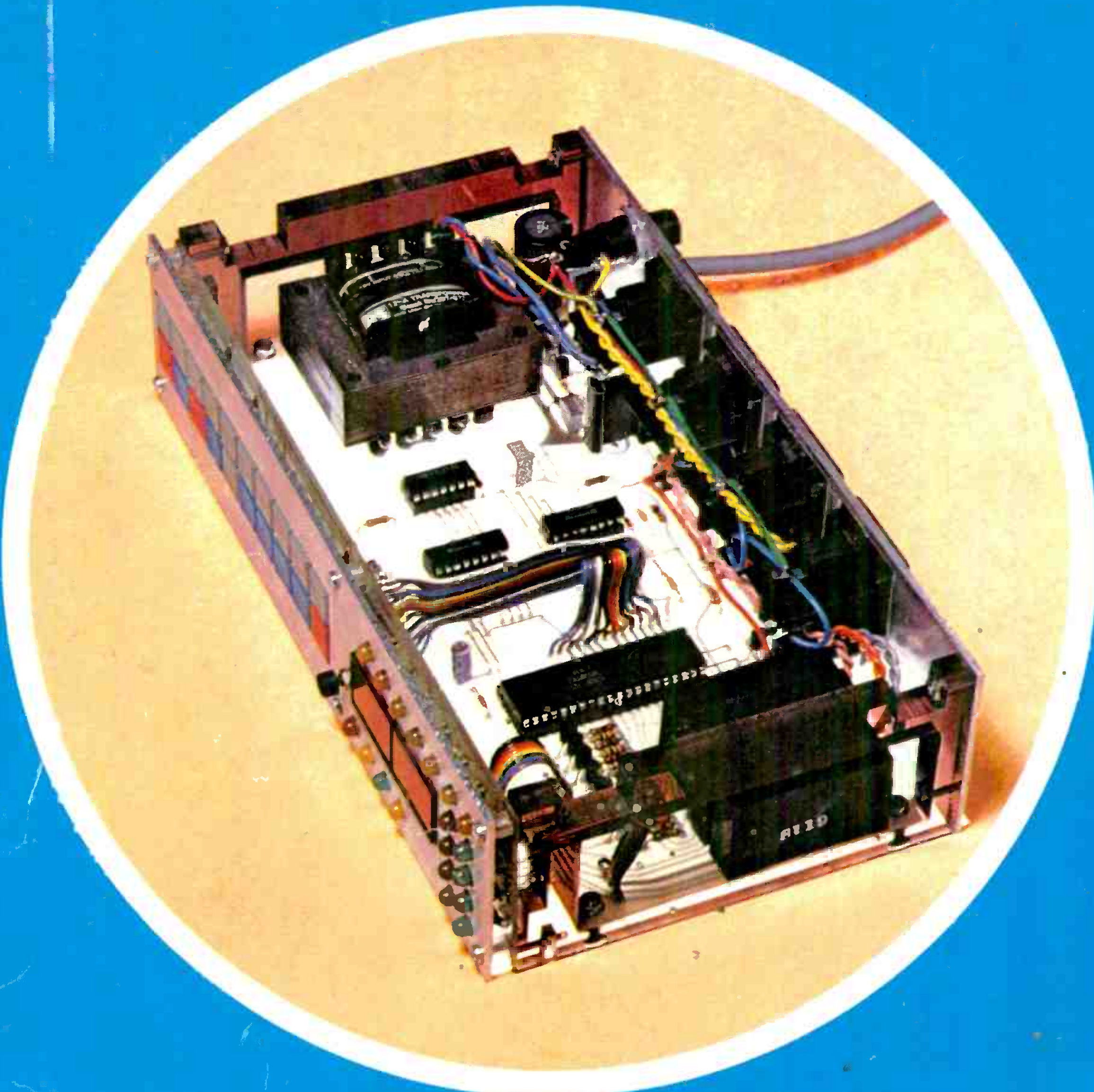
DECEMBER 1981 70p

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS



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TELEVISION

December 1981 | Vol. 32, No. 2 | Issue 374

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

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this month

OUR NEXT ISSUE DATED JANUARY WILL BE PUBLISHED ON DECEMBER 23

MANOR SUPPLIES

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

- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
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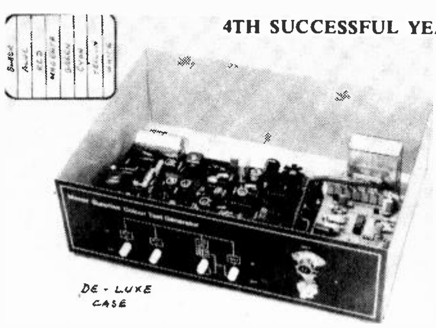
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.

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

ALL ABOVE PRICE INCLUDE VAT 15%.

PAL COLOUR BAR GENERATOR (Mk 4)

4TH SUCCESSFUL YEAR



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

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

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

(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

Remote control of stations & teletext.

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Further details on request **P/P £2.80.**

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"TELEVISION" MONO PORTABLE RECEIVER PARTS AVAILABLE. WORKING MODELS & PANEL TEST SERVICE.
"TELEVISION" COLOUR RECEIVER (LARGE SCREEN) PROJECT ALL PARTS AVAILABLE. SEND OR PHONE FOR LIST. WORKING MODEL ON SHOW WITH TELETEXT. (PANEL TEST SERVICE)
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BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 90p.
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BUSH 161 TIMEBASE PANEL A634 **£3.25** p.p. £1.40.
DECCA "Bradford" IF T.B. POWER ex rental **£5.75 each** p.p. £1.40.
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THORN 3000 LINE TB PCB **£5.75 each** p.p. 85p.
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THORN 8500 Series channel selector & front control unit **£4.37** p.p. £1.80.
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THORN 8000/8500 FRAME T.B. PANELS salvaged **£5.52** p.p. £1.40.
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PHILIPS G8/G9 IF/DECODER Panels for small spares **£4.80** p.p. £1.30.
G8 IF Panels for small spares **£1.75** p.p. 95p.
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BUSH "Touch Tune" and Varicap Control Unit **£4.40** p.p. 95p.
VARICAP UHF-VHF ELC 2000S £9.80. BUSH TYPE **£8.60** p.p. 85p.
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UHF/625 Tuners, many different types in stock. **UHF** tuners transisted. incl. s/m drive, Mullard 4 position push button **£4.80** p.p. £1.30.
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MULLARD EP9000 Audio Unit incl. LP1162 Module **£4.38** p.p. 85p.
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BUSH 145 to 186SS series	**£9.20**
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DECCA 20/24, 1700, 2000, 2401	**£8.80**
FERG., HMV, MARCONI, ULTRA 850 to 1580	**£6.80**
THORN 1690, 1691	**£10.15**
GEC 2000 to 2038 series	**£7.80**
GEC series 1 & 2	**£9.20**
INDESIT 20/24EGB	**£8.80**
ITT/KB VC1 200, 300	**£8.80**
MURPHY 1910 to 2417 series	**£8.80**
PHILIPS 19TG 170, 210, 300	**£8.80**
PYE, INVICTA, EKCO, FERR. 368, 169, 569, 769 series	**£8.80**

SPECIAL OFFER

GEC 2114J/FINELINE	**£5.50**
PYE 40, 67	**£5.50**
THORN 1590/1591	**£5.50**
KB VC ELEVEN (003)	**£3.25**

COLOUR LOPTS p.p. £1.30
(BOBBINS **80p**)

R.B.M. A823	**£5.60**
R.B.M. Z179	**£6.70**
R.B.M. T20, T22 Bobbin	**£6.44**
DECCA Bradford (state Model No.)	**£10.15**
DECCA 80, 100	**£9.50**
GEC 2028	**£7.82**
GEC 2040	**£11.30**
GEC 2110 Series	**£12.20**
ITT CVC 5 to 9	**£10.15**
ITT CVC 30 Series	**£10.15**
PYE 691-697	**£14.80**
PYE 713-715	**£7.85**
PYE 731 to 741	**£7.85**
PHILIPS G8, G9	**£10.15**
PHILIPS 570	**£7.85**
THORN 3000/3500 SCAN, EHT	**£7.85**
THORN 8000/8500	**£14.80**
THORN 9000	**£10.15**

OTHERS AVAILABLE, PRICES ON REQUEST. ALSO F.OPTS.
TRANSDUCTORS Suitable for G8, A823, Bradford etc. **£1.72** p.p. 60p.
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LARGE SELECTION TESTED COLOUR PANELS POPULAR MODELS

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ALL PRICES INCLUDE VAT AT 15%

TV scores with quality

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NEW SPARE SELECTION

TYPE	PRICE £
AC107	0.24
AC113	0.22
AC115	0.23
AC117	0 30
AC125	0.23
AC126	0 23
AC127	0 22
AC128	0.22
AC131	0 13
AC141	0 24
AC142	0.24
AC141K	0 31
AC142K	0.31
AC151	0.21
AC165	0.21
AC166	0.21
AC168	0.22
AC176	0.22
AC176K	0 28
AC178	0 23
AC186	0.26
AC187	0.23
AC188	0.23
AC187K	0.30
AC188K	0.30
AD130	0.58
AD140	0.68
AD142	0.80
AD143	0.70
AD145	0.70
AD149	0.64
AD161	0.42
AD162	0.42
AD161)	
AD162)	1.00
AF106	0.42
AF114	0.37
AF118	0 45
AF121	0 37
AF125	0.30
AF126	0.30
AF127	0.30
AF139	0 40
AF150	0.27
AF151	0.30
AF170	0.92
AF172	1.00
AF178	1 00
AF180	1.00

TYPE	PRICE £
AF181	1.00
AF186	0.90
AF239	0.46
AU113	1.40
BA130	0.08
BA145	0.14
BA148	0.21
BA155	0.08
BAX13	0.05
BAX16	0 08
BC107	0.11
BC108	0.11
BC109	0.11
BC113	0 11
BC114	0 11
BC115	0 11
BC116	0.11
BC117	0 12
BC119	0 24
BC125	0.15
BC126	0 15
BC136	0.15
BC137	0 17
BC137	0.23
BC139	0 23
BC140	0.24
BC141	0.27
BC142	0.27
BC143	0 27
BC147	0.10
BC148	0.10
BC149	0.10
BC153	0 12
BC154	0 12
BC157	0 12
BC158	0 12
BC159	0 12
BC160	0 26
BC161	0 26
BC167	0 11
BC168	0 11
BC169	0 11
BC171	0.10
BC171A	0 10
BC172	0.10
BC173	0.12
BC177	0.12
BC178	0.12
BC178A	0.12

TYPE	PRICE £
BC179	0 12
BC182L	0.09
BC183L	0.09
BC183LA	0 10
BC183LB	0.10
BC184L	0.09
BC186	0.21
BC187	0 21
BC209	0 11
BC212	0.09
BC212L	0 09
BC213L	0.09
BC214L	0 09
BC237	0.09
BC238	0.09
BC240	0.31
BC249	0 35
BC251	0 22
BC257	0 20
BC262	0 18
BC263B	0.20
BC267	0 19
BC281	0 24
BC300	0 27
BC301	0 27
BC302	0 30
BC303	0.27
BC307	0 11
BC307A	0 11
BC308A	0 12
BC309	0 14
BC337	0.12
BC338	0 15
BC487	0 20
BC547	0 10
BC548	0 11
BC549	0 11
BC557	0.12
BCX33	0.10
BD112	0.39
BD113	0.65
BD115	0 32
BD116	0 47
BD124	1.30
BD131	0 36
BD132	0.36
BD133	0.37
BD135	0.30
BD136	0.30

TYPE	PRICE £
BD137	0.30
BD138	0.31
BD139	0.40
BD140	0 37
BD144	1.39
BD145	0.50
BD177	0.50
BD178	0.50
BD203	0.40
BD204	0.70
BD222	0.73
BD233	0.36
BD234	0 34
BD237	0.44
BD238	0.44
BDX22	0.73
BDX32	1 98
BDY18	0.80
BDY60	0 80
BF115	0.30
BF12:	0 29
BF154	0 12
BF158	0 19
BF159	0.24
BF160	0 23
BF163	0 30
BF164	0 30
BF167	0 30
BF173	0 21
BF177	0 26
BF178	0 24
BF179	0.28
BF180	0 30
BF181	0 34
BF182	0 30
BF183	0 29
BF184	0 27
BF185	0.29
BF186	0.32
BF192	--
BF194	0 15
BF195	0 13
BF196	0 13
BF197	0 13
BF198	0 12
BF199	0.14
BF200	0.28
BF216	0.12
BF217	0.12

TYPE	PRICE £
BF218	0 12
BF219	0.12
BF220	0 12
BF221	0.21
BF222	0.12
BF224	0 18
BF256	0 37
BF258	0 30
BF259	0.30
BF260	0.25
BF262	0 28
BF263	0 25
BF271	0 27
BF272	0.27
BF273	0 16
BF336	0 30
BF337	0.29
BF338	0 29
BF479	--
BFT	0.27
BFT	0 27
BFX84	0.27
BFX85	0 27
BFX	0.30
BFY37	0.22
BFY50	0.21
BFY51	0 21
BFY52	0.21
BFY53	0 27
BFY55	0 33
BFX	–
BHA0002	1 90
BSX20	0.23
BSX76	0 23
BSY84	0.36
BU105	1 00
BU105 02	1.50
BU105 04	2.00
BU126	1.40
BU205	1.20
BU206	1 60
BU208	1.60
OC22	1 10
OC23	1.30
OC24	1.30
OC25	1.00
OC26	1.00
OC28	1.30
OC35	1.00

TYPE	PRICE £
OC36	0 90
OC38	0.90
OC42	0.45
OC44	0.60
OC45	0.50
OC46	0 39
OC70	0.39
OC71	0.39
OC72	0.39
OC74	0.39
OC75	0.39
OC76	0 39
OC77	0.50
OC78	0.23
OC81	0 26
OC810	0.14
OC82	0.26
OC820	0.20
OC83	0 30
OC84	0 30
OC85	0 28
OC123	0.25
OC169	1 20
OC170	1 20
OC171	0.92
OA91	0.07
BRC4443	0.65
R2008B	1 50
R2009	1 30
R2010B	1 50
R2265	1 50
R2305	0.38
R2305	
BD222	0.37
R2540	2.50
S2802	--
SCR957	0 65
TIP31A	0.38
TIP32A	0.36
TIP3055	0.53
TIP31B	0.39
TIS90	0 23
TIS91	0 25
TV106	1 09
MJE340	0.50
MJE520	0.45
2N2219	0.40
2N2646	0.40
2N2926	0.15

TYPE	PRICE £
2N3053	0.21
2N3054	0 60
2N3055	0.60
2N3442	1.00
2N3702	0.15
2N3703	0.12
2N3704	0.18
2N3705	0 18
2N3706	0.14
2N3707	0.14
2N3708	0.14
2N3772	2 00
2N3773	2.50
2N3819	0 30

VALVES

DY87	0.60
DY802	0 64
ECC82	0.60
EF80	0.55
EF183	0.70
EF184	0.70
EH90	0.75
PC86	0.85
PCC89	0.65
PCC189	0.80
PCF80	0.80
PCF86	0.72
PCF801	0.70
PCF802	0.85
PCL82	0.75
PCL84	0.80
PCL86	0.85
PCL805	0.82
PLF200	1.00
PL36	£1.10
PL84	0.80
PL504	£1.30
PL508	1 50
PL509	2.45
PL802	£2.75
PY88	0.75
PY500A	1.60
PY81/800	0.70

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

E.H.T. Trays Colour

TYPE	PRICE £
Pye 691 693	4.50
Pye 715/731/735	5.50
Pye 737	5.40
Decca (Large Screen) CS2030/2232/2630/2632/2230/2233/2631	5.00
Decca 80	5.30
Decca 100	5.30
Philips G8 520/540	5.30
Philips G9	5.50
Philips 550	5.30
GEC C2110	5.50
GEC Hybrid CTV	5.10
Thorn 3000/3500	5.00
Thorn 800	2.42
Thorn 8500	4.75
Thorn 9000	5.50
GEC TVM25	2.50
ITT KB CVC 5/7/8/9	5.10
ITT KB CVC 20/25 30/32	5.50
Bush CTB25 MK3 Quadrupler	8.00
Bush X179	4.50
RRI (RBM) A823	5.00
Bang & Olufsen 4/5000 Grundig 5010/5011/5012/6011/6012/7200/2052/2210/2252R Tandberg (radionette) Autovox	6.60
Grundig 3000/3010 Saba 2705/3715 Telefunken 709/710/717/2000	6.80
Korting	6.80

E.H.T. TRAYS MONO

950 MK2 Single Stick Thorn TV 11, 16K 70V	0.75
TV 20 2 MT	0.75
TV 2016K 18V	0.75
BUSH 718	1.30

MAIL ORDER TV BARGAINS

PYE 691	22"	@ £55.00
PYE 691	26"	@ £55.00
PYE 697	22"	@ £65.00
PYE 697	26"	@ £65.00
BUSH 184	19"	@ £70.00
BUSH 184	22"	@ £70.00
BUSH 184	26"	@ £70.00
GEC 2040	19"	@ £55.00
GEC2040	22"	@ £55.00
GEC 2040	25"	@ £55.00
GEC 2040	26"	@ £65.00
KORTING	22"	@ £70.00
KORTING	26"	@ £80.00
THORN 3000	19"	@ £70.00
THORN 3000	25"	@ £60.00

Good working mono's Pye, GEC, Bush etc.

20" & 24" S/S	£20.00
20" & 24" D/S	£18.00
19" & 23" D/S P/Button	£15.00
19" & 23" D/S Rotary	£12.00

Cheques, P.O. or Cash with orders Please
Please note there is 15% VAT on all the above prices. Plus £10.00 p & p for colour TV. £5.00 for mono. ENGLAND, WALES and SCOTLAND Inland N & S IRELAND £15.00 for colour. £7.00 for mono.

IC's

TYPE	PRICE £
BTT6018	1.00
CA3605	1.20
MC7/c	
MC14016	0.50
SN76003N	1.40
SN76023N	1.20
SN76110N	1.00
SN76226DN	1.50
SN76227N	1.20
SN76532N	1.30
SN76550N	0.30
SN76666N	0.70
TAA570	1.38
TBA120AS	1.00
TBA120S	0.75
TBA120SQ	0.75
TBA395	2.20
TBA341	0.97
TBA520	1.40
TBA520Q	1.10
TBA530Q	1.10
TBA540	1.30
TBA540Q	1.45
TBA550Q	1.40
TBA560C	1.50
TBA560CQ	1.50
TBA570	1.00
TBA570Q	1.00
TBA800	1.00
TBA810	1.50
TBA920	2.00
TBA920Q	1.50
TBA990Q	1.50
TCA270SQ	1.45
TCA270SA	1.45
TCA270Q	—
TCA1327B	1.00
TCA800	2.00
TDA1010	—
TDA1327B	1.00
SBA750	1.75
SC9503P	1.20
SC9504P	1.20
SL901B	5.00
SL917B	7.00

DIODES & THYRISTORS

OA47	0.06
OA81	0.06
OA90	0.06
OA91	0.07
BA130	0.10
BA145	0.16
BA148	0.18
BA154	0.18
BA155	0.10
BAX13	0.08
BAX16	0.10
BY126	0.10
BY127	0.10
BY164	0.40
BY179	0.57
BY226	—
BY227	0.12
BYF206	0.14
1N4001	0.04
1N4002	0.05
1N4003	0.06
1N4004	0.07
1N4005	0.07
1N4006	0.08
1N4007	0.08
1N4148	0.05
1N4751	0.14
1N5401	0.12
1N5403	0.12
1N5404	0.14
1N5405	0.14
1N5406	0.14
1N5408	0.25
BR100	0.22
BR101	0.28
BT106	1.19
BT108	1.23
BT109	1.09
BT116	1.60
BT120	1.60
2N4444	0.90

BRIARWOOD TELEVISION LTD

Briarwood House, Preston Street,
Bradford West Yorkshire BD7 1LU
Tel: (0274) 306018

P. V. TUBES

Telephone: Accrington (0254) 36521

38A WATER STREET, ACCRINGTON, LANCS BB5 6PX.

WHOLESALE SUPPLIERS OF TELEVISION COMPONENTS

TRADE COUNTER OPEN MON-FRI 9 a.m.-4.30 p.m. SAT MORN. 9.30 a.m.-12 noon.

INTEGRATED CIRCUITS

MC1307	1.00	ML922	3.29	SN76131N	1.30	TAA350A	60	TBA120B	1.30	TBA570	1.00	TCA800	1.99	TDA2540	3.84
MC1327	1.00	ML926	2.18	SN76226(D)N	1.55	TAA300	58	TBA120SB	1.30	TBA641-B11	2.40	TCA940	1.60	TDA2541	2.65
MC1330P	90	ML928	2.18	SN76227N	1.10	TAA310	2.83	TBA120U	1.00	TBA641 BX1	2.00	TDA440	2.20	TDA2560	1.90
MC1349	1.20	SA5560S	1.80	SN76532N	1.50	TAA320	59	TBA395	2.20	TBA690	1.50	TDA1004A	2.96	TDA2581	2.25
MC1350	96	SA5570S	1.80	SN76533N	1.30	TAA550	28	TBA396	80	TBA673	1.10	TDA2540	3.15	TDA2590	3.25
MC1351	1.00	SA5580S	2.90	SN76033N	1.53	TAA570	1.80	TBA440N/TBA1441	2.75	TBA700	2.12	TDA1170	1.99	TDA2591	2.75
MC1352	1.00	SA5590S	2.90	SN76544N	1.35	TAA630	2.50	TBA440	2.50	TBA7200	2.12	TDA1190	2.60	TDA2593	2.50
MC1358PQ	1.50	SL901B	4.45	SN76650M	89	TAA630S	2.50	TBA480	1.20	TBA750	2.05	TDA1270	3.73	TDA2600	3.25
MC1495L	1.00	SL917B	6.25	SN76660N	60	TAA621 AX1	3.00	TBA4800	1.20	TBA800	99	TDA1327	1.00	TDA2611A	1.95
MC14011BCP	42	SL1310	1.80	SN76666N	70	TAA840/S1	1.96	TBA500P	1.58	TBA810AS	1.35	TDA1352B	1.60	TDA2640	2.25
MC14049BCP	43	SL1327Q	1.20	SW153	2.74	TAA700B	1.70	TBA510	3.00	TBA820	1.70	TDA1412	1.20	TDA2690	1.00
ML231B/ETTR6016	2.20	SL76544	2.00	TA7141P	95	TAA700	1.70	TBA5200	1.20	TBA890	3.94	TDA2020	4.66	TDA3950	2.36
ML232/ETT6016 CA3065	2.20	SN76003N	1.75	TA7050P	95	TAA661B	1.20	TBA5300	1.28	TBA920	1.80	TDA2030	2.80	UPC566H	2.95
ML236	5.35	SN76013N	1.50	TA7051P	95	TAA840		TBA530	1.20	TBA9200	1.80	TDA2521	4.17	UPC575C2	3.40
ML237	1.95	SN76013ND	1.50	TA7171P	1.80	TBA120A	70	TBA540	1.49	TBA950(2X)	2.40	TDA2522	2.40	UPC1025HI	4.50
ML238	4.20	SN76023N	1.45	TA7172P	1.80	TBA120S	70	TBA550	1.58	TBA990	1.49	TDA2523	2.20		
ML239	2.50	SN76023ND	95	TA7173P	1.45	TBA120SA	70	TBA5500	1.68	TCA160	1.20	TDA2530	1.95		
ML920	4.12	SN76110N	89	TA7074P	1.00	TBA120AS	70	TBA5600	1.59	TCA760	2.30	TDA2532	2.45		
		SN76115N	2.27	TA7176P	75					TCA270SQ	1.25	TDA2524	2.25		

SOCKETS IC

8 pin 24 16 pin 20
14 pin 18 14 pin Dil/Quil 28

WE NOW HAVE THESE SPECIAL CB INTEGRATED CIRCUITS

TA7205AP	3.72						
2SC1909	1.41	MSN5807	7.87	PLL02AG	9.89	LC7120	5.87
2SC495	1.10	AN7150	3.97	MC1351P	1.00	TA7204P	3.77
LC7130	5.93	TA7222	4.07	AN2140	3.91	TA7130P	1.93
AN240	3.84	TA7310P	2.78	LA4031P	3.21	UPC1156H	4.26

Please enquire for others

SEMICONDUCTORS

AC126	22	AU110	2.00	BC171	9	BC261B	15	BD138	23	BF115	35	BF259	24	BFY90	75	OC79	20	2N3706	10
AC127	22	AU113	1.40	BC171A	10	BC262A	15	BD139	28	BF117	36	BF262	84	BR100	17	R2008B	1.80	2N3708	17
AC128	20	BC107	20	BC171B	10	BC262B	15	BD140	31	BF125	26	BF263	50	BR101	30	R2010B	1.80	2N2904	30
AC128K	32	BC107A	20	BC172	9	BC300	33	BD144	1.20	BF127	26	BF271	24	BRC4443	80	R2265	1.40	2N5294	48
AC141K	34	BC107B	20	BC172B	10	BC301	28	BD159	65	BF154	12	BF273	12	BRX46	40	R2322	58	2N5296	48
AC142K	30	BC108	20	BC172C	10	BC303	28	BD160	1.30	BF158	18	BF310	30	BRY39	30	R2323	67	2N5298	69
AC176	25	BC108A	20	BC173C	12	BC307	10	BD166	52	BF160	27	BF311	30	BRY56	57	R2461	1.50	2N5496	53
AC176K	32	BC108B	20	BC174A/B	10	BC308A/8	17	BD179	52	BF167	24	BF336	36	BT106	1.00	R2540	2.30	2N6107	75
AC187	26	BC108C	20	BC182	9	BC327	11	BD182	72	BF173	22	BF337	30	BT108	1.24	RCA16334	90	2SC643A	1.50
AC187K	28	BC109	20	BC182LB	10	BC328	9	BD183	75	BF177	35	BF338	34	BT116	1.21	RCA16335	80	2SC1172Y	2.20
AC188	25	BC109B	20	BC183LB	10	BC337	11	BD201	85	BF178	26	BF355	37	BU104	2.00	TIP29C	43		
AC188K	37	BC109C	20	BC184	9	BC338	9	BD202	80	BF179	28	BF362	37	BU105	1.25	TIP30C	43		
AD143	82	BC114	12	BC184	10	BC461	30	BD203	80	BF180	36	BF363	33	BU108	1.80	TIP31C	41		
AD149	79	BC116A	12	BC204	10	BC547	10	BD204	84	BF181	36	BF371	30	BU124	1.30	TIP32C	42		
AD161	42	BC117	20	BC208	13	BC548	10	BD222	46	BF182	30	BF457	35	BU126	1.49	TIP33B	75		
AD161/2	1.15	BC119	24	BC209	10	BC549	8	BD223	56	BF184	30	BF458	28	BU204	1.50	TIP41C	46		
AD162	42	BC140	32	BC212	9	BC550	7	BD225	47	BF185	30	BF459	35	BU205	1.34	TIP42C	47		
AF114	40	BC141	26	BC212L	9	BC557	8	BD232	45	BF194	11	BF639	28	BU206	1.80	TIP47	70		
AF118	62	BC142	21	BC213	9	BC558	9	BD233	35	BF195	11	BFT42	28	BU208	1.60	TIP2955	90		
AF121	56	BC143	24	BC213B	10	BCY72	13	BD234	37	BF196	10	BFT43	28	BU208A	1.65	TIP3055	63		
AF124	34	BC147	9	BC213L	9	BD115	32	BD235	33	BF197	11	BFW10	60	BU208/02	2.10	TIS91	21		
AF125	35	BC148	9	BC214	9	BD116A	65	BD236	40	BF198	18	BFX29	30	BU326A	1.42	TV106/02	1.55		
AF126	34	BC149	10	BC214L	10	BD124P	60	BD237	33	BF199	15	BFX84	27	BU407	1.25	2N696	21		
AF127	32	BC157	11	BC2378	12	BD131	33	BD238	35	BF200	30	BFX85	28	BU500	1.95	2N2905	28		
AF139	42	BC158	10	BC238A/B/C	8	BD132	35	BD410	55	BF241	15	BFX86	30	EI222	28	2N3054	60		
AF239	45	BC159	10	BC251A	12	BD133	40	BD434	55	BF256LC	28	BFX88	25	MJE340	40	2N3055	60		
AL102	2.00	BC160	25	BC252A	12	BD135	26	BD517	60	BF256	28	BFY50	20	MJE520	44	2N3702	11		
AU106	2.50	BC161	28	BC252B	12	BD136	27	BD520	75	BF257	28	BFY51	22	MJ3000	2.36	2N3703	10		
AU107	2.00	BC170B	15	BC261A	18	BD137	26	BDX32	1.50	BF258	25	BFY52	20	OC71	27	2N3705	10		

THERMISTORS

VA1104	75
VA8650	55
VA1039	35
GEC Dual Posistor	1.50
GEC Dual 2040	1.50

CERAMIC FILTERS

6Mhz	74
5.5Mhz	74

CRYSTALS

4.3Mhz	1.30
8.8Mhz	1.30

NEW VALVES

30FL2	1.41	EY500A	1.33	PCL85/805	79
DY802	72	EZ80/1	56	PCL86	81
DY86/7	66	GY501	1.45	PD500	2.93
ECC81	60	GZ34	1.56	PFL200	1.35
ECC82	68	KT66	5.00	PL36	1.15
ECC83	60	KT88	6.00	PL81	94
ECC84	80	PC86	81	PL82	46
ECC85	98	PC88	81	PL83	1.43
ECC88	1.35	PC92	80	PL84	84
ECF80	80	PC97	1.14	PL95	1.00
ECF82	88	PC900	80	PL504	1.32
ECH81	1.04	PCC84	70	PL508	1.43
ECH84	1.13	PCC85	85	PL509	2.78
ECL80	84	PCC88	82	PL519	2.78
ECL82	77	PCC89	79	PL802	2.45
ECL86	84	PCC189	1.02	PY33	61
ECF86	78	PCC805	1.40	PY88	81
EF80	68	PCF80	75	PY500A	1.40
EF85	68	PCF86	1.13	PY800/1	69
EF86	1.19	PCF200	1.23	UCF80	67
EF89	1.43	PCF800	1.38	UCH81	1.43
EF183	68	PCF801	1.23	UCL82	84
EF184	68	PCF802	86	UCL83	94
EH90	1.02	PCF805	1.63	UL84	1.02
EL34	1.63	PCF806	1.30	U26	1.30
EL81	86	PCF808	1.63	U191	95
EL84	68	PCH200	1.45	6F23	85
EL90	82	PCL82	78	UY85	80
EL509	2.22	PCL83	2.00	PL802T	2.50
EY86/7	68	PCL84	81		

All valves are new – boxed – guaranteed.

Please add 15% VAT to **ALL** items.

DIODES

AA119	9	BY210/800	33	IN5401	12
BA102	17	BY298	22	IN5402	14
BA115	13	BY299	22	IN5403	12
BA145	17	BYX10	20	IN5404	12
BA148	17	BYX36/10	30	IN5405	13
BA154	6	BYX36/600	35	IN5406	16
BA155	14	BYX55/600	30	IN5407	16
BA156	15	BYX71/600	90	IN5408	16
BA317	25	OA47	9	ITT44	4
BAX13	4	OA90	5	ITT2002	11
BAX16	8	OA91	6	Y969	89
BB105B	30	OA95	6		
BB105G	30	OA202	11		
BY126	12	IN914	4		
BY127	11	IN4001	4		
BY133	15	IN4002	4		
BY164	45	IN4003	4		
BY176	85	IN4004	5		
BY182	87	IN4005	5		
BY184	55	IN4006	5		
BY223	90	IN4007	6		
BY199	28	IN4148	2		
BY206	14	IN4448	10		

ZENER DIODES

BZX61/BZX85C(1.3W)	BZY88-(400MW)
6V2-7V5-8V2-9V1	2V7-3V-3V3-3V6
10V-11V-12V-13V-15V	3V9-4V3-4V7-5V1
16V-18V-20V-22V-24V-	5V6-6V2-6V8-7V5
27V-30V-33V-36V	8V2-9V1-10V-11V
39V-47V-56V-68V	12V-13V-15V-18V
75V	24V-27V.
Price **20p** each	Price **10p** each

ACCESS ACCEPTED

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	4.25
THORN 1500 3 Stick	3.85
THORN 1500 5 Stick	4.25
THORN 1600	3.45
THORN 2000	6.60
THORN 3000/3500	6.89
THORN 8000	3.55
THORN 8500/8800	5.40
THORN 9000	7.43
DECCA CTV 19/25	5.35
DECCA 1730/1830	3.68
DECCA 1910/2213 Bradford	5.92
DECCA 30	5.92
DECCA 80	6.28
DECCA 100	6.04
UNIVERSAL I.T.T.	5.40
GEC 2040/2028	5.84
GEC 2110 Pre Jan '77	6.95
GEC 2110 Post Jan '77	6.65
PHILIPS G8 Short Focus Lead	5.85
PHILIPS G8 Long Focus 550	5.85
PHILIPS G9	6.33
PYE 691/3	5.13
PYE 713 4 Lead	7.00
PYE 731/25	5.95
R.B.M. A823 (plug in) AV	5.98
R.B.M. A823	5.78
KORTING (similar to Siemens TVK1)	6.65
ITT KB CVC5/9	5.35
ITT KB CVC20/25/30 (Mullard Type)	5.35
RRI T20	6.80

RECTIFIER STICKS

TV11	74
TV18	81
TV20	95
TV13	75

TRANSFORMERS

L.O.P.T.

R.B.M. A774 Mono	11.74
R.B.M Z179	15.00
R.B.M. Z718 22"	19.50
R.B.M T20A	13.95
PHILIPS 210/300 Mono	10.00
PHILIPS G8	10.00
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 691/3	14.50
PYE 697 (Printed)	14.50
PYE 731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80	8.58
DECCA 100	8.58
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	9.00
GEC 2040	9.50
ITT CVC 1-9	9.20
ITT CVC 25/30/32	8.00
ITT CVC 20	7.16
THORN 3000 EHT	6.38
THORN 3000 SCAN	6.38
THORN 8000	9.85
THORN 8500	10.00
THORN 9000	10.65
THORN 3000/3500 Mains Trans	10.00
THORN 1591	8.68
THORN 1591	9.68
THORN 1691	9.68
THORN 9800	1800

PANELS

I F. Gain Module (Pye, Philips)	9.00
C.O A. PANEL (Pye, Ecko, Invicta, Dynatron)	20.00
CONVERGENCE PANEL Philips G8	17.85

NEW MONO TUBES

MULLARD A31/510 110° 12"	17.00
MULLARD A34/510 110° 14"	18.50
VEGA A50/120WR .20"	13.50
VEGA A61/120WR 24"	15.00
VEGA 12" 90°	15.00

REBUILT COLOUR TUBES

17"-18"-19"-20"-22"	£30.00
26"-25"	£34.00
26" 110°	£36.00

Glass for Glass exchange
2 year warranty

MULLARD COLOUREX TUBES OR THORN NEW LIFE TUBES

18" A47/342X-A47/343X	59.00
19" A49/120X	52.00
20" A51/120X	52.00
22" A56/120X	42.00
25" A63/120X	54.00
26" A66/120X	53.00
26" A67/120X	53.00

Glass for Glass exchange
1 year warranty or 4 year option.

TUBES. Collection from trade counter only.

The staff of P.V Tubes would like to thank all their customers/friends for their support in the past year and send warmest wishes for a Merry Christmas and a Prosperous 1982

As our regular customers know orders telephoned in before 4 p.m. will be dispatched the same day. Give us a ring – we'll give you service.

P. V. TUBES

Telephone: Accrington (0254) 36521

REPLACEMENT ELECTROLYTICS

DECCA 30 (400/400/350V)	2.96
DECCA 80 (400/350V)	3.15
DECCA 100 (800/250V)	3.15
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.21
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	4.50
PYE 691/7 (200/300/350V)	2.39
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.26
(2500/2500/25V)	1.15
RBM A823 (600/300V)	2.30
RBM Z146 (300/300/350V)	3.15
ITT CVC5/9 (200/200/75/25)	2.47
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.01
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.46
THORN 3500 (1000/63V)	65
THORN 3500 (1000/70V)	84
THORN 8000/8500 (2500/2500/63V)	1.54
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.05

WIREWOUND RESISTORS

PREFERRED VALUES

		price each
4W/5W	1R 1K5	20
	2K2-3K3	20
	4K7-6K8	20
	10K	25
7W	1R-4K7	21
	5K6-12K	21
	15K 22K	21
11W	1R-6K8	24
	10K-15K	24
	22K	24
17W	1R-10K0	28
	15K-22K	28

RESISTORS

A range of the following at Preferred Values

		Price per 10 pack
0 25W		20p
0 5W	3R3 to 8M2	20p
1W	10R to 10M	36p
2W	10R to 150K	62p
2W	10M	62p

ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	7.60
Mullard ELC1043/06	7.60
4 P/B DECCA/GEC/ITT	5.80
6 P/B DECCA/GEC/ITT	7.00
4 P/B PYE	9.00
6 P/B PYE	16.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass (Square/Early)	13.50
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.75
U321 UHF Tuner	7.50
THORN 8800 SELECTOR	7.50
THORN 9000 SELECTOR	11.40

SUNDRY TUNER ACCESSORIES

RANK Tuner Push Button 1¼"×½" dia.	30p
RANK Tuner Push Button 2" long × ⅜ dia.	30p
RANK Tuner Push Button 2" long × ½" dia	30p
GEC Tuner Neons 2110 chassis	14p
Drive Cams	10p each

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/push	62
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/off	62
A1 Beam Switch (THORN 3500)	50
A1 Controls 5m (THORN 3500)	69
GEC 2110 A1 Control IM5 (Red, Blue, Green)	each 58p
GEC 2040 On/Off Switch	each 88p

THERMAL CUT OUT

THORN 3000 2A Metal	1.60
THORN 8500 2 5 Plastic	1.60
GEC 2040 Metal	2.50

SUNDRIES

ANTIFERENCE Super Set Top		6.80
ANTIFERENCE Car antenna		7.80
ANTIFERENCE Xtra Boost UHF Amp.		15.40
ANTIFERENCE SB11 Splitter		2.40
Surface Mounting Aerial Outlets		80
Cable Clips	per 100	1.18
Transductor 90°		2.08
EHT Final Anode Cap		53
Delay Line CTAV 82/DL50/50L141		2.20
EHT Cable 30kV		25p per mtr.
Coax Plugs	pack of 10	1.80
Focus control GEC/THORN		1.83
PVC Tape		35
FM Plugs		25
PL259 Plugs		40
DECCA 30 Series width control		50
DECCA 3.9R Modulohm		60
Line Connectors		35
6.3V CRT boost trans		4.35
ANTIFERENCE XG8 High Gain Aerial (State Channel)		18.00
Reducers for PL259		16

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

SOLDERING EQUIPMENT

WELLER Iron Kit 15W	3.80
WELLER Iron Kit 25W (inc tips)	4.89
WELLER Iron 25W	3.80
WELLER 3/16" Single Flat Tips	51
MIN Soldering Iron	5.00
WELLER Heat Gun Kit	14.00
WELLER Heat Gun	11.00
(Pair) Tips for Gun	36
WELLER Cordless Iron	24.78
ANTEX Soldering Iron 25W	4.89
Solder Remover Sucker	6.50
Solda Mop	70
500G Reel Solder	7.00
DIY Type Solder	43
250G Solder	3.50

MIXED DIELECTRIC CAPACITORS

Volts DC		
600V	0.1 mFd	38
1000V	0.01 mFd	20
	0.047 mFd	29
	0 1 mFd	32
	0 22 mFd	48
	0.47 mFd	75
1250V	0.1 mFd	45
1500V	0.0022 mFd	19
	0.0047 mFd	20
	0 022 mFd	24
	0.033 mFd	59

SKELETON PRESET POTENTIOMETER HORIZONTAL and VERTICAL

MINIATURE price each 14
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Silicone Rubber Tube 1106	2.98

CAPACITORS

AXIAL TYPE

Volt	MF	Price	Volt	MF	Price
10	22	7		4 7	7
	47	7		100	19
	100	8		220	30
	220	11		470	38
	470	18		1000	53
				2200	85
16	1000	20	100	10	12
25	10	7		22	14
	22	7		47	19
	47	9		100	29
	100	10		220	35
	220	17			
	470	22	300	12	30
	1000	36	450	1	23
	2200	46		4.7	28
	4700	80		10	28
40	22	9		22	56
				33	62
50	500	38			
63	1	7	500V	1	30
	2.2	7			

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

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1K	55p	10K	55p
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250ma, 500ma 600ma, 630ma, 750ma, 850ma, 1A, 1.25A	
1.5A, 2A	1.41
2 5A, 3A, 5A	2.16
20m ANTISURGE	
80ma	3.11
100ma, 160ma, 200ma	2.08
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A	1.07
2.5A, 3.15A	1.43
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100ma	45
250ma, 500ma, 630ma, 800ma,	37
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	37
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GEC27840	84
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PYE 725/31 3R0/56R/27R	94
PYE 725 56R/27R	82
PHILIPS 50501	88
PHILIPS 210/50511/LINK	64
PHILIPS G8/50832	65
PHILIPS G8 47R section	39
THORN 1500	95
THORN 3500	75
THORN 8000	96
THORN 8500	86

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In Praise of Profit

At a time when consumer organisations seem to feel that the public is entitled to get the earth for next to nothing, left-wing parties regard it as anathema, and right-wing parties believe in applying monetary pressure to just about everything in sight in an effort to restore stable economic conditions, the subject of profit seems to be rather out of fashion. It's also a fact that the fall of profits as a percentage of the country's annual income has been a feature of our economy for many years. Since our economy has not been exactly a success story, maybe it's time that greater consideration was given to profits. But who would take up the theme? One has only to ask which political party might be prepared to campaign for increased profits to realise just how unfashionable the subject has become.

Profits have had a bad image for a very long time – the image of the greedy capitalist exploiting the public. The first industrial revolution occurred in the UK, which for a time became the workshop of the world – rather long ago now. Large profits were made by many early industrialists, and there's no doubt that exploitation of the workforce often went hand in hand with high profits. But not all industrialists achieved success, and high profits more often came from exploitation of one sort or another in the remoter parts of the empire. These profits were all too often sunk in unsound, badly managed enterprises, with the net result that the rich got wise and tended to put their money into the things they knew better – property, land, livestock and so on. Manufacturing industry came to be neglected, and it was certainly not fashionable to become involved in it. Perhaps this is the reason why so many of the firms at the forefront of the gentle economic resurgence that occurred in the thirties were of US parentage – Ford, Hoover and so on. Nowadays it seems that Japanese manufacturers are the only ones with the confidence to invest in manufacturing activity in the UK.

The UK has many technological achievements to its credit. But we don't follow through. The failure is not in marketing but in between, in an inability to instal and operate the productive capacity that can generate the profits required for sound industrial development. When this topic comes up for consideration, it's usual to place a large portion of the blame on the educational system. As long ago as 1869, Herbert Spencer wrote that British schools ignore "what most nearly concerns the business of life. Our industries would cease were it not for the information men acquire as best they may after their education is said to have finished." The situation may be better today, but still leaves much to be desired. And those who've "made it" still by and large prefer their children to enter the professions – any profession other than engineering! Unfortunately for us however, those in other nations don't share this attitude. Hence the growing difficulty in finding goods with "UK made" stamped on them.

A recent visitor to Toshiba's Plymouth TV plant reports that there's a notice above the production line reading "let us together provide many other people with good and inexpensive products – smoothly." It's not only the rather odd cultural aspect of this message that strikes one, it's also the harsh realisation that this simple idea doesn't seem to find ready acceptance in the UK. It's as if our industrialists are suffering from some sort of collective loss of nerve, which is hardly surprising. Successful manufacturing requires sustained investment, which in turn is possible only in the context of profitable operation. When profits dry up, the economy can only get weaker and weaker. What inducement is there to investment in manufacturing when money can earn a better return elsewhere – in building societies, on deposit and so on? When it costs more to borrow from the bank than you can make out of running a business, then business activity must decline. This situation really is appalling. Manufacturing investment in the UK fell by 15% this year, from an already low level. It's expected to decline by a further 5-10% next year. The UK's industrial base has shrunk by 20% over the past two years.

The inescapable conclusion is that the idea of profit must come in from the cold. It is after all simply a measure of whether an organisation is producing/providing a product/service for which there is a need, and doing so efficiently. Merely to say that profit is a good thing, vital to economic well-being, won't produce it from a hat of course. But removing its bad image can only help. An overriding factor to bear in mind is that lack of productivity is a prime cause of inflationary pressure: you can't increase productivity without investment, and you can't increase investment in a profitless situation. Perhaps we need a profit party.

ACKNOWLEDGEMENT

We have been asked by the BBC to point out that the maps shown in our article on Satellite TV (October, page 639) were based on ones originally produced by the BBC Research Department. We apologise for our discourtesy in failing to mention this.

HELD OVER

Due to production difficulties with the present issue, the Simon column and Part 8 of the Colour Portable Project have had to be held over. They will appear next month.

Teletopics

W. GERMANY STARTS TWO-CHANNEL TV SOUND SERVICE

Two-channel TV sound is now being regularly transmitted by the W. German ZDF network via its 29 main transmitters which cover some 60% of the W. German population. The start of the new service was timed to coincide with the opening of the Berlin Radio Show on September 4th. The system uses the two-carrier technique developed by the Institut für Rundfunktechnik in Munich. Patents have been taken out by IGR, the W. German equivalent of BREMA, and it's expected that this will have a dampening effect on imports, which have risen substantially over the last couple of years. Most W. German setmakers exhibited dual-channel sound receivers at the Berlin show, the additional cost working out at around 12-20%. By 1983, 45% of W. German TV set production is expected to feature dual-channel sound.

The technical details are as follows. The two carriers are spaced at 5·5MHz and 5·742MHz from the vision carrier, both being frequency modulated at up to 30kHz. The separation between the two carriers (242·1875kHz to be exact) is an odd multiple of half the line frequency. The 5·5MHz carrier is transmitted at −13dB with respect to the vision carrier, the second sound carrier being at −20dB. The 5·742MHz channel also contains a 54·6875kHz subcarrier for signal identification. The subcarrier is amplitude modulated at 117·5Hz to indicate a stereo transmission and at 274Hz to indicate a dual-sound (e.g. bilingual) transmission – zero modulation indicates a mono transmission.

£50 PRIZE WINNER

A questionnaire was included in 5,000 copies of our September issue, the aim being to find out a bit more about our readers and their interests. Over 1,000 questionnaires were returned to us – many thanks to all those who waded through the thing. The results are at present being analysed (not by us, or we'd never get this issue out on time!), and we'll let you know the outcome in a later issue. The winner of the £50 prize was John L. Saunders of West Sussex.

WIND-SOLAR POWERED TRANSMITTERS

The first television transmitting station in the UK to be powered by the wind and sun has been built by the IBA at Bossiney, Cornwall. The experimental station will provide ITV, BBC and TV4 programmes to just under 300 people, and marks an important development in the design of low-cost relay stations. The experimental use of the wind and solar generators combination is intended to continue for several years, during which data will be taken daily for analysis on a computer at the IBA Engineering Centre. The results will be compared with the performance predicted on the basis of a study of the Meteorological Office's daily sun and wind records over the past ten years.

The Bossiney station's power will normally come either directly from the wind or solar generators or from a bank of 36 large lead-acid batteries (about 1,000Ah capacity) that will be kept charged by the generators. The wind generator has an output of 150W at a wind speed of 7m/sec, while the array of 24 solar panels, comprising 864 silicon solar cells, can provide a maximum output of 780W in peak sunlight. The transmitting equipment has a consumption of about 150W. The attraction of a wind-solar system in the UK is that the weather conditions will usually favour one or the other of these energy sources – only in long periods of still fog (unusual in Cornwall) is there thought to be any risk of the batteries becoming fully discharged. The solar panels, wind generator and four-channel transposer have been supplied by Laboritaire Généal des Télécommunications (LGT).

Meanwhile the BBC has brought into operation a wind and solar powered link station at Dychliemore, Argyllshire, using all-British equipment. The link is at an intermediate site between the main Torosay transmitter on the Isle of Mull and the Dalmally relay station – it's a mile and a half south of the relay station and nearly 200ft. farther up the mountain, acting as an "active deflector". The booster amplifier is supplied by a wind-driven generator or an array of four solar panels, with storage batteries to supply power during windless, sunless periods – the battery capacity is sufficient to provide power for over three weeks without recharging.

The use of wind and solar power saves little energy since the power consumption of these transmitters is small. The advantage lies in the saving of the considerable capital cost of taking mains supplies to remote sites (the Bossiney station is linked to the mains, though this power source will normally be used only to operate the sophisticated data recording system).

ZOOM MIKES

One of the problems with using a video camera is getting the sound right – in particular when a zoom for a close-up is accompanied by an almost inaudible voice.

To overcome the problem JVC have introduced two microphones for use with their GX77/88 colour cameras. The idea is to be able to "focus" the sound to match the image. The simpler microphone is type MZ250, which incorporates a manual switch for selection of two settings, unidirectional and super-directional. In the super-directional setting the sensitivity is increased four times and the directivity is narrowed. The price is £40·95. The more expensive (£82·70) type MZ500 changes automatically from an almost omnidirectional response with the camera lens at a wide angle to a super-directional effect as the lens zooms in, being linked to the powered zoom system. This microphone employs three unidirectional elements (see Fig. 1), with the third element reversed in relation to the other two. All three units have the same sensitivity and are mounted on the same axis. For super high directivity elements one and two are used; for moderate directivity element two only is used; while for an omnidirectional response elements two and three are used. Intermediate

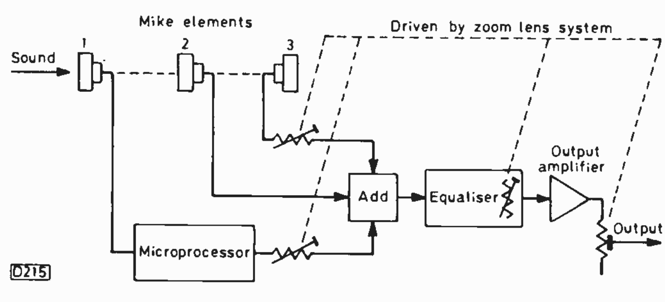


Fig. 1: The JVC MZ500 zoom microphone system.

effects are obtained since all four controls are ganged and driven from the zoom lens angle control circuit.

IC CHOPPER

Each new TV chassis that comes along seems to include something different and a bit unexpected. The latest circuit to come our way covers the GEC Models C2065H and C2265H, which are fitted with Hitachi 90° pincushion-distortion free tube assemblies. The completely new circuit features are the line output transistor, type 2SD898B, which has a common encapsulation with the shunt efficiency diode, and the extraordinarily simple switch-mode power supply – simple because nearly everything, including the chopper transistor itself, is incorporated within a single i.c. (type STR441). The over-voltage protection circuit places a short across the h.t. line in the event of excessive h.t./e.h.t.: the result is no sound or raster, with a high-pitched note to indicate that the safety circuit is operating.

MURPHY BACK

A welcome return by a well-known name in TV – Murphy. The brand is now being handled by Murphy Electronics, a subsidiary of J. J. Silber. The range will comprise sets with 20-26in. screen sizes and models with teletext facilities and remote control with frequency-synthesis tuning. The chassis used is the Rediffusion Mk. IV, which is produced at Rediffusion's Bishop Auckland factory in Co. Durham.

TRANSMITTER OPENINGS

The following relay transmitters are now in operation:
Avening (Gloucestershire) HTV West ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.
Braemar (Deeside) BBC-1 ch. 39, Grampian Television ch. 42, BBC-2 ch. 45, TV4 (future) ch. 49. The BBC transmitters are of a new BBC design nicknamed "Silver Streak": the central module of these units remains the same regardless of channel, making the transmitters cheaper and simpler to maintain.
Burnham (Norfolk) BBC-1 (East) ch. 40, Anglia Television ch. 46. BBC-1 (North) and Yorkshire Television can be received in the area from the Belmont transmitter.
Cane Hill (Coulsdon, Surrey) BBC-2 ch. 54, Thames TV/London Weekend TV ch. 58, BBC-1 ch. 61, TV4 (future) ch. 68.
Dalmally (Argyllshire) Scottish Television ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51 (see note on wind-solar powered transmitters above).
Glynn (County Antrim) TV4 (future) ch. 54, BBC-1 ch. 58, Ulster Television ch. 61, BBC-2 ch. 64.
King's Lynn (Norfolk) BBC-1 (East) ch. 48, Anglia Television ch. 52. This is a two-channel relay – see note under Burnham above.
Newtownards (County Down) TV4 (future) ch. 54, BBC-1 ch. 58, Ulster Television ch. 61, BBC-2 ch. 64.
Wells-next-the-Sea (Norfolk) BBC-1 (East) ch. 43, Anglia Television ch. 50. This is a two-channel relay – see note under Burnham above.

The above transmissions are all vertically polarised.

UP-DATING VHS MACHINES

Michael Selman Ltd. (12 Newlyn Close, Bricket Wood, Herts AL2 3UP) have introduced a VHS machine modification system that brings earlier models up to more recent standards. The modification replaces the earlier timer, adds infra-red remote control and rapid rewind, and extends the recording time to six hours.

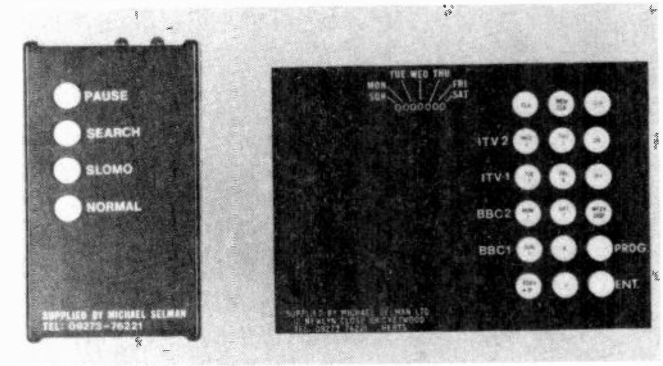
A JVC VCR incorporating the Selman up-dating modification with remote control.

The new timer is a state-of-the-art microcomputer arrangement which enables the machine to be programmed for up to ten separate recordings on any channel. The timer can remember the sequence of programmes and repeat it the following week, or erase the sequence on completion. This is called "week repeat" and is something not found on other timers. Everyday repeat is retained. Something else that's new is the way in which the information is entered into the timer – no need now for three hands! A key pad is used, with the functions selected simply by momentarily pressing the appropriate key and then typing in the times and days. Entry errors can be erased at the touch of a key.

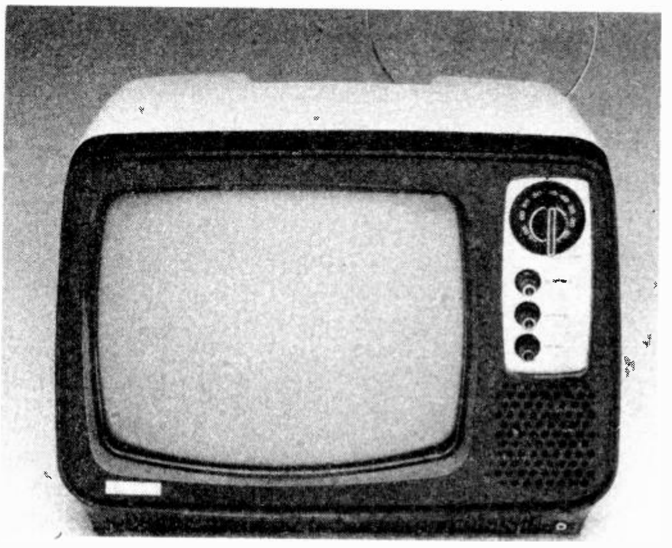
The remote control system gives remote control of pause/freeze frame, fast picture search and slow motion playback. A tri-colour LED is added to the front panel to indicate the mode selected – red for pause/freeze, green for picture search and yellow for slow motion. The additional rapid rewind mode enables the rewind time to be reduced by approximately two-thirds, and is switchable from the remote control handset.

The six-hour option is switch selected to retain normal operation. Selman claim that the quality of the sound and picture remain totally acceptable in the six-hour mode, which enables full use to be made of the advanced timer.

The modification can be carried out on most older models in the JVC, Akai, Ferguson and NordMende ranges. The additional electronics and hardware are all contained within the machine (no boxes bolted on the side!), while the electronic components mainly bridge across existing ones. The modification is available complete or in part to meet particular requirements, and after modification the entire machine is guaranteed for three months. If a



The Selman VCR modification units – remote control handset left, timer etc. right.



This smart monochrome portable is produced by the UK's newest setmaker – Network Industries.

module fails, it can be removed complete and returned for repair without affecting the normal operation of the machine. For further details write to the address given above or phone Garston 76221.

SERVICE NOTES – PHILIPS

The latest issue of *Service Link* contains a fault survey on the G11 chassis. Amongst the conditions not mentioned previously in these pages are:

(1) Hum bar on both sides of the scan with slight ripple on the picture due to transistor T4033 (BCX32) in the active filter circuit.

(2) High volume/brightness or buzz on sound due to the 12V stabiliser i.c. (TDA1412).

(3) A dark vertical bar on the right-hand side of the screen due to the sync/line oscillator i.c.

(4) Trapezium distortion/bending in from the sides due to faulty transistor(s) in the EW raster correction circuit – check T2119 (BC148C), T2140 (BC158) and T2150 (BD238).

Here's an interesting one on the G7000 video games unit: in the event of loss of picture or picture break up, check the clock oscillator circuit – if in doubt, replace the crystal and C3 (crystals covered with a grey plastic sleeve are most suspect).

THE LEGAL ASPECT

The legal aspect of video recording has never been clearly defined. One suspects that the proverbial blind eye has been turned on it. Not in California however, where the Federal Court of Appeals, in the case of Universal Studios and Walt Disney versus Sony, has ruled that VCR manufacturers are liable for damages if users of the machines infringe the laws of copyright. The case against Sony had been brought as a test because Sony's advertisements emphasized the use of their VCRs for taping TV programmes at home, and certainly won't end with the California Federal Court of Appeals. Just where it will end is another matter . . .

HITACHI LASER FOR DISC PLAYERS

Hitachi have introduced a solid-state laser diode, type HL7801, whose relatively short wavelength (780 nanometres) gives excellent reproduction when used to scan optical audio or video discs. The short wavelength reduces the size of the scanning unit and improves the signal-to-noise ratio. Whilst reliability has been a problem in the past with short wavelength laser diodes, the expected service life of the HL7801 diode is at least 100,000 hours at room temperature – equivalent to that of a typical 830 nanometre diode. The maximum output is 5mW, and a pin photodiode is incorporated in the encapsulation for convenience in assembling an automatic tracking control circuit. The availability of a suitable solid-state laser diode is likely to have a significant effect on the cost of an optical disc system.

HIGH-SPEED TELETEXT

The BBC and ITV are both now using four lines per field for teletext transmissions. In the case of Ceefax the waiting time for a page to appear has been halved – to an average 7 seconds, maximum 14 seconds. With Oracle the waiting time may be longer since the fourth text line is to be used for regional teletext.

Regional Oracle has already come to the Scottish Television area. STV's teletext service carries 60 pages of local information – news, sport, weather, travel, farming and a local "What's On".

The Oracle service throughout the UK now starts at 8.30 a.m., an hour before ITV weekday programme transmissions start.

PRESTEL FOR THE BLIND AND DEAF

At the recent National Aids for the Disabled Exhibition British Telecom demonstrated the world's first braille reader for use with Prestel. The reader has been developed by Clarke and Smith Ltd., in collaboration with British Telecom's Research Laboratories, and consists of a flat box about the size of an attache case. An array of tiny flat-topped pins is recessed into the surface of the box, selected pins being raised by the electronic equipment to create in braille the information being called up from the Prestel computer. As with an ordinary Prestel set, the braille version has a push-button control pad for page selection.

Also on show was a telephone terminal for the deaf (DCT). This consists of a small typewriter keyboard and moving strip visual display. The unit is linked to an ordinary telephone by means of two rubber acoustic cups into which the handset fits: users "converse" by using their typewriter keyboards. DCT is compatible with Prestel, and deaf people can use it to communicate with hearing people having Prestel sets with an alphanumeric keyboard.

NEW HITACHI VCR

Hitachi have introduced a new VCR, Model VT8300, to replace their successful VT8000. The new machine has a similar specification and look to its predecessor, but incorporates many circuit changes to achieve greater efficiency and reliability – much of the previous discrete circuitry is replaced by i.c.s. There's a four-digit tape counter to cater for four-hour tapes, and a ten-mode, full-function wired remote control keypad. The compact design is achieved by reducing the size of the motor system — a direct drive capstan is used, with a built-in high-precision quartz motor. The head cylinder also uses a built-in direct-drive motor with i.c. servo control. The capstan flywheel has been eliminated, the rotor performing this function. A microcomputer circuit controls the timed recordings, giving selection up to ten days in advance. To help with setting up, a test signal generator has been built in.

Letter from America: Comb Filters

Jim Edwards

BEING badly in need of a haircut (even the editor looked surprised during a recent quick return visit to the UK, and his hair is never exactly short!), my mind has been drifting to thoughts of scissors and combs, which brings us immediately to the topic this month – comb filters. Since comb filters are probably not a subject that readers will have come across in reading *The Sporting Life* and other popular papers, we'd better perhaps start by saying what they do as well as how they do it.

Every PAL colour decoder (unless of the "simple PAL" variety, and those haven't been produced in many a year) employs a form of comb filter – the chroma delay line and its associated circuitry. It's not needed in an NTSC decoder of course, but something similar has come on the scene here recently – for a somewhat different purpose.

With system M, as used in the USA, Japan and one or two other countries, the maximum vision bandwidth is 4·2MHz, the colour subcarrier sitting at 3·58MHz. As a result, if a conventional *LC* filter is used to remove the chroma information from the luminance channel, the luminance bandwidth is severely restricted. Result: loss of detail. Similarly, filtering to reduce the luminance signal in the chroma channel (to eliminate cross-colour effects) severely reduces the lower sidebands of the chroma signal.

The results obtained using conventional filtering are thus poor. The effects are not so bad with the European systems B, G and I because of the wider channel bandwidth and higher subcarrier frequency. So what's the solution? Enter some high technology in the form of a type of comb filter to separate the luminance and chrominance components of the composite video signal without the problems of bandwidth limiting.

A bit of theory is required before we go further. If you examine the nature of the NTSC signal in detail you find that the luminance and chrominance signals, together with their 30Hz and 60Hz sidebands, are arranged so that they interleave, being separated by half the line frequency ($f_h/2$). This is shown in Fig. 1 – the colour subcarrier frequency is chosen to get this effect.

This frequency spectrum, together with the relative similarity of successive lines of the transmitted picture, means that near perfect separation of the luminance and chrominance components of the signal is possible, at the expense of vertical resolution, using a transverse filter – one operating on a time delay basis rather than by bandwidth limiting. Transverse filtering brings us back to the comb filter. The idea is that, in the same way as we add and subtract the signals on successive lines in a PAL decoder to separate out the U and V components of the chrominance signal, we can use addition and subtraction of successive lines of an NTSC signal to separate out the luminance and chrominance components of the composite video signal. This is possible because with an NTSC transmission there's a 180° phase change in the colour signal on alternate lines (done to minimize subcarrier patterning on a monochrome display).

The simplest comb filter arrangement for our purpose is shown in Fig. 2. It feeds the response peaks of the luminance spectrum and the troughs of the chrominance signal spectrum into the luminance channel and vice versa. The circuit can be realised by using a glass delay line plus adder networks, an inverting amplifier and some rather critical balancing components. It operates only around the colour subcarrier frequency however, and may not eliminate the lowest colour signal sidebands. Difficulties also occur due to the fixed delay and the variable conditions when using a VCR – which is just where the system is most needed!

More recently semiconductor technology has come into use instead – employing a CCD delay line. This type of delay line has the advantages that it can operate down to the lowest video frequencies (rather than just around the colour subcarrier), and that the delay can be adjusted accurately in real time by locking the CCD clock to the colour subcarrier. Operating the filter down to the video base band has the disadvantage of destroying much of the vertical resolution however, so it's necessary to add back some of the low-frequency input to restore the vertical signals. It's possible to use vertical peaking comparable to the peaking frequently used in a video circuit to improve the picture definition.

The net result of all this applied high technology is a 40dB separation between the luminance and the chroma channels, with some 30dB attenuation of the chroma signal in the region 3·08-4·08MHz. This gives picture quality as good as that provided by continental European systems, albeit at a large add-on cost. The basic disadvantage of the NTSC system – the effect of phase shifts on colour – remains of course, but any improvement is a big help.

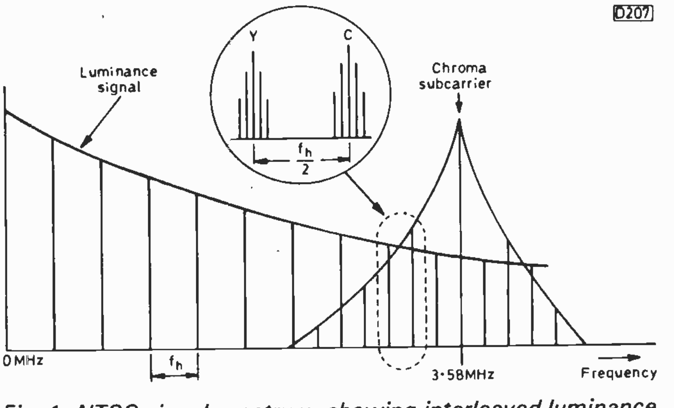


Fig. 1: NTSC signal spectrum, showing interleaved luminance and colour components.

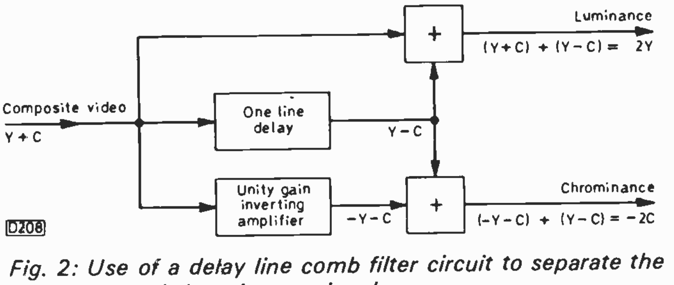


Fig. 2: Use of a delay line comb filter circuit to separate the luminance and chrominance signals.

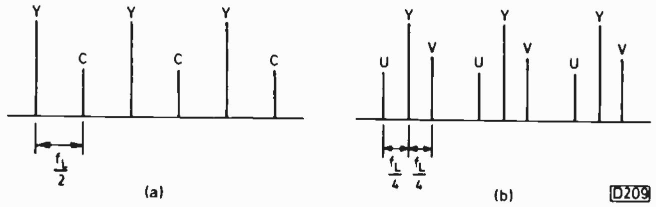


Fig. 3: Comparison between NTSC (a) and PAL (b) video signal spectra in the vicinity of the colour subcarrier.

Now you'll probably be asking why not apply the idea to the PAL system to get an even better picture? The answer unfortunately is that it won't work, not easily anyway. The problem is that when Dr. W. Bruch developed PAL he put a quarter-line offset on the subcarrier frequency (see Fig. 3). This means that the 180° relationship between the luminance and chrominance signals doesn't hold, making life difficult to say the least. You can still do this type of filtering, and in fact an allied technique is used in the latest digital standards converter units, but you need at least one frame in store and a lot of computing power, which is not economical for the domestic telly! TV is going digital however, and memory is dropping in price, so who knows what may be possible in a few years' time?

Well that about wraps it up for now. All I've got to do is to think up a subject for my next report! Maybe you'd like to make some suggestions on what you'd like to know about the US TV scene? Just drop a line, care of the editor.

Finally a tip for drinkers who are "Hitch Hicker" fans: the pangalactic gargleblaster is alive and well and living in the USA under the name of Long Island Iced Tea... Freeow!

Desolate Dan

Les Lawry-Johns

WE get a strange assortment of customers here. One of the strangest is probably Dan, whose vocation in life is the cleaning of outside pub toilets – which is why he's known as Dan the lavatory man. During his off-duty periods he goes around with an odd character called No Nose, who pushes a barrow around for a living. What's in the barrow no one seems to know, since he keeps it covered up. The two are probably friends because No Nose has difficulty smelling anything, and if there's one thing Dan has it's a smell. The principle is akin to working in a fish and chip shop – the smell follows you home. The aroma around Dan is a trifle offensive unfortunately. Even the cat, tolerant though she is about most things, beats a hasty retreat whenever Dan comes in. I can't beat a hasty retreat, so I keep a fixed smile on my face while I shake my head at whatever he asks for in the hope that he'll beat it quicker than if I nod. Honey Bunch does her disappearing act even quicker than usual when Dan is about.

Anyway, Dan brought his old Bush CTV184 (A823 chassis) in the other day with the complaint that the sound was o.k. but there was no picture.

"I've a couple of jobs to do" said Dan, "so I'll be back in about half an hour. You might have found out what's wrong by then".

"I might" I agreed, "but on the other hand I might not. But do call back. We're always pleased to see you Dan."

So off he went to slosh his toilets around a bit or whatever it is he does with them, and I turned to the set to check whether the top h.t. fuse was intact. It was, and a quick check at the tube base socket revealed that the first anode voltages were also present. The cathode voltages were a bit high, so attention was turned to the RGB output transistors which were found to be without any forward base bias. The preceding driver transistors had a negative voltage at their bases.

"Clamp pulses" I muttered, as though I knew what I was on about. There's a feedback clamp system you see, the clamp pulses coming from the line output transformer. Oh dear, all this complication. I looked at the circuit for a bit of help. Ah yes, the pulses come via the power supply panel. Let's take a look here. Two diodes near the h.t. smoothing resistors provide pulse clipping, so the bench lamp was directed on them. Glory be, one was away from its tag. Checks proved that the diodes were in order, so we soldered the diode back on and the voltages returned to normal.

Which is more than the picture did. It was plain red. The green and blue tube base voltages were right, so we thought we'd check the tube's emission. Red good, nothing on the blue, nothing on the green. Patient reactivation brought them up to scratch, but it took a time and Dan's return would not be delayed much longer. Now that the emission of the three guns was about equal, we could set up the picture for natural colours. I was quite pleased with the result.

Dan came back, accompanied by No Nose. I turned the set round so that Dan could see the results of my good work. The reaction was not what I expected.

"What have you done to my picture? It was a lovely red, now it looks like anyone else's."

"It looks all right to me" said No Nose.

"Yes, but you didn't see it the way it was" said Dan. "It was a sort of cosy colour. Made you feel comfortable just looking at it. Now it looks... ordinary."

"Don't worry Dan" I said. "It'll soon be all nice and red again. If not this week then next, or possibly next month. It'll go back to red sooner or later, and then you'll be happy and it'll be worth waiting for."

Dan looked dubious, but I had to get rid of him somehow as it was getting a bit thick and I didn't care to think what other customers would say when they came in and sniffed the local air.

So Dan and No Nose carried the set out, leaving us to coax some breeze through the shop.

Teleton Touch Tuner

We then turned our attention to a Teleton set which had been waiting for us to summon up enough patience to find

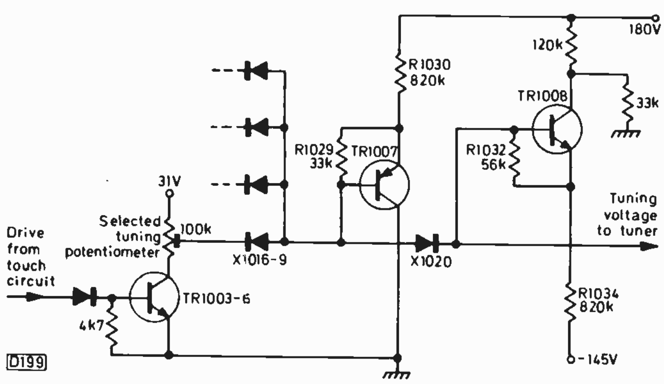


Fig. 1: Tuning voltage selection arrangement used in the Teleton Model C18BS.

out why the tuner wasn't tuning. A touch-tuner type, Model C18BS. We located the lead which should have carried the tuning voltage to the varicap tuner, but there was nothing there at all. Over to the selectors. The situation that confronted us here was as follows: about 30V at the supply end of the tuning potentiometers, but no tuning voltage output to the tuner unit – if anything there was a slight negative voltage, which was rather upsetting. We then received a distinct h.t. kick on the hand, which we'd carelessly rested on the end of the panel. Fancy that we thought, and decided to check the voltage. 180V. It feeds a couple of resistors, one of which (R1030) has the fairly high value of 820k. It seemed reasonable to see what the voltage at the other end of this resistor was. Nothing, because the resistor was open-circuit. Correct tuning was restored on fitting a replacement.

Fancy that we thought, Mrs. Crabbe will be pleased.

We then took a closer look at the circuit (see Fig. 1) to see what had been going on. As usual, there's an isolating diode in series with the slider of each of the tuning potentiometers. The idea is that only the diode connected to the selected potentiometer conducts, the others being reverse biased by the 30V supply. For the selected diode to be held conductive, there has to be a hold-on current path. This is provided by TR1007 and R1030, the transistor acting as a shunt stabiliser to hold the voltage at the junction of R1029/R1030 constant at some 1·2V above the voltage at the slider of the selected tuning potentiometer. So with R1030 open-circuit, the diode in series with the slider of the selected potentiometer won't conduct and there will be no tuning voltage output.

What does the rest of the circuit do? X1020 provides temperature compensation for X1016-9 (whichever is conductive). It too requires a hold-on current path, which this time is provided by TR1008 and R1034. The fact that the emitter of TR1008 is returned to a −145V rail explains the slight negative voltage we found on the tuning line.

And Then

Our peace was shattered by the arrival of Mr. Bore-Crashing, who claims to be an authority on all matters electrical. We'd crossed swords over his hi-fi equipment in the past, and he still claims that if he records a cassette here and sends it to a relative in the USA it will play at a different speed due to their 60Hz mains supply. This time he brought in his Ferguson colour receiver (Thorn 9600 chassis) and announced that the h.t. was low. As he was busy, he didn't feel like tracing the circuit through to find out where the h.t. was being dropped. I've learnt not to ask questions of him, because you get only a load of "I think" and "I know" but no description of the fault. So I plugged the thing in and connected it to an aerial. A picture appeared, with a gap at each side and a bit of a kink right down the centre.

"There you are" said Mr. Bore. "Not enough h.t. to fill the picture out. Now tell me I'm wrong!"

"You're wrong" I said, having had a similar case the previous week. "Your E-W modulator isn't modulating."

"There you are" he said, "it's not modulating because it's not got enough h.t. to modulate it." Too late, I realised I'd given him a new term to play with. He caught sight of Honey Bunch mucking about with the window display.

"My modulator's not working properly" he confided to her.

"You poor man" she replied, "I do hope it gets better soon."

So he gave that up and returned to watch me shining a light into the right side of the main panel to see whether W810 – one of the modulator diodes – was feeling sorry for itself. It was a bit charred, and came out in pieces. It's a BY298, but I generally fit a BYX71 as a replacement since these seem to last longer and anyway I keep these and BY223s in stock for use in this position.

"Ah, the h.t. rectifier" proclaimed Mr. Bore.

"You could call it that, but it isn't" I said wearily, not wishing to go into the niceties of 110° scanning as I lazily soldered the replacment on the underside of the panel and checked with an ohmmeter to see that I'd got it the right way round.

"We'll soon see if it works" said the impossible Mr. Bore.

It did, for about a minute or so. The picture then sort of shuddered in and out and a cloud of grey smoke came from the approximate area of the tripler. Triplers don't give off grey smoke however, and they don't smell like that. It was like what you get from a hybrid ITT set when the mains filter capacitor starts steaming off whilst leaving the set working, thereby spreading consternation throughout the household (you know what I mean – those yellow ones). So it appeared to be a defective capacitor, and the circuit suggested that it might be C815 (1μF) which provides filtering between the driver transistor and the two modulator diodes. It didn't look an easy matter to get at it, so I suggested to Mr. Bore that he might like to call back later.

He seemed to hesitate, as though loath to leave the set in the hands of an incompetent idiot who couldn't even replace an h.t. rectifier without blowing up something else, but he eventually wandered off. So I called for coffee and had to make it myself as Honey Bunch was busy playing with a radio which was getting CB, with an interesting conversation about a Teddy Bear or something.

When I'd got up enough courage to tackle the suspect, which was hiding away at the front of the scan panel, I had to remove the tripler to reach it. I then found that I didn't have a 1μF capacitor with the correct voltage rating, so I ended up with two 2μF capacitors in series. This seemed to work all right, and I'd hardly replaced the back when the horror returned. Not the smoke or anything wrong with the set, but Mr. Bore himself.

"I though I'd better not stay away too long in case you might need a bit of help."

Repeat Performance

Hardly had he gone than a Rank Z718 was brought in with a no-go symptom. The h.t. feed was o.k., but something was preventing the line output stage from working. Unhooking the top retainers enabled us to get at the front of the right side panel, where just for fun we checked the same circuit (the EW modulator – not quite the same, but you know what I mean). The two diodes here are 5D5 and 5D6. 5D6 was faulty, and turned out to be an SKE something or other. Anyway we stuck in a BYX71, which is what the circuit actually said, and order was restored. Funny how things seem to go in cycles, isn't it?

If you get one Thorn 1500 in with poor sync for example, you can bet your life that there'll be at least two others close behind waiting to have their 47kΩ sync separator screen grid feed resistors replaced.

We've also had a run of solid-state GEC colour sets in recently (C2100 series), all with line output stage trouble where the 40V rectifier diode D601 (fed from a winding on the line output transformer) goes short-circuit. In goes another BYX71, underneath instead of on top. I wonder what it'll be next?

Microcomputer Clock-Timer

Part 1

Luke Theodossiou

The idea for a comprehensive timer project originates from a colleague who owns a Philips N1500 VCR with its rather inadequate built-in timer. We had a look at several design approaches and eventually settled for a rather "inflated" unit, partly because we didn't think that there are many readers with these now old Philips machines and also, since we were going to produce a timer, it may as well be as versatile as possible to cater for a wide range of uses.

The unit may be used to switch four totally independent devices on and off on an hourly, daily or weekly schedule. It may be used for a variety of applications around the home and workshop, for example in crime prevention by periodically switching *different* lights on and off around the house; controlling the central heating; switching on the TV, radio, electric blanket, kettle for morning tea; greenhouse heating etc.

Circuitry

The circuit is shown in Fig. 1. It is designed around a Texas Instruments microcomputer, the TMS1601. The device requires a 50Hz input and this is conveniently taken from the secondary of the mains transformer and injected to the i.c. via a buffer/pulse shaper comprising Tr102 and its associated components.

Data entry is from a twenty-switch matrix keyboard. The memory uses two 2102 i.c.s and data is loaded into the memory via a shift register, IC101. The display used is a 4-digit multiplexed common cathode type, whilst l.e.d.s are used to show status and days of the week. The display devices are driven by buffer transistors with the current limited by resistors in the collector leads. The cathodes are switched on via a Darlington driver i.c. (IC1) from the row outputs R1-R10 of the timer i.c.

The switch outputs from the timer i.c. are used to trigger solid state relays. These devices offer opto-coupled mains isolation, eliminate failure due to contact wear and are totally silent in operation. The ones we have chosen are able to switch 2·5A r.m.s. each but larger types are available which can switch 10A r.m.s. These are larger than the ones we are using, therefore they will need to be accommodated outside the case. Heatsinking is also required by these larger devices, so it may be as well to use mechanical types if very large loads are to be switched.

Next month we shall provide constructional notes, the complete programming guide, the circuit diagram of the power supply section and the component overlay diagrams.

★ Components List

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

R1	470R	R110	4k7	R122	24k ±1%
R2	470R	R111	1k8	R123	22R
R3	470R	R112	22k	R124	22R
R101	2k2	R113	18k	R125	22R
R102	2k2	R114	10k	R126	22R
R103	10k	R115	10k	R127	22R
R104	10k	R116	10k	R128	22R
R105	10k	R117	10k	R129	22R
R106	10k	R118	10k	R130	22R
R107	10k	R119	10k	R131	5k6
R108	4k7	R120	10k	R132	3k3
R109	2k2	R121	10k		

Capacitors:

C101	47p	ceramic plate	
C102	4μ7	50V	radial electrolytic
C103	2200μF	25V	radial electrolytic
C104	220n	100V	Siemens B32560
C105	470n	100V	Siemens B32560
C106	220n	100V	Siemens B32560
C107	470n	100V	Siemens B32560

Semiconductors:

D1-D2	1N4148
D101-D106	1N4148
Tr101--Tr110	2N3904
Tr111	BC182L
LED1-4	0·2" green l.e.d.s
LED5-LED11	0·2" yellow l.e.d.s
LED12	0·2" green l.e.d.
LED13	0·2" yellow l.e.d.
LED14	0·2" red l.e.d.
LED15	0·2" yellow l.e.d.
LED16-LED19	0·2" red l.e.d.s
4-digit display	RS Components 587-507
IC1	RS Components 307-109
IC101	74LS164
IC102	2102
IC103	2102
IC104	TMS1601
IC105	7905
IC106	7905
RLA1-RLA4	RS Components 348-431

Miscellaneous:

20 p.c.b. keyboard switches 12·7mm square
S1 RS Components 339-241
T1 RS Components 207-677
Heatsinks for IC105 and IC106: Staver F9-4-220

F101 1A antisurge fuse with p.c.b. fuse clips
Output sockets: RS Components 488-797
Mating plugs: RS Components 488-781
Output fuses: 2·5A antisurge with chassis-mounting fuse holders.

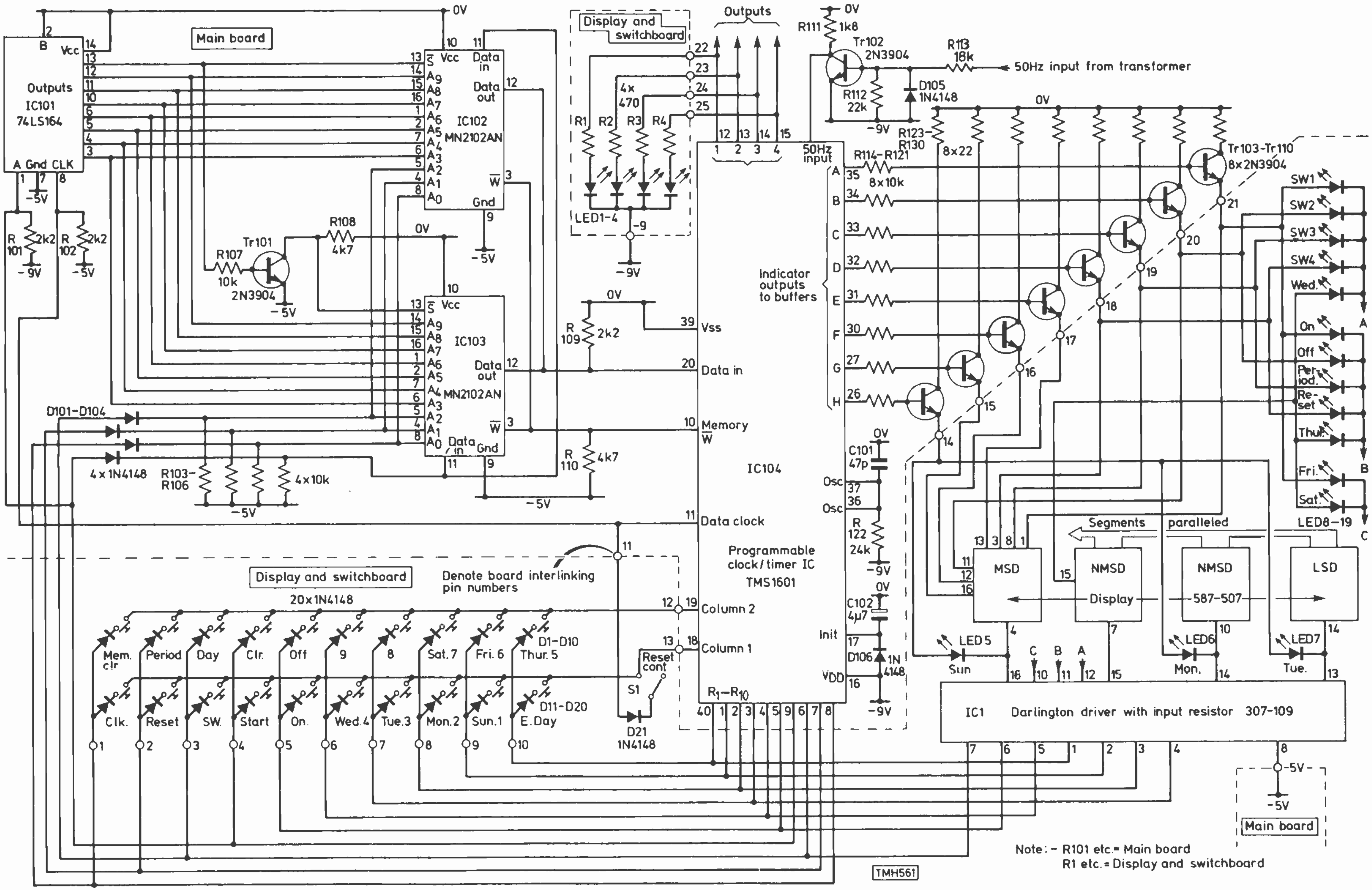


Fig. 1: Circuit diagram of the microcomputer clock-timer unit, with the exception of the power supply section and the output interface. These will be shown next month – they are all mounted on the main printed panel.

Fidelity's Monochrome Portables

S. George

FIDELITY Radio entered the TV field for the first time late last year, with a neat 12in. monochrome portable (Model FTV12). The use of six i.c.s means that the component count is low: apart from the loudspeaker, the c.r.t. assembly and the user controls, all the components are on a compact, horizontally mounted panel. Subsequently a version with remote control was added, Model TVR120, the infra-red remote control system providing on/off from a stand-by mode and stepping through six preselected channels. Tuning on the basic model is by means of a rotary potentiometer. Emboldened by the success of these sets, Fidelity entered the colour TV market earlier this year. We'll be taking a look at the colour chassis in a subsequent article: for the moment the subject is the monochrome portables.

Circuitry

On the signals side there are just two transistors, the BC148 video emitter-follower and BF257 video output transistor. Everything else is done by four i.c.s, two in the i.f. department and two on the sound side. The varicap tuner is followed by an SL1432 which provides i.f. preamplification and a.g.c. for the tuner unit. The SL1432 drives an SW153 SAWF, the i.f. strip being contained within a TDA440 i.c. The 6MHz intercarrier signal is selected by a ceramic filter and passed to a TBA120S i.c., audio amplification (1W output) being provided by a TBA820M i.c. All very straightforward, with only three tunable coils – one each for the vision and sound detectors and a sound trap in the feed to the video circuit.

On the timebase side, field deflection is taken care of by a TDA1170 i.c. while a TDA1180 acts as the sync separator and line generator, providing a pulse to drive the line output stage. Since the latter uses a BU807 Darlington line output device (see Fig. 1), no driver stage is necessary. This makes things simple indeed. The line drive pulse from pin 2 of the TDA1180 i.c. is capacitively coupled to the base of the BU807 by C306, the d.c. restorer network D306/R304 setting the pulse at the correct d.c. level. The shunt efficiency diode is encapsulated within the BU807, while the series boost diode D306 produces some 24V across C312.

The power supply uses a bridge rectifier followed by a

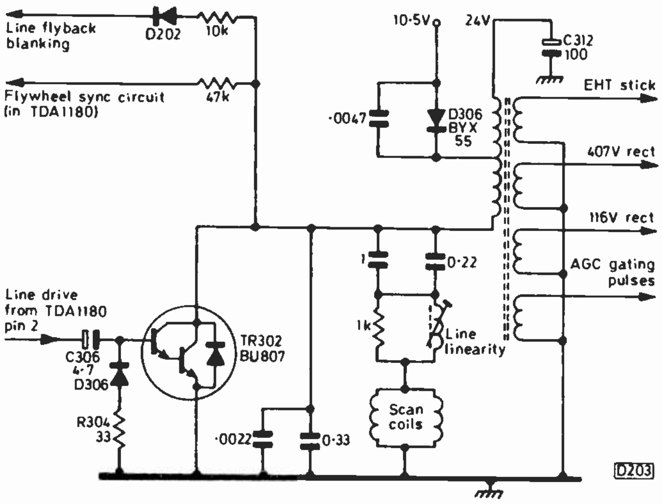


Fig. 1: The simple line output stage, with the BU807 Darlington output transistor driven directly from the sync processor/line oscillator i.c.

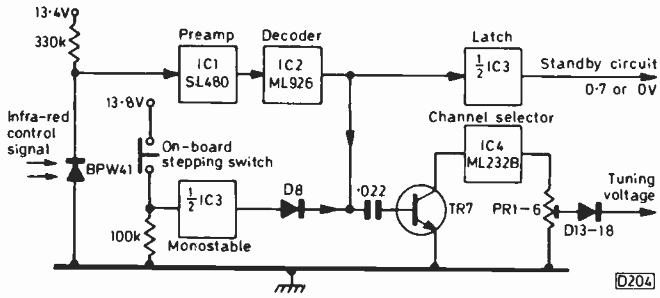


Fig. 2: Block diagram of the remote control receiver.

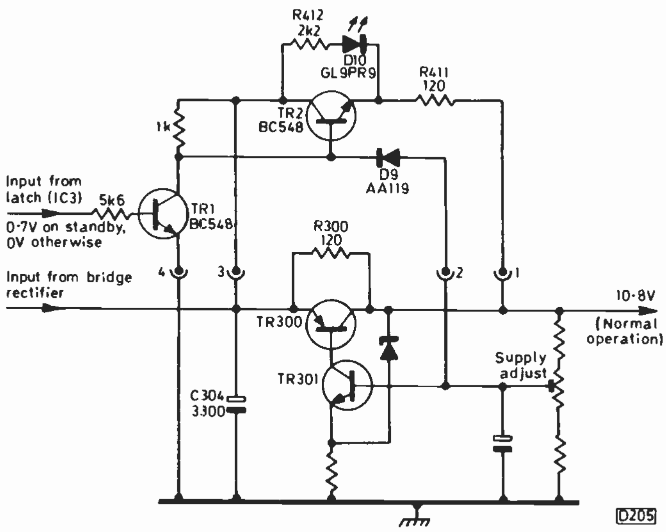


Fig. 3: The stand-by arrangement – when TR1 is switched on, the base of TR301 is shorted to chassis via D9. The regulator then turns off, its output voltage falling from 10·8V to a very low figure.

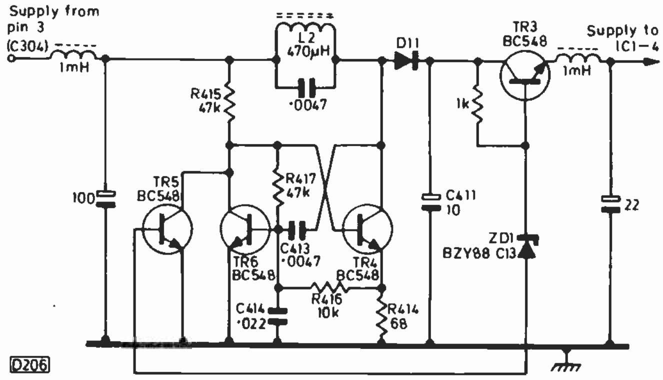


Fig. 4: The remote control receiver unit's power supply, with TR3 providing regulation. With a low input voltage the inverter comes into operation, the circuit then operating as a step-up regulator.

conventional two-transistor series regulator circuit, the regulator transistor TR300 being a pnp device (type BD534).

Remote Control Version

The infra-red remote control system has several interesting features. The transmitter unit uses an SL490 i.c. to produce the control pulse signal; this is followed by a three-transistor amplifier to drive the CQY99 infra-red emitting diode. The receiver unit (see Fig. 2) employs four i.c.s and seven transistors. The first i.c., type SL480, is simply a preamplifier. This is followed by an ML926 to decode the received control signal. Its output drives, via TR7, the ML232B channel selector i.c. (IC4). It also drives a two-gate latch in IC3 to give the stand-by action. The other two gates in IC3 are connected as a monostable which, with a front-panel switch, gives channel stepping at the set itself.

Now to the stand-by arrangement – see Fig. 3. TR300 is the conventional series regulator transistor and C304 the bridge rectifier's reservoir capacitor. The output from the latch, 0·7V on stand-by and 0V at all other times, is applied to the base of TR1. TR1 is thus normally switched off: its collector voltage will then be at some 13V, so diode D9 will be reverse biased. TR2 on the other hand will be conductive, shorting out the stand-by LED D10 and its series resistor R412.

When a stand-by command signal is received, the latching circuit raises the voltage at the base of TR1 to 0·7V. TR1 switches on, and since its collector voltage is now almost zero diode D9 is forward biased. As a result, the base of the error detector transistor TR301 is shorted to chassis – via D9 and TR1. TR301 switches off, removing the drive to TR300 which also switches off. The 10·8V line falls to a very low voltage, since the only current feed is via the start-up resistor R300 and the parallel LED path. The rest of the set is now virtually without power, and since TR2 switches off the stand-by LED D10 lights up. The voltage across C304 rises to something like 20V on stand-by mains operation, since the rectifier circuit is unloaded.

An ingenious arrangement is used to power the four i.c.s on the remote control receiver panel – see Fig. 4. TR3 with zener diode ZD1 form a conventional voltage stabiliser circuit, with the anode of ZD1 returned to chassis via TR5. Since TR5 is saturated, TR6 is shorted out. On battery operation or a low mains supply, ZD1 will cut off, switching TR5 off. The inverter circuit consisting of L2, TR6/4 and the feedback components C413/R416 then comes into operation to boost the voltage across the reservoir capacitor C411 to the point at which ZD1 again conducts. The action continues intermittently.■

Guide to the Philips K12 Chassis

Derek Snelling

THE Philips K12 chassis is of continental manufacture and is not seen in great quantities in the UK. It's used principally in a Philips and a Pye 26in. model featuring hi-fi sound – there are two speakers and a built-in bass reflex enclosure. Features include: 10W audio output with separate bass and treble controls; a LED to indicate that the VCR channel is selected; a LED to indicate optimum tuning; variable channel indicator brightness; headphone socket; speaker on-off switch; tape socket; and full infra-red remote control. The tube is of the 20AX type.

Plug-in Boards/Modules

Like many continental chassis, the design is based on the mother/daughter board principle, which in this case seems to have been carried to the extreme – there are no fewer than 15 plug-in panels/modules (16 if a v.h.f. tuner is fitted), three of which are mounted on the tube base! Looking at the chassis from the back, starting at the top left-hand corner and going round the chassis in a clockwise direction, the panels are as follows:

(1) U555 EW correction panel. Rectifiers on the panel provide 225V and two separate 30V rails.

(2) U590 field timebase panel.

(3)* U410 luminance/chrominance matrixing panel. Also black-level clamping etc.

(4) U405 decoder panel.

(5) U585 sound panel.

(6)* U450 i.f. detector module. Contains part of the a.f.c. circuit.

(7)* U455 sync module. Sync circuits plus VCR switching.

(8)* U440 i.f. amplifier/a.g.c. module.

(9)* U431 u.h.f. tuner. Also U430 v.h.f. tuner if fitted.

(10) U535 stabiliser panel. Contains part of the a.f.c. circuit and provides stabilised 32V, 12·7V and 12V supplies plus the 28-31V tuning voltage supply.

(11) U540 mains rectifier panel. Mains bridge rectifier (OF432) etc. plus degaussing components.

(12) U548 supply panel. Contains the BU426 chopper transistor, its BSX21 driver transistor and the TDA2581Q control i.c. The driver and chopper transformers (T549 and T525) are on the main panel. The chopper transformer has a tapped primary winding and provides a 145V output; the two secondary windings drive the 2SD350A line output transistor and feed a 30V supply rectifier on the EW panel.

(13-15) The red, green and blue output stage modules. These are mounted on the tube base panel. The RGB drives are applied to the c.r.t.'s grids, the cathodes being held at 200V by the regulator transistor TS617 (see Fig. 1).

Unfortunately the manual provides no information other than block diagrams and voltage check points for the items marked *. Philips presumably consider that these should be replaced as complete units. Fortunately they don't seem to cause trouble.

Circuit Notes

The TDA2581Q i.c. on the U548 power supply panel provides over-voltage and overload protection, plus switching to stand-by when a voltage arrives from the remote control panel. The chopper transistor (TS204) is the one on the heatsink on this panel.

The line output stage is conventional, with a diode-split line output transformer which also supplies 7·5kV to the focus control – this is part of another little module, with the first anode controls, beside the line output transformer at the bottom left.

The field timebase employs a TDA2780Q i.c. as generator and for linearity correction. It feeds a BD327/BC337 (TS362/TS351) driver stage and in turn the BD291/BD292 (TS363/TS357) output stage – the output transistors are mounted on heatsinks on the panel. There are four 1Ω resistors in parallel providing feedback to the i.c.

The sound department is certainly elaborate by TV standards. There are two chips, a TDA2790Q which contains the intercarrier sound channel plus audio preamplifier and tone control circuitry, and a TDA2010Q which provides up to 10W of audio. Transistor TS294 provides buffering for the tape recorder output while TS293 provides a regulated 12V supply for the TDA2790Q i.c.

The decoder panel uses two i.c.s, a TDA2560 luminance/chrominance amplifier/processor and a TDA2523 reference oscillator/demodulator i.c. The panel provides separate luminance and colour-difference signal outputs.

The supply rails are complex, and the guide given in Fig. 2 should help.

Control Panels

The control panels are situated at the front of the set, near the speaker. U800 is the panel with the tuning potentiometers and channel selector i.c.s; panel U655 contains the customer controls. The panel in the can is the infra-red receiver unit – it also contains the preset brightness and colour controls. Also situated at the front are two small panels, one with the mains fuses and the other with the channel number indicator and driver. A preset next to the stand-by light adjusts the brightness of the channel number display.

Servicing

The chassis can be hinged out for servicing by releasing the catches at the top and bottom on the right-hand side.

The location of the adjustments – and panels – is shown in Fig. 3. Two controls affect the line synchronisation, R11 on the sync module and R209 on the supply module. To adjust, short-circuit pins 14 and 15 of IC201 (the TDA2581Q) and adjust R209 for an upright, stationary picture; remove short, then short-circuit points 15 and 16 on the sync module and adjust R11.

To set up the supplies, connect a voltmeter between test point M2 (adjacent to the chopper transformer) and chassis and adjust R223 on the supply panel for 145V. Then connect the voltmeter between pin 19 of the stabiliser module and chassis and adjust R198 for 12V.

If the over-voltage circuit needs setting up due to tripping or component replacements, proceed as follows: set the brightness and contrast to minimum and turn R228 (on the supply module) fully clockwise; connect meter between M2 and chassis; adjust R223 for 155V, then adjust R228 until the supply just starts to trip; switch off, turn R223 down slightly, switch on and readjust R223 for 145V.

To adjust the grey scale, connect a meter between pin 17 of the green drive module on the tube base and chassis and adjust the green first anode potentiometer (in housing next to line output transformer) for 44V, then repeat similarly for red and blue. Finally adjust R413 and R414 (next to the chroma module) for correct whites.

If the brightness or colour is incorrect at switch on, adjust the preset R056 or R066 on the infra-red receiver module. If the volume is incorrect, adjust the preset in the control drawer.

To switch off the green, or green and blue, guns to assist with convergence, use SK2 at the top centre of the main board (next to the matrix board). This switch is rather unusual: it earths either the G – Y or the G – Y and B– Y signal inputs to the matrix board rather than switching the first anodes.

Handling the RGB Modules

Note that particular care should be exercised when handling the thick-film RGB modules on the c.r.t. base panel – rough treatment can cause intermittent contacts or breaks in the print, resulting in intermittent wrong colours etc. Philips Service recommend the following procedure when removing or refitting one of these modules: (1) bend both retaining arms slightly outwards; (2) lean the module towards the bevelled edge of the retaining arms, then lift out; (3) refit by placing the module into the edge connector at an angle, with the plain side against the bevels of the retaining arms, then gently press the module into the grooves of the retaining arms by pressing on both sides of the module – *not the centre.*

Faults

When it comes to repairing the K12, it's usually spoken of in hushed tones – basically because loud noises seem to start it tripping! Requests for help from Philips are inclined to be met by maniacal laughter at the other end of the phone... We've had the following faults on several sets however, and they seem to form something of a "stock fault" pattern. My thanks to colleague John Bourne, the one who gets lumbered with K12s in our service department.

Dead set with mains fuse(s) blown: Line output transistor TS488 short-circuit. Alternatively the chopper transistor TS204 could be short-circuit.

Dead set – tripping: D551 (BYX71-600) in the chopper

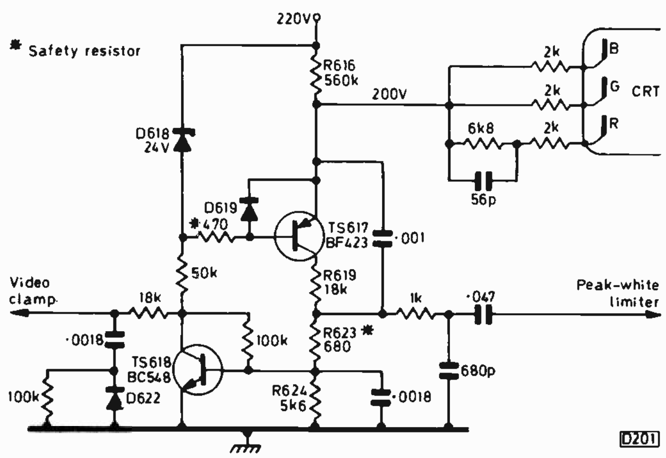


Fig. 1: The unusual c.r.t. cathode circuitry – the RGB signals drive the grids. Transistor TS617 acts as a voltage-regulating emitter-follower, holding the cathodes at about 200V since its base is biased by the 24V zener diode D618. The c.r.t. cathode currents flow via R624, R623, R619 and TS617, the voltages at various points in the chain being used to operate the peak-white limiter and to provide a video clamp reference source.

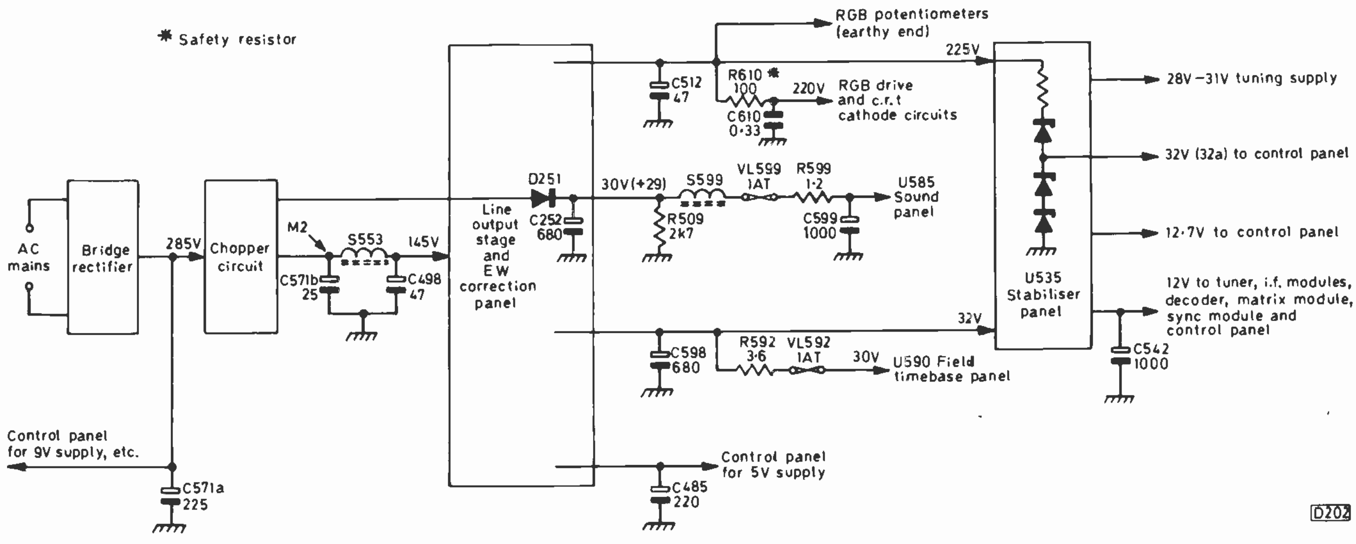


Fig. 2: Sources of the various supply lines in the K12 chassis.

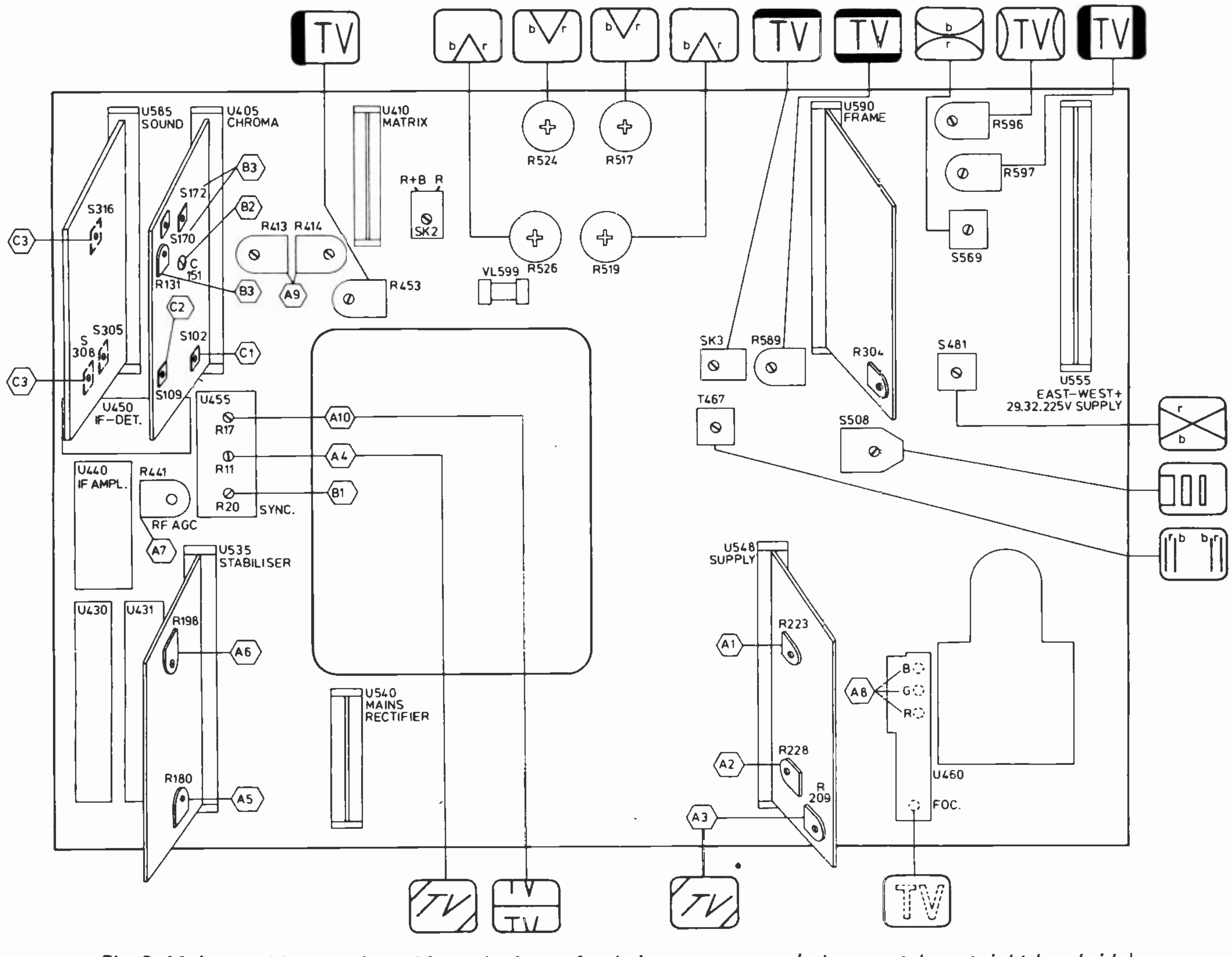


Fig. 3: Main panel layout, viewed from the front after being swung open (release catches at right-hand side).

circuit (it's the "efficiency diode") short-circuit. Check R550 and R551 (in series with D551) as they usually go open-circuit.

Set ticking: D255 (BY206) on the EW modulator panel short-circuit. This rectifier provides the 225V rail, which will read 33V.

Power supply trips: Check setting of the over-voltage preset, also the 145V and 12V presets. The settings of these controls seem to be critical and subject to drift.

Contrast fades after one hour: Check for dry-joints around pin 10 of the matrix module.

Channel indicator not lit: Check adjustment of preset on front of set – many customers don't realise it's there, and if it's knocked while dusting or the kids mess about with it they think the set is faulty.

No sound: Similar remarks to the channel indicator trouble – check the speaker on-off switch at the bottom right-hand corner. ■

VCR Servicing

Part 4

Mike Phelan

In following the luminance signal path through the JVC HR3330 machine in the record mode last month, we reached the point where the signal has been used to frequency modulate a 3·8MHz carrier. The resultant f.m. signal next goes to the record current amplifier on the pre-rec board, and we'll examine this month the way in which the signals are recorded on the tape and how they are amplified on playback. The relevant circuitry is shown, in simplified form, in Figs. 23 and 24.

On the pre-rec board, the signal passes first to the f.m. record level preset. The purpose of this is to enable the amplitude of the signal to be adjusted so that the extreme edges of the f.m. signal fall within the linear part of the tape's BH characteristic (see Fig. 2, Part 1). This is necessary, if you recall what we said in Part 1, to ensure that the chroma signal is recorded linearly – the latter is an amplitude modulated signal, the f.m. luminance also acting as the bias for the chroma signal. The chroma signal is added to the luminance signal via the chroma record level preset, the combined signal then going to a class AB amplifier consisting of X3-X7 in a configuration that will be familiar enough to anyone acquainted with audio circuitry and equipment, i.e. an emitter-follower (X3), a complementary-symmetry driver stage (X4/5) and a complementary-symmetry output stage (X6/7).

The signal then goes two ways (because there are two video heads), each branch going to one winding of the rotary transformer that couples the signal to the rotating heads. A preset is included in one branch to provide compensation for differences in transformer and head characteristics. The signal at this point is around 2-3V peak-to-peak, the chroma signal being about 100-200mV peak-to-peak and just visible at the edges of the luminance f.m. waveform.

Record/playback switching on this particular machine is carried out by using opposite ends of the transformer windings for record and playback, transistors X8-X11 earthing the ends not in use. These transistors are switched on by the Rec 12V and PB 12V rails. Some machines use mechanical switches and some small relays for this purpose, but we digress.

Playback Operation

Next to playback – we'll deal with the chroma side of things later, since most of the chroma circuitry is common to the record and playback modes.

As can be imagined, the signal coming from the heads on playback is minute. The initial circuitry is enclosed in a screening can therefore. X10/11 will be off, due to lack of forward bias from the Rec 12V supply, while X8/9 are turned on by the PB 12V supply, earthing the record ends of the transformer windings.

Each channel (see Fig. 24) has a trimmer capacitor and a potentiometer across the input to adjust the frequency response of the signal – to make up for differences in the Q and inductance of the heads. The trimmer is adjusted to peak the response at 4·5-5MHz, the potentiometer being adjusted for a fairly level response below this frequency. To do this, a special tape with a sweep recorded on it is required.

The signals are next amplified by IC1/X12 and IC2/X13 respectively. Even after this, the level is only about 5mV peak-to-peak! We now come to X14/15. We mentioned in a previous instalment the use of a squarewave derived from the drum servo to switch off the head not being used. This is what X14/15 do, being driven by the squarewave so that one or other is always switched on, depending on which head is in contact with the tape.

The two signal paths converge at the playback f.m. balance potentiometer, which is present to equalize the luminance signals from the two channels. From here the luminance signal goes via another preset to adjust the overall level. This is followed by several stages of amplification in IC3 (18V103). The signal can be checked at TP7 before it goes to the Y-C board: don't forget TP7 –

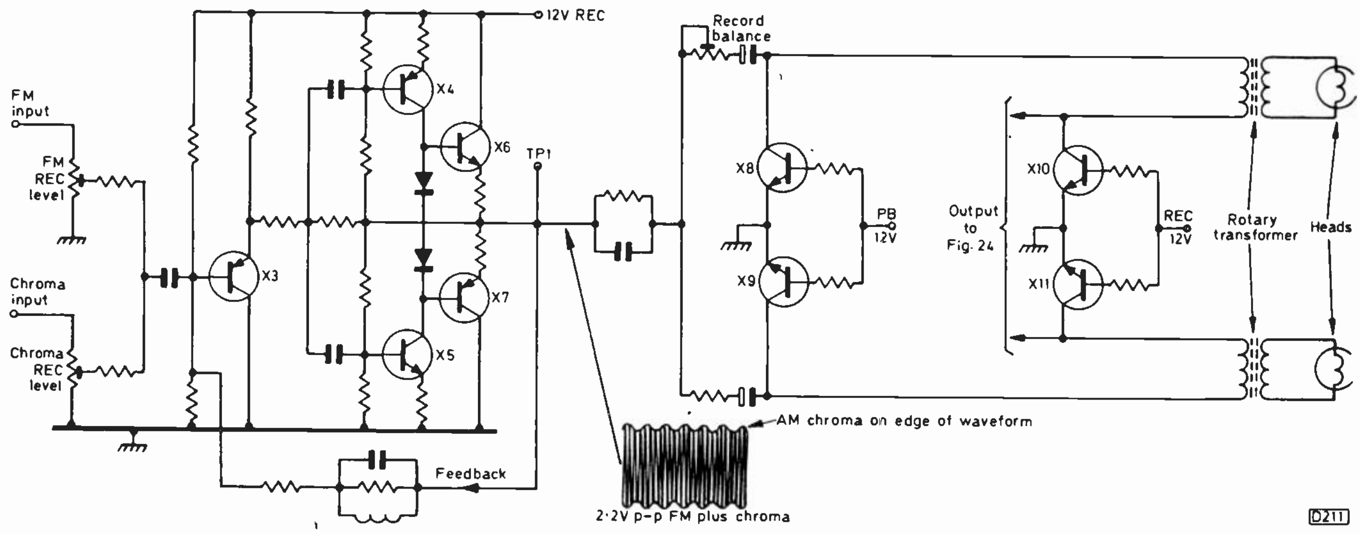


Fig. 23: The recording amplifier (X3-X7) and the video feeds to and from the heads.

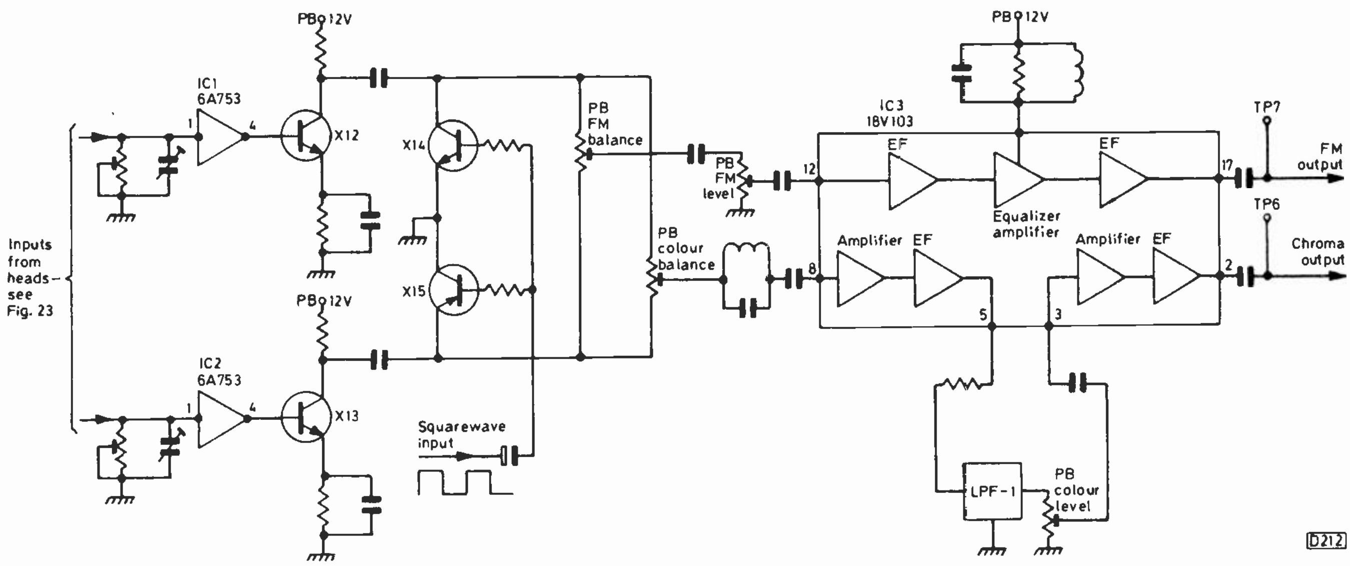


Fig. 24: Playback signal amplification on the pre-rec board.

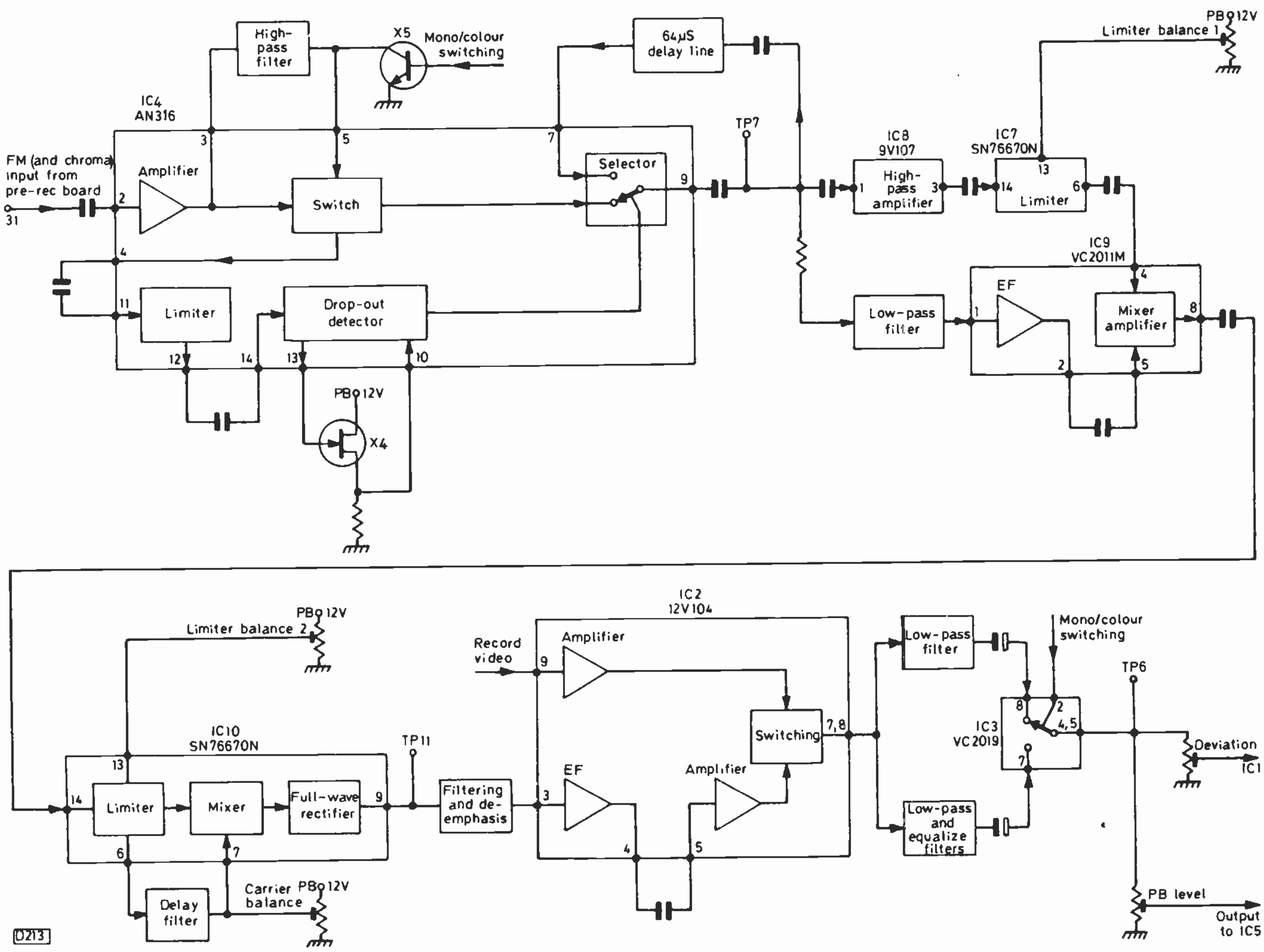


Fig. 25: Luminance signal processing on the Y–C board.

it will later be seen to be one of the most useful test points in the machine.

Another potentiometer, the playback colour balance control, is connected in parallel with the f.m. balance preset. The signal from the slider of this control goes through a similar chain to the other one, using the rest of IC3, but a low-pass filter in the circuit passes only the chrominance signal, eliminating the f.m. carrier. The filtered chroma signal goes to the Y-C board via TP6, where we'll leave it for now to concentrate on the luminance channel.

The luminance signal enters the Y-C board at connector 31 (see Fig. 25) and goes to IC4 (AN316) which contains a stage of amplification and in addition the drop-out compensator circuit: a discrete high-pass filter between pins 3 and 5 removes the chroma component of the signal. This is shorted out by X5 in the monochrome mode to allow more of the lower sidebands of the f.m. signal through for better reproduction. Then follows drop-out compensation.

This operates in conjunction with the one-line delay line. Normally the signal passes directly from pin 9 to the following circuitry. If the f.m. signal falls to zero however, due to a portion of oxide being absent from the tape, this fact is detected and the selector switches in the signal from the previous line, via the delay line, instead.

Limiting

The next step is limiting. The problem here is that the use of a simple limiter can result in low-amplitude, high-frequency signal components being lost (see Fig. 26). So the signal is first separated by means of high- and low-pass filters, the high-frequency component only being limited to start with. The limited h.f. and the l.f. components are then added in IC9 and passed to IC10 which provides further limiting followed by demodulation. The latter process is carried out in conjunction with a delay filter: the basic idea is that the mixer adds direct and delayed signals to produce a symmetrical signal whose pulse width depends on frequency. After full-wave rectification the carrier is filtered out and the signal de-emphasized: we are now left with video.

The following section of the circuit, around IC2 and IC3, is also used in the record mode and was described last month. The processes involved consist of amplification and frequency response limiting. From the playback level control the signal goes to IC5, which enhances the h.f. component to make up for the loss of definition above 3MHz and also adds the chroma to the luminance signal. Exactly how this is done, and other exciting things, will be our subject next month. Fig. 26 will appear next month.

Linear Ohmmeter

William E. Harrison

IF your's is digital, read no further: this design is for analogue meter types – those suffering from cramp in the Ohms scales. Making resistance checks accounts for a great deal of time in servicing work, so anything that makes life easier must be of value. The design uses a junction-f.e.t. operational amplifier as an inverting amplifier and a meter with decade scaling to read ohms like volts.

Circuit

The circuit is shown in Fig. 1: in this type of arrangement, the value of the operational amplifier's input resistor, i.e. the resistor connected to pin 2, is the meter's full-scale resistance reading. The resistor being tested is connected in position X: since it provides feedback, its value determines the gain of the amplifier. When the values of the input and feedback resistors are equal, the operational amplifier's gain is unity and the meter reads full scale.

To prevent operational amplifier overloading, the minimum input resistor value is 1kΩ. In most circuits of this type, 0-1kΩ is the lowest range. This disadvantage is overcome by using a second operational amplifier to boost the gain on the lowest ranges by ten and a hundred. The meter has ranges in decades from 0-10Ω to 0-10MΩ, plus 0-20MΩ for TV work. As the absence of a test resistor in position X would give full gain due to the open-circuit feedback loop, a push-to-read push-button switch is connected across the test resistor terminals. This prevents meter activity until the reading is made.

The 1V stabilised line obtained at the emitter of Tr1 supplies a reference input for the amplifier, the buffer transistor coping with current variations as the meter ranges are switched.

The circuit includes the meter and its associated resistors – the values of these must be selected to suit the meter movement used. The values shown are suitable for use with a 100μA meter.

Construction

Construction is not critical and is left to individual choice. Every care must be taken to avoid possible leakage paths however, since high-resistance ranges are included. The accuracy of the meter depends on the ranging resistors used – they should be close-tolerance types, wired directly to the switch wafers. The 10MΩ resistor may have to be an ordinary one, as high-stability types of this value are rare. The operational amplifier may be the single TL081 type, or alternatively the dual TL082 type can be used (RS stock numbers 304-223 and 304-217 respectively).

To set up the meter, short-circuit the input pins (pin 2) of the operational amplifiers and adjust the 22kΩ offset trimmers for a null reading. Then switch to the 100kΩ range, connect a known accurate 100kΩ resistor in the test position, and adjust the meter's series trimmer for full-scale deflection.

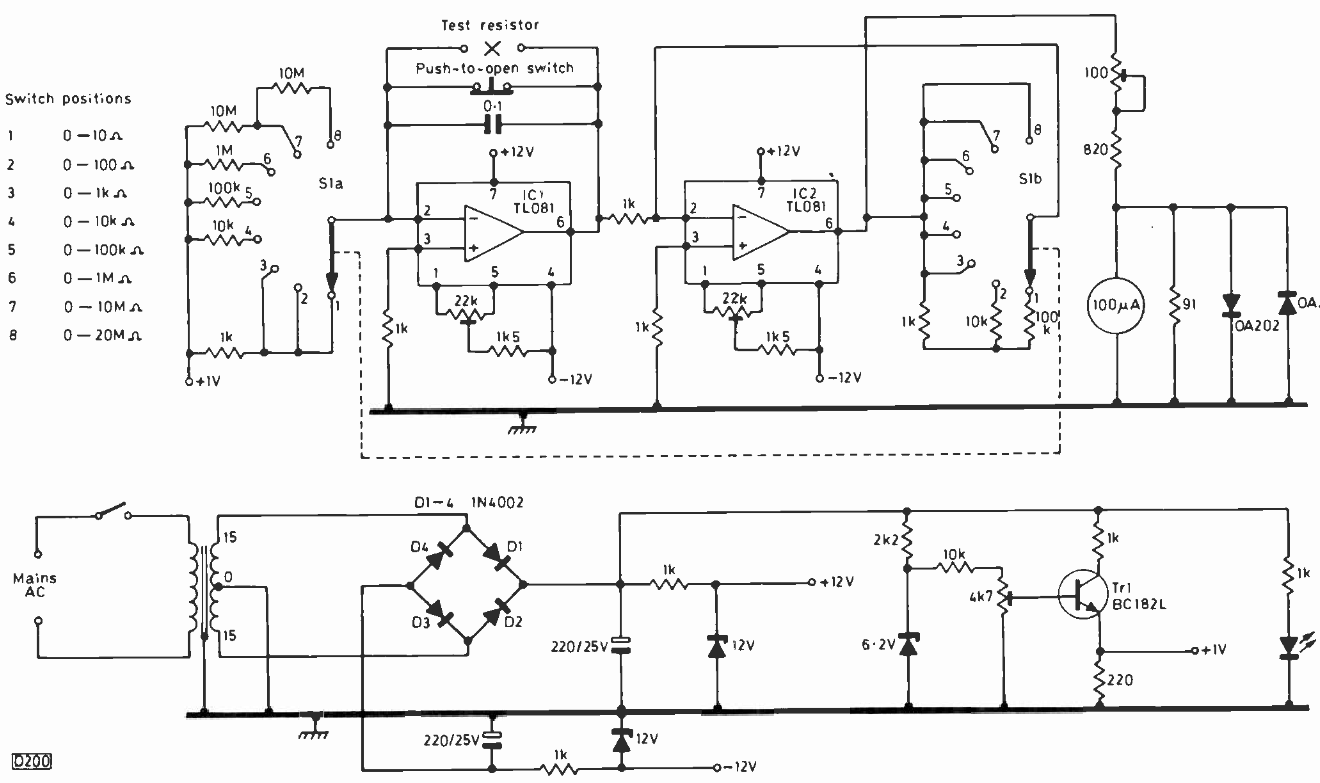


Fig. 1: Circuit diagram of the linear ohmmeter. The mains transformer is rated at 3VA, e.g. the RS 207-841 with the secondary windings connected in series. The wafer switches are of the make-before-break type. Use metal-film H.S. resistors for range selection. The values of the resistors in the meter circuit depend on the movement used. Those shown are suitable for use with a 100μA meter – any 0-10 meter can be used, up to say 1mA f.s.d. The diodes in parallel with the meter provide protection against overloading.

TV Receiver Design: The Decca/Tatung 120 Series

Part 2

Ray Wilkinson

In Part 1 last month the basic considerations behind the design of the Decca/Tatung 120/130 series chassis, also the circuitry used, were outlined. The subject this month is the colour decoder and the RGB output stages.

The Decoder

Most of the PAL decoder circuitry is incorporated within a µPC1365C integrated circuit, which was initially produced by NEC and is now also available from Plessey. Several setmakers use it. The resulting decoder is economical, the i.c. itself has a good reliability record, text signals can be added, and a Secam add-on i.c. is available.

The full circuit of our version of this decoder is given in the service manual. For the present purposes, block diagrams are the most suitable means of illustrating the decoder's operation.

A simplified block diagram of the i.c. is shown in Fig. 5. Let's follow the chrominance signal path first. From the bandpass tuned circuit, the chroma enters the i.c. at pin 11. The initial processing consists of a.c.c. (automatic chrominance control) and burst gating. The latter extracts the burst signal for application to the subcarrier regenerator, at the same time removing the burst from the chroma signal feed to the following colour control amplifier. The colour and contrast controls track together to avoid saturation changes when the contrast control is adjusted. The amplified chroma signal emerges at pin 9 and passes via Q501 to the usual PAL delay line circuit. This separates the U and V components of the chroma signal, driving the appropriate synchronous demodulators at pins 24 and 25. Proportions of the R – Y and B – Y colour-difference signals are matrixed to form the G – Y signal, the three colour-difference signals then being matrixed with the luminance signal to obtain RGB outputs at pins 26, 28 and 27 respectively. Line and field flyback blanking is also carried out in the RGB matrix circuitry, using pulses stripped from the sandcastle pulse (see Fig. 6).

The subcarrier regenerator and PAL ident/switch blocks produce the reference subcarriers required by the synchronous chroma demodulators. A signal is also produced in this section to disable the colour killer when acceptable chrominance is present.

The black-level feedback clamp is shown in greater detail in Fig. 7. The luminance signal enters the i.c. at pin 5, passing to an amplifier whose d.c. operating point is controlled by the voltage at pin 3. The voltage from the contrast control is fed in at pin 7, adjusting the amplitude of the luminance signal. The output from the contrast control amplifier is sampled during the back porch period by a sampling circuit which is switched on by the burst gate pulse. The level of the sample is compared with the d.c.

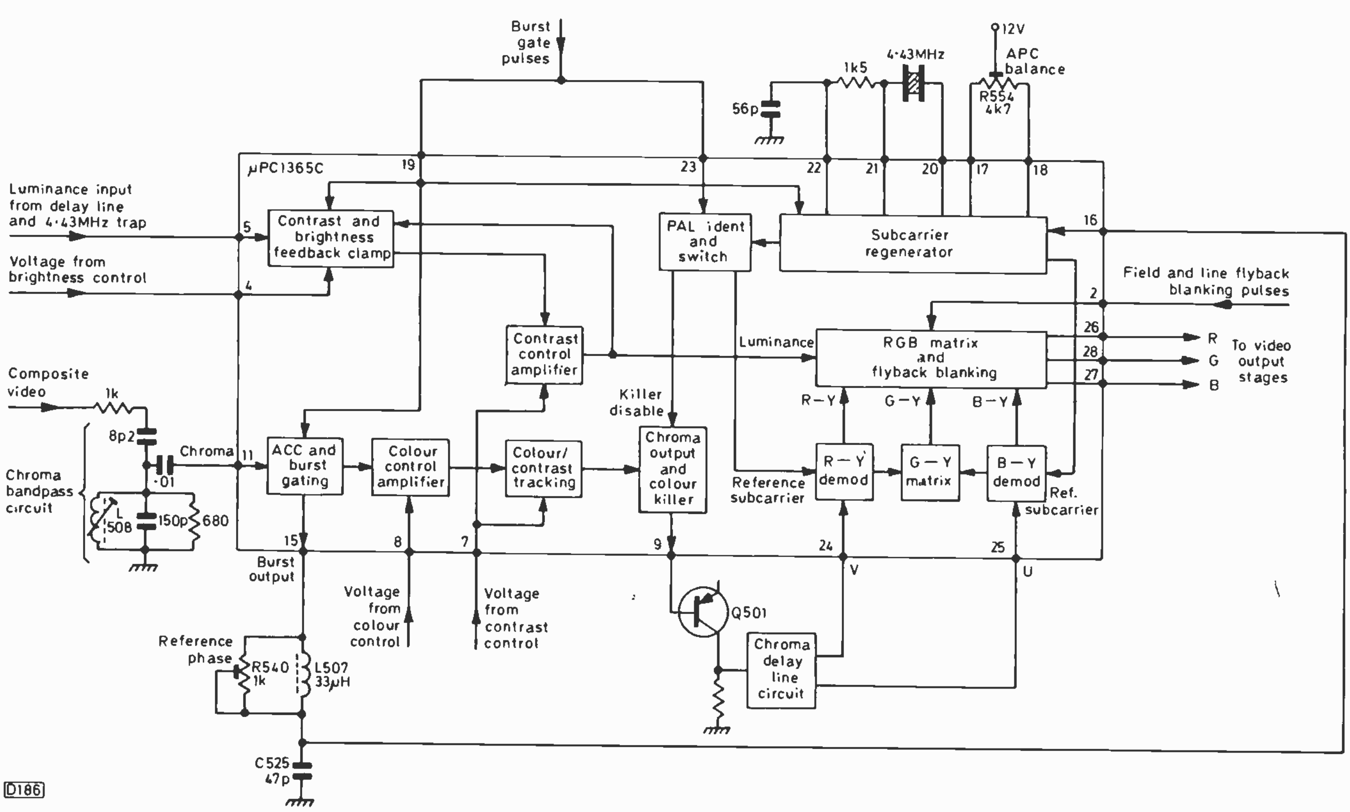


Fig. 5: Simplified block diagram of the decoder.

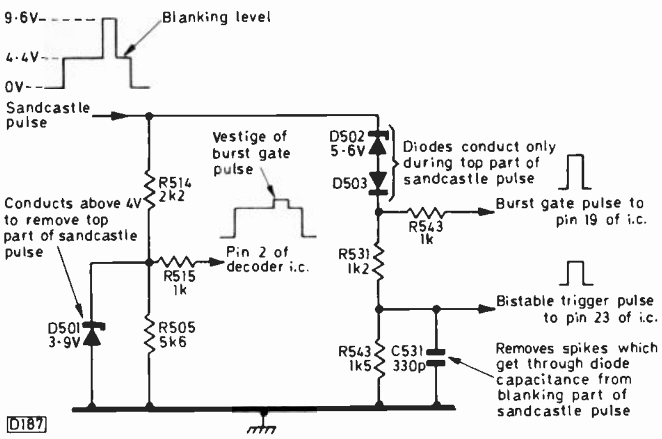


Fig. 6: Sandcastle pulse separating circuit.

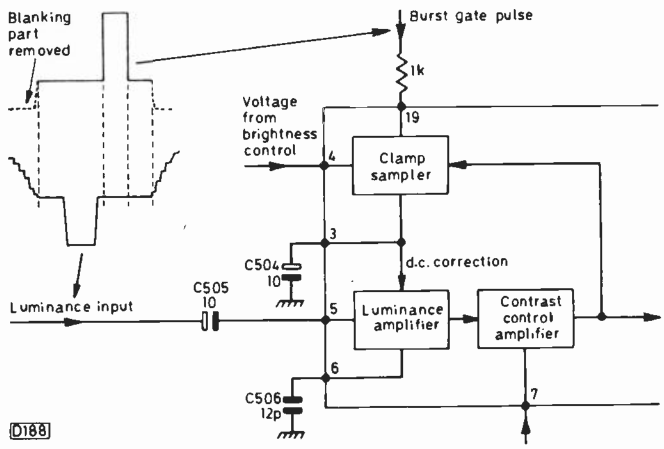


Fig. 7: Black-level clamping. C506 provides frequency response correction.

voltage from the brightness control, the resulting voltage produced across C504 being used to correct the luminance amplifier's d.c. conditions. The output from this section of the i.c. thus consists of a luminance signal whose black level has been clamped to a voltage determined by the setting of the brightness control and whose amplitude is determined by the setting of the contrast control.

Fig. 8 shows the operation of the a.c.c. circuit. The idea is

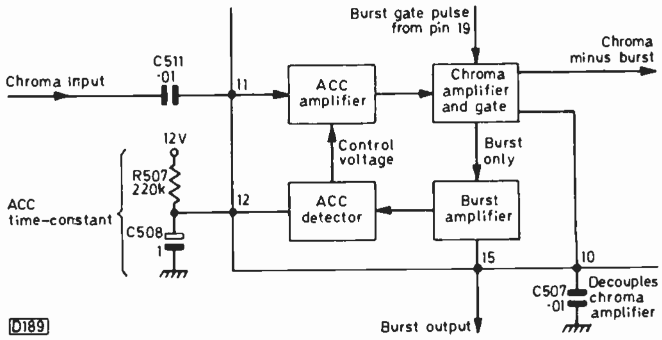


Fig. 8: The a.c.c. loop.

to keep the amplitude of the burst signal at pin 15 and the chroma signal fed to the colour control amplifier constant. For this purpose the a.c.c. detector produces from the bursts a d.c. voltage to control the a.c.c. amplifier.

Reference Oscillator and Ident

The subcarrier regenerator (4·43MHz reference oscillator plus its phase-locked loop) and PAL ident/switch sections are shown in greater detail in Fig. 9. This is all conventional, the crystal oscillator being phase-locked by a d.c. voltage from the a.p.c. (burst) detector. The a.p.c. balance potentiometer does the initial setting up.

The R – Y reference signal must be switched through 180° on alternate lines, and this switching must be in the correct phase. The H/2 detector compares the 7·8kHz ident signal ("swinging burst") from the a.p.c. detector with the output from the H/2 bistable (the bistable is triggered by the burst gate pulses). If the two signals applied to the H/2 detector are in phase, the d.c. voltage at pin 13 falls below 6·2V. The level detector uses this fact to recognise that the amplitude of the chrominance/burst signal is adequate and that the bistable is operating in the correct phase. It then sends out a signal to disable the colour killer, allowing the chroma signal output to appear at pin 9. If the amplitude of the burst signal is poor or the bistable is operating in the wrong phase condition, the d.c. voltage at pin 13 rises to about 7·2V. The killer then blocks the chroma signal and the bistable is inhibited until it comes back into phase.

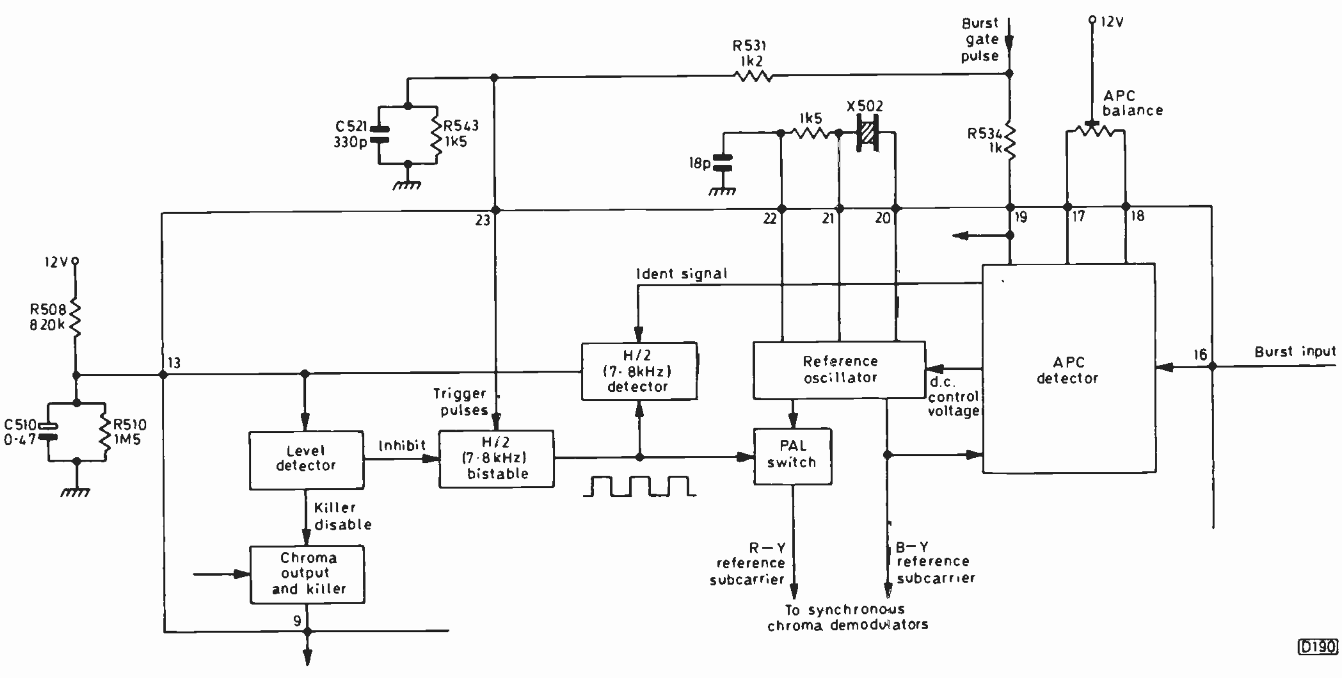
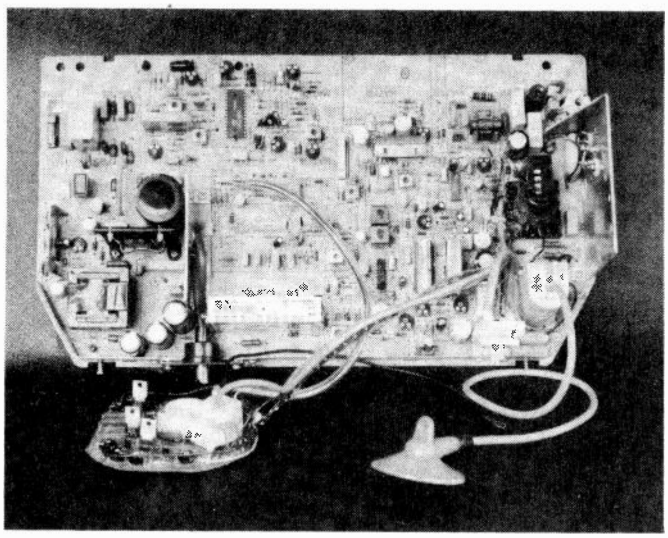


Fig. 9: The reference oscillator and ident system.



The Decca/Tatung 120 chassis.

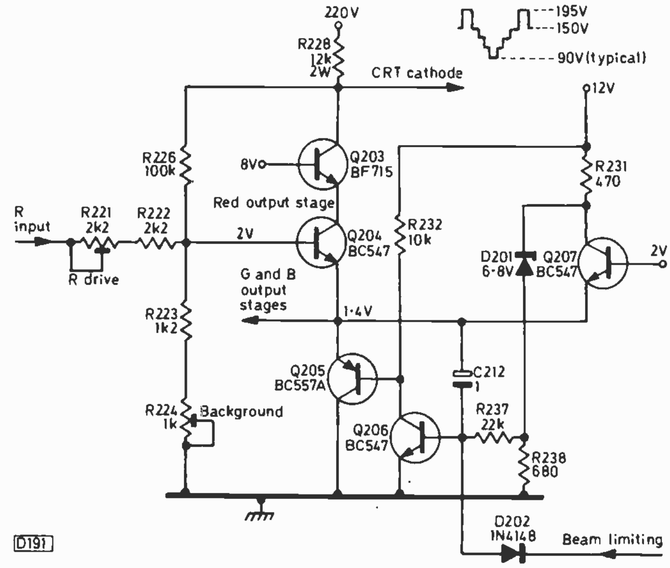


Fig. 10: Video output stage – simplified circuit. Q205/6/7 and their associated components are common to all three (RGB) output stages.

To disable the colour killer externally, you simply dab a resistor of about 47kΩ across R510 to reduce the voltage at pin 13 below 6·2V.

RGB Output Stages

Now to the RGB output stages. During the development of the chassis we carried out an investigation into video output circuits, looking particularly at the display of text information. We wanted to establish what was important in getting the best text display. We found that due to the limitations of the tube, i.e. spot defocusing at high beam currents, there was no advantage to be obtained from maintaining the video amplifier bandwidth beyond about 4·5MHz. What was important, as you might expect, was a good phase response which, together with the frequency response, needed to be maintained over the full black-to-white range. This meant a smooth roll-off to the frequency response, with no fancy peaking circuits at the output – these tend to cause nasty overshoots and ringing, which the tube can't resolve and displays as a smear.

The choice of video output stage load resistor value is always a compromise, bearing in mind the c.r.t.'s input capacitance. A low-value resistor gives a wider frequency response but higher dissipation. If the resistor's value is increased to reduce the dissipation, the frequency response goes for a chop. We chose 12kΩ as a reasonable value.

Fig. 10 shows most of the components in the circuit we finally developed. We decided upon a cascode arrangement for a number of reasons, the most important being: (1) No input frigging is needed to compensate for the output transistor's collector-base capacitance, since this transistor is within the feedback loop (R226). (2) In some earlier circuits we tried, the compensation had to be varied according to the drive setting in order to keep the frequency response constant. (3) No temperature compensation is needed for the output transistor, again because it's within the feedback loop. With a single transistor output stage, the variation in the base-emitter voltage with temperature can cause noticeable changes in the black level at the tube's cathodes. (4) Temperature compensation for the low-voltage transistor is easily done using low-voltage, low-power devices. (5) Since the output transistor's collector-base capacitance is within the feedback loop, variations in this characteristic from one device to another are unimportant and the choice of output transistor type is not so restricted. With a single-transistor output stage, we found that fractions of a pF difference caused noticeable changes in the frequency response.

The cascode configuration is widely used and should be familiar to most readers. Taking the red output stage as our example, Q204 is connected in the common-emitter mode to provide current gain, driving Q203 which is connected in the common-base mode to provide voltage gain. The stage gain is the ratio of the value of the feedback resistor R226 to R221 and R222, with R221 made variable to provide amplitude (drive) adjustment. Output d.c. level adjustment is provided by R224, which is set up for a black-level output voltage of 150V. Q203's base is held at about 8V by means of a decoupled potential divider fed from the 12V rail.

The rest of the circuit provides temperature stabilisation and d.c. compensation for Q204 (and the corresponding transistors in the other two channels). Q207's emitter matches these three and as the temperature varies they all track fairly closely. The feedback via D201, R237, Q206

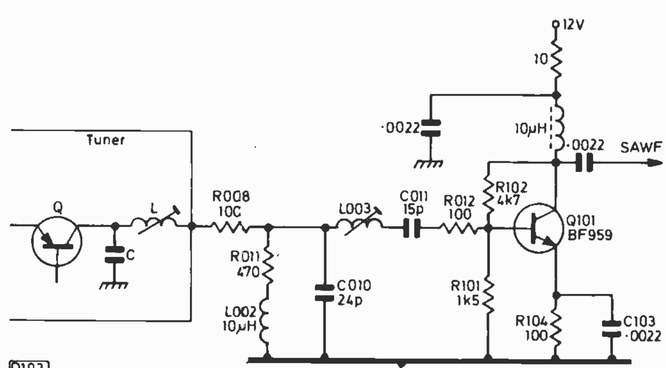


Fig. 11: Coupling the tuner to the SAWF.

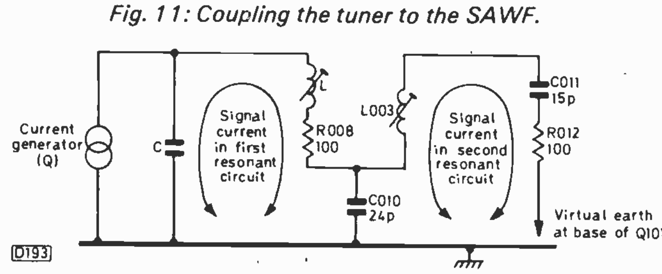


Fig. 12: Principle of the coupling circuit.

and Q205 provides a stable d.c. at low impedance for the emitter of Q204 and the corresponding transistors in the other two channels. C212 maintains the h.f. stability of the loop.

The chassis has a conventional beam-limiter circuit acting on the contrast control. If a fault occurs however, or the first anode voltages are wrongly set, this circuit can run out of range. It's common practice therefore to add a beam-quenching circuit which cuts off the tube cathodes to avoid potential damage to the tube. As the beam current rises, the voltage at the cathode of D202 falls until, at a predetermined level, D202 conducts, turning Q206 off. Q205 and Q204 (also the corresponding transistors in the other two channels of course) quickly follow suit. The voltages at the collector of Q203 etc. then rise to h.t., taking the c.r.t. cathodes up into the blanked region. When the cathodes are cut off there's no beam current, and unless something is done about this the whole system will rapidly come on again. D202 charges C212 to hold the circuit in the cut-off state.

The video output stage d.c. levels are accurately set at the chassis test point, only small background adjustments being necessary at final test to take into account tube tolerances. We recommend adjusting only two of the background presets – in the direction away from blanking. (The first anode controls provide a third degree of freedom.) This avoids reducing the blanking capability with the brightness control range.

Although the collector-base capacitance of the output transistors is not significant, since the capacitance is within each output stage's feedback loop, the capacitance of the feedback resistor itself is important. It was necessary to choose a component that has low capacitance, and to take care with the board layout in the vicinity of this resistor. For the same reason, the dressing of the leads also has to be carefully controlled in production.

Tuner Coupling

A recent article in *Television* (September 1981) went into the subject of tuner coupling, so it might be of interest to explain the system we use. Fig. 11 shows the relevant circuit (UK version), with part of the tuner's output circuit included. In Fig. 12 the circuit is redrawn to make the action clearer.

Transistor Q in the tuner forms a current source, the d.c. return for its collector being via R011 and L002. You can see that from the a.c. point of view the set up consists of two resonant circuits. Both are tuned to the same frequency, with bottom-capacitance coupling by means of C010. L and C, with R008 to determine the circuit Q, form the first tuned circuit. L003, C011 and R012 form the second tuned circuit. The currents in both circuits flow via C010, whose value is selected to get critical coupling between the resonant circuits for a broad-topped bandpass response.

So how do we get the signal out? Since the emitter of Q101 is decoupled and there's feedback between the collector and base, the transistor's base is at "virtual earth". The signal current flowing through R012, i.e. the current in the second resonant circuit, thus flows into this low impedance. Q101 drives the bandpass shaping SAWF from its collector, the stage gain being set by the ratio of R102 to R012.

Next Month

In the concluding instalment next month we'll be dealing with the switch-mode power supply.

Servicing Luxor 110° Hybrid CTVs

Part 2

Mike Phelan

LAST month we dealt with the power supplies and the signal circuits up to the decoder. Time next to take a look at the colour-difference amplifier panel, which also houses the luminance output stage and two transistor luminance amplifier stages (Q401/2 – see Fig. 3).

The CDA Panel

Q401 is the luminance delay line driver. After passing through the delay line, the luminance signal is fed to the emitter-follower Q402 which provides matching to the low-impedance contrast control. An interesting little network (D413/R416/R426) is included here to cancel the line sync pulses at the emitter of Q402 so that adjustment of the contrast control doesn't affect the black level. The luminance signal is then a.c. coupled by C410 (0·1μF) to the control grid of the PL802 luminance output valve. A two-diode driven clamp is used in the control grid circuit, while a conventional transistor flyback blanking arrangement is included in the cathode circuit. Between the anode of the PL802 and the c.r.t. cathodes there's a simple diode beam limiter network (D404/C429/R446). It's non-adjustable – probably the best sort, being simple and immune from itchy screwdrivers. There are no cathode drive presets.

Faults in this area are usually straightforward. No luminance with a very dark raster normally means that either Q401 or the delay line is short-circuit or the flyback blanking transistor Q403 is open-circuit. A faulty delay line can also produce a multiple-ghost effect on the picture. When Q402 develops an emitter-base short-circuit, the contrast is reduced and the definition impaired. The PL802's anode load resistor R444 (2·7kΩ) goes open-circuit to give a bright, blank raster.

The colour-difference signals are amplified by three EF184 valves which, surprisingly enough, rarely fail. The signals are then a.c. coupled to the c.r.t. grids, with more two-diode driven clamps in each feed. The clamp diodes (D406, D407, D408, D409, D411 and D412) give a fair amount of trouble, the symptoms ranging from shading or coloured bands down one side to complete loss of clamping on one colour – this is best seen on a test card, the monochrome part of the picture altering in colour when the saturation is advanced. The BY206 is a suitable replacement, and the diodes should be renewed in pairs.

Grey Scale

The CDA panel also carries the c.r.t. first anode controls – on a subpanel mounted at one end – but alas there are no switches, and you can't pull off the c.r.t. cathode leads as in a set with RGB drive. Turning the appropriate potentiometers to minimum is the only convenient way of turning the guns off. The two potentiometers at the other end of the board, R458 and R461, provide a fine, albeit limited, adjustment for the highlights. They set the green and blue clamp voltages. Inability to set up the grey scale within the range of these adjustments usually means that the c.r.t. is faulty. Either an A66-140 or an A66-410 can be used as a replacement – the "quick heat" facility of the latter is no advantage however, and a 33Ω 2W resistor must be connected across pins 1 and 14 if the A66-410 is used.

Field Timebase

The field timebase employs a PC92 triode in a blocking oscillator circuit and a PL508 output pentode. There are also a couple of transistors – the sync pulse amplifier Q752 (BC147B) and Q753 (BFR39) in the output stage automatic bias stabilisation circuit (see Fig. 4). A

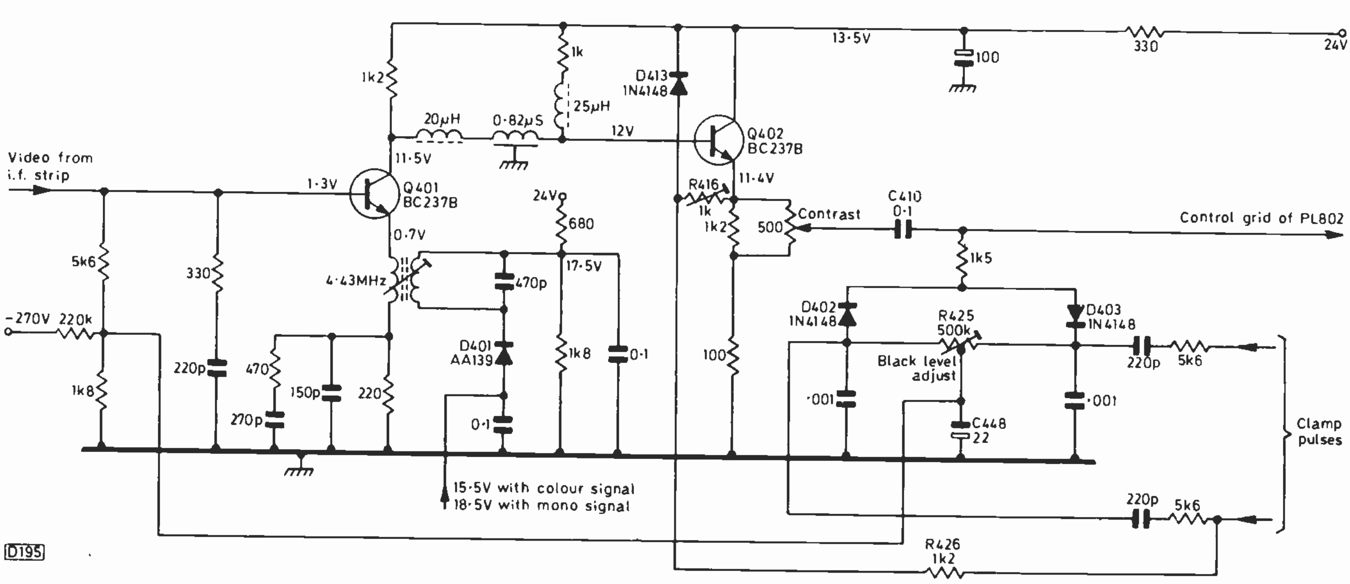


Fig. 3: The luminance delay line driver and emitter-follower circuits. D402/3 form a two-diode driven clamp in the PL802 luminance output pentode's control grid circuit. One of the clamp pulses is also used to switch D413 on to remove the sync pulses from the feed to the contrast control – when D413 switches on, Q402 switches off.

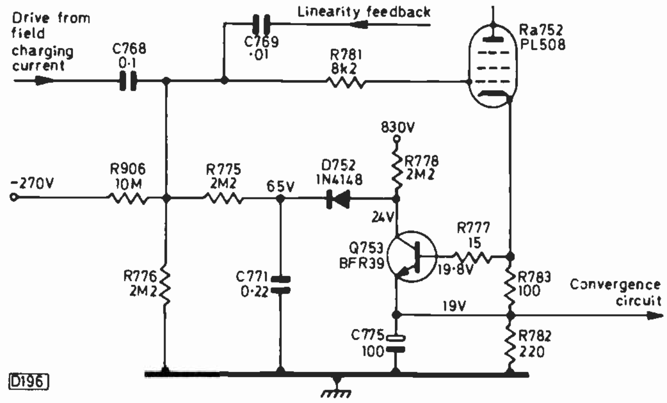


Fig. 4: The auto-bias circuit used in the field output stage. During the forward scan Q753 is conductive and D752 is cut off. When the PL508 field output pentode switches off during the flyback period, there is no voltage across R783 and Q753 switches off. D752 is then forward biased via R778, and C771 charges to 65V.

characteristic of the latter arrangement is the tendency for the whole thing to go into oscillation if the height control is increased slightly above the normal setting – this produces a violent field bounce. Cures are to connect a 390kΩ (1W) resistor and a 1μF paper capacitor between pin 1 (anode) of the PC92 and chassis, or a 250-500μF 25V electrolytic from the cathode of the PL508 to chassis.

No field sync usually means failure of Q752 – the SN76532 sync separator/line oscillator i.c. rarely gives any trouble. The PC92 is occasionally responsible for no field scan, but more often the culprit is the PL508. Lack of height or very poor linearity should lead one to suspect the bias switch transistor Q753 and the associated diode D752.

Sometimes the printed board becomes conductive between the height control and chassis, quickly leading to the formation of a large hole. R771 (2·2MΩ), which is in series with the height control, also increases in value with age, causing lack of height.

Line Scan

The line output stage (see Fig. 5) is similar to those used in several other continental chassis of the time, e.g. the Kuba 110° hybrid chassis, and it must be stated at the outset that the line output valve must be a PL519, not a PL509, and one of reputable make at that. The genuine PL519 has its cathode and suppressor grid brought out on separate pins – the same pins are used on the PL509, but the electrodes are connected together internally. This also applies to some valves we've come across marked PL509/519. If one of these is fitted, R901 (10kΩ) between the suppressor grid and the 24V rail will burn out.

The high-value resistors in the width circuit cause little trouble – lack of width is more often due to R901 or the screen grid stopper resistor R908 having increased in value.

There's a secondary, rapid-acting width/e.h.t. feedback loop, D904/R912/C903/C902/R907, which has a much shorter time-constant than the main control loop and keeps the e.h.t. constant during rapid changes in scene brightness. In cases of poor e.h.t. regulation, check D904 (BYX10) and the clipper diode D902 (E800 C5), either of which may be open-circuit. Failure of either the tripler or the line output transformer in this chassis is very rare indeed.

Focus troubles can be caused R951 (27MΩ) or R952 (39MΩ) – these resistors are in series with the focus control, at either end – or by the screened cable being short-circuit

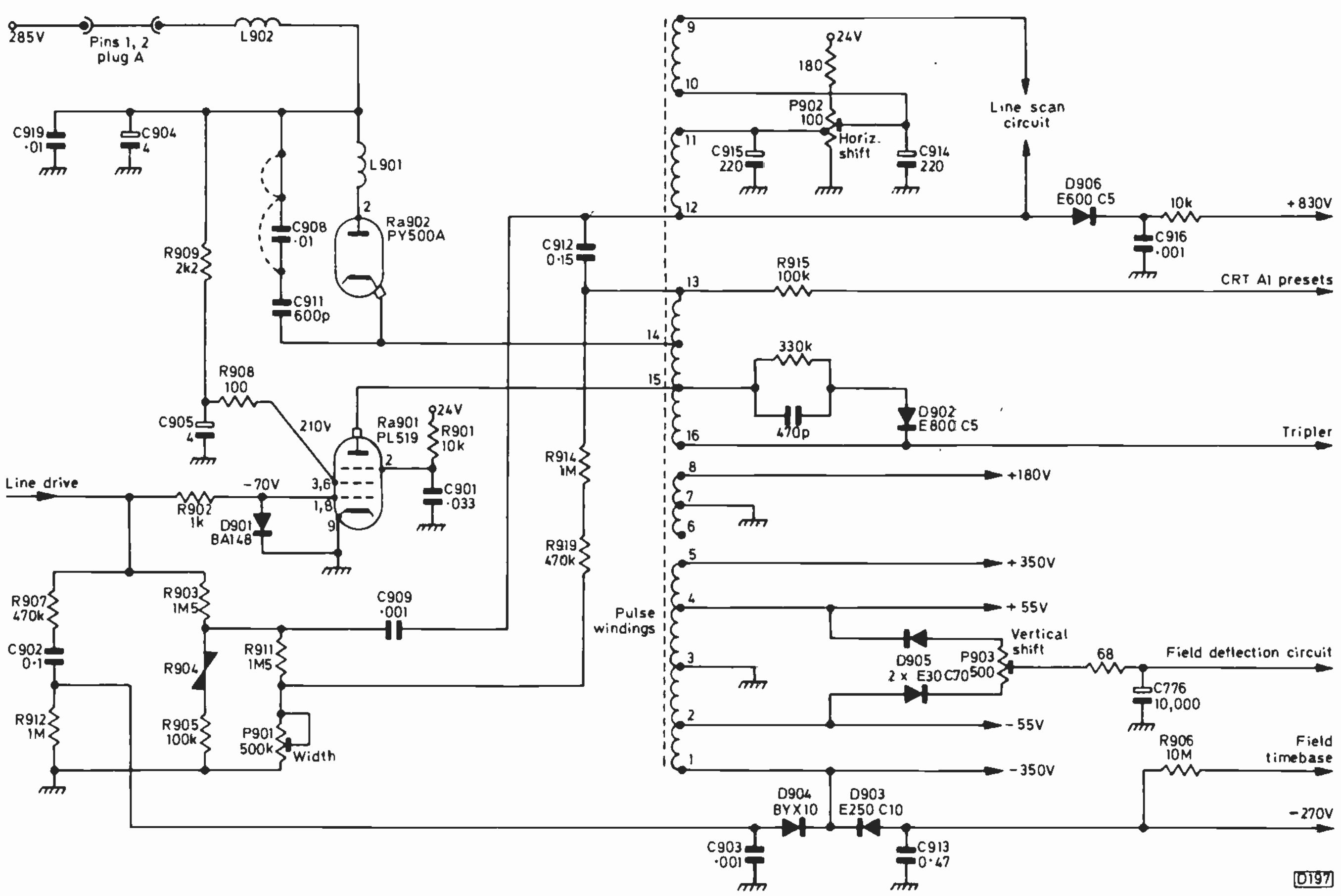


Fig. 5: The line output stage. There are two feedback loops in the PL519 line output valve's control grid circuit – via C909 and via D904 (the latter loop is fast acting). C912 is the boost reservoir capacitor.

because someone has not replaced it in its clip, the result of this being that it has cooked against the PL508.

A fairly common fault on this chassis is heavy loading on the line output stage, with a very small raster and low e.h.t. Before starting to disconnect things from the line output transformer, examine the corner correction transductors L852 and L853 on the raster correction panel for signs of burning. An occasional culprit is the EW correction transductor L858 (the blue one), which runs very hot if faulty. Variations in raster shape (the corners folding in) or corner convergence with changes in brightness can be cured by replacing C852 (220μF), C855 (220μF) and C853 (25μF) on this panel. If the line linearity coil (L851) burns out frequently, see the note last month on the l.t. supply.

Failure of one half or the line scan (i.e. a keystone-shaped raster) is often due to the fact that one of the windings on L852, L853 or L858 is dry-jointed. The first two can be repaired but L858 is encapsulated in resin.

That summarises the line scan department. Between the line oscillator i.c. and the line output stage there's a transistor (Q751, BF292C) line driver stage on the field timebase panel.

Convergence

The convergence circuitry is rather complicated, as you'd expect with a 110° delta-gun tube, a control being provided to remove almost every sort of error. Stock faults are few, the most common being failure of the static blue lateral convergence control P803 (470Ω). Breaks in printed tracks, and absence of red/green corner convergence on either the right- or left-hand side due to Q805 or Q804 (both BC147) being defective, are other fairly frequent faults. Most faults however require the standard approach of noting which controls work and which ones don't or have reduced effect, followed by cold checks on the relevant passive components.

The functions of the convergence controls are shown on a diagram inside the back cover, but the controls on the raster correction panel may require some explanation. There are four small presets in a row, one large preset, one small coil, one large coil, a transductor with a movable magnet and a coil with two magnets – this one is for line linearity. The adjustable transductor should be set for the straightest horizontal centre lines consistent with parallel sides to the raster; the large coil is the NS phase and the large potentiometer the NS amplitude control; the small potentiometer below it is the EW amplitude control – adjust for straight sides.

The remaining four controls are for convergence and should be adjusted as follows. Connect pins 5/6 to 7/8 on the raster correction panel and remove the plug nearest the raster correction panel on the convergence board. Adjust the balance coil (on top of the scan coils) for best R/G horizontal convergence in the centre, then remove the short on the raster correction panel and adjust P852 (next one down from the EW potentiometer) for the same effect. Replace the plug and carry out the convergence procedure, then adjust the remaining two potentiometers for best horizontal corner convergence at the top and bottom. Both these controls provide differential adjustment between the right- and left-hand corners. The small coil (L857) provides a fine adjustment of the top and bottom corners.

P751 on the field timebase board provides adjustment to straighten the centre verticals. It may be necessary to carry out the convergence and raster correction adjustments several times for best results, but these should then be very good.

Audio Department

Finally, a brief note about the audio department. The only trouble we've had here, apart from noisy sliders, has been intermittent or permanent failure of the audio driver transistor Q272 (BC161). The audio quality from the two large speakers is quite good. ■

Service Notebook

George Wilding

Field Collapse

Two monochrome sets fitted with the Thorn 1500 chassis came our way recently with almost identical fault symptoms. The causes turned out to be rather different however. The first had complete field collapse, so as a first step a new PCL805 was fitted. As this made no difference we checked the voltages around the valve. The pentode's anode and screen grid voltages were about normal, but the triode's anode voltage was lower than normal. This is usually the case, since failure to oscillate leaves the triode conducting continuously. Touching various points in the circuit with the test prod instigated slight movement of the horizontal white line, confirming that the fault was lack of oscillation rather than failure of the pentode section to drive the scan coils. The oscillator cross-coupling networks came under suspicion therefore, and as a first step we tried shunting the coupling capacitors with equivalents. This failed to restore the scan, and as all the resistors had the original unblemished paint coding it seemed certain that the trouble was due to a dry-joint – resoldering that often troublesome 18kΩ resistor R102 cured the problem.

In the second set the symptoms were misleading. When the set was switched on from cold a raster of about half the normal height would present itself, quickly reducing to a horizontal white line. This is often due to a defective PCL805, and tapping the glass may then momentarily produce at least a partial scan. In this case a new valve once again made no difference, and we discovered that there was zero voltage across the pentode's cathode resistor R103, i.e. the pentode was not conducting. Touching the pentode's control grid (pin 9) with a test prod produced a restricted scan, so it was clear that the trouble was due to the absence of a d.c. path between the control grid and chassis. The d.c. path is via four fixed resistors and the two linearity presets R104/6, the fault being due to R106's track being open-circuit.

Broken Oscillator Core

The fault we had recently with a Decca hybrid colour set was sound but no picture. The set had apparently slipped off a make-do stand, and on removing the battered back we discovered that the line output stage valves were running hot due to lack of drive – the line oscillator coil unit was broken. Unfortunately I didn't have a spare, and the set was wanted urgently. An exact replacement was found in a Pye set however, so this was pressed into service.

When we switched the set on the line frequency was well out, as expected. There were also some ominous crackling noises from the back of the chassis, around the line output stage. It seemed as if the line frequency was so far out that excessive e.h.t. was being developed. We switched off, turned the core well away from its initial position, then tried again. This time there was an excellent picture, with just a suggestion of line trembling at the top – a little further adjustment cured that. The moral is to position the core similarly to the one in the original coil if you ever have to change a line oscillator coil – and to be careful with large sets unsecured on incorrect stands!

Similar Symptoms – Different Faults

You sometimes find similar symptoms produced by very different causes. For example, not long since the owner of a Pye hybrid colour set phoned to say that the picture was too large and the brightness was poor. On inspection we found that the picture was oversized in both directions, dark and with poor e.h.t. regulation. Clearly the e.h.t. voltage was low. The PL509 and PY500 were both running hotter than they normally do, and the next thing we noticed was a large, raised semicircle on the tripler, clearly indicating that a severe leak in it was pulling down the e.h.t.

A few days after replacing the tripler and obtaining a good picture, the owner phoned to say that the symptoms had returned. This time the two line output stage valves were much cooler than they usually are, the basic fault being low h.t., due to a big loss of capacitance in the h.t. reservoir capacitor C306 (200μF). This is encased in the same can as the smoother (C315), which seems to fare much better. We always replace the dual canister however – whenever in fact there's the slightest indication of rounding and slight swelling of the insulating end cap.

Tuning Trouble

The owner of a hybrid ITT colour set phoned to say that he could get only ITV. The set was one of the earlier ones, with a five push-button selector and common tuning knob, with no visual indication of the tuning position unless the back and convergence box are removed, when red plastic "travellers" can be seen. After some retuning, we managed to get BBC-1 and BBC-2, but they would drift off at the slightest provocation, giving the impression that the sliders were making poor electrical contact with the tracks.

Now we do get occasional complaints of intermittent colour drop-out and mistuning due to faulty tracks on this selector unit and the later seven-button version, and ITT have a repair/exchange service for them. Sometimes only two or three buttons may be affected, the owners still being able to get all the channels they want, but the trouble invariably progresses until they end up with only one or two good selectors.

On this occasion there was no sign of the usual flickering tuning variation, and we found that acceptable stability could be obtained if we tuned each selector to a channel other than the one to which it had previously been tuned. So we thought it would be worth applying a little switch cleaner to the tracks, running the sliders repeatedly over the new tuning positions. This gave a big improvement, and no further trouble has been reported. It was an unusual case however: generally the only cure is to use the ITT repair/exchange service.

No Results

A Bush monochrome set fitted with the Rank A774 chassis was brought in with the complaint "no results". So naturally our first move was to check for continuity across the mains plug. Ignoring the initial charging current taken by the reservoir/smoothing capacitors, we found that there was no continuity in either direction across the plug. On lowering the chassis we found that the PL504 line output valve's fusible screen feed resistor 3R56 was open-circuit. This rather suggested that a fault in the line timebase had resulted in the PL504 drawing excessive current, either the PL504 or the PY88 boost diode developing a heater-cathode short with its heater then going open-circuit. The valve heaters were intact however, the lack of heater continuity being due to a dry-joint at the top end of the heater chain. But on repairing this the heater circuit was still open-circuit. The second break was found to be where the earth lead from the tube heater is soldered to the chassis – the lead is the outer braid of a piece of coaxial cable.

Resoldering this and the fusible resistor restored normal results, but within a few minutes there was sparking in the PY88 and 3R56 went open-circuit again. A new PY88 put that right, and the set worked happily during a long soak test. As to the heater circuit dry-joints, we can only assume that they'd been present for some time and had been healing up at switch on when the full mains voltage would be present momentarily across them – the tiniest of sparks would be sufficient to bridge the high-resistance soldered joint.

Reusing Heads

It's been some time since there's been criticism of any of the articles we've published – other than mine . . . More than a couple of VCR manufacturers have contacted me on the hot line however since the appearance of "Reusing Heads" last month. Special concern has been expressed by Pete of big G – they give credit on returned video head drums, and have received head assemblies that have obviously had a screwdriver applied to the video head fixing screw.

Some years ago I used to service Shibaden (Hitachi actually) reel-to-reel monochrome machines. If a video head failed, both could be changed – they were supplied in pairs. Each head had to be changed individually, and this involved the use of a large micro jig which was fitted on to the VCR chassis by means of big bolts. It had two eyepieces (one for each eye) so that each head could be critically adjusted using the calibrated microscope – each head had to be aligned three-dimensionally, for height, overlap and angular position, to an accuracy of five microns. Since the adjustments were interdependent, they were done on a rotation basis.

So, before you decide to start messing about with the heads, consider the following points. (1) If you proceed as outlined in the article, you cannot guarantee that each head is even on the same track, let alone correctly displaced. (2) Can you measure the overlap to two-three thousandths of an inch? (3) For colour crosstalk purposes, the heads are not 180° apart but are displaced by one video line. Can you align two heads exactly 180° apart and then move one of them in the correct direction by one line?

Otherwise, you'll end up with a machine that's miles out of tolerance, able to record and replay only its own tapes, not to mention the wiggle at the top of the picture. Take my advice: leave the video heads alone – fit a new head drum complete.

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

Long-distance Television

Roger Bunney

A STARTLING development in the broadcasting field – it looks as if the UK, along with the rest of Europe, could be enjoying satellite TV before the end of the year, though you'll need a three-metre dish for reception. Brian Haynes, director of Satellite TV Ltd., a London-based company, has obtained permission from the thirteen national PTT bodies in the Eutelsat organisation (and also the blessings of the Home Office and British Telecom) to use a redundant transponder aboard the OTS satellite for transmitting back to Europe, with a footprint ranging from Tunisia in the south to Finland in the north. The transmissions will consist of a commercial TV service with a single English language track. There will initially be two hours of programme material nightly, based around a first run movie, increasing to six hours during the week and ten hours at weekends as things develop. Advertising agencies have already booked time for such well known items as Coca Cola, Levis, Esso, Schweppes and so on.

The venture is regarded as being an incentive to aerial manufacturers and an experiment through which the advertising world can gauge the reaction from an international audience to a commercial service using the English language. Due to the low transmitter power, the use of a three-metre dish will be necessary to obtain satisfactory reception and it's assumed that cable operators and perhaps hotels and such like will be the main users. The signals may be scrambled.

Programme origination will be in London, with the service linked by British Telecom to Goonhilly for uplinking to the satellite. The down transmissions will be at approximately 11·6GHz, just below the allocated satellite broadcast band. The use of this redundant transponder means that there are no back-up facilities – so if a fault develops, the service will come to an end.

The BRT (Belgium) teletext index page 100, photographed by Jeff May (Colchester) on the screen of his unmodified Philips colour receiver (KT3 chassis). The transmission was on ch. 43, using an aerial directed at Dover.

If the project gets going quickly, the closing months of the year could be an exciting time – the service should be in operation by the time these words are read. I've been making a few enquiries as to the availability of 12GHz equipment – it can certainly be obtained, but in one-off quantities and matching prices. It seems likely however that domestic equipment will become available within a year or so, either from Western Europe or the Far East – rumours suggest that at least two UK firms are taking active steps. Now if someone reading this column can design a simple terminal that's easy to duplicate, I'm sure we shall all be pleased to hear . . . And now to DX matters.

Conditions during September

September was unusually active, with Sporadic E propagation continuing, a period of enhanced tropospheric propagation early in the month and the first signs here of F2/TE reception. First the SpE log.

1/9/81 TSS (USSR) ch. R1.
2/9/81 TSS R1, 2; TVP (Poland) R1, 2, 3; RAI (Italy) IA, B; RTVE (Spain) E2, 3, 4; RTP (Portugal) E3; JRT (Yugoslavia) E3; ARD (W. Germany) E2; plus unidentified signals.
5/9/81 RTVE E2, 3, 4; NCT-Italy E3/IA; ORF (Austria) ch. *E2* – a new one!
6/9/81 TSS R1, 2; unidentified ch. R1, 2 signals.
8/9/81 RAI IA, B; JRT E3.
9/9/81 CST (Czechoslovakia) R1, 2 – using the EZO pattern with RS-KH identification; SR (Sweden) E3.
13/9/81 TSS R1, 2; RTVE E3.
14/9/81 TVP R1, 2; TSS R1; SR E2; Switzerland E2, 3.
16/9/81 NRK (Norway) E2, 3; RTVE E2, 3, 4.
17/9/81 RTVE E2, 3, 4; RTP E3.
18/9/81 NRK E3.
19/9/81 TSS R1, 2; MTV (Hungary) R2; RTVE E4.
20/9/81 RAI IA, B; RTVE E2, 3, 4.
21-22/9/81 RAI IA.
23/9/81 RTVE-1 E2, 3, 4; RTVE-2 E2.
27/9/81 TSS R1, 2; unidentified signal on ch. R1.

The above SpE log is based on reception by Cyril Willis (Ely), Arthur Milliken (Wigan), Ray Davies (Norwich) and myself at Romsey.

Tropospheric conditions improved from the end of August, giving enhanced Band III/u.h.f. reception. August 28/29 produced noiseless French u.h.f. signals on many channels, and the ATV G8RYC station at Ely. Conditions then veered to give reception from a more easterly/NE direction, with NRK signals in Band III and DR (Denmark) ch. E7, plus lots of W. German stations on all channels! Early morning openings continued over the next few days, with similar signals, but the peak occurred over the 5-7th. This produced the above signals, plus further NRK stations, SR up to chs. 30, 33 and 42, very strong signals from DR on chs. E5, 7, 10 and several ATV stations – Cyril Willis apparently had G8SUY from London producing overloading! Reception was subsiding rapidly by the 8th, with only W. Germany on chs. 35/48.

Ionospheric activity in the F2 layer commenced early in the month, with US paging stations on 35·22 and 35·58MHz from about the second week. On the 12th I could resolve them using an indoor Tandy portable! Conditions continued to improve, with the MUF rising into the low 40MHz region, and on the 20th I received both GBC (Ghana) and ZTV (Zimbabwe), fighting over ch. E2, from 1720-1810 BST (via TE). Hugh Cocks also logged

ZTV/GBC between 1600-1800 on the 21st and 22nd. During the afternoon on the 26th I heard harbour control at a Florida resort discussing the berthing of a large cabin cruiser with a patrol officer (the latter was on the stern of the ship, using a hand-held unit). This is indicative of the low powers that can be propagated via F2 when active – the signals were at 37·9MHz.

My thanks to Cyril Willis, Arthur Milliken, Ray Davies, Hugh Cocks and Jeff May (Colchester) who all contributed to this tropospheric/F2 report.

MS (Meteor Scatter) reception has also been present throughout the month, with the usual signal pings.

News Items

Eire: Further news from Trevor Plowman (Dublin) about the independent TV station operating in the city. The station identifies itself as "Channel 3 – Independent Television Dublin" and transmits on ch. D in Band III (not ch. C as earlier suggested). The test pattern consists of colour bars with the lower part of the screen carrying the identification mentioned above (moving across from left to right): it comes on air at 0000, followed by advertisements at 0010 and a film at 0015 until close down at around 0145. The station is at the former State cinema in the Phibsboro district and has two reserve transmitters and a large supply of feature films on video. There's no information on transmitter power or polarisation to date, but the signals can be seen at a distance of some 35 miles (this report from Mike Pettigrew, Church Hill, Wicklow).

India: Plans for an Indian TV broadcasting satellite (INSAT-3) suggest a launch in early 1982, with two channels. The INSAT-1 satellite already in orbit at 102°E may be used for TV, relaying at 4·17GHz. India has adopted the PAL colour system. The Russian Stat-T craft (99°E, 714MHz) continues to provide the Moscow-1 TV service from 0615-1515GMT.

Sri Lanka: A full TV service will start in January, with PAL colour, from Colombo ch. E5, Kokuvil (Jaffna) ch. E7 and Kandy ch. E10. Report from Bindu Padaki (Madras).

Mozambique: The first scheduled TV service starts in January, using system I, initially in monochrome only.

Saudi Arabia: Transmitters are now in operation on chs. 22, 23, 24, 25, 26, 27, 30, 39, 42, 45 and 47. Our correspondent mentions that European (particularly UK) football matches are commonly transmitted in full, with the original commentary and an occasional Arabic commentary laid "over the top". This is quite usual in fact in the Middle East and certain African countries.

New Transmitters

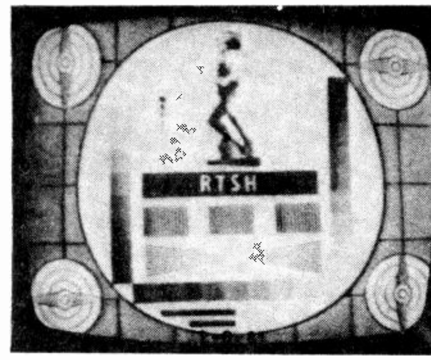
Two new pirates in Holland, one at Duivendrech (south of Amsterdam) on ch. 43 and the other at Monnikendom on ch. 27. Two new TVR (Rumania) transmitters have been received in Holland – simultaneously, on ch. R2. The RTM (Morocco) Band I transmitter operates on ch. E4. An HR (W. Germany) transmitter has opened at Rhon for the HR-3 service, on ch. 37 with 364kW. The GDR (E. Germany) Helpterberg station now operates on chs. E22 and E37 – it's thought that the E3 outlet may close.

Mysteries

Westward TV is reported as having been received recently in northern France on ch. E3! The 1956 RETMA test card has been received in Holland on ch. E2, via SpE, from a south-easterly direction. The identification "RTA

King Hassan of Morocco talks to RTM-TV (ch. E4).

TSS (USSR) received via Band III SpE on June 7th (ch. R9).



Albania ch. IC received in Holland via SpE.

Above photos courtesy of Ryn Muntjewerff.

Algerie" has also been seen in Holland on ch. E2 – fortunately it was photographed.

CB Interference

Our recent comments on this subject produced a mixed reaction. Complaining to the Post Office should in theory produce action, particularly where an active base station is reported, but in practice this doesn't always follow – at least in some areas. When the local (Southampton) Customs and Excise were approached in early September concerning an operator/base station, they refused to take action even when the operator was named and proved to be using an FCC standard a.m. transmitter. This was apparently "on instructions from above". In such cases one has to take preventive action oneself – or suffer.

Information has been received from three makers of CB filters. Labgear Ltd. are about to introduce their CM9700 filter. This has both braid and internal filtering, with a quoted attenuation at 27MHz of 70dB (transverse) and 26dB (longitudinal), falling to under 1dB in the group A spectrum and 0·5dB for groups B/C/D. The Packer Communications (Coniston, Cumbria LA21 8HQ) UL8 braid/inner break filter has been tried at a Southampton semi where the neighbour was operating a base station with a linear amplifier. This caused havoc with reception, but with the filter in circuit adjacent to the TV aerial socket there was only slight disturbance to an otherwise normal picture when the operator keyed to transmit. Other filters are available for hi-fi speakers, mains leads and v.h.f. (we hope to test this one shortly) – send s.a.e. for leaflet and prices. S. A. Collard (PO Box 40, Osmaston Works, Osmaston Road, Derby DE3 8NJ) also supply CB appliances, including their TV27, a 27MHz notch filter with 100dB attenuation falling to under 1dB above 470MHz (75Ω).

The PO Radio Services at Norwich advise that when fitting braid break filters the possibility of mains lead breakthrough shouldn't be ignored. Suitable ferrite ring filtering should be included prior to the receiver's mains lead entry point to minimise the possibility of r.f. currents being induced in the chassis. I hope to report further on the problems of CB interference shortly.

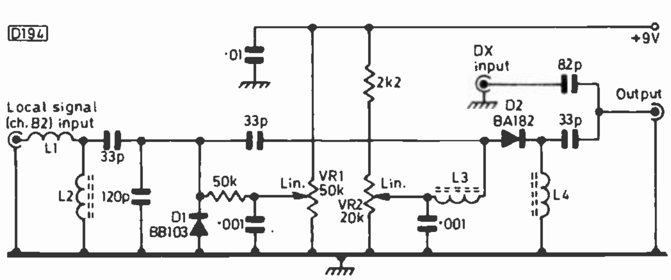


Fig. 1: Aerial phasing circuit used by Paul Barton. L1 consists of 10 turns of 20 s.w.g. wire, of 3/16in. diameter, 1½in. long. L2/3/4 are 15 turn close-spaced v.h.f. chokes.

From Our Correspondents . . .

Paul Barton, an experienced enthusiast from Harrogate, has sent details of an effective aerial phasing unit (see Fig. 1) which he has been using to null out the local ch. B2 sound for ch. E2/R1 reception. The design is much simpler than the one we presented last January, but provided the BBC signal at the local signal input is of higher strength than at the DX input the unit works well, with a considerable though not complete phasing null. The original circuit uses a BA182 in position D2, but I suggest that using a BA379 would be an advantage. As before, the idea is to get a phase shift between the unwanted signals at the two inputs and to adjust their amplitude so that they cancel at the output. Paul comments that SpE focusing must be occurring at times – as an example, he quotes strong reception from Tallinn (TSS) ch. R2 whilst the signal from Helsinki (ch. E2) only some 50 miles distant was very weak.

John Dempsey (Co. Tipperary) has been experimenting with reception from N. Ireland at u.h.f., using a home-made 22½ft diameter dish. At the focal point of the dish he used a Wisi bowtie, but this has since been replaced by a group A dipole plus oval reflector dish, giving improved and consistent results. The dish is mounted atop a 45ft tower!

Red Mathews reports that the HS Kabel-TV A/S relay company in Stavanger, Norway, has been given planning permission to erect a parabolic aerial some 18 metres high by 12 metres wide to receive BBC/ITV transmissions across the North Sea. A satisfactory service for 60% of the time is expected. The charge for connection to the cable network will be 3-4,000 Kroner – BBC radio will also be distributed.

Ed Baker (Cramlington) has spent an active summer with considerable success. He mentions that during a bullfight on August 9th – the usual protracted RTVE OB coverage of such events – the bull flattened the matador, jumped the barriers and got stuck halfway, scattering the spectators and confusing the picadors. I recall a similar event during the 60s, when the bull got behind the barriers and chased the spectators into the ring. This is not an activity I sympathise with however.

Finally Robert Copeman (Melbourne, Australia) reports improved F2 conditions during September with Vladivostock (TSS ch. R1) on the 13th plus various harmonics, including Spanish mobiles at 41MHz, and a harmonic from REE Spain at 35·2MHz on the 20th.

VCR Clinic

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

THERE'VE been a few moans since I announced that I was concentrating on writing my book on VCR servicing instead of reporting on VCR troubles for the magazine, so I thought I'd better mention some recent experiences.

First a Grundig SVR4004 – the very slow four-hour machine using the Philips format. The fault was that the video head drum went round at high speed. This was confirmed when the recorder almost hovercrafted off the bench – Andy offered to sit on it to hold it down, but I told him it would be better to deal with the fault.

The reason the drum went so fast was the absence of 50Hz reference pulses to the head drum servo. These are derived from a crystal oscillator, after division by a counter. The answer was simple enough – replace the counter i.c. That cleared the fault, but only for a while. Some time later the VCR was switched on again and the fault reappeared. The same i.c. was dead. Well, logic says that innocent little counter i.c.s don't just die. No, they're killed off by some nasty, evil cause. If in doubt, over to Grundig – ring Peter, that's my motto.

Peter said that it was probably the power supply capacitors, and that they'd come across the problem once before – there can be a voltage surge at switch on when the machine is plugged into the mains. As a result, the i.c. receives a higher supply than its usual 15V. Fair enough, I'd never have found that. So I whipped out the power supply panel and went over the capacitor connections with a soldering iron. Being smart (sometimes) I decided to watch the power supply waveform rise on the scope rather than immediately insert another sacrificial i.c. No overshoots or voltage peaks above the norm however. Check the 15V rail as the book says and find 15·1V, all o.k. Thinks "I'm missing something, better recheck the power supply at switch on." One does talk to oneself on occasions like this, doesn't one?

So we left the machine unplugged for a bit, then checked again. Apply mains and check the 15V rail. It rose to just over 15V and stayed there. Wait a minute – how much is "just over?" Check with the meter instead of the scope, and find 19V. Well CMOS i.c.s don't fancy that sort of voltage much, so out with the power supply again.

On the bench the power supply's off-load output was nearer 23V. Loaded with a lamp it settled at 15·1V. The manual lays down the conditions for measuring the 15V rail on full load, i.e. record. So the question was, should the power supply rise like it did off-load? To cut a long story short, the answer from Grundig was "no".

The power supply has an i.c. regulator with a Darlington power output transistor. As it was regulating, it seemed reasonable to replace the transistor. Wrong again! This time try the regulator i.c. That cured it, so we put in a new counter i.c., set up the machine and returned it to another satisfied customer with a long face (when he saw the bill).

Motor Trouble

A Toshiba V5470 machine came along for attention recently – in fact it was returned to us only some three weeks after we'd sold it. "Somat wrong wi' picture" was the complaint, so Andy tried a prerecorded tape and announced that the picture had lots of wiggles in the verticals. A quick check around the servo department revealed the presence of a large a.c. waveform across the drum motor. Since this was not present at the servo's d.c. output, it was obviously the motor. Well, we hadn't got one, so we lent the customer another machine of the same sort.

Two hours later he was back again, complaining that his recording of Top of the Pops had been all right on the previous machine. This causes puzzlement sometimes, doesn't it? If a defective recorder makes a recording with the speed of its drum motor varying, the recording will replay all right on that particular machine, but a prerecorded tape will have bent verticals, as will the recording if replayed on a good machine. So he'd got a duff recording as well. Replacing the drum motor assembly cured the original fault.

Blow Up

We can all blow one up from time to time. I was merrily editing away on an HR7700 to provide myself with off-air colour bars as a test tape. The edits were necessary because the TV set I was using as a monitor kept on having colour drop-outs. When the tape was taken out, it was in two halves. It shouldn't happen of course, but the pinch roller solenoid drive transistor decided that my edits were a bit too fast and died, clamping the tape firmly between the pinch roller and the capstan as the transistor went short-circuit.

Microprocessor Faults

I've had a number of faults due to microprocessor logic problems. It's only fair to mention however that these tend to be isolated cases.

One such problem occurred with a Toshiba V8600. It had been out for a few weeks and came back with problems on the wired remote control. In this sort of case, a few minutes or so checking which controls work and which don't are minutes well spent. The machine would fast forward and rewind, but there was no play or end of tape stop. On the wired remote control unit, pressing fast forward gave play.

The functions seemed chaotic, but there was a pattern and a close scrutiny of the systems control microprocessor and its input signals showed that "scan line 2" was involved in the play and end of tape stop functions. The scope then showed that it was loaded down. There were several possibilities, including a remote control decoder i.c., so an advance replacement i.c. was ordered pending further investigation. Ordering this was a waste of time, because Toshiba hadn't got any. The i.c. was subsequently eliminated anyway, the fault being traced to the counter 0000 switch which had been pressed too hard, a lump of solder shorting to chassis. Easy enough to find on a quiet day with the wind in the right direction . . .

Another logic fault, on a JVC HR7700, looked more difficult than it was. Every so often the remote control wouldn't select channels properly. If channels 1, 2, 3 and 4 were selected, 5, 6, 7 and 8 came up – selecting these latter channels was all right. Also the clock, counter and programme setting tuner/timer functions wouldn't operate at all, yet all the tape transport functions – play, fast-forward, rewind, stop etc. – worked perfectly. The machine's on-board controls operated normally, so the instant diagnosis was a faulty remote control unit. This was wrong, because the tape transport remote functions were o.k.

Analysis of the binary codes showed that a data bit D2 error would produce incorrect channel selections. So we checked the binary D2 line within the machine and discovered a faulty gating i.c. on the tuner/timer board – this little operation took half an hour.

Warping

Whilst on the subject of the HR7700, the last batches we've had have suffered from loud noises during rewind, due to warping of the tension arms and idler wheel brackets – they are all plastic/nylon, and catch on the turntables and opto-coupler housings.

Interruption

A brand new Ferguson 3V23 (HR7700) caused Andy some problems on test. It would stop dead after it had been on for only a few minutes, with the cassette still threaded, and would have to be switched off for a period of time before the cassette could be ejected. Just before it switched off, the picture would go spotty on the top half.

A scope was used to check and confirm the presence of an interrupt signal to the microprocessor – the interrupt signal indicates that the machine has stopped for some reason, rightly or wrongly. There mightn't be anything actually wrong, it's just that the machine thinks there is, so various inputs to the interrupt circuits have to be checked.

The drum flip-flop signal produced by the servo is used to tell the machine that the drum has stopped rotating – for example if the tape ties itself in a reef knot around the drum. The signal is a symmetrical squarewave, and when we took a look at it we found that there was some distortion – this could also be the explanation for the spots on the picture prior to the actual switch off. The culprit turned out to be IC3 in the servo ciruit – it produces the flip-flop signal from the rotating drum. We found that the squarewave became distorted as the chip warmed up – squirting it with freezer restored the correct waveform.

Will it end up in the river?

Here's another difficult fault we had recently with an HR7700 – another new machine. We put it on our checking bench and tuned each channel to an off-air programme. So far so good. Incidentally Andy checks out all our machines before despatch, and we've had to put many a fault right. So our failure rate in the field is extremely low – if I was a customer and got a faulty machine, I'd certainly be upset! Anyway, the HR7700 was used by yours truly the following day only to discover that there were no off-air signals. After a period of torture (three episodes of Crossroads) Andy admitted that he may not have stored the tuning voltages in the memory. So we did it again, checked the memory, and everything was o.k.

The following day we discovered that the tuning memory had again gone (this time *I* had to watch Crossroads). So something was not quite right, and those of you who know what's involved in this "simple" process will by now be cringing at the thought of it all. Not me though! Oh no, I screamed obscenities at the dog, CP. (That's her name, from Candy to Candy Puff through CP30 to CP, and she answers to them all . . .) Back to the HR7700.

The first check with a case of this sort is to find out whether the memory is being erased at power on. Being an EPROM, the memory chip has three power supply lines and a reset, the power supply lines being delayed at switch on so that they appear in sequence. We checked the lines and the delays, and everything was in order. The next move was to change the memory i.c., since it was now number one suspect.

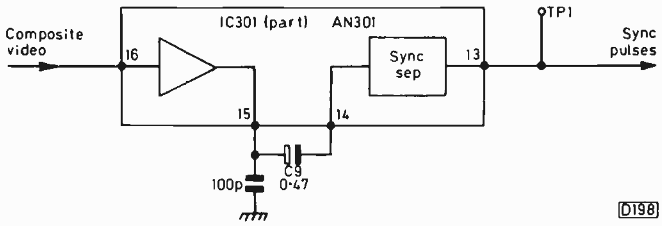


Fig. 1: Servo sync separator circuit, JVC Model HR3330.

Two days later, after yet another couple of memory losses, I was mucking about storing new programmes. As a result of this, a weird sequence came to light. Assuming that the memory was completely clear, I retuned channel 1. On switching to channel 2 however the memory had returned and was tuned in. So I checked channels 3, 4, 5 and 6 – all were blank. Try channel 4, get nothing, so press the store button and move up one to channel 5. Lo and behold, there's a picture. This meant that pressing the store button was getting the tuning voltage from the memory, which in turn indicated that the memory was storing data which was not being released by the microprocessor. Naughty micro. Arrrgh! Change micro, tune in and leave over weekend.

Monday morning was a tense time. Will the tuning be there? Will Steve throw an HR7700 into the river Trent and claim the insurance? Well, it worked. Andy tied the boat back up and we put the recorder in stock. Latest score JVC 0, Steve 7.

Picture Jump

An HR3330 had a fault which persisted despite being sent to more than one service department. It had occasional picture jump with changes in off-air picture, to the point that the servo would sometimes be disrupted in the record mode. I'd a couple of gents with me at the time on a training course, so I asked them to run the machine until they could find a way of making the fault appear.

It transpired that the fault regularly coincided with recordings of ITV adverts, and we concluded that when the adverts were replayed the servo went off lock. Some time was spent waiting for the adverts with a scope, and sure enough during an advert picture change the servo went off lock. We then found that the fault occurred when the picture went from white to black, so we arranged for this with my pattern generator to get the problem to come and go at will. We then checked the field sync pulse input to the servo, and discovered that the pulses disappeared during the transition from white to black. I said it was capacitor trouble, someone else decided it was an i.c. and another remained uncommitted.

I won when it was discovered that C9 (see Fig. 1), which should have been 0·47μF, was actually 10μF – an assembly error. How did I manage to guess this one correctly? Well, having done some design work on video amplifiers, I knew that the d.c. level on which a video signal sits after capacitive coupling depends on the video signal amplitude, the level being critical with a sync separator circuit.

Manuals

Despite a bit of flak at times, I do have a good relationship with most video firms. But I must say that the manuals they provide vary enormously. JVC's are excellent – all the information you need is there. Grundig are making a great effort. I've suggested to some of the importers that they spend less time running two-day courses that most people forget by the time they come face to face with a faulty VCR, and spend more money on producing decent manuals in understandable English. Sectionalised details plus block diagrams and a detailed circuit description should be given, since a service engineer is in a better position to carry out repairs if he knows how the machine works and has the details to hand for easy reference. So how about it all you importers?

Letters

VDU MODIFICATION

A recent item in your *Service Bureau* column (October 1981, page 661) prompts me to say that I've found the Thorn 1690 monochrome portable to make an ideal VDU. It has an isolated chassis of course, and there's a link on the board ideally (intentionally?) positioned to form an injection and extraction point for video signals at a level tolerably close to the standard 1V peak-to-peak with negative-going syncs. The link, physically adjacent to R33, isolates the base of the video output transistor TR7, the input to the sync separator circuit and the 6MHz intercarrier sound rejection trap from the video driver transistor circuitry. A simple analogue changeover switch can be used to replace the link, providing selection between TV and VDU use. I've been using my set successfully for teletext and home computing use for some years.

J. W. Attwood,
Watford, Herts.

EHT PROBE

Looking through the many articles you've published in the past on c.r.t. testers and reactivators, I found no mention of discharging the e.h.t. potential which is generally still present at the final anode when the base is removed for tube testing/reactivating. On some colour sets, the single-standard Pye hybrids for example, there's no problem since the tube's capacitance gets discharged via the focus VDR. On most later sets however a hefty e.h.t. potential is left on the final anode and, as I've found from bitter experience, can cause havoc with video output transistors etc. when the base is refitted.

Having plenty of old Pye hybrid chassis focus units available, I decided to try some experiments with the carbon VDR rod from one of them. The main problem was obviously going to be insulation of the e.h.t. end of the probe. I came across a long, tapered plastic watering can spout from a Weedol applicator in the garden shed, and this became the basis of the probe (see Fig. 1). The older (black) type focus units have a red rubber sleeve which helps with the insulation problem.

The sleeve was pushed farther down the rod, to about half an inch from the end, the rod then being pushed into the plastic tube. The end was fastened with Araldite. Since the rod has wire connections, there's no problem with fitting a short copper connector at the e.h.t. end: the black earth connection is long enough to use at the earth end. A scrap soldering iron handle was then taped to the end of the tube, with the earth lead threaded through.

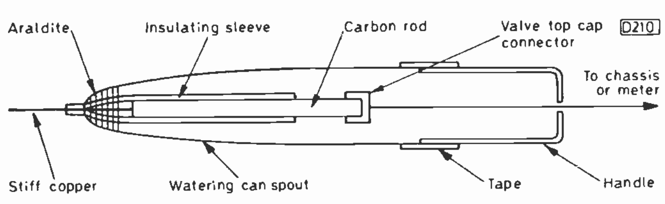


Fig. 1: P. Smith's e.h.t. probe.

I was now ready to test the device – an old Rank A823 chassis was used for the purpose. A cheap, 20kΩ/V meter (1kV scale) was connected between the probe and chassis, and after switching the set off the arrangement was tried. Sure enough, the meter reading rose to about half f.s.d. and then slowly died away to zero. I then decided to switch on with the probe still connected. The reading rose to a steady one just above half f.s.d. I now realised that I had a means of making direct e.h.t. readings.

To cut a long story short, I fitted a crocodile clip to the earthy end of the carbon rod and by trial and error adjusted the clip to give me a reading of 25 on the 30V scale with the brightness turned down (switching the set off each time an adjustment was made). The rod was then cut off at this point and an earth connection made, using an old valve top cap pushed over the end of the rod. The probe has been used on many occasions subsequently, and was later found to be accurately calibrated by checking against a colleague's commercial e.h.t. meter.

The following safety precautions should be observed. (1) Insulate the copper connector so that no bare wire protrudes from under the e.h.t. connector's cover. (2) Always make connections with the set switched off – including moving or changing meter scales. (3) Keep the earthy end earthed at all times.

P. Smith,
Hathersage, Sheffield.

AN AWKWARD ONE

A Luxor solid-state colour TV receiver (Model no. 18066641) with automatic search tuning was brought into the radio/TV/electronics instruction department of the Irvine Skillcentre as a last resort, having been to a dealer who'd been unable to locate the cause of the trouble. On switching on we found that the vision was normal but the sound was absent; also the 850mA fuse on the power board had blown. On checking the transistors on the audio board, one of the output pair was found to be short-circuit base-to-collector. The two transistors (BD676 and BD675) and the 850mA fuse were replaced, but on switching on the fuse again blew.

We'd no service information on this particular model, so I decided to trace out the circuit. As a result, I was amazed to find that the transistor connections were wrongly printed on the top side of the board! The connections marked "B" were in fact connected to the positive and negative supply rails; the emitters were marked correctly; but the hole marked "K" was connected to the collector of the driver transistor.

On fitting two new output transistors the right way round, replacing the fuse and switching on the sound came up normally. A board error that could prove quite costly in components and time!

G. Sauter,
Kilwinning, Ayrshire.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 99 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

RANK T20 CHASSIS

The initial problem was that the fusible resistor 5R3 in the h.t. feed to the line driver transistor would go open-circuit. Resoldering the spring would bring the picture back for about a week before the resistor would spring open again. The set is now giving the no results symptom, i.e. there's h.t. but the line timebase is not working. Components that have been checked include the line output transistor and the line oscillator i.c.

The opening fusible resistor suggests that the problem lies in the line driver rather than the line output stage. With no drive, the line output stage remains cut off. More obvious things to check are the line driver transistor 5VT3 and 5C5 which decouples 5R3. It would also be worthwhile checking (by substitution) the damping network components (5C2/5R4) in the driver transistor's collector circuit, and 5D1 which is in series with its emitter. A defective driver transformer (5T1) cannot be ruled out – it's inclined to suffer from short-circuit turns in this chassis.

NATIONAL MODEL TC85G

We're having problems with a line sync fault on this set. The flywheel sync circuit has been thoroughly checked and the waveforms in the line oscillator department all seem to be right. To start with, the set would take a long time to lock – the time gradually got longer. Now the picture won't lock at all – the line oscillator seems to be running fast.

We've had this one ourselves, though it doesn't seem to be a common fault. The characteristics of the sinewave line oscillator's coil, or more likely its core, change over a period of time (these sets are now seven years old). A new coil assembly will put matters right, but as a temporary measure the value of the tuning capacitor (C510, 8,200pF) can be changed to the next standard value and the coil retuned.

ALBA MODEL T14

There's tuning trouble with this set. To start with the picture would remain for only a short period, then loud hissing noises etc. would almost drown out the sound and the picture would go right out, leaving just the raster. Now the picture cannot be tuned in on any of the three channels – the sound can be tuned in, with a lot of noise and now and again patterning on the screen.

These sets are fitted with the Thorn 1591 chassis, and it would appear that the tuner unit is defective. You can either replace or repair it – Thorn four push-button tuners are advertised quite cheaply. Repair should consist of cleaning the spring washers which contact the tuner body to the rotary spindle, removing the grease and improving the contact, and replacing one or both of the transistors as necessary. Ensure that the push bar is firmly soldered to the swing arms.

TELETON MODEL TVC20

The problem is lack of height – at the top and bottom of the screen. I've replaced the 21LU8 field oscillator/output valve and checked most of the associated resistors and capacitors, but the fault remains.

The main suspect is R725 (1·8MΩ) over in the line output section. It feeds the height control from the 700V boost rail. If this is o.k., check R616 (1·2MΩ) and R618 (1MΩ).

GRUNDIG MODEL 6010

When the set is switched on from cold the picture tends to roll diagonally across the screen for the first quarter of an hour. Once the set has warmed up however the picture is perfect.

The effect is due to weak or intermittent line sync. Check R408 (2·7MΩ) on the line sync panel – it provides bias for the sync separator stage in the TBA920 i.c. If this resistor is o.k., the chip itself is suspect. Set up the line hold control R426 when the repair has been completed.

SONY MODEL KV1300UB

This set was condemned by a dealer as requiring seven new transistors and a new tube. I tested the tube, which appears to be all right, so I decided to investigate further. On switching the set on, the cut-out operated. I disconnected the c.r.t.'s e.h.t. cap and left it off, then checked the chopper transistor Q903. This was short-circuit emitter-to-collector, so I fitted a replacement and tried again, with an e.h.t. probe connected to the e.h.t. supply and a meter connected to the 110V h.t. rail. The chopper transistor again blew, but I noticed that the e.h.t. rose to about 8kV and the h.t. line to about 100V before the cut-out operated. To check further, I applied an external 18V supply to the junction of D608/R574 and found that the line oscillator and chopper driver stages seem to be in order. But another chopper transistor went the way of the first two.

First check the line output transistor Q801 (2SC1034) and the flyback tuning capacitor C802 (7,500pF, 1·5kV). Then check the components associated with the crowbar action – D610 (12V zener), Q605 and thyristor Q606. The kick-start components C604 and D602 would be worth checking, also the chopper circuit "efficiency diode" D607 and, less likely, the chopper driver transformer T603.

DECCA MODEL DR21

The original fault on this set was incorrect line speed. This was cured by replacing C114, C116 and C120 in the line oscillator/discriminator circuit – they are all polystyrene capacitors. The problem now is foldover on 405 lines – the 625-line picture is o.k. This foldover is not at the side of the screen but part way across, giving the appearance of a pleat in the picture: there is also lack of width on the left-hand side.

You've had a go at the capacitors in the line oscillator circuit (we hope you used 5% Suflex replacements), now you'll have to check the resistors. The usual cause of this fault is R130 (680kΩ) going high in value, but the associated resistors R139 (330kΩ) and R140 (56kΩ) should also be checked. These resistors are all in the grid circuit of one half of the ECC82 line oscillator valve – the other grid is tied to the line sync circuit. The fault can be confusing in showing up on one standard only.

THORN 3500 CHASSIS

The problem is pulling to the right with captions etc. The i.f. and sync transistors have been checked, and all relevant voltages except that at the collector of the luminance delay line driver transistor VT105 are correct. The latter is at 12V instead of 7·5V.

First check that R125 (a.g.c. adjustment) is not over advanced. Then check the sync separator's base bias resistor R215 (2·7MΩ) and the associated diode W201, and ensure that any substitute transistors used in the sync circuit (VT202 and VT203) are suitable, Thorn-approved types.

BEOVISION 3200

The set comes on normally, with a good picture, but after about five minutes the picture starts to blur then loses width. When the fault appears, the PY88 and PL504 valves overheat.

Try replacing the PY88 and PL504 valves, adding a 1kΩ, 5W wirewound resistor in series with the PL504's fusible screen grid feed resistor R540. If this fails, isolate the outer core of the screened lead feeding R532 and R533 in the PL504's control grid circuit (on the base panel) – it sometimes shorts to the inner core. If the fault persists and the line drive is present and correct, the line output transformer is suspect.

SCOPE USE

When I try to tackle solid-state chassis such as the Decca 100 with my 10MHz scope, the h.t. rectifier goes short-circuit. I appreciate that this is due to the chassis being live, but am not sure what procedure to adopt.

Your earthed scope introduces a short-circuit to earth when the probe is connected to the TV chassis. There are two possible solutions. Either operate the set from a mains isolating transformer, or remove the earthing lead from the scope's mains plug so that it's floating electrically.

HITACHI CNP860

The line driver transistor TR39 was replaced (it had gone short-circuit emitter-to-collector), also its h.t. feed resistor R720. This restored the picture, but there is a slight "belly dance" effect which is most noticeable when the set is used with a teletext decoder.

We suggest you check C713 and C711 (both 10μF) which smooth the supplies to the line driver and line oscillator stages respectively, also C718 (100μF) which is associated with the feed to the line output stage. If there's any suggestion of hum on the picture, check the series regulator transistor TR41 and the associated electrolytics.

TELEFUNKEN 711 CHASSIS

The tuner is stuck on channel 7 and won't change. The two i.c.s (SAS560 and SAS570) in the channel selector circuit have been replaced, but the problem is still present.

This fault is usually due to the SAS570 i.c. failing, and we're surprised that its replacement hasn't solved the problem. The only other trouble we've experienced has been leakage across the plastic of the touch sensor itself. Disconnect R1007, the resistor connected to the number seven sensor, and see whether channel changing is then possible. If so, the touch sensor is faulty. Clean it with switch cleaner and gently scrape the plastic to remove any conductive material that could be present.

ITT CVC9 CHASSIS

When the set is first switched on, there's loss of colour lock – the colour breaks into one-inch horizontal bars. Rapidly switching the set off and on again produces a normal picture, but on changing channels colour lock is again lost – BBC-2 is particularly bad, the colour usually remaining unlocked and going almost to monochrome. Is the tuner suspect?

The trouble is unlikely to be in the tuner unit – a careful tweak of the reference oscillator frequency control R311 (at the top left-hand side of the chassis) may be all that's required. If the fault persists, replace D36 (1·5V zener) and C208 (6·8μF tantalum) in the reference oscillator control loop, then reset R311. If you replace D36, note that it's cathode goes to chassis.

DECCA CTV19

This set has developed an appetite for PL509 line output valves. The picture seems to be o.k., but after about ten minutes the line output valve glows red, its cathode current being about twice what it should be at 400mA. The line output transformer and the valves in the line timebase have been replaced, and the line drive seems to be correct (–60V at the PL509's control grid). There doesn't seem to be anything amiss in the line timebase.

It could be that the line drive waveform is the wrong shape – triangular instead of rectangular. This can happen if C400 (400pF) in the waveform shaping network or the line oscillator's anode load resistor R327 (39kΩ) is faulty. Also make sure that the line drive coupling capacitor C402 (0·01μF) is not leaky. Other possibilities are: short-circuit turns in the d.c. feed choke L408 or the shift choke L400 (the latter can be disconnected as a check), missing gapping paper in the line output transformer, or maladjustment of the harmonic tuning coil L405.

BUSH TV350

The trouble with this portable is no raster. When the set has been on for a few minutes the line output transistor becomes unbearably hot, its collector voltage falling to about 6V. The odd thing is that removing the tube's final anode lead produces a nice, healthy spark.

That spark is the clue! The e.h.t. rectifier stick is almost certainly faulty, due to leakage. If the fault persists after the stick has been replaced, the line output transformer is suspect.

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TELEVISION DEC. 1981

RANK T20 CHASSIS

The original trouble was very bad streaking of whites across the screen when a picture containing whites or captions was present. This was cured for a few days by replacing 3C16 (220μF) which decouples the supply to the TBA560C luminance/chrominance i.c. Before that a streak-free picture could be obtained only by reducing the brilliance and contrast controls to a very low level. The fault has now returned however, though it's not as bad. In addition, there are now flyback lines on the picture.

We suggest you check the luminance coupling capacitor 3C15 (100μF) and the clamp reservoir capacitor 3C18 (0·47μF) – substitute with known good components. If the problem persists, the TBA560C and TCA800 i.c.s are suspect.

SABA H CHASSIS

The fault with this set is pulling, first to the right, with increasing speed, then slowing down and pulling to the left. The picture then stabilises itself and there's no more trouble till the next time the set is switched on.

The TBA920 line oscillator i.c. is generally responsible for this, due to an intermittent internal fault. Replacing it should cure the problem.

TEST CASE

228

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.

Wednesday's a quiet day for most of the technicians hereabouts – our service department is closed on Wednesdays, save for one man. With his glorious but temporary title of Duty Engineer, he roams the lanes and villages armed with a bleeper and a handful of 10p pieces. With these he regularly interrogates the Answerphone machine, tending to the needs of those customers and TV sets that have the temerity to disturb the peace on our day off.

The Post Office two villages away also shuts on Wednesdays. In his den above the shop, the postmaster watches the horse racing on his Grundig TV set, the stamps and pension books temporarily forgotten while he sits there with the windows shut and curtains drawn. Cigarette in mouth, he stabs the buttons on his remote control unit – but the set adamantly stays on BBC-1. He's had this trouble before – batteries lasting no time, and the set fizzing and spluttering for half an hour from cold. He phones the service department.

When the technician called, he entered the smoke-laden room and listened to the postmaster's problems – remote control doesn't work unless the transmitter is close to the set, spitz-and-sparken in the back, dim picture. Pondering on how many fags a day his customer gets through and the state of his lungs, our technician removed the set's back. Sticky, yellow gunge had accumulated around the tube's final anode cavity, and this was the cause of the corona effect. The area was quickly cleaned with meths and a thin film of silicone grease was applied. That cured the fizz. A go over the tube face with the meths then brought up a brighter picture than the postmaster had seen for many a long day.

The remote control action was very weak. A new battery was tried, but gave little improvement. If the transmitter was held in line with the receiver and fairly close, it would work. With this set (Model 1632GB), the Tele-pilot 120 is used for remote control. The technician ascertained that another was available at the showroom, and a couple of days later called at Crowfield Post Office to try it. The results were rather better, but still not up to the standard of the one in the shop.

An oscilloscope check was next made at C1206, the output from the Tele-pilot preamplifier in the set. This was found to be low and doubtful when the transmitter was operated from a distance of eight feet. As a last resort, a new preamplifier was tried – but made not a jot of difference! As he examined the original preamplifier unit, our technician suddely realized why the remote control system had become insensitive and was able to clear the problem. What did he do? Answer next month.

ANSWER TO TEST CASE 227
– page 46 last month –

A strange convergence problem and then a traffic warden confronted our man last month. Despite the salesman's confident diagnoses, neither the convergence system nor the tube was responsible for the red fringeing effect on the Decca 30 series hybrid receiver. It will be recalled that only the vertical lines of the crosshatch pattern were affected, and that transposing the red and blue drives from the decoder transferred the fault to the blue raster, proving that the trouble lay on the decoder panel.

In fact the fault was in the red output stage. This smearing effect is usually due to reduced bandwidth: as the RGB output stages have to handle the combined luminance/colour signal, a bandwidth of 5MHz or so is required. This frequency response is achieved, as in most designs of this vintage, by the use of frequency-selective negative feedback in the emitter circuits of the RGB output transistors. In the Decca set's red output stage the key component is C262 (470pF), which has an increasing shunt effect across the emitter bias resistor R302 (1·2kΩ) as the frequency rises, i.e. the negative feedback introduced by R302 is reduced at the higher frequencies due to the decreasing reactance of C262. The stage's h.f. response is thus enhanced – not in our set however, since C262 was completely open-circuit!

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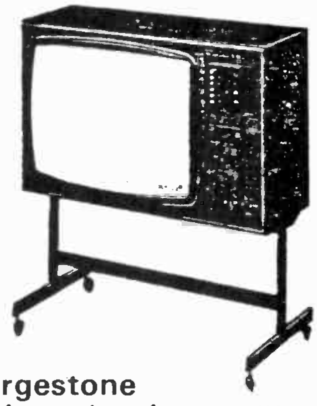

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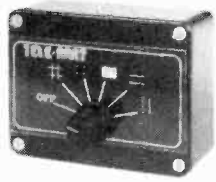

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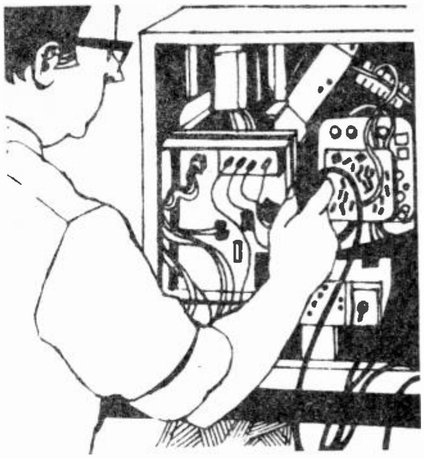

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