FEBRUARY 1978

Australia 85c; Malaysia $2.50; New Zealand 85c

50p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

ON-SCREEN CLOCK

ALSO:

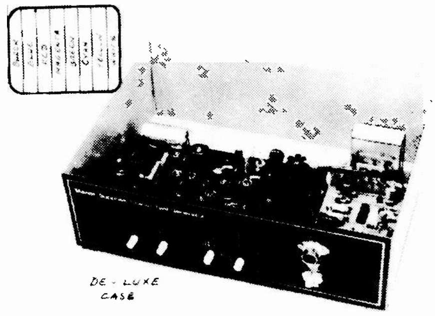
LONGER VCR PLAYING TIME

SERVICING SABA COLOUR RECEIVERS

MANOR SUPPLIES

COLOUR BAR GENERATOR

plus CROSS HATCH KIT (Mk. 4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars, all R–Y, B–Y and Lum. Combinations.
- ★ Plus cross hatch grey scale, peak white and black levels.
- ★ Push button controls, small, compact battery operated.
- ★ Simple design, only five i.c.s. on colour bar P.C.B.

PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £35.00 + 8% VAT + £1.00 P/Packing.

CASES, ALUMINIUM £2.40, DE-LUXE £4.80, BATT. HOLDERS £1.40. ADD 8% VAT TO ALL PRICES!

ALSO THE MK3 COLOUR BAR GENERATOR KIT FOR ADDITION TO MANOR SUPPLIES CROSS HATCH UNITS. £25.00 + £1.00 p.p. CASE EXTRA £1.40. BATT. HOLDERS £1.40. ADD 8% VAT TO ALL PRICES.

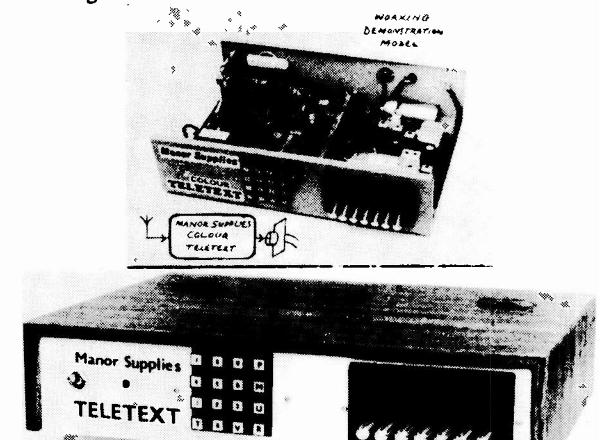
- ★★ Kits include drilled P.C. board, with full circuit data, assembly and setting up instructions.
- ★★ All special parts such as coils and modulator supplied complete and tested, ready for use.
- ★★ Designed to professional standards.
- ★★ Demonstration models at 172 West End Lane, NW6.
- ★★ Every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

ALSO NOW AVAILABLE

MK4 DE LUXE (BATTERY) BUILT & TESTED £58.00 + 8% VAT + £1.20 P/Packing.

ALTERNATIVE MAINS SUPPLY KIT £5.78 + 8% VAT + 65p P/P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £3.50.
INFORMATION ON VIDEO TAKE-OFF FOR C.C.T.V.

MANOR SUPPLIES TELETEXT 77 KIT (incl TEXAS DECODER). Full facilities in colour. External unit. AE input to set. Write or call for further information. See working demonstration model!



15½" × 10" × 3½".

COLOUR, UHF & TELEVISION SPARES

T.V. PORTABLE PROJECT LOPT, SCAN COILS, DRIVER £12.50; EHT RECT. £1.20; ELC1043/05 £5.50, CONTROL UNIT £1.00; VIS GAIN, VIS SELECT (TESTED) £3.80; PACKS: I.C. £5.20, CAPS TANT £2.75, ELECTROLYTICS £3.20, CERAMICS £2.00, POLYESTER ETC. £1.35; PRESETS 90p, TRANSISTORS £3.90, SEMICONDS £3.80, BRIDGE REC. £1.95, C106 90p; BYX71/600 (2) £2.40; RELAY £2.25, CONTROLS £1.18; 6MHz FILTER 68p, COIL £1.00; 3A CHOKE 18p; POST & PACKING 85p. MAINS TRANSFORMER £6.80 p.p. £1.00. OTHER PARTS AVAILABLE.

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 £11.00 + 45p. p.p.* (ALUM. CASE £2.00 p.p. 75p.*) **COMPLETE TESTED UNITS, READY FOR USE (DE-LUXE CASE) £19.80** p.p. 90p.* **ADDITIONAL GREY SCALE KIT £2.90** p.p. 30p.*

"NEW TYPE" UHF SIGNAL STRENGTH METER KIT £18.00 p.p. 90p. (**VHF VERSION £18.80** p.p. 90p.*)

CRT TESTER & REACTIVATOR PROJECT KIT £18.80 p.p. £1.30*

"TELEVISION" COLOUR SET PROJECT. MARK II DEMONSTRATION MODEL WITH LATEST IMPROVEMENTS. WORKING AND ON VIEW, SPARE PARTS STILL AVAILABLE.

"TELEVISION" PROJECT CROSS HATCH KIT £3.60 p.p. 20p.*

SPECIAL OFFER I.F. Panel, leading British maker, similar design to "Television" panel. Now in use as alternative inc. circuit and connection data, checked and tested on colour **£14.80** p.p. 95p. Also **DECODER** panel checked and tested on colour, full details, **£19.80** p.p. 95p.
"FIVE in ONE" PANEL replaces Tuner IF, Decoder, RGB, and sound boards of original project. Tested on colour, with all data. **£35.00** p.p.£1.20.
MAINS TRANSFORMER 280W for "T.V." Colour Set **£11.50** p.p. **£1.50.**
TRIPLER £6.00 p.p. 75p, **ERIE FOCUS £2.20,** p.p. 30p, **NEW AUDIO UNIT £2.60** p.p. 35p.
STABILISER UNITS, "add on" kit for either 40V or 20V, **£2.80** p.p. 35p.
BUSH 161 TIMEBASE PANEL A634 **£3.80** p.p. 90p.
BUSH 161 I.F. PANEL A583 **£3.80** p.p. 90p.
GEC 2040 Surpl Panels, ex-rental, Decoder **£5.00.** T.B. **£5.00** p.p. 90p.
BRC 3000 Surplus/Salv Panels, Decoder **£7.50, Video £7.50** p.p. 90p.
DECCA Colour T.V. Thyristor Power Supply. HT, LT etc. **£3.80** p.p. 95p.
BUSH CTV25 Power Supply Unit **£3.20** p.p. £1.50.
BUSH CTV174 Decoder plus C.D.A. **£8.50** p.p. £1.00
PYE 697 Line T.B. P.C.B. for spares, **£1.50** p.p. £1.00.
MULLARD AT1023/5 convergence yoke. New **£2.50** p.p. 75p.
DLIE delay line. New **90p** p.p. 40p. AT1025/06 blue lat. **75p** p.p. 30p.
PHILIPS G6 single standard convergence panel, incl. 16 controls, switches etc., and circuits **£3.75** p.p. 85p, or incl. yoke. **£5.00. PHILIPS** G8 panels for spares, decoder **£2.50** p.p. 85p.
VARICAP. Mullard ELC1043 UHF tuner **£4.50,** ELC1043/05 **£5.50,** G.I. type (equiv. 1043/05) **£3.50** p.p. 35p. Control units, 3PSN **£1.25,** 4PSN **£1.50,** 5PSN **£1.80. Special offer** 6PSN **£1.00,** 7PSN De-Luxe **£1.80** p.p. 35p. TAA 550 **50p** p.p. 15p.
VARICAP VHF PHILIPS £3.80, ELC1042 **£4.80,** p.p. 35p, ELC1042 on PYE P.C.B. **£5.40,** p.p. 65p.
VARICAP UHF/VHF ELC 2000S **£12.50** p.p. 65p.
UHF/625 Tuners, many different types in stock. Lists available. **UHF** tuners transistd. incl. s/m drive, indicator **£2.85;** 4 position push button **£2.50,** 6 posn. push button **£4.50** p.p. 90p. AE ISOL **30p** p.p. 20p.
TRANSISTORISED 625 IF for T.V., sound tested (as featured in Practical Wireless, Nov. '75). **£6.80** p.p. 65p.
PHILIPS 625 I.F. Panel incl. cct **50p** p.p. 50p.
TURRET TUNERS, KB "Featherlight" VC11, Philips 170 series, GEC 2010 **£2.50.** GEC 2018, 2019, 2038, 2039 5 position **£4.20** p.p. 85p.
TBA "Q" I.C.s. 480, 530, 540, **£2.20,** 550, 560C, 920 **£3.20** p.p. 15p.
HELICAL POTS, 100K. 4 for **£1.20** p.p. 20p.
BUSH 161 Mains Droppers, two for **90p** p.p 50p.

LINE OUTPUT TRANSFORMERS. New guar. p.p. 85p.

BUSH 145 to 186SS, etc. **£6.80**
DECCA DR1, 2, 3, 121/123, 20/24, MS1700, 2001, 2401 .... **£6.40**
DECCA MS2000, 2400 .... **£5.80**
FERG., HMV, MARCONI,
ULTRA 850, 900, 950 Mk. 1 ...... **£7.30**
950II, 1400, 1500, 1590 .... **£5.90**
GEC 2000, 2047 series, etc.......... **£6.40**
INDESIT 20/24EGB **£6.40**
ITT/KB VC2 to 53, 100, 200, 300.**£6.40**
MURPHY 1910 to 2417, etc. **£6.80**
PHILIPS 19TG121 to 19TG156 . **£4.80**
PHILIPS 19TG170. 210, 300...... **£6.40**
PYE 11U, 368, 169, 769 series..... **£6.40**
PYE 40, 67 series (36 to 55)......... **£3.80**
PAM, INVICTA, EKCO,
FERRANTI equivalents as above.
SOBELL 1000 series.................. **£6.40**
STELLA 1043/2149 .... **£6.40**

SPECIAL OFFERS
BUSH TV125 to 139....... **£2.80**
EKCO 380 to 390........... **£1.00**
EKCO 407/417 .... **£1.00**
FERR. 1084/1092 .... **£1.00**
GEC 448/452................. **£1.50**
KB VCI, VCII (003) **£2.80**
MURPHY 849 to 939..... **£2.80**
REG 10-6, 10-17 etc. **£1.00**
SOBELL 195, 282 to 8.... **£1.50**
MANY OTHERS STILL AVAILABLE

COLOUR LOPTS p.p. £1.00.
BUSH 182 to 1122 etc..... **£9.80**
MURPHY Equivalents.... **£9.80**
DECCA "Bradford" (state Model No. etc) ... **£7.80**
GEC 2028, 2040............. **£9.20**
ITT CVC 5 to 9 .... **£5.80**
PYE 691, 693, 697 .... **£17.80**
THORN 8500................. **£9.80**

THORN 850 Time Base Panel, Dual Standard **50p** p.p. 80p.
MULLARD Scan Coils **Type AT1030** for all standard mono 110° models, Philips, Stella, Pye, Ekco, Ferranti, Invicta **£2.00** p.p. 85p.
PHILIPS G8 Tripler (1174) **£6.00** p.p. 75p. Others available.
6·3V CRT Boost Transformers **£2.90** p.p. 75p.; Auto type **£1.80** p.p. 45p.

CALLERS WELCOME AT SHOP PREMISES
THOUSANDS OF ADDITIONAL ITEMS AVAILABLE NOT NORMALLY ADVERTISED

MANOR SUPPLIES
172 WEST END LANE, LONDON, N.W.6.
(Near W. Hampstead tube stn: 28, 59 159 Bus Routes) 01-794 8751
Mail Order: 64 GOLDERS MANOR DRIVE, LONDON N.W.11.
PLEASE ADD 12½% VAT TO PRICES (EXCEPT * 8%)

TELEVISION

February 1978

Vol. 28, No. 4
Issue 328

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

BINDERS AND INDEXES
Binders (£2.85) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders add 60p to cover despatch and postage.

BACK NUMBERS
Some back issues, mostly those published during the last two years, are available from our Post Sales Department (address above) at 70p inclusive of postage and packing to both home and overseas destinations.

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 "Your Problems Solved". Send to the address given above (see "correspondence").

this month

OUR NEXT ISSUE DATED MARCH WILL BE PUBLISHED ON FEBRUARY 20

EX-EQUIPMENT SPARES

MONO TUBES
(tested)
19" Rimguard **£4.50**
23" Rimguard **£6.00**
20" Rimguard **£6.00**
24" Rimguard **£7.50**
+ £3.00 p.p.

MONO TUNERS
6 - button integrated all at **£6.50**
U.H.F. P/Button D/S **£4.50** U.H.F. P/Button S/S **£6.50** Rotary **£3.00**
+ £1. p.p.

MONO LOPTS
All D/Standard Lopts at **£4.00** + £1. p.p.
All S/Standard at **£4.00** + £1. p.p.

MONO PANELS
i.e. Philips, Bush etc.
£3.50 + £1 p.p.
Quotations for complete S/Hand chassis if required. (Diff prices)

MISC. S/Output Trans. £1 + VAT + £1 P&P
F/Output Trans. £1.25 + VAT + £1. P&P
Scancoils £1.50 + VAT + £1. P&P. Other spares available. please write or phone for details.

VALVES (MONO & COLOUR)

PCL82	0.10	PCF802	0.10	PCC86	0.10	EY86/7	0.10	30PL1	0.10	PL509	0.50
PCL83	0.10	PCF805	0.10	PC97	0.10	EY8/7	0.10	30PL13/4	0.10	PY500	0.50
PCL84	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30P12	0.10	GY501	0.50
PCL85	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	30FL1/2	0.25	PL508	0.50
PCL86	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC82	0.10	PCH200	0.50
PFL200	0.10	PCC189	0.10	EF183	0.10	PL504	0.25	ECC81	0.10	PCF200	0.50
PCF801	0.10	PCC86	0.10	EF184	0.10	PL81	0.10	ECH81	0.10	CEY51	0.15
30C1	0.10	30C15	0.10	6BW7	0.10	6/30L2	0.10	ECL80	0.10		
30C17	0.10	30C18	0.10	ECC85	0.10	U26	0.10	ECL82	0.10		
PL83	0.10	PL84	0.10	EH90	0.10						

Please note there is 25p p.p. per order

D/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	EHT	REG	CON	S/OUTPUT	POWER	L/TB	F/TB
Bush/Murphy	6.50	6.50	6.50	–	–	6.50	1.50	6.50	–	–
GEC/Sobell	6.50	7.50	–	–	–	6.50	–	–	–	7.50
Philips	6.50	9.50	–	–	–	7.50	–	–	–	6.50
Decca	6.50	12.50	12.50	–	–	6.50	2.00 (19" only)	8.00	–	6.00
Thorn 2000	6.50	7.50	7.50	6.50	6.50	7.00	–	8.00	9.50	6.50
Pye	7.50	7.50	9.50	–	–	6.50	–	–	–	4.00
Baird	6.50	8.50	8.50	–	–	6.50	–	–	–	6.00

Postage & Packing £1.25

S/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	VIDEO	CON	POWER	L/TB	F/TB
Bush 184	9.50	–	20.00	–	8.00	6.00	20.00	–
GEC Hybrid	9.50	9.50	15.00	–	6.00	–	–	12.00
Philips G6 S/S	9.50	–	15.00	–	9.00	–	–	10.00
Thorn 3000	10.00	9.00	18.00	10.00	6.00	20.00	20.00	10.00
Pye 691/693	15.00	7.50	18.00	–	15.00	–	28.00	7.50
Thorn 3500	10.00	9.00	18.00	10.00	10.00	20.00	20.50	10.00

Korting and other foreign panels available on request.
Postage & Packing £1.25

COLOUR TUBES

19"	18.00
19" A49.192	£20
20"	20.00
22"	25.00
25"	18.00
26"	32.00

Plus P & P £4

COLOUR TUNERS

Bush	6.50
GEC	6.50
PhilipsG6S/S	6.50
Thorn 3000	6.50 (£8 new)
Pye 691/697	7.50

Some new tuners in stock can suppy on request. Many Foreign Tuners also available on request. Plus P & P £1

COLOUR LOPTS
Most lopts available from £7.00. Both British & Foreign makes. Please ring or write.
P & P per lopt £1

MISC.
S/Output transformer from £1.50
F/Output from £1.25
Scancoils from £5.00
P & P £1
Other spares available on request.

CABINETS
Many British & Foreign cabinets available. Please state.
Speakers, masks, etc., available on request. Please phone or write.

T.V.'s (MONO)

Rotaries

GEC	5.00
Thorn 950	5.00
K.B. Trans–tuners	5.00
Pye	5.00
etc.	

P/Button

Thorn 1400	9.00
Bush 161	9.00
Baird	9.00
Philips 210	9.00
Pye	9.00
etc.	

P/Button

	20"	24"
Bush		11.00
GEC		11.00
Philips		11.00
Pye		11.00
etc.		

S/Standard

	20"	24"
Bush		15.00
GEC		15.00
Philips		15.00
Pye		15.00
Thorn		15.00
etc.		

COLOUR T.V.'s

D/S Colour
19", 25" from £30
i.e. GEC. Bush Philips, Baird etc.,

S/S Colour
19", 20", 22", 24" from £50
Working from £65
includes many makes as well as foreign models.

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WHY NOT TRY OUR EXPRESS MAIL ORDER ON ANY OF THE ITEMS LISTED.
PLEASE ADD 12½% V.A.T. TO ALL ITEMS AND OVERSEAS AT COST. CASH WITH ALL ORDERS.

BRIARWOOD TELEVISION LTD.

Legram Mills, Summerville Road, Bradford, West Yorkshire BD7 1NS Tel (0274) 306018

BRIARWOOD TELEVISION LTD.

Legrams Mills, Summerville Road, Bradford, West Yorkshire BD7 1NS. Tel: (0274) 306018.

All transistors, IC's, offered are new and branded. Manufactured by Mullard, I.T.T., Texas, Motorola etc.

Please add 12½% VAT to all items and overseas at cost.

P & P U.K. 25p per order, overseas allow for package and postage. Cash with all orders. All prices subject to alteration without notice.

TYPE	PRICE £
AC107	0.23
AC113	0.17
AC115	0.17
AC117	0.24
AC125	0.20
AC126	0.18
AC127	0.19
AC128	0.15
AC131	0.13
AC141	0.23
AC142	0.16
AC141K	0.29
AC142K	0.29
AC151	0.17
AC165	0.16
AC166	0.16
AC168	0.17
AC176	0.15
AC176K	0.28
AC178	0.25
AC186	0.26
AC187	0.21
AC188	0.19
AC187K	0.34
AC188K	0.34
AD130	0.50
AD140	0.65
AD142	0.73
AD143	0.70
AD145	0.70
AD149	0.64
AD161	0.41
AD162	0.48
AD161 / AD162	1.30
AF106	0.42
AF114	0.20
AF115	0.22
AF116	0.22
AF117	0.22
AF118	0.58
AF121	0.43
AF124	0.33
AF125	0.29
AF126	0.29
AF127	0.29
AF139	0.39
AF151	0.24
AF170	0.29
AF172	0.20
AF178	0.49
AF180	0.49
AF181	0.60
AF186	0.29
AF239	0.43
AU113	1.29
BA130	0.06
BA145	0.14
BA148	0.12
BA155	0.08
BAX13	0.03
BAX16	0.08
BC107	0.07
BC108	0.09
BC109	0.09
BC113	0.08
BC114	0.14
BC115	0.12
BC116	0.09
BC117	0.13
BC119	0.24
BC125	0.12
BC126	0.09
BC136	0.14
BC137	0.14
BC138	0.24
BC139	0.21
BC140	0.31
BC141	0.22
BC142	0.19
BC143	0.19
BC147	0.07
BC148	0.06
BC149	0.08
BC153	0.12
BC154	0.08
BC157	0.07
BC158	0.09
BC159	0.10
BC160	0.28
BC161	0.28
BC167	0.13
BC168	0.09
BC169C	1.00

TYPE	PRICE £
BC171	0.07
BC172	0.11
BC173	0.15
BC177	0.14
BC178	0.11
BC179	0.11
BC182L	0.08
BC183L	0.07
BC184L	0.11
BC186	0.12
BC187	0.08
BC209	0.14
BC212	0.13
BC213L	0.09
BC214L	0.14
BC237	0.07
BC240	0.31
BC281	0.24
BC262	0.20
BC263B	0.20
BC267	0.19
BC301	0.26
BC302	0.30
BC307	0.10
BC337	0.09
BC338	0.09
BC307A	0.12
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	0.29
BD116	0.47
BD124	1.00
BD131	0.32
BD132	0.34
BD133	0.37
BD135	0.23
BD136	0.24
BD137	0.24
BD138	0.23
BD139	0.40
BD140	0.28
BD144	1.39
BD145	0.64
BD222/T1P31A	0.39
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	0.19
BF158	0.19
BF159	0.24
BF160	0.27
BF163	0.27
BF164	0.14
BF167	0.23
BF173	0.21
BF177	0.28
BF178	0.24
BF179	0.28
BF180	0.30
BF181	0.34
BF182	0.29
BF183	0.29
BF184	0.23
BF185	0.29
BF186	0.30
BF194	0.09
BF195	0.09
BF196	0.09
BF197	0.10
BF198	0.15
BF199	0.14
BF200	0.28
BF216	0.12
BF217	0.12
BF218	0.54
BF219	0.12
BF220	0.12
BF222	0.80
BF221	0.21
BF224	0.19
BF256	0.37
BF258	0.24
BF259	0.25

TYPE	PRICE £
BF260	0.24
BF262	0.39
BF263	0.25
BF271	0.20
BF273	0.12
BF336	0.35
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	0.18
BFY51	0.17
BFY52	0.18
BFY53	0.27
BFY55	0.27
BHA0002	1.90
BR100	0.16
BSX20	0.23
BSX76	0.23
BSY84	0.36
BT106	1.18
BT108	1.23
BT109	1.09
BT116	1.23
BT120	2.08
BU105/02	1.87
BU105/04	2.25
BU126	1.40
BU205	1.97
BU208	2.49
BY126	0.09
BY127	0.10
OC22	1.10
OC23	1.30
OC24	1.30
OC25	0.45
OC26	0.40
OC28	0.60
OC35	0.45
OC36	0.58
OC38	0.43
OC42	0.45
OC44	0.18
OC45	0.18
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	0.85
R20108B	1.79
R2008B	1.79
R2010B	1.59
R2305	0.38
R2305/BD222	0.37
SCR957	0.81
TIP31A	0.38
TIP32A	0.36
TIP3055	0.53
T1590	0.19
T1591	0.19
TV106	1.09
DIODES	
1N4001	0.04
1N4002	0.04
1N4003	0.06
1N4004	0.07
1N4005	0.07
1N4006	0.08
1N4007	0.08
1N4148	0.28
1N4751A	0.11
1N5401	0.10

TYPE	PRICE £
1N5404	0.12
1N5406	0.13
1N5408	0.16
VALVES	
DY87	0.40
DY802	0.48
ECC82	0.42
EF80	0.40
EF183	0.50
EF184	0.50
EH90	0.60
PC86	0.70
PC88	0.70
PCC89	0.55
PCC189	0.60
PCF80	0.50
PCF86	0.58
PCF801	0.60
PCF802	0.70
PCL82	0.60
PCL84	0.55
PCL86	0.60
PCL805	0.60
PLF200	0.70
PL36	0.85
PL84	0.52
PL504	0.90
PL509	1.75
PY88	0.52
PY500A	1.00
PY801	0.50
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1500 18" 19" stick	2.37
1500 24" 5 stick	2.48
Single stick Thorn TV 11.16K 70V	0.75
TV 20 2 MT	0.75
TV20 16K 18V	0.75
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SN76013N	1.48
SN76013ND	1.20
SN76023N	1.50
SN76023ND	1.20
SN76226DN	1.50
SN76227N	1.20
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TBA520Q	1.50
TBA530Q	1.40
TBA540Q	1.45
TBA560CQ	1.90
TBA570Q	1.40
TBA800	1.00
TBA810	1.50
TBA920Q	1.80
TBA990Q	1.60
TCA270SQ	1.45
TCA270SA	1.45
TCA1327B	1.00
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Philips G8 520/40/50	5.66
Philips G9	5.79
GEC C2110	5.97
GEC Hybrid CTV	5.57
Thorn 3000/3500	5.50
Thorn 800	2.42
Thorn 8500	5.23
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GEC TVM 25	2.50
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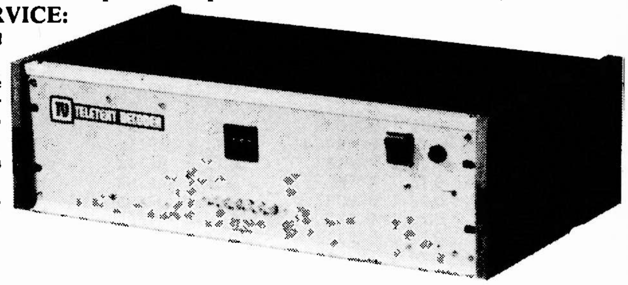

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AC126	23p	AF125	23p	BC147	12p	BC251A	16p	BF152	30p	BF337	34p
AC127	30p	AF125	23p	BC148	11p	BC301	32p	BF154	30p	BF338	34p
AC12701	50p	AF127	23p	BC149	13p	BC303	59p	BF157	30p	BF458	59p
AC128	23p	AF139	34p	BC153	19p	BC307	11p	BF158	24p	BFX29	29p
AC12801	50p	AF178	53p	BC154	19p	BC308	9p	BF163	24p	BFX84	24p
AC141	24p	AF179	55p	BC157	14p	BC327	12p	BF167	24p	BFX85	25p
AC141K	40p	AF180	53p	BC158	12p	BC328	12p	BF173	24p	BFX88	23p
AC142	24p	AF181	49p	BC159	14p	BC337	15p	BF177	29p	BFX89	30p
AC142K	25p	AF186	39p	BC171	14p	BC547	12p	BF178	32p	BFY50	22p
AC153	23p	AF239	39p	BC172	13p	BD115	64p	BF179	32p	BFY51	22p
AC176	24p	AL102	1 05	BC178	21p	BD116	60p	BF180	34p	BFY52	22p
AC17601	50p	AU107	1 05	BC179	19p	BD124	79p	BF181	32p	BU105/01	1.90
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AC187	23p	AU110	1.85	BC182L	10p	BD131	44p	BF182	43p	BU105/04	2.50
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AC194K	31p	BC113	12p	BC186	24p	BD136	45p	BF195	14p	BU206	1.90
AD140	45p	BC114	19p	BC187	26p	BD137	47p	BF196	14p	BU208	3 00
AD142	50p	BC115	19p	BC203	15p	BD138	49p	BF197	14p	MJE340	65p
AD143	50p	BC116	19p	BC204	15p	BD139	80p	BF198	19p	MJE520	80p
AD145	50p	BC117	19p	BC205	15p	BD144	2 10	BF199	24p	AF126	1.10
AD149	1.00	BC118	28p	BC206	15p	BD155	74p	BF200	34p	MJE3055	73p
AD161	45p	BC119	28p	BC207	15p	BD157	74p	BF240	19p	MPSU05	65p
AD162	45p	BC125	21p	BC208	11p	BD183	55p	BF241	21p	MPSU55	1 25
AF114	50p	BC126	19p	BC209	15p	BD235	74p	BF256LC	44p	R2008B	3.00
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The Hitachi Problem

There is much to be said on both sides when it comes to Hitachi's proposal, now shelved, to start a TV plant in the UK. The most obvious point to make is that the UK has more than enough TV setmaking capacity already, and that due in part to the depressed economic conditions, and also to market saturation in most countries with colour television, that plant is being under used – TV setmakers in the UK have been operating at around 60% capacity for many months – and is likely to remain so. This is not an economic level of production, and were it not for the fact that TV setmaking in the UK is carried out by firms with enough other interests to be able to support TV manufacture through a lean period there is no doubt that substantial close downs would already have taken place. To this one has to add the fact that UK TV setmakers have had to undertake considerable investment in recent times in order to start up production lines for sets using the newer types of colour tube and other technical developments, and to be able to compete on the reliability side with the competition from you know where. Thus the UK industry can well say that the UK needs Hitachi's colour plant as badly as a hole in the head.

But a lot of cogent arguments can and have been put forward in favour of the Hitachi plant. To start with, if Hitachi is determined to set up production in the EEC it's to our advantage that the jobs should be in the UK. If Hitachi goes elsewhere – there has been a strong suggestion that it may set up in Eire – the sets will still be on the market in competition with UK produced ones but the employment we'd have otherwise gained will be lost, along with the technical and financial backing the plant would have brought with it. Hitachi was prepared to guarantee that most of the sets would have been exported, while those sold locally would mainly replace sets imported by Hitachi from Japan. Another point is that UK component manufacturers would benefit. There's a strong case for the Hitachi plant then, especially when you add the point about creating new jobs in an area of high unemployment.

You could also argue that the competition would be good for the UK industry, and that why shouldn't the UK consumer be offered the undoubtedly excellent sets Hitachi would produce here? You might add that it's up to UK setmakers to sharpen their competitiveness.

But there's a difference between competition and what looks suspiciously like trade war. As we pointed out not long since, you just try selling in the Japanese market. So far as the UK's TV market is concerned, it would be impossible to find a more openly competitive one. There are seven major indigenous setmakers, and in addition Sony, National Panasonic and Tandberg have substantial capacity in the UK. The market is wide open to anyone who cares to export to us, and most major continental and Japanese setmakers do just that.

The conclusion one comes to is that this extraordinarily difficult problem has to be thought of in terms of time scale. UK setmakers are concerned, rightly, with their present lack of profitability and the adverse market conditions, both at home and abroad. There is no likelihood of a significant expansion of sales in the foreseeable future – the domestic market has already become a mainly replacement and young couples first-time-purchase one. The UK industry, in pointing this out, is simply saying that more plant means less output from the plants already in operation. And if you think in terms of two-three years or even the next five years their conclusion seems irrefutable. So what, you may ask, is Hitachi after? One has to conclude that their planning time scale is rather longer. If you think in terms of a large, aggressive concern with world-wide operations then perhaps you can plan for say ten years hence. In such terms it makes sense for Hitachi to establish plant in the EEC, preferably in a comparatively low-cost country – if not the UK, perhaps Eire or Spain when it joins the EEC or maybe Greece. Certainly it would be unwise for a concern such as Hitachi to rely in the long term on too much of its production being based on Japanese plant – the appreciation of the yen is making this increasingly uncompetitive even now, and there are already rumblings amongst Japanese industrialists.

What to do about this problem is difficult to say. Our own embattled TV industry is not in a position to be able to plan that far ahead – remember how Thorn's tube plant folded in a matter of months – nor to consider establishing world-wide operations. The industry is right therefore to argue that the government must not just sit back and watch while the UK's domestic electronics industry is overwhelmed – as has largely happened in the US. The fact is that Japan's large-scale industry does not operate in an independent manner, free of any governmental intervention. On the contrary, the Japanese government works very closely with Japanese industry (with the larger concerns anyway), and their joint planning relates not only to the domestic but to export markets as well (there's a Ministry of International Trade and Industry, whose minister has cabinet rank). When faced with competition of this sort, you can't just rely on the liberal economic principles of the nineteenth century and hope for the best. Six reports on the UK electronics industry are due to be presented to the National Economic Development Council this month: these, the council and the government should be looking rather farther ahead than they seem likely to do however.

Teletopics

MULLARD LOOKS AHEAD

Mullard is anticipating a substantial increase in the demand for consumer integrated circuits over the next few years, and is investing in development work to meet this market with a range of new i.c.s which will not only cater for current requirements but also be compatible with likely future developments. The present £12 million a year market is expected to increase to over £30 million by 1982 – the main increase being in new i.c.s for TV receivers.

The basic reason for this increase is the growing complexity of TV receivers – Mullard think that full remote control will become standard on most receivers while facilities for teletext and Viewdata reception will be included on all but the cheapest models. Integrated circuits to provide digital tuning is another development – since this approach provides much more accurate and stable tuning.

One of the developments revealed by Mullard is a third generation PAL decoder (they call it a second generation decoder but someone's either forgotten the current TBA560C/TBA540/TCA800 range or the still only just coming into use TDA2560/TDA2522 combination). The new decoder consists of just two i.c.s, with development type numbers for the present. These are the V840 which accepts the chrominance signal and carries out the complete decoding/demodulating process, providing R–Y and B–Y colour-difference output signals, and the V844 which matrixes these with the luminance signal and also provides for saturation, brightness and contrast control and the insertion and blanking of data signals. As an alternative to the V844 there's the TDA2800 which has a slightly more limited range of data handling possibilities.

Digital channel selection involves another group of i.c.s. Basically, what you have to do is to divide the local oscillator frequency, compare this with the frequency required for the station selected, then produce a tuning voltage which pulls the tuner – varicap of course – into tune. Digital circuitry is the ideal way of doing this. In addition to the improvements this gives there could be a great reduction in the number of service calls – it has been suggested by some sources that about half the service calls made at present are due to tuning problems.

Also under development are large-scale integrated circuits for teletext, Viewdata, TV games (with microprocessor control) and sophisticated control systems.

Mullard director Bill Everden comments that the future over the next four to five years and beyond should be interesting and attractive, with the emphasis in 1978 on i.c.s for teletext and by late 1979 quantity production of Viewdata chips. Full scale production of new i.c.s designed for these purposes should result in a substantial fall in the cost of sets equipped for data reception – by the mid-1980s Mullard predict that a set able to receive teletext and Viewdata should cost only some £25 more than a standard receiver.

IBA STUDY SPACE TV

Engineers at the IBA's Crawley Court (Winchester) engineering centre have begun a study of 12GHz signal propagation. A 12GHz satellite receiving terminal was designed and built last summer for about £75,000, and is being used in conjunction with a 3-metre dish aerial for a study programme planned jointly with the Post Office and European broadcasting authorities. The aim is to establish a Eurovision satellite distribution network some time in the 1980s and, in the longer term, to open the way for direct satellite broadcasting to homes. The start of the programme was delayed by the failure of the European Space Agency's Orbital Test Satellite (OTS) last September. The Italian Sirio satellite, launched last August, carries transmitters in the s.h.f. range operating at almost the same frequency as the intended OTS transmissions and by reorientating the Crawley dish the IBA engineers, with the co-operation of the Italians, are able to use these signals.

HI-FI TV SOUND

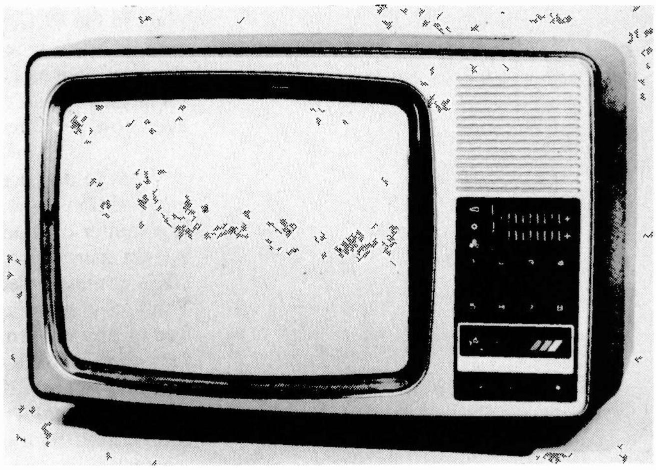
National Panasonic have introduced an unusual TV set to give television viewers hi-fi sound. The set separates the audio part of the TV signal so that it can be fed to a high fidelity installation, and includes a 5in. monochrome monitor screen. The set can be used separately therefore – linked to suitable audio equipment – or with a large-screen set with the volume turned down. Another use is for recording TV sound. The suggested retail price is £110·95.

POCKET TRANSMITTER GUIDE

The IBA has published a new edition of its invaluable pocket guide to UK TV and ILR transmitters. It gets thicker with the ever expanding network, and there are now twelve pages. Copies are available free of charge from the IBA Engineering Information Service, Crawley Court, Winchester, Hants SO21 2QA.

COLOUR PORTABLE FROM BUSH

Rank have added to their Bush range a portable (mains only) colour receiver – the first small-screen colour set to be



The Bush Model BC6004, a 14in. mains-only colour portable made for Rank in W. Germany. It's the first small-screen colour receiver to appear under a well known UK brand name.

marketed under a well known UK brand name. The set itself (Model BC6004) is manufactured in W. Germany and is fitted with a 14in. 90° in-line gun c.r.t. The chassis is of modular construction, and the dual-band tuner covers channels 2-12 and 21-68. There's 3W of audio and, concealed behind a removable cover, a five-pin DIN socket for tape or headphones – the socket has two positions, one muting the set's loudspeaker.

RELAY STATION OPENINGS

Haslemere (Surrey) BBC-1 channel 22, ITV (Southern Television) channel 25, BBC-2 channel 28. Receiving aerial group A.
Hughenden Valley (Buckinghamshire) BBC-1 channel 40, ITV (Thames Television/London Weekend Television) channel 43, BBC-2 channel 46. Receiving aerial group B.
Wincoband (Sheffield) BBC-1 channel 55, ITV (Yorkshire Television) channel 59, BBC-2 channel 62. Receiving aerial group C/D.

All these transmissions are vertically polarised.

NEW FROM MULLARD

In addition to the i.c.s mentioned above, there are several new components from Mullard for TV set use. First is a surface acoustic wave filter, type SW102, to provide the bandpass filtering required at the input end of the i.f. strip. It replaces several coils with a simple, compact four-pin package that needs no adjustment. A surface acoustic wave filter consists of two transducers on a piezoelectric substrate: the input transducer converts the signal to an ultrasonic one which then travels across the substrate to the output transducer which converts it back to an electronic one. The design of the transducers, which consist of pairs of enmeshed comb-shaped electrodes, determines the bandwidth of the device.

Secondly there's an interesting new e.h.t. tripler, type BG100, for use with colour receivers. This employs an entirely new method of construction in order to give improved reliability. A conventional tripler circuit is employed, but there are no soldered joints between the components and in order to minimise the risk of breakdown to nearby components the highest potentials are at the centre of the tripler. The basic construction is shown in Fig. 1: the capacitors are in the form of two rolls, with the diodes inserted in between.

On the audio side, there's a 4in. woofer intended to give hi-fi TV sound when used with a tweeter and a 4·7μF filter capacitor in a suitable reflex enclosure. The woofer is type AD4050/W4 and has a power rating of 6W; suitable tweeters are the AD2290/T8 or AD2090/T8 which are rated at 2W. Both the woofer and the tweeters have Ticonal magnets, which keeps the stray fields well below the level at which problems could occur in colour sets. The combined frequency response is 30-19,000Hz ± 22dB, and trials show that the system can handle 15W without problems.

VIDEO DISCS

It's beginning to look as though a video disc war as hot as the videocassette one that's been raging in the USA in recent months may be about to break out. The French Thomson-CSF video disc system has now been demonstrated in the UK: it's similar to the Philips system in using a laser beam to scan the disc, and was first mentioned in these pages by Philip Ross in his Montreaux Report in the September 1975 issue. The playing time and other features are also similar to the Philips system. Now Matsushita

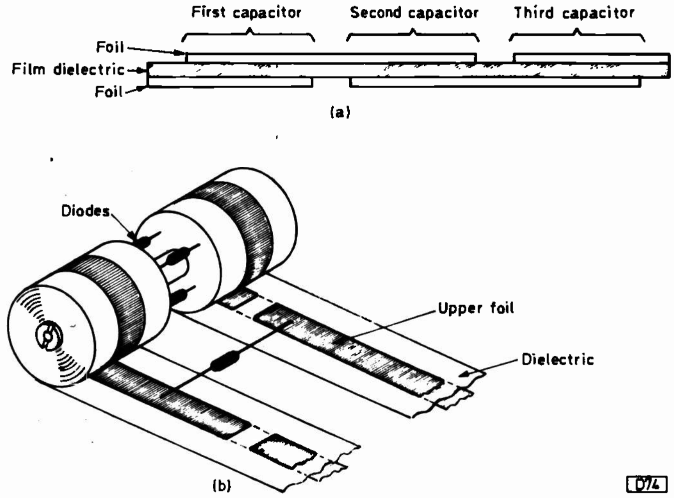


Fig.1: The constructional methods used in the new Mullard BG100 e.h.t. tripler for colour receiver use. (a) Formation of the capacitors and their interconnections, using a roll of film and strips of foil. Lengthwise section (not to scale) through the unrolled winding. (b) Capacitor windings partially unrolled to show one of the diodes. In addition, there's an insulating film not shown here.

Electrics (National Panasonic) have announced the development in Japan of a domestic video disc system with one-two hours playing time in colour (all systems announced so far operate in colour) and with stereo sound. A price in Japan of around £300 is being aimed at. That brings the number of video disc systems under development to at least six.

NEW IBA DIRECTOR OF ENGINEERING

The IBA has taken little time to appoint Thomas Robson, OBE, C. Eng., MIEE to succeed Howard Steele as Director of Engineering. Mr. Robson was Deputy Director of Engineering and joined the ITA in 1957 after working on TV transmitter development at EMI for ten years. Before that he worked on transmitters at the BBC.

SIEMENS TV COMPONENTS

A new set of PAL decoder chips has been introduced by Siemens, the TDA2560/TDA2522/TDA2530. The first two of these second-source the latest Philips/Mullard decoder i.c.s, with the TDA2560 as luminance and chrominance signal amplifier and the TDA2522 as the reference oscillator/chrominance demodulator. Interesting features of this set up are the fact that the burst signal passes through the chrominance delay line and the fact that the reference oscillator operates at 8·86MHz, a digital divider providing exactly 90° phase displaced 4·43MHz outputs without the need for a phase shift coil. The first UK produced chassis to use these i.c.s is the Tandberg CTV3, the larger UK setmakers staying for the time being with the TBA560C/TBA540/TCA800 combination. The third i.c. from Siemens is the TDA2530 which supersedes the well known TBA530 luminance/colour-difference signal matrixing i.c. The TDA2530 contains a negative feedback driver amplifier and internal clamping in addition to the matrixing network.

The Siemens Congleton, Cheshire factory has produced its millionth e.h.t. tripler since production started there in 1974. Production is now running at the rate of a million triplers a year, about 66% of which are exported. Siemens quote a failure rate of less than 0·1% for every thousand hours' use for their e.h.t. triplers.

'Twas on a Monday Morning . . .

Les Lawry-Johns

I WAS busy wondering what to do when this policeman came in. "It wasn't me" I maintained stoutly, remembering my breaking and entering days.

"I've been told you repair things" he said pleasantly.

"If you'd like to bring it in we'll do our best" we assured him.

"I have it with me" he said, taking off his helmet.

Now we've been asked to service many things in our time, but never before a policeman's helmet.

"What's gone wrong with it?" we asked, expecting it to contain a transistor transceiver or some James Bond gadget.

"The top loop's O.K. but the bottom one has broken away from the badge so that the matchstick won't hold it steady."

Lots of people wonder what a Scotsman wears under his kilt. If they want to know, all they have to do is catch a train from King's Cross (if they live in the south) to Edinburgh Waverly station and stand at a windy corner and they'll soon find out. If you've wondered about policemen's helmets however I'm now in a position to tell you. They contain matchsticks. Not whole ones mind you, but short pieces to go through the small loops to keep the silver top motif in position.

With the badge on the bench it could be clearly seen that the lower fixing had broken away and it was a matter of fixing the peg back on in the right position so that it would enter the hole at the front at the same time as the upper one (which went downwards) entered the top one. But the angle needed to be right.

Surprisingly enough, the badge was chrome on copper as was the peg, so soldering was no problem, only the angle. It took two attempts to achieve a correct fitting, but we did it and on it went and in went the matchsticks to keep it in position.

An Electronics Wizard with a Thorn 8000

That was the first job of the day, the rest will perhaps be of more interest as they concern television sets (what's the name of this magazine?). A Thorn 8000 was the first one to hit our bench: the owner was an electronics wizard and in no time at all he'd whipped out the circuit diagram and spread it on the bench. "Here's the trouble", he stated. "The line oscillator is not functioning. That's why there's no picture. I've checked this, this, this and this, the voltages are wrong here, there, and here. It's probably something simple but I can't put my finger on it."

I gazed at him in open-mouthed admiration. "You mean, you've done all that and it still doesn't work?"

"No", he explained. "It wants a 'scope on it and mine at work is too big to cart home. Can you put one on it?" "Can't afford one", I confessed. "I did have one once but it only made a lot of squiggles that I couldn't understand so I gave it up and I've felt much better since".

He looked at me suspiciously. "I suppose you can't read that Avo either". I said that I could read the Avo when I took my glasses off but the trouble was the needle stuck about a third of the way up the scale so even here there wasn't much to write home about from a servicing point of view.

He smiled at his wife who waited patiently during this exchange. "I can see we're in good hands here dear, let's go and get the shopping done and we'll call back later to see how our friend has got on".

Dropper Troubles

Before they went he mentioned that the lower end of the dropper consisted of two sections of five and six ohms, and that the six ohm section had failed some time ago so that the surge limiter was now only five ohms instead of eleven. Would I do that as well while I was about it?

So off they went, leaving me to ponder upon what my mum had told me years ago. Never decrease the value of a dropper she had said. So I thought I'd have a look at this first. It was one of the vertical ones with several tappings rather than the later horizontal fat one with a few. Idly putting the meter across the sections I found not only that the six ohm section had gone (and was not in use) but that the top section (56Ω in the feed to the line output stage) was also open-circuit.

Oh dear, I thought. The poor chap has been chasing an elusive butterfly in a neck of the woods where there aren't any butterflies. So we put in a new dropper with a 12Ω section and of course the rest. Upon switching on, the e.h.t. rustled up nicely and the resulting picture, apart from some misconvergence, seemed quite nice too. A twiddle here and there was all that was necessary. Not wishing to embarrass the chap in front of his wife we wrote the bill out with the bare essentials, merely stating that we had restored supplies to the line timebase etc.

When they called back they were pleased that the job was done and of course he asked what the basic fault had been. "The line oscillator was not being allowed to develop its full potential, and as you asked, we replaced the dropper".

He smiled, I smiled and his wife smiled too. So off they went leaving me to bash the Avo top on the bench to clear the movement as it had fallen bottom on the floor to cause the sticking in the first place.

A Call from Ernie

The phone pulled me away from a particularly awkward unit audio. It was Ernie, who is the landlord of one of our local pubs. He said he'd lost his colour and would I pop down. I said I would and perhaps he could take a brandy in the meantime as this might help him.

Cartridge Warning

Just for the record (oh no!) we thought you might like to hear about the unit audio which had come in because the cartridge was damaged. We fitted a new cartridge and

plonked Jim Reeves on the turntable. There was the usual loud hiss as the stylus made its way toward "I fall to pieces", but the resulting melody was very very low and distorted. We raised the pick-up arm and moved it back. This gave a good response as did a finger on the leads to the cartridge. The amplifier was clearly in order, so we tried again.

Volume up, lots of response as the arm did its thing, lots of hiss but no Jim. Now that boy has sung loud and clear for many years on that record and if the surface noise was there, why wasn't Jim? So as not to bore you more than is usual, we'll cut a long story short. It amounted to two new cartridges being defective in a row.

The moral of this is always to have a shelf full of cartridges, because more than one may be defective and you might be led to think you are going dotty like you do when you find two new valves or transistors faulty in exactly the same way. Consumer protection? There ought to be a society for the protection of us.

Who's been Barred?

Now to Ernie. To get upstairs to the pallid TV I had to go through the bar. "Here Les", he called. I made my way to the part of the bar where he presided.

"I must tell you about a friend of mine before you go up". His head jerked sideways as he said this. Thinking he wanted me at a more private part to impart some gossip, I moved along in the direction his head had indicated.

"What have you gone up there for?" demanded Ernie. As he said this I saw his head jerk again and realised that it was a nervous twitch rather than an invitation to a private tête-à-tête. I then realised why he had such an amazing success rate with the female species. I moved back to his end.

"This friend of mine has just taken a pub over in Essex", confided Ernie. "You know the first bloke he barred?" I mentally ran through a list of suspects who would be likely to cause a riot in a bar. I confessed I couldn't think, so as not to steal his thunder. "The bloody vicar", said Ernie triumphantly. "Would you believe it, the bloody vicar? . . . When he got a few jars down him he was preaching to everyone so as soon as he came in all the locals cleared off and the bar was practically empty. So he barred him. He's doing very well now. Would you believe it?"

Well as a matter of fact I do believe that vicars, like a lot more of us, live under quite a bit of stress, attending to the troubles of others rather than attending exclusively to themselves, and that a couple of drinks helps to relieve the stress. And one usually leads to another.

Restoring the Colour

However, upstairs the hybrid Pye produced very little in the way of colour, just a few unlocked bands across and these were weak. Knowing the area however, where the signal is pretty weak, we were not inclined to go on a witch hunt. Propping the mirror in front of the set, and tuning in a test card, we were able to achieve reasonable colour by setting up the reference oscillator a.p.c. bias preset RV10 on the front left of the decoder panel. Good colour could not be achieved because of failing green gun emission, but the results looked fairly pleasing and no one complained. Failing emission of one or more guns is a fact of life which has to be lived with as sets get a few years over their heads, and as even regunned tubes are pretty expensive, the customer is often content to jog along with less than perfection.

Returning to the bar, we reported our findings and asked if Ernie was happy with them. Ernie shook his head but said yes.

Smoke Signals

Our next call was to a GEC 2040 colour set – the single-standard hybrid model. Investigating the complaint of "lots of smoke from that side", we removed the screening cover of the line output section. A glance at the line output transformer (not the original) was sufficient: one winding burnt away. "Not another one" cried the distressed owner, "that one hasn't been in a dog watch". As this was a new customer (Ken's had a nervous breakdown, so we've got quite a few new ones) we couldn't help much but it transpired that it was in fact well over a year since the new one had been fitted. So in the van went the GEC.

Next call was to an ageing Philips G6. No picture, smell of burning plastic. Makes your eyes smart. Remove screening from right side X-ray department. No X-rays, PL509 fairly hot, no voltage step up to the e.h.t. rectifier. Overwinding warm and smelly. Give estimate but advise caution as tube is known to be somewhat low. Think about it and ring us later.

Next call was to another ageing Pye dual-standard colour set. Owner would like a new set but is in love with the folding door presentation of this one and would prefer to keep it if possible. Suppressing a scream of "oh no, not another one", we asked if there had been any smoke. "Only a bit", we were informed, "but there was no real picture, only a blur".

We cautiously rotated the focus control at the rear. It didn't want to rotate and made a nasty scraping noise. This meant that it had been overheating, which in turn meant either a faulty focus rectifier (single stick) or a shorted disc capacitor (270pF high pulse – C230) or both as the control is returned to chassis via the line output transformer and usually suffers when there is trouble in the above pair. We didn't have a control with us and as replacement is no joke over went the set, off came the legs and the large and heavy beast was persuaded into the van.

Smoking Bush TV175

Back on the bench there was a Co-op version of the Bush TV175. Smoke. Pitch type line output transformer, less pitch. Unload van and attack the Co-op set. Whip out transformer, unsolder wiring loom, solder to new replacement and fit. We do not fit the replacements complete with loom as although these are easier to fit their life expectancy is uncertain. We obtain our replacements from an advertiser in this magazine, and over the years have found them most reliable.

The Awkward Ones

We will not bore you with the difficult jobs of that day. The ITT CVC8 with intermittent gain due to dry-joints on the bottom i.f. modules. The Pye CT200 with dry-joints in the i.f. gain and filter module. The Philips G8 with intermittent width variation due to a faulty line output transformer. Variation of primary colours on a Thorn 3500 due to the thick-film resistor unit which the nits use in place of the reliable separate wirewound RGB transistor load resistors used in earlier versions.

Needless to say they didn't all get done that day, and when we get our humour back we may tell you all about it.

On-Screen Clock

Part 1

E. A. Parr, B.Sc., C.Eng., MIEE

THE introduction of l.s.i. MOS integrated circuits has allowed semiconductor manufacturers to include many complex functions on one chip. General Instruments have produced several such chips for the TV industry, amongst the more interesting being the AY-5-8300 series of channel and time display chips. These provide video outputs which superimpose a digital clock or the channel number on the television picture. It's interesting to see how fast semiconductor technology has advanced. The author produced a similar scheme for scoring for TV games, published in the September 1975 *Practical Wireless*: this used about 20 m.s.i. TTL chips, and produced an inferior display to the G.I. chips.

Circuit Description

The display chip chosen for this article is the AY-5-8320. This provides a four-digit clock display with decimal point and a channel number display from 1-16. Both displays appear on a background rectangle for easy viewing. The time and channel displays can be enabled independently.

To the display chip we must add a digital clock. This is again an l.s.i. MOS chip, the G.I. AY-5-1203A. Like most digital clocks it uses the 50Hz mains as a clock input, with digital counters to produce the time display output.

Pin connections for the two l.s.i. chips, and a typical TV display, are shown on Fig. 1.

The circuit diagram of the digital clock and the character generator is shown on Fig. 2: IC1 is the 1203 digital clock chip and IC2 the display chip.

The digital clock produces a four-digit output. To transmit this in binary form would require sixteen lines. The clock chip economises on pin connections by sending each digit (four binary bits) in turn. This is called multiplexing. These four binary bits are available at pins 16 to 19 of the 1203. To identify the digits as they are sent, the 1203 provides four multiplex slot signals MX1-4 which appear at pins 3-6. When MX1 is at a binary 1 the minutes units binary bits are on pins 16 to 19, when MX2 is at a 1 the minutes tens binary bits are present and so on.

A strobe output is provided at pin 20. This occurs in the centre of each multiplex slot, and is used by the display chip to gate the data from the clock. The display chip thus obtains and stores all four digits of the time display. The multiplexing frequency is determined by a capacitor (C2) from pin 23 to the positive supply. It is nominally set to 50kHz, although this is not critical.

The 8320 display chip IC2 requires (in addition to the time data) line and field sync pulses to position the display, and a 1·1MHz oscillator input. The 1·1MHz oscillator has to be inhibited by the line sync pulse and synchronised on each TV line to prevent ragged edges appearing on the characters. The oscillator consists of the quad CMOS nand IC3, with the frequency of oscillation determined by R3, RV1, C1.

The sync pulses are produced by the sync extraction circuit shown in Fig. 3 (to be described later). These pulses may be positive-going or negative-going depending on the TV set being used. The circuit requires positive-going line sync pulses at pins 8 and 9 of IC3, and negative-going field sync pulses at pin 7 of IC2. The inverters (IC4 a-d) and the wire links allow the correct polarity signal to be chosen.

There is little data available as to what actually goes on inside the 8320 display chip, although it is probably along the lines of the score display article in the September 1975 *Practical Wireless*. The necessary delays will be generated by digital counters from the 1·1MHz clock.

The display chip IC2 produces two outputs, a time output on pin 3 and a background output on pin 2. These are at a binary 1 in the asserted state. These outputs are buffered by IC5 and inverters IC4 e and f to produce the following signals for the video switching:

(a) Gate Video. This is at a binary 1 when the normal TV picture is present on its own and at a 0 when the background and time display are added.

(b) Gate Time. This is the video output for the time/channel digits and is at a 1 in the asserted state.

(c) Background a (IC5 pin 11). This is the background output, inhibited during the time display. It's at a 1 during the background but at a 0 during the time/channel display.

(d) Background b (IC4 pin 6). This is a 1 for the entire background and time display.

Depending on the colours required for the number and background, the "gate hue" and "gate background" outputs can be taken from background a or b by selecting the corresponding wire links.

The time display is produced by taking pin 22 of IC2 to a binary 1. Capacitor C5 keeps the display on for about six seconds after the 1 input is removed. Pin 22 can be triggered by a momentary contact on a push-button or, ultimate luxury, from an ultrasonic remote transmitter.

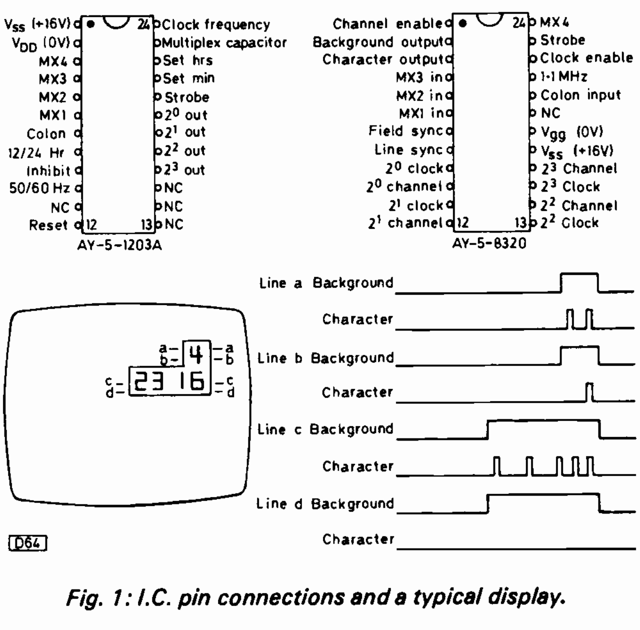


Fig. 1: I.C. pin connections and a typical display.

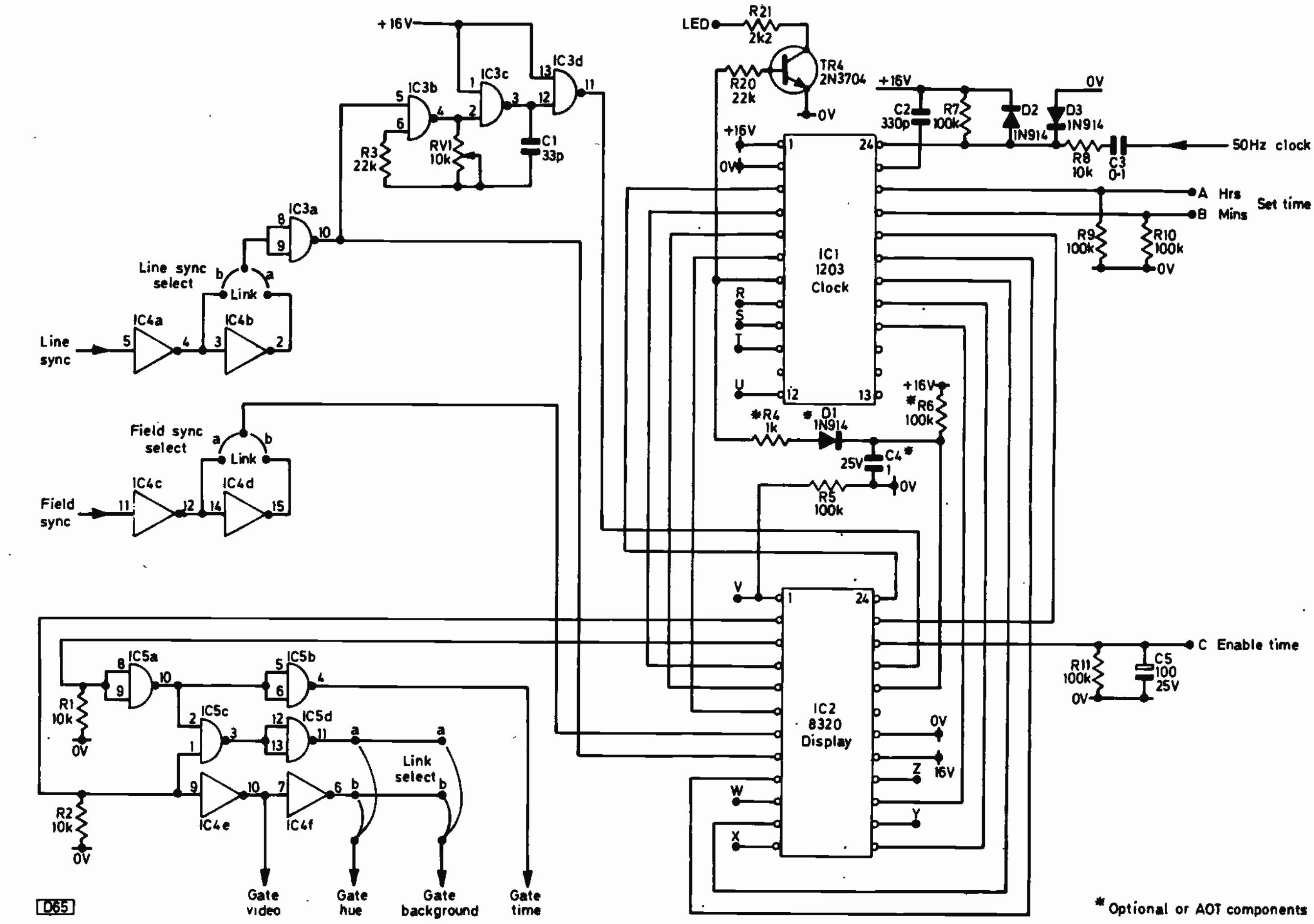


Fig. 2: Digital clock and character generation circuits.

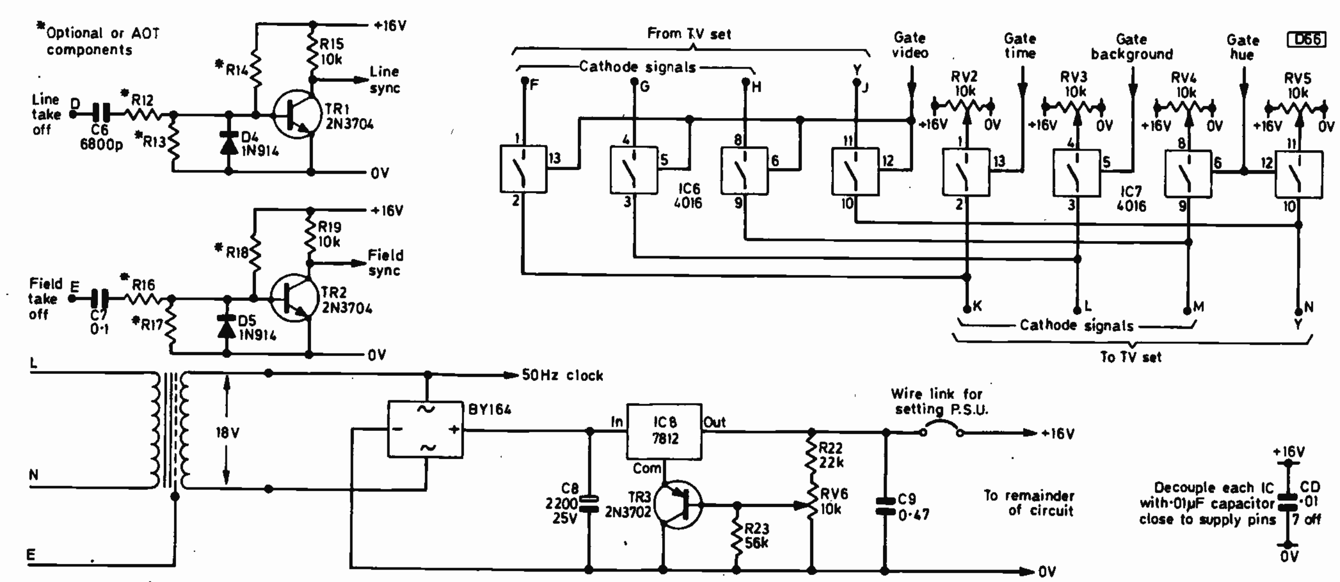


Fig. 3: Sync extraction, video switching and power supply circuits.

The time is set by connections A and B. Taking A to a 1 advances the minutes display at two per second; taking B to a 1 similarly advances the hours.

The 50Hz clock arrives via C3 and is clipped and buffered by R7, R8, D2, D3.

The clock chip IC1 produces at pin 7 a 50kHz burst for 0·5 seconds every second. This is smoothed by R4, D1, C4 and presented to the colon input (pin 20) on the display chip to give a flashing colon display. Some people find flashing colons annoying: if R4, D1 and C4 are omitted and R6 is inserted the colon becomes steady. The colon output from the clock also drives Tr4 to give a front panel LED display. The colon stops flashing after a power failure, and starts again when either of the set time buttons is pressed. The front panel LED thus indicates that the clock is healthy.

The channel data is presented in binary form at terminals W, X, Y, Z, W being the least significant bit. The display is offset by one bit, i.e. 0000 gives 1, 0100 gives 5 and so on. The channel display is enabled by taking terminal V to a binary 1.

Interfacing with the Television Receiver

Fig. 3 shows the sync extraction circuits and a general purpose video mixing circuit. Before describing these it's probably best to outline the basic requirements of the television interface.

The display system needs field and line sync signals from the television receiver. It's highly unlikely that these would be available at the correct levels, and depending on the set and the take-off point chosen they can be of either polarity.

If oscillograms are shown in the service manual, suitable signals should be easily found – in most if not all television sets. They will probably be found in either the sync separator, the flyback blanking circuits or around the scan output stages. If oscillograms are not available it will be necessary to do a bit of detective work around likely points in the circuit. It's preferable to use scan flyback pulses because of their amplitude and the low source impedance (this avoids loading the sync circuits).

The sync extraction circuits shown in Fig. 3 will accept either positive- or negative-going signals. For negative-going inputs, Tr1 and Tr2 are forward biased by R14/R18: with positive-going inputs R13/R17 are used instead. The input resistors R12 and R16 form a potential divider with the selected resistor, and the transistors are turned on for positive inputs or off for negative inputs. The wire links shown in Fig. 2 allow the correct polarity signals to be chosen for the display circuit.

The values for R12-14 and R16-18 depend on the amplitude of the incoming waveforms. Transistors Tr1/Tr2 need about 0·1mA base current, so the values will be of the order of 100kΩ. This should not load the TV circuit to which it's connected. With some waveforms which are close to or cross 0V, capacitors C6 and C7 can be replaced with wire links. If C6 and C7 are used they should be of suitable voltage rating for the circuit to which they are connected.

The connection to the video stages presents many options. The majority of colour TV sets today are cathode driven with RGB signals. The description of techniques for interfacing the time display with the set's video circuitry will be mainly directed at cathode drive therefore.

A typical simple RGB output stage is shown in Fig. 4. The RGB signal from the demodulator i.c. is fed first to a preamplifier or buffer (generally a one transistor stage) then to the high-voltage transistor which drives the appropriate c.r.t. cathode.

A "brute force and ignorance" method of inserting the time and background display is to parallel three high-voltage transistors Tr1 etc. with the RGB outputs along the lines shown in Fig. 5. The signals driving these could be picked up from the "gate time", "gate background a and b" outputs (Fig. 2). The trimpots RV1 etc. set the current through the output transistors and hence the cathode potentials when the logic signals are at a binary 1. By selection of the right logic signals and suitable settings of the trimpots almost any colour combination for the time

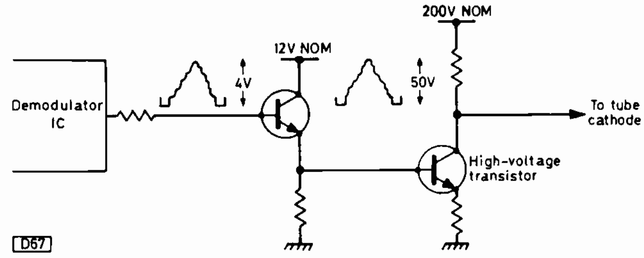


Fig. 4: Basic RGB circuit for cathode drive.

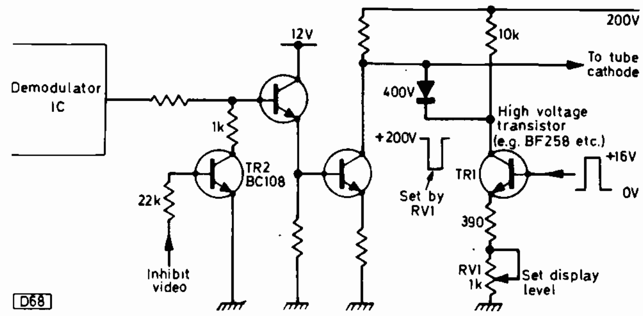


Fig. 5: Brute force method of display driving.

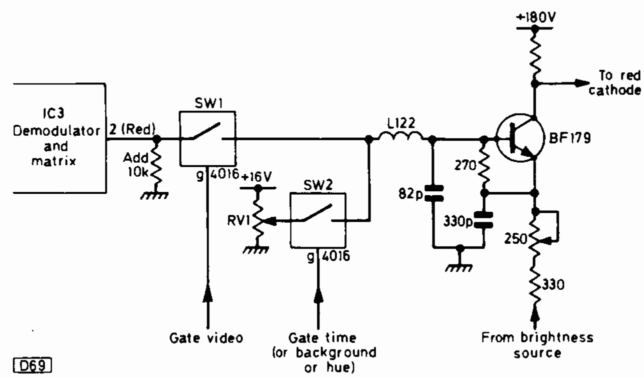


Fig. 6: Connecting a 4016 i.c. to a d.c. coupled RGB output stage (Thorn 8000 chassis). Note that the chassis is at 0V: on some more recent sets the chassis is at "half mains" voltage.

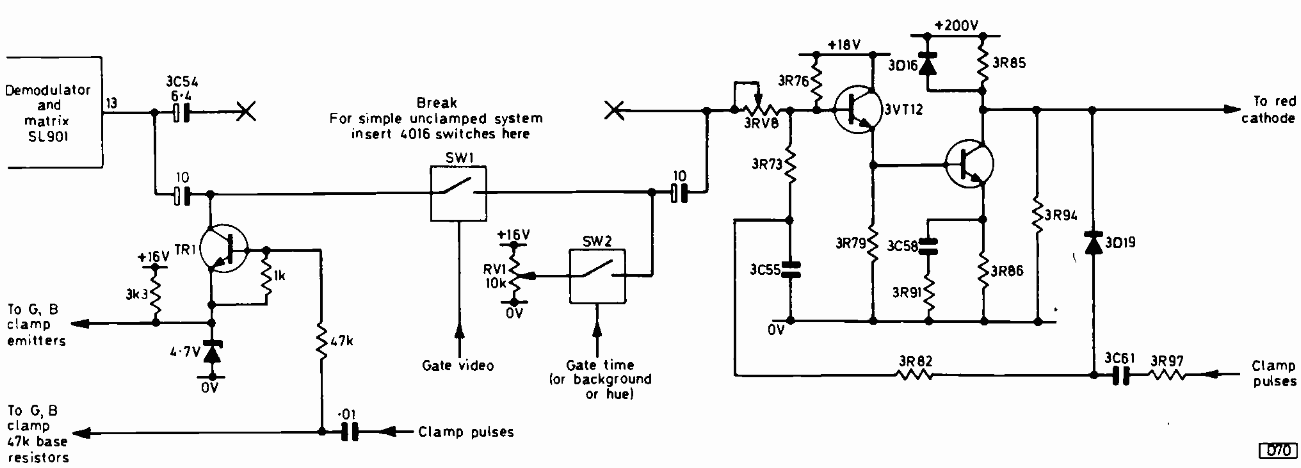


Fig. 7: Connecting a 4016 i.c. to an a.c. coupled RGB channel (Rank A823 chassis).

and its background could be chosen.

To prevent the display appearing superimposed on the video from unused cathodes, it will again be necessary to resort to brute force. Transistors Tr2 etc. pull down the bases of the buffer preamplifier transistor, turning the television RGB signals off. These transistors are driven from the "background b" signal which is present for the entire display on each line.

A more subtle method is to use the 4016 CMOS analogue switch to intercept the video from the demodulator i.c. and substitute in its place the time display. The 4016 i.c. looks like a perfect switch in series with a 300Ω resistor. The switch is controlled by the logic gate input, the switch being closed for a binary 1 and open for a binary 0. The operating time is around 200nS, which is adequate for our application.

Cathode drive RGB output stages fall into two categories: direct coupled from the demodulator to the cathode with clamping earlier in the circuit, or a.c. coupled with clamping at the c.r.t. cathodes.

Direct coupled amplifiers are the easiest ones to modify, so these will be dealt with first. Typical sets with direct coupled output stages are the Thorn 8000 chassis and the Philips G8 chassis. All that's usually required here is to insert the 4016 switch in the base circuit of the output transistor. Fig. 6 shows a suitably modified red drive circuit for the Thorn 8000 chassis. Switch SW1 controls the video and SW2 the voltage set by RV1. Switch SW1 is closed by the "gate video" signal from Fig. 2, and SW2 from the selected logic output (gate time, background or hue). The other two amplifiers are dealt with in a similar manner.

One small modification is required to the output from the demodulator i.c. This doesn't like having no load, tending to wander off and do its own thing when the video switches are open. To prevent this, a 10kΩ resistor should be added from pins 1, 2 and 4 to 0V as shown.

Next we must deal with a.c. coupled circuits. A typical example is the Rank A823 chassis described in the November 1977 issue of *Television*. The RGB output circuit (red one) used in this chassis is shown in Fig. 7. The simplest way to deal with this is to insert the 4016 switch at the point shown. Because the video is unclamped at this point, the time display levels will vary according to the picture content. For the best results it's necessary to clamp the video before substituting the time display.

This is done by the transistor clamp shown in Fig. 7. The video is a.c. coupled and clamped by Tr1. The clamp voltage of 4·7V is chosen to bias the 4016 switches in the centre of their range. The clamped video is then switched, along with the d.c. levels from the trimpot RV1, to insert the time display. The modified video is then a.c. coupled back to 3RV8 on the TV chassis. The 300Ω resistance of the 4016 is effectively connected in series with 3RV8 etc. These may require slight adjustment therefore. Alternatively the dearer 4066 chip may be used. This is identical to the 4016, but has a resistance of 60Ω.

With the general description over we can turn to the circuit in Fig. 3. IC6 and IC7 are two quad CMOS switches. IC6 gates the video from the three demodulator outputs. IC7 gates the levels on RV2 – RV4 to give the three outputs on pins K, L, M. The fourth, Y, is used in older colour-difference sets and will be described later. The gating of the levels on RV2 – RV4 is done by the gate logic signals from Fig. 2.

Also shown in Fig. 3 is the power supply. This is a fairly conventional i.c. regulator, made adjustable by the inclusion of Tr3 in the common return line. The operating voltage range for IC1 is 12-18V, for IC2 it's 16-19V, and for the B series CMOS it's less than 18V. The supply chosen is 16-17V therefore. A wire link is included so that the power supply can be adjusted before it's connected to the rest of the circuit.

Table of Connections and Options

A	Take to +16V to set hours.
B	Take to +16V to set minutes.
C	Take to +16V to enable the time display.
D	Line take off. Select R12 to suit signal amplitude. For positive waveform omit R14 and use link b on line sync select. For negative waveform omit R13 and use link a.
E	Field take off. Select R16 to suit signal amplitude. For positive waveform omit R18 and use link b on field sync select. For negative waveform omit R17 and use link a.
F-J	Video inputs. Selection depends on application.
K-N	Video outputs. Selection depends on application.
P, Q	240V input.
R	12/24 hour select. If left open 24 hour is selected, if taken to 0V 12 hour is selected.
S	Inhibit. If taken to 0V stops clock.
T	50/60Hz select. If left open 50Hz is selected, if taken to 0V 60Hz operation is selected.
U	Resets clock to zero when taken to 0V.
V	Channel enable. Take to +16V to enable the channel display.
W-Z	Channel data in binary form. W is least significant.
LED	Connect to cathode of LED for one second flashing indicator.
Flashing colon	Omit R6. Use R4, D1, C4.
Steady colon	Omit R4, D1, C4. Use R6.

Construction and Connection to Set

A printed circuit board will be available for Figs. 2 and 3, simplifying construction. CMOS i.c.s can be easily damaged by static, so the safest method of mounting the i.c. is to use sockets. If you're going to solder the i.c.s directly, the soldering iron bit should be earthed and the i.c.s inserted last, after all the other components. In any case try not to touch the i.c. pins. CMOS is not quite as temperamental as its reputation suggests, but it does pay to take care. Unused inputs on the 4016 should be connected to 0V.

Note that the circuit 0V is connected to the set 0V, not earth. Depending on the set and the competence of the electrician who wired the house, the set's 0V could be connected to earth, neutral or the live side of the mains. A great deal of care should therefore be taken when testing the circuit.

The board can be mounted inside the set and the three push buttons (set hours and minutes and enable) brought out on the front panel. This keeps lead lengths small and saves the cost of a box. If an external box is used the case should be earthed.

The 240V mains input could be obtained from the set's supply, but the clock would then have to be reset each time the set is turned on. Taking the supply to the clock from the live side of the TV switch is not recommended. The safest way to have a permanent supply to the clock is via a separate supply lead and plug.

CONTINUED NEXT MONTH

Faults Encountered . . .

Dewi James

ONE recent week was rather unusual for us: three Sony colour sets in all at once! A KV1810UB with a grainy picture, a completely dead KV2000UB, and a KV1300UB (one of the non-standard PAL ones) with incorrect colours.

A Group of Sonys

It would have been easy to assume that the grainy picture on the KV1810UB was due to tuner trouble. Luckily, and more out of curiosity than anything else, I removed the a.g.c. lead from the tuner. This greatly improved the quality of the picture, so the obvious thing to do was to look into the a.g.c. circuitry. There are effectively two separate a.g.c. circuits in this set, one controlling the i.f. strip and a second, which is driven from the collector of the first i.f. amplifier, to control the tuner unit (see Fig. 1). It was apparent that the trouble was in the latter, which involves two transistors Q211 and Q212. Having got this far it was easy enough to make checks and discover that Q211 (2SA677) was faulty. A replacement gave a complete cure.

The dead KV2000UB was not such an easy matter: it's got a complex chopper switch-mode power supply circuit. In the presence of an overload the power supply shuts down – leaving us with a complete absence of symptoms. This makes it difficult to decide whether the fault is in the power supply itself or in another part of the circuit.

To isolate the power supply whilst maintaining a load (thus keeping it operational) remove plug F4 (h.t. out) and connect a 100W bulb across the output. If it lights, the power supply is in order and can be eliminated. In this case the power supply turned out to be in order, so the obvious thing to suspect was the line output stage. It turned out that the damper diode D806 was short-circuit, causing the power supply to shut down so that the 135V h.t. line was removed. We've had the same trouble when the SG613 gate-controlled-switch line output device (Q901) is faulty.

In the case of the KV1300UB, the customer had complained of a "greenish picture". On examination during a test card transmission two colours seemed to be present, green and pink! – at least it looked like pink to me. The display was such that we were inclined to think in terms of ident trouble, so we decided to investigate the bistable circuit which controls the line-by-line signal switching to convert the PAL signal into an NTSC one. We discovered that the waveforms at the collectors of the two transistors Q307 and Q308 were different: they should both be equal mark-space ratio squarewaves of approximately 14V peak-to-peak (with the scope timebase running at line frequency). The waveform at the collector of Q308 was correct, but in addition to a different waveform Q307's collector voltage was low. Replacing this transistor restored normal colour, and I must admit to a feeling of relief that there was no need to delve further into this complex twin reference oscillator decoder.

Incidentally, we've had several cases of Sony KV1800UBs with no sound or raster but with the stabilised 110V rail present. The problem is due to the absence of the l.t. rails, which are derived from the line timebase. The line oscillator has a capacitor start circuit – similar to the arrangements used in the Rank Z718 chassis (see the September 1977 *Television*) – and as the capacitor (C531, 10μF, 160V) ages so the oscillator fails to start.

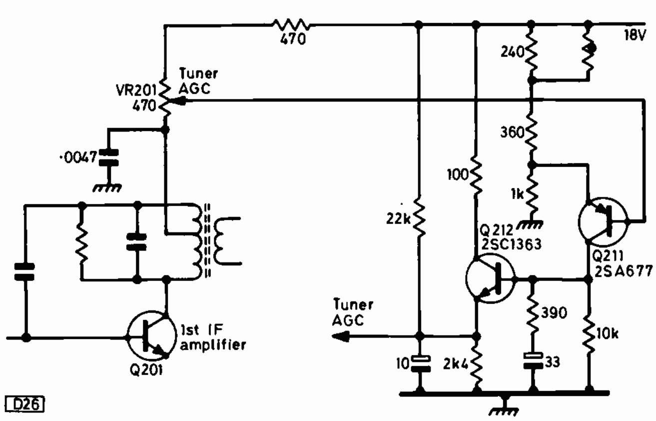


Fig. 1: The tuner a.g.c. circuit used in the Sony Model KV1810UB. The circuit is driven from the collector of the first i.f. amplifier transistor, which receives its base bias from the emitter of the second, gain-controlled i.f. amplifier transistor Q202.

Hitachi Faults

Just to make life a little easier the set which followed this one was an Hitachi Model CNP190 with field foldover (at the bottom only). This turned out to be the field driver transistor TR36 (2SA15). We found that an AF127 worked satisfactorily, while an AC128 produced field bounce. We've noticed before that Hitachi field timebase circuits seem to act rather temperamentally if the exact replacement transistor is not available.

Another of these sets came in with the symptom no colour – a normal monochrome picture was displayed – and was again easy to deal with. Over-riding the colour killer by applying 4V to point J on the decoder panel, thus biasing on the chroma delay line driver transistor TR32, restored colour. Normally this transistor is biased either on or off by the colour-killer transistor TR28 (2SA15V), which turned out to have an open-circuit base.

The problem with an Hitachi Model CNP192 was poor convergence, which couldn't be corrected, at the sides of the screen. This was eventually traced to the 3·3μF electrolytic capacitor C853, which provides the signal feed to the horizontal blue convergence circuit, being defective.

Intermittent loss of colour on this and other similar Hitachi colour sets can be caused by unbalanced burst detector diodes.

Two Hitachi CEP180s have come our way recently. The trouble with the first was no sync. The voltages around the sync separator, a pnp device, were incorrect but the transistor itself turned out to be in order, the fault being due to the diode (CR4, 1N60) in series with its base being short-circuit. The trouble with the other was no sound or raster, due to absence of e.h.t. (the 12V line feeding the low-voltage stages is derived from the line output transformer). Checking back through the line timebase we found that the trouble was due to the base-emitter coupled blocking oscillator which, instead of oscillating, was forward biased. It turned out that one of the capacitors in this stage (C709 0·068μF) was defective.

In some varicap tuned Hitachi sets the earthing of the 33V stabiliser is via the tuner metalwork. This can lead to tuning difficulties. The solution is to add an extra earth lead from the stabiliser to chassis.

Mitsubishi with Shattered Fuse

I'm indebted to a colleague for the following tip which is worth noting. The trouble was neither sound nor raster on a Mitsubishi Model CT200B, with the 3A fuse F903 shattered. This is connected in series between the mains bridge rectifier and chassis. The cause of the fault was the 10W fusible resistor R904 going open-circuit – it's connected in parallel with the two parallel-connected series regulator transistors. The point is that when the spring clip of R904 opens it can come into contact with the chassis. The cure is to connect it the other way round or use a piece of insulating tape to cover the chassis area involved.

ITT VC300 Portable

Our usual line of UK produced sets is the ITT range. The VC300 portable chassis is relatively trouble free, but we've had to change the series regulator transistor T2 (R2441) on several occasions – it goes open-circuit, giving the dead set symptom. This may be confusing to some since although the 11V rail, measured from the l.t. fuse F2 to chassis, is missing there is still 17V across the bridge. The reason, as shown in Fig. 2, is that the regulator transistor is connected in series with the negative side of the supply.

Other faults we've had on these sets are D18 going open-circuit, thus removing the c.r.t.'s 400V first anode supply, and the boost diode D15 (F210) going open-circuit, giving the dead set symptom due to the loss of the HT2/HT3 lines.

ITT CVC9 Chassis

Lack of sync on the CVC9 hybrid colour chassis is often caused by R330f (3·3MΩ) going open-circuit: it's the sync separator's base bias resistor. Weak signals have been traced to the i.f. preamplifier transistor T13d (BF123), while intermittently weak signals can be caused by the tuner unit or breaks in the printed circuit along the i.f. strip. Watch the line output transformer earthing on this chassis! We were caught out yet again the other day by this: not your usual cracking and banging but complete instability, blanking out the picture and sound, due to an open-circuit earth connection.

A Cautionary Tale

Finally, a cautionary tale. Living in a country district as we do, there is a lot of resort to DIY methods. This is all right, but when it comes to colour television receivers ... Especially when carried out by Mr. X next door but one, who has always been very good with his hands (?). Anyway, the set concerned was fitted with the Philips G8 chassis. Originally the 600μF h.t. reservoir capacitor had exploded, which is not uncommon on these older sets (520 series). Several *months* later, it was brought to us. On

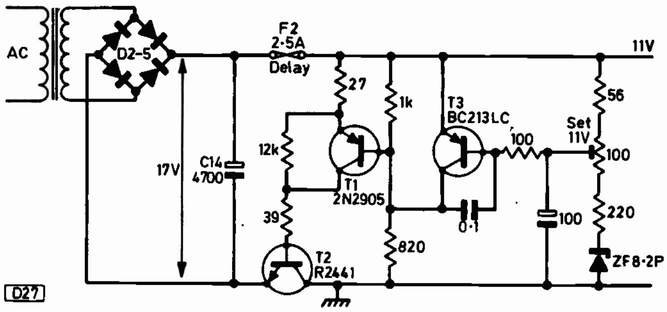


Fig. 2: The series regulator circuit used in the ITT VC300 chassis (simplified by the omission of switching). Note that the regulator transistor T2 is in the negative side of the supply: when it goes open-circuit, there's no voltage at the fuse but the reservoir capacitor C14 still charges. As in all portables, the bridge rectifier diodes are inclined to develop leaks, producing a narrow band of distortion which travels up the screen or worse symptoms.

examination, the h.t. at fuse FS1391 was found to be only about 35V, rising to normal on removing the fuse (in series with the supply to the line timebase). The set h.t. and overvoltage controls operated normally so long as the fuse was disconnected. On replacing it, down went the h.t. Surely if the line timebase was drawing that amount of current the fuse would have blown? The fault had to be in the power supply therefore, and it was eventually found to be the printed circuit connecting the power supply chassis to the main chassis (i.e. the print running to pin 3 of plug L). Repairing the damaged print restored some life to the set – sound and a bright raster with flyback lines – but there was no picture. This was traced to L7381 being open-circuit, thus removing the h.t. supply to the RGB output transistors. Putting this right restored the picture, but red was missing, and on removing the chroma demodulator i.c. (IC7001, TBA520) we discovered a minute blob of solder which had shorted some of the pins, causing irreparable damage. The remaining symptom was cleared up on replacing this i.c. So what was originally a simple fault had been turned into a catalogue of trouble by ham fistedness and lack of knowledge.

The Story of UK Test Cards

Malcolm Burrell

ONE of the TV technician's most important tools is the test card. Viewers find it boring, but sometimes abuse its purpose by demanding impossibly perfect reproduction.

Some years ago there was a great variety of different test card designs in use throughout the then widening television world, and I suspect that it was curiosity about them and other TV systems that stimulated DX enthusiasts to try to receive them as an alternative to the then familiar Test Card C. There were many artistic designs, like those from France with the prancing horse at the centre, or from Monaco with pictures of buildings. These cards were smothered in patterns of squares and frequency gratings, giving an extremely attractive result even if not quite fulfilling their main duty of providing a comprehensive technical check on the system.

Test Card Design

If one set out to design a test card to be used for setting up TV receivers, what would be the main requirements? Taking monochrome first, some of the main features required would be:

(1) To provide a check on picture scanning linearity.
(2) To define the extremities of the picture area.
(3) To give an indication of focus overall.
(4) To provide a typical example of contrast range.
(5) To check the high-frequency response.
(6) To check the low-frequency response.
(7) To show up deficiencies such as ghosting in the receiving system.
(8) To check the recovery of the synchronising circuits after the blanking periods.
(9) To provide an acceptable demonstration picture for non-technical people.

Many of these features are easy to arrange in the form of a group of idealised patterns. Accurate photographic reproduction, in quantities sufficient to enable a card to be produced and then replaced as needed with identical duplicates, or for several broadcasting organisations to utilise the same pattern and standards of assessment, creates problems however. The making of test cards is today a very specialised job, and although broadcasting organisations sometimes produce their own their manufacture and development is usually undertaken by experts in the field of photography and printing such as The Colour Centre in Regent Street, who have supplied test cards to over 25 different countries, or W. R. Royle and Son Ltd., who worked closely with the BBC in test card production and currently make special test cards for setting up colour cameras.

Prewar Test Cards

Perhaps the first "test card" was the dummy head used by John Logie Baird in his experiments. The first pattern drawn for the purpose of setting up cameras in a boadcasting organisation was Test Card A however. It was used by the BBC in the 1930s and took the form (see accompanying photograph) of a simple black and white drawing. This provided a limited check of linearity (the circle), picture centring (castellated border), and frequency response (gratings for h.f. response, the "letter box" for l.f. response). It was not normally transmitted, and dealers had to rely on a demonstration film for setting up receivers outside programme hours. The only signal broadcast for test purposes was a cruciform (black cross on a white background) which, ironically, was produced electronically.

The cruciform was useful for low-frequency response checks (steaking in the large black and white areas), while the high-frequency response could be checked by observing the edge transitions from black to white. It also gave a rough guide to picture centring. Any accurate measurement of definition was considered relatively unimportant, due to the fairly low brilliance and small screen size of the cathode-ray tubes normally used at the time. In any case, the resolution of the Emitron camera tube then in use was thought to be only about 2MHz.

Test Card B followed. It remained substantially the same but with the letter box moved to the top and a spectral response chart inserted at the bottom. This was not a true "step wedge", and caused some confusion due to its misuse as such.

Test Card C

In 1949 the BBC introduced the first trade test card, designated C (see photograph). This was a comprehensive test of both the transmission and receiving systems.

The castellated border indicated the extremities of the picture area and facilitated picture centring whilst also demonstrating the recovery of the synchronising circuits after the blanking interval – a fault here usually showed up as displacement of parts of the picture in sympathy with the black and white border. Due to the effect this had on the centre circle, the characteristic came to be known as "cogging".

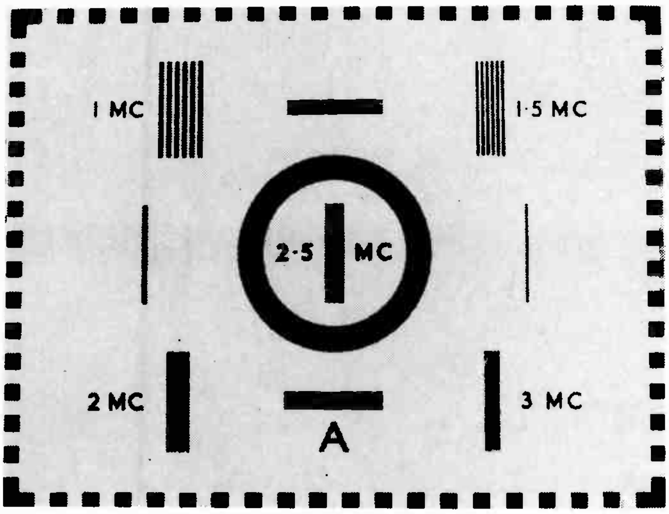
Line and field linearity could be checked by the white grid on the grey background while, due to the human eye being particularly sensitive to deviation from a truly circular shape, concentric black and white circles were placed in the middle.

Diagonal blocks of lines were placed at the corners to facilitate checking the edge focusing. This was done in conjunction with the blocks of high-frequency gratings in the central area at either side of the five-step contrast wedge.

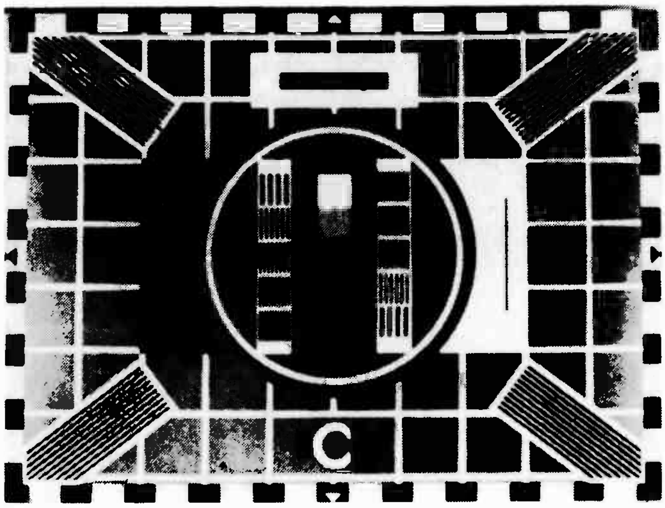
The frequency gratings were intended to indicate the response in steps of 0.5MHz on the 405-line system, i.e. 1MHz, 1.5MHz, 2MHz, 2.5MHz and 3MHz.

The letter box at the top showed up poor low-frequency response as streaking to the right, although for some years imperfections in the transmission system induced some slight defects here.

At either side of the circle there was a box containing a vertical line. This was useful in showing up ringing or ghosting effects, particularly as the sense of the left-hand block was opposite to that of the right-hand one, so that either positive or negative ghosts could be seen.

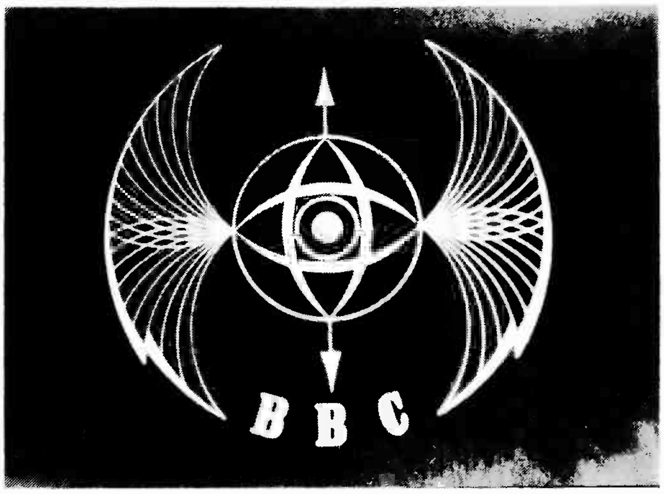


The original prewar BBC Test Card A.



The famous BBC Test Card C. Copyright BBC.

The BBC tuning signal/clock, circa 1950. Copyright BBC.



The BBC "television symbol", introduced in late 1953. Copyright BBC.

It's interesting to note that although it was intended as a technical aid the test card was so well arranged in a symmetrical fashion that it provided at a glance a good indication of the operation of a TV receiver.

Test Card C remained in service on the 405-line system until 1964. It was also in service on the 625-line BBC-2 network – in modified form – until the introduction of regular colour transmissions on this network in 1967.

Tuning Signals

Before continuing with the history of test cards, mention should be made of the large number of simpler cards, known as tuning signals, that were used during the era of Test Card C.

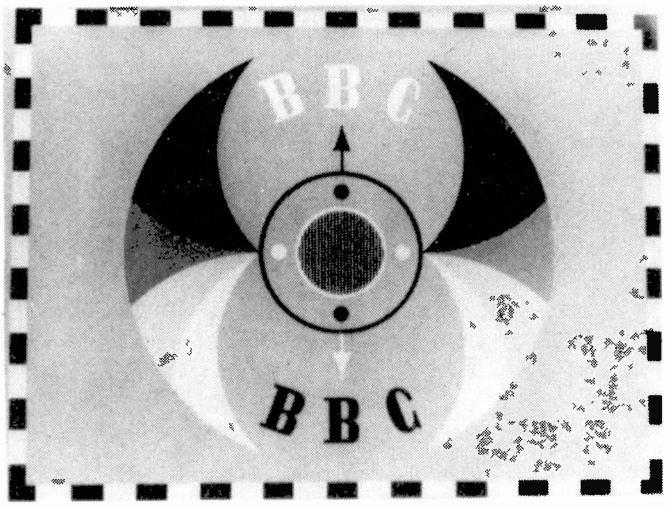
One of the first, which was often shown in old instruction books, took the form of a signal which also displayed a clock. The pattern had a castellated border, a centre circle, and two sets of grey-scale "biscuits" at either side. In the centre of the circle, which housed the clock, there was a set of fine-frequency gratings corresponding to about 2·5MHz. This was mainly for checking focus. The intention of these tuning signals was to enable the viewer to adjust the set's controls prior to the commencement of programmes.

A variation on the above chart was one of similar design, but without the clock face. Both these charts carried the identification "BBC Television Service".

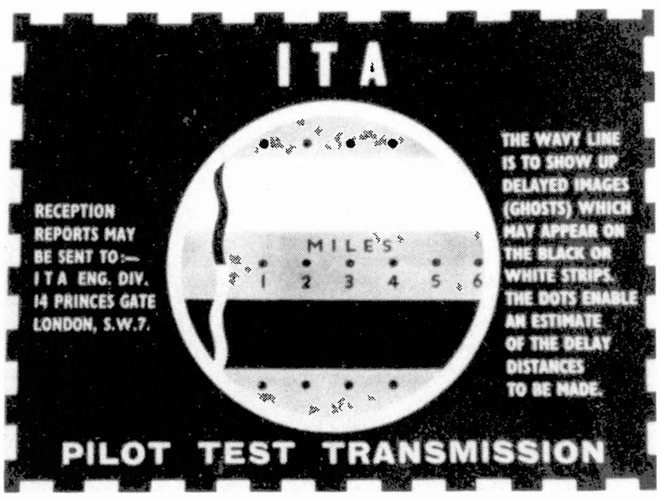
In the early 1950s, instead of displaying the familiar BBC "coat of arms" after the tuning signal the BBC produced their "television" symbol. This was an animated film with a central moving area and an effect reminiscent of radar. The tuning signal was subsequently altered to match. It remained much the same as the previous patterns, with the central circle slightly enlarged and made black while a simplified (non-animated) symbol was superimposed in white. The central frequency gratings were retained, as were the grey-scale biscuits, but the identification markings were updated in design, the letters BBC being prominently displayed at the top and bottom of the picture and the words "Television Service" omitted.

Finally, in the late 1950s, before the BBC abandoned test cards altogether as tuning signals, the pattern of the BBC TV symbol was incorporated into the design in such a way that the contrast wedge almost filled the screen. The centre circle contained four black and white spots, and the inner circle with its frequency gratings was retained.

"Alternative programmes" came with the advent of the then ITA. The first tuning signal radiated by the ITA from London was a simple card with a castellated border and concentric black and white circles inside which were five-step contrast wedges on either side of a square of fine frequency gratings. Subsequently – up to 1969 when all TV services commenced colour transmission – the ITA used a simple tuning signal with a black circle, a larger block of



BBC tuning signal introduced in June 1956. Copyright BBC. When broadcast, the grey-scale "wings" were inverted, giving white at the top and black at the bottom.



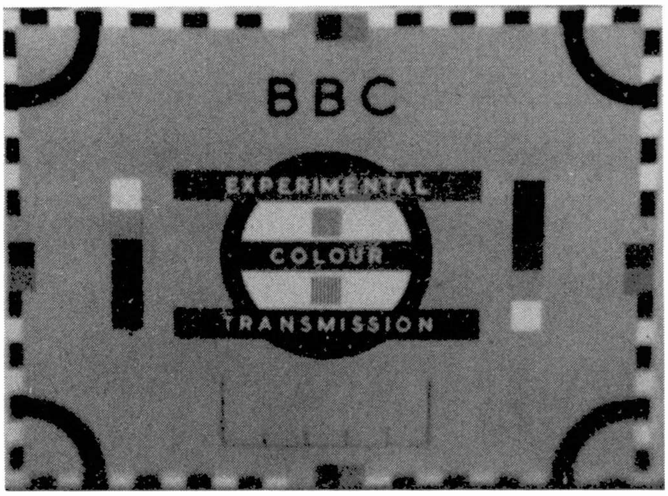
An ITA test card.

frequency gratings moved to the right and nearer the top, and simple almost indistinct arrows to indicate the picture extremities instead of the castellated border. At first these cards usually carried the transmitter names, e.g. ITA–Croydon, but as the network became increasingly complex the identification became more general, e.g. ITA–East of England.

Interesting Cards of the 1950s

One of the more unusual test cards radiated in the mid-1950s came from an experimental mobile Band III transmitter operated by Belling-Lee. The card carried the call sign G9AED, together with details of the site and operating frequency. It was also used by the ITA in pilot test transmissions. There was a white circle on a black background, and inside the circle were a wavy line and a number of black dots arranged at intervals to enable the distance over which any multipath reception (ghosting) was taking place to be estimated.

In this period the BBC began its first experimental colour transmissions, using a 405-line adaptation of the NTSC system. These were radiated by the London area transmitter at Alexandra Palace, then by the higher power transmitter at Crystal Palace when this came into service. Perhaps the first British colour test card was the apology caption "Normal Service Will Be Resumed After Tea", with the latter two words inserted in red, but a test card was then developed for the tests. This was quite simple in make-up, consisting of a central circle and quadrants across the corners. These curved shapes were all in black, with white spots to indicate the quality of the receiver's convergence. Red, green and blue bars horizontally across the circle displayed the words "experimental colour transmission", with two small blocks of frequency gratings interposed between. A five step grey-scale wedge was inserted at either side of the circle. Incorporated in the edge castellations were blocks of complimentary colours – yellow, magenta and cyan – probably to check the recovery of the reference oscillator after the blanking period.



The BBC's experimental colour test card.

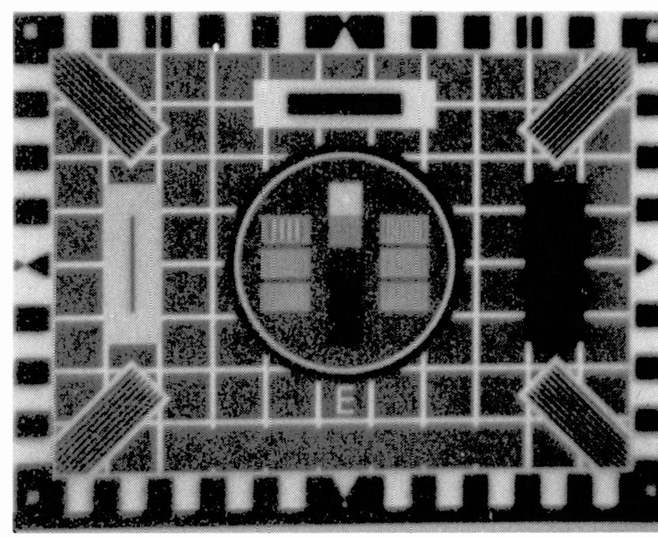
A colour tuning signal was also developed. It followed the style of the last monochrome tuning signal, and was very pleasing to look at though somewhat limited technically. The inner part of the "wings" formed a grey-scale with six steps, whilst the outer parts were coloured from the top red, magenta, yellow, green, cyan and blue. Inside the circle was an attractive picture of one of the TV announcers of the time, Sylvia Peters. There were no frequency gratings or checks for misconvergence.

On to 625 Lines

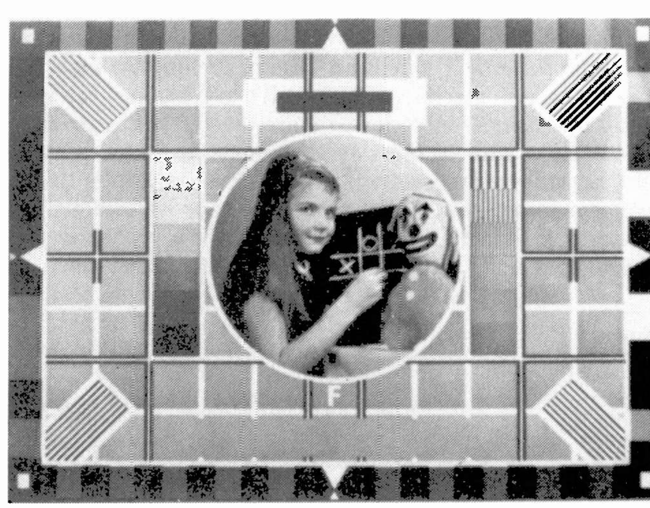
Most of the problems with Test Card C related to the frequency gratings. When observed on an oscilloscope, these resemble a square wave. When passed through circuits of limited frequency response however the fundamentals will pass through increased in amplitude by a factor of $4/\pi$. If however the gratings have a gradual transition from white to black, so that the resultant display is in effect a sinewave, the problem does not arise. This was made a feature of the gratings used on Test Card D – on the screen they looked much "softer". This card retained the features of its predecessor but with some rearrangement and improvement. It's debatable whether the service technician found it more helpful however.

With the start of the BBC-2 625-line service in 1964 a new test card suitable for use on this standard was devised. It was a modified version of Test Card D, with an "improvement" in the rendering of the frequency gratings. The frequency gratings were surrounded by a grey tone of mean-bar density, so that the start of the cycle of sinewaves as viewed on an oscilloscope commenced from this level and gave an exact number of cycles. The appearance of these gratings on a receiver screen was completely unacceptable however, and since it would have been pointless to redesign the master drawings in view of the impending introduction of a regular colour service the test card was not used. Until the start of the colour service in 1967 therefore, BBC-2 used a modified version of Test Card C.

BBC colour tuning signal, circa 1957.



Test Card E – the 625-line version of Test Card D.



The ultimate – Test Card F, used by BBC-2 from 1967 onwards and by BBC-1 and ITV from 1969. Copyright BBC, BREMA, EEA and the IBA.

The Colour Test Card F

The basic Test Card D design was retained for the colour Test Card F, but the frequency gratings were moved outside the centre circle to make way for a colour picture. Rectangular bars were reintroduced, but the modulation depth was reduced slightly to allow for the $4/\pi$ effect described above. Coloured edge castellations allow checks to be made on the reference oscillator's recovery and whether or not it is being affected by picture information. And some of the lines in the background grid have black outlines to facilitate convergence checking.

The centre picture had to be aesthetically pleasing, sufficiently colourful to contrast with the monochrome areas in the picture, and have a high standard of flesh tones which would not be unduly prejudiced by changes in accepted standards of cosmetic fashion. For this reason, the picture of a child was selected. The BBC is to be congratulated on the standards it has maintained in the consistency of colour reproduction of this card over ten years. The noughts and crosses game on the blackboard gives a very good check of centre convergence.

Test Card F has been regularly broadcast by all the UK TV networks, but with the heavy programme commitments of the IBA services today, and the current change to automated systems, the remaining short trade test periods increasingly rely on electronic pattern generators. The BBC, whilst occasionally using a modified Philips PM5544 pattern (designated by them Test Card G, but not to be confused with the variant on Test Card C also known as G) from regional centres or the network, still fortunately uses Test Card F in the main. The electronic G pattern was very fully described in the April 1976 issue of *Television*.

Test Card Pictures

Except for the colour test card, there never seems to have been room for photographs in our test cards. Demonstration film was used in the early days to give non-technical people an idea of the quality of TV reproduction. For some years Test Card C was alternated with a film sequence every fifteen minutes. Later test transmissions alternated the test card with a suitable slide – one which had plenty of contrast. Of particular interest was the one used by the ITA, showing the famous London Sphinx: a very dark subject, contrasted with the background of the River Thames.

During the late 1950s the BBC broadcast colour slides alternately with the test card in the mornings, and when regular 625-line colour tests and subsequently programmes commenced in the 1960s this practice continued. It's only in recent years, with so many programmes being broadcast during the day, that it has been felt unnecessary to include pictures during the test transmissions.

The Future

The changeover from the use of the traditional type of test card to electronically generated patterns is likely to accelerate. But while TV engineers may nowadays have plenty of test equipment, it's unlikely that in day-to-day servicing we can use it fully every time Mrs. Jones' TV set has to be attended to. From this point of view, Test Card F is an infinitely more useful tool: its picture insert is invaluable in trying to maintain a reasonable consistency of colour reproduction. The longer it's broadcast, the happier service engineers will be. ■

TV Servicing: Beginners Start Here...

Part 5

S. Simon

LAST month we went into valve line output stages in some detail, with particular reference to the circuit used in the Thorn 1500 chassis and the things that go wrong with it. One of the faults we mentioned was no raster (no screen illumination) due to no e.h.t. supply due in turn to no drive to the line output valve – with the line output valve and efficiency diode overheating as a result. This takes us then to the preceding line oscillator circuit whose function is to provide a waveform to switch the line output valve on and off. Staying with the Thorn 1500 chassis, the circuitry concerned is shown in Fig. 1.

Line Oscillator Circuit

The oscillator itself consists of the triode valve V1B and its associated components. Transformer T1 provides feedback coupling between the valve's anode and its grid, and there are two *RC* networks, R64/C53 and C52/R58/R61/R62. Let's consider the first of these, which generates the basic waveform used to drive the line output valve. Once the h.t. voltage is established, C53 will charge up via R64, a positive-going waveform appearing at the junction of these two components. This is coupled to the line output valve's control grid via C100 (see Fig. 1 last month), and once the waveform is sufficiently positive the line output valve will switch on. The next thing we have to do is to switch the line output valve off again – at the appropriate time – in order to start the flyback. For this purpose the positive-going waveform must be followed by a rapid negative-going section, giving us a sawtooth drive waveform (more commonly a square-shaped waveform is used to drive the line output valve, but there is no change in the principle since the essence of the matter is to have a rapid negative-going part of the waveform with which to switch off the line output valve at the appropriate time).

The function of the line oscillator valve is to switch on at this point, thus discharging C53 to provide the negative-going signal excursion at the junction of C53/R64. To find out how this happens we must transfer our attention to the other *RC* network. R58 and R62 form a simple voltage divider network, the voltage at their junction being determined by their values and, in addition, the extent to which transistor VT10 is conducting (more about that shortly). This voltage is linked to C52 and the grid of the valve by R61.

Oscillator Action

Thinking again about what happens once the h.t. supply appears, it will be obvious that a positive voltage will develop at V1B's grid. The valve will switch on therefore. Now because of the way in which the windings of the feedback transformer T1 are connected, the negative-going waveform thus produced at the anode of the valve will appear as a positive-going waveform at its grid. The idea is to drive the valve into full conduction as rapidly as possible. Once the valve is conducting to the maximum extent, there will be no further change in the waveform at its anode and in consequence there will be no drive waveform at its grid. While the valve is conducting heavily, grid current will flow and C52 will acquire a negative charge. The net result at the end of all this is that the voltage at the grid of V1B is negative and the valve switches off. This time T1 couples a negative-going waveform to the grid to ensure that the switch-off is rapid. C52 is left with a negative charge however and as long as this is present V1 remains cut off

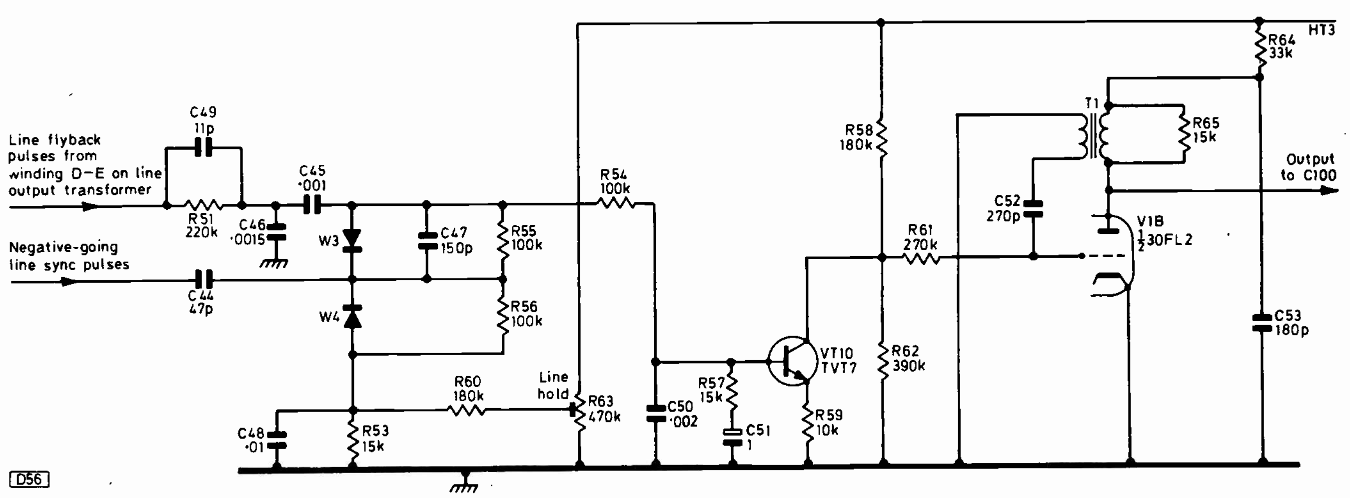


Fig. 1: Line oscillator and flywheel line sync circuits, Thorn 1500 chassis.

and at the other side of the circuit C53 charges again via R64.

Circuit Timing

The crucial component is C52, which we can call the timing capacitor since it controls the time at which V1B will switch on again. It does this since the negative charge it acquires during the brief conduction of V1B leaks away gradually via R61 and R58. As a result, the waveform at the grid of V1B consists of a relatively slow positive-going sawtooth, and once it's sufficiently positive V1B will conduct again. Obviously then the voltage at the junction R58/R61/R62 and the value of C52 are the factors which determine when V1B conducts and, in turn, when the line output valve is switched off. The circuit is called a blocking oscillator – since it's blocked off so long as the timing capacitor holds a negative charge.

Since the value of C52 is fixed, it's obvious that the only way in which the timing of the circuit can be changed is by altering the voltage at the junction of the three resistors R58/R61/R62. This voltage depends on the conduction of transistor VT10, which is simply a d.c. amplifier, i.e. it provides at its collector a voltage which is amplified in proportion to the smaller d.c. voltage present at its base. This is the first time we've come across transistors in this series of articles, so before seeing how the voltage at the base of VT10 is set in order to synchronise the operation of the line oscillator and thus the line scanning we had better say something about how transistors operate.

The Transistor

To give a full account of how transistors work we would have to delve into the atomic structure of the materials they are made out of. This is neither appropriate nor necessary here. From the servicing viewpoint we need to know only whether a transistor is working properly or not, and to understand this a bald statement of what a transistor is and does is adequate. The transistor concerned here has the Thorn classification TVT7 and is equivalent to a type BC117. It's a silicon transistor (most are, though many earlier ones were made from germanium), and is of the npn type. N denotes negative and p positive – transistors are three-layer devices with the layers in either npn or pnp formation. Each layer has an external connection and these are termed the emitter, base and collector (see Fig. 2). The base is the centre one, and the other important point is that there are two junctions in the device, the emitter-base junction and the base-collector junction.

The device operates as an amplifier or a switch just as a valve does, but has the advantages that it doesn't need a heater supply, it doesn't lose emission, and it operates at much lower voltages. The emitter is roughly equivalent to the cathode of a valve: current flows from the external circuit via the emitter, base and collector regions of the transistor, the amount of current flowing depending on the bias applied between the base and the emitter. So, again very roughly, the transistor's base and collector (it "collects" the electrons from the base) are equivalent to the control grid and anode of a valve. Within a valve there is a vacuum between the electrodes – the cathode, grid and anode in the case of a triode. In a transistor however there are boundaries between sections of the silicon (or germanium) of different type: thus transistors and allied devices are referred to as "solid-state".

So provided the external conditions are right we have a current flowing through our transistor, in this case VT10.

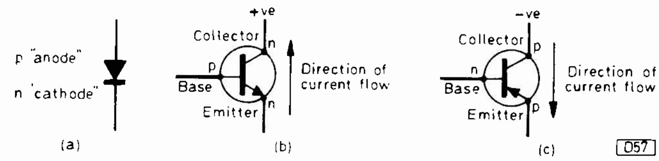


Fig. 2: Circuit symbols for basic semiconductor devices, (a) diode, (b) npn transistor, (c) pnp transistor. The diode conducts when its cathode is negative with respect to its anode and there is an external circuit to complete the path for the current. An npn transistor passes collector current when its base is positive with respect to its emitter and the collector is supplied from a positive line. The voltage conditions for a pnp transistor are the reverse of those for an npn transistor.

For example, our npn transistor requires a positive voltage at its collector to attract electrons from the base, which in turn needs a positive voltage (much lower) to attract electrons from the emitter. In the case of a pnp transistor the direction of current flow is reversed, as are the external conditions – the collector requires a negative voltage and so on.

To stick with our npn transistor however, if the base is made sufficiently positive with respect to the emitter a small current will flow via the base into the external circuit connected to it and a much larger current will flow via the collector (provided it has a suitable positive supply voltage applied to it). The base and collector currents are proportional to each other and if the base current is increased too much the collector current will be excessive and the device could be damaged. Heat is generated in the process, and this in itself increases the current flowing – so the thing can get carried away and destroy itself in a short time. For this reason transistors which are designed to pass a goodly amount of current have to be provided with some form of heatsink whose purpose is to dissipate the heat so that it doesn't concentrate in the transistor itself.

As with valves, the operation of a transistor stage can be checked by taking voltage measurements at the "electrodes". To measure the current would mean opening the circuit at some point and inserting the meter, which is obviously less convenient.

Action of the DC Amplifier

Returning to our Thorn 1500 circuit, if VT10 was not conducting the voltage at V1B grid would rise excessively and sync would be lost: conversely if it was fully on or short-circuit the voltage at V1B grid would be too low and the fault would be a stopped oscillator. What happens more often however is that VT10 conducts slightly more or less than it should or its conduction varies when it shouldn't, thus giving rise to sync problems. Assuming that it's in order however then the synchronisation of the line scanning will be set by the voltage at its base. Time then to go back to the preceding stage, the flywheel sync discriminator, which sets VT10's base voltage.

Flywheel Line Sync

In early receivers the line sync pulse at the end of each line was used to trigger the line timebase. The problem was that if the received sync pulse was distorted or weak, or if it was distorted in the receiver, or if it was accompanied by excessive noise, then the synchronisation of the receiver would be disturbed. If the pulses were lost for any reason, then sync would be lost. To overcome this, all TV sets for many years have employed flywheel synchronisation, which means basically that the line oscillator is controlled by a voltage obtained from a filter – the filter provides a flywheel effect, hence flywheel sync. With this arrangement, synchronisation does not depend on the individual line sync pulses but on the average line sync pulse frequency over a period of time. In consequence, the timebase is rendered immune to short-term disturbances to the sync pulses.

Flywheel Sync Discriminator

The heart of the flywheel sync system is the flywheel sync discriminator, which consists of the two diodes W3/4 and their associated components. There are two inputs to this circuit, the sync pulses themselves, which are coupled in via C44, and a reference signal from the line output

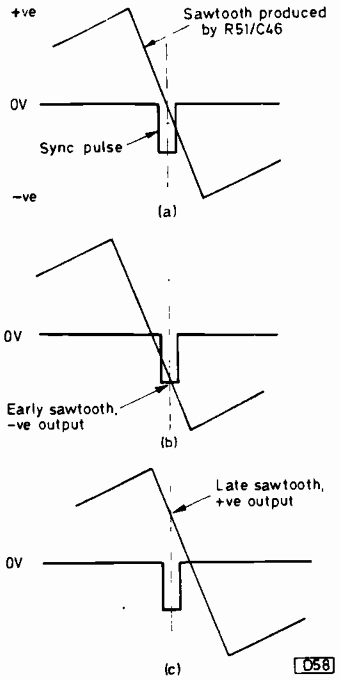


Fig. 3: Flywheel line sync action. (a) Line timebase running in sync with the transmitted line sync pulses: the sawtooth waveform derived from the line flyback pulse passes through zero when the line sync pulse arrives. (b) Line oscillator running too fast, so that the sawtooth waveform is advanced with respect to the line sync pulse. In consequence, the sawtooth is at a negative value when the sync pulse arrives, and the flywheel sync discriminator produces a negative-going output to pull the oscillator back into lock. (c) Line oscillator running too slow, so that the sawtooth waveform is delayed with respect to the sync pulse. This time a positive going output voltage is produced to speed up the line oscillator. If the sync pulse arrives when the line oscillator is so fast or slow that it occurs during the ascending portion of the sawtooth waveform sync is lost.
The above illustration implies that correct sync occurs when there is zero output voltage from the flywheel sync circuit. In practice the output from the discriminator circuit is usually superimposed on a bias voltage. In Fig. 1 for example the output from the discriminator circuit is superimposed on the bias voltage tapped from the slider of the line hold control R63, i.e. it adds to or subtracts from this bias voltage. Now an interesting aspect of this arrangement is what happens when a small adjustment is made to the hold control. As we increase or decrease the bias voltage – say from 0V as shown above – clearly the sync pulse will move up or down the slope of the sawtooth. The picture will remain in lock, but will move slightly to the left or right – because the phase of the line scan has shifted with respect to the video signal and the sync pulses. The farther we move the control of course the greater the likelihood that sync will be lost: In a few sets this picture shift effect is used to centre the picture in the screen.

transformer – from winding E-D (see Fig. 1 last month again). What is happening then is that the timing of the flyback is being compared with the arrival of the sync pulses, any disparity resulting in the generation of a control voltage (at the base of VT10) to pull the line timebase into lock.

Diodes W3/4 conduct when the negative-going line sync pulse arrives at their cathodes. The line flyback pulse is converted into a sawtooth voltage by R51/C46 and this is fed to the discriminator diodes via C45. It's the negative-going part of the sawtooth that should be present when the diodes conduct, and since this is an a.c. waveform the sawtooth voltage will be swinging between positive and negative values (see Fig. 3). If the timebase is in sync the sawtooth waveform will be zero (centre point) when the sync pulse switches on the diodes and there will be zero output (not quite, since the line hold control R63 provides a small bias voltage so that the circuit can be set up). If the timebase is running too fast or too slow the sawtooth voltage will be at a negative or positive value respectively when the sync pulse switches W3/4 on, and this will appear at the output of the discriminator (it's present as a charge on C45).

The discriminator output is fed to the flywheel sync filter which consists of R54/C50/R57/C51. Because this has a relatively long time-constant, i.e. the voltage takes some time to vary at the output end (the base of VT10), we get the flywheel effect we've talked about.

Flywheel Sync Faults

What goes wrong here? The most common trouble is that the diodes go out of balance – they should have roughly the same reverse resistance (the resistance they record when reverse biased, i.e. with the black meter lead to the cathode and the red meter lead to the anode and the meter on a resistance range). Lack of balance will produce incorrect output from the discriminator, leading to either lack or loss of sync. The other main trouble in this type of circuit is faulty capacitors. In the 1500 chassis C51 is a common offender, either becoming leaky or drying up. In the former case the voltage of VT10's base is affected and the usual outcome is weak line hold: in the latter case the flywheel effect is reduced and you get line pulling and similar disturbances.

Line Oscillator Faults

Faults in the line oscillator stage of the 1500 are not common. Obviously the valve can lose emission so that there is no output. Occasionally the transformer causes trouble due to the effect of heat over the years. This affects the synchronisation. The most common offender however is the charging capacitor C53.

Obviously if this goes short-circuit there is no output. What usually happens however is that it starts to break down, resulting in a tearing type of disturbance on the screen.

Types of Line Oscillator

Many types of line oscillator have been used in the past. The two most commonly encountered in servicing today are the blocking oscillator and the sinewave oscillator. The latter is particularly widely used in colour sets, and in dealing with it next month we will depart briefly from our chosen chassis, the Thorn 1500.

Letters

ACTIVE FILTER

I read with interest Allan J. Latham's article on the co-channel interference filter in the December issue, but would like to point out an error in the terminology used. The circuit is described as consisting of "an *RC* notch filter followed by an amplifier to increase the *Q* of the circuit". The selectivity of an *RC* filter is expressed in terms of its figure of merit *Q*o however – and if an inductance was added to enhance the selectivity of the circuit this would still be expressed in terms of *Q*o. The type of network chosen was nevertheless possibly the best for the job.

The filter consists essentially of a passive potentiometer tuned network with a figure of merit under open-loop conditions of about a half. The negative feedback from the source-follower Tr1 increases the selectivity many times. An f.e.t. has almost certainly to be used since although an emitter-follower has a fairly high input impedance an input impedance of several megohms is required here in order to minimise the load on the *RC* network. The only disadvantage of using a f.e.t. is the slight loss of gain compared to a bipolar transistor, giving marginally reduced selectivity. – **P. G. Dixon, MRTS,** *Crawley, Sussex.*

EXCESSIVE BLUE

Excessive blue was the complaint on an ITT set fitted with the CVC9 chassis, and at first glance it looked as if the fault was in the blue output stage or that the c.r.t. blue first anode voltage was too high. It was most noticeable at low brightness levels, when everything was very blue: at higher brightness settings white areas of the picture still had a blue tint, but to a lesser degree.

When the d.c. conditions in the blue output stage were compared to those in the green output stage, it was discovered that the blue output transistor's base and emitter voltages were somewhat higher. There was no great variation in the c.r.t. first anode voltages, while the output transistor collector voltages were within 10V of each other. The blue driver and output transistors were replaced, but the fault persisted.

When the green, red and blue components of the colour-bar signal were separately displayed in the workshop, the fault was seen to be in the blue signal only: the blue gun was not being cut off on alternate bars as it should have been, thus producing a blue cast. On making further voltage checks, the voltage at the base of the blue driver transistor was found to be excessive. The base is d.c. fed from the blue output (pin 4) of the TDA1327A chroma demodulator i.c. via a preset control: adjusting this control reduced the fault effect, but the driver transistor still had excessive base voltage. The next suspect was the i.c., but replacing this again made no difference.

The scope was then brought out and revealed that the waveform at the blue output pin of the i.c. was incorrect – it resembled a modulated B – Y signal. We decided to look next at the reference signal inputs. The input at pin 12 was correct (1V peak-to-peak), but the signal at pin 13 was 4V peak-to-peak, four times what it should have been. There's an *RC* phase shift network connected across these pins, and on replacing the capacitor (C171d, 0·001μF) a normal subcarrier level was restored at pin 13. The waveform at pin 4 was also now correct.

So what appeared to be a simple case of too much blue due to a blue output stage or c.r.t. bias fault turned out to be demodulation trouble in the middle of the decoder. – **J. J. Herbert,** *Witham, Essex.*

YOUR PROBLEMS SOLVED

I'd like to comment on a couple of the readers' problems dealt with in your November issue. First, the Pye 713 chassis with peculiar a.f.c. effects could well have one or more dry-joints inside the i.f. module. Depending on where these are, the effects can be a noisy picture, hum bars that vary with tuning, or the shape of the response curve can be altered so that the a.f.c. pulls the tuning to one side. The offenders are the ceramic capacitors on the half of the board with the printed coils on it. Unsolder them and move them slightly away from the panel.

In the case of the Pye 697 chassis which blows the mains fuse, the problem may well be the on-off switch though another possibility is the 680Ω resistor in the degaussing circuit. After about the third 3·15A fuse, this resistor usually explodes! – **M. Phelan,** *Holmfirth, W. Yorks.*

RANK A823 CHASSIS

I read with interest R. W. Thomson's articles on the Rank A823 chassis and would like to endorse his comments on the reliability of its line output transformer. I worked for some years with the Nottingham Co-op, which had something like ten thousand sets out on rental, 80% of them using the Rank chassis. During the six years following the introduction of the A823 we had to replace only two line output transformers – and in both cases this was because they had noisy cores.

The setting up procedure given for the line drive balance coil(s) is o.k. for the earlier models but is impractical in most later ones because 6C4 and 6R6 were deleted. RRI say refit them, balance the stage up, then remove them. There are a couple of other methods however. (1) Reduce the h.t. to minimum (8RV1) and set the cores flush. Then adjust 6L5 as in the article for minimum width, then 6L4, again as in the article, for minimum width. Alternatively, (2), reduce the h.t. as before, connect an Avo model 8 across the right-hand section of the dropper resistor (viewed from the back of the set), and adjust the cores as in the article for maximum voltage (as you do in the Philips G8 chassis).

The focus spark gap can also be damaged due to the h.t. being too high, due in turn to faulty over-voltage circuit setting (in the event of the thyristor rectifier 8THY1 going short-circuit between its gate and cathode the h.t. rises to over 300V and the e.h.t. escalates).

The scan-correction capacitor 6C3 is a common cause of the h.t. fuse 8F3 blowing: in this event, check by removing the yellow plug 6Z3. It can be replaced by two 0·22μF capacitors in parallel.

Only the other day I had trouble with the line sync on a set with the A823 chassis. It was very weak, with the discriminator a mile off. The trouble turned out to be 5C6 (1,500pF) which tunes the primary of the discriminator drive transformer. As a result the transformer was ringing like blazes. It all makes life interesting though! – **A. Denham,** *Mansfield-Woodhouse, Notts.*

30-Channel Remote Control

Part 2

T. E. Barrett

LAST month we examined the transmitter and receiver circuits of the Thorn 4200 chassis. In this article we shall be looking into the remote-controlled ITT chassis and also at some ways of localising faults.

The Transmitter

ITT's transmitter circuit is shown in Fig. 4, and is virtually identical to Thorn's, shown in Fig. 1 last month. The main difference is in the power supply. When the transmitter is used to control the receiver remotely, it is powered from the 9V battery via D2. In this particular design, the transmitter doubles up as an in-situ control panel when inserted into a slot on the front of the set. In this condition, in order to extend battery life, the transmitter is powered directly from the set at a slightly higher voltage (10V). This causes D2 to become reverse biased, thus cutting off the battery from the circuit.

Since this particular receiver does not incorporate teletext, only 16 out of the possible 30 channels are used.

Receiver Unit

ITT's receiver circuit is shown in Fig. 5. In reality it is quite similar to the Thorn circuit shown last month. The ultrasonic preamplifier is a discreet design, but provides an identical drive to the SAA1025 as in the Thorn circuit. The SAA1025 has very similar peripheral circuitry, including the proportional (analogue) control functions and on-off, so no further description is really necessary. ITT do not offer contrast by remote control, which is quite sensible since this control is generally misused by the consumer.

Instead, in addition to the normal contrast control provided by R91 on the control board, a light sensitive resistor is incorporated which automatically adjusts the contrast to compensate for variations in ambient lighting.

Changing Channel

Of the 16 commands used by the system, eight are allocated to channel change. The five-bit code for the channel change information uses logic low (10V) on pins 9 and 8 (C and D) of IC1. The other three bits on pins 7, 11 and 12 (A, B and E) make up the code 'word', and this is applied to IC2, which is modified by its method of connection to act as a BCD store for this 'word'.

When C and D are low, T5 is turned off, thus producing a pulse at its collector. If either C or D is high, the base of T5 will not go low enough to turn the transistor off, and hence no pulse will be produced at its collector. This pulse is differentiated by C14 and R32, and applied to pin 1 of IC2 where it triggers the flip-flop in the i.c. thereby starting the count. T5 thus behaves as a NOR gate, allowing channel change information through to IC2.

This i.c. is designed as an edge triggered synchronous up/down BCD counter, but in this circuit pins 5 and 15 are kept permanently low, and pins 3 and 10 permanently high.

When channel change information comes through, pin 1 will go high, thus enabling the flip-flops to change their state in accordance with the three-bit word A, B, E at pins 4, 12 and 13. These flip-flops store the last command received. Immediately after switch-on, current from the 18V rail charges C15, and a pulse (differentiated by C15 and R33) is produced causing pin 9 of IC2 to go momentarily high. This pin is the reset for the flip-flops and a positive pulse resets the counter to zero, i.e. position 1 (BBC-1).

Assuming that a new channel has been selected, the flip-flops in IC2 will change their state accordingly and the logic outputs to IC3 will change. Table 1 shows the method of connection. The B and $\overline{B}$ inputs to IC3 set the 'enable' for each decoder, and the A and E inputs are paralleled into each decoder. Table 2 shows how the 0 to 7 (the only way of coding eight commands in pure binary using only three bits is to count 1 to 8 as 0 to 7) binary information appearing at the outputs of IC2 is used to generate the 1 to 8 channel change commands.

This arrangement takes advantage of the fact that in pure binary coding the most significant 'bit' will be in the left-hand column, the last two columns being sequentially identical. The A and E bits are therefore applied to each of the two decoders inside the i.c., whilst the B and $\overline{B}$ bits are used to enable the trigger. If B is low, the first decoder is enabled and A to E will be decoded as 1 to 4. For the second decoder, the $\overline{B}$ input is high and the A to E bits are decoded as 5 to 8. Since the two decoders in the i.c. are identical, the $\overline{B}$ input has to be inverted to enable the count 5 to 8.

The outputs of IC3 are designed to go low when activated. Thus when a channel is selected, that particular output will be low, thereby turning on the transistor it is connected to. This in turn connects the potentiometer which passes the tuning voltage to the supply. The l.e.d. in the

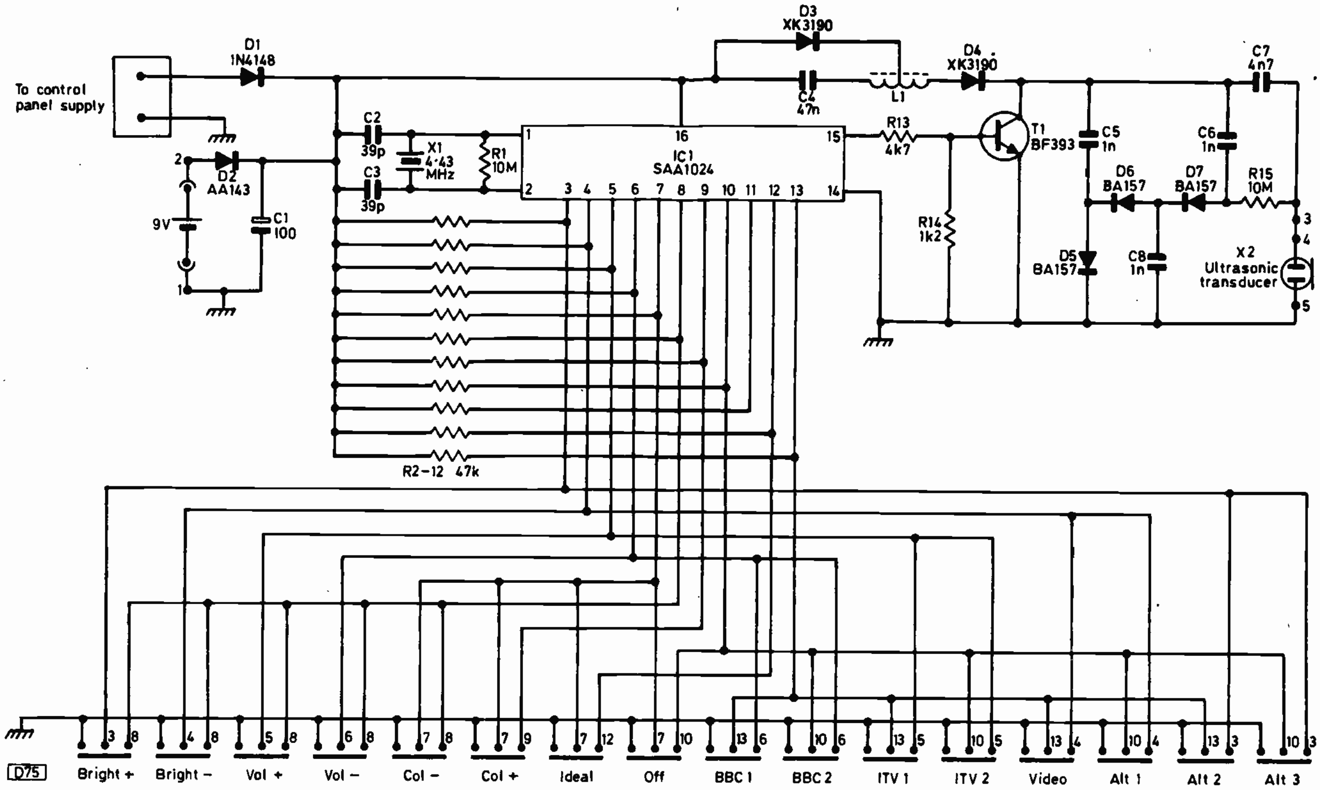


Fig. 4: Circuit of the ITT transmitter unit.

emitter circuit will light up indicating the selected channel. The diodes connected in series with the wiper of each potentiometer are all cut-off except for the one in the selected channel. This prevents the other potentiometers from being connected in circuit and affecting the tuning voltage. D13 is for temperature compensation.

Provision for VCR operation is made on channel 5. When this is selected, T14 is switched on and causes the line oscillator time constant to be altered.

Transmitter Fault Finding

The circuit will not operate correctly if the battery voltage drops below 5·5V, and for good range it should be greater than 7V. If a short-circuit exists, suspect the i.c. If any commands fail to operate, check the switch contacts.

Receiver Fault Finding

The receiver has four main sections: the ultrasonic pre-amplifier; the SAA1025 (including the 4·4336MHz clock); the proportional controls; and the digital controls. As usual the appropriate supply rails should be checked first in the case of either total or partial system failure.

In the case of total failure, if all else is correct check that pin 14 of the SAA1025 has an input. If not, ensure that the transducer is polarised (approx. 200V). If the resistors supplying this voltage to the transducer have gone appreciably high, the receiver will suffer from greatly reduced sensitivity.

If the clock signal is absent, check for dry joints on the crystal. In the case of no proportional control (or wrong 'range') check the relevant transistors and also check for leaking integrating capacitors.

The digital controls can refuse to work if the decoders are faulty; it is best then to suspect the i.c.s themselves. It is also possible that the switching transistors at the outputs may be at fault.

When these sets have been in service for a year or so, some specific problem areas may become apparent – perhaps due to production techniques or inept components. Until then, when confronted with faults – treat them logically!

Table 1: Channel change coding.

IC2 pin no.	IC3 pin no.	Code bit
6	1	B
7	15	$\bar{B}$
11	3, 13	A
12	2, 14	E

Table 2: Truth table showing how the channel information is decoded.

B	A	E	Channel no.
0	0	0	1
0	0	1	2
0	1	0	3
0	1	1	4
$\bar{B}$	A	E	
1	0	0	5
1	0	1	6
1	1	0	7
1	1	1	8

Receiver circuit overpage →

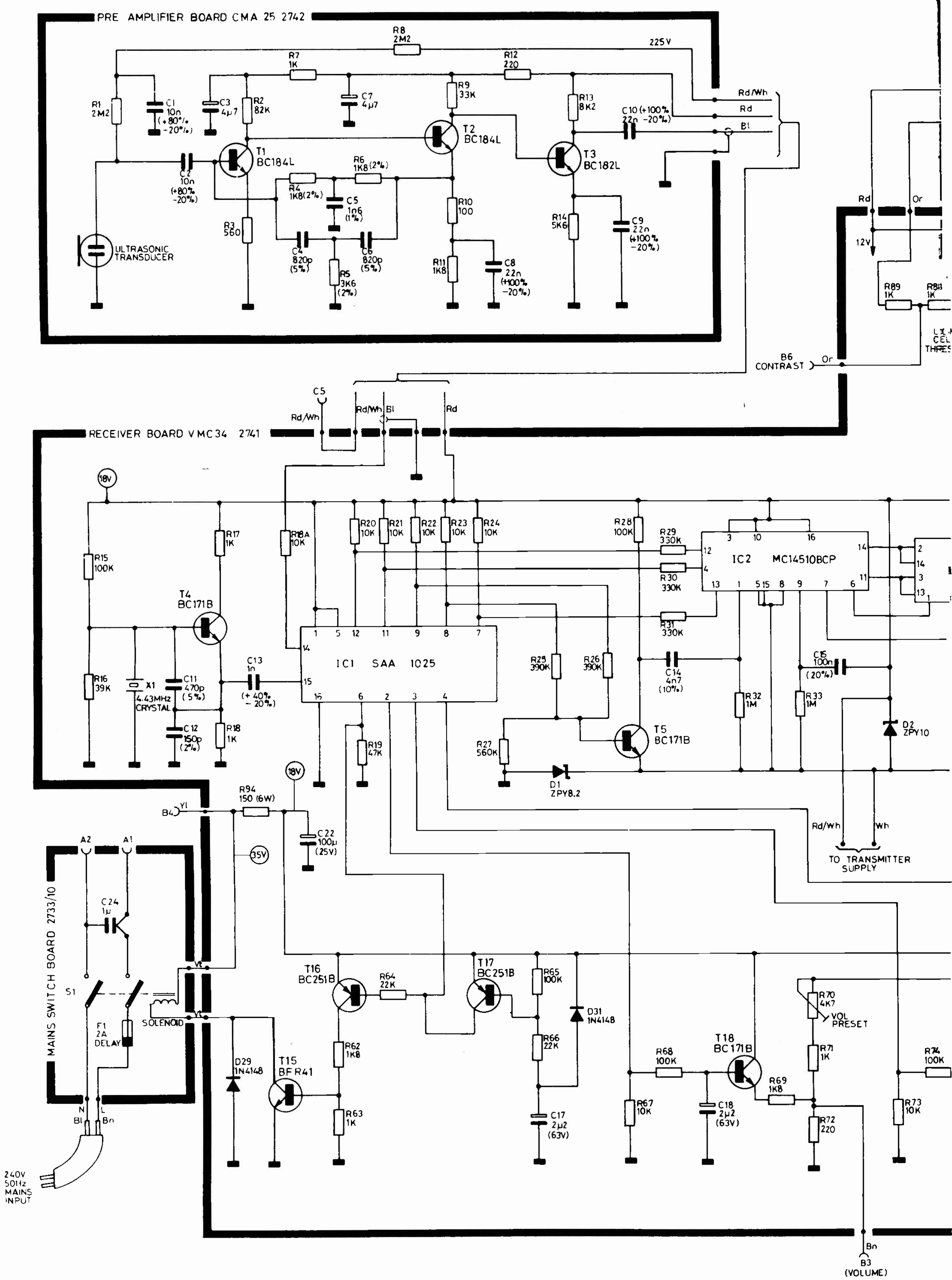
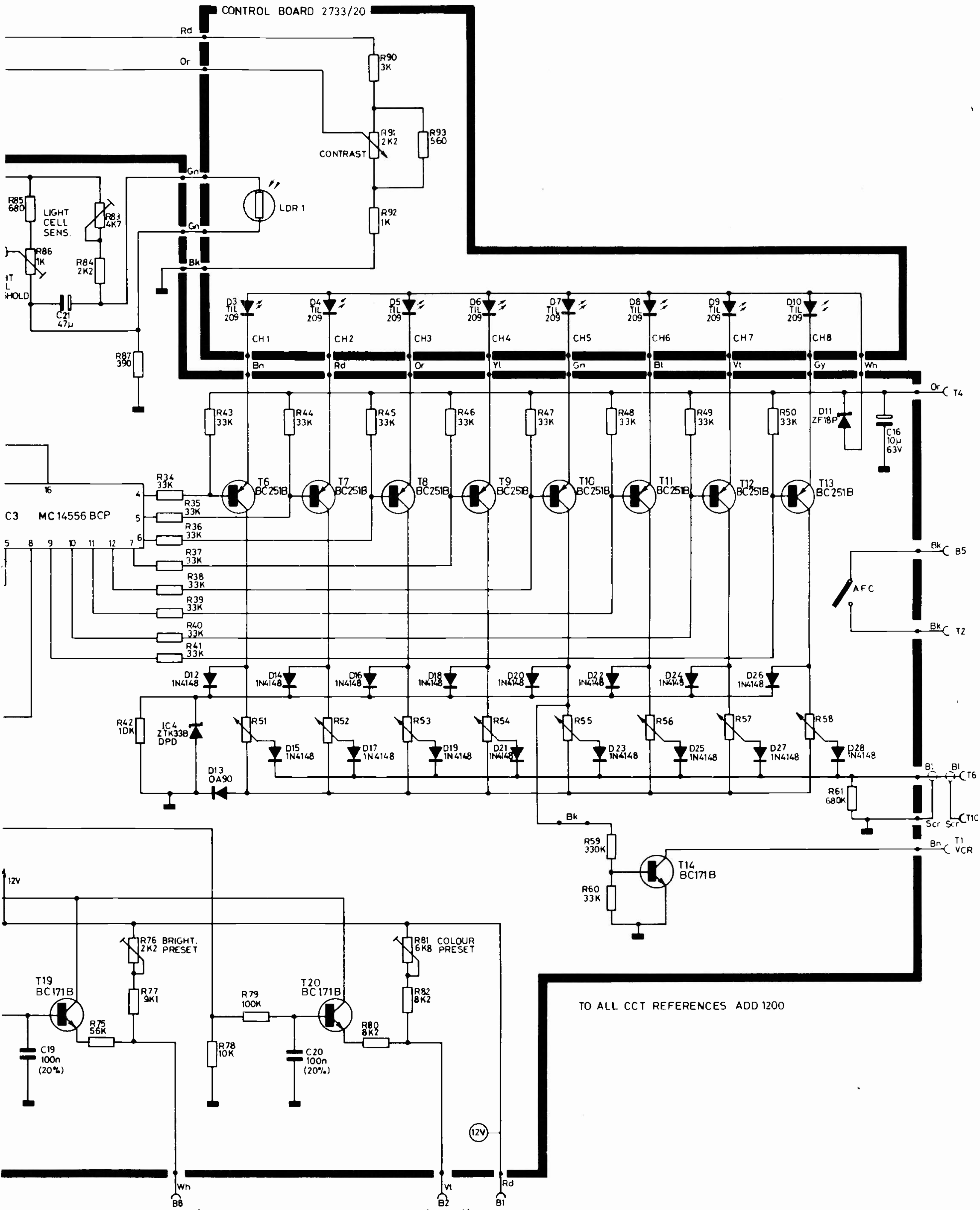


Fig. 5: Circuit of the ITT



receiver and control unit.

Adding AFC

A tuning drift problem solved

E. Trundle

LIKE all Japanese receivers, National Panasonic colour sets are most reliable and capable of very good performance. One recently came into the workshop however with the complaint that the tuning drifted. Soak testing confirmed that a degree of drift was indeed present on all channels, BBC-1 (channel 49 here) being the worst affected channel, with a quite noticeable sound/chroma beat after about forty minutes running. Tuning drift on the other channels was less severe, but bad enough to call for retuning.

The Problem

Perusal of the record sheet showed that the set had been fitted with an exchange tuner about a year before for the same trouble. We blew hot and cold on the tuner and the stabiliser i.c., using a hairdryer, but no concrete diagnosis emerged. The manual confirmed that no a.f.c. is employed in this model (TC85G), and we found that some other early models from the same stable were likewise innocent of any form of a.f.c. – the TC85H, TC42EU, TC42G and TC42H.

Solution: AFC

Another replacement tuner might have solved the problem, or perhaps the tuner control unit was wavering a little. One thing we were quite sure of: we have never seen any other commercial colour set that worked satisfactorily without a.f.c., especially where the ambient temperature varies widely. We then found that the later versions of these sets (with the suffix A) and all subsequent models had an updated "magic line" i.c. incorporating a.f.c., so thoughts were turned to modifying our set to use this device. A simpler alternative presented itself however when we remembered that the Pye hybrid colour chassis (697) has a similar arrangement of varicap tuner and discrete i.f. strip, along with a very effective a.f.c. circuit. In true Dr Christian Barnard style we found a suitable donor – a forlorn Ekco colour set with a flat tube and burnt line output transformer – and scrubbed up . . .

Circuit Used

The Pye circuit was adopted with very few modifications, the arrangement we used in the National Panasonic set being shown in Fig. 1. The components within the dotted line are all inside the discriminator can, which is available as a prealigned unit (see parts list). The circuit is powered from a convenient 24V line in the receiver, and is fed from the

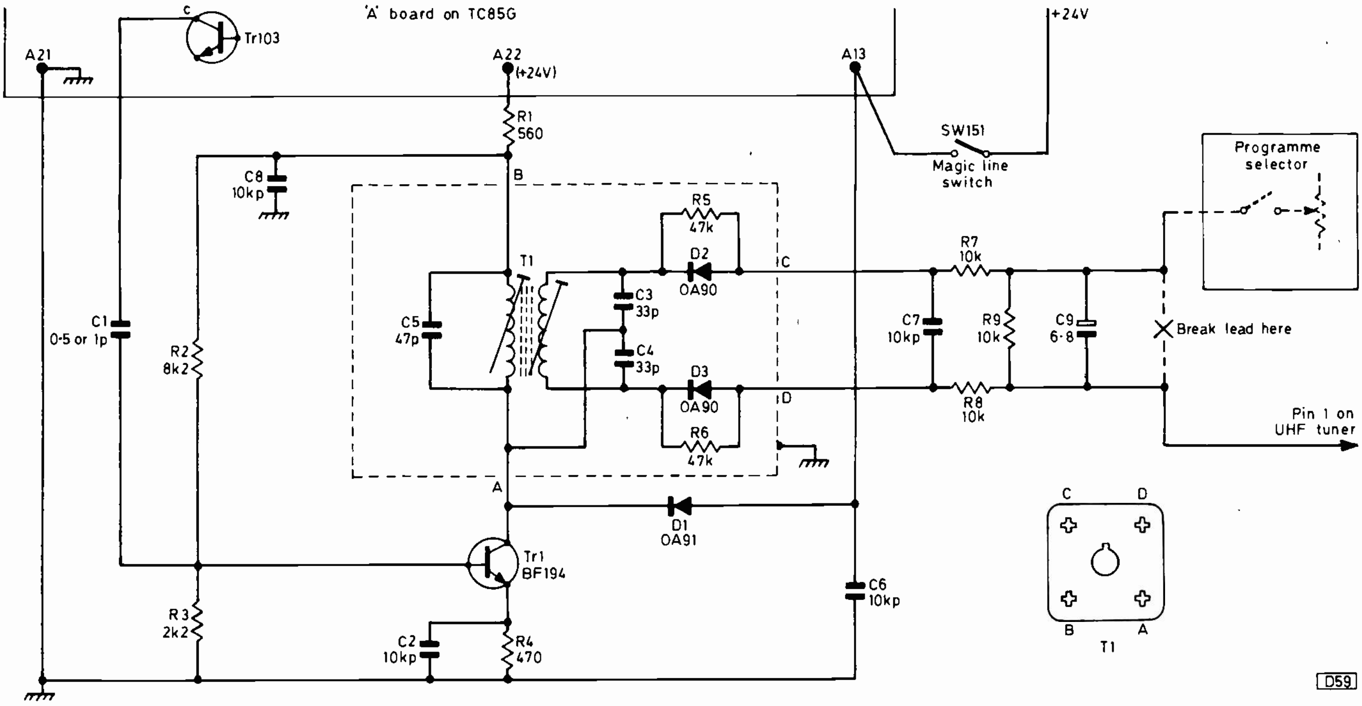


Fig. 1: The a.f.c. circuit and the connections to the National Panasonic Model TC85.

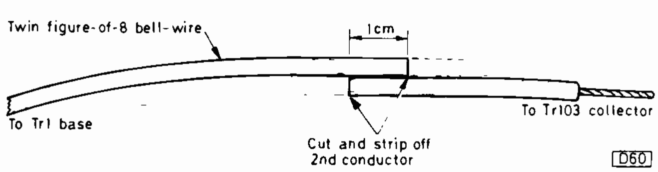


Fig. 2: Construction of the coupling capacitor C1 from a short length of bell wire.

final vision i.f. amplifier via a small capacitor (see Fig. 2) of 0·47pF or 1pF.

The d.c. output from the discriminator (zero volts when on tune) is applied to the tuner in series with the control voltage from the programme selector. The lead is easily found on the tuner, each pin of which is marked with its function. It's important that the correction voltage is properly polarised, otherwise the a.f.c. will pull the set off tune! This won't happen if the pinning diagram for the discriminator transformer (see Fig. 1) is followed.

For convenience, the "magic line" switch was arranged to switch out the new a.f.c. circuit so that the tuning can be preset exactly: the OA91 diode D1 deletes the signal at the collector of Tr1 when the 24V enabling potential appears at pin A13 of the A board.

★ *Components List*

C1	See Fig. 2	R1	560Ω
C2	0·01μF	R2	8·2kΩ
C6	0·01μF	R3	2·2kΩ
C7	0·01μF	R4	470Ω
C8	0·01μF	R7	10kΩ
	miniature ceramics	R8	10kΩ
C9	6·8μF or 10μF	R9	10kΩ
	25V electrolytic		½W film or carbon
Tr1	BF194		
D1	OA91		
T1	AFC discriminator assembly from the Pye 697 chassis – Philips Service part no. 218·27157.		

Construction

Engineers' time in a dealer's workshop comes dear, so we bird's-nested the components around the disciminator can and soldered the resulting christmas tree to the top of the i.f. panel – not very pretty, but the job took only a couple of hours from conception to completion. No doubt a little more love would have resulted in a neater job, but however it's done there are two important points regarding the wiring – keep the leads between the unit and the tuner short and as direct as possible in order to avoid hum pick-up, and mount the coupling capacitor C1 as close as possible to Tr103 in the large screening can on the A board. We soldered the capacitor direct to the collector lead-out and anchored the other end to a stand-off tag soldered to the inside wall of the screening can.

Results

With the value of R9 selected, the modification worked beautifully, pulling in the tuning from no colour at one extreme to almost complete break-up at the other. Although the discriminator transformer is prealigned, a slight tweak of the *top* core with a hexagonal plastic tool may be necessary to set the correct tuning point.

There is no reason why the arrangement should not work in any other receiver which lacks an effective a.f.c. circuit, but in all conscience we can't think of any such set which also incorporates varicap tuning!

In conclusion it has to be said that the TC85G and the other models mentioned are not unduly prone to tuning drift, so if excessive drift is encountered the chances are that the tuner, the stabiliser i.c. or the station selector unit is defective, in which case the a.f.c. may not be able to cope. This also applies of course to any other candidate for modification, so try to prove that the trouble stems from thermal drift before putting solder to iron. ■

Service Notebook

G. R. Wilding

Rapid Fault Diagnosis

Although most service work is relatively straightforward, the time required for diagnosis of even the simplest breakdowns can often be reduced by observing all symptoms and using simple tests to prove whether suspect components or stages are working normally. Take for example a Pye hybrid colour set which came our way recently. The raster had suddenly vanished, leaving the sound unaffected.

This could be due to many things of course. For example: failure of the PL802 luminance output pentode to pass anode current, thus leaving the c.r.t. cathodes at a high positive voltage so that the tube is cut off; or lack of e.h.t. due to a defective PL509 line output valve, or its screen grid feed resistor being open-circuit, or the PY500A boost diode, PCF802 line oscillator, line output transformer or tripler being defective; or one of the many components which determine the c.r.t. first anode or grid voltages being at fault.

On removing the back we found that the PL509 and PY500A were running hotter than normally, though neither of the anodes was glowing. As only the slightest suggestion of a spark could be obtained at the anode of the PL509 however the cause of the absent raster was clearly no e.h.t. Both valves were probably o.k., and as the PL509 was hot its screen grid feed resistor was obviously intact. The most common trouble with PY500As is heater-cathode leakage, but this always results in the anode glowing red after a few minutes, prior to the fuse blowing.

On these Pye sets the boost filter resistor R227 frequently falls in value, placing the associated filter capacitor C224 across the transformer and chassis. This damps the line output stage and removes the e.h.t. But the resistor's appearance was normal, so this area could be ruled out. The PCF802 could not have stopped oscillating, or the PL509 anode would be glowing, so the two main possibilities were shorting turns in the line output transformer or a defective e.h.t. tripler – scan coil failure is another but much less common possibility.

The fact that there was a slight spark at the anode of the PL509 suggested that line drive was present but that the line output transformer was being excessively loaded. Checking for normal negative voltage at the PL509 control grid would confirm the diagnosis at this point.

On very rare occasions your can get a short or a heavy leak from the tube's final anode to an internal earthed point. So the next move, since this entailed no unsoldering, was to remove the anode cap connector and leave it suspended well away from other components and metal work. No corona developed on switching on again, confirming the absence of e.h.t. The next step was to check the pulse feed from the transformer to the tripler. On this chassis it's from an anti-corona soldering point on the transformer, and it's both awkward and time consuming to disconnect this. You could snip the lead off at the transformer, but if the tripler then turns out to be o.k. you have to remake the connection with a lead that was initially only just long enough. Easier to feel the outer casing of the tripler, checking for excessive temperature – especially hot spots.

The casing turned out to be really warm at one particular point, clearly indicating an internal failure. Tripler failure is often accompanied by a characteristic odour of course, but in many cases this isn't evident until the unit is removed and held close to the nose. It's worth mentioning here that line output transformers in colour receivers tend to break down in a positively identifiable manner, i.e. arcing across from one winding to another, from one winding to the frame, or developing a short from a live point to the frame and thus chassis. The impaired insulation or shorted turns common with oldish monochrome receivers are less often encountered. When they do arise, defects tend to quickly cause complete breakdown, probably due to the higher operating voltages.

Now what would have been the quickest course in diagnosing the lack of raster had the e.h.t. been present? Assuming that the tube heater is alight, there would have to be incorrect voltages at either the c.r.t. cathodes, grids or first anodes. It's quickest to look first, and check with the meter after. These sets use colour-difference drive, so the first action should be to check the operating temperature of the PL802 luminance output pentode which drives the c.r.t. cathodes. If it's cool, the screen grid or the cathode resistor could be open-circuit, the blanking transistor in series with the cathode could be non-conductive, or there could be excessive negative bias at the control grid from the brilliance control/beam limiter circuit. If in doubt, measure the anode voltage and check that it varies to an adequate extent as the brightness control is rotated from one extreme to the other. If the valve is at its usual temperature however the stage can be assumed to be operating normally.

So that would leave the grids and first anodes. A fault in the first anode supply in these sets would, as previously mentioned, remove the e.h.t. (i.e. R227 or C224 defective). If the first anode supply is suspected in other receivers, short the grid and cathode base connections of any gun to see whether this results in a full, unmodulated output from that gun, i.e. either an all red, all blue or all green raster. If you get any of these the first anode supply is in order.

That leaves the grids. In these Pye receivers there will be inadequate tube grid voltages if either of two wire-wound resistors on the colour-difference amplifier panel goes open-circuit. These are R389 which feeds the screen grids of the colour-difference output pentodes, or R393 which feeds the cathodes of the clamp triodes. Since they are connected in series, if either goes open-circuit the triode cathode voltages will be very low instead of 107V. Finger tip checking will quickly show whether either resistor is open-circuit, but bear in mind that R393 won't be as hot as usual if R389 is open-circuit.

If you know the circuit, or study it beforehand, the many possible causes of basic faults can be whittled down quickly without unnecessary valve changing, lead unsoldering, plug removal or even meter tests. The essence of rapid fault diagnosis is to eliminate all unnecessary actions!

Defective Transformer: Thorn 3000 Chassis

The problem with a Thorn colour set fitted with the 3000 chassis was no results, due to both the mains input fuse and the overload cutout being open-circuit. The other fuses were intact, so we decided to remove the plug connecting the degaussing circuit and make a resistance check across the primary winding of the mains transformer. A reading of about 25Ω was obtained, but unfortunately the manual doesn't quote the correct figure. On replacing the cutout and mains fuse, but leaving the degaussing circuit disconnected, the fuse blew immediately on switching the set on. Suspicion centred on the mains transformer therefore and a check was made on the primary winding resistance of another, working set with this chassis. A reading of almost 35Ω was obtained, so it seemed that there was a partial short-circuit across the primary winding of the faulty set. No further trouble was experienced after obtaining and fitting a replacement transformer.

Wavering Picture: Pye 697 Chassis

The picture on a set fitted with the Pye 697 hybrid colour chassis would waver and jump in a horizontal direction, suggesting poor slider/track contact in the line hold control. This control, which is rarely moved in these sets, was found to be perfect however (if readjustment of the line hold is required it's usually done by setting the potentiometer midway and then adjusting the line oscillator coil slug for optimum lock).

Next suspect was the flywheel sync circuit. The discriminator diodes were both perfect however, as was the pulse feedback resistor R203 which so often in these sets falls in value to cause line sync problems. The 1μF electrolytic providing feedback between the triode and pentode cathodes of the PCF802 line oscillator valve was next changed, since it's been known to give trouble in the past, but the effect persisted. Changing the other two electrolytics in the line oscillator circuit gave some improvement, but it wasn't until we changed the oscillator feedback capacitor C211 (320pF) that the fault cleared completely.

Field Collapse: Thorn 1600 Chassis

Twice recently we've come across 17in. monochrome portables fitted with the early version of the Thorn 1600 chassis and with the same fault – no field output. A pair of BC147 transistors form the field oscillator, followed by an SN76033N i.c. as the field amplifier/output stage. The field output appears at pin 6, and is coupled to the field scan coils by a 1,000μF electrolytic (see Fig. 1). The earthy end of the scan coils is taken to chassis via a 1Ω resistor which provides a feedback waveform. The voltage at pin 6 should be 16·5V, but in both cases it was zero and a resistance check revealed an almost dead short to chassis. It was simplest to check the electrolytic first, but this proved to be perfect, the short-circuit being within the i.c.

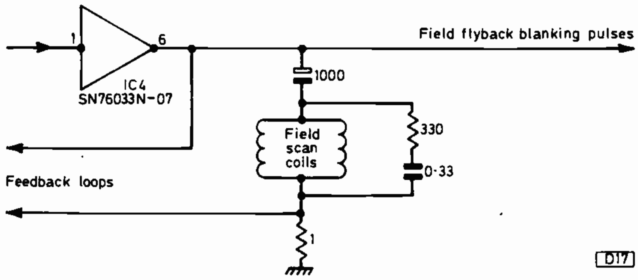


Fig. 1: Field scan coil circuit, Thorn 1600 chassis (early version).

In one of the sets the width was found to be excessive after the i.c. was replaced, and a check showed that the 32V rail, which is derived from the line output stage, was well above this figure. The voltage is set by R149 which should not normally require adjustment. If misadjustment is suspected, adjust it for 140V between the junction R158/C130 and the cathode of W34, with the negative meter lead to W34's cathode (use a 20kΩ/V meter on the 250V range and turn the brightness, contrast and volume controls to minimum). The height can then be adjusted by means of R95 and the width by means of L23.

In later versions of the chassis a CAH76023N i.c. is used in the field output stage, along with a switching transistor. In the most recent versions the field output i.c. and its associated circuitry are replaced by a field output module with a driver i.c. and a complementary symmetry pair of output transistors.

Cumulative Effects

Sometimes the fault symptoms present seem to point to one major defect when in reality they are due to two or more cumulative causes. Take the dual-standard monochrome set fitted with the Thorn 1400 chassis we were called to see recently for example. The trouble was good sound but a very weak picture. The set was used on 625-lines only, and the absence of grain on the screen indicated that the aerial input was adequate. Now a common cause of low u.h.f. gain on this chassis is when R7, the high-value resistor between the slider of the contrast control and the a.g.c. line, goes high in value so that the negative a.g.c. voltage can't be offset and the set's sensitivity becomes low. A quick test of this possibility is to short the a.g.c. rail end of R7 to chassis with the contrast control fully advanced and a strong signal being received: if this action increases the gain, R7 can be considered open-circuit or high-resistance. In the set concerned however R7 turned out to be o.k. Since these sets are now mostly quite old the next step was to ensure that the valves were in order. Replacing the EF183 first i.f. amplifier valve produced negligible improvement, but when the 30FL14 second i.f. amplifier was changed there was a real transformation. On then changing the v.h.f. tuner valves – they're used as i.f. preamplifiers on u.h.f. – really good contrast was obtained.

When a set has low gain so that the brightness control has to be advanced too far, the impression can be given that the c.r.t. is past its best: always make sure therefore that all signal amplifiers are up to scratch.

Blown HT Fuse: Pye 731 Chassis

No results in a solid-state Pye colour receiver fitted with the 731 chassis was found to be due to the 1A fuse in the h.t. feed to the line output stage having blown. There could be several reasons for this of course: a short-circuit BU108 line output transistor; breakdown in the insulation between the primary of the line output transformer and the core or an earthed secondary winding; or excessive line output transformer loading due to a short-circuit rectifier diode or capacitor. Ohmmeter checks revealed that the transformer and the transistor were in order, so we decided to check the large 1·25kV capacitor mounted above the transformer. This is C563, and is connected at the earthy end of the e.h.t. overwinding to act as a reservoir for the c.r.t. first anode supply (hence its high working voltage). It turned out to be a dead short-circuit.

A Simple UHF Modulator
to CCIR Standard

David K. Matthewson, B.Sc.

VARIOUS inexpensive u.h.f. modulators (Crofton, Maplin, etc.) are available to the amateur, and there is also the option of converting a u.h.f. tuner (see *Television* April 1975). Although these approaches can be cheap and effective there are various drawbacks, such as indifferent handling of colour signals and inability to modulate the sound as well as the vision signals. Agreed, if only one TV set is being used this is not too great a problem, but if either several sets are being used (as in a small CCTV distribution system) or the modulator and set are separated by a long distance then modulation of both the sound and vision is required.

We required a modulator which, when running through a suitable u.h.f. amplifier, would be capable of driving five colour sets (some of which were rental ones and thus could not be interfered with in any way) spread over several hundred metres as part of a colour CCTV and MATV distribution circuit. Various manufacturers, for example Sony and Aston, manufacture suitable sound and vision modulators, but these were considered too expensive. A home built solution was required therefore.

We use Philips VCRs a lot, and after a bit of thought it was decided to build a modulator around the Philips VCR modulator, a "black box" functional unit available from Philips Service (type U10, part number 4822 – 216 – 90422, at about £15 trade). The circuit is shown in Fig. 1. The unit's housed in a small alloy box, about 10 × 6 × 3cm, and requires a composite PAL (or monochrome) video input of about 1V p-p, an audio signal of about 0dBm (0·775V), and a d.c. supply of 12V at about 3VA. The only "oddity" about the unit is the need of a d.c. voltage (about 3V) at the video in (P) terminal. The modulator gives a u.h.f. signal on channel 37 (600MHz) of about 3mV into 75Ω.

Construction

Construction is very straightforward, neither the layout nor the component positions being critical. We built the modulator into a pressed steel box, about 20 × 6 × 10cm, but any suitable metal case would suffice. The design really breaks down into three parts, and each may be modified to suit a particular application.

First there's the power supply – ours is very simple, providing 12V and the d.c. bias for the video input to the modulator.

Next's there's the filter network. This is designed to adjust the group delay of the video signal to the CCIR transmission standard, but is not essential for general use. The two coils are identical and available (to the trade) from Philips Service (part number 4822 – 156 – 10409) at about £1.

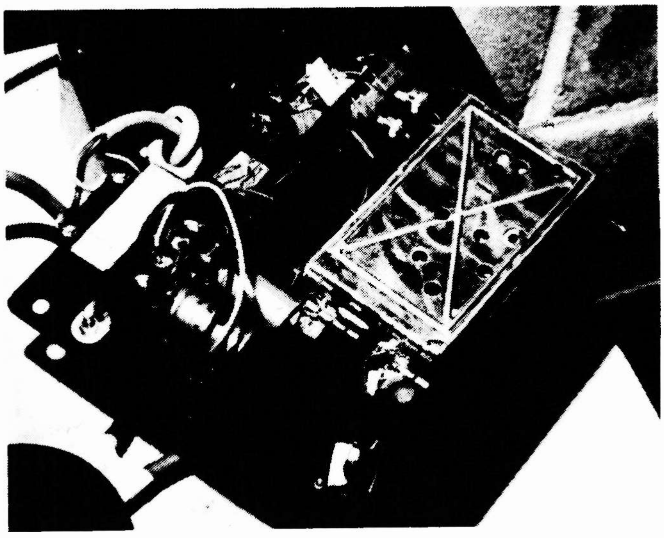
Finally, there's the modulator itself. Little needs to be said about this but ensure that the alloy case is securely earthed and that the output lead (75Ω cable) from the modulator to the socket is as short as possible.

The power supply and the filter can be assembled on veroboard or terminal board and bolted, along with the transformer and modulator, to the lid of the box. Input and output connectors are fitted as required – we used a Belling-Lee output socket, PL259 u.h.f. input connector and a mono-audio-jack socket. A balanced line transformer could be also used if required.

Setting Up

Once the assembly is completed and checked, apply a video signal and an audio signal, connect the modulator to a TV set, and apply mains power. Tune the TV set to about channel 37, and, with luck, the vision will appear. Don't be put off if no sound is present, as the final tuning of the modulator can be a bit tricky.

Adjust C453 inwards to decrease the modulator frequency until the TV set is receiving the upper sideband of the double-sideband signal, bearing in mind that channels 32-42 are the extreme limits of adjustment. If retuning covers more than one channel, R466 and C438 must be readjusted. This is best done with the aid of a grey scale/colour bar generator, although this is not essential. Adjust R466 to make the bar on the left of the screen as



Internal view of the completed unit.

★ Components list

Capacitors:

C1-3	10,000μF, 25V
C4	4·7μF, 16V
C5-6	330pF
C7-8	47pF
C9	47μF, 16V

Resistors:

R1	220Ω
R2	6·8MΩ
R3	22kΩ*
R4	3·3kΩ*
R5	1kΩ

*To give 2·9kΩ

Miscellaneous:

T1	12V 6VA RS type 196-303
U10	Philips 4822 – 216 – 90422 modulator unit
L1-4	Philips 4822 – 156 – 10409 coils (two required)
D1-2	1N4001 (50V 1A)
Z1	BZY88C3V9 400mW

Belling-Lee coaxial connectors or similar
Audio jack or XLR to taste

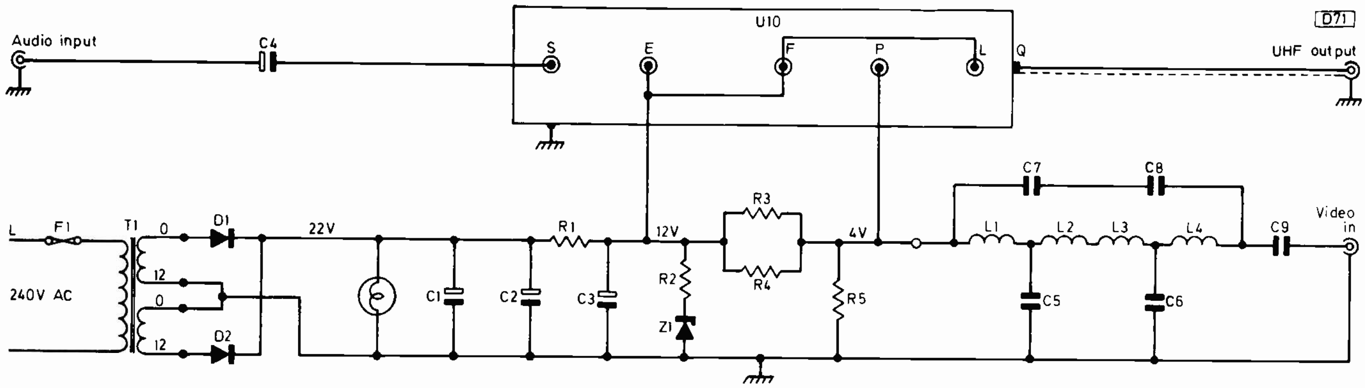


Fig. 1: Circuit diagram. The polarity of C9 depends on the source. F1 is 250mA (anti-surge).

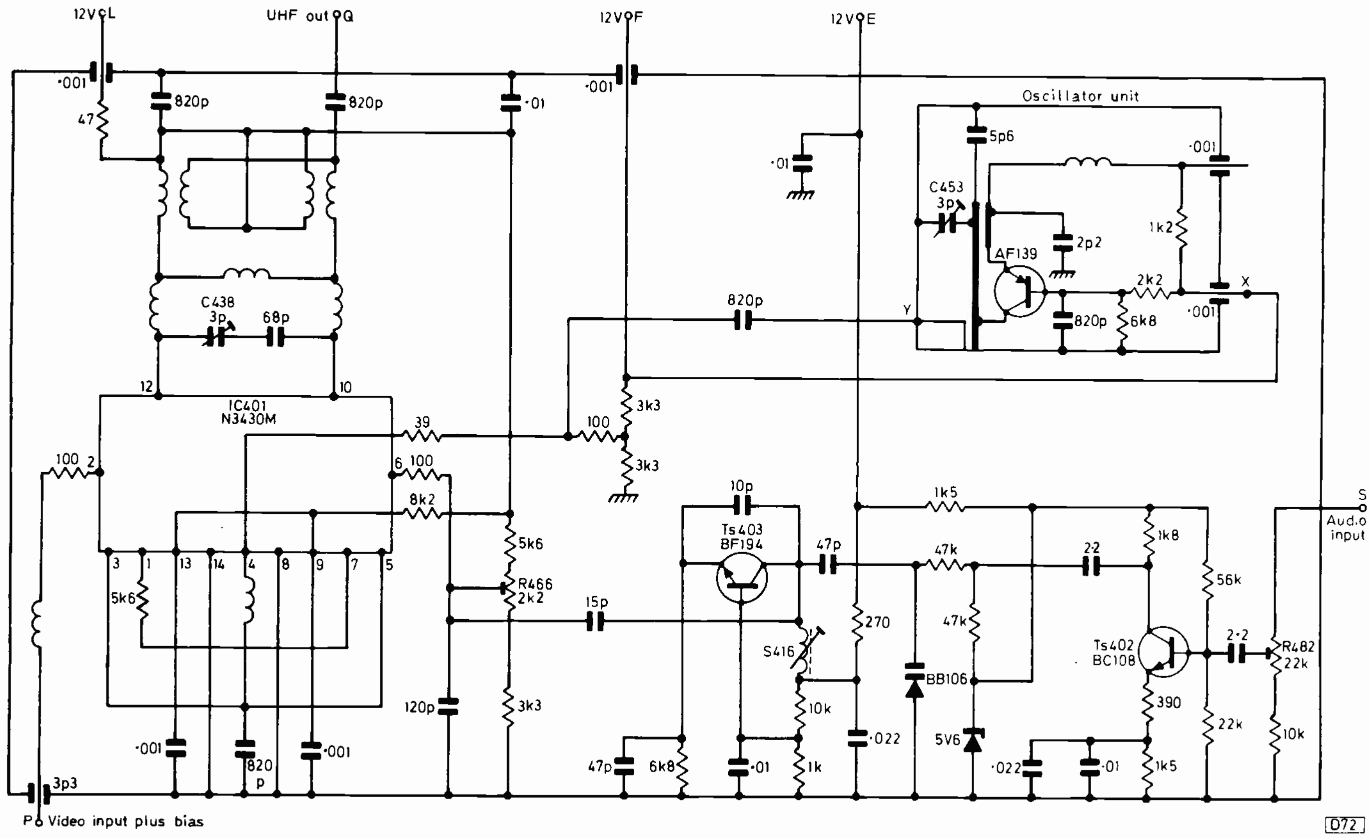


Fig. 2: Internal circuit of the U10 modulator unit.

bright as possible, then adjust C438 to obtain the same results. Turn R466 so that the contrast is slightly reduced. Turn the set volume up fully and adjust C438 for minimum sound interference (intercarrier buzz). This should result in perfect sound and vision.

Modulator Operation

The modulator consists of three sections: (1) A 6MHz oscillator for generating the sound carrier. (2) A tuneable u.h.f. oscillator. (3) A modulator circuit to modulate and mix the signal from the u.h.f. oscillator with the 6MHz sound signal and the composite video signal.

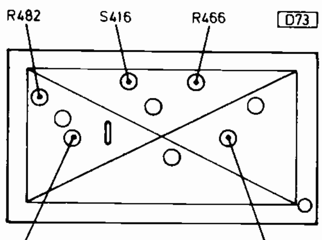


Fig. 3: Top view of the modulator, showing the positions of the adjustable components.

The audio signal is applied to point S of the modulator. This in turn frequency modulates the 6MHz oscillator. The composite PAL video signal is applied to point P. The output is a double-sideband signal, of about 3mV at 75Ω, and is tuneable between channels 32-42.

When the modulator is placed into its box the frequency may alter slightly. If this occurs and is of importance, small holes could be drilled in the outer case to enable tuning to be carried out on the finished unit.

Footnote

An interesting i.c. which promises another solution to this problem should by now be available. The National LM1889 is an 18-pin DIL chip which combines a composite video signal, chroma and audio to produce two r.f. outputs, one on ch.3 at 61·25MHz and the other on ch.4 at 67·25MHz. It can also be used to combine the luminance and syncs with the chroma to produce an encoded output (NTSC only, unfortunately). The chip is designed primarily for use with some TV game chips. Hopefully a PAL version will become available. ■

LONG-DISTANCE TELEVISION

ROGER BUNNEY

NOVEMBER this year has been singularly uneventful – at least so far as television reception is concerned. The midmonth Leonids Meteor Shower didn't prove exactly exciting, with the exception of the early morning periods of the 18th and 19th which gave excellent signal pings from Central and Eastern Europe. Sporadic E was noted on the 9th, from 0930, with signals from the USSR – both TSS-1 and TSS-2 as floaters. Towards the end of the month (26th 1800-1900) there was a reasonable Sporadic E opening with reception from RTVE (Spain) on several channels.

With the help of Ron Ham's Hallicrafters v.h.f. receiver I've been able to monitor the low v.h.f. spectrum – with a view to signs of possible F2 reception. On the 5th and 6th the m.u.f. reached 35.22MHz with various tone signals: one signal at 35·5MHz was noted. Unfortunately the m.u.f. plunged towards the end of the month. An unusual reception occurred on the 27th: at 0900, with high-level foreign (suspected Russian) voices, over the 48-50MHz spectrum – this faded abruptly some 15 minutes later.

On November 12th I visited Hugh Cocks in South Devon. This visit followed an extremely unsettled spell of weather, with very high winds over the whole country. A number of DX enthusiasts have reported severe damage due to the storm force winds – David Martin, Garry Smith and George Ridgwell all suffered damage to their installations, but possibly the worst report came from Chris Haig Harrison (Christchurch) whose 20ft. mast, carrying a high-gain u.h.f. array, crashed down together with the chimney stack, damaging the roof and internal structure. Hugh's new mast was still standing however, and most impressive it looks high on the hill.

A slight digression on the subject of foreign voices. On November 26th the Hannington (ch. E42) Southern Television transmitter that reradiates the main Rowridge transmissions (ch. E27) carried a rather unusual signal. During the local news broadcast, the programme was marred by a voice (and musical effects) suggesting that it came from an outer galaxy and warning the population of impending doom! The result – apart from national news publicity – caused many viewers to ring the police and the broadcaster. It seems that the extra "material" entered the transmitter from a low-powered transmitter operating near the Hannington mast on ch. E27. Since the system normally receives Rowridge on ch. E27 it obviously reacted quite normally to the alternative (and probably much stronger) local signal source!

Alan Gamble (20 Douglas Drive, Ormskirk, Lancs) has offered a Bush TV125 to any aspiring DX enthusiast who would care to collect it.

For the record, I am making a collection of the ATS Indian satellite receptions in the UK as shown by enthusiasts' photographs. If anyone wishes to assist, please send in a photograph together with information on the receiving "set-up" used.

I understand that a further run of the "*World wide guide to Test Cards*" by Keith Hamer and Garry Smith has been printed. These are still available at the old price (£1.30 inclusive of postage) from HS Publications, 7 Epping Close, Mackworth Estate, Derby DE3 4HR.

Reception from Rhodesia

We can now confirm that Hugh Cocks' reception on August 17th was from Gwelo, Rhodesia! Confirmation comes from Chris Ellison at Derby – two of his Rhodesian friends report that on Wednesdays Rhodesian TV broadcasts a quiz programme at 2030 local time (+2 hours GMT), sponsored by the National Food Company. Apparently Spanish TV had been received quite regularly in Rhodesia in the early 60s, prior to the start of Rhodesian TV. The Gwelo transmitter was installed by Philips, and the original unit is still probably in operation. The checkerboard pattern and a card not unlike the RETMA one are used. Breakdowns are common due to the shortage of spares, but there's a thriving domestic TV industry with two or three companies building receivers from mainly Japanese components.

From our Correspondents . . .

Following our mention of the Barco multistandard TV receiver we have heard from S. Solano who recently returned from employment in Saudi Arabia where he serviced these receivers. The Riyadh, Dharan and Jeddah transmitters are now using SECAM, but with variable tolerances – not PAL as we suggested in the November column. Transmissions start at approximately 1600 local time with cartoons, and continue with prayers and singing programmes (with at least one breakdown nightly) until midnight.

Gosta Van der Linden writes that Xandir Malta (Tele Malta Corporation) is transmitting on ch. E10 with 4·8kW e.r.p. and ch. E21 with 3·2kW e.r.p., using system B. The test card is transmitted from 0730-1130 and 1530-1700, when programmes commence until 2230 – all times GMT. The test card is similar to the EBU bar but with colour bars at the bottom and the station identification across the centre.

Ryn Muntjewerff tells us that troposopheric reception on October 18th included some really excellent signals, with TSS (Russia) on chs. R10 and 11, Pajola YLE (Finland) ch. E34 at 1820kms (a record I suspect), TVP (Poland) on chs. R22, 25, 29 and 35, and CST-2 (Czechoslovakia) on chs. R31, 33, 35, 36, 38. Our congratulations.

The GBR TV test pattern, Rome channels E33 and E47 – one of the Italian "Free" TV stations.

Robert Copeman (Sydney, NSW) points out that the sunspot maximum and the Jupiter Effect (?) both occur in 1982, which could well result in a good year for high m.u.f.s and hence TV DX. The next peak will be in 1993. The Australian Sporadic E season should be in full swing now.

Following my comments on coverage of the low v.h.f. band Cliff Dykes suggests using the government surplus unit R308 (a later version of the R208). It works well to 100MHz, with coverage over 19-145MHz. The Hallicrafters S27 receiver also gives good v.h.f. coverage, though it's an elderly unit. Denco (Clacton) Ltd. make a series of coils for v.h.f. coverage, up to 78MHz. Details are available in their booklet DTB-1, which is available at 34p + 15p postage from 357-9 Old Road, Clacton-on-Sea, Essex.

Italian "Free" TV Stations

The increase in the number of "free" TV stations has been explosive. Although most of these operate at u.h.f. several fortunately operate at v.h.f. with a few in Band I – ideal for summertime Sporadic E! Thanks to Michele Dolci (Bergamo), we can now list the ch. IA and IB transmitters. The powers are not known but are certainly well under 1kW e.r.p.

Ch. IA: Nord Center Television (Udine, Tre Venezie).

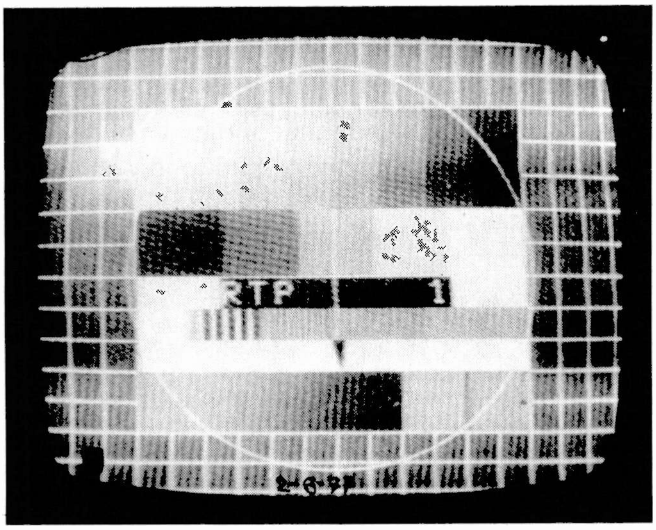
Ch. IB: Tele Marsica (Avezzano, Abruzzo e Molise), Tele Ciociaria (Cassino, Lazio), Tele Bari (Bari, Puglia e Basilicata), Video Fata Morgana (Reggio Calabria, Calabria), Radio Tele Oristano, (Oristano, Sardegna), To Sardegna (Sassari, Sardegna), TVC 4 Mori (Cagliari, Sardegna).

It's interesting to note that the names of the TV stations do not always follow the town names or locations – examples are Tele Gluck, Tele Jolly and Tele Fantasy! We are including the test pattern of station GBR Radio Televisione, Rome: GBR apparently stands for Green, Blue and Red!

News Items

Holland: Following our recent report that the Lopik ch. E4 NOS-1 transmitter is to stay in operation, we hear that a new transmitter is to be installed towards the end of 1978.

Belgium: Peter Vaarkamp writes that BRT-2 now operates from Tuesday-Friday inclusive at 2015 to close; RTB-2 operates from Monday-Thursday inclusive at 1845-close.



The Fubk test pattern used by RTP (Portugal), ch. E3. Photo courtesy Ryn Muntjewerff.

France: Breton nationalists have destroyed a microwave link station at Pre-en-Bail, W. France, removing the network TV to Normandy and Brittany from 23-25th October. Caen ch. F2 was off the air during this period.

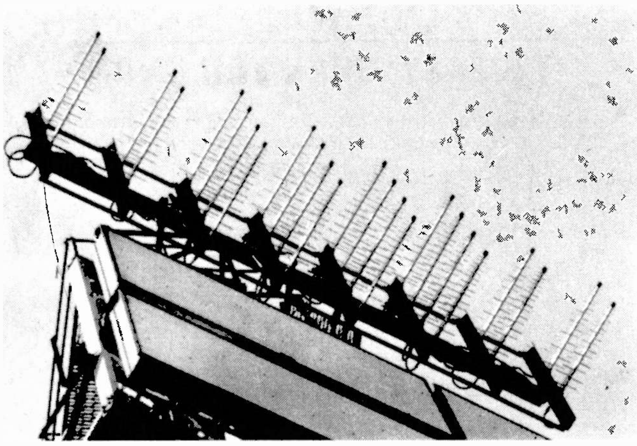
Spain: The RTVE network is being expanded to bring the RTVE-2 coverage to the whole country – previously only 70% of the population has been able to receive the network. Fifteen new transmitters have come into operation during 1977, increasing the coverage to 90% and leaving only seven provinces without the RTVE-2 programme – this includes Las Palmas and Teneriffe, Canaries. It's hoped that complete national coverage will be achieved by the end of 1978. At the present time 60% of the transmissions are in PAL colour. Some RTVE-2 programmes may be sponsored.

France: Thomson CSF are to supply 76 new u.h.f. transmitters for the TF1 network (colour). The powers range from 4-50kW.

Gibraltar: Link Electronics are to equip the studio and presentation areas with PAL colour equipment, together with a new transmitter and translator. It's hoped that test transmissions will start shortly with a view to the service commencing towards the end of 1978.

South Korea: The Korean Broadcasting System (KBS) is venturing into colour, with RCA supplying equipment for a new broadcasting centre at Seoul.

USA: Construction of the tallest tower (and possibly the tallest structure) in the world, at the transmission site of WSFA-TV (ch. A12), Montgomery, Alabama is well advanced. The tower will be 1935ft above ground level and 481ft higher than the Sear's building in Chicago. New transmitters and the extra height will increase the coverage to 20,000 square miles.



The receiving array used by the BBC in the Channel Islands for the cross-channel link: there are 24 log-periodic aerials.

Radio Telefis Eireann, Dublin 4, Eire have sent us a copy of their 1977 Handbook, which includes the 1976 Annual Report. It contains useful information, including maps, on the transmissions, services and aims of RTE Broadcasting Service. Considerable information is given on the various "home grown" programmes and on the future plans for the network. The 104 page book is available from RTE Publications Office, 1st. Admin. Block, RTE, Dublin 4, Eire at £2.00 post paid.

New EBU Listings

West Germany: Ostfriesland/Aurich ZDF ch. E33 e.r.p. reduced from 410kW to 220kW.

Egypt: Several new Band III transmitters have come into operation, including El Minya ch. E5 160kW e.r.p.

Spain: La Musara RTVE-2 ch. E57 01E03 41N15 395kW e.r.p. (horizontal).

Israel: Tel Aviv ch. E27 2000kW e.r.p. (horizontal).

Meteor Shower Reception

Keith Hamer has sent us the 1978 dates for the more favourable meteor showers:

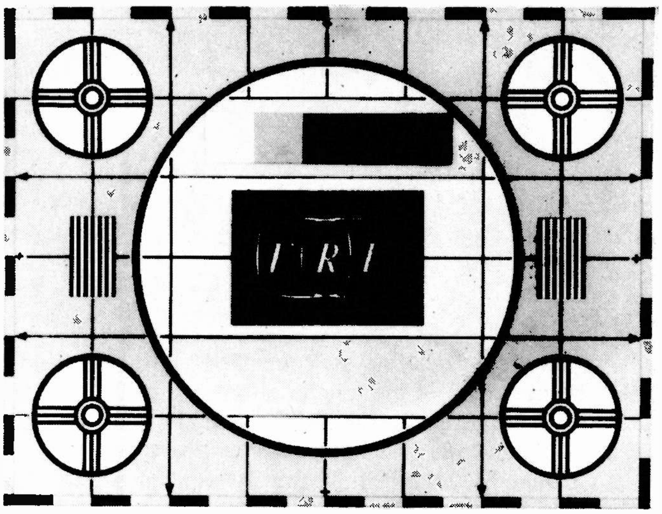
Quadrantids	January 1st-6th, peaking on the 3rd at 2200.
April Lyrids	April 19-24th peaking April 21st at 2200.
May Aquarids	May 1st-8th peaking May 5th.
June Lyrids	June 10-21st peaking June 16th.
July Aquarids	July 15th-August 15th peaking July 27-28th.
Perseids	July 25th-August 18th peaking August 12th at 1000.
Orionids	October 16-26th peaking October 21st.
Taurids	October 20th-November 30th peaking November 8th.
Cepheids	November 7-11th peaking November 9th.
Leonids	November 15-19th peaking November 17th at 1300.
Geminids	December 7-15th peaking December 14th at 0700.
Ursids	December 17-24th peaking December 22nd.

All times are GMT.

Meteor Scatter/Shower Reception

Meteor scatter (MS) reception enables long-distance signals to be received on a daily basis throughout the year. These signals, from the E layer (some 70 miles above the earth), are of short duration and much weaker than Sp. E ones, but make some reception possible at times when there's nothing else about in the way of long-distance TV signals. As a meteorite burns up, it leaves a tail of ionisation, and it's this that makes signal reflection possible. Such burns occur throughout the twenty-four hour period, but are random. Burns during the early morning period tend to be stronger, due to the earth's rotational position relative to the oncoming meteors. Meteor showers on the other hand are predictable and can provide quite spectacular reception (see list for 1978 above).

MS signals usually occur in Band I, occasionally in Band



The new test pattern used by the Hellenic Broadcasting Corporation (Greece). The initials ERT stand for Elliniki Radio-fonio-Tileorassis.

III, and the skip distance is generally 600-1300 miles. Shorter skip signals are sometimes received, but care needs to be taken in identifying them since high flying aircraft can give similar affects. A meteor entering the atmosphere at high speed will burn up sooner, i.e. higher, and in consequence can give reception over a greater skip distance than a slower meteor burning out at a lower height. It's very common for a meteor to reflect several signals as it burns out. Another common effect is for a higher frequency signal to be received first (say ch. E4) then a few seconds later a lower frequency one (E2). With improvements in v.h.f. and u.h.f. amplifiers it's becoming common, given an efficient aerial, to receive Band III signals via MS over distances similar to Band I.

The aerial for Band I needs to be efficient, and obviously the higher the gain the better. The number of signals received may fall however if the array has too sharp a forward pickup lobe. From experience I have found that for Band I use an H or three-element array, horizontally mounted, will give good results. Due to the angle of the incident signal the array need not be high – heights up to 25ft seem to work well, but care must be taken to avoid local screening. Band III reception requires high gain since any incident signal tends to be much weaker – a multielement array is generally necessary.

Signals are often weak, at times strong, but usually marginal. Our North American friends refer to MS signals as either pings (those signals too short to be recognised), bursts (signals that can usually be recognised and may be sustained for several seconds) and super pings (signals lasting for perhaps five seconds, of fair strength and easily recognised).

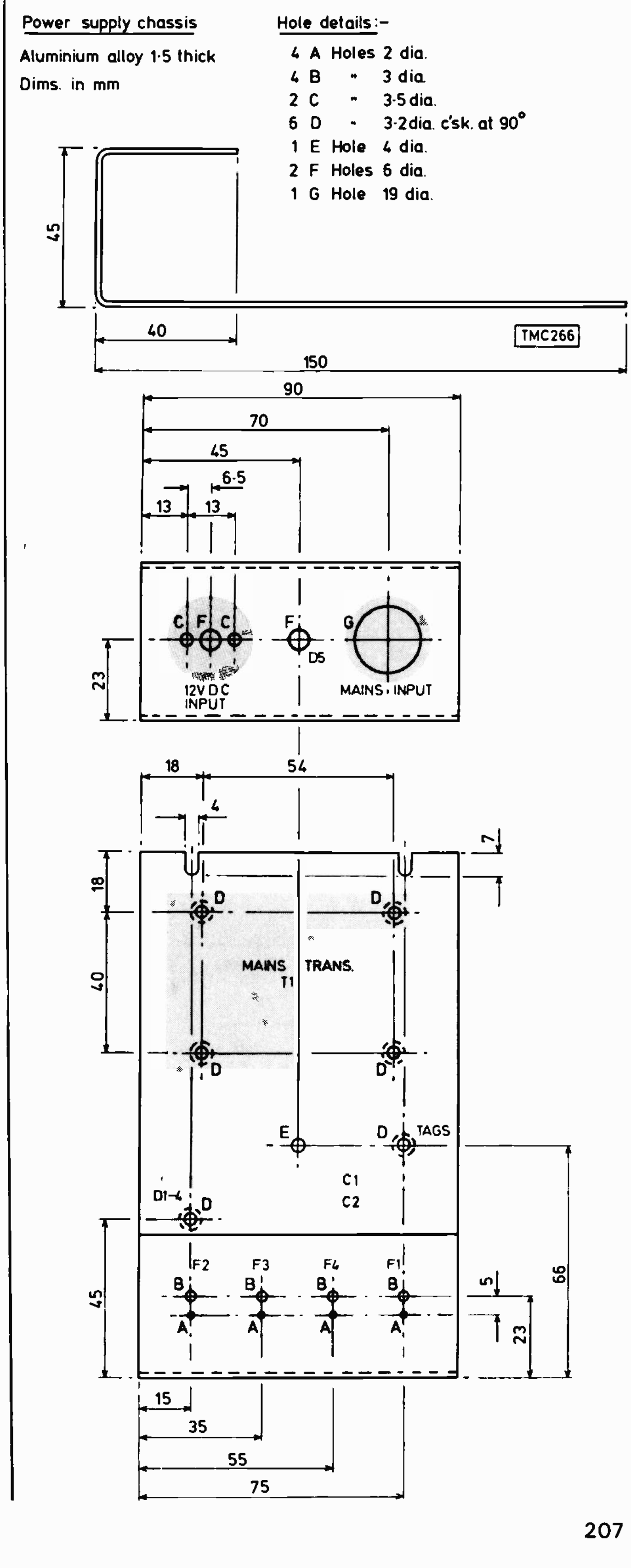
For successful MS reception the receiver must be in really first class condition. In particular the gain must be high and the field and line synchronisation both accurate and stable. A further requirement is that it must be possible to tune to the correct video carrier frequency and know that if a signal is received the tuning will be exactly correct.

Aerial amplifiers are essential, but this topic has been often discussed in this column.

I have found it advantageous to adjust the a.g.c. on my receivers to "distant" and to remove the a.g.c. from the tuner, operating it at maximum gain. This ensures that the receiver's threshold is very low. Thus an incoming weak signal is less likely to be masked by noise or incorrect a.g.c. action.

The Television Monochrome Portable

WE regret that in giving constructional information last month details of the power supply unit were inadvertently omitted. The power supply chassis and component positions are shown below.



Servicing Saba Colour Receivers

Models T6715, T6716, T6735, S6715, S6716 and S6735

Part 1

P. C. Murchison

ONE of the most commonly encountered imported German television chassis is the first fully transistorised Saba one. It's used in several models, all variations on the same basic design which features a 110° cathode-ray tube and a thyristor line output stage. The reliability of these receivers is fairly good, but perhaps this is just as well since the chassis is not made up of separate plug-in modules, consisting instead of two main chassis units, one for the timebase circuits and the other for the signal and decoder circuits. Thus any field service problems have to be sorted out on site.

This is not quite as bad as it may seem since most of the integrated circuits, the decoder reference oscillator unit, the sound output panel, the line oscillator and the tuner unit are all unpluggable. This considerably eases servicing, since i.c.s can be quickly and easily substituted and a whole range of faults eliminated. The i.c.s used in the decoder and signal circuits are from the familiar TBA range, the decoder using four i.c.s (TBA510, TBA520, TBA530 and TBA540) whilst the luminance i.c. is a TBA500 and the intercarrier sound i.c. a TBA120.

Although the cabinet styles vary, there are two basic versions of the chassis, the simplest being fitted to Models T6715, T6716 and T6735. These have eight touch buttons for changing channels, and ordinary slider controls for regulating volume, brilliance and colour. The more complex Models S6715, S6716 and S6735 are ultrasonically controlled, with the colour, brilliance, volume, on/off and channel change functions all controlled via an ultrasonic link. The operation of the touch buttons on the T models is very similar to those on the Telefunken 711 chassis, using an SAS560 and an SAS570 i.c. Since this type of circuit was adequately described in the Telefunken article (see *Television* August 1976) it's not proposed to go into details of this part of the set in the present series.

The convergence unit is easily accessible from the front of the set. Remove the loudspeaker grille to reveal the static and the dynamic convergence controls. These are clearly labelled for adjustment in numerical order. The service switch and the first anode controls for grey-scale adjustment are also situated on this panel. Thus the complete setting up proceedure can be carried out without having to remove the back cover – and without having to wrestle with static convergence magnets on the tube neck whilst trying to look at the screen, static convergence being entirely electrical.

Two red plastic pegs are supplied with the set and should be found sitting in two slots in the back, just above the bump covering the c.r.t. projection. These pegs, often missing, are used to remove the speaker grille when pushed into the slots in the top left- and right-hand corners. The grille then hinges down to reveal the convergence panel. The volume should be turned right down before doing this, because the loudspeaker will then be disconnected from the output stage and damage to the output transistors could possibly result.

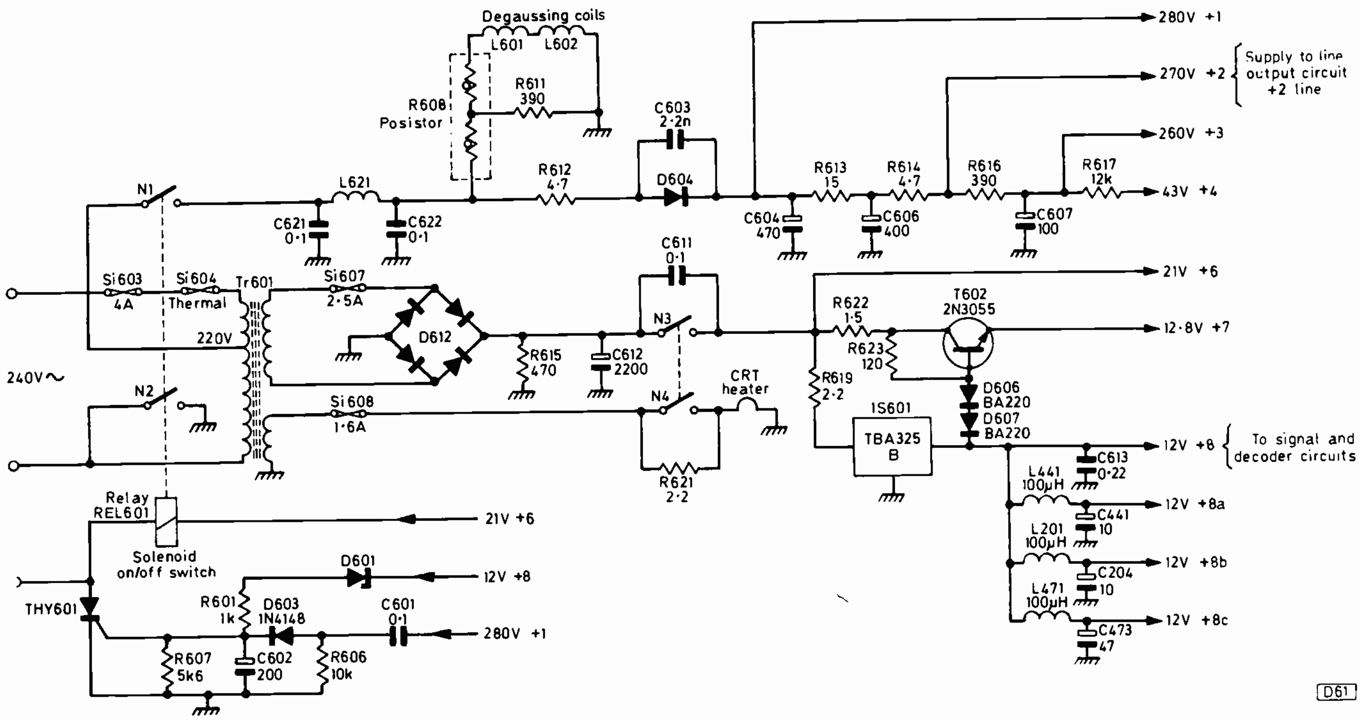


Fig. 1: Power supply circuit of the T6716 and associated models. Note that the c.r.t. heaters are energised via R621 the whole time the set is connected to a mains supply. N1/2/3/4 are the on-off switch contacts and in addition to normal operation will be switched off electrically via relay Rel601 in the event of an overload.

Having taken a brief look at the general nature of the receiver, we will now move on to examine it in more detail, starting with the power supply unit.

Power Supply Section

The power supply is much simplified in receivers employing a thyristor line output circuit since it's not necessary for the main h.t. line to be stabilised, stabilisation taking place in the thyristor line output stage itself. There are still some interesting points to be considered however. Fig. 1 shows the power supply circuit of the non-ultrasonic Models T6715 and T6716, along with the overload protection circuit which is centred around thyristor Thy601. This causes the mains switch to disconnect the supply rails should an overload occur.

Starting at the input end, the mains transformer primary is connected directly to the supply via fuses Si603 (4A) and a thermal fuse Si604 which is buried in a small tube within the mains transformer itself. This thermal fuse is a constant source of trouble, having a habit of blowing for no apparent reason. If a replacement is fitted it may last for several months or it may blow within a few weeks of replacement, so it would seem that these fuses are a weak link in the mains input circuit. The supplies and transformer are adequately protected with conventional fuses and there is the added bonus of the protection circuit: the author recommends shorting out this thermal fuse with a wire link to prevent further wasted time.

Instant-on

The mains transformer is permanently energised as long as the set is connected to the mains supply, the reason for this being to provide a constant voltage to the cathode-ray tube heater so that an instant picture and sound are obtained when the receiver is first switched on. The c.r.t. heater voltage is only 80% of normal under the "standby" condition, the 2·2Ω resistor R621 then being in circuit to reduce the heater voltage. When the mains switch is depressed, a pair of contacts (N4) on the switch short-circuits R621 and the c.r.t. heater then receives it's full voltage (6·3V). At the same time contacts N2 make the chassis connection, N3 connect the l.t. rectifier to the stabilising circuits and N1 connect the mains supply to the h.t. power supply circuits and the degaussing circuit.

Overload Protection

The mains switch is an unusual component in so much as it's normally operated manually but can also be turned off electrically by means of a magnetic coil (Rel601) which releases a latch at the rear of the switch, causing it to fly out, opening the contacts, accompanied by a loud click. This coil is connected to the protection circuit, which energises the coil should there be an overload on the 12V line or the h.t. supply – the supplies to the integrated circuits and the line timebase.

The anode of thyristor Thy601 is connected to the switch coil Rel601, so that when the thyristor is triggered the coil will be connected to chassis and current will flow through it, energising the coil. The control voltage for the thyristor comes from either the 12V or 280V line.

The ripple voltage on the 280V h.t. line is normally 2·5V peak-to-peak. This is supplied to diode D603 via the 0·1μF capacitor C601. Thus D603 rectifies the ripple voltage and charges C602 to around 0·35V, which is not quite large enough to trigger the gate of the thyristor. Should the h.t.

Table 1: Power Supply Lines and Destinations.

Line	*Voltage*	*Circuits supplied*
AC1	200V a.c.	Bias for telecommander receiver capacitive microphone.
AC3	14V a.c.	IC951; motor-operated mains on/off switch; electronic channel selection.
AC4	35V a.c.	Control motors for brightness, saturation and volume.
+1	280V	Protection circuit.
+2	270V	Thyristor line output stage; illuminated figures; channel indicators.
+3	260V	TBA530 and RGB output stages.
+4	33V	Tuner tuning voltage.
+5	10V	Channel selector board.
+6	21V	Audio circuits.
+7	12·8V	TBA920; line drive pulse shaping transistors T671/2; T674 (E/W correction); convergence circuits.
+8	12V	Vision and sound i.f. circuits; TBA500, TBA510 and TBA520.
+8a	12V	TBA510 and TBA540.
+8b	12V	Tuner; T1062/3/4 (switching transistors for band changing).
+8c	12V	TBA530.

load current suddenly increase, a much bigger ripple voltage will appear at capacitor C601. This is rectified and triggers the gate of the thyristor which completes the circuit to the switch off coil.

The +8 l.t. rail (12V) is also protected. The voltage is applied to the 15V zener diode D601 and should it exceed 16V the zener diode threshold potential will be reached and a potential of about 0·6V will appear across R607, causing the thyristor to trigger and the set once again to switch off.

Spurious Triggering

There have been problems with the set switching off for no apparent reason. This can often be traced to the voltage at the thyristor gate being slightly higher than 0·35V. The remedy here is to lower the trigger sensitivity by reducing the value of R607 to 4·7kΩ: at the same time the gate potential is slightly reduced. Another cause of spurious triggering is an unearthed line oscillator can: the remedy here is to solder an earth lead from a chassis connection on to the can. Later production models are fitted with this earth link.

The +8 supply will increase should the 12·8V series regulator transistor T602 go short-circuit collector-to-base, or alternatively should the stabiliser i.c. IS601 become short-circuit: in either case the 21V from D612 will be applied to D601 and the circuit will trigger. A short-circuit on the 12V line can cause a voltage surge and hence triggering, though rather surprisingly the circuit will trigger if the +8 supply is open-circuit with no current flowing. In this case the voltage on the 12V line increases to 21V, current flowing through R623 and the two BA220 diodes D606/7, once again causing the cut-out to trigger.

LT Supplies

Having mentioned the various ways in which the 12V +8 supply can cause triggering, we must give some attention to the 12V supply itself, especially as the stabilising i.c. is "short-proof", a point which can be misleading. If the i.c.'s output current exceeds 600mA it will shut down and give just a few volts output, a fault condition which is also given by a faulty i.c. without the current being excessive. In order

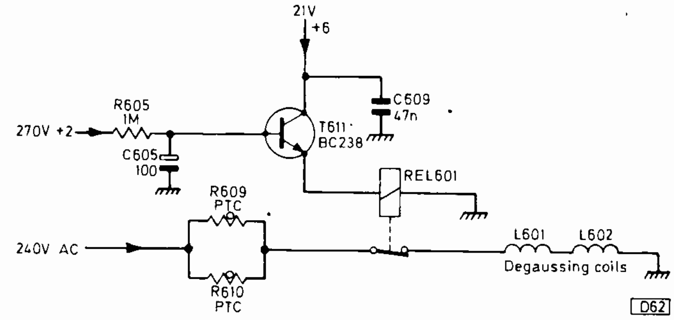


Fig. 2: Alternative degaussing circuit used in some versions of these sets. The degaussing cycle is determined by the time-constant of C605 and R605.

to decide whether the i.c. is faulty or whether to investigate the external circuitry, disconnect the outgoing supply rail and substitute a load resistor of around 40Ω. With this load, the current drawn should be around 300mA and a normal 12V should once again be present at the output of the i.c., proving that all is well and that the external circuitry is drawing in excess of 600mA. It's worth noting that the 12·8V +7 supply will be lost if the 12V line fails, because this provides the base reference voltage via the two diodes D606 and D607.

The only other fault prone component in this section of the power unit is the l.t. rectifier D612 which often fails, causing the fuse Si607 to blow as it usually goes short-circuit between one leg of the a.c. input and the negative output lead.

HT Supplies

The h.t. side consists of a conventional half-wave rectified supply. Should the 4A fuse blow, the components to suspect are C621 and C622, the 0·1μF capacitors in the mains filter circuit. They often go short-circuit. Failing this the mains rectifier D604 may be short-circuit, along with R612 open-circuit.

The +2 line (270V) is the supply to the thyristor line output stage. Should a thyristor or diode in this circuit fail, the power supply line will be overloaded and the trigger will cut the set off. Unfortunately the trigger is often not quite fast enough in switching the set off, the result being a shattered thermal resistor R613 and sometimes an open-circuit 4·7Ω resistor R614. It's good policy therefore to check the thyristor line output stage before switching the set on after replacing these components!

Degaussing Circuit

The degaussing circuit is conventional, the automatic degaussing being controlled by the double posistor R608. Some receivers employ a different type of degaussing circuit however, as shown in Fig. 2. Here the degaussing coils are completely disconnected from the a.c. supply after a fixed time of approximately eight seconds. Initially maximum current flows through the degaussing coils via the cold posistors R609/R610, the magnetic field produced quickly dying away as the posistors get hot. After eight seconds (the time-constant of R605 and C605) C605 has charged sufficiently to allow T611 to conduct. Relay Rel601 then operates to disconnect the degaussing circuit.

Remote Control Versions

The ultrasonic version of the receiver employs a slightly more complicated power supply circuit, as shown in Fig. 3.

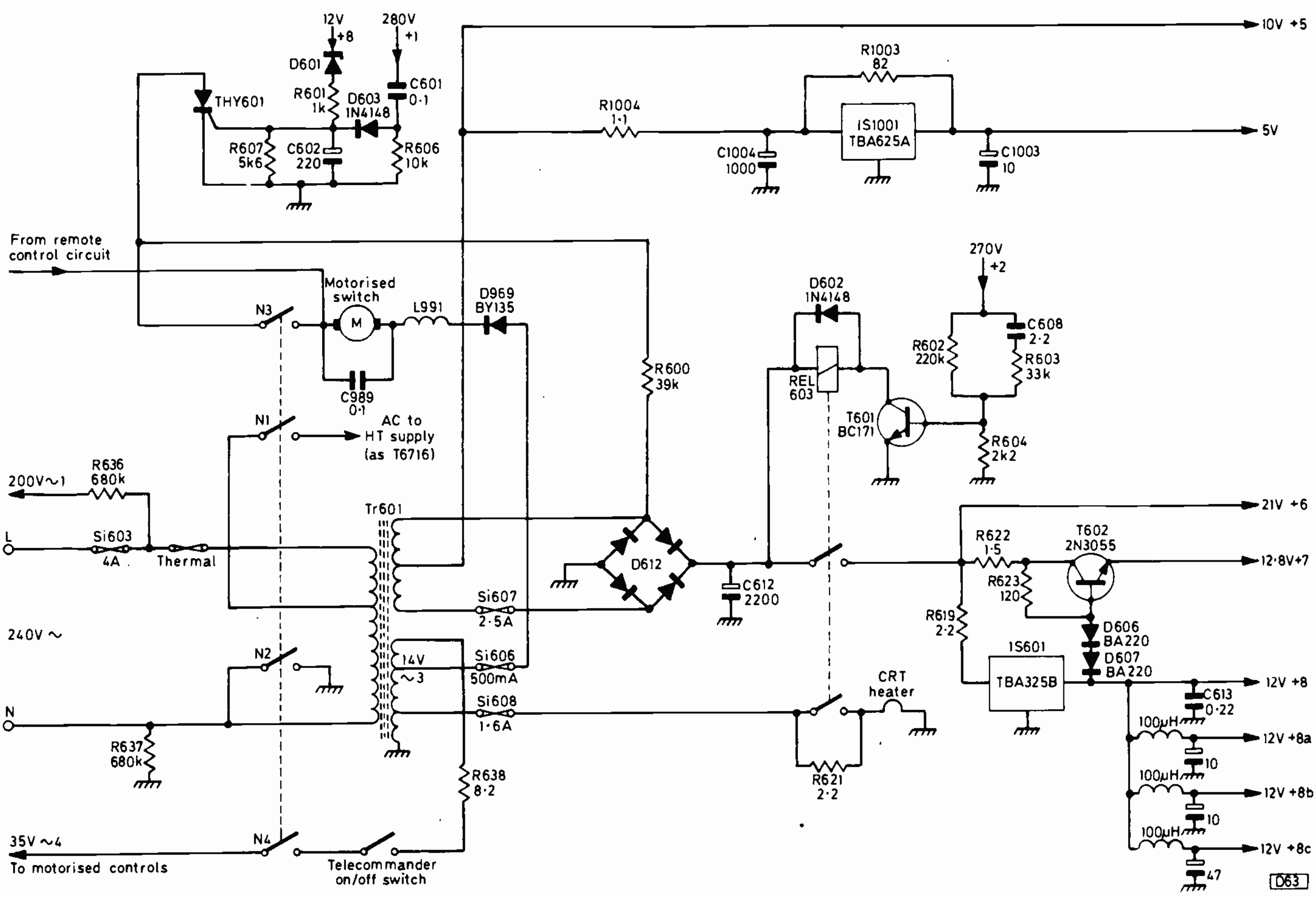


Fig. 3: Power supply changes in ultrasonically controlled versions. In these sets the on/off switch is motor driven and there are extra supply rails for the additional circuitry involved.

It employs motorised colour, volume, brilliance and on/off controls, along with a system of electronic station selection. These extra complications are incorporated so that the set can be operated remotely via the ultrasonic transmitter – details of these circuits will be covered in Part 3 of the series. Several extra power lines are required for these systems, and a mains transformer with extra tappings is used to provide the 35V and 14V a.c. supply lines for the motors. The feed to D612 is taken from a separate winding, and a centre tap is added to this winding to supply 10V to IC1001, the 5V stabilisation i.c. which supplies the i.c.s used in the electronic station selector circuit.

The protection circuit is combined with the motorised on/off switch so that should an overload occur the motor starts up and switches the mains supply off by breaking contacts N1 to N4, at the same time breaking its own supply. The motorised switch can be switched on either manually or via the ultrasonic link, so as to return power to the set. The c.r.t. heaters' standby switch and the l.t. switch are controlled by relay Rel603 which comes into operation when the 270V supply is present, this being established when the mains switch contacts N1 are made. R602 supplies the base of T601 with voltage. In consequence T601 turns hard on and the relay closes its contacts. Rapid switchover is ensured by the 2·2μF capacitor C608.

Supply Line Destinations

One of the main difficulties when servicing the power supply is in trying to find out exactly which sections of the receiver each line supplies, the circuit diagram having many arrows pointing in many directions, all labelled with various supply numbers! The various supply lines and their destinations are listed in Table 1.

Longer VCR Playing Time

John de Rivaz, B.Sc.(Eng.)

It was originally hoped to be able to modify a Philips N1500 VCR so that four tape speeds could be selected by a switch, as in audio recorders. The positions would be normal, $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ speed. Each speed reduction would see a loss of quality, the first giving a loss of vertical resolution (which is barely noticeable, as the horizontal resolution is only about half that broadcast), the remaining reductions giving more jerky movements. Display of a test card or other static picture would suffer no loss as the speed is reduced beyond half speed. Sound quality will fall with speed reduction, and indeed will be of barely telephonic quality at $\frac{1}{8}$ speed. It may be possible to use speech bandwidth compressors to improve this however, and also time-scale convertors to remove the excessive wow that would be present at low speed. Unfortunately this would mean adding bulky extra circuit boards that could not be accommodated within the main frame.

Speed Reduction

It was decided to proceed with the mechanical process of reducing the speed first. A cycloinvertor was tried, giving 25, 12·5, and 6·25Hz to the motor in the form of a differentiated squarewave derived from the mains. This gave accurate reduced speeds, but excessive heat was dissipated by the motor. Indeed the mains current rose to 2A, so the experiment was abandoned. Next, a phase-control system was tried, operating the motor with excessive slip controlled by a servo. Such a system is used in the Revox A77 series of audio recorders. Unfortunately the circuit I tried turned out to be far too unstable for reliable use. According to textbooks, many induction motors are deliberately designed to run at a fixed speed or not at all, and different motor designs are required for variable-slip working.

Also tried was the rather expensive experiment of installing an N1502 d.c. motor (it costs about £10) in the N1500. It was found that this motor could easily stall during rewind or if the cassette was a little stiff. I should imagine that this happens in the N1502, as this machine has special circuitry to shut it down if the motors stall to avoid burning them out. A servo was built similar to that used in an audio recorder, but with the refinement that the speed could be reduced slightly by a current from the existing N1500's servo. Thus the N1500 servo was operating in its original mode, i.e. to reduce slightly the speed of an over speeding motor.

I am still on the lookout for either a more powerful d.c. motor or a pole switchable 50Hz motor (similar to that used on the Akai X360 audio tape recorders) of suitable dimensions to fit into the N1500.

Half Diameter Motor Pulley

In order to get some results, I have now adopted another method to get half-speed working of the N1500 using the existing heads. This is by buying another drive motor pulley, turning it down to half the diameter and fitting it to the existing drive motor using the existing drive belt. It should be turned down on a lathe of course, but I managed to do it by rotating the pulley in a drill and filing, checking the diameter every so often with calipers. The groove for the pulley is made with a triangular file.

In fact, this is all you need do to get some sort of result. There is some patterning on the picture however, and the servo is frequency dividing so less stable. The sound quality is also muffled.

The Servo

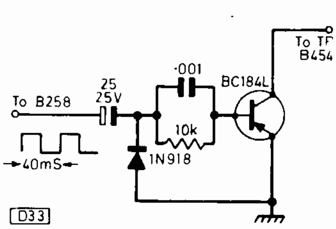
In order to improve the servo characteristics, buy another servo take-up head and fit it on a small bracket so as to lie on a radius 90° to that of the existing one on the flywheel. Connect it in series with the existing head. Use an oscilloscope to check that they are series aiding, and make the bracket adjustable so that it can be set at the correct angle. Adjust the angle of the radius by connecting the oscilloscope to test point 223 on board D, and adjust for minimum ripple. To avoid drilling plate 517, the bracket was made to fit over bearing 521 and be fixed with its three screws and washers 23 and 11 (the numbers refer to the service manual drawings).

These heads form part of a monostable, which has a relatively high input impedance. Thus the impedance of the head not in use has little effect on the circuit, and a frequency similar to that produced at full speed is now available at half speed.

Sound Quality

Considering the original tape speed, the quoted frequency response of 12kHz is poor. In fact the sound circuits are really rather basic. A crude modification was used therefore to bring back subjectively the original frequency response in the low-speed mode. A 0·22 μF capacitor was connected across R555 on board 45 (circuit diagram B) to provide h.f. boost on replay.

If the VCR was operated at $\frac{1}{8}$ speed, the tape speed would be 1·78625cm/s. I have had an audio cassette recorder going at 1·190625cm/s and obtained acceptable results on speech with a frequency response of 3kHz, though the wow and flutter were very bad. I finally settled for the original $1\frac{7}{8}$,



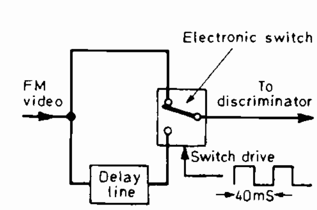


Fig. 1 (left): Modification for skip-field operation.
Fig. 2 (right): Proposed experimental time corrector.

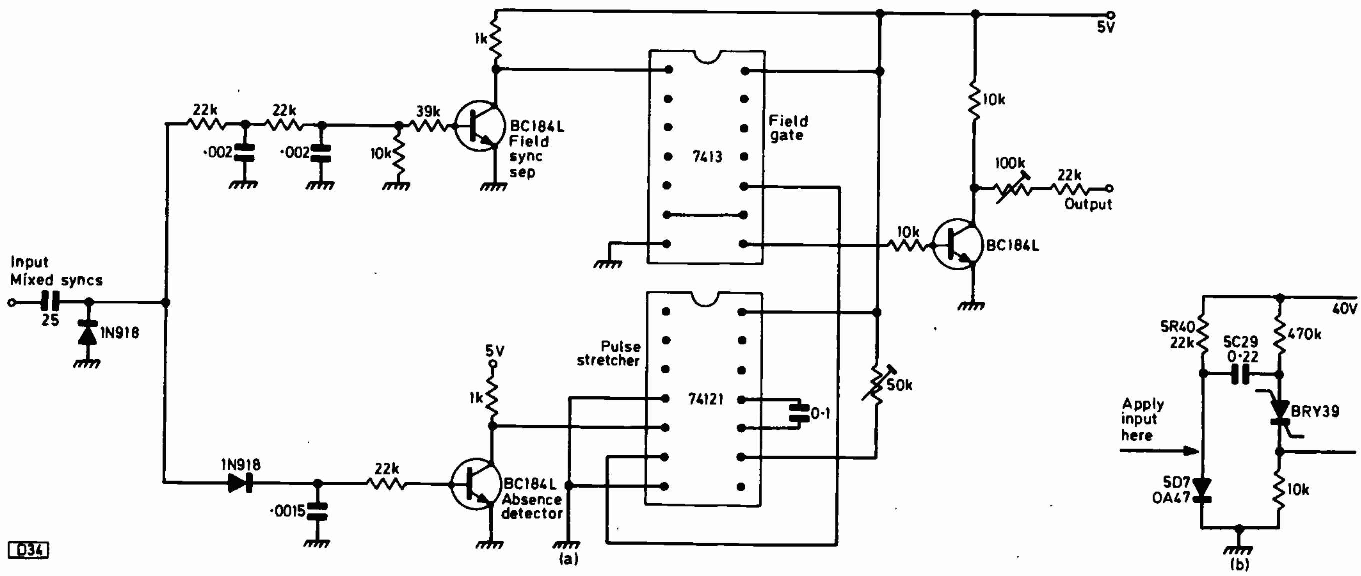


Fig. 3: (a) Extra circuitry for inclusion in the receiver. (b) Input to the Rank A823 chassis' field oscillator circuit.

$\frac{15}{16}$ and $\frac{5}{8}$in/s for the three-speed ACR (!). From this it would appear to be possible to get an acceptable bandwidth at 1·78625cm/s. However, I feel that it may be necessary to provide a more sophisticated audio amplifier to get best results.

Video Patterning

To cure the video patterning, it may be possible to use an N1700 type head as a direct replacement in the N1500 as modified above. I don't at the time of writing know whether it's mechanically compatible, or whether it will be available at a similar price. Running the VCR at half speed will save sound head wear: it will make no difference to the video head wear however, as most of the rubbing is due to the rotation of the head, not the passage of the tape. Some news items on the N1700 talk of reduced head wear, so it's just possible that the N1700 heads will be twice as expensive!

If for one reason or another the N1700's heads are not suitable, then skip-field operation gives acceptable results. The modification to the VCR is very simple. As shown in Fig. 1, the 40ms servo waveform is used to close a transistor switch, cutting off the luminance record and chroma bias signal at the limiter diodes D402 and D403. The components are easily accommodated on board 45, circuit B.

Curing Field Bounce

This modification introduces a large field bounce of two lines, which is not explainable simply by the skipped field. As it does not appear on still frame, it must be due to the forward motion of the tape. If the video waveform is observed on an oscilloscope, a blank duration of two lines will be seen at the end of one of the pairs of fields, while the sync pulses will be seen to have acquired pulse position modulation at 25Hz. It would be nice to introduce a modification to the VCR to get over this, and indeed it may be possible to transfer time from one field to the next by switching in a delay line on alternate fields, as shown in Fig. 2. Noting the trouble involved in using delay lines for drop-out suppression however I've not tried this.

Instead, I modified the receiver. Fig. 3 shows the circuit, which provides a pulse on alternate fields. This is used to modulate the field oscillator triggering to make up for lost time. A monostable pulse stretcher is fed by a detector that detects the absence of sync pulses and provides a pulse that overlaps alternate field sync pulses. These pulses are gated with the field sync pulses to provide pulses every alternate field to modulate the field frequency. In the case of the Bush A802A scan output and e.h.t. panel used in my receiver the pulses are fed to the junction of 5R40/5D7/5C29. For other sets, refer to the manual to find out which point is sensitive to triggering to initiate the flyback. This circuit will not respond to pulses except those in the flyback period, and is therefore immune to interference and automatically switches off during normal signals.

Identification Problems

Unfortunately this circuit introduces PAF – phase alternation field (!). So the decoder's ident circuit has to adjust on every field, introducing a bluish band at the top of the picture. It's not too troublesome, and could be cured by using chroma lock decoding (see August 1976 *Television*, page 535-543). The band is also widened by the VCR's 562·5kHz oscillator being interrupted by the gap: this can be prevented by connecting a 100kΩ resistor between the drop-out detector (panel 47, point 436) and the VCR sync i.c. pin 4 (field blanking input) to prevent noise shifting the oscillator off frequency during the gap. Unfortunately some non standard PAL receivers, e.g. early Sony ones, have ident correction on a field by field basis: these could not be used therefore with the VCR modifications suggested here.

Conclusions

Since receiver modifications are necessary the system outlined is really suitable only for enthusiasts. It points the way to alternative approaches however, and is obviously cheaper than selling an N1500 in order to buy an N1700. A tape recorded on a skip-field N1500 plays back in lock on an unmodified one with a 2:1 speed up. Clearly, if the $\frac{1}{4}$ speed is ever achieved there would be some interesting time-lapse possibilities for CCTV home movie enthusiasts. Flowers could be seen opening and storm clouds brewing. Unfortunately slow motion is seen as a series of jerks with gapping bands running up and down, so only speed up is possible.

The other problem is that rewind takes twice as long, and is twice as expensive as the video heads receive twice the wear during rewind. This would not arise with a multispeed motor. Clearly there is a case anyway for a separate rewind unit that does not bring the tape into contact with the heads at all. If one is lucky enough to get for a few pounds an old VCR chassis that has been written off it would probably be possible to salvage a few parts to make such a unit. With the advent of the new standard N1700 series machines, N1500s may well become very cheap on the secondhand market, as did the Sony CV2000B, a 405-line reel-to-reel machine, which can now be had for about £60.

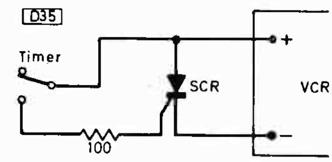
According to the news report in the August 1977 issue of *Television* the speed of the N1500 is 14cm/s. It isn't, it's 14·29cm/s. The report also states that the N1700 speed is 6·5cm/s. This may be wrong also, the speed being 7·145cm/s. If this is the case, a slant-head modified N1500 will be compatible with the new system. If 6·5cm/s is correct however then converted N1500s will be only curiosities, and any tapes recorded on them will become useless once spare parts for the machines are no longer available. (It's actually 6·56cm/s – *Editor.*) This is a very important point for anyone wanting to build up a collection of recorded material. Skip-field tapes will only ever be of the curiosity class of course, although a system may evolve using slant heads on an every third field system in order to achieve quarter speed working. It would not be possible to have an alternate field system with on-slant heads, as the second field would be gated out or at least rather noisy. Experience may prove me wrong on this point however.

It's likely that very few N1502s were made. I have not seen one and am never likely to be able to experiment on one, although its d.c. motors would make it ideal for speed experiments. I should think that if an N1502 owner were to add another servo pick up head his machine may well automatically select the slow speed. If not, all that would be necessary would be to dig into the servo circuits. The machine could easily be speed switchable, as no mechanical changes are necessary. Reference to the service manual should find the recording limiting diodes and the 40ms waveform for the skip circuit, and maybe the colour oscillator will survive without the need for the drop-out pulses, as there have no doubt been some improvements. There may be some problems as I believe that this machine is made up from modules, but this shouldn't be insurmountable.

Appendix – the Clock!

The clock will work for just over an hour only. An SCR can be added to get over this – see Fig. 4. As a safety measure, automatic shut down should be added in the event of the auto-stop failing. How this can be done using a reed switch on the counter pulley is the subject of a separate article.

Fig. 4: Extending the timer period.



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PHILIPS G6 CHASSIS

I've seen several of these sets with a horizontal light bar moving either up or down the screen. Is there any particular reason for this hum bar being present?

This fault is very common on the G6 chassis and is usually due to poor earthing in the power supply. Check the tagstrips, which are screwed to the chassis, by slackening and then retightening the screws. Similarly check the earthing straps across the smoothing electrolytics. If this doesn't do the trick, clean between the heater pins and the other pins of the three PCF200s and the PFL200 on the copper side of the boards – decoder and i.f. respectively. Failing this you will have to check the smoothing of the various supply lines – this is most easily done with a scope. Don't forget that any of the valves in the video or chroma stages could be responsible.

ITT VC300 CHASSIS

There's neither sound nor raster on this portable, though the sound channel is operative (noise on advancing the volume control). The loss of signals seems to be due to trouble in the line timebase, since the i.f. strip is powered from the boost rail. The voltages round the SN76532N sync separator/line oscillator i.c. are incorrect, though the associated components seem to be in order and a replacement i.c. has not restored results. The l.t. rail voltage is correct, but the voltage at the collector of the line driver is only 0·6V instead of 9·6V. The line driver and output transistors are in order.

The supplies to the i.c. are fed via the smoothing resistors R102 (to pin 2) and R108 (to pin 13). If less than 1V is being developed across R102, check the print which earths pin 14 of the i.c. Check that R102 and R108 have not changed value, and that the associated smoothing electrolytics C82 and C83 are intact. Check C81 (47μF) which is associated with the line sync circuit, and check that pin 12 can be set to 3·2V by adjusting the line hold control.

PHILIPS TS7 CHASSIS

I have a Pye portable fitted with this chassis. Erratic video and faulty synchronisation has been traced to the TBA890 a.g.c./sync separator i.c., but I'm having difficulty in obtaining a replacement.

You should be able to obtain one through Philips Service Ltd. whose main depot is at 604 Purley Way, Waddon, Croydon, though there are a number of local depots.

THORN 3000 CHASSIS

There's sound but no e.h.t. The set is one of the earlier ones with two transistors in the line output stage, one of which runs very hot. The beam current sensing resistor R907 on the beam limiter panel also runs red hot if the set is left on for a short while. R917 in the damping network across the primary winding of the driver transformer is badly discoloured and reads low at 90Ω instead of 120Ω.

You will have to remove the two line output transistors and the associated tuning capacitors C517, C518, C521 and C522 and check each carefully. Replace as necessary – also R907 and R517. If overheating continues after switching on disconnect in turn the e.h.t. tripler, the scan coils and the c.r.t. first anode and shift rectifiers W505/W506 until the voltage across R907 returns to its normal value

BUSH TV161 SERIES

The trouble is vision on sound, and the gain seems to be poor. The picture gives good detail, but the contrast control cuts off sharply at the bottom while it seems to make little difference as it's advanced towards full gain. The a.g.c. control also seems to have little effect.

The first thing to do is to get the a.g.c. circuit operating properly. Check the back-to-front resistance readings of the two diodes 2MR1 and 2MR2 in the a.g.c. line, and check the smoothing capacitor 2C3 for leakage. Then if necessary check the emitter voltages of the three i.f. transistors – 3·3V, 11V and 3·8V respectively – checking the transistor and circuit where the reading is incorrect. Once the a.g.c. line is working, align the ratio detector transformer (2L27/8/9) and adjust the discriminator balance control 2RV2 for minimum buzz.

GRUNDIG 7200

Reception is excellent except for a slight buzz from the speaker on BBC-1. This becomes very annoying as the volume is increased. On ITV there's slight distortion on sound, mostly noticeable on US films. Is there an adjustment that can be made to the tuner?

The fault is unlikely to be in the tuner. Locate the sound module on the left-hand side of the chassis (viewed from the rear), then adjust the quadrature coil (no. 30) to eliminate the effects. Use the correct tool, and carry out the adjustment very slowly.

PYE 697 CHASSIS

It's very dificult to lock the field timebase, and the position varies during use – very slight movement of the hold control will often lock the picture but it requires further slight adjustment, usually in the opposite direction, after a time. The hold sometimes remains steady for an hour or two, but is always very critical. Another problem is that the colour occasionally changes and then corrects itself, while very occasionally the picture disappears completely, returning after a few seconds. This usually occurs during the first quarter of an hour after switching on.

The critical field hold is probably due to a fault in the sync separator stage – this is on the i.f. panel. Check the 4·7MΩ base bias resistor R33 (often increases in value) then if necessary the protection diode D4 (BA155). The other trouble is probably due to the contact spring clips on the rear of the CDA panel. Clean them in order to improve the contact with the studs on the chassis and the clip housing on the panel.

THORN 1500 CHASSIS

On investigating the cause of a blown mains fuse I discovered that the on-off switch was apparently burnt out while the mains filter capacitor C84 was short-circuit. These items were replaced, the set then working for about fifteen minutes before going off again. The next time round the set worked for about five-ten minutes.

We suggest you replace the PY801 boost diode: this valve tends to go short-circuit from heater to cathode, with the result that the resistance between the h.t. line and chassis is only about 100Ω. Alternative causes are leaky h.t. line smoothing electrolytics, an intermittent short-circuit in the BY127 h.t. rectifier W8, or defective h.t. or heater rectifier protection capacitors (C83 and C85 – these should be to BS415 and rated at 1kV). We assume you changed the on-off switch – the contacts tend to arc when C84 has gone short-circuit and this can cause fuse blowing. The fuseholder should also be checked for arcing.

PYE 697 CHASSIS

This set has been extensively reconditioned and gives an excellent picture apart from the following faults: slightly impaired l.f. response (smearing to the right of the top centre black rectangle on the test card); and noise and smudging in saturated red areas of the picture – test card blues and greens are quite clean. All valves are new, and the decoder has been realigned. The R – Y preamplifier transistor and its emitter decoupling electrolytic have also been replaced, as have all the capacitors in the luminance and colour-difference output stages.

Your description suggests that the emission of the c.r.t.'s red gun might be low. Adjust the focus on all three colours, then examine the red only picture: if this is fuzzy, the tube is at fault. The smeary picture could be due to the same cause, but first check the flyback blanking stage in the luminance output pentode's cathode circuit. Poor l.f. response is generally caused by one of the electrolytics in the screen grid and anode circuits of the luminance output pentode – C352/3/4. The snowy red could be a fault in the R – Y preamplifier stage, but you've already replaced the two most likely components here. Make sure that the associated resistors have not changed value, and that there are no signs of burning on the board around the R – Y PCL84. Another possibility is low i. f. gain: adjusting the presets RV3 then RV2 in the a.g.c. circuit may improve results.

THORN 3500 CHASSIS

The picture disappeared, leaving a blank raster accompanied by smoke, then the picture reappeared before I switched the set off. On examination, I found that the blue tilt control R758 on the convergence panel had burnt out, along with its series resistors R759 and R760 and the series diode W752 having gone short-circuit. These were replaced, but on switching on there was smoke once more and W752 had again gone short-circuit. I have checked the convergence and pincushion distortion correction circuitry but have been unable to trace the cause of the trouble. On the last test there was a two inch gap on each side of the raster, but I had to switch off since smoke was issuing from the blue amplitude control R755 and the series resistors previously mentioned.

There are two resistors, R751 (10Ω) and R752 (18Ω), connected in series across the horizontal convergence circuit: R752 is shunted by a diode (W754). The usual sequence of events is that one of these resistors, along with the diode, goes open-circuit. As a result, the entire line scan current flows through the horizontal convergence circuit. This can result in diodes W751, W752 and W753 failing and transistors VT751 and VT752 self-destructing, along with the 200Ω cermet potentiometer R766. Under the resultant strain R755, C755, R756, R758, R759, R760, C756 and often R753 burn up – and if you are unlucky enough about six square inches of the board. All these components will have to be checked therefore. The trouble is not uncommon and is due to the wirewound potentiometers being underated – the later types subsequently used should not fail. 1S44 or 1N4148 diodes can be used in positions W751/2/3, and a Y860 or 1N4004 or equivalent diode in position W754. Note that W752 and W753 are shown the wrong way round on the plastic covered circuit diagram (reference 01P1-626). If the components on the convergence board turn out to be in order, check the scan-correction capacitor C524 and the *RC* network which shunts it (R529/C530), also the setting of the 55-62V h.t. rail.

GRUNDIG 5011

There is severe pincushion distortion at the top and bottom, the sides hardly being affected. The distortion has got slowly worse, until now the top centre is two inches below the corners.

Assuming that controls NSP, NSS and NSA (north-south phase, symmetry and amplitude) have little effect, it's likely that the printed tracks or soldered joints connecting R483 and R484 to tags f and h on the line output transformer are faulty. If this is the case, the vertical shift control BZ will not work. Poor joints around the line output transformer are common on these sets. Also check the joints around the NS correction transductor PTC1.

THORN 1590 CHASSIS

The trouble with this portable is field collapse – with just a thin white line across the centre of the screen. The d.c. coupled field timebase circuit is tricky to check. Any suggestions?

A common cause of this trouble is when the flyback diode W5 goes open-circuit – it's in series with the field output transistors. Almost any sort of silicon diode can be used as a replacement – say a 1N4001. Check it with an ohmmeter switched to the low resistance range. If it's in order it will read low one way round, higher the other way round. If the diode's in order, check the voltages on the field oscillator transistors VT14/15, then check forwards to the field output stage. When you come to the first wrong voltage, check the associated transistor. If the transistors are in order, check the output coupling capacitor C78 (1,000μF) and the soldered connections to it – also the connections to the field scan coils.

MURPHY CV2210D

The problem with this set is pulling to the left over the top inch or so of the raster – the trouble is present only with certain types of picture content however.

The sync separator transistor is 2VT9 on the i.f. panel. We suggest you first check its base coupling capacitor 2C51 (1μF) and bias resistor 2R46 (390kΩ). Then check 3C17 and 3C18 in the flywheel sync filter circuit, preferably by substitution. If there's no improvement, try the effect of adding an earthed screening can over the line oscillator coil 3L4 – the coil can be affected by radiation from the line output stage. If you try this, it will probably be necessary to readjust the coil to achieve line lock.

GEC 3133 PORTABLE

There are about four-eight modulated white lines (teletext style) about 5cm from the top of the screen. The raster is reasonably linear, with no undue cramping at the top or bottom. Replacing the field output transistor hasn't helped, but I found that if the field hold control is adjusted so that the picture jitters but doesn't roll the lines take up their correct position above the picture – collapsing the field to half the normal size also corrects their position.

The field output is provided by an i.c., which may be one of several types, the transistor in series with the feed to the scan coils being switched off during the flyback to give an unclamped flyback action. You should be able to get rid of the lines by adjusting the field blanking potentiometer P253. Don't over adjust, or the top of the picture will be suppressed. If this doesn't work, suspect the SN76544N field/line timebase i.c. or C256/D251 which are in the field timing circuit associated with pin 12 of this i.c.

ITT CVC8 CHASSIS

For the first one to three minutes after switching on the picture has a green tint – on one occasion the raster went vivid green with all picture detail lost. Normally however there is a perfect picture after three minutes. Do you think that the green output transistor T26 or its driver T25 could be at fault?

These transistors could indeed be the cause of the trouble. It's more likely however that the earthing connection to T25's collector is faulty: check the soldering on the earthed land to the right of L73 on the i.f./decoder panel print.

TEST CASE

182

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 ITT receiver fitted with the CVC8 chassis produced good colour pictures for most of the time, but at random intervals the saturation would fall and the colour would tend to slip out of sync. This could be corrected to some extent by carefully retuning the front end.

The symptoms certainly had the appearance of being somewhere in the decoder circuit – but where? Fault tracing was made difficult by the intermittent nature of the trouble. It was also found that when the fault did occur a sharp knock on the printed circuit board around the bistable area, or the connection of a test probe, would suddenly clear it. This made it difficult to measure signal amplitudes etc. with the 'scope.

It was decided to adopt a "scientific" approach therefore, concentrating on the colour sync slip effect, and to work out theoretically the circuit areas in which the trouble might lie. The plan was to replace vulnerable components in these areas in turn, followed by a trial run to see whether the fault had cleared. The least number of component changes was thus sought.

The technician reasoned that because the colour is synchronised by a d.c. output from the burst detector, a good place to start looking would be at the burst detector. This is driven by a BC171B transistor (T34d), the burst gate/amplifier. The detector itself is fed with the gated out bursts and a feedback signal from the reference oscillator circuit. The soldered joints in this area were scrutinised under a magnifying glass and any dubious ones remade. The resistors and capacitors appeared to be o.k., so the BC171B and the phase detector diodes were then replaced: the fault remained however.

Was the technician following the best course of diagnosis, or was there any clue he had overlooked? See next month's Television *for the answer and for a further item in the* Test Case *series.*

SOLUTION TO TEST CASE 181
– Page 160 last month –

The no colour symptom described last month is not untypical. The technician was correct in suspecting that the colour-killer controlled stage was not being biased on. But this can be due to various causes.

The ident signal is obtained from the 7·8kHz ripple present at the output of the burst detector. This detector is fed with two inputs, the gated out bursts and a feedback signal from the 4·43MHz reference oscillator. If either of these is missing, there will be no ripple output, no ident signal and hence no killer turn-on bias.

The technician was given a good clue as to the fault location by the colour suddenly appearing while he was making checks in the colour circuits. Reference oscillators often become "lazy", needing an impulse to get them started. This is just what happened when the voltage tests, etc. were being made: an impulse started the oscillator.

One prime cause of this is an ageing 4·43MHz crystal, and this in fact turned out to be the trouble. There is not much that can be done to improve crystal activity – not by the service technician anyway! Crystal replacement cleared the fault.

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5Y3GT	0.65	6GH8A	0.80	50CD6G		ECL86	0.64	PCC84	0.39	UABC80	
5Z3	1.40	6GK5	0.75		4.00	EF22	1.00	PCC85	0.47		0.45
5Z4G	0.75	6GK6	2.00	85A2	1.40	EF40	1.00	PCC89	0.49	UAF42	0.70
6/30L2	0.90	6GU7	0.90	807	1.10	EF41	1.00	PCC189	0.60	UBC41	0.70
6AC7	0.70	6H6GT	0.50	5763	2.75	EF80	0.40	PCF80	0.80	UBC81	0.55
6AG7	0.70	6J5GT	0.65	AZ31	1.00	EF83	1.70	PCF82	0.45	UBF80	0.50
6AH6	0.70	6J6	0.35	AZ41	0.50	EF85	0.45	PCF86	0.57	UBF89	0.39
6AK5	0.45	6JU8A	0.90	DY51	2.00	EF86	0.52	PCF200	1.35	UC92	0.50
6AM8A	0.70	6K7G	0.50	DY86/7	0.52	EF89	0.55	PCF201	1.00	UCC85	0.45
6AN8	0.70	6K8G	0.50	DY802	0.50	EF91	0.70	PCF801	0.49	UCF80	0.80
6AQ5	0.75	6L7(M)	1.50	E80CF	6.00	EF92	0.70	PCF802	0.80	UCH42	1.00
6AT6	0.60	6Q7G	0.75	E88CC	1.20	EF183	0.50	PCF805	2.25	UCH81	0.52
6AU6	0.62	6SA7	0.70	E188CC	4.50	EF184	0.50	PCF806	0.70	UCL82	0.70
6AV6	0.65	6SG7	0.70	EA50	0.40	EH90	0.65	PCH200	1.00	UCL83	1.00
6AW8A	1.15	6U4GT	1.00	EABC80		EL41	1.00	PCL82	0.62	UF41	0.70
6AX4	0.75	6V6G	0.50		0.48	EL81	1.00	PCL83	0.75	UF42	1.00
6BA6	0.65	6X4	0.95	EAF42	1.00	EL84	0.48	PCL84	0.46	UF80	0.40
6BC8	0.90	6X5GT	0.50	EAF801	1.50	EL86	0.60	PCL86	0.72	UF85	0.50
6BE6	0.70	9D7	0.70	EB91	0.25	EL95	0.95	PCL805	0.65	UF89	0.52
6BH6	1.10	10C2	0.70	EBC41	1.00	EL360	2.50	PFL200	1.12	UL41	0.90
6BJ6	0.75	10DE7	0.80	EBC81	1.00	EL506	2.00	PL33	1.00	UL84	0.65
6BK7A	0.85	10F1	0.67	EBF80	1.00	EL509	2.50	PL36	0.80	UM80	1.00
6BN8	1.00	10F18	0.65	EBF89	0.40	EM80	1.00	PL81	0.49	UY41	0.70
6BQ7A	1.40	10P13	0.80	EC86	0.84	EM81	1.00	PL81A	0.75	UY85	0.70
6BR7	1.00	10P14	2.50	EC88	0.84	EM84	1.00	PL82	0.50	U19	4.00
6BR8	1.25	12AT6	0.45	EC92	1.00	EM87	1.45	PL83	0.50	U25	1.00
6BW6	3.50	12AU6	0.50	ECC33	2.00	EY51	0.65	PL84	0.50	U26	0.90
6BW7	0.65	12AV6	0.60	ECC35	2.00	EY81	1.50	PL95	1.00	U191	0.50
6BZ6	1.50	12BA6	0.50	ECC40	1.00	EY83	1.50	PL802	3.20	U301	1.00
6C4	0.50	12BE6	0.85	ECC81	0.52	EY87/6	0.45	PL504	1.05	U404	0.75
6C9	2.00	12BH7	0.55	ECC82	0.52	EY88	1.00	PL508	1.30	U801	1.00
6CB6A	0.65	13D8	2.00	ECC83	0.52	EY500	1.45	PL509	2.55	VR105	0.50
6CD6G	4.00	19AQ5	0.65	ECC84	0.50	EZ40	1.00	PL519	2.80	VR150	0.75
6CG8A	0.90	19G6	6.50	ECC85	0.50	EZ41	1.00	PY33/2	0.50	X41	1.00
6CL6	0.75	19H1	4.00	ECC86	2.00	EZ80	0.42	PY81	0.60	Z759	6.50
6CL8A	0.95	20P1	1.00	ECC88	0.72	EZ81	0.45	PY82	0.40		
6CM7	1.00	20P4	0.84	ECC807	2.80	GY501	1.25	PY88	1.12		
6CU5	0.90	30C15	1.00	ECF80	0.65	GZ32	1.00	PY500A	1.56		
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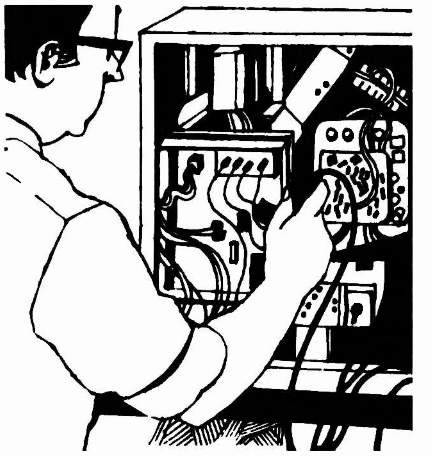

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