence Panel GEC	£1.00
Eth Lead Split Diode LOPT	£1.00
ITT Push Button	25p
THORN Push Button	20p
MR 856	15p
Mains On/Off Rotary	13p
DP Push Button	12p
PHILIPS Tuner/Unit UHF	£2.00
UHF TV Aerial Portable	50p
TV Sound Tuner Kit ideal for Hi Fi TV sound	£9.50
AD 149	80p
KBL005 4 amp 40V	25p
LT340T 12V Reg	20p
RANK TOSHIBA Prey front control Units Type 0354	£9.50
TCE520	25p
FUA 78M24UC	20p
MC 7724CP	20p
MTO 309 THORNE	20p
TIP 640	£1.00
2SC 2122A	£1.00
BRC 1693	£1.00
Touch Buttons RANK TOSHIBA	10p
2SB566	10p
THORN Hearing Aids	£3.00

SENDZ COMPONENTS

**63 BISHOPSTEIGNTON,
SHOEBURYNESS,
ESSEX SS3 8AF.**

**Reg. Office only.
Callers by appointment only.
Add 15% VAT.**

**Add 50p postage.
Add postage for all overseas parcels
Goods despatched on receipt of order.**

INTEGRATED CIRCUITS

CA270CE	50p
CA270CW	50p
CA3089Q	50p
MC1327	£1.00
MC1349	50p
MC1352	£1.00
SAA1020	£4.00
SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SA1130	£2.50
SAA5040	£2.50
SAS560	£1.00
SAS570	£1.00
SL901	£3.50
SL918	£2.50
TAA320A	50p
TAA470	£1.50
TAA550	25p
SAA570	£1.00
TAA700	£1.00
TBA120A	40p
TBA120AS	40p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120U	40p
TBA120C	40p
TBA1441-TBA440	£1.00
TBA510	£1.00
TBA520	£1.00
TBA540	£1.00
TBA550Q	£1.00
TBA560CQ	£1.00
TBA560C	£1.00
TBA570	£1.00
TBA720A	£1.00
TBA750	£1.00
TBA800	40p
TBA810S	£1.00
TBA820	£1.00
TBA890	£1.00
TBA920	£1.00
TBA920Q	£1.00
TDA2541	£1.00
TBA950	£1.00
TBA990Q	£1.00
TCA270	£1.00
TCA270Q	£1.00
TCA4500A	£1.00
TCA640	£1.00
TCA650	£1.00
TCA660	£1.00
TCA740	£1.00
TCA800	£1.00
TCA830S	£1.00
TCEP100	£1.20
TDA1003	£1.00
TDA1170	£1.00
TDA1190	£1.00
TDA1327	£1.00
TDA1412	30p
TDA2010	£1.00
TDA2530	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2560	50p
TDA2600	£2.75
TDA2653	£1.00
TDA2002	£1.00
TDA2640	80p
TDA2680	£1.00
TDA2690	£1.00
TDA3560	£1.50
SN168ZAN	£1.00
SN16964AN	50p
SN29764	£1.00
SN29848	50p
SN75108AN	£1.00
SN76001	£1.00
SN76003*	£1.00
SN76013*	£1.50
SN76023*	£1.50
SN76115	50p
SN76131	50p
SN76226	£1.00
SN76227	60p
SN76530P	50p
SN76532	50p
SN76533	£1.00
SN76544N	£1.00
SN76546	£1.00
TBA480Q	£1.00
SN76650	50p
SN76660	50p
SN76666	50p
SN76707N	75p
SN76708N	75p
TBA820	£1.00
ML236E	£1.50
ML237B	£1.50
ML238	£3.50
BTT822	£1.00
BTT6018-ML237B	£1.50
BTT8124	£1.00
BTT8224	£1.00
SAS660	£1.00
SAS670	£1.00
TDA2522	£1.00
UA783P3C	40p
EQVTBA810	40p

SEMICONDUCTORS

AC128	25p
AC153K	25p
AC176K	25p
AF139	25p
AF239	25p
AU113	£1.20
BA159	7p
BA182	7p
BA248	7p
BB103	7p
BB105	7p
BC107	7p
BC108	7p
BC109	7p
BC139	7p
BC147	7p
BC148	7p
BC149	7p
BC154	7p
BC157	7p
BC158	7p
BC171	7p
BC173	7p
BC174	7p
BC182L	7p
BC183	7p
BC207	7p
BC212	7p
BC213	7p
BC237	7p
BC238	7p
BC245	7p
BC250	7p
BC251	7p
BC252	7p
BC257	30p
BC300	30p
BC303	30p
BC307	7p
BC308	7p
BC327	7p
BC337	7p
BC338	7p
BC350	20p
BC365	10p
BC413	7p
BC454	7p
BC460	25p
BC462	7p
BC463	7p
BC546	7p
BC548	7p
BC559	7p
BD131	30p
BD132	30p
BD135	30p
BD136	30p
BD207	30p
BC221	20p
BD228	25p
BD238	20p
BD239	12p
BD331	20p
BD332	20p
BD253B	35p
BD416	25p
BD595	35p
BD596	35p
BD681	25p
BD807	20p
BD534	20p
BF127	20p
BF137	20p
BF157	20p
BF180	20p
BF181	20p
BF182	20p
BF185	20p
BF195	7p
BF198	7p
BF199	7p
BF200	20p
BF240	7p
BF245	7p
BF263P	15p
BF264	15p
BF273	7p
BF274	7p
BF337	24p
BF338	24p
BF458	12p
BFR79	15p
BFT43	25p
BFY50	15p
BFY90	20p
BR100	25p
BSX20	7p
BT100	30p
BT106 Special	60p
BT106	£1.00
BT109	£1.00
BT138/10A	70p
BT151/800R	70p
BTY80	20p
BU105/104	80p
BU108	£1.00
BU124	50p
BU126	80p
BU137	50p
BU204	50p
BU205	£1.00
BU208	60p
BU208A	£1.00
BU407	50p
BU426V	50p
BU526	£1.00
R2008B	£1.00
R2010B	£1.00
E1222	20p
BDX32	£1.00
OA90	7p
MJE51T	25p
MJE2801	30p
BY127	10p
BY133 1600V/1 Amp	10p
BY134	10p
BY176 Type	25p
BY179	35p
BY184	25p
BY187	10p
BY190	40p
BY206	10p
Fast Recovery	8p
600 Volt 3A	10p

DIODE 2AM 600/800v

BY210/400	5p
BY210/800	10p
BY223	25p
BY226	15p
BY227	10p
BY296	10p
BY298	10p
BY299	10p
BYF3123	40p
BYF3126	40p
BYX38/600	50p
BYX38/300	25p
BYX71/350	20p
BYX71/600	30p
BYX72/300	20p
2N2222	7p
2N3055	40p
2N4444	£1.00
2SN30A	7p
TIP29C/A	20p
TIP31A/B	25p
TIP32	20p
TIP33B	25p
TIP100	30p
TIP130	30p
TIP2955S	40p
IN60	3p
Y716	20p
Y827	30p
BYW56 2A/1000v	8p
BYV95	8p

MIXED PACKS

20 Convergence Pots	80p
100 Mixed Sticks	£1.00
10 Thermisters	50p
20 Slider Pots	£1.00
30 Presets	50p
40 Pots	£1.50
300 Condensors	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs	40p
100 Diodes	£1.00
100 Fuses	£2.00
100 W/W Res	£1.50
100 2.7 4.7 Res	£1.00
300 Carbon Film Res	£1.50
20 Slider Knobs	70p
8 Mixed Gun Switches	50p
20 I/C Holders	£1.20
Red Green L.E.D.	£1.00

DIODES

1 Amp 1600v	7p
3 Amp 100v	7p
3 Amp 1200v	10p
W004 Bridge	15p
W005 Bridge	20p
9000 Thorn O/P Transistors with Heatsink T903 8v	£1.00
SW150 Surface Wave Colour TV Filter	£1.00
TiC 126N Thyristor 800v/12A	50p
Mullard Surface Wave Filter RW154	£1.00
7 Seg Display, Led, Red	50p
LM340T12 Reg	25p
1800/4KV	5p
4.7NF/5KV	10p
180/8KV	10p
210PF/8KV	10p
270PF/8KV	10p
330PF/8KV	10p
1000PF/10KV	10p
1200PF/12KV	10p

ITT SPARE PANELS

CVC9 Power Supply Board	£1.50

DECODER PANEL

ITT CVC20-25 30-32-40	£7.50
Audio Amp Driver Mod	£1.50
ITT Control Panel 5 Sliders	£1.50
ITT 3 Sliders Control Panel	£3.50
BF858	50p
TDA1010	£1.00
TA7607	£1.00
TA7609	£1.00
TA7315	£1.00
TDA2653	£1.00
TDA2560	£1.00
TDA7315	£1.00
Delay Lines TAU80	£1.00
TAU80	£1.00
DL50	£1.00
DL70	£1.00
DL700	£1.00
3.15 AS Fuses	5p
G11 Teletex Panel No. 3113-267-1597	£30.00
THORN R1039	70p
THORN R1038	70p
FE04/1/220/4 3 pin ITT 1 MFD 4 Amp Mains Filters	25p
Scan Coil Correction Condenser .91/210v G11	20p
G11 Philips 0.91M/210v Scan Coil Correction	25p

SENDZ COMPONENTS

63 BISHOPSTEIGNTON,
SHOEBURYNESS,
ESSEX, SS3 8AF

Reg. Office Only.

Callers by appointment only.

Add 15% VAT and 50p postage.

All items subject to availability.

Add postage for all overseas parcels.

Goods despatched on receipt of order.