MAY 1980

Australia $1.50; Malaysia $5.10; New Zealand $1.60

60p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

MONO PORTABLE PROJECT PART 1

SERVICING NOTES

VCR COLOUR SYSTEMS

TELEVISION

May
1980

Vol. 30, No. 7
Issue 355

this month

OUR NEXT ISSUE DATED JUNE WILL BE PUBLISHED ON MAY 21

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, Lavington Street, London SE1 0PF.

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

THE PROFESSIONAL CHOICE. NATIONWIDE

NEW SPARES

TYPE	PRICE £
AC107	0.20
AC113	0.17
AC115	0.17
AC117	0.24
AC125	0.20
AC126	0.18
AC127	0.19
AC128	0.17
AC131	0.13
AC141	0.23
AC142	0.19
AC141K	0.29
AC142K	0.29
AC151	0.17
AC165	0.16
AC166	0.16
AC168	0.17
AC176	0.17
AC176K	0.28
AC178	0.16
AC186	0.26
AC167	0.21
AC188	0.20
AC187K	0.30
AC188K	0.30
AD130	0.50
AD140	0.65
AD142	0.73
AD143	0.70
AD145	0.70
AD149	0.64
AD161	0.40
AD162	0.40
AD161 } AD162 }	1.30
AF106	0.42
AF114	0.23
AF115	0.22
AF116	0.22
AF117	0.30
AF118	0.40
AF121	0.33
AF124	0.33
AF125	0.29
AF126	0.29
AF127	0.29
AF139	0.39
AF151	0.24

TYPE	PRICE £
AF170	0.25
AF172	0.20
AF178	0.49
AF180	0.60
AF181	0.30
AF186	0.29
AF239	0.43
AU113	1.29
BA130	0.08
BA145	0.14
BA148	0.17
BA155	0.08
BAX13	0.05
BAX16	0.08
BC107	0.10
BC108	0.10
BC109	0.10
BC113	0.09
BC114	0.12
BC115	0.10
BC116	0.10
BC117	0.11
BC119	0.22
BC125	0.12
BC126	0.09
BC136	0.12
BC137	0.12
BC138	0.21
BC139	0.21
BC140	0.24
BC141	0.22
BC142	0.19
BC143	0.19
BC147	0.07
BC148	0.07
BC149	0.07
BC153	0.12
BC154	0.12
BC157	0.10
BC158	0.11
BC159	0.11
BC160	0.22
BC161	0.22
BC167	0.09
BC168	0.09
BC169C	0.09
BC171	0.08

TYPE	PRICE £
BC172	0.08
BC173	0.12
BC177	0.12
BC178	0.12
BC179	0.12
BC182L	0.09
BC183L	0.09
BC184L	0.09
BC186	0.18
BC187	0.18
BC209	0.11
BC212	0.09
BC213L	0.09
BC214L	0.09
BC237	0.07
BC240	0.31
BC281	0.24
BC262	0.18
BC263B	0.20
BC267	0.19
BC301	0.22
BC302	0.30
BC307	0.10
BC337	0.11
BC338	0.09
BC307A	0.10
BC308A	0.12
BC309	0.14
BC547	0.09
BC548	0.11
BC549	0.11
BC557	0.11
BD112	0.39
BD113	0.65
BD115	0.30
BD116	0.47
BD124	1.30
BD131	0.32
BD132	0.34
BD133	0.37
BD135	0.26
BD136	0.26
BD137	0.26
BD138	0.26
BD139	0.40
BD140	0.28
BD144	1.39
BD145	0.50

TYPE	PRICE £
BD222/T1P31A	0.37
BD225/T1P31A	0.39
BD234	0.34
BD222	0.50
BDX22	0.73
BDX32	1.98
BDY18	0.75
BDY60	0.80
BF115	0.24
BF121	0.21
BF154	0.12
BF158	0.19
BF159	0.24
BF160	0.23
BF163	0.23
BF164	0.17
BF167	0.23
BF173	0.21
BF177	0.26
BF178	0.24
BF179	0.28
BF180	0.30
BF181	0.34
BF182	0.30
BF183	0.29
BF184	0.23
BF185	0.29
BF186	0.30
BF194	0.09
BF195	0.09
BF196	0.12
BF197	0.10
BF198	0.11
BF199	0.14
BF200	0.28
BF216	0.12
BF217	0.12
BF218	0.12
BF219	0.12
BF220	0.12
BF222	0.12
BF221	0.21
BF224	0.12
BF256	0.37
BF258	0.27
BF259	0.27

TYPE	PRICE £
BF260	0.24
BF262	0.28
BF263	0.25
BF271	0.20
BF273	0.12
BF336	0.28
BF337	0.24
BF338	0.29
BFT42	0.26
BFT43	0.24
BFX84	0.27
BFX85	0.27
BFX88	0.24
BFY37	0.22
BFY50	0.15
BFY51	0.15
BFY52	0.15
BFY53	0.27
BFY55	0.27
BHA0002	1.90
BR100	0.20
BSX20	0.23
BSX76	0.23
BSY84	0.36
BT106	1.18
BT108	1.23
BT109	1.09
BT116	1.23
BT120	1.23
BU105/02	1.50
BU105/04	2.00
BU126	1.40
BU205	1.20
BU208	1.60
BY126	0.09
BY127	0.10
OC22	1.10
OC23	1.30
OC24	1.30
OC25	1.00
OC26	1.00
OC28	1.00
OC35	1.00
OC36	0.90
OC38	0.90
OC42	0.45
OC44	0.20

TYPE	PRICE £
OC45	0.20
OC46	0.35
OC70	0.22
OC71	0.28
OC72	0.35
OC74	0.35
OC75	0.35
OC76	0.35
OC77	0.50
OC78	0.13
OC81	0.20
OC810	0.14
OC82	0.20
OC820	0.13
OC83	0.22
OC84	0.28
OC85	0.13
OC123	0.20
OC169	0.20
OC170	0.22
OC171	0.27
OA91	0.05
BRC4443	0.65
R2008B	1.50
R2010B	1.50
R2305	0.38
R2305/BD222	0.37
SCR957	0.65
TIP31A	0.38
TIP32A	0.36
TIP3055	0.53
T1590	0.19
T1591	0.19
TV106	1.09

SPECIAL OFFER

SL901B	3.50
SL917B	5.00

DIODES

1N4001	0.04
1N4002	0.04
1N4003	0.06
1N4004	0.07
1N4005	0.07
1N4006	0.08
1N4007	0.08
1N4148	0.03
1N4751A	0.11
1N5401	0.12
1N5404	0.12
1N5406	0.13
1N5408	0.16

VALVES

DY87	0.52
DY802	0.64
ECC82	0.52
EF80	0.40
EF183	0.60
EF184	0.60
EH90	0.60
PC86	0.76
PC88	0.76
PCC89	0.65
PCC189	0.65
PCF80	0.70
PCF86	0.68
PCF801	0.70
PCF802	0.74
PCL82	0.67
PCL84	0.75
PCL86	0.78
PCL805	0.75
PLF200	1.00
PL36	0.90
PL84	0.74
PL504	1.10
PL509	2.45
PY88	0.63
PY500A	1.60
PYB1/800	0.57

SPECIAL OFFER

Philips PL802 2.55

E.H.T. TRAYS MONO

950 MK2 1400	2.00
1500 18" 19" stick	2.37
1500 24" 5 stick	2.48
Single stick Thorn TV 11.16K 70V	0.75
TV20 2 MT	0.75
TV20 16K 18V	0.75

IC's

SN76013N	1.20
SN76013ND	1.00
SN76023N	1.20
SN76023ND	1.00
SN76226DN	1.50
SN76227N	1.20
TBA341	0.97
TBA520Q	1.10
TBA530Q	1.10
TBA540Q	1.45
TBA560Q	1.40
TBA560CQ	1.50
TBA570Q	1.00
TBA800	1.00
TBA810	1.50
TBA920Q	1.50
TBA990Q	1.50
TCA270SQ	1.45
TCA270SA	1.45
TCA1327B	1.00

E.H.T. TRAYS COLOUR

Pye 731	5.20
Pye 691/693	4.50
Decca (large screen) CS2030/2232/2630/2632/2230/2233/2631	5.00
Philips G8 520/40	5.30
Philips 550	5.30
GEC C2110	5.50
GEC Hybrid CTV	5.10
Thorn 3000/3500	5.00
Thorn 8000	2.42
Thorn 8500	4.75
Thorn 9000	5.50
GEC TVM 25	2.50
ITT/KB CVC 5/7/8/9	5.10
RRI (RBM) A823	5.00
Bang & Olufsen 4/5000 Grundig 5010/5011/5012/6011/6012/7200/2052/2210/2252R Tandberg (radionette) Autovox	6.60
Grundig 3000/3010 Saba 2705/3715 Telefunken 709/710/717/2000	6.80
Korting	6.80

P & P 75p per order.

All transistors, IC's offered are new and branded. Manufactured by Mullard, I.T.T., Texas, Motorola etc. Please add 15% VAT to all items and overseas at cost P & P U.K. 50p per order, overseas allow for package and postage. Cash with all orders. All prices subject to alteration without notice.

TELEVISION SALE
DISCOUNT FOR QUANTITY

Colour sets sold with good c.r.t.'s 100% complete. Working colour £15.00 per set. In batches of ten.

GEC 2040 - £20.00 BUSH/MURPHY S/C - £30.00
PYE G91 - £20.00 THORN 25" 3000 - £30.00
PYE G97 26" - £25.00

MONO Rotaries 19" & 23"

GEC	£3.00
Thorn 950 etc.	3.00
K.B.	3.00
Pye	3.00
Thorn 1400	4.50

D/S P/B 19" 23"

Thorn 1400	7.00
Bush 161 etc.	7.00
Baird 660 etc.	7.00
Philips 210 etc.	7.00
Pye Olympic etc.	7.00

D/S P/B 20" 24"

Bush	10.00
GEC	10.00
Philips	10.00
Pye	10.00
Thorn	10.00

S/S 20" 24"

Bush 313 etc.	£12.00
Pye 169 chassis	12.00
Thorn 1500	12.00
GEC series 1 & 2	12.00
Decca MS series	12.00

S/S COLOUR

	19" £	20" £	22" £	25" £	26" £
GEC	40	40	40	40	40
Philips	—	—	40	40	40
Thorn	55	—	60	45	65
Korting	—	—	55	—	60
Pye Mechanical	40	—	40	40	40
Pye Varicap	45	—	45	45	45

MAINS DROPPERS

Mono

Bush 161	60p
Philips 210 30+125+2K85	50p
Philips 210 118R+148R	48p
Thorn 1400	75p
GEC 2018	58p
Thorn 1500	70p

Colour

Bush A823	72p
Pye 723 27Ω+56Ω	57p
GEC 2110 41Ω	45p
GEC 2110 12R5+12R5	47p
GEC2110 27R5	45p
Thorn 3500	58p
Thorn 8000	58p
Thorn 8500	54p
Philips G8 47R	30p
Philips G8 2.2+68	42p

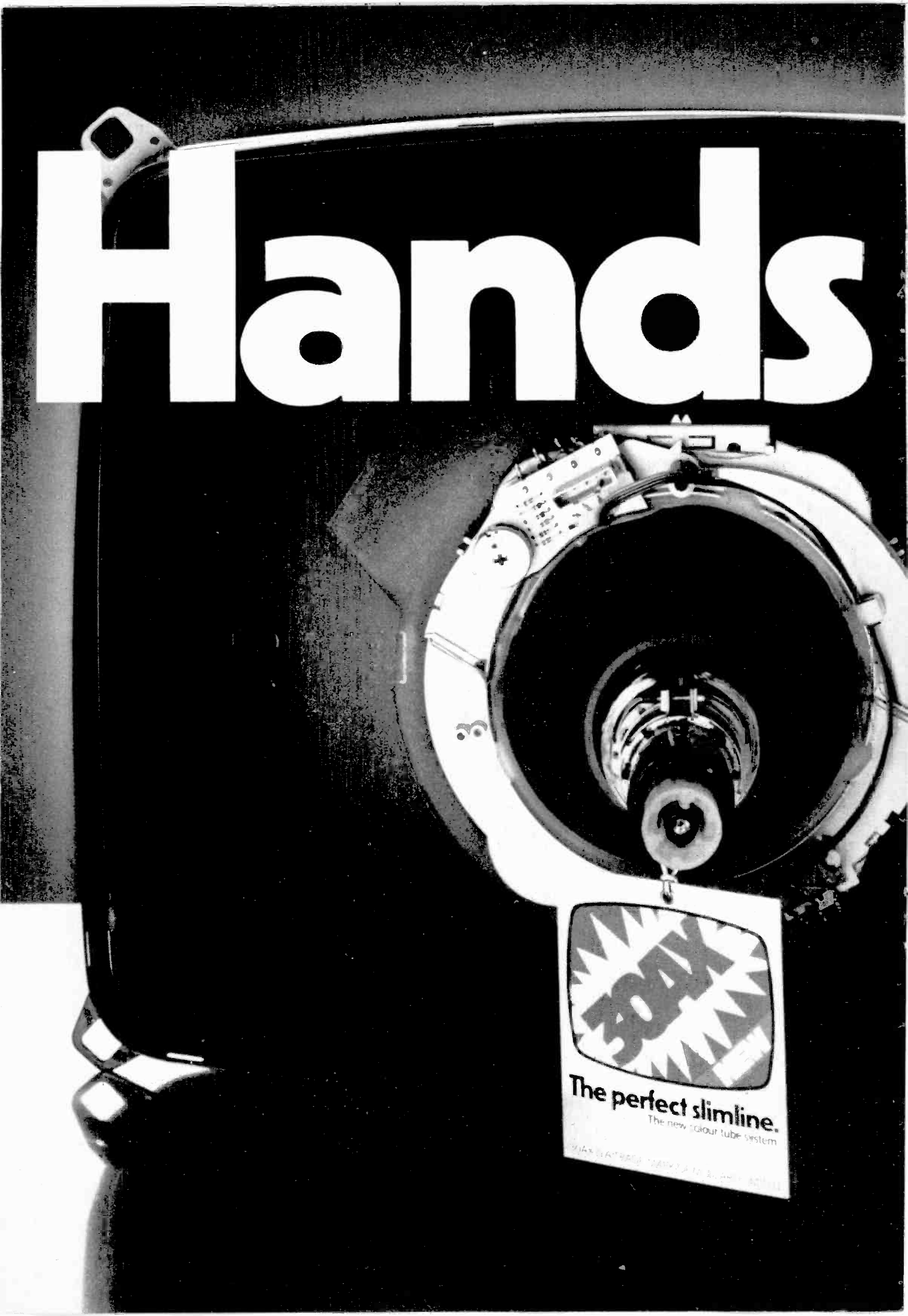
All plus VAT at 15%

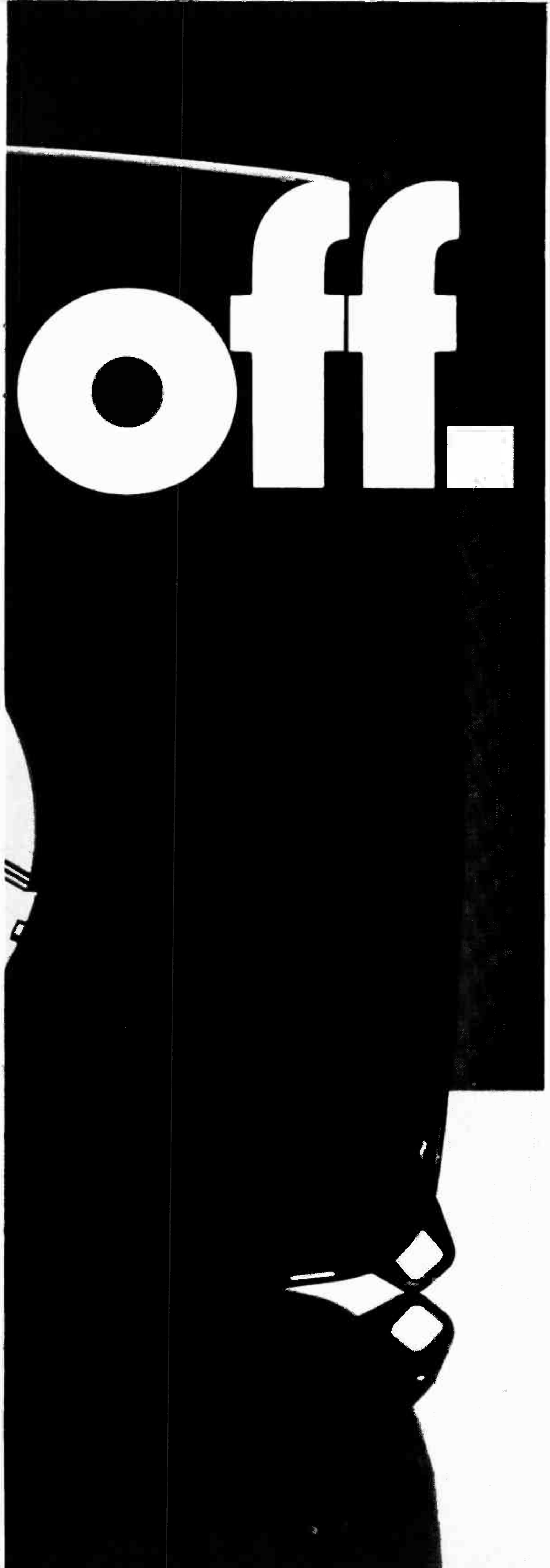
WHY NOT TRY OUR EXPRESS MAIL ORDER ON ANY OF THE ITEMS LISTED.

EXPORT COLOUR & MONO T.V.s AVAILABLE READY FOR USE OVERSEAS

TELEVISION

Briarwood House Preston Street
Bradford West Yorkshire BD7 1NS
Tel. Bradford 306018 (STD code 0274)


Hands
30AX
The perfect slimline.
The new colour tube system



We mean it.

The new 30AX colour tube system from Mullard doesn't need innumerable twists and turns of a screwdriver to set it up.

It needs no adjustments at all. Because every one has been 'designed out'.

Every tube that leaves our factory is completely pre-adjusted by us. Leaving only the turn of one screw to affix or remove the coil.

No dynamic convergence adjustments.

No colour purity adjustments.

And no raster orientation adjustment.

As for what it has to offer, the 30AX's focus is sharper and its definition greatly improved.

Its in-line guns and specially built coil provide the best picture shape yet.

And rest assured it'll stay that way. In a slim 110° package that trims about 3″ off conventional 22″ 90° TV cabinet depths.

Some features of the 30AX however, are a little more established.

Like its excellent colour registration. High brightness. Soft flash protection. Fast warm-up. And of course, greater overall reliability. This is the new 30AX colour tube system.

For more information just write your name and address on this page and send it to Dept. MCG, Mullard Ltd., Mullard House, Torrington Place, London WC1E 7HD.

30AX is a trademark of Mullard Ltd.

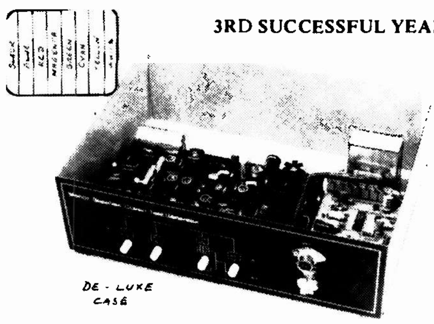
Mullard

30AX. The perfect slimline.

MANOR SUPPLIES

PAL COLOUR BAR GENERATOR

plus CROSS HATCH KIT (Mk. 4)



3RD 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 + £1.40 P/Packing. DE-LUXE CASE £5.95. ALUMINIUM CASE £3.30, BATT HOLDERS £1.70, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55.

ALSO THE MK3 COLOUR BAR GENERATOR KIT FOR ADDITION TO MANOR SUPPLIES CROSS HATCH UNITS. £28.75 + £1.15 p.p. CASE EXTRA £2.00. BATT. HOLDERS £1.70.

- ★★ Kits include drilled P.C. board, with full circuit data, assembly and setting up instructions.
- ★★ All special parts such as coils and modulator supplied complete and tested, ready for use.
- ★★ Designed to professional standards.
- ★★ Demonstration models at 172 West End Lane, NW6.
- ★★ Every kit fully guaranteed.

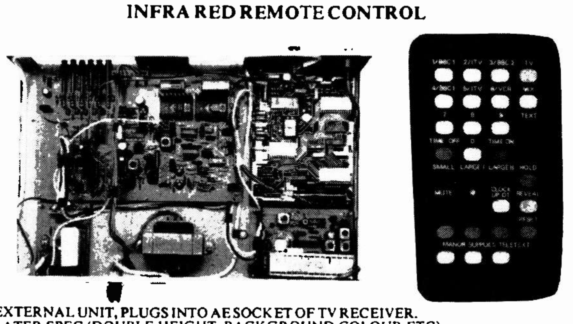
MK4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.70 P&P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £4.60.
INFORMATION ON VIDEO TAKE-OFF FOR C.C.T.V.
(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES

TELETEXT KIT (MK2)

(INCORPORATING MULLARD DECODER 6101VML)

INFRA RED REMOTE CONTROL



- EXTERNAL UNIT, PLUGS INTO AE SOCKET OF TV RECEIVER.
- LATER SPEC (DOUBLE HEIGHT, BACKGROUND COLOUR ETC).
- INFRA RED REMOTE CONTROL (MULLARD 5000 SYSTEM) STATION SELECTION, TEXT, MIX, TIME, DOUBLE HEIGHT, HOLD, CLOCK, REVEAL RESET ETC, ETC.
- INCLUDES COMPLETE & TESTED 6101 VML (MULLARD) DECODER, SAW FILTER IF PANEL & 32 BUTTON REMOTE CONTROL HANDSET.
- SUITABLE FOR BBC DEAF SUB-TITLE TRANSMISSIONS-REMODULATES PICTURE.
- CONVERTS ANY UHF RECEIVER TO STATION SELECTION REMOTE CONTROL AND TELETEXT.
- EVERY KIT EASY TO ASSEMBLE & FULLY GUARANTEED.
- DE-LUXE CASE MEASUREMENTS APPROX. $15\frac{1}{2} \times 10\frac{1}{4} \times 3\frac{1}{4}$.
- WORKING MODEL AT 172 WEST END LANE, N.W.6.

FURTHER DETAILS ON REQUEST

ALSO, MANOR SUPPLIES TELETEXT MK1 KIT (TEXAS) STILL AVAILABLE, SPECIAL OFFER PRICE £193.20 P/P £2.80.

COLOUR, UHF & TELEVISION SPARES

SPECIAL OFFER TEXAS XM11 TELETEXT MODULE NEW & TESTED, LIMITED QUANTITY AT HALF PRICE **£75.00** p.p. £1.40.
NEW 'TELEVISION' COLOUR RECEIVER PROJECT ALL PARTS AVAILABLE AT PRESENT. POWER, SIGNAL & TIMEBASE. SEND OR PHONE FOR LIST. WORKING DEMONSTRATION SET NOW ON SHOW WITH TELETEXT.
NEW SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND TESTED FOR T.V. SOUND & VISION **£32.80** p.p. £1.10.
TELETEXT 5V STABILISED MAINS POWER SUPPLY (FOR TEXAS OR MULLARD DECODERS) **£6.70** p.p. £1.00.
TEXAS XM11 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. 50p. (ALUM CASE **£2.60** p.p. 80p.) COMPLETE TESTED UNITS READY FOR USE (DE LUXE CASE) **£26.00** p.p. £1.25.
ADDITIONAL GREY SCALE KIT **£3.35** p.p. 35p.
UHF SIGNAL STRENGTH METER KIT £20.00
ALUM CASE **£2.00** DE LUXE CASE **£5.95** p.p. £1.60.
CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO **£25.80** p.p. £1.80.
"TELEVISION" COLOUR SET (1974) SPARE PARTS AVAILABLE
THORN 9000 TOUCH TUNE, REMOTE CONTROL RECEIVER UNIT PLUS TRANSMITTER HANDSET **£18.40** p.p. £1.40.
THORN 9000 FASCIA INCL. CHANNEL SELECTOR, INDICATOR SET CONTROLS, SPEAKER **£6.90** p.p. £1.60.
PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 75p.
BUSH Z718, BC6100 SERIES SURPLUS LINE T.B. PANEL Z904, INCL. LOPT, EHT STICK, FOCUS ETC, 18" or 22" **£17.25** p.p. £1.80.
BUSH A823 (A807) Decoder Panel **£8.65** p.p. £1.35.
BUSH A823 IF PANEL (EXPORT VERSION) **£3.25** p.p. 95p.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 80p.
BUSH A816 IF PANEL (SURPLUS) **£1.90** p.p. 80p.
BUSH 161 TIMEBASE PANEL A634 **£4.40** p.p. £1.25.
GEC 2010 SERIES TIMEBASE PANEL **£1.15** p.p. 95p.
DECCA Colour T.V. Thyristor Power Supply. HT, LT etc. **£4.40** p.p. £1.40.
BUSH TV 312 IF Panel (Single I.C.) incl. circuit **£5.75** p.p. 75p.
BUSH TV Portable Eleven Volt Stab. Power Supply Unit **£4.40** p.p. £1.10.
PYE 697 Line T.B. P.C.B. salvaged **£4.80** p.p. £1.50.
THORN 3000 IF Panel **£9.78** p.p. £1.00.
THORN 3000 LINE TB PCB **£5.75 each** p.p. 85p.
THORN 3000 VID, IF, DEC, Ex Rental **£5.75 each** p.p. £1.20.
THORN 8000/8500 POWER/SALV. SPARES **£2.88** p.p. 60p.
THORN 8000/8500 TIME BASE, SALV., SPARES **£5.52** p.p. £1.00.
THORN 9000 LINE T.B. SALV., SPARES **£8.62** p.p. £1.60.
MULLARD AT1022 Colour Scan Coils **£6.90** p.p. £1.60, AT1023/05 Convergence Yoke **£2.90** p.p. 95p, AT1025/06 Blue Lat. **90p** p.p. 40p.
PHILIPS G9 Signal Board Panels for small spares **£4.80** p.p. £1.00.
PHILIPS G6 Single standard convergence panels **£2.90** p.p. £1.20.
G8 Decoder panels salvaged **£4.25.** Decoder panels for spares **£2.00** p.p. £1.15.
VARICAP UHF MULLARD U321 **£8.97,** ELC1043/05 **£6.35** p.p. 40p., G.I. type (equiv. 1043/05) **£4.00** p.p. 40p. Control units, 3PSN **£1.40,** 4PSN **£1.75,** 5PSN **£2.00,** 6PSN **£2.10, Special Offer** 6PSN **£1.15** p.p. 40p.
BUSH "Touch Tune" assembly, incl. circuit **£5.75** p.p. 85p.
VARICAP UHF-VHF ELC 2000S **£9.80.** BUSH TYPE **£9.00** p.p. 85p.
UHF/625 Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, **£3.28.** Mullard 4 position push button **£2.88** p.p. £1.30.
TRANSISTORISED 625 IF for T.V., sound, tested. **£7.82** p.p. 75p.
MULLARD EP9000 Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
LINE OUTPUT TRANSFORMERS. New guar. p.p. £1.00.

BUSH 145 to 186SS series	**£8.50**
BUSH, MURPHY A816 series	**£9.80**
DECCA DR 121/123, 20/24, MS1700, 2000, 2401	**£8.50**
FERG., HMV, MARCONI, ULTRA 850, 900, 950 Mk. 1	
95011, 1400, 1500, 1580	**£6.80**
GEC 2000, 2047 series, etc	**£8.50**
INDESIT 20/24EGB	**£8.50**
ITT/KB VC2 to 53, 100, 200, 300	**£8.50**
MURPHY 1910 to 2417 series	**£8.50**
PHILIPS 19TG170, 210, 300	**£8.50**
PYE 40, 67, 368, 169, 769 series	**£8.50**
PAM, INVICTA, EKCO, FERRANTI equivalents as above.	
SOBELL 1000 series	**£7.85**
STELLA 1043/2149	**£7.85**

SPECIAL OFFER

GEC 2114J/FINELINE	**£5.50**
GEC 448/452	**£1.75**
THORN 1590/1591	**£5.50**
KB VCI, VCII (003)	**£3.25**

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Type	Price (£)
AC107	0.48
AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.46
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.42
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	0.35
AF115	0.35
AF116	0.41
AF117	0.42
AF118	0.98
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.36
AF180	1.35
AF181	1.33
AF186	1.48
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	1.58

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

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

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	0.13
BC548*	0.13
BC549*	0.15
BC550	0.24
BC556	0.23
BC557*	0.16
BC558*	0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.06
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	0.37
BD136	0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	0.51
BD155	0.90
BD157	0.51
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.88
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
BD222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

Type	Price (£)
BD234	0.68
BD235	0.63
BD236	0.63
BD237	0.68
BD238	0.68
BD253	1.58
BD410	1.65
BD433	0.65
BD435	0.70
BD436	0.71
BD437	0.74
BD438	0.75
BD519	0.88
BD520	0.88
BD599	0.87
BD600	1.23
BD663BR	0.86
BDX18	1.56
BDX32	2.95
BDY16A	0.63
BDY18	1.65
BDY20	2.29
BDY38	1.38
BF115	0.48
BF117	0.45
BF120	0.55
BF121	0.85
BF123	0.48
BF125	0.68
BF127	0.51
BF137F	0.78
BF152	0.19
BF158	0.25
BF159	0.27
BF160	0.20
BF161	0.84
BF163	0.65
BF164	0.95
BF166	0.50
BF167	0.38
BF173	0.35
BF177	0.36
BF178	0.46
BF179	0.58
BF180	0.53
BF181	0.53
BF182	0.44
BF183	0.52
BF184	0.44
BF185	0.42
BF186	0.42
BF194*	0.14
BF195*	0.13
BF196	0.14
BF197	0.15
BF198	0.29
BF199	0.29
BF200	0.25
BF218	0.42

Type	Price (£)
BF222	0.51
BF224 & J	0.22
BF240	0.32
BF241	0.31
BF244*	0.51
BF245*	0.43
BF254	0.48
BF255	0.58
BF256L*	0.49
BF257	0.44
BF258	0.52
BF259	0.54
BF262	0.73
BF263	0.88
BF270	0.47
BF271	0.42
BF272A	0.80
BF273	0.33
BF274	0.34
BF336	0.63
BF337	0.65
BF338	0.68
BF355	0.72
BF362	0.49
BF363	0.49
BF367	0.29
BF451	0.43
BF457	0.46
BF458	0.49
BF459	0.52
BF594	0.16
BF596	0.17
BF597	0.27
BFR39	0.30
BFR40	0.29
BFR41	0.30
BFR50	0.29
BFR52	0.33
BFR61	0.29
BFR62	0.28
BFR79	0.30
BFR80	0.29
BFR81	0.30
BFR88	0.42
BFT41	0.48
BFT43	0.55
BFW11	1.02
BFW30	2.58
BFW59	0.19
BFW60	0.20
BFW90	0.65
BFX29	0.38
BFX84	0.42
BFY50	0.38
BFY51	0.37
BFY52	0.36
BFY53	0.36
BFY90	1.98
BPX25	1.62

Type	Price (£)
BPX29	1.62
BR101	0.53
BR103	0.64
BR303	1.06
BRC4443	1.76
BRY39	0.60
BRY56	0.44
BSS27	0.92
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	3.35
BU105	1.80
BU105/02	1.95
BU108	2.98
BU126	2.91
BU204	2.50
BU205	2.58
BU206	2.59
BU208	2.75
BU407	1.38
BUY77	2.50
C106D	0.80
C106F	0.43
C111E	0.46
D40N1	0.64
E300	0.42
E1222	0.47
E5024	0.19
GET872	0.46
ME0402	0.18
MF0404/02	0.18
ME6001	0.18
ME6002	0.18
MJ2955	1.30
MJ3000	1.58
MJE340	0.68
MJE341	0.72
MJE370	0.74
MJE371	0.79
MJE520	0.85
MJE521	0.95
MJE2955	1.20
MJE3000	1.95
MJE3055	1.22
MPF102	0.40
MPS3702	0.33
MPS3705	0.30
MPS6521	0.36
MPS6523	0.36
MPS6566	0.44
MPSA05	0.30
MPSA06	0.32
MPSA55	0.43
MPSA56	0.45
MPSA93	0.56
MPSL01	0.33
MPSU01	0.61

Type	Price (£)
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
MPSU60	0.82
MPU131	0.59
OC26	1.90
OC28	1.49
OC29	1.60
OC35	1.25
OC36	1.25
OC42	0.90
OC44	0.68
OC45	0.63
OC70	0.65
OC71	0.73
OC72	0.73
OC81	0.83
OC81D	0.95
OC139	1.30
OC140	1.35
OC170	0.80
OC171	0.82
OC200	3.90
OC201	3.95
OC202	2.40
OC205	3.95
OCP71	1.98
ON236A	0.94
R2008B	2.72
R2010B	2.79
R2322	0.75
R2323	0.85
ST2110	0.49
ST6120	0.48
TIC44	0.25
TIC46	0.35
TIC47	0.45
TIP29A	0.47
TIP30A	0.50
TIP31A	0.51
TIP31C	0.67
TIP32A	0.56
TIP32C	0.72
TIP33A	0.77
TIP34A	0.84
TIP41A	0.72
TIP42A	0.80
TIP2955	0.77
TIP3055	0.58
TIS43	0.44
TIS73	1.36
TIS90	0.23
TIS91	0.28
ZTX108	0.14
ZTX109	0.16
ZTX213	0.23
ZTX300	0.16
ZTX304	0.26

Type	Price (£)
ZTX500	0.18
ZTX502	0.22
ZTX504	0.28
2N404	1.30
2N696	0.46
2N697	0.46
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.48
2N918	0.54
2N930	0.29
2N1164	8.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.45
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	0.15
2N2926O	0.14
2N2926Y	0.14
2N2955	1.12
2N3053	0.48
2N3054	0.66
2N3055	0.72
2N3250	0.52
2N3254	0.58
2N3391A	0.38
2N3633	0.80
2N3703	0.17
2N3704	0.19
2N3705	0.17
2N3706	0.16
2N3707	0.18
2N3708	0.17
2N3715	1.70
2N3771	2.09
2N3772	2.08
2N3773	2.90
2N3794	0.40

Type	Price (£)
2N3819	0.47
2N3820	0.72
2N3866	1.08
2N3904	0.20
2N3905	0.20
2N3906	0.20
2N4036	0.94
2N4123	0.17
2N4124	0.17
2N4126	0.17
2N4236	2.20
2N4289	0.32
2N4292	0.32
2N4416	0.85
2N4444	1.90
2N4921	0.80
2N5042	1.65
2N5060	0.28
2N5061	0.30
2N5064	0.63
2N5086	0.49
2N5087	0.50
2N5208	0.59
2N5294	0.66
2N5296	0.68
2N5298	0.71
2N5322	1.16
2N5449	0.18
2N5457	0.46
2N5458	0.40
2N5459	0.58
2N5494	0.85
2N5496	1.05
2N6027	0.55
2N6107	0.71
2N6122	0.60
2N6178	1.07
2N6180	1.39
2N6211	2.74
2SB337BP	4.28
2SC458C	0.78
2SC643A	2.25
2SC930D	1.50
2SC1061	1.45
2SC1172Y	3.55
2SD234	1.48
3N128	1.60
40250	0.98
40251	1.14
40327	0.67
40361	0.48
40362	0.50
40410	0.94
40429	0.88
40530	0.79
40595	1.39
40603	1.13
40636	1.25
40654	0.89

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LINEAR IC's

Type	Price (£)
BRC1330	0.93
CA810QM	2.44
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.80
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC4008	0.85
MFC4060A	0.98
MFC6040	1.11
MFC8020A	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SC9504P	1.38
SL414A	1.91
SL432A	2.52
SL450	5.10
SL901B	4.20
SL917B	5.60
SL918A	5.95
SN72440N	2.21
SN76001N	1.67
SN76003N	2.20

Type	Price (£)
SN76008KE	2.56
SN76013N	1.56
SN76013ND	1.40
SN76018KE	2.56
SN76023N	1.56
SN76023ND	1.40
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.48
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.85
TAA320	1.10
TAA350A	2.48
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	1.89
TAA621AXI	2.33
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
(Filter)	0.98
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.1[illegible]

Type	Price (£)
TBA240A	3.98
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20
TBA480Q	1.84
TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.74
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	2.55
TBA641A12	2.35
TBA641B11	2.61
TBA651	2.12
TBA673	2.31
TBA700*	2.50
TBA720AQ	2.38
TBA720Q	2.38
TBA750*	2.18
TBA800	1.65
TBA810AS	1.69
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA280A	1.43
TCA290A	3.46
TCA420A	2.10
TCA440	1.67
TCA640	4.28
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA760	1.52
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	2.73
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	2.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

* Indicates Q version is also available.

DIODES

Type	Price (£)
AA113	0.17
AA119	0.21
AA129	0.28
AA143	0.18
AAY30	0.28
AAZ13	0.42
AAZ15	0.35
AAZ17	0.28
AY102	3.85
BA100	0.24
BA102	0.36
BA104	0.19
BA110	0.80
BA111	0.70
BA115	0.17
BA116	0.56
BA121	0.85
BA129	0.45
BA145	0.19
BA148	0.19
BA154	0.06
BA155	0.17
BA156	0.12
BA157	0.25
BA158	0.28
BA159	0.40
BA164	0.14
BA182	0.27
BA201	0.13
BA202	0.14
BA203	0.14
BA216	0.08
BA219	0.11
BA243	0.45
BA317	0.06
BA318	0.07
BAV10	0.10
BAV21	0.18
BAW62	0.06
BAX13	0.07
BAX16	0.10
BAX17	0.19
BAY72	0.16
BB104B	0.52
BB105B	0.33
BB105G	0.30
BR100	0.40
BY100	0.35
BY103	0.35

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

ZENER DIODES

400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	† £1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each
75W stud	7.5-75V	£7.95 each

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
R53	1.75
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.46
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	2.00
PCL82	0.93
PCL83	1.12
PCL84	0.65
PCL86	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PL84	0.79
PL504	1.50
PL508	1.85
PL509	3.10
PL519	3.10
PL802	3.25
PY81/P810	0.60

BRIDGES

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

10A and 25A ranges also stocked.

RESISTORS

Carbon Film (5%)

	Ea	10 of one value	Mixes of a minimum of 10pcs of any value: 50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.49	£6.40
½W 10Ω-10MΩ (E24)	3p	25p	95p	£1.49	£6.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£26.90

Wirewound (5%)

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

Presets (†)

0.1W (Vertical and Horizontal)
100, 220, 470Ω, 1, 2·2, 4·7, 10, 22, 47, 100, 220, 470kΩ, 1, 2·5, 5MΩ **all 14p each**

0·2W (Vertical and Horizontal)
Values as 0·1W **all 14p each**

FUSES (all packs of 10)

20mm Time Delay (BEAB)

40mA	£3.68
50, 63mA	£2.55
100mA	£1.86
160, 200, 250mA	£1.44
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all £1.19

20mm quick-blow (BEAB)

100mA **68p**
200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A **all 56p**

2A circuit breakers metal **£1.52** plastic **£1.48**

LABGEAR (Details of full range on request)
COLOURTEXT ADAPTOR 7026
Full facility Colourtext decoder to place between aerial and receiver. All you would expect of a quality ready-made unit. Leaflet on request. †£340.20

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CM6052/DB. VHF/UHF gives standard B band colour bars + variable tuning + front panel on/off switch + sync trigger output + blank raster + red raster · crosshatch · greyscale stepwedge · colour bar · centre cross · dot pattern + centre dot. **£182.25**

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Giro A/c 23 532 400. *A/c facilities available*

CAPACITORS

Metallised Paper

2n2F	1500V DC	60p	10nF	500V AC	80p
2n2F	600V AC	24p	15nF	300V AC	30p
3n6F	1700V DC	60p	22nF	300V AC	32p
4n7F	1500V DC	60p	100nF	1000V DC	20p
10nF	1000V DC	22p	470nF	1000V DC	60p

H.V. Disc Ceramic (†)

1kV	1.5nF	18p
3kV	1.5nF	20p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p
8kV	250, 270, 300pF	39p
10kV	1nF	67p

CONVERGENCE POTENTIOMETERS
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Spindles for above **5p each**

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TELEVISION

Satellite TV

Satellites have long been used for TV purposes. Telstar–1, which carried the first active up-down TV link, was put into orbit on July 10th, 1962, while TV pictures had previously been "bounced" from the passive Echo-1 satellite. Synchronous satellites, which remain in stationary orbit with respect to Earth at some 22,300 miles above the equator, followed during the next two years. They were developed (the Syncom series) by the Hughes Aircraft Company, with the support of NASA and the US Defence Department. Syncom III was used in 1964 to relay TV pictures during the Tokyo Olympic Games. The Syncom satellites were experimental: the first operational communications satellite, the famed Early Bird (officially Intelsat–1), entered service in July 1965. The Intelsat system proved capable of relaying colour TV transmissions, and was steadily developed during the late sixties. During the seventies, satellite systems for programme distribution over large land-masses were introduced – the Russian Molniya, Canadian Anik and American Satcom and Westar satellites. More recent have been the proposed Indonesian and Australian satellite services, and the launch of the European OTS and the Japanese BSE satellites. In fact the development of satellite TV services seems to be accelerating at present. The French/German governments propose to start a full satellite TV broadcasting service for domestic viewers by 1985 – apparently some German TV sets are already being sold as "ready for satellite TV reception." In the UK, the Home Secretary announced in the Commons a few days ago that a study into the possibility of a satellite television broadcasting service is to be carried out. It's hoped that the results will be published by the end of the year, and a service could be in operation by 1985.

Well, there's no question about the technical feasibility of such a service, and in fact the UK was allocated five channels in the 12GHz band at orbital point 31°W at the 1977 World Administrative Radio Conference. The question rather is who would pay for it? By now most people – only the most optimistic of sales managers excepted – have come to accept that sales graphs don't automatically rise year in and year out. We live in a finite world, and this applies even to advertising. In fact there have been strange reports of late suggesting that the enthusiasm of the ITV companies for TV4, which is due to start in 1982, has begun to falter. The possibility that breakfast TV could start at much the same time is adding to their concern. If a limited amount of advertising gets spread over too wide a field, everyone's profits will end up being squeezed. That in fact would seem to be the main obstacle to a UK satellite TV service for the present.

Our US friends are luckier. With several distribution satellites each with twelve or more channels to choose from, all you've to do is to get your 10ft. dish and point it heavenwards. As we reported last month, the FCC will have no objection. And the cost of s.h.f. (in the 4GHz band this time) receiving equipment has been falling dramatically.

The official attitude in the UK has been that we already have a perfectly satisfactory terrestial TV network able to provide the number of channels that can be sustained in the present economic situation. Thus with no requirement for satellites for distribution purposes, there's no call to do anything much about a satellite TV service. This is perfectly true. But the pressure for a satellite service will certainly mount as services start elsewhere. It's highly likely that the signals from the French/German satellites and the proposed Radio Luxembourg one will be receivable in the UK. The Japanese seem to have enough terrestial channels for their needs and a similar lack of any requirement for satellite programme distribution. They are nevertheless interested in the prospects and have carried out a lot of development work. Development work has not been lacking in the UK – we carried a report on a Mullard s.h.f. reception system for satellite use back in February 1971. But as an article on a later page brings out, recent and apparently very effective Japanese research has been centred on the development of low-cost s.h.f. receiving front-ends.

The fact is that the international satellite TV bandwaggon has started to roll. We'll probably jump on it sooner or later. We won't see TV5-9 by 1985, that's for sure – look how long it took for TV4 to happen! But in the fullness of time the parabolic s.h.f. aerial is likely to be a familiar rooftop sight.

Teletopics

VCRs: FINAL LINE-UP?

For how long will the three non-compatible VCR systems – the Philips V2000, JVC etc. VHS, and the Sony Betamax – continue? Surely sooner or later one or more must drop out. Meanwhile, the choice is left to us, the customers. Philips and Grundig machines are only just arriving in any number, various more sophisticated VHS machines have been announced, while Sony have launched their ultimate Betamax machine, the C7.

Panasonic's NV7000 VHS machine is smaller and, at under £700 including VAT, cheaper than its predecessors. A new aluminium diecast chassis and a new head assembly plus compact direct-drive motors for the head and capstan have lead to a reduction of about a third in size compared to previous Panasonic VCRs. Among the features are Dolby noise reduction– the first time this has been offered on a VCR. The timer allows up to eight programmes to be selected, irrespective of channel, over a fourteen day period.

From Sharp comes another VHS type VCR, the VC6300H. The first shipment to be sent to the UK by air freight apparently suffered some damage, so it's not known when the machine will be available in quantity. But when they do... well, it's undoubtedly one of the most sophisticated yet. The timer enables up to seven programmes spread over seven days on up to seven different channels to be recorded. Having programmed the thing to record a week's TV while you're away, you would normally have the problem of finding say where the fifth programme on the three-hour tape started. This can be a rather hit and miss business, as anyone who has tried it knows. To overcome the problem, the VC6300H uses an ingenious system which records a short pulse on the tape as the VCR starts to record. This tags each programme, and the VCR can subsequently be set to search for the required programme, in either fast forward or fast rewind, stopping at the correct point. The VC6300H uses an electronic tape counter, with a microcomputer i.c. to control the timer/counter functions – as on the Sanyo VTC9300P (see the February and March issues, Computerised TV Parts 1 and 2). The display is of the liquid crystal type, and there's a six-function remote control system which comes as standard, giving normal play, half-speed slow motion, double-speed fast motion, still frame, frame-by-frame advance and variable slow motion from still to normal play. Another interesting device indicates the amount of tape left – LEDs light up at fifteen minute intervals to give this indication.

Sony's C7 has a striking appearance and a sophisticated specification. One major feature is what Sony call Picture Search, enabling you to look at the picture while the tape is being run fast forwards or backwards. The timer can be set to record up to fourteen days in advance, on all four channels. There's triple-speed operation, slow motion, still frame, and frame-by-frame either automatically or at your own selected speed. The remote control unit covers all main functions. Automatic programme search automatically locates the beginning of each programme, and an alarm warns that the end of a tape has been reached on record. Sony expect the machine to sell at around £650. The present SL8080 is to stay on the market. Further Sony introductions are a portable recorder, the SL3000P, priced at £625·40, and a new colour camera, the HVC2000P, priced at £628·50. In launching the C7, Sony emphasize that an adequate supply of machines was made available to dealers prior to the announcement of the new VCR.

PHILIPS/PYE E2 CHASSIS

The latest E2 large-screen monochrome receiver chassis from the Philips/Pye group has some similarities with its predecessor (the Pye 176 chassis) but has undergone a general up-dating. An i.c. (TDA2541) is now used in the i.f. strip, and both the intercarrier sound and audio sections are in i.c. form (TBA120AS plus TDA2611AQ). The video output transistor is a BF422, and as before the c.r.t. is of the type operated with its first anode and focus electrodes supplied from the h.t. line. The sync separator/line generator i.c. is a TBA920T, the line output transistor being a BUY71. As before, the power supply consists of a bridge rectifier feeding a series regulator circuit, but this time the series regulator transistor (TS310, type BUX84) is connected in the negative side of the supply. A new, discrete component field timebase is used, featuring a Miller oscillator and complementary-symmetry output stage.

NEW AERIAL CATALOGUE

A new, expanded catalogue has been issued by South West Aerial Systems (Roger Bunney and David Martin). Included this time are a wide selection of bandpass/bandstop filters and the Teldis range of preamplifiers. The catalogue is available for 25p in stamps. Separate lists of caravan equipment and 27MHz CB equipment (modified 28MHz amateur band) are available – all three lists for 30p. Apply to South West Aerial Systems, 10 Old Boundary Road, Shaftesbury, N. Dorset.

AUSTRALIAN TELETEXT SERVICE STARTS

Following a successful trial period, the Australian government has given the go-ahead for a fully operational teletext service. Six commercial stations have already begun operations, using equipment based on UK designs. The service is also being used as an advertising medium.

VIDEO DISC LATEST

Activity in the video disc field seems to be on the increase. RCA have signed an agreement with Zenith Radio Corporation giving each access to the other's video disc developments, the aim being to produce compatible equipment. On the programme side, Lord Grade's Associated Communications Corporation has signed an agreement with RCA covering various films and programmes including the exclusive disc rights to Jesus of Nazareth. Lord Grade commented: "We have deliberately chosen this system because we believe it is the one that will have the biggest commercial success." Toshiba have demonstrated a working player that's compatible with the RCA Selectavision disc system, and are also understood to be working on a Philips VLP type disc player. Various other Japanese firms have shown interest in the VLP system: Sharp and Sanyo have demonstrated VLP player units, and Pioneer have delivered over 200 such units to General Motors in the USA.

STATION OPENINGS

The following relay stations are now in operation:

Batley (West Yorkshire) BBC-1 ch. 57, Yorkshire Television ch. 60, BBC-2 ch. 63, TV4 ch. 67. Receiving aerial group C/D.

Carno (Powys) BBC-Wales ch. 21, HTV-Wales ch. 24, BBC-2 ch. 27, TV4 ch. 31. Receiving aerial group A.

Clydach (Gwent) HTV-Wales ch. 23, BBC-2 ch. 26, TV4 ch. 29, BBC-Wales ch. 33. Receiving aerial group A.
Haywards Heath (West Sussex) BBC-1 ch. 39, TV4 ch. 41, Southern Television ch. 43, BBC-2 ch. 45. Receiving aerial group B.
New Cumnock (Strathclyde) BBC-1 ch. 40, Scottish Television ch. 43, BBC-2 ch. 46, TV4 ch. 50. Receiving aerial group B.
Redditch (Worcestershire) BBC-1 ch. 22, ATV ch. 25, BBC-2 ch. 28, TV4 ch. 32. Receiving aerial group A.
Waunfawr (Gwynedd) BBC-Wales ch. 22, HTV-Wales ch. 25, BBC-2 ch. 28, TV4 ch. 32. Receiving aerial group A.
Wensleydale (North Yorkshire) TV4 ch. 53, BBC-1 ch. 57, Tyne Tees Television ch. 60, BBC-2 ch. 63. Receiving aerial group C/D.

All the above transmissions are vertically polarised.

ILEA'S EDUCATIONAL VIDEOCASSETTES

Programmes and films made by the Inner London Education Authority's television service are now available in videocassette form to schools and colleges both in the UK and abroad. There are over 200 programmes, most in colour. The cassettes can be bought, rented or hired for a school term period, and are available in the four leading tape formats. All programmes are based on one-hour cassettes, and are offered at a basic price of £30 plus the cassette cost, e.g. for a VHS cassette a total price of £35. A 48-page illustrated catalogue is available to schools and colleges free of charge.

SERVICE BRIEFS (PHILIPS/PYE)

TX Chassis: Trouble with a bright vertical line at the left-hand side of the picture has been experienced with some of these portables. If replacing the line output transformer fails to overcome the problem, the following modifications in the line driver stage are suggested: change the transistor (TS410) from a BC337 to a BC636 (note that the lead connections differ), and the value of the collector circuit damping capacitor C412 from 0·012μF to 0·0068μF.
G11 chassis: Correct dressing of the e.h.t. and focus leads in sets with infra-red remote control teletext is emphasized – otherwise the leads can come into contact with wirewound resistor R3120 on the line scan panel or R4031 on the power supply panel.

VIDEORASER

The Broadcast and CCTV Equipment Division of SGI is marketing an eraser which will erase video and audio cassettes and tapes in seconds. The Videoraser is used instead of the recorder's own mechanism, thus reducing head wear. It's also claimed to give very much improved erasure, providing higher re-recording standards and prolonging the usable life of the tape. Though used extensively by N. American broadcasting organisations, the price of £49·50 plus VAT should make the device a worthwhile investment for domestic video users. With a magnetic flux of 1,400 gauss, it can erase 2in. cassettes. For further information apply to SGI Ltd., Broadcast and CCTV Division, Fircroft Way, Edenbridge, Kent, TN8 6HA.

THE ANTIFERENCE XTRASET

Antiference have added to their already extensive range the Xtraset mains-operated u.h.f. wideband amplifier which, with its built-in splitter, enables two u.h.f. TV sets to be operated from a single aerial. The Xtraset amplifier makes up for splitter and cable losses, and isolates the two sets so that plugging or unplugging one of them does not affect the other. The mains consumption is low, so the Xtraset can be left on permanently. Installation is simplicity itself: just fix to an internal wall or skirting board (screws provided) and connect the mains lead to the nearest power point. The Xtraset has a neat, white high-impact plastics case. The suggested retail price is £12·80 plus VAT.

METERS GALORE

Several new multimeters have been introduced by Thorn's Measurements and Components Division. From Taylor come two general-purpose analogue meters using a taut band suspension movement, Models 131 and 132. The 131 has 16 ranges covering a.c. and d.c. voltages up to 600V, d.c. up to 300mA and resistance up to 3MΩ. The sensitivity is 20,000Ω/V, and there are also two scales calibrated in decibels. The UK trade price is £12·50 plus VAT. The 132 has 19 ranges covering a.c. and d.c. voltages up to 1kV, a.c. and d.c. up to 5A and resistances up to 3MΩ. There are two dB calibrated scales and the sensitivity is 30,000Ω/V. The trade price is £18 plus VAT.

From AVO come three digital multimeters. The DA211 and DA212 are pocket-sized instruments with 3½ digit liquid crystal displays. The DA211 covers a.c. and d.c. voltages up to 1kV, d.c. up to 10A, and resistance up to 2MΩ. There's also a diode test facility. The input impedance is 10MΩ, and the meter is rated to withstand accidental application of 250V from the mains on any range except the 10A socket. A single 9V zinc carbon battery of the PP3 type gives a life of approximately 200 hours. The trade price is £45 plus VAT. Function and range selection with the DA211 is by means of pushbuttons. The ranges on the DA212 are selected by the more traditional AVO type rotary switches. The DA212's display also includes symbols for polarity, decimal point, low battery warning, over range and units of measurement. Its ranges are: d.c. voltages up to 1kV, a.c. voltages up to 750V, a.c. and d.c. up to 1A and resistance up to 20MΩ. The input impedance is 10MΩ, and by using the "Hi-Lo" ohms facility resistance values in sensitive semiconductor circuits can be measured using a voltage of less than 0·35V. Four zinc carbon batteries of the HP7 type give a life of about 200 hours. The trade price of the DA212 is £65 plus VAT.

The main feature of the AVO DA117 is fast auto-ranging on all ranges, including current. The size and styling of this instrument are the same as the successful AVO DA116. The ranges covered are a.c. and d.c. voltages up to 1kV, a.c. or d.c. up to 2A, plus manual 10A, and resistance up to 20MΩ. Range extension accessories and e.h.t. and r.f. probes are available extras. There is also a semiconductor junction test of 0·5mA, reading the voltage over the range 0-2kV. The LCD includes symbols for over-range, battery low warning, range held manually, d.c. polarity, a large decimal comma and unit of measurement. The auto-ranging response on all d.c. and resistance ranges is less than one second. There is a manual override facility which is considered useful for repetitive or comparative readings or for resistance measurements in electrically noisy environments, a hazard that's proved to be a problem with some auto-ranging digital multimeters. The DA117 is the first Avometer to use CMOS – a large-scale, custom designed i.c. produced by GEC Semiconductors Ltd. (over fifty standard i.c.s would be required to do the same job), plus six standard i.c.s. Battery life is typically 400 hours from four HP11 zinc carbon cells. The protection is such that accidental application of the 250V mains supply is withstood without damage on any range. The trade price is £135 plus VAT.

Letters

Once such modification has been made, the chip should give excellent service for distant signal reception. With appropriate bandpass circuits at the input and the output, the device can also be used as an i.f. gain block, fitted between the tuner's i.f. output and the i.f. strip's input.
Roger Bunney,
Romsey, Hants.

CITY AND GUILDS LICENTIATESHIP

For over 100 years the name of the City and Guilds of London Institute has been synonymous with sound standards of technical education and practical ability, and there can be no doubt that qualifications based on such standards are becoming more than ever important in today's highly competitive world. Now the City and Guilds is associated with a new high-level qualification for craftsmen – the Licentiateship of the City and Guilds of London Institute. Holders of this qualification are entitled to use the designatory letters LCG after their names.

Details of the routes to obtaining a Licentiateship are set out in a leaflet available from: Mr. K.E. Pow, City and Guilds of London Institute, 46 Brittania Street, London WC1X 9RG. They include the City and Guilds radio, television and electronics courses.
R. Gregory,
City and Guilds of London Institute.

THE OM335 AMPLIFIER

Those thinking of using the wideband hybrid preamplifier featured in the April issue may be interested in the following points, based on my experience of the OM335. Being a high-gain, wideband device with no element of selectivity at the input, the front-end sees a multitude of lower-frequency signals, both in the short and medium wavebands. Used as a Band I preamplifier for DX-TV reception, I found that radio breakthrough in Band I was present at various times of the day and night, showing up in the form of Arabic broadcasts mixed up with programmes in other languages.

There are several ways of reducing or completely avoiding these problems. Adding a v.h.f./u.h.f. choke across the input will normally stop such breakthrough – eight turns of 26 s.w.g. enamelled wire.close spaced, air cored with a diameter of about an eighth of an inch should do, or alternatively a commercial type can be obtained fromany Maplin Electronics. A simple high-pass filter (see Fig. 1) will attenuate frequencies below 40MHz while introducing negligible loss above this frequency. A commercial high-pass filter, such as the Home Office type 45A, will provide about 40dB of attenuation below 40MHz, ending troublesome radio breakthrough. Cross-modulation effects produced by radio stations are particularly noticeable when the amplifier is used in conjunction with a v.h.f. tuner using transistors.

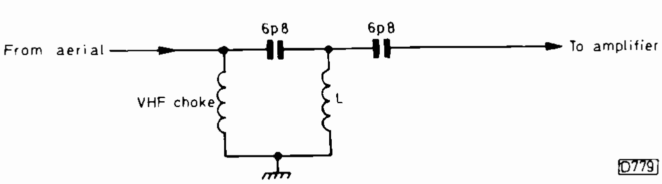

Fig. 1: Suggestions for front-end filtering for use with the OM335 wideband amplifier. Coil L in the high-pass T filter consists of $3\frac{1}{2}$ turns 1/10in. diameter 26 s.w.g. enamelled wire close spaced and air cored.

INDESIT MODEL T24EGB

Having serviced a number of these sets over the last few months, I'd like to mention the following points regarding the resistors used in and around the line output stage.

(1) The 4·7MΩ resistors R427 and R428 in the width stabilisation circuit are subject to a lot of radiant heat from the line output valve and tend to go low in value, producing the symptoms excessive width with increased brightness. Replace them with a chain of four 2·7MΩ $\frac{1}{2}$W resistors.

(2) The tube's first anode and focus supplies are derived from the boost rail via the filter resistor R434, with a potential divider network consisting of R003 and R004 (to chassis) on the tube base to provide the focus voltage. R003 and R004 are both 3·3MΩ, and are of the type that changes value readily, giving rise to brightness problems. R004 has a habit of going open-circuit, putting almost the full boost rail voltage on the first anode. The tube then has a short but very bright life. A very satisfactory repair is obtained by using a chain of six 1·2M Ω $\frac{1}{2}$W resistors. Note that the first anode voltage is nearer 500V than the 600V quoted on the service sheet (and in the circuit we published in the December 1975/January 1976 issues – *editor*).

(3) The line output valve's screen grid feed resistor R433 (3kΩ, 5W) may look like a vitreous covered wirewound but isn't and tends to go low in value. Check it and replace if necessary with a standard 3·3kΩ, 5W wirewound type.
J.E. Edmands,
Bristol.

THORN 1400 CHASSIS

In the March *Service Bureau* you mention the problem of herringbone patterning on u.h.f. on the right-hand half of the screen on a set fitted with the Thorn 1400 chassis. I've had this one on several occasions, and in every case the fault was due to the line output valve's screen grid decoupling capacitor (C115, 1μF).
J. Palmer,
Portland.

Editorial note: Several readers wrote in to point this out. Thanks to one and all. In later versions of the 1400 chassis C115 was changed to an 0·1μF, 20% 350V type to give increased reliability.

THE STANDBY MODE

A year ago you published an article of mine on remote control and auto-tuning. It's possible to be led up the garden by one of these sets, so I'd like to emphasize a point I took for granted in the original article.

Most remote control sets have a standby position on the handset to turn the main TV circuitry off until the viewer wants to use the set again. This operates on the power supply protection or start-up circuitry in such a way as to fool the set into thinking that something is amiss, the h.t. supply then being shut down. To prevent this happening every time the set is switched on, an extra pair of contacts is fitted to the on-off switch to momentarily inhibit the stand-


QUARTZ LCD 5 Function
Hours, mins, secs., month, date, auto calender, back-light, quality metal bracelet.
£6.65
Guaranteed same day despatch.
Very slim, only 6mm thick.
M1
SOLAR QUARTZ LCD 5 Function
Genuine solar panel with battery back-up. Hours, mins., secs., day, date. Fully adjustable bracelet. Back-light. Only 7mm thick.
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Guaranteed same day despatch.
M2
QUARTZ LCD 11 Function SLIM CHRONO
6 digit, 11 functions. Hours, mins., secs., day, date, day of week. 1/100th, 1/10th, secs., 10X secs., mins., Split and lap modes. Back-light, auto calendar. Only 8mm thick. Stainless steel bracelet and back. Adjustable bracelet. Metac Price
£10.65 Thousands sold!
Guaranteed same day despatch.
M3
QUARTZ LCD ALARM 7 Function
Hours, mins., secs., month, date, day. 6 digits, 3 flags plus continuous display of day and date or seconds. Back-light Only 9mm thick.
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£9.95
Guaranteed same day dispatch.
M4
MULTI ALARM 6 Digits 10 Functions
• Hours, mins., secs.
• Months, date, day.
• Basic alarm.
• Memory date alarm.
• Timer alarm with dual.
• Time and 10 country zone.
• Back-light.
• 8mm thick.
£18.65
M5
FRONT-BUTTON Alarm Chrono Dual Time
6 digits, 5 flags, 22 functions. Constant display of hours and mins., plus optional seconds or date display. AM/PM indication, month, date. Continuous display of day. Stop-watch to 12 hours 59·9 secs., in 1/10 second steps. Split and lap timing modes. Dual time zones. Only 8mm thick. Back-light. Fully adjustable open bracelet.
~~£22.65~~
£18.95
Guaranteed same day dispatch
M6
SOLAR QUARTZ LCD Chronograph with Alarm Dual Time Zone Facility
6 digits, 5 flags. 22 functions. Solar panel with battery back-up. 6 basic functions. Stop-watch to 12 hours 59·9 secs., in 1/10 sec., steps. Split and lap timing modes. Dual time zones. Alarm. 9mm thick. Back-light. Fully adjustable bracelet.
~~£27.95~~
£19.95
M7
ALARM CHRONO with 9 world time zones
• 6 digits, 5 flags.
• 6 basic functions.
• 8 further time zones.
• Count-down alarm.
• Stop-watch to 12 hours 59·9 secs. in 1/10 sec. steps.
• Split and timing modes.
• Alarm.
• 9 mm thick.
• Back-light.
• Fully adjustable bracelet.
~~£29.65~~ £24.95
M8
SOLAR QUARTZ LCD Chronograph
Powered from solar panel with battery back-up. 6 digit, 11 functions. Hours, mins., secs., day, date, day of week. 1/100th, 1/10th, secs., 10X secs., mins. Split and lap modes. Back-light, auto calendar. Only 8mm thick. Stainless steel bracelet and back. Adjustable bracelet. Metac Price
£12.65
Guaranteed same day despatch.
M9
SEIKO Alarm Chrono
LCD, hours, mins., secs., day of week, month, day and date, 24 hour Alarm, 12 hour chronograph, 1/10th secs., and lap time. Back light, stainless steel, HARDLEX glass.
List Price £130.00
METAC PRICE
~~£105.00~~
£57.50
M10
SEIKO MEMORY BANK
Calendar watch M354 Hours, mins., secs. Month, day, date in 12 or 24 hour format all indicated continuously. Monthly calendar display month, year and all dates for any selected month over 80 year period. Memory bank function. Any desired dates up to 11 can be stored in advanced. 2 year battery life. Water resistant.
£59.95
List Price £130
Metac Price ~~£79.50~~
M11
Dual time-alarm Chronograph
Mineral glass face. Battery hatch for DIY battery replacement. Top quality finish with fully adjustable bracelet.
£35.00
M12
HANIMEX Electronic LED Alarm Clock
Features and Specification
Hour/minute display. Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on/off control. Display flashing for power loss indication. Repeatable 9-minute snooze. Display bright/dim modes control. Size 5.15" x 3.93" x 2.36" (131mm x 11mm x 60mm) Weight 1.43 lbs (0.65 kg)
AC power 220V.
~~£9.65~~ Thousands sold!
£10.20
Mains operated.
Guaranteed same day despatch.
M13
HANIMEX portable LCD clock radio
• Time set & alarm controls.
• Snooze & sleep controls.
• Wake to music or alarm.
• AM/PM indicator.
• Battery operated. No plug required.
• Receives all standard AM radio broadcasts.
• Drawstring carrying case included.
• Back-light.
• Batteries supplied free.
• Quartz crystal controlled.
£17.95
M14
QUARTZ LCD Ladies 5 Function
Only 25 x 20mm and 6mm thick. 5 function. Hours, mins., secs., day, date and back light and auto calendar. Elegant metal bracelet in silver or gold. State preference.
£9.95
Guaranteed same day despatch.
M15
Price breakthrough only
~~£18.95~~
£14.50
OUTSTANDING FEATURES
• DUAL TIME. Local time always visible and you can set and recall any other time zone (such as GMT). Also has a light for night viewing.
• CALENDAR FUNCTIONS include the date and day in each time zone.
• CHRONOGRAPH/STOPWATCH displays up to 12 hours, 59 minutes, and 59.9 seconds.
• On command, stopwatch display freezes to show intermediate (split/lap) time while stopwatch continues to run. Can also switch to and from timekeeping and stopwatch modes without affecting either's operation.
• ALARM can be set to anytime within a 24 hour period. At the designated time, a pleasant, but effective buzzer sounds to remind or awaken you!
Guaranteed same day dispatch.
M16
HOW TO ORDER
Payment can be made by sending cheque, postal order, Barclay, Access or American Express card numbers. Write your name, address and the order details clearly, enclose 30p for post and packing or the amount stated. We do not wait to clear your cheque before sending the goods so this will not delay delivery. All products carry 1 year guarantee and full money back 10 day reassurance. Battery fitting service is available at our shops. All prices include VAT.
Trade enquiries: Send for a complete list of trade prices – minimum order value £100
Telephone Orders. Credit card customers can telephone orders direct to Daventry or Edgware Rd. 24 hour phone service at both shops: 01-723 4753 03272 76545.
CALLERS WELCOME
Shops open 9.30 - 6.00.
Metac ELECTRONICS & TIME CENTRES
North & Midlands
67 High Street, DAVENTRY
Northamptonshire
Telephone: 03272 76545
South of England
327 Edgware Road
LONDON W.2
Telephone: (01) 723 4753

by signal at the instant of switching the set on. If these extra contacts don't make, or the set is turned on elsewhere, say at the wall, it will come on in the standby mode and you'll need to play a tune on the handset to get a picture. This is obvious to the user, who sees the standby light glaring at him, but can mislead the service engineer with his nose in the back of the set. So beware!
Harold Peters,
Lowestoft.

FIFTY YEARS OF TV

In the March issue you comment on the above subject and draw attention to the exhibition at the Science Museum, London. Readers in the West Country may be interested to know that the Admiral Blake Museum, Bridgwater, Somerset is holding an exhibition entitled *Broadcasting in the Twenties and Thirties* during the months of April and May. The main purpose of the display is to draw public attention to the unique BBC Collection of Retained Broadcasting Items, the majority of which have never been on public show before. Included are the oldest surviving tape recorder (the Blattnerphone), a Fultograph (the first ever home picture machine), yet another Televisor (!) and a unique display of early microphones.
Jim Butterworth,
Woodcombe, Grove Road, Blue Anchor,
Minehead, Somerset TA24 6JX.
P.S. I've been trying for a long time to obtain a 7in. CRM71 c.r.t. for my 1937 Ekco vision-only TV set. Can any other reader help?

A PLEA FOR HELP

My father, who was then 75 years old, constructed the colour TV project you published in 1972–3. He completed the receiver and enjoyed years of viewing until he died last August. The receiver has since been a great comfort to my mother, but has unfortunately failed. I'm wondering whether any other constructor in this area could offer any help? I could pay a fee and, having some knowledge of electronics, could do the "donkey work".
D.V. Staynor,
40 Furzehill Road,
Boreham Wood, Herts.
Tel: 01-953 4351 (after 7p.m.).

AN APOLOGY REQUIRED

The right-hand photograph in Roger Bunney's *Long-distance Television* column in your March issue is captioned "Texts from the Koran". This is not so, and the following translation shows how wrong you are: "Big sale at Mansoor Exhibition to clear the stock of military uniforms. Buy before the sale is over from Mansoor Exhibition, Jufa Firas Circle in Amman, Jordan." I would request that you make an apology for this grave mistake and in future when making translations suggest you approach a knowledgeable source and not take for granted that everything written in Arabic is a text from the Koran.
Sabiha Niaz,
Doha, Qatar.
Editorial note: Red faces indeed at the editorial office, and we hasten to apologise for this offensive error. We can only assume that the misapprehension arose due to the time of the reception, i.e. at the start of programme transmissions. Greater care will be taken in future.

next month in TELEVISION

● COMPONENTS FOR TV
Substantial changes in the technology of electronic component manufacture have taken place over the past few years. The old fashioned carbon composition resistor has largely given way to the carbon film type for example, while waxed paper capacitors have been replaced by plastic foil types. One thing that seems to be lacking however is a summary of the characteristics and performance of today's components. We've set out to fill this gap, with a four-part series by Harold Peters. He refers to it as a plain man's guide to components for TV.

● CLASS AB VIDEO CIRCUITS
Two-transistor video circuits of the class AB variety provide improved h.f. response compared to simple single-transistor class A stages. This improved response is particularly important for data (teletext etc.) displays, so such stages are being ever more widely used. Another advantage of course is reduced power consumption. George Wilding describes the action of the two commonly used circuits, the two npn transistor type and the complementary-symmetry type.

● SERVICING THE KUBA FLORENCE
The Kuba Florence 110° colour set was imported in some quantity during the great colour boom period in the early 70s. It's a reasonably reliable set with above average picture quality and is relatively simple for a set with a delta-gun 110° c.r.t. The only valves are in the line output stage. Mike Phelan provides a servicing run-down on the set.

● VCR MUTING TECHNIQUES
An interesting feature of several recent domestic VCRs is the inclusion of a muting circuit to cut off the sound and vision signals when a stable picture is not present, e.g. when the VCR goes from stop to play. David Matthewson describes some of the methods used.

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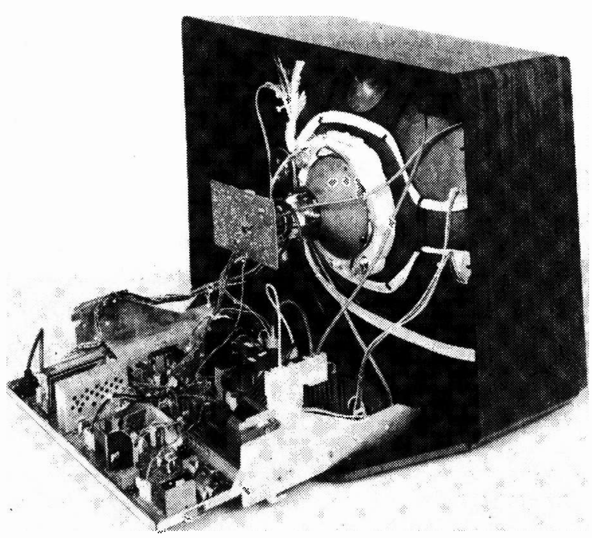
The TX10: Thorn's New Chassis for 110° Colour Tubes

Last year saw the introduction of Thorn's remarkably compact TX9 colour chassis, designed to drive 90° tubes of the PIL variety in sizes up to 22in. A detailed account of it appeared in our February issue earlier this year. Now comes the TX9's big brother, the TX10, which is designed to drive 22 and 26in. 110° tubes. By big brother, we don't mean to suggest that it's physically large, since the TX10 is in fact another remarkably compact design. It's again based on a single main panel plus c.r.t. base panel concept, but at a late stage in assembly the main board is separated into two sections so that the signals part can be mounted vertically. The reason for this is simply to minimise the cabinet depth. The sets in the TX10 range incorporate the new Philips/Mullard 30AX tube, which requires no convergence circuitry, no NS correction and only 8 per cent EW correction, and has no preset neck magnets. The chassis will also drive the RCA S4 110° PIL tube without modification, and 90° PIL tubes with only a few component value changes. A versatile arrangement!

Switch-mode Power Supply Provides Mains Isolation

The versatility of the chassis is further enhanced by the use of a switch-mode power supply to provide mains isolation. As a result, it's easy and simple to provide such facilities as external loudspeaker and headphone sockets with switches, and video and audio input and output sockets. With the latter in use, the chassis can be operated with its r.f. and i.f. sections switched off, giving clean, noise-free pictures. The video and audio input and output levels have been chosen to match most available VCRs. TV games, cameras, video disc players and home computers can all be connected to the set at video level. A custom designed 25W hi-fi audio unit will be available for use with the chassis. This unit will have its own mains input, but will plug into the TX10 to receive the TX10's audio signal under the control of the TX10's controls – either direct or remote. In fact the chassis has been developed to dovetail with all known facilities, e.g. tuning by voltage or frequency synthesis, teletext, viewdata and telesoftware (if this service comes into operation).



The Thorn TX10 chassis, shown in the rear latched service postion, i.e. with the signals panel horizontal, exposing all components. The switch-mode power supply is beneath the cowling on the right-hand side. A very neat and compact chassis. The tube shown is the Mullard/Philips 30AX type. The RGB output stages are mounted on the c.r.t.'s base panel. Additional panels for remote control operation etc. can be added on the left-hand side.

The switch-mode power supply is controlled by a TDA2582 i.c., and uses a BU208A as the chopper transistor. The interesting point technically however is that the chopper transformer is of the diode-split variety, providing the e.h.t. and most of the supply lines in the receiver. Why didn't anyone think of that before? Generating the e.h.t. at this stage in the receiver is efficient and provides good regulation (less than 1MΩ). Even the c.r.t. heater is fed from this transformer, which has power in hand to provide stabilised supplies for teletext, viewdata etc. as required. The main difference between this and other diode-split line output type transformers is that since it forms the third and final mains isolation barrier it's constructed and tested to BS415. Thorn say that several hundred thousands of these transformers have already been made, and the reliability has proved to be excellent.

A small mains transformer, with its own cover, is used to power the switch-mode power supply drive circuits until the power supply comes into full operation, and to power the remote control receiver during standby operation when the switch-mode power supply is off. Since it forms one of the isolation barriers, this transformer is tested to 5kV and constructed to provide generous creepage performance to BS415. The mains rectifier circuit charges a large reservoir capacitor which feeds the chopper transistor via a current sensing transformer. All this "live" circuitry is covered by a red, safety plastics cowling, both above and beneath the board. The mains switch has its own cover and the degaussing coils are double insulated to guarantee full isolation to chassis and service engineers.

The Line Output Stage

Since the e.h.t. is generated elsewhere, the line output stage is very simple (with only a tiny line output transformer). The EW correction circuitry is also simplified, since it's not necessary to use a diode modulator arrangement. For EW correction a field sawtooth voltage is fed to a Miller integrator to obtain a field frequency parabola. This is fed via an amplifier to the EW output transistor, which is connected in series with the line output transistor. The width control sets the bias on the EW output transistor, and due to the excellent spot centrality of the 30AX tube (±4·5mm) no line shift control is required – raster positioning is achieved with a small amount of phasing correction. The line output transformer produces a flyback pulse for this purpose and for line flyback blanking. It also produces a negative pulse which after rectification provides a 60V supply for the touch or ramp tuning options. In addition, it provides the c.r.t. first anode supply in order to protect the tube in the event of line scan failure.

Timebase Circuits

A sophisticated sync processor i.c., type TDA2576, is used to provide the sync actions and also contains the line oscillator (the line drive is provided by the chopper/e.h.t. transformer – see Fig. 1). The field timebase consists of a TDA1044 i.c. driving a class B complementary-symmetry output stage.

The Signals Section

The tuner and i.f. strip arrangements are identical to the TX9 chassis. Various types of tuner and SAWF can be fitted to cater for most of the European transmission standards. The sound side is also similar to the TX9, using a TDA1035T i.c. which delivers 3W to an 8Ω loudspeaker.

Again like the TX9 chassis, there's a single-chip decoder – but this time it's a different chip, the Mullard/Philips TDA3560, which has been designed to meet Thorn's requirements in this area. The advantages of this i.c. are reduced component count, fast blanking and data inputs, very simple test and alignment, and a peak sensing circuit which limits the maximum contrast level. The particular advantage of using this chip is its performance in the mixed programme picture/data display mode: the i.c. punches "holes" in the picture, giving a sharp data display, the brightness and registration of both the data and the picture being retained simultaneously.

The TX10 chassis is the first one from Thorn to use class AB RGB output stages. This gives low consumption (less than 1W at black level) and wide bandwidth, which is particularly important in achieving fine definition for data displays. Each stage uses three transistors – the circuit has been shown in these pages before, for example in our November 1978 issue (pages 28-9). To minimise the capacitance at the output, giving improved performance and keeping the radiation when operating on fast switching data to a minimum, the entire video output circuitry is mounted on the tube base board. The d.c. load resistor for each RGB output stage is a type selected for minimum capacitance.

Power Consumption

That briefly summarises the circuitry employed. The power consumption has been reduced to 70W at black level, a very good figure for a chassis designed to drive a 110° tube, and the set will operate over a voltage range of 165-265V without degradation of the picture performance. The component count is only 448, with but four cableforms, a reduction of 35 per cent compared to the previous 9600 series chassis.

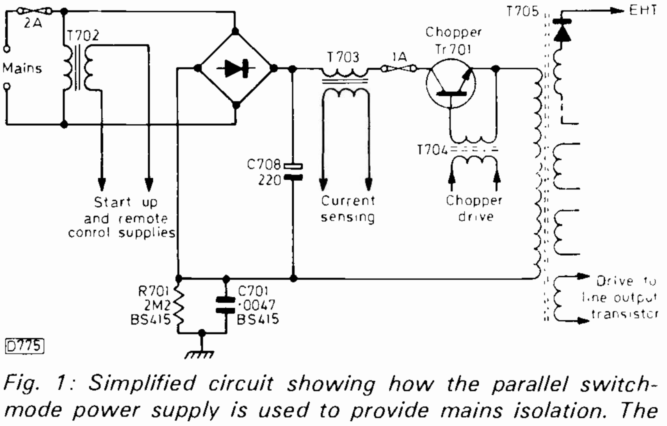


Fig. 1: Simplified circuit showing how the parallel switch-mode power supply is used to provide mains isolation. The supplies provided by the chopper transformer T705 include the e.h.t.

Production Facilities

As important as the circuitry used in a modern TV chassis is the production technology employed in its manufacture. Thorn have invested a considerable amount of capital in the engineering and production facilities. Computerised draughting equipment for example produces punched tapes which in turn drive a photo plotter to produce the artwork, a jig boring machine to produce the press tools required and drilling equipment for trial and short-run PCBs. This equipment has improved the accuracy and quality of the boards. In the board production area, new printing, etching, cleaning and preserving equipment has been purchased. Boards are tested on an automatic test station twice, with four visual inspections, before being forwarded to the assembly plant. Here, Thorn are continuing their policy of high capital investment in automatic component insertion facilities. To utilise this equipment fully, great care was taken to maximise the number of components that can be automatically tested and inserted (70 per cent can). The latest acquisition for producing the two TX series chassis is a number of stations which insert a variety of components (pins and shorting links as well as electronic components) with no man handling between stations. All the components inserted are automatically tested for values, tolerance and orientation before insertion and soldering.

After hand insertion of the more complex components, the board assembly moves on to a solder wave: the soldering equipment has been designed and built by Thorn specially for the TX series. Finally, the board assembly goes to a computer controlled test station where the complete unit is checked for component values, orientation, open-and short-circuits. The equipment provides a readout showing the operator any faults discovered and their position.

It's no good inserting the components correctly if there's any doubt about the components themselves of course. Thorn point out that the components have been chosen from world-wide sources for technical performance and maximum reliability, every single component having a detailed, written Thorn specification.

The mechanical side has been much simplified compared to the 9600. Rivetting and welding operations have been completely avoided for example, and only nine fixing screws are used on the complete chassis asssembly. The chassis itself is held in the cabinet without the use of fixing screws (there are three service positions incidentally). The number of plugs and sockets has been reduced from 23 to 13.

From every angle, the TX10 is an elegant engineering exercise. The pictures we saw were excellent.

Initial Models

The first set to be fitted with the TX10 chassis is the Ferguson 3765, a 22in. table model. Subsequent models using the TX10 chassis will be the 3767 and 3791 (both 22in.) and the 26in. Models 3785 and 3788. The 3767 and 3788 feature infra-red remote control. There are also a number of new sets fitted with the TX9 chassis: the 14in. 3756, 18in. 3760, 20in. 3768 and 3769 and the 22in. 3792. The 3756 and 3769 feature remote control.

Monochrome Portable

Part 1

Luke Theodossiou

IT IS now over two years since we published a design for a monochrome portable set. Circuit techniques have advanced sufficiently to justify a more up-to-date design. We have managed to achieve improved performance in various areas, and have simplified construction by splitting the circuit into two main blocks – the signals side and the timebase/power supply section. They are each built on a separate p.c.b., which provides maximum mounting flexibility. Any 110° 20mm neck tube may be used, the choice being left to the constructor. Guidance on suitable tube types will be given in a later article.

Tuner Unit

This month we are concentrating on the signals board. The circuit is shown in Fig. 1. The Mullard U321 tuner was chosen since it's readily available, small, and meets the special requirements for the UK. A full circuit description and circuit diagram for this tuner were given in the November 1978 issue of *Television* (pages 24–26). We felt it unnecessary to go into full details again – suffice it to say that the U321 has excellent signal handling performance, primarily due to the use of a pin diode attenuator arrangement at its input and a Schottky diode mixer.

IF Module

The i.f. module is a proprietary unit (see components list) and its circuit is shown in Fig. 2. We decided to use a ready-built module since this dispenses with the alignment which necessitates the use of an accurate 39·5MHz signal generator.

The tuner's i.f. output is coupled to R1 via terminal 8. This resistor is the d.c. load for the tuner's i.f. output transistor. The signal is then passed to IC1. The parallel effect of R1 and the input impedance of IC1 damps the tuner's i.f. coil and provides a reasonable wideband response, which is necessary if the SAWF is to do its job properly. The i.c. provides around 26dB of gain, and it's output is applied differentially to the SAWF.

The signal is also applied to an internal amplifier and detector which generates the a.g.c. current required by the tuner. C2 is the a.g.c. reservoir capacitor, the signal being coupled to the tuner via terminal 6 of the i.f. module. This method of generating the a.g.c. signal is much better than the usual way (detecting the amplitude of the signal after band shaping has taken place). We felt that this was a desirable feature in a portable, since the a.g.c. system needs to be able to cope with wider variations in signal level than are normally encountered with a set connected to a roof-top aerial system.

The band-shaped output from the SAWF is applied to the input of IC2, the well-known TDA440. Since the tuner a.g.c. system contained in this i.c. is not used, the external component count is reduced. The *RC* network connected to pin 4 allows for maximum gain in the i.f. amplifier section of the i.c. Resistor R5, connected to pin 10, determines the amplitude of the video output signal, and is selected by the module manufacturer for 3V pk-pk. The TDA440 produces both negative- and positive-going video signals at pins 12 and 11 respectively. The positive-going video signal has the intercarrier sound signal removed by a 6MHz ceramic filter. The i.f. module is prealigned and should not therefore be tampered with. Incidentally, the sharp-eyed reader may already have spotted the absence of an a.g.c. crossover control. This is due to the accuracy of the internally preset takeover point in IC1.

Video Circuit

The positive-going video signal from terminal 1 of the i.f. module is applied to the video output stage via the usual bridge-type contrast control VR1. The biasing is such that the d.c. voltage at black level remains constant when VR1 is adjusted. This is important, since it's the black level that we try to keep constant at all times for optimum picture quality.

The signal is applied to the base of Tr1, which is the lower transistor of a cascode amplifier. Transistor Tr1 is operated with a collector voltage of around 10V (since the base of Tr2 is at 10·5V, its emitter is at 10·5V–0·6V). Tr2 is operated in the common-base mode.

The configuration has numerous advantages. First of all, the Miller capacitance effect of Tr2 is reduced to a minimum, increasing the bandwidth. Secondly a small-signal type transistor is used in position Tr1. This has considerably higher gain than the usual video type transistors. We therefore increase the black-level stability against supply voltage variations, and spreads in the gain of Tr2 (which can be quite large) no longer affect the d.c. stability of the circuit. Also, since the collector voltage of Tr1 is only 10V its power dissipation is very low, therefore its junction temperature and hence its base-emitter voltage variation are kept low. This has a dramatic affect on the black-level stability as compared to single-transistor circuits. We found that with a single-transistor circuit the black level can change by as much as 15V as the video transistor warms up. With the circuit we adopted the black level remains extremely stable at all times.

Field blanking is applied to the emitter of Tr1 via connector B3.

Operation of the Beam Limiter

The video output signal is coupled to the c.r.t. cathode via the beam current limiter comprising D1, C4 and R7. This works as follows. The collector of Tr2 is at a nominal voltage determined by the black level and the setting of the contrast control. Let's for simplicity assume that this voltage is 100V. If no beam current flows through the tube, or we disconnect the c.r.t. cathode lead, then D1 will be forward biased by R8 and R7 and the current flowing through D1 will be $100 \div 330\text{k}\Omega = 303\mu\text{A}$. When the tube draws beam current via Tr2 and D1, it will do so until the beam current equals $303\mu\text{A}$. At this point D1 will cut off, since there's no longer any current flowing through it. The

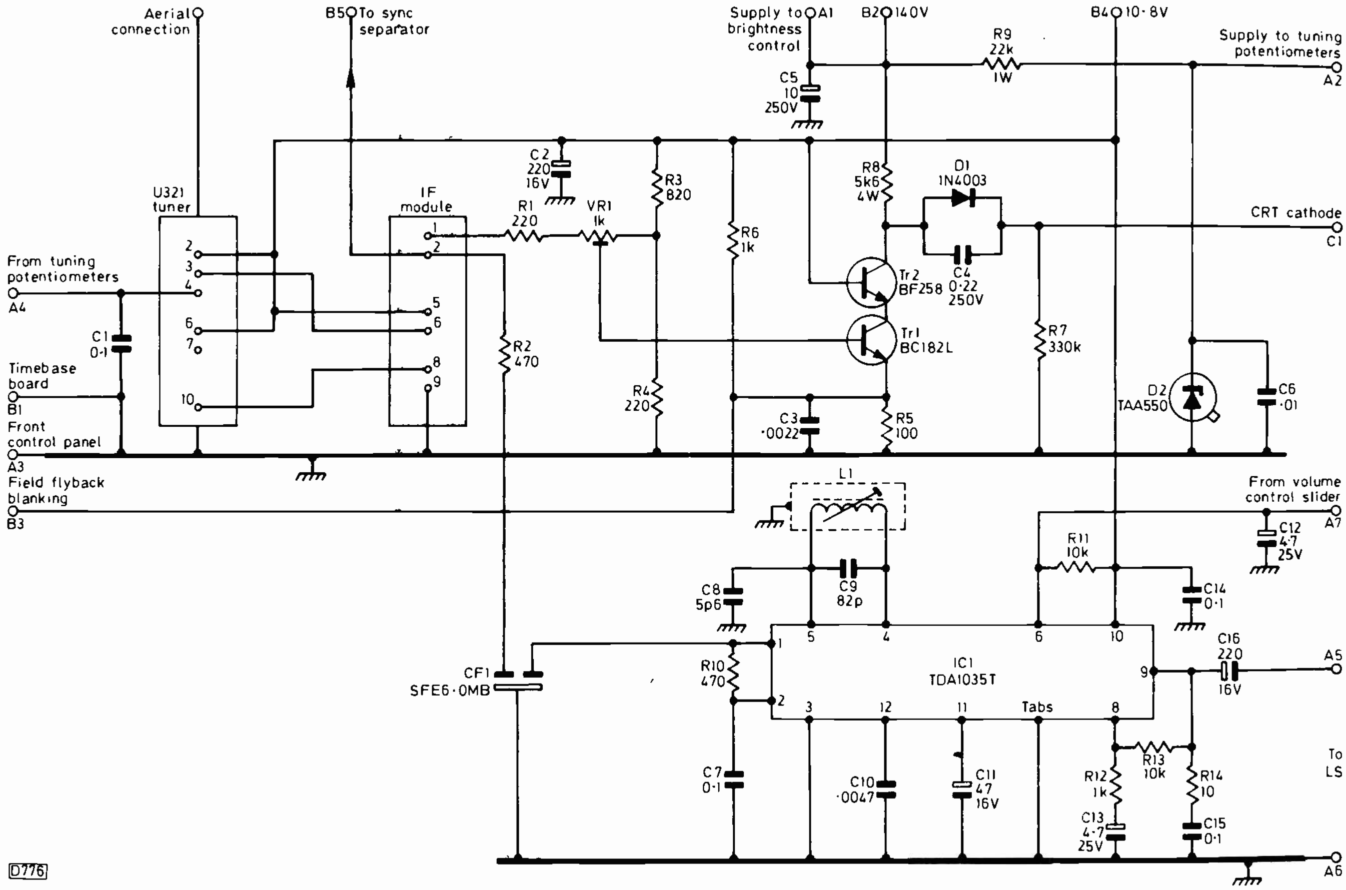


Fig. 1: Circuit diagram of the signals board. Note that the i.f section is a preassembled unit.

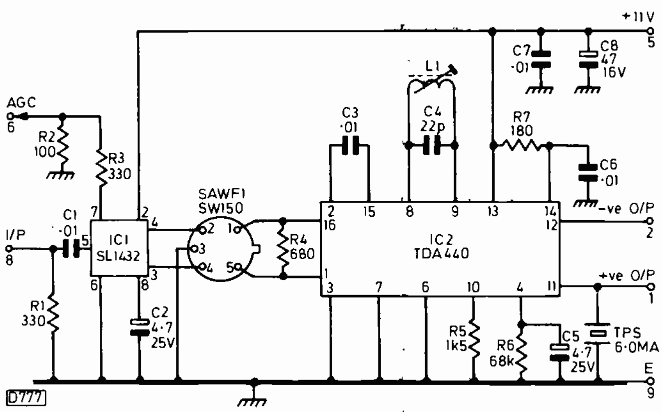


Fig. 2: Circuit of the i.f. unit. The SL1432 i.c. is not at present available through distributors in one-off quantity.

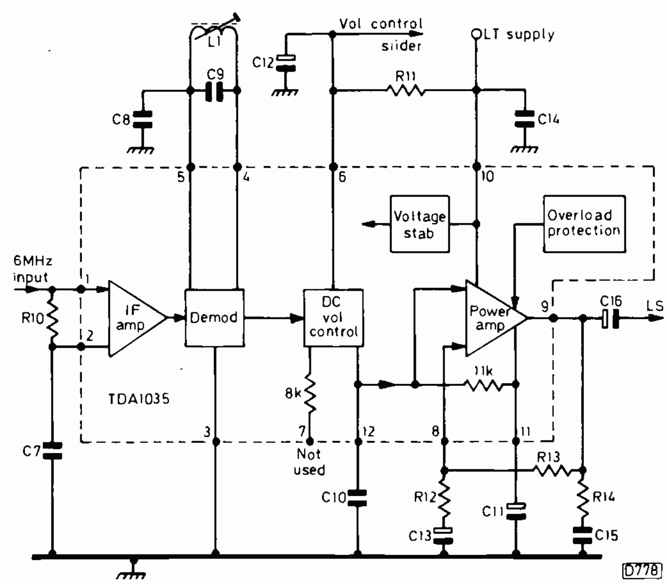


Fig. 3: Block diagram of the TDA1035 intercarrier sound and audio output i.c.

video signal is then capacitively coupled to the c.r.t.'s cathode via C4. The mean d.c. level at the cathode is thus increased, providing the beam limiting action.

Sound Channel

Turning finally this month to the sound channel, the 6MHz intercarrier sound signal is extracted from the composite video signal by means of the ceramic filter CF1. The 6MHz signal is then applied to the TDA1035T IC1, which amplifies, limits and detects the signal and then feeds it to an audio power amplifier which is also in the i.c. A block diagram of the i.c. is shown in Fig. 3.

De-emphasis is provided by C10, connected to pin 12. The gain of the power amplifier is set by the potential divider R12/13. C13 is a d.c. block, allowing 100 per cent d.c. feedback to stabilise the power amplifier's d.c. working conditions. The Zobel network R14/C15 prevents h.f. instability. The d.c. volume control is connected to pin 6 of the i.c., and is basically a potential divider in conjunction with R11. As a result, pin 6 is provided with a d.c. voltage which can be varied from 0V to 5V.

Tuning Voltage stabiliser

The only remaining item on the signals board is the 33V stabiliser. This consists of a TAA550 i.c. supplied from the 140V rail via R9.

★Components List – Signals Board

Resistors: 0·25W carbon film
±5% except where stated.

R1	220Ω
R2	470Ω
R3	820Ω
R4	220Ω
R5	100Ω
R6	1kΩ
R7	330k
R8	5k6 4W wirewound
R9	22k 1W
R10	470Ω
R11	10kΩ
R12	1kΩ
R13	10kΩ
R14	10Ω

Capacitors:

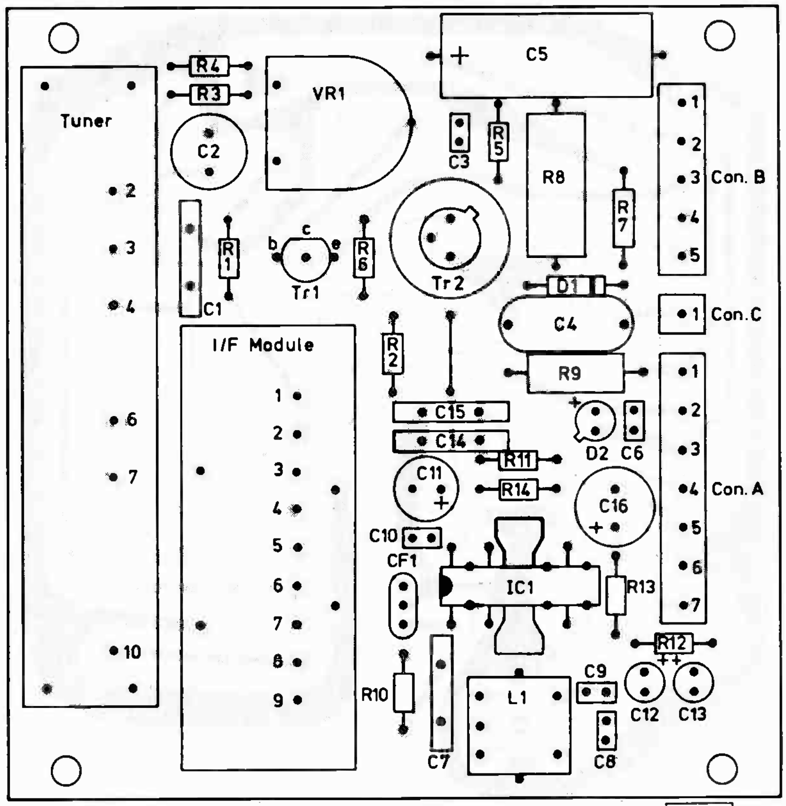
C1	100n ceramic disc
C2	220μF 16V plug-in electrolytic
C3	2n2 ceramic plate
C4	220n 250V polyester
C5	10μF 250V electrolytic
C6	10n ceramic plate
C7	100n ceramic disc
C8	5p6 ceramic plate
C9	82p ceramic plate
C10	4n7 ceramic plate
C11	47μF 16V plug-in electroytic
C12	4μ7 25V plug-in electrolytic
C13	4μ7 25V plug-in electrolytic
C14	100n ceramic disc
C15	100n ceramic disc
C16	220μF 16V plug-in electrolytic

Semiconductors:

Tr1	BC182L
Tr2	BF258
D1	IN4003
D2	TAA550
IC1	TDA1035T

Miscellaneous:

L1 Thorn ref. no. 90D0-172-001-TD01
CF1 Murata SFE6·0MB
Mullard U321 tuner
I.F. module ref. no. 96-13-09 (available from Moffit Communications Ltd, Blaris Industrial Estate, Altona Road, Lisburn, Co. Antrim, N. Ireland. Price £10.50 inclusive of VAT and p & p.)
TO-5 heatsink for Tr2
P.C.B. ref. no. D074
Molex 0·2″ strip connectors



TMF 821

Fig. 4: Component locations on the signals board.

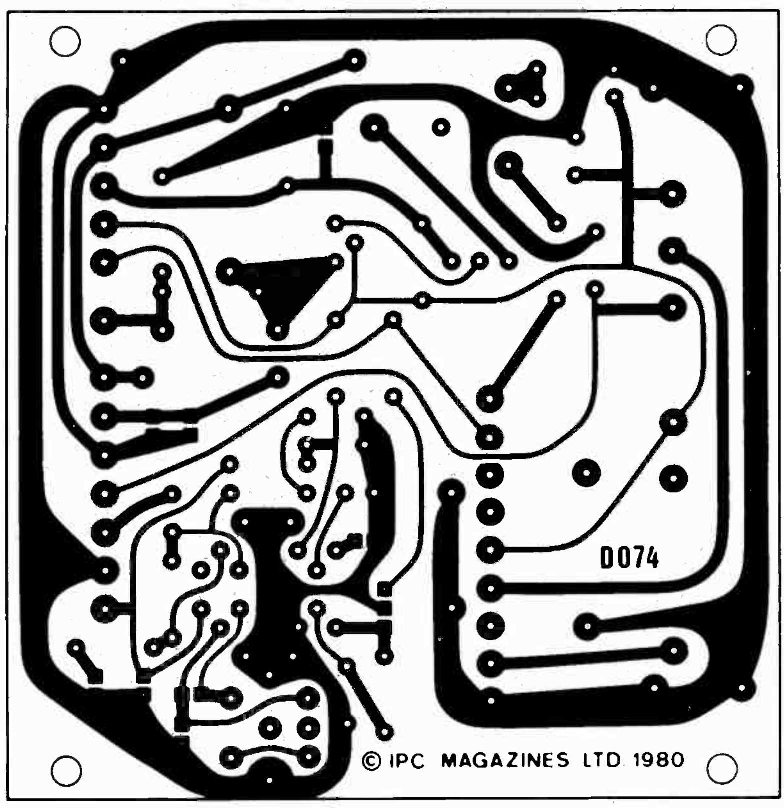


Fig. 5: Signals board print pattern (same size).

CONTINUED NEXT MONTH

A Square Deal for LOPTs

Les Lawry-Johns

NOW as you all know I'm second to none in my admiration for the line output transformers used by Thorn: jelly pots are tops as far as I'm concerned. I ask you: how many times have you had to replace the line output transformer in one of the 1500 series sets for example, or for that matter the preceding 1400 or even earlier? Ah, you may say. What about the e.h.t. transformer in the 3000/3500 series? Not guilty we say: blame the tripler. Hissing Sid is guilty of knocking the jelly pot over.

In short (sorry!) we may say that the e.h.t. rectifier is more often the faulty item and that the transformer rarely is.

If we accept this proposition, who was the bright boy who, some years ago now, decided to incorporate the single-stick e.h.t. rectifier inside the line output transformer's overwinding? We are not referring to split diodes and windings, simply to an item which is at the end of the overwinding and could easily have been left outside for replacement. If one sticks to the letter of the BEAB regulations one has to replace the relatively expensive transformer simply because it has a defective inexpensive item buried inside the plastic housing.

If the rectifier has gone short-circuit, so that removal of the e.h.t. cap and any associated capacitor (which could have caused the trouble in the first place and would have to be disconnected anyway to prove the point) restores normal timebase working and the capacitor (if present) is in order, it seems reasonable to fit a new stick rectifier in a fully insulated housing on top of the line output transformer assembly, thus restoring the set to normal working without replacing the transformer itself. Such fully shrouded units are readily available, and come complete with e.h.t. cap and lead. So why not use them? We do.

The objection of course is that the defective rectifier may have a high-resistance leak, which would cause sizzling and varying e.h.t. on bright scenes or when the brilliance is advanced. So far however we've not found this to be the case. Apparently when they short they short – and good. This of course is not what we're on about: why put the stick inside in the first place? Greater reliability? Safety? I doubt it.

More Moans

Having groaned about the Thorn 1690/1691 series portables (oh, that's what he was on about), let's have a groan about the cheaper imported portables which keep coming in because the stores that sell them are loath to repair them. They appear with the most unlikely names adorning the front fascia, but are usually much of a muchness.

There seem to be two common failings. One is caused by the use of underrated diodes in the mains bridge rectifier circuit. Even if all four diodes haven't cooked up and taken the supply leads with them (due sometimes to incorrect battery connections) it's still essential to turf out the lot and fit more robust diodes and preferably a series fuse if one isn't fitted.

The other common failing is caused by the use of unreliable transistors in the a.g.c. circuit. The customer's complaint will be that the screen lights up but there are no vision or sound signals. Oddly enough, the transistor usually responsible stands up on long legs somewhere at the front of the panel, like a sore thumb. A quick check with an ohmmeter will establish whether or not this is the guilty party. Probably in the set you next get for repair the guilty transistor will not be so obvious, but it doesn't take long to check each suspect, and hopefully the print will be marked B, C and E to enable you to use a transistor of the type you have in stock, say a BC108 or a BC148, with the base in the middle, assuming it's an npn transistor of course. There's a fair amount of design variation so we can't be too explicit.

Having said that, we must now confess it wasn't all that long ago that much time was spent in checking the a.g.c. and the i.f. stages of one particular portable only to find that the tuner was responsible after all, and we've yet to find out how this could have rendered the i.f. stages well nigh inoperative.

Mrs. Ferguson's HMV

Have you noticed the number of complaints of late about turntables not playing new records properly? I rather suspect that this is really down to the record makers, but not being an expert on anything I'm not able to say for sure. We're expected to cure all the ills that afflict the home entertainment scene however, and a pick-up arm bouncing around on a new record is not conducive to harmony in the home. Hence the arrival of Mrs. Ferguson, with her HMV stereo, an Indesit T12 portable and a son who was a Hi-Fi expert.

Ernest (the son) immediately launched into an explanation of what was wrong with the stereo unit and what was needed to put it right.

"It obviously needs a better cartridge, one with better tracking capability – say a Shure V15 type IV – but I doubt if my mother will spend eighty quid or so on a decent cartridge and anyway I don't suppose you would keep such good, er . . ." He didn't complete the sentence, but I guessed he was casting aspersions upon my what's-its-name.

"If the cartridge is not at fault, which it isn't, she would be wasting her money if she followed your advice" I mumbled. "Why don't we find out what the trouble really is, if there is any?" Mrs. Ferguson then got her bit in.

"Shut up Ernie," which was a good start I thought. "If we leave it with you, perhaps you can sort it out and ring us when it's ready and perhaps have a look at our portable telly – everything looks long."

And off they went, Ernie still on about the stereo needing equalisation to prevent cross-talk between the tracks or something technical like that.

As it used a Garrard deck, we immediately removed the turntable and checked on the free movement of the changing cycle actuating plates. These as usual were a little stiff, but not as tight as we have known them. Sometimes we've found the plates completely immovable, which must have meant intense discomfort to the end tracks of the records played under these conditions.

So off next came the changing wheel (I know it has a proper name, but I can't recall it at the moment) and off came the upper and lower plates to enable the spindle to be freed off in its bush, which is where the trouble originates. Having ensured that they could freely flop about, we reassembled the unit and tried several records. All played through to the very end without incident, including my all-time favourite "Night in a Turkish . . ." (censored by the editor).

I still had doubts about the performance of new records on it, in view of Ernie's comments about tracking capability, but I had shot my bolt and could do no more since the arm was as free as a bird and the weight was right.

The Indesit was where I really came unstuck. The complaint was excessive height, which was obvious as soon as the set was switched on. Since access to the height and linearity presets is through holes in the aerial input moulding, I assumed that no one had been at them and immediately started checking components in the height and linearity circuits, removing the tuner unit in order to gain easier access.

Everything appeared to be in order – capacitors had capacitance and didn't leak (even the tant), resistors had the correct resistance, the presets were intact, and the driver transistor was in order. I didn't suspect the output transistors in view of the nature of the fault.

It wasn't until I reduced the height control setting that I discovered that the bottom came up but the top didn't reduce at the same rate. Adjusting the linearity didn't have much effect, so now we had a much more familiar symptom which directed attention to where it should have been directed in the first place (and would have been if we'd thought about the possibility of Ernie twiddling with a fine screwdriver through the plastic moulding of the earial panel).

A quick check on the output transistors revealed that one had an open-circuit junction and the other a slight leak on a reverse reading. So out they came and in went a new pair. All that messing about could have been saved if I'd followed my own advice: always check first the things that run warm, or where there's heat there's a probable trouble spot. This was the first time I'd found the output transistors at fault when the complaint was excessive height.

A Philips K80

A friend (?) asked me if I'd tackle a set that had really got him losing sleep. It was a Philips S26K414 (K80 chassis) and I hadn't seen one before, so they can't be all that thick on the ground. I'd had many a battle with the earlier K70 however, so I thought I'd stand a sporting chance. Having a 110° tube it's not as bulky as the K70, but at first glance with the rear cover off it has the same unnerving effect, due to the sheer mass of circuitry.

The problem, which I got second-hand, was that the present "no raster" condition had been preceded by incorrect grey scale and no proper colour signals.

Screwing up courage, we made a tentative start. Switching on produced an initial bright glow in the valve heaters, particularly the PL802 luminance output valve. I was also pretty sure I saw a spark inside this valve. The top right line output section houses the two PL509 valves and a PY500. Under these is the line output transformer, and under this again is the tripler.

I heard the e.h.t. rustle up, so this was one relief. Another was that the sound was present and of the expected high quality – the set has a tweeter and woofer.

Since the e.h.t. was present, the obvious course was to check the c.r.t. base voltages. The first anodes were at just over 500V, so no problem here. The grids were also about right at a little under 100V (the grids are driven by three PCF200 colour-difference output valves). Next, as expected, the cathode voltages were high – about 240V. So there didn't seem to be too much of a problem after all – fit a new PL802 we thought and all would be well. A new PL802 produced no voltage drop at all at the c.r.t. cathodes however, so it was time to take a closer look at the luminance output stage.

With the chassis let down to the extent of the knot in the retaining cord, we chased the white luminance lead from the tube base to the print near the PL802. The anode load resistor was found to be a hefty 5·6kΩ wirewound type, and there was only about 20V across it – so clearly the PL802 wasn't passing much current. Its cathode voltage was about 2V, and there was a slight negative voltage on its control grid. With a knowing wink, we decided to get a more healthy current flow: with the meter still connected to the anode, and recording 240V, we shorted the control grid to chassis to remove the negative bias. To our astonishment, the meter's reading didn't budge from 240V.

Measure the negative voltage on the grid more carefully – just a little over 2V. Now I'm no mathematician, but the removal of a 2V negative bias on the grid should have produced a marked increase of anode current. The fact that it didn't suggested that the new PL802 was not up to scratch. Fit another. Results identical, so I bashed my head on the bench just for fun.

All right I thought, if removing the grid bias doesn't do anything, let's remove the cathode bias instead. Connecting the cathode to chassis resulted in the anode voltage falling to 70V and to my mind becoming a complete blank. Daft as a brush, I checked the continuity of the grid socket of the valve base to the print, and of course it was o.k. I then checked the continuity of the cathode socket to the print. Again o.k.

Just for fun, check from the cathode pin to chassis. Something like 400Ω. 400 *ohms*? It should have been 27Ω. I then remembered the spark in the original PL802. With the damaged 27Ω resistor replaced, the anode voltage dropped quite nicely and there appeared to be something on the screen, which was mainly green, but what was there kept changing around so much that I concentrated more on what the voltages were at the tube cathodes. These were fluctuating around pretty wildly, though the voltage at the white lead input remained steady.

We then took a closer look at the tube base panel, and wished we hadn't. On the bottom of the panel is a plastic housing which contains four sliders to enable the highlights to be set slightly differently for monochrome and colour. The selector switch is on the right side, operated by a solenoid powered by the colour-killer – which confused me all over again.

It was clear that the sliders were not contacting the resistive element properly, and furthermore couldn't be made to do so, hence the varying tube cathode voltages. Having failed to improve the contact we decided to bypass the presets and switches, applying the luminance signal directly to the cathode resistors. The result was a weird but fairly steady picture, which should have been in monochrome but was so badly converged and generally set up that we had to start from the very beginning with purity, convergence, grey scale etc.

The convergence panel pulls out from the front once the two rear fixings have been released. At last a reasonable monochrome picture was resolved, but the contrast control was inoperative. So we wearily set about finding the reason for this. Since the contrast control operates on the control grid of a PCF80 valve (triode section) on the top centre panel, we thought we would find the source of the trouble here. Not so! The PCF80 triode cathode voltage was too high (about 7V instead of 1·9V), but to find the cause of this we had to trace back down on the main signal board – to the second chroma amplifier transistor (BF195), which had a base-collector short. Ah we thought, we can kill two birds with one stone. Replace this and we'll not only regain control of the contrast but we'll also restore the colour. We regained control of the contrast all right, but of colour there was no trace.

Since signals were now passing through the chroma amplifier, but nothing worth mentioning was coming from the detectors, it seemed that we next had to lean heavily on the reference oscillator. We were about to do this when Mrs. Crooke burst in.

Negative Picture

Mrs. Crooke was in such an agitated state that I had to forget about the K80 for a while. It was put down and Mrs. Crooke's Bush was put up in it's place. She was a small woman who seemed never to stop talking (shouting) – even to draw breath. I wondered if she knew Mrs. Brashley, but couldn't get a word in edgewise to find out. The torrent continued while I was trying to find out what was wrong, and I didn't really pay much attention to what she was saying except to the bit where she said that the reason she had brought the set in was that her husband worked all hours at the office and rarely arrived home until late at night and then went straight to bed. I wondered why.

The Bush A823 was not functioning because the l.t. line was very low, though the a.c. input to the bridge was normal. Since the fuse was intact there were clearly no shorts, so it was pretty obvious that the bridge rectifier was at fault. It read all right on an ohms test, but it was a green one and green is not my favourite colour. We had the option therefore of putting in four diodes or a black BY164.

The never ending chatter was putting me off my game, so I suggested that Mrs. Crooke should pop off round the shops for half an hour or so. Mrs. Crooke scratched the cat's head (Spock had been listening impassively during the tirade, and it was about time she came in for some attention).

"Your dad's fed up with my chatter darling. He wants to get rid of me so he can do his work properly. I do talk too much I suppose. Everyone tells me so. But you don't mind do you my sweet? Cats are much better than people, especially men." And off she went, leaving Spock and I feeling sort of drained.

Not feeling energetic enough to fit four diodes, I popped in a nice new BY164 and was comforted to hear the e.h.t. come to life and the sound come on – even if it was two women chattering. The comfort didn't last long when I looked at the screen. The picture was completely black and white but reversed, i.e. negative.

I was fairly sure that the SL901B i.c. in the decoder was responsible for this condition but couldn't figure out how the loss of the l.t. line could have caused it to go. Mine's not to reason why however, and fitting another chip restored normal operation.

I'd just finished writing out the bill when Mrs. Crooke returned, presumably from a brief encounter with the hind legs of a donkey, making a bee-line for the cat. Off she went, nattering away ten to the dozen – until I handed her the bill that is. There was a deathly hush. Unearthly it was. You would have thought it was a ransom note.

The wife ran in to see what all the quiet was about. "You take the money from Mrs. Crooke dear" I whispered, coward to the last, "and I'll put her set in the car for her". When I got back Mrs. Crooke had regained her composure and was talking about the cost of living, having handed over three fivers and received her change.

The K80? Well, the above took place only an hour ago, and I haven't got back to it yet.

Surplus Tuner Control Unit

Hugh Cocks

DURING a recent visit to Sendz Components I came across an interesting varicap tuner control unit that could prove useful to TV set constructors. The unit was made by GEC and has eight channel selector switches. Only a very light touch is needed to change channels. A large nixie tube displays the selected channel.

The unit is designed to be mounted in the set vertically, by means of the bracket on its left-hand side. When the whole unit is depressed, the innards spring forward giving access to the tuning potentiometers.

Fig. 1 shows the panel arrangement and the inputs/outputs, which are straightforward. When one of the selector buttons is depressed, a feed to mute the a.f.c. circuit to facilitate channel selection is obtained at pin 10 of the 14-pin connector (note that pin 1 of the connector is towards the centre of the board edge, pin 14 towards the corner). Pin 11 is connected to a switching transistor and can be used to adjust the time-constant of the flywheel line sync circuit for VCR use (the original model used a TBA920 sync/line oscillator i.c., the switching transistor being used to short-circuit pin 10 of this i.c.). The transistor switches on when channel 8 is selected. Pins 12, 13 and 14 are connected to a Band I/III/UHF selector switch associated with each channel. This can be ignored for ordinary UK use, though some DXers might wish to make use of it.

In the original design the TAA550 tuning voltage stabiliser i.c. was mounted on the i.f. panel and fed from R18 on the control unit via pin 5 – the idea was to prevent the TAA550 overheating when its loading (the tuner control unit) was disconnected. It's a simple job to add a TAA550 and bypass capacitor (say 0·005μF) on the PCB side of the control unit – positive side to pin 5, negative side to pin 3, with pins 4 and 5 linked. There are four i.c.s on board PC677.

The unit is currently available from Sendz Components at £5·00 plus 30p postage and 15% VAT. A full circuit is supplied.■

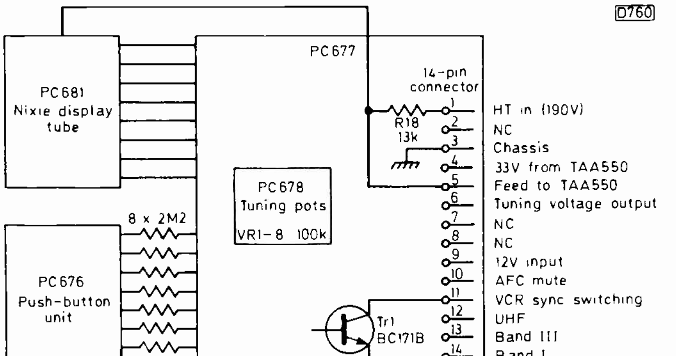


Fig. 1: The panel arrangement used in the surplus varicap tuner control unit, and the connections to the fourteen-pin connector.

Long-distance Television

Roger Bunney

FEBRUARY unfortunately did not see the hoped for lift in F2 propagation, and it seems that the peak in the sunspot cycle has now passed. The highest mean sunspot count, 188·2, occurred in October, with November a close second at 185. Provisional sunspot figures show that the highest, 302, occurred on November 10th, while during the period October 1979–January 1980 the number fell below 100 on only very few days. There is every hope that F2 conditions will improve again, if not in the near future perhaps in the Autumn, with the lower Band I channels active once more.

I've been reorganising my DX-TV equipment during the month, so loggings here have been few. From various letters it seems I chose a good time for this, since DX conditions have been dead.

There have nevertheless been a few points of interest. F2 reception from Russia was present here at Romsey on February 10th, for about half an hour, starting at 0820, and two days earlier Hugh Cocks also received Russian F2 signals. The outstanding reception this month however was Hugh's reception of the Australian channel A0 on the 14th, from 0855-0910. The signal was weak and the image smeary, but fortunately the video consisted of a caption which remained constant during the period. This gave rise to a suspicion that it could be an announcement relating to the closure of ATV0, Melbourne. A letter just received from Anthony Mann (Perth) confirms that ATV0 have been radiating a caption to say that ch. 0 transmissions have ceased, retune to ch. 10 – this signal was monitored by Anthony in Australia via SpE, and of course confirms Hugh's Australian reception on the 14th.

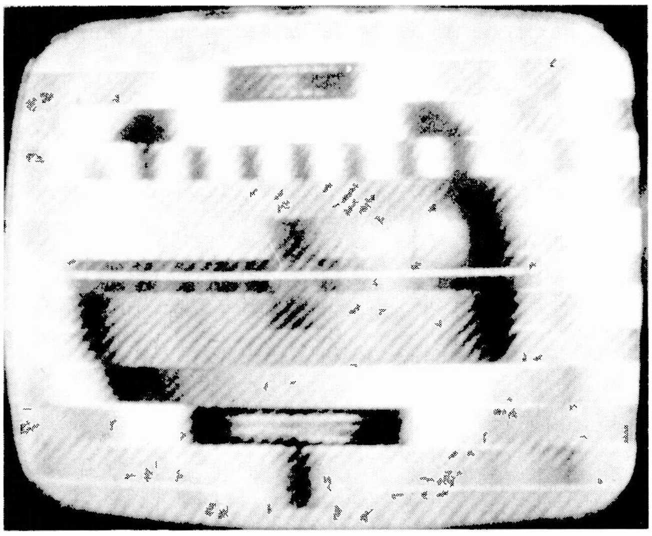
There was an intense tropospheric opening from the evening of the 28th to the early morning of the 29th, giving good u.h.f and Band III signals in the UK from the Low Countries, West Germany and France. Gareth Foster (Isleworth) logged many u.h.f. stations, using a new ELC2060 tuner (more on this later) feeding into a Bush TV125 (actually a Murphy V849). A fluttery ch. E2 signal, suspected as being Gwelo, Rhodesia, was logged on the 18/19th in East Sussex, also on the same days there was enhanced tropospheric reception from the south, with Switzerland at u.h.f. David Martin, Geoffrey Chapman and myself visited Hugh during the month, and I can now understand why signals are so abundant at his East Sussex location. From his hilltop position near Bexhill, noise-free SECAM signals are available from France, while during our visit Luxembourg ch. E21/E7 and West German Band III and ch. E55 signals were locking – despite heavy rain at the time!

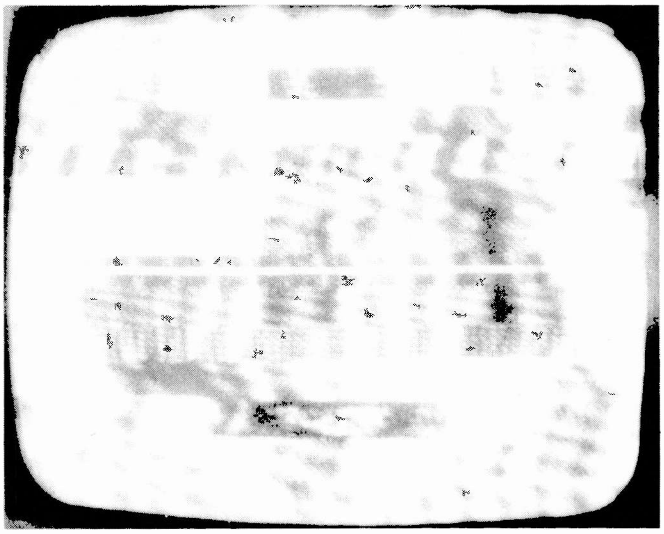
Reports from Overseas

It's the SpE season in Australia at present, with the usual transcontinental signals and Tasmanian Sea hops from NZ. Apparently near record tropospheric conditions occurred on January 23rd, including a 1,300 mile signal received in Adelaide from Perth, Indonesian Band III stations seen at Carnarvon, and multiple-hop reception of Te Aroha (NZ ch. 1) in Perth. F2/TE conditions have been active, with the UK ch. B1 received on the 31st – vision and sound of course. It's interesting that on some days the ch. F2 sound signal is strong while the ch. B1 sound is weak while on other days the conditions reverse. January 31st was a good day apparently, with Anthony Mann reporting reception of ch. B1 sound and vision, ch. F2 sound, chs. E2 and R1 and ch. B2 sound (at 48·25MHz). There was an intense F2 opening to the north on February 17th, with ch. A0 received via back-scatter.

Conditions in South Africa improved considerably during mid-February, with F2/TE providing signals at up to ch. R2 sound, including Italian TV sound and military communications from UN Forces along the Lebanese border. During such conditions the band tends to get cluttered with Portuguese and Spanish TV sound signals.

Finally this month congratulations to John Combs of Orlando, Florida, who on November 17th last received Puerto Rico ch. A7 via a 1,100 mile tropospheric duct over





Mystery Arabic PM5544 test pattern received at Romsey, Hants on December 12th last at 1250. The F2 signal is suspected of having come from Iran. The set – an elderly KB Featherlight portable!

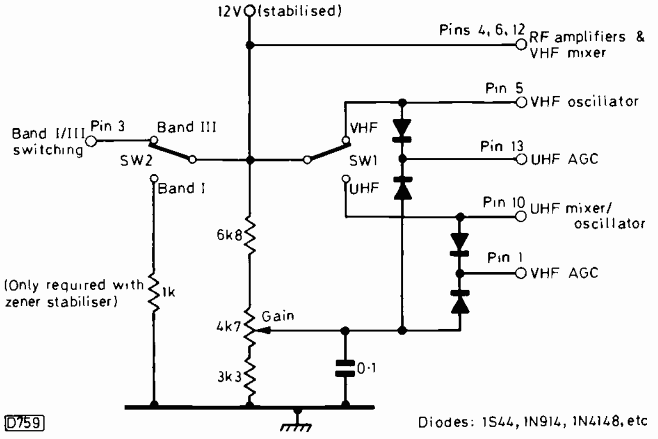


Fig. 1: Diode switching network adopted by Gareth Foster to enable a single v.h.f./u.h.f. gain control to be used with the ELC2060 v.h.f./u.h.f. varicap tuner.

a sea path, with in addition a possible ch. A12 signal. A first in the USA.

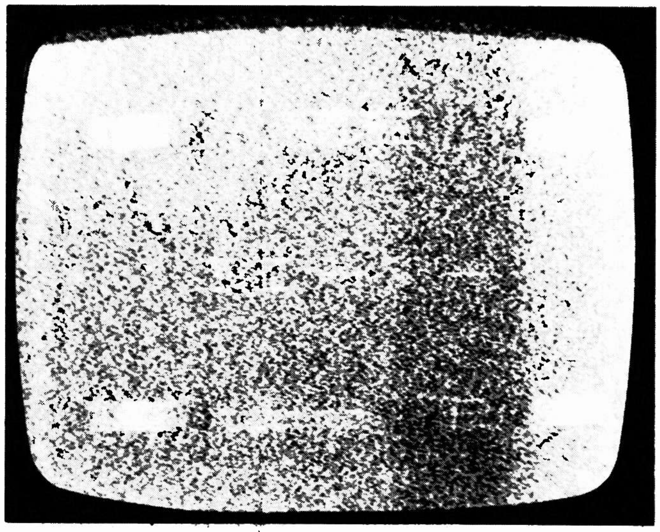
The ELC2060 Tuner

These tuners, which cover the v.h.f./u.h.f. bands, are now available in quantity on the surplus market, in new condition and mounted on a setmaker's PCB (specifically those from Sendz). Gareth Foster obtained one of these units and for his purposes removed it from the PCB. He discovered that if both a.g.c. lines are connected to a common gain control the r.f. amplifier not in use draws a heavy current, loading down the a.g.c. line so that the gain control is inoperative, i.e. the gain is left at maximum. Inspection of the PCB revealed that both r.f. amplifiers are permanently on, with only the oscillators and the a.g.c. lines switched. Gareth adopted the circuit shown in Fig. 1 for band switching – the diode matrix comes from the PCB. The r.f. amplifier not in use is kept at minimum gain via the diode which ties its a.g.c. line to the other oscillator supply. The problem is that with both r.f. amplifiers in operation at maximum gain, local u.h.f. signals break through on the v.h.f. bands. For pin connections, see page 595 last September.

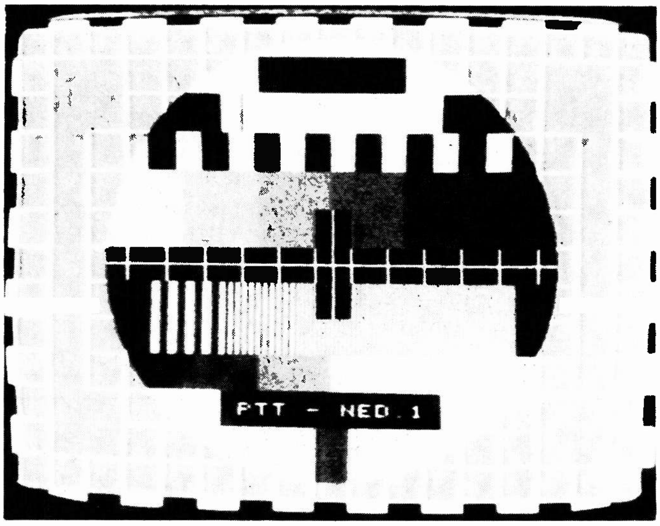
News Items

Australia: An ethnic TV service is to start this autumn. If the government hasn't organised a u.h.f. transmitter in the Melbourne area by that time, ch. A0 may be put back into operation. TVQ and ABMN are to continue operating on ch. A0. More u.h.f. relays are planned for the difficult areas around Sydney.
Spain: RTVE is now broadcasting a TV magazine programme on Friday afternoons – hence on Fridays RTVE does not go off air between 1640-1815 as it does on all other weekdays. The RTVE-1 test card is shown at 1815-1835. Regional stations transmit their own programmes from 1405-1430 on weekdays.
Holland: According to a Dutch TV guide, American (AFN) and UK (BFBS) forces TV transmitters are to be sited at Brunssum and Maastrict. BFBS will transmit conventionally, but the AFN signals will be "scramblen".
South Africa: A TV service for coloured viewers, in five languages, is expected to start by January 1st 1982. Programme origination will be from the main Johannesburg studio centre.
UK: It seems that the close down of the 405-line network will start in 1982, commencing with the least used relay

Swedish channel 1 schools programme caption received by Ryn Muntjewerff in Holland.



China channel X received via F2 by Petri Pöppönen in Lahti, Finland on December 15th last.



An example of the strength of the signals received by Andrew Tett in Surbiton, Surrey last November (29th). This Dutch NED-1 PM5544 test pattern was received on ch. E29 at 1600. No amplifiers or accessories were used – just a dipole in the loft. The set is fitted with the Thorn 1400 chassis.

transmitters and extending to the whole network by January 1986.

In Brief: Experimental colour transmissions have been carried out in New Delhi, India . . . A feasibility study for a TV network is being carried out in Papua, New Guinea . . . The Libyan TV network is being extended, with nine new transmitters.

Sunspot Numbers

The Swiss Federal Observatory's service of Zurich posted bulletins on sunspot numbers is being closed down and subscriptions are no longer being accepted.

Band I Intruders

Trevor Brook (G3WBQ), writing in the RSGB's magazine *Radio Communication* (December 1979), provides a summary of various broadcasting stations whose harmonics can be regularly heard in Band I, giving a pointer to possible openings and indications of likely reception directions. The seventh harmonic of the Nauakchott (Mauritania) 41 metre band station (4,000km) can be heard at 50·723MHz, sometimes at very high strengths, in Arabic, French or an English language pop show at 1900-1930GMT. The seventh harmonic of Radio National Espana can be heard at 49·735MHz, though it's not certain whether this is via SpE from the mainland or the Canaries. Along the south coast a signal consisting of a mixture of vision and sound, varying in strength with the prevailing tropospheric conditions, can be heard at 50·4MHz. This is apparently a "funny" from Caen ch. F2. An authorised source is the Gibraltar beacon ZB2VHF, which should be received at high levels when RTVE is present via SpE.

New Hybrid Amplifier IC

SGS-ATES UK Ltd. have introduced a new, higher gain version of their SH221 wideband hybrid amplifier i.c. which we featured in the July 1978 issue. The new version is known as the SH225, has a gain of 26dB with a 24V supply and a noise figure of 5dB. The pin connections are similar to the SH221.

From Our Correspondents . . .

Following Ian Beckett's reception of an Indian Head test card via F2 recently, Keith Hamer writes to say that CBC use this card during the mornings before the start of programme transmissions. CBC are experimenting with the Philips PM5544 test pattern, including a digital clock insertion. Mike Gaskin (Croydon) has received confirmation of reception of another Canadian ch. A2 station via F2 – a strong System M signal was received on December 15th last at 1625. At 1630 a new programme started, with the CBFT caption – the transmitter call sign of a Montreal station. Congratulations, Mike.

During the tropospheric openings at the end of November and January, Robin Crossley (St. Albans) received a great many u.h.f. transmitters using a Fuba XC391 and an 18-element Wolsey array,with a two-stage Labgear amplifier.

Finally, Petri Pöppönen (Lahti, Finland) has sent a photograph of the Chinese transmission he received on ch. X (57·75MHz) last December 15th at 1025GMT. Despite the noise, the Chinese characters can be seen. The caption was present for ten minutes, and although the signal is weak there's little sign of the usual F2 multiple imaging.

VCR Colour Systems

Part 1

Steve Beeching, T.Eng. (C.E.I.)

WHEN PAL colour receivers first appeared on the scene in the late 60s, there was concern in the industry about the reliability of such complex – for the time – circuitry, and about what could be done in the event of faults occurring. The same concern is now being expressed about some of the circuitry being used in domestic VCRs. Time therefore to take a look at the operation of the colour record and replay techniques used in the various VCR systems, with a view to making fault finding that little bit simpler.

First though, let's consider the basic problem. We're talking about the current generation of "long-play" (as opposed to the earlier N1500 generation) machines – the Philips N1700, VHS and Betamax VCRs. With these machines the tracks are laid down on the tape side-by-side, with no guard band between. If the heads do not maintain very accurate alignment with their appropriate tracks therefore, there's the possibility of interference due to signals on adjacent tracks being picked up (crosstalk). The problem is not difficult to overcome for the luminance signal, which is frequency modulated on to a carrier in the higher part of the bandwidth. If the heads are tilted with respect to one another (the slant azimuth technique), one will not reproduce anything recorded by the other and vice versa. The problem with the chrominance signal is that it's modulated on to a low-frequency carrier (562·5kHz with the N1700, 626·9kHz for VHS and 688kHz with Betamax), and gap tilting is not then effective.

In the Philips N1700 system no special circuitry is used to overcome the problem. If the lines of adjacent fields are laid down next to each other, taking care that the phase of the V component of the signal is the same on adjacent lines, then if one head picks up the other's colour information it will add to rather than interfere with the colour output, and the eye will not notice this (the human eye is not very sensitive to minor colour inaccuracies, as we all know). In practice, this works out satisfactorily. When we come to the VHS and Betamax systems however we encounter even higher storage density on the tape, i.e. narrower track widths. So additional signal processing is used with these systems to deal with the problem.

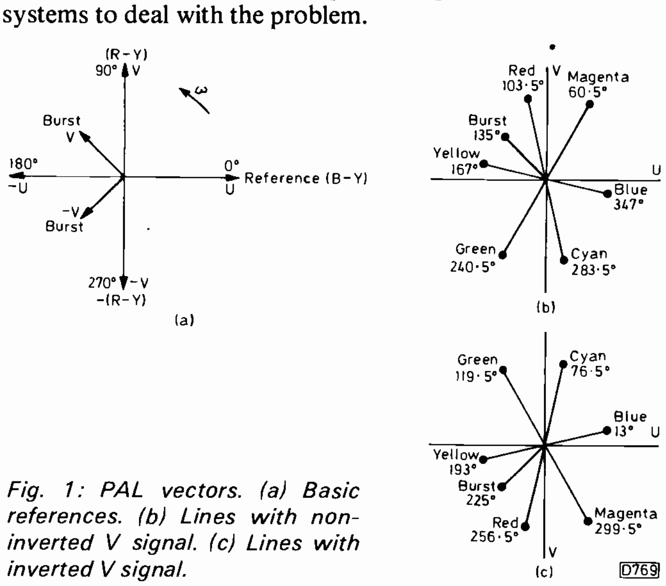


Fig. 1: PAL vectors. (a) Basic references. (b) Lines with non-inverted V signal. (c) Lines with inverted V signal.

To start off, a brief recap on the PAL colour system vector diagrams will help. Fig. 1(a) shows the basic, well known diagram. The subcarrier frequency is 4·433619MHz, with the U chroma phase 0°. The vector rotates anticlockwise, as indicated by the little arrow, one complete circle being 360° or one subcarrier cycle. Our vector then is rotating at 4·433619 million times every second. At 90° we have the phase selected for the V signal. In generating the PAL chrominance signal, we take two 4·43MHz (for short) subcarriers with a 90° phase difference, modulate one in amplitude with the V video signal and the other with the U video signal, then add the two together. The receiver separates the U and V components of the chrominance signal, using a comb filter (chroma delay line etc.), timed demodulators and a phase-locked reference signal source.

The result of adding together the two quadrature modulated subcarriers is that we get a single subcarrier which is modulated in phase and amplitude to indicate the full range of colours and their saturation – see Fig. 1(b). The maximum saturation of each colour is indicated by the dot at the end of the appropriate line (phasor). In the PAL system the V signal is inverted on alternate lines, i.e. phase shifted by 180°, with the result that the colours on these lines have the phases shown in Fig. 1(c). Note that the burst is at 135° when V is at 90°, and 225° when V is at 270°. If you draw Fig. 1(a) on a piece of paper and fold it along the U axis, you will see that the V and burst are mirror imaged. The same applies with Fig. 1(b) which becomes Fig. 1(c) when folded along the U axis. It's important to remember that the signal pattern recurs on every *second* line, i.e. V is at 90° on lines 1, 3, 5 etc. and at 270° on lines 2, 4, 6 etc. The idea is that by adding instantaneous signal voltages from two successive lines, the effect of phase errors is largely overcome.

The VHS and Betamax record and replay systems both make use of this two-line repetition sequence to cancel the effects of colour crosstalk. Staying with the basic PAL system for a moment however, let's recall how a delay-line PAL decoder operates (see Fig. 2). The delay line provides a signal delay of one line duration, so that its output at any instant consists of the signal from the previous line. This is fed to add and subtract networks along with the direct, i.e. undelayed, signal. If the signal at a given instant is U + V,

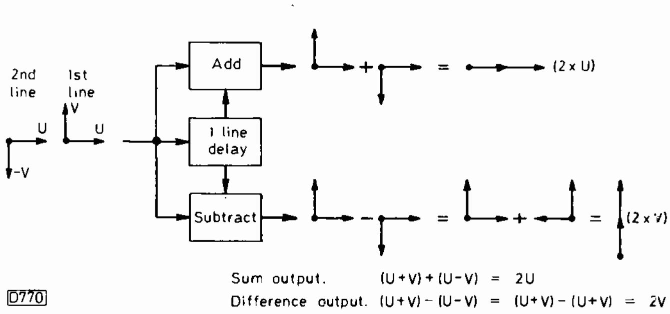


Fig. 2: Separation of the V and U components of the chroma signal using a delay line in conjunction with add and subtract networks. The separation process also has the effect of converting signal phase errors into slightly reduced saturation.

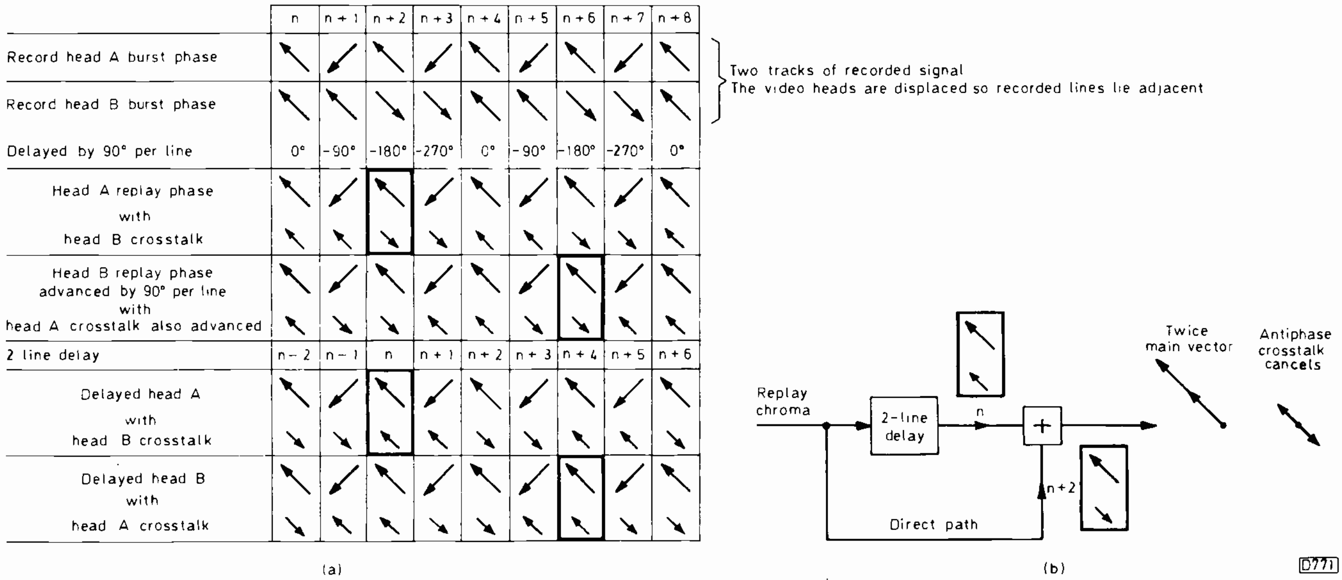


Fig. 3: Technique used with VHS VCRs to cancel chroma crosstalk between adjacent tracks due to slight head misalignment. (a) Signal and crosstalk phasors from line to line. (b) Use of a two-line duration delay line to cancel crosstalk.

then the output from the delay line will be U − V. Adding these two signals gives us 2U, and subtracting them (inverting U − V to give −U + V then adding the result) gives us 2V. We've thus separated the two components of the chroma signal, and if you care to draw out some vectors you'll see that the effect of any phase error has been converted to a slight reduction in saturation (after demodulation). The basic point to keep in mind however is this addition and subtraction business. A further complication in practice is that the delay line introduces a 180° phase shift, as a result of which the add circuit gives us 2V and the subtract circuit 2U, but we digress.

The basic objective of the VHS and Betamax colour systems, although the methods employed differ, is to produce the colour error or crosstalk on replay in opposite phase to the correct signal *every two lines,* so that they can be cancelled using a two-line delay. Hence our discussion of the basic PAL vectors. But by carrying out error cancellation over a period of every two lines, the basic PAL switching remains unaffected.

The VHS System

VCRs use two rotating heads to record/replay successive fields. In the VHS machine, one head records the colour subcarrier (626·9kHz) in the normal phase while the other records the carrier phase retarded by 90° per line. Fig. 3(a) charts the phase of the burst signal resulting from this arrangement. The first line of the chart shows the burst phase recorded by head A – with the normal burst swing of 135° and 225° on successive lines. The signal recorded by head B is a different story, since it's being phase retarded by 90° per line (retarded is clockwise), not continuously but in the steps of 0°, 90°, 180° and 270° on successive lines. As a result of the combined effects of the PAL switching and the 90° phase retardment, head B records two lines at 135° followed by two lines at 315° – note the two-line pattern!

The third line of the chart shows the head A replay signal, which is obviously the same as its record signal: the small arrow added indicates the phase of the crosstalk picked up from the adjacent head B tracks. The fourth line shows the head B replay signal, with a 90° phase *advance* (anticlockwise) so that it now corresponds with the head A replay signal. The small arrows (head A crosstalk) are also advanced 90° per line: note that they are 135° for two lines then 315° for two lines. The last two lines of the chart show the signals delayed by two lines.

Now do some comparisons. Take for example the head A replay signal for line n + 2 (the first thicker line box). If this signal and the delayed line n head A signal shown lower down are taken together you will see that the main vectors are in phase and will add while the crosstalk vectors are in antiphase and will cancel – see Fig. 3(b). This is true for any line from any head. Cancellation is done at 4·43MHz since it's easier than at 626·9kHz.

Fig. 4 shows a block diagram of the VHS chroma record system. The video signal is first fed to a 4·43MHz filter to separate the chroma information. At the same time, sync pulses from a sync separator stage on the servo board are fed to a special i.c. (MN6061A) to lock a 2·5MHz phase-locked loop. Field sync pulses are fed to the small part labelled "phase select", while line sync pulses go to both the phase select section and to the a.f.c. phase detector as one of its two inputs. 2·5MHz is 160 times the line frequency, so this is counted down by 4 and then 40 to produce the other input to the phase detector. The result of this is to produce an error signal to lock the 2·5MHz voltage-controlled oscillator.

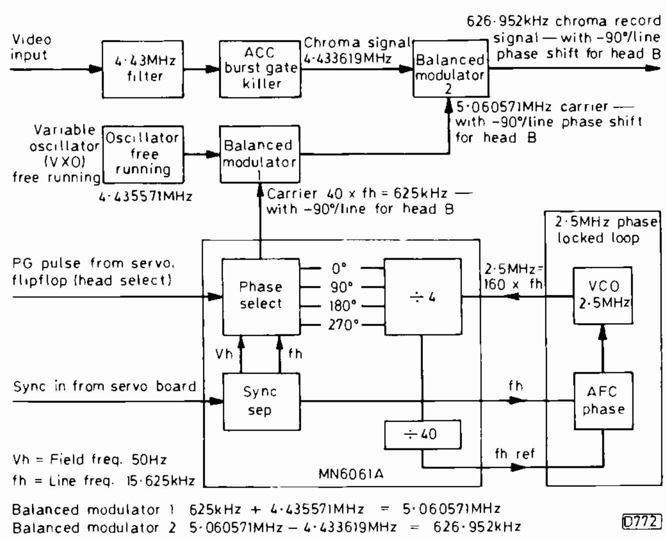


Fig. 4: VHS chroma record system.

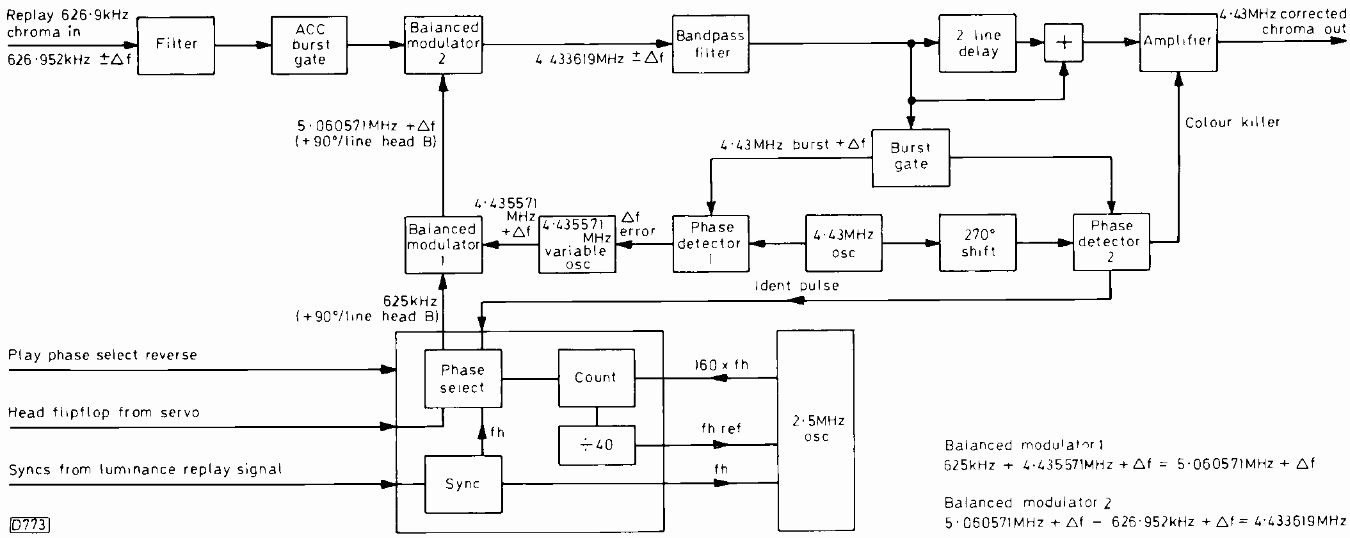


Fig. 5: VHS chroma replay system.

The times four counter provides four outputs, 0°, 90°, 180° and 270°, at a frequency of forty times the line frequency (625kHz). These go to the phase selector which controls the phasing of the signals fed to the heads line by line. The phase selector uses a PG signal from the head servo to identify the head, and line sync pulses to control the phase step sequence for head B.

The 4·435571MHz variable oscillator is used in the free-running mode on record. Its output is mixed with the 625kHz carrier in balanced modulator 1, the result being an intermediate carrier at 5·060571MHz which has the head B retard on it. Mix this with the 4·433619MHz chroma signal in balanced modulator 2 and the result is a difference frequency of 626·952kHz which contains the chroma information and, for head B, the phase retard information. This is the chroma record output, which is added to the luminance f.m. carrier and recorded on the tape.

Fig. 5 shows the chroma replay system in block diagram form. The off-tape signal is fed to a filter to extract the

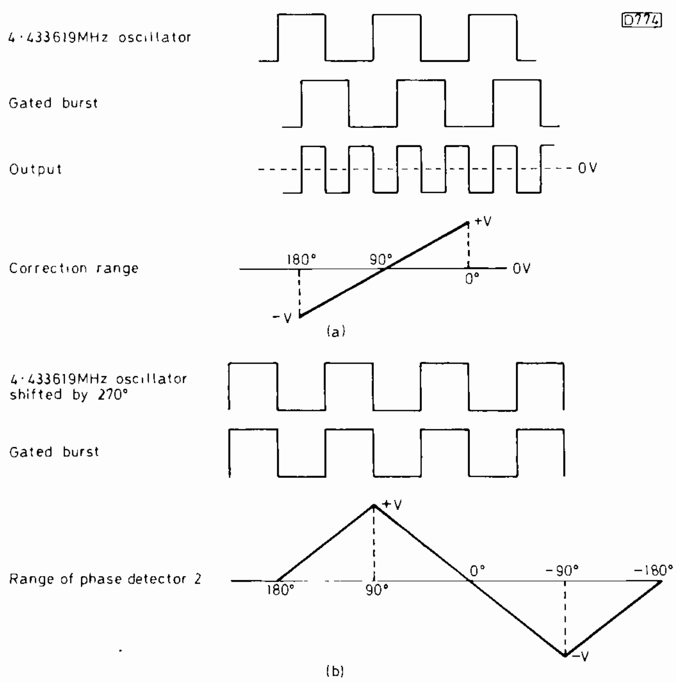


Fig. 6: Illustrating the effect of the two extra phase detectors used in the replay mode. (a) Phase detector 1; (b) phase detector 2.

626·9kHz component, with the −90° per line phase shift in the case of the head B signal. The method of correcting this shift is the inverse of that on record. Comparing Figs. 5 and 4, you'll notice that there are a couple of additional phase detectors in Fig. 5.

Let's start at the bottom. Sync pulses obtained from the luminance replay signal are used to phase lock the 2·5MHz oscillator, as in record, producing a 625kHz signal after counting down. A PG pulse from the head servo indicates to the phase selector which head is scanning the tape, line frequency pulses stepping the phase selector line by line when head B is operative. As in the record mode, an intermediate carrier is obtained by adding 4·435571MHz and 625kHz to give 5·060571MHz. In the record mode 4·433619MHz is subtracted from 5·060571MHz to give 626·952kHz: in the replay mode 626·952kHz is subtracted from 5·060571MHz to give 4·433619MHz (balanced modulator 2). It's in this modulator that the head B phase retard for recording is undertaken and corrected in replay by reversing the process.

The replay system has to be able to correct for phase errors caused by changes in the tape speed and tape fluctuations. These phase errors are shown as Δf in Fig. 5. If the 4·433619MHz off-tape signal contains Δf, the output from the burst gate will also contain Δf. This signal goes to phase detectors 1 and 2. Detector 1 applies a corresponding error signal to the 4·435571MHz variable oscillator, so that the error will also appear at the output of balanced modulator 1. Balanced modulator 2 thus receives two inputs, both with the error Δf, and as these inputs are subtracted Δf will disappear, leaving a fairly steady chroma output.

Phase detector 2 is concerned with phase errors much larger than Δf. On replay there could be a bit of tape drop-out or a sync pulse could be missing, and the phase error could then be as large as 180°. In this event phase detector 2 sends an ident pulse to the phase selector, shifting the 625kHz signal by 180°. As a result, the error returns to the area that can be dealt with by phase detector 1.

Last but not least is the two-line delay in the output section to eliminate crosstalk. Phase detector 2 also provides a colour-killer output to switch on or off the output amplifier (in this case the detector doubles as a burst presence detector).

The action of the phase detectors is shown in a little more detail in Fig. 6. There are two inputs to phase detector 1, 4·433619MHz from a crystal oscillator and the gated

bursts from the replay signal. When these two signals are 90° apart, the output waveform is symmetrical and averages out at 0V. If the replayed burst signal drifts to either side, then the mark-space ratio of the output will alter and the average voltage will swing positively or negatively.

Phase detector 2 is concerned with ensuring that errors fall within the scope of phase detector 1. The 4·433619MHz input signal is phase shifted by 270° so as to be in phase with the gated burst. With correct conditions the output is positive, but a phase shift greater than 180° produces a negative output which in turn shifts the 625kHz signal by 180°.

Faults

There haven't been many faults to date in the chroma circuitry, but here's an interesting one. The machine was sent to us with the complaint "intermittent colour replay". For some days no fault showed up, the machine replaying the tapes correctly. Eventually however during an interesting replay of "Bullit", just as Steve McQueen was about too . . . well anyway I was left with a rather dirty looking monochrome picture with a lot of patterning on it. The video output was examined on an oscilloscope, and seemed to be drowning in some kind of mush. The next procedure was to replay a colour bar signal, tracing the replay signal in its 626kHz form as far as possible. This took us as far as balanced modulator 2, where the 5·060571MHz signal is added and the resultant 4·433619MHz filtered out.

The output was erratic, and a frequency counter on the 5·060571MHz line showed this to be way out and varying. Obviously there was no phase locking somewhere. On taking a look around the 625kHz phase-locked loop I discovered that there were no sync pulses to the i.c. Now these are separated from the video, such as it was, on the servo board. Over on the servo board there was no video at all. The video comes from the chroma board, so back we go again. The problem was that there was video to the output socket, but no video out, the trouble being due to the connection of pin 83 on socket J432.

In fact plug and socket connections are the most common problem I've had so far, so before you go round tearing out the chips just check the signals around them, because the trouble is not likely to be the chip.

Next month we'll go on to the Sony Betamax system.

JVC's Video Disc System

David K. Matthewson, B.Sc., Ph.D.

IN writing about video disc systems last month I commented that little is known so far about the JVC VHD video disc system, apart from the basic facts that the information is stored capacitively and that the sensing stylus moves across the surface of the disc, as with the Philips system, instead of being guided by a groove. We can now fill in some of the details.

One interesting design requirement that was laid down is that the players should be able to replay both colour video and digital audio discs. This is very different from the Philips approach of two different systems, one for video and one for audio. JVC also intend their basic system to be suitable for both domestic and business/educational use. This implies that the system should be able to give perfect still frames, with rapid access to any individual frame, as required for the retrieval of text information. Other basic design requirements laid down by JVC are that the system should be mechanically and electronically reliable, and that it should not rely on very sophisticated technology.

The JVC system appears to have achieved all the goals set. The player will provide all the necessary video effects, such as rapid random access to frames, still frames, and slow and fast motion. The playing time is an hour per side, and the discs are produced using existing audio disc pressing techniques. Since the PVC discs are double-sided, the total playing time is two hours per disc.

The picture and stereo sound information are recorded in the form of pits in the surface of the plastic disc. As with an ordinary LP disc, the pits are arranged as a spiral track, though there's no groove, the disc's surface being smooth. Fig. 1 gives some idea of the way in which the signals are recorded on the disc, and the way in which the sapphire stylus tracks the disc. The stylus is made to follow the information signal pits by a servo system which controls the tracking – tracking signals are recorded alongside the signal information and are picked up and used to control the positioning of the stylus. The sliding stylus has about ten times the contact area of a conventional groove/stylus combination – useful in prolonging the life of both the disc and the stylus.

Electronically, the conductive disc acts as one plate of a capacitor, the sapphire stylus acting as the other plate. The information is recorded in the form of pulse code modulation, a laser being used to produce the master disc.

The servo system (see Fig. 2) which controls the arm has to be not only very quick in responding to control signals but also has to be able to move the pickup in both the vertical and horizontal planes. The sapphire stylus is mounted at the end of a cantilever arm which has a small permanent magnet at the other end. The coil of an electromagnet is wound closely round the fixed magnet, and next to this is a pair of anti-phase vertical coils. As the currents flowing in these coils are derived from the timebase error and tracking signals respectively, the position of the arm can be controlled quite easily. The tracking coils are also used to move the stylus to any selected part of the track for rapid access to information, etc.

Fig. 3 shows the way in which the master disc is cut. A flat glass disc is coated with photographic emulsion and

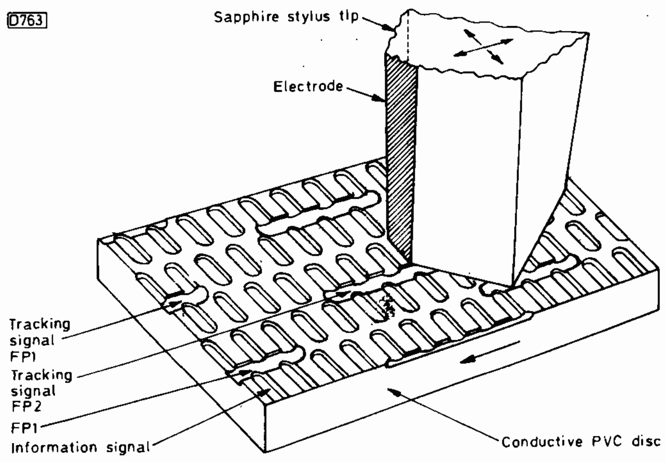


Fig. 1: The video and sound signals are recorded on the disc in the form of a spiral series of pits. The sapphire stylus covers an area of approximately three signal information tracks, the metal sensing electrode at the front following the track actually being replayed. Tracking signals are recorded at each side of the information tracks to operate the servo system that keeps the metal electrode in alignment with the information track.

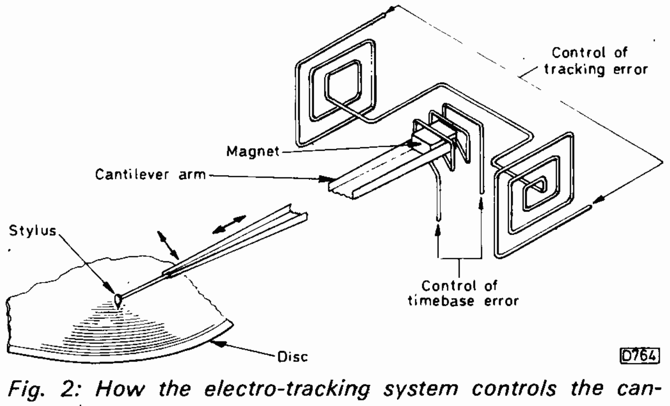


Fig. 2: How the electro-tracking system controls the cantilever/arm assembly.

VHD Disc System Specification

Pickup system: Variable capacitance by means of pits. No groove guidance; electronic tracking.
Playing time: One hour per side. Probably longer for audio only.
Disc material: Conductive PVC.
Stylus material: Sapphire.
Track pitch: 1·4μm.
Disc size: 300mm.
Rotational speed: 900 r.p.m.
Disc life: >10,000 replays.
Stylus life: >2,000 hours.

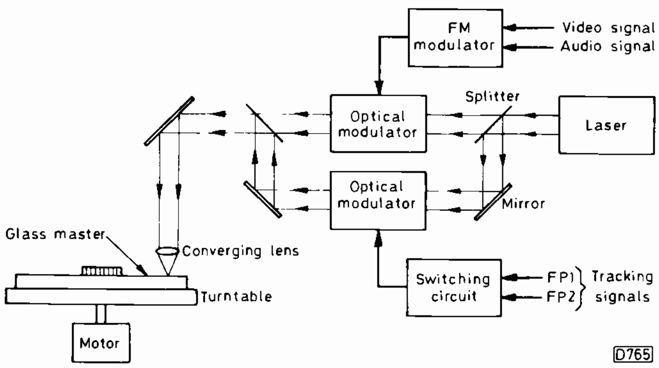


Fig. 3: Method of recording/cutting the master disc.

spun at 900 r.p.m. (the nominal disc speed). The disc is illuminated by the laser beam, which moves across the surface of the disc. An arrangement of mirrors and optical splitters is used to provide a multiple beam which carries the sound, vision and tracking signals, a lens being used to converge these beams at the surface of the disc. The glass disc is developed, then a metal master is produced. The process is repeated for the reverse side. The metal master is used for pressing copies of the disc.

By using the system for both video and audio applications, the consumer has to purchase only one player. The audio disc could provide several hours' of high-quality sound. JVC have promised remote control of all these functions. The question is: when?■

The G11 – and Others

Dewi James

TIME to summarise our fault experiences in recent times with the Philips/Pye G11 chassis – this is our main rental line now. Most faults are inevitably in the power supply or the timebases. Let's take the power supply first.

Power Supply

We had a rather unusual "dead set" case the other day. No voltage at the h.t. fuse FS4037, nor across the h.t. reservoir capacitor C4029, indicating that the h.t. rectifier thyristors were not being fired. The trigger pulses are generated by a BR101 silicon controlled switch (D4061), and pass to the h.t. rectifier thyristors via the Darlington trigger pulse amplifier pair T4068/T4077. Voltage tests showed that these two transistors were not being switched on, so that the cause of the trouble was absence of trigger pulses. We eventually traced the fault to R4044 (120kΩ, 1W) in the feed to D4061 being open-circuit.

Intermittent h.t. variations have been traced to the connections to R4059, the large 15kΩ (9W) resistor mounted on a small bracket. The reason is that the resistor's legs are sometimes cut too short, so that they make intermittent contact at the print.

Surely we've all by now had trouble with the two transistors (T4085/6) in the beam limiting circuit causing the power supply to shut down: to confirm this diagnosis, temporarily disconnect the print connection to the emitter of T4086.

Remote Control Models

We had a dead Philips Model G26C672 in recently – no h.t. at fuse FS4037. This model has the G11 chassis plus full remote control. Now before thinking about trigger pulses, the inhibit circuit etc. on such sets, remove plug 74X1 on the remote control receiver panel (it's a brown lead). This disconnects the standby h.t. inhibiting circuit (see Fig. 1) from the power supply. If this restores normal results, the fault is in the remote control system. In our case the trouble turned out to be due to the standby switching transistor T519 (BC158). Under normal working conditions pin 6 of IC443 (SAA1025) is at almost 18V (from the 18V supply line), T519's base voltage being not less than 9·8V so that it's cut off. In the standby condition however the voltage at pin 6 of IC443 falls to zero. T519 then conducts heavily, reducing the voltage at the emitter of the trigger pulse phase control transistor T4045 in the main power supply circuit to less than a volt. This prevents the formation of trigger pulses, thus removing the h.t.

Line Timebase

Moving over to the line timebase, apart from the early demise of the line output transistor, a situation greatly improved by the advent of the BU208A, we've recently encountered our first two faulty line output transformers. The symptoms were no results with intermittent tripping of the power supply – audible as a regular clicking coming

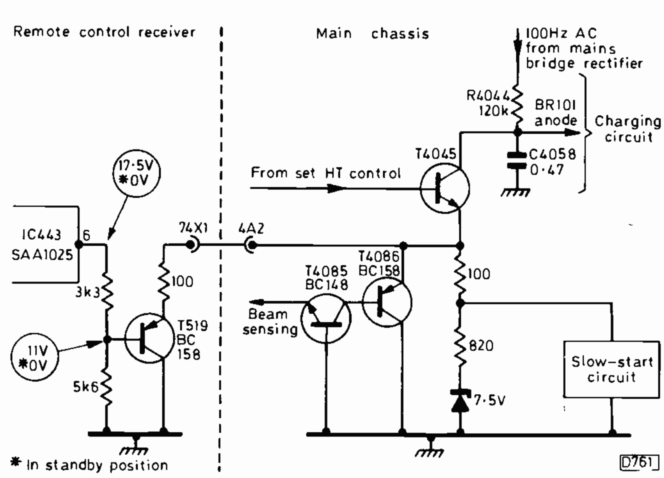


Fig. 1: The charging/phase-shift circuit (R4044/C4058) in the G11's power supply circuit. When the charge on C4058 rises above the voltage at the gate of the BR101, the BR101 fires to produce the trigger pulse for the two thyristor mains rectifiers. The charging of C4058 is controlled by T4045 which is in turn under the control of the slow-start circuit, the beam limiter transistors T4085/6 and, on some sets, the remote control standby system.

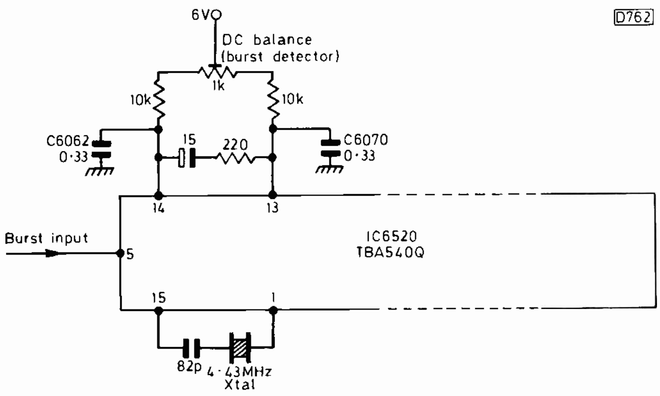


Fig. 2: The burst detector is in the TBA540Q i.c.: defective capacitors in the external detector balance circuit produced the no colour symptom.

from the power supply.

Can anyone explain why R3106 (820Ω) which provides the supply to the line driver transistor suddenly burns up for no apparent reason, sometimes quite violently? As a test we've replaced this component only after each failure, and to date the sets concerned have continued to work normally.

R3120 (15Ω) has gone open-circuit once or twice, removing the h.t. supply to the line output stage and stopping just about everything else in the process. Lastly in this area the scan-correction capacitor C3135 (0·91μF) has a disconcerting habit of blowing itself to bits. It's a good idea to carry one around therefore.

Timebase Panel

Next the timebase panel. The TDA2590Q (later TDA2591Q) line oscillator i.c. has given us little trouble, the faults on this panel being very much a matter of the field timebase and EW correction circuits. Field collapse is usually due to failure of the TDA2600 field timebase i.c. (IC2520). Another, though far less frequent, cause of this symptom is the field output filter coil L2092 going open-circuit. This can often be opened and repaired.

If the bottom half of the scan is completely missing, i.e. the whole scan is shifted vertically, possibly blowing the LT3 supply fuse FS3143 (800mA) after a few seconds, check the field output coupling capacitors C2099/2100 (both 1,000μF) for being short-circuit or leaky. If the bottom half of the scan is o.k. whilst the top half is distorted, with a bright horizontal line across the centre of the screen, check the coupling capacitor C2072 (4·7μF) which is connected between pins 2 and 3 of the i.c.

EW pincushion distortion has usually been cleared by replacing the EW modulator driver transistor T2150 (BD238). The other cause we've had is a dry-joint on coil L3134, which is in series with the drive to the modulator.

Decoder

I.C. failures occur from time to time on the decoder panel, but the most common fault is defective RGB output transistors (BF458) causing complete shutdown of the set or a pulsating red, green or blue picture due to the action of the beam limiting transistors (T4085/4086). An elusive fault gave us the no colour symptom until we disabled the colour-killer by removing the lead from point A on the board. This produced horizontal bands of colour running through the picture, suggesting either that the reference oscillator was running at the wrong frequency or that it was out of phase with the bursts. The trouble was eventually traced to C6062/C6070 (0·33μF, see Fig. 2) in the d.c. balance control circuit associated with the burst discriminator within the TBA540Q reference oscillator i.c.

IF Panel

Finally the i.f. panel. A blank raster with no sound and the voltage across the zener diode D5012 in the a.g.c. circuit down to 2·3V was caused by failure of T6462 (BF196). This is the second transistor in the i.f. selectivity/gain module – the one to which the a.g.c. is applied. The tuner unit has been responsible for failure to tune stations at one end of the scale, low gain, and a case of intermittent horizontal black lines flashing across the screen. A case of no colour on one channel was traced to misalignment of the a.f.c. coil L5630 in the vision detector module.

One way and another, we've had a fair bit of hassle with these sets lately. Still, we do have a lot of them to look after.

Pye 725/731 Series

Our other main line is the Pye 731 and associated chassis. Predictably, the faults are usually in the power supply or timebase sections, and have been well documented in past articles (see the September 1979 and subsequent issues for example). Nevertheless we've had a few troubles that are perhaps not so common and worth mentioning. The spring link between R972 and R973 on the h.t. resistor unit going open intermittently for example. This has been caused by the thick-film resistor unit (R428) in the RGB output circuit or the focus spark gap breaking down intermittently.

No sound and a blank screen are the symptoms when IC165 (TCA270Q) fails, while an intermittently dark screen has on a number of occasions been traced to 3C11 (10μF) which decouples the slider of the brightness control. (Yes we do know about R642/3 in the c.r.t.'s first anode control circuit changing value to cause a change of brightness level.) A common cause of a blank raster with the sound o.k. is when R476 (47Ω) which supplies the RGB output transistors goes open-circuit. We know that an open-circuit h.t. reservoir capacitor (C880) produces a small picture with the associated resistor R973 overheating: exactly the same thing happens when the orange lead in plug/socket SK876 is removed, say after some servicing work, so make sure that it's pushed firmly into position.

Another odd one we've had is no output from the power supply due to the over-voltage circuit transistor VT881 (BC147) going short-circuit. Apart from the occasional tripler and C563 (first anode supply reservoir capacitor) blowing fuses however our 731s etc. have not been giving much trouble lately.

Decca 80 and 100 Chassis

We also have a considerable number of sets fitted with the Decca 80 and 100 chassis under our care. These must be amongst the most reliable of current chassis, giving very little trouble. Apart from one or two low-gain tuners (sometimes intermittent), the only problems we've had are as follows. On the 100 chassis, reduction of the field scan to about an inch can be caused by R371 (2·2kΩ) in the second driver transistor's base circuit going open-circuit – use a replacement rated at ½ or 1W. On the 80 chassis two elusive cases of an intermittently dead set were cured by replacing R324 (5·1kΩ) which provides the start-up supply to the TBA920 line oscillator i.c.

Satellite TV

Part 1

Roger Bunney

THERE'S been speculation in both the popular and technical press in recent times about the possibility of Radio-Luxembourg starting a direct to home TV service from an orbiting satellite – most likely one in the Ariene series. Whether such a service will eventually be inaugurated is a speculative matter, depending as it does on both technical and political decisions. What is reasonably certain however is that at some time during the next decade domestic satellite TV transmissions will start in western Europe, probably in West Germany. There has also been talk about Scandinavian satellite TV services. For the present, the only transmissions are the experimental ones from the OTS satellite, at 12GHz. What about receivers?

It's a surprising fact that one can visit the offices of NEC (Nippon Electric Co.) in London and buy their Model 790, a five-channel, 12GHz satellite receiver, for about £7,500 (all prices as at mid-1979). When regular transmissions are available, in two-three years' time say, the price is expected to fall to around £600, including a 1·2m dish aerial. If you go to Japan however you may find on offer in Tokyo (as John Tellick did recently) similar equipment off the shelf for the equivalent of £2,600.

Japanese Research

The Japanese have undertaken considerable research into satellite TV transmission and reception, in particular into simple, low-cost receivers which can be mass produced. During his visit, John Tellick went around the Japanese broadcasting authority's (NKH) laboratory, and was fortunate in having as his guide Dr. Yoshiro Konishi. What he saw was quite striking.

The Japanese already have in orbit the BSE satellite, with two TV channels in the 11·95-12·13GHz band. One of the channels is constantly in use to enable manufacturers to carry out experiments, the transmissions being of both test signals and programme material. In conjunction with this, NHK are using an NEC equipped mobile transmit/receive truck.

John reports that it has 0·6, 0·9 and 1·2m receiving dish aerials on its roof, feeding three sets side by side – in colour, and with little difference in the picture quality. During rain/snow the quality of the picture obtained on the receiver fed from the 0·6m aerial does suffer. On the other hand excellent picture quality has been obtained even with the 0·6 and 0·9m dish aerials used indoors – through glass and with the roof partially obstructing the beam. The 0·6m dish can be moved "quite a bit" before the signal quality is degraded, the dish having a 3° beamwidth incidentally. Dr. Konishi mentioned that surface tolerance is not too critical, and that typical aerial riggers will, once regular public transmissions start, be able to rig a dish system in half an hour. Once large-scale production starts, the cost of a receiving installation in expected to fall to about £175.

NKH have completed a research programme into wideband, low-noise satellite receivers, and the results have been passed to several Japanese setmakers for costing out and eventual mass production. So it seems that when 12GHz transmissions do start in Europe the Japanese setmakers will be ready and able to supply efficient low-cost receiving units. NHK incidentally are working on many experimental projects including an automatic ghost-cancelling system, stereo sound for TV and methods of obtaining "natural" three-dimensional pictures.

The NEC 790 Receiver

The NEC Model 790 satellite TV receiver has push-button channel selection (five channels), an external dish aerial on which the s.h.f.-u.h.f. converter is mounted, a coaxial downlead and an indoor converter/amplifier followed by f.m.-a.m. conversion to provide a standard u.h.f. signal for feeding to an ordinary domestic receiver. (It's normal practice to use f.m. for the video signals transmitted from satellites, since the transmitter power requirements are reduced and improved performance generally is obtained.) The frequency range is 11·95-12·13GHz (others to order) and the dish a 1·2m type. The gain of the dish is quoted as 41dB at 12GHz with linear polarisation (circular polarisation types available), with adjustment in azimuth of $\pm 5°$ and elevation 20-55°. The receiver specification is particularly good, with a noise factor of 4·3dB. The output is a.m. at v.h.f., with the vision carrier 85dBμV and the sound 14dB down on the vision. The power consumption is only 11W.

The OTS version has a 3m dish covering 11·58-12·08GHz, with a gain of 48dB at 12GHz. The five channels are: A1 11·60164GHz, A2 11·62082GHz, B1 11·64GHz, B2 11·65918GHz and B3 11·67836GHz.

The NHK Receiver Design

The specification of the basic receiver developed by NHK is perhaps even more exciting. Initially, a low-noise gallium-arsenide f.e.t. was tried as a first stage, but the noise figure obtained was in excess of 4dB at 12GHz. In the final design (see Fig. 1) there's no preamplifier stage, the signal being fed straight to the first down converter (frequency changer). This arrangement gives a noise figure of only 3·7dB over a 300MHz bandwidth.

The first frequency changer stage is laid out in planar form on a metal sheet built into a section of waveguide (see Fig. 2). In conventional microwave technology high-precision machining is used to produce the circuit elements. This is very expensive. In NHK's arrangement the pattern is punched or etched out on the metal sheet, a much cheaper technique.

A Schottky diode (a silicon-metal junction device) is used as the mixer. An external L-band (1·12-1·7GHz) oscillator drives a step-recovery diode which acts as a times four frequency multiplier to produce the local oscillator frequency required by the frequency changer. The step-recovery diode is an interesting device: as its name suggests, there's a sharp edge in its characteristic (the reverse conduction cut-off point actually) and in consequence an output rich in harmonics is obtained.

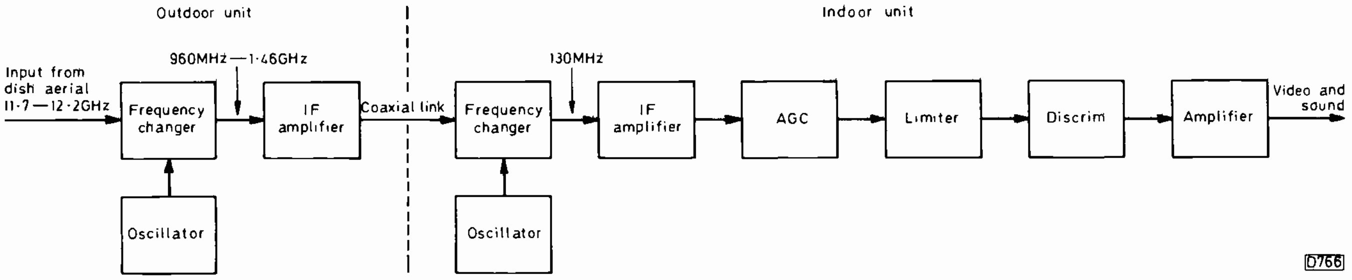


Fig. 1: Block diagram of the NHK 12GHz receiver unit. For optimum noise performance, the signal is fed direct to the first frequency changer instead of to a low-noise preamplifier.

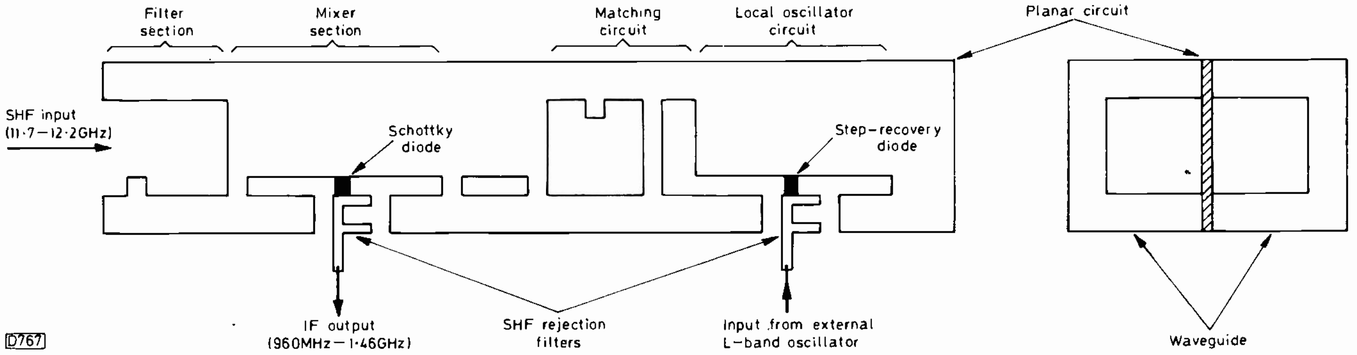


Fig. 2: Planar layout of the first frequency changer, which is built into a section of waveguide and mounted at the "feed" point of the parabolic aerial.

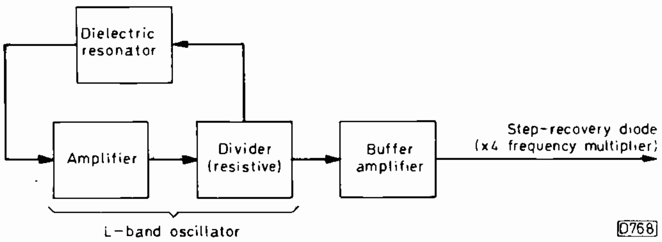


Fig. 3: Block diagram of the L-band oscillator. The stability achieved with this arrangement is such that a.f.c. is not required.

The external oscillator (see Fig. 3) uses an L-band bipolar transistor amplifier with feedback via a dielectric resonator. The *Q* of the resonator is of the order of 8-10k, enough to provide frequency stability of ±100kHz between −50°C and +60°C.

The 960-1,260MHz i.f. output is then fed to a 50dB amplifier with a noise figure of only 1·4dB before being fed via a 30m coaxial cable to the indoor section of the receiver. Here the second frequency changer converts the incoming signal to a lower i.f. of 130MHz. This is followed by amplification, a.g.c., limiting, demodulation and finally amplification at video frequency. Subsequent amplitude modulation and conversion to u.h.f. provides a signal for feeding to an ordinary domestic TV receiver.

The aerial is designed for the reception of circularly polarised signals, with a small circular polariser mounted on top of the radiator. The system can be easily changed for the reception of linearly polarised transmissions however.

Home Construction

Unfortunately the measurements associated with circuits operating at 12GHz are such that the average constructor will be unable to produce his own receiving head. Dimensions given by NHK in their published specifications indicate internal ridge limits of 0·3mm and waveguide widths of 9·5mm. More experienced constructors have been able to make equipment for receiving the transmissions from the Russian TV satellites, used for internal programme distribution across the continent in the 3·5-4GHz bands, simply by scaling down equipment shown in amateur radio publications. Certainly the indoor unit could be made easily and cheaply however, and I propose to give some circuitry next month.

In the meantime, I'd appreciate hearing from anyone who has successfully constructed equipment for satellite reception in the GHz bands – and of any sources of surplus equipment.

Reference Source

Those seeking more detailed information on satellite TV will find the IBA's Technical Review No. 11, *Satellites for Broadcasting,* of interest. It's available at £1·50 from the IBA, Crawley Court, Winchester, Hants SO21 2QA.

LEDCo CDA PANEL NOW AVAILABLE IN KIT FORM

LEDCo's solid-state replacement colour-difference amplifier panel for the Pye hybrid colour chassis is by now well known. It replaces the original, which used four valves and tends to deteriorate over the years due to the effects of heat. The LEDCo replacement panel was reviewed in some detail in our June 1979 issue. It seems that a number of readers have enquired about the possibility of the panel being made available in kit form, and LEDCo have now decided to do this. The kit contains exactly the same types of components as are used in LEDCo's current production panels, and with careful construction will provide a panel to exactly the same specification and performance as ready-built ones. A really helpful constructor's manual is included with the kit.

Test Report: Beckman 3020 DMM

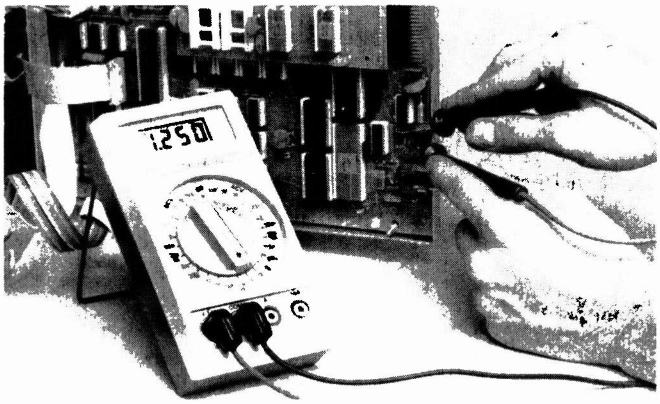
Eugene Trundle

IT'S some four years since we reviewed, at length, a range of digital multimeters for use in general servicing applications. Since then the advent of LCD displays has revolutionised watches, calculators and digital instruments, offering many advantages over the LED or nixie-tube displays which were used in all the instruments we reviewed back in February 1976.

The need for digital instruments has never been greater. Valves have largely gone, transistors are becoming increasingly fewer in number in today's receivers, and domestic equipment is moving into an era of precision where the accuracy and high input impedance of digital test equipment is increasingly important. As real prices of consumer electronics come down, and circuit complexity (if not component count) increases, labour costs continue to rise and the speed and ease of digital diagnosis are becoming a significant factor. Digital instruments also have the advantage of invulnerability to the sort of overload that can write off a cheap analogue meter.

The need for analogue instruments is still there – the Avo or whatever will be required whenever the measurement of intermittent or fluctuating quantities is necessary. Try connecting a digital voltmeter across a working loudspeaker to illustrate this! The analogue meter also lends itself to ballistic methods of estimating capacitor values, and to resistor substitution using the meter's internal resistance. These are areas where the DVM cannot compete, so the dial and pointer will continue to have a place on the bench alongside the winking digits.

The Beckman 3020 is a good example of the latest digital multimeter technology. A single 28-position rotary switch selects the range and function, with two separate "high" input sockets for current ranges. The $3\frac{1}{2}$-digit, 12mm LCD display is easy to read under any lighting conditions. The LCD system, unlike a LED display, imposes very little load on the instrument's power source (in this case a standard 9V battery, type PP3), so that battery life is about 2,000 hours with an alkaline type and 1,600 hours with the ordinary zinc/carbon type battery. Our four-year old LED designs varied between 25 and 60 hours use per battery! For this reason, mains operation is not necessary or



The Beckman 3020 digital multimeter in use.

provided for in the 3020, and between one and two years life may be expected of the battery.

Other improvements over first-generation DVMs are apparent in the 3020. The current reading capability is up to 10A a.c. and d.c., and the overload protection is improved – a safe overload capability of 1,500V peak on the voltage ranges, and 300V on the resistance ranges. Bearing in mind the price of the 3020 and the inflation in recent times, the accuracy/price factor is better than for earlier designs. Following the current trend in all electronic gear, the component count has been greatly reduced – to less than forty in fact – though in all fairness reliability is seldom a problem in any test gear in our experience.

Special Features

The 3020 incorporates a patented Beckman feature, "Insta-ohms". Because of the long response time, particularly on the higher resistance ranges, that's a characteristic of digital ohmmeters, many engineers prefer to use an analogue meter when making continuity tests. To overcome this, the 3020 display incorporates an Ω symbol in one corner: this appears as soon as continuity between the test prods is established on the resistance ranges. Very often this is all that's required, but within one second (four seconds on the 20MΩ range) the resistance reading has stabilised on the display and can be read off, to an accuracy of 0·2% + 1 digit on all ranges except 20MΩ where 1% + 1 digit is the quoted accuracy.

Another digital meter characteristic that often gives rise to uncertainty is unpredictable behaviour when testing semiconductor junctions. Some designs use a sufficiently high applied voltage to turn on a semiconductor. This is

Brief Specification

General: Calibration accuracy specifications guaranteed for a year. Warrantee also one year. Sampling rate four per second nominal. Decimal point blinks at 200 hours expected life to give low battery indication.

D.C. voltages: Ranges 200mV, 2V, 20V, 200V, 1,500V. Resolution 100μV on 200mV range. Accuracy 0·1% +1 digit. Input impedance 22MΩ on all ranges. Response time < 1 second. Over-voltage protection 1,500V peak on all ranges.

A.C. voltages: Ranges 200mV, 2V, 20V, 200V, 1,500V. Resolution 100μV on 200mV range. Accuracy: 45Hz-2kHz 0·6% + 3 digits, 2kHz-5kHz 1% + 5 digits, 5kHz-10kHz 2% + 9 digits. Calibration: average sensing, r.m.s. calibrated for sinewave input. Input impedance 2·2MΩ/75pF. Response time < 2 seconds. Over-voltage protection 250V d.c., 1kV r.m.s.

D.C.: Ranges 200μA, 2mA, 20mA, 200mA, 2A, 10A. Resolution 100nA on 200μA range. Accuracy 200μA-2A ranges 0·35% + 1 digit, 10A range 1% + 1 digit. Response time < 1 second. Over-current protection, A input 2A-250V fuse, 10A input 20A unfused.

A.C.: Ranges 200μA, 2mA, 20mA, 200mA, 2A, 10A. Resolution 100nA on 200μA range. Accuracy 45Hz-2kHz 0·9% + 3 digits (except 10A range); 45Hz-400Hz 1·5% + 3 digits on 10A range. Calibration: average sensing, r.m.s. calibrated for sinewave input. Response time < 2 seconds. Over-current protection, A input 2A/250V fuse, 10A input 20A unfused.

Resistance: Ranges 200Ω, 2k, 20k, 200k, 2M, 20M. Resolution 0·1Ω on 200Ω range. Accuracy 0·2% + 1 digit on the 200Ω-2M ranges, 1% + 1 digit on the 20M range. Maximum test voltage 500mV. Response time < 1 second on the 200Ω-2M ranges, < 4 seconds on the 20M range. Overload protection 300V r.m.s. or d.c. on any range.

claimed to be an advantage. Other designs use a low test voltage. The manufacturers this time claim the great advantage of not giving misleading readings due to junction conduction when testing components in circuit! The 3020 will not turn on a silicon semiconductor junction on its resistance ranges, as the applied voltage is less than 500mV. This means that in-circuit tests on components around transistors may be carried out on any resistance range. A diode test facility is available at one switch setting however, and in this mode 2V is available off-load. The voltage appearing across a forward-biased junction, be it a transistor or diode, is then read directly from the display – silicon devices may be expected to set up 600-800mV and germanium devices 150-300mV.

Evaluation

The meter spent some weeks in our workshop and did the usual round of audio and TV bench work and also some field duties. We managed to blow up a very nice 18in. Sony receiver with it when we forgot to reposition the probe plug after taking current measurements – our fault entirely! No other disasters befell us, even when we tested the overload protection by plugging the probes into the mains with the instrument set to 200mV d.c. We didn't put to the test Beckman's claim that the meter is proof against a 6ft drop however.

We had no reason to doubt the accuracy of the 3020, though it's difficult to devise ways of testing such an instrument to very close tolerances. The Insta-ohm feature was much used and appreciated. Regarding the diode test facility, old habits die hard and we all found ourselves going back to the Avo for quick semiconductor tests.

Physically the 3020 has much to recommend it. The switch and display are recessed below panel level for protection, and a multiposition tilt-bail at the rear is used as a handle and support prop. The light weight (1lb, 453g) and long battery life make the instrument ideal for mobile work. Like most of their competitors, the makers supply great brutish test prods quite unsuitable for PCB use, although a de-luxe probe set is available as an extra. Another minor minus point is the necessity to remove the back of the instrument (four screws) to replace the overload protection fuse.

A wide and useful range of accessories is available – a carrying case, 200MHz r.f. probe, a.c. (up to 200A) probe, de-luxe test lead set, and an e.h.t. probe for 50kV. Although we didn't have the latter probe for evaluation, we have reservations about its usefulness in view of the limited effective resolution and loss of accuracy when measuring 20-25kV on a $3\frac{1}{2}$-digit display. Most workshops already have an adequate means of checking e.h.t. voltages anyway.

Conclusion

This DMM was well received by all the technicians in our service department, the use made of it depending on the individual's attitude rather than the instrument's versatility. We would not suggest for a moment that a LED or Nixie-type instrument be discarded in favour of the newcomer, but if a requirement for a DMM arises, we can recommend this one.

The Beckman 3020 is available at £115 plus VAT from various distributors – a list can be obtained from Beckman Instruments Ltd, Queensway, Glenrothes, Fife, Scotland KY7 5PU. Phone 0592 753811.■

TV Servicing: Beginners Start Here . . .

Part 32

S. Simon

IN the last two issues we took a fairly close look at the Thorn 3000 chassis and saw how the receiver can appear almost dead (apart from the tube heaters glowing) even though there may be fairly high voltages at some points. We'll consider next the servicing and safety aspects of another very popular solid-state colour chassis, the Philips G8.

We made brief reference to this chassis in an earlier issue, so some of what follows may have a familiar ring. Once again we'll assume that the set is not functioning at all.

Dealing with a Dead G8

With the rear cover removed and the mains supply connected, our first move should be to observe the neck of the tube to see if the heaters are glowing. If they're not, it's fair to assume that the supply is broken. We then have to find where the live side of the supply is and where it has failed. In fact one would concentrate on the left side plug and socket and fuse cover. In the vast majority of cases the 3·15A anti-surge mains fuse FS1387 (see Fig. 1) will be found to be blown, but in order to be methodical we should first confirm that the supply is present at the (push type) on/off switch's live contacts and not present at the neutral contacts – using a simple neon screwdriver.

Having proved this, we should then investigate the condition of the fuse with the plug and cover removed. It's a fact that these fuses can blow with no fault being present in the set to cause this. In this case one can assume that a sudden surge in the mains supply was responsible, and that replacing the fuse will restore normal operation. Whilst this is a distinct possibility, it is only that.

If the fuse is blackened, it's far more likely that the mains rectifier thyristor (SCR1379) has gone short-circuit from anode to cathode, thus placing the h.t. reservoir capacitor C1385 across the a.c. mains input, with only R1367 to limit the current flow. So our first check in this event is on the thyristor, using our ohmmeter.

Several types of thyristor were used during the production of this chassis, the BT106 being the type most commonly found. This has a threaded stud fitting, the body being the anode. Of the two arms, the longer one is the cathode and the shorter one the gate. Thus the check would be between the body and the long arm. The alternative type BT116 or OT112 (there are several alternatives) is of the tab format with three legs, the anode being the centre one. If in doubt replace the device, refitting the heatsink as on the original.

If the thyristor is not at fault, the mains filter capacitor (C1366) adjacent to the fuse and on the inside of the frame should be viewed with suspicion. The type used in these receivers is not as suspect as those commonly used in other makes however.

There are very few other causes of failure of the 3·15A mains fuse – a shorted h.t. reservoir electrolytic could be one, but this is pretty rare – since the other parts of the receiver are separately fused. These fuses generally indicate the faulty section of the set as we shall see.

Tube Heaters Glowing

If the mains fuse is intact, the tube's heaters will generally be glowing. This means that the mains transformer L1301 is functioning. It could also mean that the thyristor is receiving its anode supply, and that some capacitors may be charged. One proceeds with caution therefore. A neon tester or voltmeter can be used to verify the presence of a.c. voltage at the body or anode of the thyristor and d.c. at the cathode. It's simplest to check for the first at the bottom section of the front left dropper resistor (R1367, 2·2Ω) and the second at the top section (R1381, 68Ω). In fact either section could be open-circuit, the lower to shut off the a.c. supply to the thyristor, but more commonly the upper to shut off the h.t. supply to the rest of the receiver.

The thing to bear in mind in this latter event is that although there will be no h.t. on the top tag of this upper section the lower tag will be standing at about 300V, as the thyristor will still function and the h.t. reservoir capacitor C1385 will be fully charged *and will remain so when the set is switched off*. The capacitor can remain charged for a considerable period of time, so that if the set is switched off at night in the fault condition the fact that you look at it the

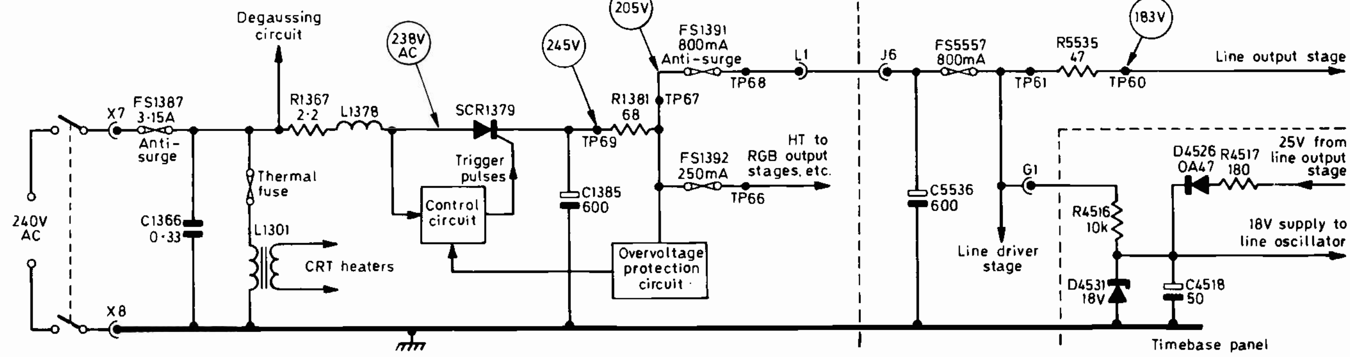


Fig. 1: Simplified circuit showing the h.t. supply arrangements used in the Philips G8 chassis.

following day without connecting it to the mains is no guarantee that you cannot receive a severe shock from it. It's important therefore to apply the neon or meter to the lower tag of the upper section to check whether the capacitor is still fully charged. If it is, connect a resistor from the upper to the lower tag, or from chassis to the lower tag, to discharge the capacitor. It's then safe to replace the dropper.

In many cases both sections of the dropper resistor will give a live indication when the set is switched on, and in this case the two fuses (FS1391 and FS1392) at the rear of the power panel will also be live at some 200V or so d.c.

Over to the Line Output Module

This suggests that all is not well with the right side line output stage module. Since the supply for the sound output stage is derived from the line output transformer, failure in this area shuts off both the picture and the sound, thus giving the same symptoms as a fault on the power supply board.

Having established that the power supply board is functioning and that the fuses on this are intact, we turn our attention to the right side and identify the 800mA fuse FS5557 which is about half way up the rear edge. There are one or more other fuses (depending on which version of the panel is fitted), but these don't concern us for the moment. If fuse FS5557 is open-circuit, it must at first be assumed that there has been an overload which has caused it to fail. Checks may prove however that all is in order (no shorts), and a replacement may then restore normal working. It may, but there is little point in fitting a new fuse only to see it fail immediately. So we have to adopt some sort of routine.

The one we personally adopt on this chassis is a little different to what we'd do with others, but it does make sense in the light of our experience of the G8.

The right-hand horizontal panel carries the whole field timebase plus the line oscillator and a few other bits and pieces. Among these bits and pieces is the raster distortion correction transductor L4485 which carries line and field scan currents, modifying each to correct pincushion distortion of the raster. It looks like a small transformer with windings on each of its legs, and is sited on the right side of the board, half way down. Behind it is a socket into which "plug H" (red) from the line output stage panel plugs. Behind this transductor is a small resistor, R4484. If this 120Ω resistor looks the worse for wear, close inspection of the transductor may show that this may have been passing excessive current.

This happens when the transductor suffers from a breakdown of the insulation between its windings, and the only remedy is to replace it (if we wish to keep the edges of the raster straight). The point is however that we don't need to keep the edges straight if we only need to prove a point. So if the appearance of L4485 and R4484 give rise to any suspicion, just pull out plug H and for test purposes leave it out.

We've thus removed one source of possible fuse (FS5557) blowing.

In the same way we can also unplug the tripler by removing the lead from the nipple on the line output transformer.

A close look at the line output stage panel will show the connections to the two line output transistors – the bases, emitters and collectors. A quick ohmmeter check can be made on each transistor, black probe to collector, red to the emitter or base, to see if there's a dead short. This is not a conclusive test, and a very low reading should be followed up by a second check with the leads off.

Having made these very few checks, which can be done in moments, we can next ascertain what sort of current the fuse is being asked to carry by connecting the meter, switched to its 1A range, in place of the fuse. If on switching the set on a reading of some 400mA is recorded the line timebase can be reckoned to be functioning normally and further checks can be made with the tripler reconnected and plug H reinserted. If on the other hand the reading is excessive, the fault is still present and it's highly likely that some noise of sparking may be heard from the line output transformer, which is suspect on this chassis.

If the transformer is not at fault (which is not easy to prove if there are no obvious signs) the next step is to unhook the secondary services supplied by the transformer. This can generally be done by removing the relevant fuses (later versions have more fuses than early ones) in order to isolate the faulty diode or capacitor etc., each of which can be tested separately once the faulty circuit has been identified.

If these secondary circuits (45V supply etc.) are not at fault, one must look at the transformer and the two output transistors with suspicion, subjecting the latter to more stringent checks. The transformer is more difficult to check without specialised equipment, but an internal breakdown of the insulation is usually self-evident.

It's quite common to find fuse FS5557 intact, with over 200V at each end. In this event one looks at the front of the line output stage panel, where there's a fairly hefty 47Ω wirewound resistor (R5535). This may well be found open-circuit, i.e. with h.t. at one end (the bottom) but not at the top. This may seem a very simple matter, and of course it is if the resistor remains open-circuit. In fact however it often becomes intermittent, the act of removing the rear cover being enough to seal it up temporarily thus restoring the set to normal working for a brief period.

Similarly, it can be very tiresome to find that the h.t. is present at all the points where it should be but the line timebase does not function until some point is touched with a test prod, this very simple act restoring normal operation until the set is switched on the next time. This is normally due to a poor connection somewhere on the top line drive panel (beside the line output transformer) and a thorough check on all soldered connections will probably be fruitful, particularly around the base and emitter terminations (from the line output transistors).

If the line output stage remains inactive although voltages are present at the previously mentioned points and at the collector of the rear output transistor (T5531), check at the collector of the front one (T5532). If there's no voltage here, it could well be that there's no line drive from the preceding stage.

No Line Drive

The driver transistor is T5519 and, being the same size as the output transistors (though not of the same specification, we hasten to add) is a pretty rugged fellow which rarely gives trouble. Voltage checks on it can be revealing however. It should have over 200V on the body (collector), with 1·65V at its emitter. It's the base reading which gives us the clue however, because if the preceding trigger amplifier and line oscillator stages are functioning correctly there will be a small negative reading here (about −1·5V).

If this negative drive is absent, it's prudent to make a quick check on the timebase panel where there's a 10kΩ

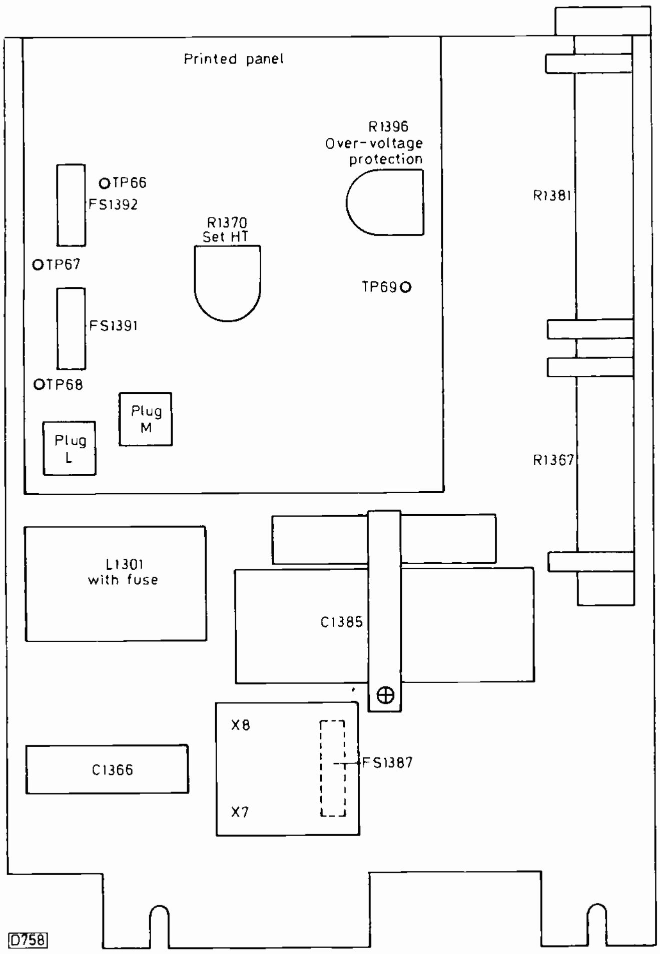


Fig. 2: Simplified power supply module layout, Philips G8 chassis.

wirewound start-up resistor (R4516). The lower end of this resistor is stabilised by an 18V zener diode, the top end going to the h.t. rail. Once the line output stage is functioning, the 25V line from the line output transformer feeds the 18V line via R4517 and diode D4526, thus taking the strain off the 10kΩ resistor. In the event of the 10kΩ resistor being open-circuit, the line oscillator cannot start functioning and the line output stage will be inoperative.

The importance of this simple start-up action cannot be too highly stressed, since it applies (in principle) not just to the G8's line oscillator but to a whole basketful of other chassis using various sorts of power supply where a kick-start is necessary to get the engine turning. To summarise: the line oscillator drives the line output stage, and the line output stage provides the 25V supply line for the line oscillator; thus a separate supply to the oscillator is required to get it working in the first place. A consequence of this is that the 10kΩ resistor can become open-circuit while the set is working, but will not be missed until the next time the set is switched on.

G8 Check List

So we now have a check list for the G8 chassis, which is pretty reliable except for the rare "one off" faults.

If the tube heaters are glowing: Check for a.c. at the bottom tags of the dropper. Check for h.t. at the top tags.

Check for 200V or so at the two fuses at the rear of the power panel. Check for the same at the 800mA fuse on the line output stage panel and on both tags of the front 47Ω wirewound resistor R5535.

If all h.t. points are correct, check the line oscillator supply and for a small negative voltage at the base of the line driver transistor.

If present, check the line output stage for dry-joints.

If the 800mA fuse FS5557 has blown, unhook plug H (red) to the transductor and remove the tripler cap from the line output transformer. Check the current taken with these disconnected. If still excessive, suspect the line output transformer and output transistors.

If the tube heaters aren't glowing, check the 3·15A mains supply fuse FS1387, then thyristor SCR1379 and the filter capacitor C1366 if the fuse has failed.

HT Flutter

It is characteristic of thyristor power supplies to produce rapid h.t. voltage fluctuations. This results in an unpleasant "vibration" of the picture. It's normally due to a slightly defective thyristor, but in some cases the trigger diac D1377 (BR100 or replacement) can cause it.

Always check the h.t. voltage at the rear two fuses on the power panel. Reset it with R1370 if it's above 205V. R1370 is in the centre of the panel.

A lower frequency voltage variation can occur if the supply line is high or the overvoltage circuit is operating prematurely. To adjust, turn R1370 to increase the h.t. to 225V. Then adjust R1396 (front end of panel) to reduce the h.t. voltage to 220V – the picture should then flutter. Finally reset R1370 to reduce the h.t. voltage to 205V.

These brief notes cannot of course cover all the fault conditions that could give the "dead set" symptom on the G8 chassis. They should however give some idea of the routine to follow in the light of the G8's known habits.

Miller's Miscellany

Chas. E. Miller

Whoever it was who coined the phrase about troubles never coming singly might well have been a television engineer. Most of us have at one time or another experienced the phenomenon whereby no sooner has one rather unusual fault been cured than another similar one occurs. It happened to me recently with a couple of sound faults – one on a GEC all-transistor colour TV receiver, the other on a Pye hybrid colour set.

In both cases the prime suspect was the sound module, since there was not the slightest noise from the loudspeaker – which had of course been checked. In fact it was the power supplies that were at fault. That in the GEC chassis is stabilised by a large zener diode (D603) mounted on the line transformer can: it had gone dead short, opening the associated fusible resistor. This at least was easy enough to trace and replace, which is more than can be said for the Pye defect. In these sets (later 697 chassis) there's a separate 26V supply for the sound module, supplied by a small rectifier (D51A) mounted close to the main low-voltage bridge rectifier at the bottom corner of the timebase printed panel. It had gone open-circuit: strangely enough in all the hundreds of these sets I must have serviced I've never come across this particular fault before – and the diode is a pig to find without the aid of a detailed plan!

Will I Never Learn?

Even after years of finding that it's always someone else who gets the nice, easy faults I still have a misguided faith in the possibility of doing quick, uncomplicated jobs. For instance ... My brother-in-law phoned one tea time to report that his GEC hybrid colour set had suffered field collapse. "No problem!" I commented reassuringly. "Bring it over and I'll do it straight away." How easily we set ourselves up for a swift kick in the pants from fate!

Now my experience of these sets is that if the PL508 field output valve is not at fault field collapse is usually due to R526 (560kΩ) in the feed from the boost rail to the height control going open-circuit. A new valve made no difference, so the voltage at R526 was checked. Result: zero at both ends. Now R526 looked as if it had been running a little hot, though not seriously so since the colour coding was still plainly visible. At this point I became distracted, noticing that the nearby resistor R529 (100kΩ) which feeds the c.r.t. first anode controls was suspiciously new. In fact whoever had fitted it had been either colour blind or careless, using a 10kΩ type. While putting this right I discovered that the short wire link between the two resistors had become unsoldered, robbing R526 of its voltage. Once this had been connected, the field scan was pretty much as normal – except for the rather unusual setting of the height control-minimum for a full picture. By this time however both my brother-in-law and I were anxious for our teas, so I let what seemed to be an unimportant fault go unchecked.

The following morning the phone rang early. The set had lasted just an hour before the field had once again collapsed. My first reaction was that maybe I should have changed the PL508 anyway, to have been on the safe side, but it turned out that this would not have helped: the connection at the bottom of R526 had failed for a second time.

Knowing that I'd made a good solid joint, I could only conclude that the resistor had been running hot enough to melt the solder. When I measured it I discovered that it had in fact dropped to less than a tenth of its original value – to around 50kΩ. Instead of going by its appearance, I should have taken the precaution of measuring it first off.

This wasn't the end of the affair. Within a few days the set had failed again, this time the picture going altogether. My brother-in-law had a look into the works and noticing that one of the valves had gone white on top wondered whether it was to blame. The bottle in question proved to be the PCF802 line oscillator, and from the minute crack around two of its pins I suspected that it might have been bent over a little during the previous repair sessions.

A new valve put things right, and while I was fitting it the long arm of coincidence appeared in the shape of a farmer who'd come to collect a similar but older set which had been ready for him for over a month. I thought I had better check that it was still o.k., which was just as well since no picture appeared on the screen. Sure enough, the PCF802 in this set had also gone soft. The farmer was suitably impressed by my confident diagnosis, made before unscrewing the back, but not impressed enough to pay the bill there and then!

Earning Power

Mention of money brings me to a sad little story reported in the press at the beginning of January. A certain TV engineer was sacked by a multiple store for refusing to work overtime on Saturdays because he had to look after his young child whilst his wife was working. He appealed to an industrial tribunal, who ruled in his favour and awarded him £1,330 for unfair dismissal. So what's sad about that? Wait for the sting in the tail. The young man (he's 36) is now staying at home full-time while his wife runs a hair-dressing business. He apparently commented: "I don't like it much, but she can make more money that I can."

Regrettably, this state of affairs is not only wholly believable but also unlikely to change radically in the near future. It's several years now since the subject of wages received an airing in the reader's letters page of *Television,* when a number of former engineers revealed that they had been forced to seek other employment to earn a decent wage. I particularly remember the chap who said he was much better off driving a hearse than he had been behind a bench. Could it be that there are just too many engineers, and that the defection of many of them to other jobs will give the remainder of us a rarity value? It's not a very agreeable theory, but there's no doubt in my mind that something must be done to enable skilled people in our trade to earn a worthwhile salary without having to work over long and unsocial hours.

Vintage Spot: The Ekco TMB272

With the portable television set such a popular and commonplace item nowadays, it's difficult to remember that it simply did not exist (in this country anyway) before 1956. It was in that year that the original Ekco company introduced their wondrous new model – a compact 9in. set that would work on either a.c. mains or a 12V car battery.

The term "compact" was relative of course. In comparison with the massive table and console models then in vogue it was no doubt small, but with a tube measuring over 15in. in length and a chassis and "cabinet" both made of steel it was no midget. The overall dimensions were approximately 10in. wide by 12in. deep and 16in. long. The weight was about the same as that of a Thorn 8000 colour set!

In designing the set Ekco had borrowed freely from components already in use in their full-size models – the tuner unit and the sound, field and line output transformers for example being virtually identical. To illustrate further an apparent indifference to really saving weight, space and power, the designers eschewed such new-fangled ideas as printed circuits and transistors (which were both by then in proven service elsewhere). No fewer than six current-hungry thermionic diodes were employed, instead of the widely available semiconductor alternatives.

The set worked on 405 lines only (Bands I and III), but the tuner also covered Band II to provide reception of v.h.f./f.m. radio: when the latter was selected, a ratio detector had to be switched into circuit in place of the normal a.m. television sound detector, accounting for two diodes. (This sort of thing was quite common in the 50s. Ironically, almost as soon as 625-line TV arrived with its convenient f.m. sound system interest in combined radio/television sets waned.)

In all there were fifteen valves plus the c.r.t., connected in two series/parallel heater chains each totalling 12V. On radio the c.r.t. and timebase valves were switched out. For both mains and battery operation the h.t. was provided by a multi-winding transformer which operated with inputs of either 200/250V 50Hz or 12V at around 115Hz delivered by a heavy-duty vibrator unit. There was a bridge-type metal rectifier (unusual in TV sets at that time), which one might have thought would have given a sufficiently smooth output to make the large h.t. choke unnecessary. For mains operation there was a 24V heater winding on the transformer, centre-tapped to earth to suit the two heater groups. The latter were switched across the 12V input on battery operation.

The consumption of the set was quoted as 7A at a nominal 12V, which made it advisable to restrict one's viewing hours on outings unless one had either (a) a damn good battery or (b) had parked on a hill! Nevertheless the performance was adequate, and the set undoubtedly fulfilled a long-felt need for some people.

Pungent Smell of Paraffin

As far as I'm concerned, the memory of the TMB272 will always be associated with the pungent smell of paraffin fumes. For almost every one I serviced belonged to local gypsies, who took them up enthusiastically for their caravans. Many were still in use ten or more years after they first appeared, since it was not until then that transistorised sets from Perdio, Philips, Ferguson and Pye began to be built in quantities. Maybe there's still somewhere a wrinkled old nut-brown twit watching a 9in. picture and defending his ears against the penetrating 115Hz buzz of the vibrator!

The Game of the Name

Over the years we've become accustomed to firms changing their names fairly capriciously and for no obvious good reason (e.g. the Thorn/BRC/TCE saga). Here for a change is one that was plainly justified when it took place a few years ago (according to one of my reference books).

New name: The Minnesota Mining and Manufacturing Co. Ltd.

Previous name: The Durex Abrasive Company.

Service Notebook

George Wilding

Weak Colour

Weak colour on a set fitted with the Rank A823 chassis was considerably improved on readjusting the critical i.f. gain control 2RV2. From experience of these sets we then decided to change the a.c.c. transistor 2VT7. This restored the saturation to the normal level.

The tube was past its best, but carefully adjusting the focus control improved the definition. Even with the brightness control at minimum however the picture brightness level was too high, making the blacks milky. The picture was also tinted towards green, so our next move was to adjust the three c.r.t. first anode presets to balance the outputs from the three guns – as a tube ages, these controls need to be reset if best results are to be obtained. The range of the three controls seemed to be limited however. This was confirmed by checking the tube's first anode voltages at pins 4, 5 and 13 on the base connector – the normal range is 400-500V, but the figures we obtained were well above this. The fault of course was due to the resistors which connect the earthy end of the presets to chassis via diode 4D2. These are 7R8 and 4R3, which should both be 220kΩ. 7R8 measured almost 350kΩ and 4R3 nearly 300kΩ. Replacing them enabled the grey scale to be set up correctly.

Loss of Sync

Two colour sets fitted with the Thorn 3500 chassis came our way recently with exactly the same fault – complete loss of sync. In both cases the cause was the same, a collector-emitter short-circuit (punchthrough) in the pnp emitter-follower transistor VT202 (type E5024) which acts as a buffer following the sync separator transistor VT203. Both these transistors are mounted on the video panel. When checking them it's also worth checking diode W201 (BA155) which is in series with the base of VT203 and, if the sync is weak, R215 (2·7MΩ) which supplies forward bias to the base of the sync separator via W201.

No Sound

There was no sound on a hybrid ITT colour set (CVC8 chassis), due to the fusible resistor R381 having gone open-circuit, removing the h.t. supply to the PCL86 audio output valve. No short-circuit was evident, but as fusible resistors don't often go open-circuit unless they are subjected to an overload current we decided to replace the PCL86 as a precaution. This restored normal, ample sound, but the next day the owner phoned to say that the sound had gone again – after two hours' use.

R381 was again open-circuit, and on inspecting the area around the PCL86 we noticed that R78 was rather the worse for wear. This resistor is decoupled by the 2μF electrolytic C76, and supplies the valve's screen grid and triode anode circuits. C76 was clearly suspect, but seemed o.k. on test. The obvious course was nevertheless to replace it, and since then there have been no further comebacks.

I've known leaky electrolytics take some minutes to break down completely after the normal working voltage has been applied, but this is the first time I've known one take a couple of hours to do so. It's particularly surprising in view of the capacitor's apparently perfect condition when tested cold.

Dark Picture

There was a dark picture on a set fitted with Thorn 3500 chassis, the brightness control having only a very limited effect. Momentarily shorting the grid and cathode of any of the guns produced a brilliant raster of the appropriate colour, so clearly the first anode voltages were present and the fault was the result of incorrect tube biasing.

Attention was concentrated on the beam limiter board, since this contains most of the circuitry regulating the basic brightness level. Adjusting the two presets failed to improve matters, so we checked the voltage across the beam/line timebase current sensing resistor R907. This was well above the correct figure of 1·3V, while R907 was naturally running hotter than usual. Did this mean excess current demand in the line timebase, or possibly that R907 had gone high-resistance as it sometimes does? The h.t. rail voltage was correct, also the width, while even the focus control provided optimum focus at its mid-point setting. This all suggested that the e.h.t. and thus the current demand were normal.

Replacing R907 with the one from our test line-scan panel more than restored correct brightness – in fact the beam limiter and preset brightness controls had to be readjusted.

No Line Sync

The trouble with an old ITT monochrome set was loss of line sync. A new PCF802 line oscillator valve restored firm locking, but the hold control had to be at one end of its travel. Slight readjustment of the oscillator coil was clearly required, but the core, perhaps not surprisingly, couldn't be shifted – at least with the force it was sensible to apply. Fortunately the frequency with the hold control set to the centre of its range was too high, since this meant that the core needed screwing in more towards the centre of the coil to increase the inductance. We always carry a few spare slugs with us, and were able to fit one at one end of the paxolin tube so that it increased the circuit's inductance sufficiently to obtain lock even when the hold control was turned from almost one end of its travel to the other.

Loss of Signals

We've had the same fault recently on four Pye hybrid monochrome sets (169/769 chassis) – either permanent or intermittent loss of sound and vision, leaving a noise-free raster. When the fault is intermittent, the set may perform perfectly for days on end, and if the fault appears at switch on it can often be cleared by switching off and on again. Failure of one of the stages in the i.f. strip of course, and each time we've found the culprit to be VT2 (BF194), the upper transistor in the cascode stage. The precise fault has always turned out to be a complete or intermittent base-emitter short-circuit, and we can only assume that the cascode configuration imposes a greater than normal voltage strain in the upper, emitter-driven transistor. Anyway, if you get these symptoms in one of these sets, make a bee-line for VT2.

Smoke

"Good picture and sound on this set" said the voice on the phone, "but while watching last night smoke started to appear through the slider openings on the front panel." We knew what to expect: the yellow cased mains filter capacitor used in these sets (ITT CVC5 chassis) sometimes develops a leak, the heat caused by the resultant current producing a great amount of smoke. The current is usually insufficient to blow the mains fuse, as viewers switch off within minutes. As usual, there was a tell-tale drop of solidified wax under the small panel on which the capacitor is mounted, and on replacing the culprit with a 1kV type normal results were restored.

No Sound or Vision

A Thorn portable (1591 chassis) hadn't been used for a couple of years, and on plugging it in and switching on only a blank raster appeared – no sound or vision. Meter checks soon showed that the cause was an open-circuit base-emitter junction in the first i.f. amplifier transistor VT2. A good picture was now obtained, but the sound was distorted in a very unusual manner.

We suspected the TBA120A intercarrier sound chip until we found that the distortion was greatly reduced at low volume control settings. Since the detected signal from the TBA120A goes via the volume control to the discrete transistor audio amplifier/output section, the chip was cleared of suspicion. The chassis was freed so that we could make voltage checks, but this greatly improved the sound quality – in fact after a couple of minutes it was almost normal. Switch off, then on again. Sound distorted for a few seconds, then back to normal (almost). We waited an hour then tried again – with the same results.

We were eventually able to make some voltage checks while the distortion was present, and discovered that there was much more than the usual 0·7V across the base-emitter junction of the lower transistor, VT13, in the complementary-symmetry push-pull output stage. Replacing VT13 restored sound quality to almost normal from switch on, but to get best results the other transistor in the output stage had to be replaced as well.

Bridge Rectifier Trouble

A mains/battery portable fitted with the ITT VC300 chassis would work perfectly for about ten minutes, then a hum bar would appear and the picture size would diminish slightly. The cause was found to be a defective diode in the mains bridge rectifier. The diode was going open-circuit after ten minutes, so that the output was then half-wave instead of full-wave. Diodes frequently go open- or short-circuit of course, but this is the first time I've had one which was all right to start with and then went open-circuit after a few minutes' use.

Occasional Field Roll

A Thorn colour set fitted with the 3000/3500 chassis had quite adequate field hold though every now and again there was a "one field" roll. We've had this one in the past, the difficulty persisting even when all the usual causes of weak field sync on these chassis have been eliminated from the search (the interlace diode W421, the field sync pulse coupling capacitor C422, the multivibrator transistor – VT421 – to which the sync pulses are fed, and the 2·7MΩ resistor R215 which biases the base of the sync separator transistor). The cure is to replace the field charging capacitors, C427 (25μF) and C428 (10μF). Well worth knowing!

Small Picture

The picture on a Thorn portable (1590/1 chassis) was lacking in height and width by about an inch, clearly indicating that the l.t. rail voltage was low. We've known a bad track on the "set h.t. volts" control R104 cause similar trouble on occasion, but on removing the back we found that the cause was that the series regulator transistor VT21 was cold and therefore non-conductive, the supply to the set being via its 10Ω shunt resistor R99 only.

Now being a pnp device, the base of VT21 should be slightly negative with respect to its emitter. Our tests showed virtually no voltage difference between these points however. This could have meant that the transistor's base-emitter junction was short-circuit, but due to the low value of the associated resistors this possibility was difficult to check with certainly without isolating the junction. Instead, we made voltage checks around the other transistor in the circuit, the error detector/amplifier transistor VT22 which drives the base of VT21.

All the readings were to some extent wrong, indicating that this stage rather than the series regulator itself was at fault. VT22's base-emitter junction could be checked with greater confidence than that of VT21, since the effective shunt resistance is in the region of 300Ω. The junction turned out to be open-circuit, the resultant lack of collector current from VT22 removing the drive from VT21. A new transistor in the VT22 position restored the normal l.t. rail voltage and a full sized picture.

Using Domestic Video Cameras

David K. Matthewson, B.Sc., Ph.D.

IN the January issue I summarised the basic features offered by typical monochrome and colour video cameras of the domestic variety. If you've decided that one of these is just what you've been looking for, you'll want to know how to get the best out of your investment.

Programme Planning

First and foremost, a non-technical point: plan in advance and in as much detail as possible what you are going to shoot. Since you probably won't have access to videotape editing facilities, you must shoot everything in the correct order. By using as long a shot as possible, the number of jumps between each take will be minimised. At present, none of the domestic battery-operated videotape recorders has an auto-edit facility to get smooth transitions between individual camera shots. It's useful to record in a notebook each shot and the recorder counter number – particularly if you're going to dub an audio commentary on afterwards.

Whenever we do an outside broadcast production, we write out a story board (a sketch of the scenes, with the accompanying dialogue beneath) and then a shooting script. The latter is a detailed list of each shot with its commentary, visual effects etc. alongside. As we can edit videotapes electronically, we don't always shoot sequences in order and can use a clapper board with the scene and take number written on to identify each take. Well, we *do* do it for money! You don't need to go that far, but some forward planning will enable you to produce little Emma's christening programme a bit better than might otherwise have been the case.

Wobble

Now for the technicalities. Although all the domestic video cameras can be hand held, there are several reasons for doing this as little as possible. The first is that you will get quite tired holding the thing, and your pictures will begin to wobble. This wobbling will make your audience tired as well! The use of a tripod is a great advantage, enabling you to get smooth pans and zooms with no shake or wobble. Alternatives to tripods are monopods, or even a foam rubber cushion rested on top of a wall or a car roof.

Use of the Zoom Facility

Unless you buy a very cheap camera, it will be fitted with a zoom lens – probably in the 25-105mm. range. This gives considerable flexibility to the camera but introduces its own problems. I'm sure we've all seen Uncle Fred's super eight holiday movies, shot using an automatic camera operating in the "hose-pipe" mode. Hose-pipe mode? – yes, point and squirt! Panning and zooming *can* be very effective – if used in moderation. There is nothing worse than your audience being distracted by the camera shots and losing interest in the subject. Try and avoid zooming on shot. Instead, take one shot at wide angle, stop the recorder, alter the shot to a much tighter one and then start recording again.

Sound

All domestic video cameras have a microphone built into the front panel. Thus some sound at least will be recorded simultaneously with the vision. The more discerning may well become dissatisfied with the quality this gives. Most of the microphones are omnidirectional, that is they'll pick up sound from all round. This unfortunately will include not only the required sounds but also the noise of the zoom lense moving, the cameraman's breathing (and curses when things go wrong) and various extraneous background noises.

The answer to this problem is to use a rather better quality auxiliary microphone. A highly directional rifle microphone will do a good job at recording sports events etc. Most cameras and recorders automatically disconnect the camera microphone when an external one is plugged in. If you're involved in recording a children's party say, either a rifle microphone or a single omnidirectional microphone in the middle of the table etc. will give good results. For

Table 1: Colour temperatures of common light sources.

Light source	*Colour temperature (°K)*
Tungsten lamps	2600-2900
Quartz halogen lamps	3200-3500
Morning and evening sunlight	5600-5700
Hazey daylight	5700-5800
Overcast daylight	6000
Clear noon sunlight	6700
Mediterranean sunlight	10000-12000

interviews or discussions between two people, a hand-held directional microphone pointed at each speaker in turn will give good results. It's possible to use more than one microphone to obtain even better results, but this involves using a microphone mixer. Cheap microphones (about £10 each) which clip on to people's ties or jackets can be purchased: these pick up only the voices. If a microphone mixer is not considered essential, or is too expensive, a passive microphone mixer can very easily be built.

Lighting

One important consideration is lighting – particularly the lighting problems that occur when using colour cameras. A simple black and white camera, such as the Panasonic WV460 or the JVC GS1000, will give usable pictures with ambient light levels of around 100 lux. In practice this means that indoor shooting can be done under normal domestic room lights.

Most domestic video cameras have some form of automatic level control to ensure that more or less correctly exposed pictures are produced under any lighting conditions. Although this may seem to be a great advantage, there are problems. Such circuits work by examining the scene being viewed by the camera, effectively reducing or increasing the video amplifier gain so that the average level of the video signal is 0·7V. Some systems reduce the sensitivity of the vidicon tube under conditions of very bright light, increasing the tube's sensitivity when the lighting is reduced. This however means that if a bright light or window is included in the shot the camera will take the bright illumination as the average lighting level and reduce the gain accordingly. The result will be a correctly exposed

The JVC GX77 colour camera.

window or light and a blacked out foreground. The object of interest will thus be totally under exposed. When shooting indoors therefore, make sure that there's no unevenness in the scene lighting, and if possible switch off the ALC (automatic level control).

Similar problems occur outdoors, for example when shooting somebody standing on a cliff top with a bright sky behind. Unless you can override the ALC, the figure will end up as a silhouette.

Colour Temperature

When using a colour camera the problem is somewhat worse! One has all the problems just mentioned plus several more. These additional problems relate to the phenomenon of "colour temperature". This is a way of describing the quality of the light produced by an illuminating body, be it the sun, tungsten bulbs or halogen spotlamps. Each of these gives out light which is of a different colour. As a result, the same objects viewed under different light sources will appear to have different colours. The human eye tends to compensate for these shifts, although those of you who buy suit lengths or curtain lengths of material will be familiar with the need to take it out of the shop into daylight to determine the true colour. The camera cannot do this compensation automatically, and needs either additional filters or electronic adjustment to enable it to work in daylight and various types of artificial light. (The same problems arise with colour film when used in and out of doors.)

Table 1 shows the types of illumination you are likely to come across and the approximate colour temperatures. As an interesting aside, one sometimes sees both glass filters and electronic adjustments on domestic colour cameras allegedly to balance them for use with fluorescent tube lights. This in fact is not possible, all that can be achieved being an approximate match. Fluorescent tubes you see are not continuous light sources – they go on and off at 50Hz, and thus don't have a colour temperature. If at all possible, avoid recording under these tubes.

When we are using colour cameras, either in the studio or outside, we measure the colour temperature of the light source with a special meter, matching the cameras accordingly. For most domestic users this approach will not be possible: all you will have will be a switch giving a choice of daylight, overcast daylight, tungsten bulbs, or fluorescent tubes. By monitoring the recorded picture on a well set up colour receiver the best colour match can be achieved.

Using Colour Cameras Indoors

Although many domestic colour cameras will give pictures at illumination levels of around 1000 lux, the pictures are not very good. The Panasonic WV3300 needs around 1500 lux and the Hitachi GP5 around 2000 lux before acceptable colour pictures are obtained. This means that once you take your colour camera indoors you'll need some form of additional lighting to get satisfactory pictures.

For general domestic use, probably one of the easiest ways of doing this is to use a cine light of the quartz-iodine type, giving about 1kW output. This will give you around 2000 lux at 16 feet from the light source. It will act as a floodlight, giving you a rather flat picture, but at least you'll have a good depth of field, with everything in focus and a good colour match. The real problems of colour balance occur when you try matching two cameras together. But that's another story!

Happy shooting!!■

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a 75p postal order (made out to IPC Magazines Ltd.), the query coupon from page 388 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

ITT CVC9 CHASSIS

At switch-on the height is normal, but over about an hour it decreases gradually until there's a half inch gap at the top and bottom. Adjusting the height control fills the screen, but the next time the set's switched on again there's excessive height to start with. I've tried a new PCL805 and replaced R355 (1MΩ), which is in series with the height control, and the output pentode's cathode decoupler C247.

The trouble could be due to the sound muting circuit loading down the boost rail – check D57 and R413 (200kΩ). Then if necessary check the boost rail filter resistor R417 (270kΩ) and R344 (1MΩ) and R341 (560kΩ) in the field linearity network.

THORN 2000 CHASSIS

I'm having difficulty obtaining a line timebase power supply regulator transistor as the original type (2SO34) is apparently no longer in production. An equivalents book I've looked in gives no suggestions.

We suggest you use a BU126. This has a higher rating than the 2SO34 and should be more reliable, though a little more expensive.

ITT CVC8 CHASSIS

Within ten minutes of tuning a station in, the picture reverts to a fuzzy monochrome one. This can go on for some time before a good picture remains. It's also necessary to retune after each channel change.

The problem is not uncommon with these sets. The tuning voltage stabiliser i.c. (D11) could be the culprit, but it's more likely to be the varicap tuner or the tuner control unit (push-button assembly). A substitution test is the sure way to find out which is at fault.

RANK A774 CHASSIS

There's excessive width, which cannot be controlled by means of the line stabilisation control 3RV8, and the line output stage spring-off resistor goes open-circuit after one–two hours' use. Since there's plenty of brilliance with no sign of ballooning, I assume that the line output transformer and valves are in order. The line output valve's screen grid voltage is low at 120V – the decoupling capacitor has been replaced and a new valve tried. There are also a couple of water marks down the picture.

The line output valve is clearly passing excessive current, and we feel that all the symptoms are due to the same cause. The fundamental clue is that the stabilisation control is inoperative: make sure that the bottom has not come off earth due to a print fault, and that about 350-400V is present at the top. If so, and the slider voltage varies with adjustment, check the values of the other resistors in the line stabilisation circuit (3R58/61), the line oscillator's anode load resistor (3R55), and the drive waveform shaping capacitor 3C41 for leakage. It's just possible you've fed in a faulty PL504!

ITT VC300 CHASSIS

The problem with this set is partial field collapse. Since the field timebase circuit is d.c. coupled throughout I'm uncertain where to start checking.

Field collapse on this chassis is usually due to failure of one of the driver (T9/10) or output transistors (T11/12). You'll have to test them individually. Also check R91 (330Ω, 1W), which is connected across T11, and replace if found to be burnt.

PYE 169 CHASSIS

There's no sound or raster, though the screen lights up briefly when the set is switched off. I discovered that the final i.f. amplifier transistor VT4 and its emitter bias resistor R20 were faulty, and have replaced these. R20 keeps overheating however.

The usual cause of this trouble is a dry-joint in VT4's base circuit. This results in excessive bias, with the stage being overrun.

ASA CT6000B

We're having difficulty with an intermittent fault on this set. A few minutes after switching on, an h.t./picture flutter may occur, clearing after a few cycles. This happens even with the tripler disconnected (h.t. monitored with a meter). Then, after some hours or days, the fusible line timebase feed resistor Re1 goes open-circuit. Reconnect this and the set will work all right for several hours or days, then the trouble is repeated. I've monitored the set with the scan thyristor shorted out, and no tripping then occurs. In an attempt to reduce the line output stage loading, I've reduced the h.t. to minimum.

This sort of thing is usually due to dry-joints around the commutator transformer Tre1, while flutter will be experienced if the h.t. is set too low.

THORN 3000 CHASSIS

The problem with this set is excessive width. Any ideas?

Assuming that the h.t. voltage is not low, the main suspect is a defective line output stage flyback tuning capacitor – C517 if the set has the two-transistor line output stage, C518 if it's the single-transistor version. In either case replace with a Thorn-approved part – ordinary capacitors won't survive long in this position.

EHT ADJUSTMENT

I'd like to adjust the e.h.t. on this Pye hybrid colour set (697 chassis), but all I have is an Avo Model 8. Is there a procedure that could be used?

It's possible to set the e.h.t. with an Avo 8 only if you have the e.h.t. probe which is supplied as an extra. Provided not much has been disturbed in the set however a rule of thumb method is to adjust on test card for optimum picture size – with the vertical castellations just vanishing at the sides.

THORN 8000 CHASSIS

The trouble is that the colour fades by roughly half when the set has been on for about half an hour. When this happens there's also a faint sizzle and buzz when captions appear on the picture. The fault sometimes clears after a while. It doesn't seem to be tuner drift, because if I try to retune for more colour I get too near to picture break-up. Incidentally, low sound on this set was traced to C138 (1μF) which decouples the d.c. volume control having been connected the wrong way round. Apart from these problems the set has given excellent performance.

The present trouble appears to be on the lower left side, where the tuner output meets up with the first i.f. amplifier stage. Remove the screening, and check in particular the coupling capacitors C107/C116 in this compartment, then the connections to the series tuned coil L103 etc.

MITSUBISHI CT200B

There's an intermittent fault on this set – faces occasionally turn purple, the picture taking on a purple cast. Changing channels restores correct colours.

It seems that the green colour-difference signal is dropping out from time to time. Check back from the tube's green grid (pin 7) to the G – Y output transistor Q637 on the decoder panel. If there are no poor connections or dry-joints, the transistor is suspect. The two electrolytics in the stage, C6E1 and C6E5 (both 10μF) may need to be checked.

DECCA MS2420

The set is o.k. when switched on. After a while however it goes pop and the picture becomes grainy. There are one or two other troubles. At times the screen goes very dark, though there's still a picture in the background. Also the picture may fold to the centre and then return to normal. After being on for three-four hours these faults no longer occur.

There appears to be more than one fault. The grainy picture is probably the result of a fault in the varicap tuner – look for a dry-joint around the input end. For the collapsing picture fault, check for a poor connection in the feed to the scan coils on the print under the line output transformer. When the picture goes dark, check the tube base voltages, especially at pin 3 (first anode), then check back to see where the incorrect voltage stems from.

THORN 9000 CHASSIS

Over the period of a few weeks the colour went to maximum, adjustment of the colour control making no difference. Replacing the SN76226 chrominance/luminance signal processing i.c. got the colour control working again – but with weak colour and bands of the picture across the centre of the screen breaking up. As a temporary measure, I've replaced the old SN76226 and obtained correct colour by backing off the a.c.c. preset control R213.

We suggest you replace C157 (1μF) which decouples the slider of the colour control. If this doesn't do the trick, we'd be very suspicious of the replacement SN76226 – try another if necessary.

WALTHAM W125

There's a peculiar no sound fault on this set. To start with, for some weeks the sound would appear only three-four minutes after the picture. Then it refused to come on altogether. The supply resistor R409 was red hot, so I replaced this. Still no sound. I next changed the PCL86 audio valve and the output section's cathode bias resistor R214 (looked burnt), but on switching on there's still no sound and R409 begins to smoke again.

Remove the PCL86 and switch on. If R409 continues to overheat, change its reservoir capacitor C408 (22μF). If, as is more likely, R409 cools off, change the audio coupling capacitor C216 which is probably short-circuit. Then recheck the PCL86, which may not have weathered the storm – a short-circuit C216 (0·022μF or near) will put 100V on the PCL86's pentode control grid, causing excessive current.

THORN 1590 CHASSIS

When the line output transistor's collector is connected to chassis, the 2·5A l.t. fuse blows. When the collector is disconnected, the fuse holds and all the other circuits appear to work normally. A new line output transistor has made no difference, and there don't seem to be any leaky capacitors in the line output stage.

Disconnecting the line output transistor's collector from chassis disables the line output stage. It seems then that with everything connected up the line output transformer is being heavily loaded. Disconnect in turn the e.h.t. stick (W12) and the two rectifier diodes W13 and W14. If the timebase is restored to life when any of these is disconnected, check the rectifier and make sure that its reservoir capacitor is in order. The e.h.t. stick's reservoir capacitor C115 can be left out if fitted. A faulty diode is the most likely cause of the trouble, but the line output transformer or scan coils could be responsible.

DECCA MONOCHROME SETS

The problem with a Decca Model MS2400 is a white line down the centre of the screen. I've noticed the fault before on a number of these sets, and also on the DR23/24, but have never been able to find the cause.

The fault is likely to be due to a dry-joint under the line output transformer – you'll probably find it blackened by sparking.

THORN 8500 CHASSIS

The set has not been used much and performed well until recently, when several faults occurred. The first was a rapidly changing raster size. Replacing the h.t. regulator thyristor cured that. Subsequently the line output transistor, the flyback tuning capacitor (C406), the e.h.t. stick and the line oscillator transistor had to be replaced. The fault now is that with the brightness control at maximum the picture is very dark on dark scenes (objects can just be seen moving about) though on lighter views the brightness is about right. The h.t. is correct, but at TP27 (feed to the c.r.t. first anode presets) there's only about 200V instead of 700V. I've checked the rectifier (W403) and its reservoir capacitor (C401), and replaced the line output transformer. The voltages around the luminance amplifier transistor and the brightness source transistor are all about right.

The first anode supply voltage is the thing to concentrate on, since the picture will indeed be dark at such a low voltage. You don't mention R402 (3·3kΩ) which is in series with the rectifier – this could have increased in value. The line output stage itself would seem to be in order since you've presumably got full scan. The first anode control network could be loading down the supply – check the insulation resistance of the spark gaps and the tracks of the first anode controls themselves.

SABA H CHASSIS

The set switches itself off about five minutes after being switched on. I assume that the trouble is in the line output stage, but both thyristors seem to be in order and there don't seem to be any shorts. Incidentally, can you suggest any alternatives for the RCA thyristors (40888 and 40889)?

The switch-off solenoid is operated by thyristor THY601. Intermittent switch off can be due to several things. First check that the line oscillator can has an earthing link connected to chassis: if not, fit one. This will prevent occasional misfiring of the flyback thyristor THY671. Next check C681 (one of the tuning capacitors) for signs of overheating. This blue capacitor sometimes cracks and becomes discoloured, at the same time becoming dry-jointed where soldered to the board. Check the spark gap on the tube base – where the focus lead goes on to the print: dust across this can cause spurious triggering of the switch-off circuit. Finally, the switch-off circuit itself could be over sensitive. The voltage at the gate of the thyristor (THY601) should be exactly 0·35V: if it's higher, reduce the value of R607 to 4·7kΩ. The 40888 can be replaced with a BT119 and the 40889 with a BT120.

DECCA SERIES 10 CHASSIS

The trouble with this set is that the brightness, contrast and colour controls all have to be turned to maximum to get a good picture. It's difficult to see why all three should have to be adjusted in this manner.

A tired PCF802 line oscillator valve, or a faulty anode load resistor (R444, 33kΩ) or possibly R453 (330kΩ) in the width circuit can degrade the line drive waveform. The result is that the line output valve draws excessive current, turning down the signal via the beam limiter. To check this, short pin 8 of plug/socket PIF to chassis. If this doesn't result in things being brightened up, the line timebase is in order and the preset brightness control VR601 (on the bottom power supply panel) should be adjusted to give a satisfactory brightness range.

TEST CASE

209

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.

An elderly Sobell Model 1040 colour receiver arrived in the workshop with the complaint of lack of height with a bright line at the bottom of the picture. The fault had initially been investigated by the field technician, who had replaced the PL508 field output valve without success. He'd then tried adjusting the various presets in the field timebase, again without obtaining much improvement, and under the impression that he could smell burning he decided it would be prudent to bring the set back to the workshop.

The set is fitted with the GEC single-standard hybrid chassis, employing an ECC82 as the field oscillator and a PL508 as the field output valve. On examination, signs of burning were indeed found. The small resistor (R526) which supplies the height control was found to be well cooked and running at a high temperature. R526 is connected between the height control and the boost rail, and is decoupled by an 0·01 F capacitor (C519). A leak in C519 was an obvious first suspicion, and although no leak could be measured using an ordinary ohmmeter the capacitor was replaced. This gave little if any improvement, so new valves were tried. The results remained the same, and no fault could be found with the other resistors and capacitors in the oscillator circuit. The PL508's cathode bias resistor (R528, 330Ω) can be responsible for linearity troubles with a lack of full scan, but a replacement again made no difference. A replacement R526 continued to cook and discolour – yet no significant leakage between its height control end and chassis could be detected.

What could have been responsible? See next month for the solution and another item in the series.

SOLUTION TO TEST CASE 208
– page 326 last month –

The technician dealing with the field timebase fault in the ASA Model CT5003 was happy to find that the horizontal line was displaced when the meter's probe touched the control grid connection to the PL508, since this proved that the field output stage was almost certainly operative. Attention was next turned to the oscillator section of the ECC81, and since a raster of sorts developed when the control grid was touched with the meter probe the technician had a fair inkling that the grid circuit was open or of abnormally high resistance. What was happening was that the meter's resistance was correcting the circuit conditions to some extent – sufficiently in fact to indicate that the blocking oscillator circuit was not in very great trouble.

The relatively high-value (1·5MΩ) fixed resistor (R401) in the timing circuit seemed a likely culprit in view of the results of the foregoing tests. It had in fact risen substantially in value, a replacement solving the problem.

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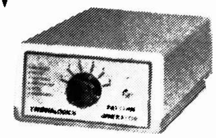

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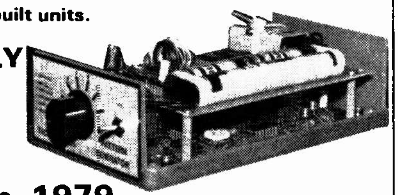

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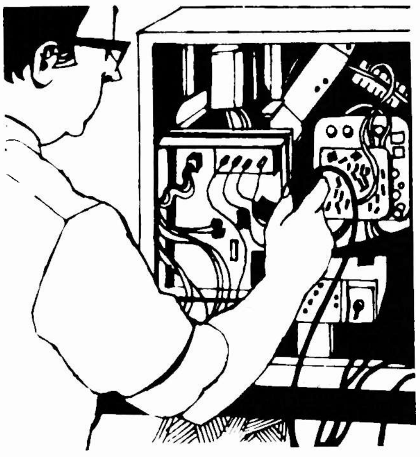

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30FL2	£1.39	EF183	77p	PCC88	£1.04	PL81A	58p
DY802	81p	EF184	77p	PCC89	82p	PL84	81p
DY86/7	71p	EH90	86p	PCC189	82p	PL95	£1.15
ECC81	64p	EL34	£1.87	PCC805	57p	PL504	£1.36
ECC82	70p	EL81	£1.04	PCF80	83p	PL508	£1.72
ECC83	64p	EL84	64p	PCF86	£1.15	PL509	£2.86
ECC84	76p	EL90	78p	PCF200	£1.63	PL519	£3.20
ECC85	69p	EL509	£2.55	PCF800	£1.15	PL802	£2.00
ECC88	93p	EY86/7	69p	PCF801	£1.15	PY33	44p
ECF80	82p	EY500A	£1.53	PCF802	83p	PY81	70p
ECF82	82p	EZ80/1	56p	PCF805	£1.87	PY83	70p
ECH81	64p	GY501	£1.43	PCF806	93p	PY88	83p
ECH84	£1.02	GZ34	£1.79	PCF808	£1.87	PY500A	£1.63
ECL80	76p	KT66	£3.69	PCH200	£1.23	PY800/1	70p
ECL82	78p	PC86	93p	PCL82	75p	UCF80	81p
ECL86	90p	PC88	93p	PCL84	83p	UCH81	78p
ECF86	94p	PC92	93p	PCL85/805	87p	UCL82	91p
EF80	52p	PC97	83p	PCL86	87p	UCL83	£1.08
EF85	63p	PC900	90p	PD500	£3.36	UL84	£1.08
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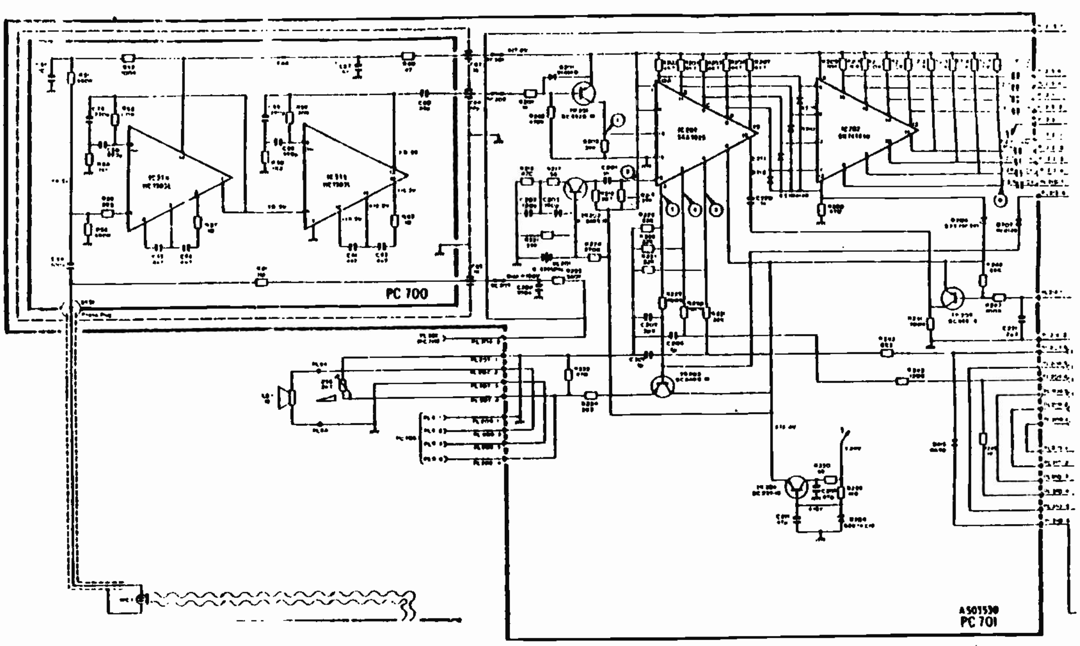

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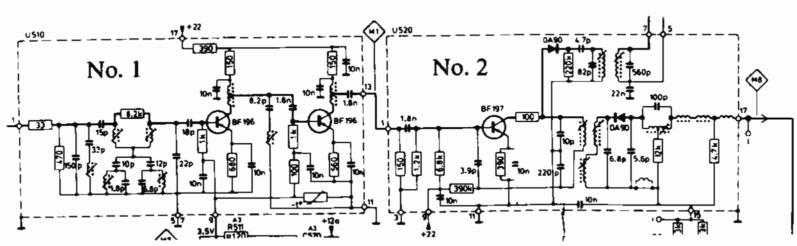

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