DECEMBER 1980

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

60p

TELEVISION

SERVICING · VIDEO · CONSTRUCTION · DEVELOPMENTS

SMALL-SCREEN MONITOR

SETTING UP THE COLOUR

TALKING T V

PLUS ALL THE REGULAR FEATURES

TELEVISION

December 1980

Vol. 31, No. 2
Issue 362

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

this month

OUR NEXT ISSUE DATED JANUARY WILL BE PUBLISHED ON DECEMBER 17

THE UNBEATABLE BRIARWOOD SERVICE

EX-EQUIPMENT SPARES

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

MONO TUBES
(tested)
19" Rimguard **£3.00**
23" Rimguard **£4.00**
20" Rimguard **£5.00**
24" Rimguard **£6.00**
+ £5.00 P.&P.

MONO TUNERS
6-button integrated all at **£4.00**
U.H.F. P/Button D/S **£3.50**. U.H.F. P/Button S/S **£4.00**. Rotary **£3.00** + £1 P&P.

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

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

PLEASE ADD 15% V.A.T. TO ALL ITEMS AND OVERSEAS AT COST. CASH WITH ALL ORDERS.

VALVES (MONO & COLOUR)

PCL82	0.10	30C1	0.10	PCC189	0.10	EF183	0.10	PL504	0.25	ECL80	0.10
PCL83	0.25	30C17	0.10	30C15	0.10	EF184	0.10	6/30L2	0.10	PL509	1.00
PCL84	0.10	PCF802	0.10	30C18	0.25	6BW7	0.10	30PL1	0.25	PY500	1.00
PCL85	0.10	PCF805	0.25	PC97	0.20	EH90	0.10	30PL13/4	0.10	GY501	1.00
PCL86	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30FL1/2	0.25	PL508	0.50
PFL200	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	ECC82	0.10	PCF200	0.50
PCF801	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC81	0.10	EY51	0.15

Please note there is 25p Postage and Packing per order.

WE DO NOT SELL RUBBISH AT BRIARWOOD TV

D/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	EHT	REG	CON	S/OUTPUT	POWER	L/TB	F/TB
Bush/Murphy	5.00	5.00	6.50	—	—	5.00	1.50	5.00	—	—
GEC/Sobell	5.00	5.50	—	—	—	5.00	—	—	—	7.50
Philips	5.00	7.00	—	—	—	5.00	—	—	—	5.00
Decca	5.00	9.00	9.00	—	—	5.00	2.00 (19" only)	6.00	—	5.00
Thorn 2000	5.00	5.00	5.00	6.50	6.50	7.00	—	6.50	10.00	5.00
Pye	7.00	6.00	7.00	—	—	5.00	—	—	—	5.00
Baird	6.50	8.50	7.00	—	—	5.00	—	—	—	5.00

Postage & Packing £1.25

S/STANDARD COLOUR SPARE PANELS

	IF	LUM	CHROMA	VIDEO	CON	POWER	L/TB	F/TB
Bush 184	9.50	—	12.00	—	6.00	6.00	12.00	—
GEC Hybrid	6.00	6.50	9.00	—	5.00	—	—	12.00
Philips G6 S/S	9.50	—	10.00	—	5.00	—	—	6.00
Thorn 3000	6.00	6.00	6.00		5.00	20.00	20.00	6.00
Pye 691/693	6.00	6.00	8.00	—	5.00	—	15.00	5.00
Thorn 3500	6.00	6.00	6.00	6.50	12.00	20.00	20.50	6.00

Korting and other foreign panels available on request.

Postage & Packing £1.25

COLOUR TUBES

17"	£15.00
18"	£15.00
19"	£15.00
19" A49/192	£18.00
20"	£18.00
22"	£20.00
25"	£15.00
26"	£22.00

Plus P&P £6.00
New rebuilt tubes available on request.

COLOUR TUNERS

Bush	£5.00
GEC	£5.00
Philips G6 S/S	£5.00
Thorn 3000	£5.00
Pye 691	£5.00

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

COLOUR LOPTS
Most Lopts available from £5.00. Both British & Foreign makes. Please ring or write.
P&P per Lopt £1.

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

THORN 1500 TUNERS
NEW SPECIAL OFFER
AT £8.00
Postage & Packing £1.00

CALL IN AND SEE 100's OF TOP QUALITY COLOUR TV's ALWAYS IN STOCK

All with good tested tubes • Clean cabinets complete • All sets ready for inspection

OPENING TIMES MON-FRI 9.00-12.00/1.00-5.45 (CLOSE 4.30 SAT)

Briarwood T.V. Limited
Britain's Mail Order T.V. Specialists

BRIARWOOD

THE PROFESSIONAL CHOICE. NATIONWIDE

NEW SPARES

TYPE	PRICE £
AC107	0.20
AC113	0.17
AC115	0.17
AC117	0.24
AC125	0.20
AC126	0.18
AC127	0.19
AC128	0.17
AC131	0.13
AC141	0.23
AC142	0.19
AC141K	0.29
AC142K	0.29
AC151	0.17
AC165	0.16
AC166	0.16
AC168	0.17
AC176	0.17
AC176K	0.28
AC178	0.16
AC186	0.26
AC187	0.21
AC188	0.20
AC187K	0.30
AC188K	0.30
AD130	0.50
AD140	0.65
AD142	0.73
AD143	0.70
AD145	0.70
AD149	0.64
AD161	0.40
AD162	0.40
AD161 } AD162 }	1.30
AF106	0.42
AF114	0.23
AF115	0.22
AF116	0.22
AF117	0.30
AF118	0.40
AF121	0.33
AF124	0.33
AF125	0.29
AF126	0.29
AF127	0.29
AF139	0.39
AF151	0.24

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

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

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

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

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

SPECIAL OFFER

SL901B	3.50
SL917B	5.00

DIODES

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

VALVES

DY87	0.52
DY802	0.64
ECC82	0.52
EF80	0.40
EF183	0.60
EF184	0.60
EH90	0.60
PC86	0.76
PC88	0.76
PCC89	0.65
PCC189	0.65
PCF80	0.70
PCF86	0.68
PCF801	0.70
PCF802	0.74
PCL82	0.67
PCL84	0.75
PCL86	0.78
PCL805	0.75
PLF200	1.00
PL36	0.90
PL84	0.74
PL504	1.10
PL509	2.45
PY88	0.63
PY500A	1.60
PY81/800	0.57

SPECIAL OFFER

Philips PL802 2.55

E.H.T. TRAYS MONO

950 MK2 1400	2.50
1500 18" 19" stick	2.60
1500 24" 5 stick	2.80
Single stick Thorn TV 11.16K 70V	0.75
TV20 2 MT	0.75
TV20 16K 18V	0.75

IC's

SN76013N	1.20
SN76013ND	1.00
SN76023N	1.20
SN76023ND	1.00
SN76226DN	1.50
SN76227N	1.20
TBA341	0.97
TBA520Q	1.10
TBA530Q	1.10
TBA540Q	1.45
TBA550Q	1.40
TBA560CQ	1.50
TBA570Q	1.00
TBA800	1.00
TBA810	1.50
TBA920Q	1.50
TBA990Q	1.50
TCA270SQ	1.45
TCA270SA	1.45
TCA1327B	1.00

E.H.T. TRAYS COLOUR

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

P & P 75p per order.

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

TELEVISION SALE
DISCOUNT FOR QUANTITY

BRIARWOOD'S UNBEATABLE OFFER TO THE TELEVISION TRADE COLOUR SETS WITH TESTED TUBES & GUARANTEED COMPLETE

	IN 10'S	IN 20'S	GOOD WORKING IN 10'S
PYE 691	£18.00 EACH	£15.50 EACH	£33.00 EACH
BUSH 184	£23.00 EACH	£21.00 EACH	£38.00 EACH
THORN 3000 25"	£23.00 EACH	£21.00 EACH	£38.00 EACH
KORTINGS	£25.00 EACH	£21.00 EACH	£43.00 EACH
TELPRO	£23.00 EACH	£21.00 EACH	£38.00 EACH

*COLOUR T.V'S AS THEY COME COMPLETE BUT WITH UNTESTED TUBES @ £15.00 IN BATCHES OF 10'S.

MAINS DROPPERS

Mono

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

Colour

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

All plus VAT at 15%

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

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

TELEVISION

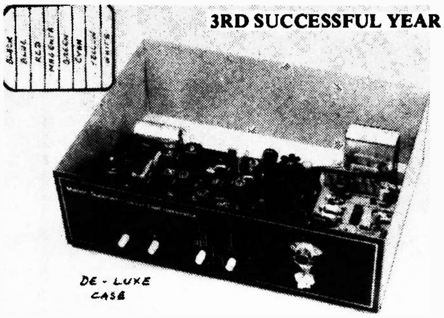
Briarwood House Preston Street
Bradford West Yorkshire BD7 1NS
Tel. Bradford 306018 (STD code 0274)

MANOR SUPPLIES

PAL COLOUR BAR GENERATOR

plus CROSS HATCH KIT (Mk. 4)

3RD SUCCESSFUL YEAR



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

PRICE OF MK4 COLOUR BAR & CROSS HATCH KIT £40.25 + £1.40 P/Packing. DE-LUXE CASE £5.95. ALUMINIUM CASE £3.30, BATT HOLDERS £1.70, ALTERNATIVE STAB. MAINS SUPPLY KIT £5.55.

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

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

MK4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £1.35 P&P.
MK 4 DE LUXE (MAINS) BUILT & TESTED £80.50 + £1.50 P&P.
VHF MODULATOR (CH1 to 4) FOR OVERSEAS £4.60.
INFORMATION ON VIDEO TAKE-OFF FOR C.C.T.V.
(ALL PRICES INCLUDE 15% VAT)

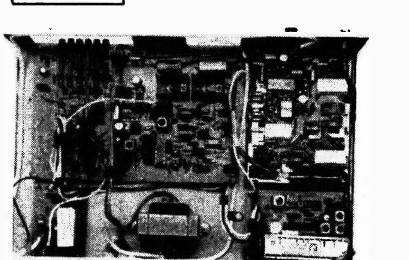
MANOR SUPPLIES

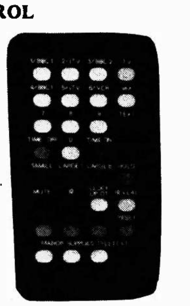
TELETEXT KIT (MK2)

(INCORPORATING MULLARD DECODER 6101VML)

BACKED BY YEARS OF EXPERIENCE

INFRA RED REMOTE CONTROL





- EXTERNAL UNIT, PLUGS INTO AE SOCKET OF TV RECEIVER.
- LATER SPEC (DOUBLE HEIGHT, BACKGROUND COLOUR ETC).
- INFRA-RED REMOTE CONTROL (MULLARD 5000 SYSTEM) STATION SELECTION. TEXT. MIX. TIME. DOUBLE HEIGHT. HOLD. CLOCK. REVEAL RESET ETC. ETC.
- INCLUDES COMPLETE & TESTED 6101 VML (MULLARD) DECODER. SAW FILTER IF PANEL & 32 BUTTON REMOTE CONTROL HANDSET.
- SUITABLE FOR BBC DEAF SUB-TITLE TRANSMISSIONS-REMODULATES PICTURE.
- CONVERTS ANY UHF RECEIVER TO STATION SELECTION REMOTE CONTROL AND TELETEXT. (SIMPLIFIED KIT AVAILABLE FOR REMOTE CONTROL ONLY).
- FACILITIES FOR VIDEO OUTPUT, MONITORS, CCTV ETC.
- AUDIO OUTLET FOR EXTERNAL HI-FI AMPLIFIER.
- EVERY KIT EASY TO ASSEMBLE & FULLY GUARANTEED. TECH. BACK-UP SERVICE.
- DE-LUXE CASE MEASUREMENTS APPROX. 15¼ × 10¼ × 3¼.
- WORKING MODEL AT 172 WEST END LANE. N.W.6.

FURTHER DETAILS ON REQUEST

ALSO, MANOR SUPPLIES TELETEXT MK1 KIT (TEXAS) NOW WITH REMOTE CONTROL PRICE £193.20 P/P £2.80.

TELETEXT & TELEVISION SPARES

"TELEVISION" NEW PORTABLE RECEIVER PARTS AVAILABLE.
WORKING MODEL & PANEL TEST SERVICE
SPECIAL OFFER TEXAS XMII TELETEXT MODULE NEW & TESTED, LIMITED QUANTITY AT HALF PRICE **£69.00** p.p. £1.40.
NEW CTV SIGNALS BOARD PARTS NOW AVAILABLE.
'TELEVISION' COLOUR RECEIVER PROJECT ALL PARTS AVAILABLE AT PRESENT. POWER, SIGNAL & TIMEBASE. SEND OR PHONE FOR LIST. WORKING MODEL ON SHOW WITH TELETEXT. (PANEL TEST SERVICE NOW AVAILABLE).
NEW SAW FILTER IF AMPLIFIER PLUS TUNER COMPLETE AND TESTED FOR T.V. SOUND & VISION **£32.80** p.p. £1.10.
TELETEXT 5V STABILISED MAINS POWER SUPPLY (FOR TEXAS OR MULLARD DECODERS) **£6.70** p.p. £1.00.
TELETEXT 23 BUTTON DE-LUXE HANDSET WITH 5 YDS. CABLE **£11.30** p.p. £1.00. XM11 INTERFACE PANEL (THORN) **£2.10** p.p. 75p.
CROSS HATCH UNIT KIT, AERIAL INPUT TYPE, INCL. T.V. SYNC AND UHF MODULATOR. BATTERY OPERATED. ALSO GIVES PEAK WHITE & BLACK LEVELS. CAN BE USED FOR ANY SET **£12.65** p.p. 50p. (ALUM CASE **£2.60** p.p. 80p.)
ADDITIONAL GREY SCALE KIT **£3.35** p.p. 35p.
TV TEST GENERATOR UHF MODULATOR £4.60 p.p. 40p.
UHF SIGNAL STRENGTH METER KIT £20.00 (VHF VERSION **£21.60**). ALUM CASE **£2.00** DE LUXE CASE **£5.95** p.p. £1.60.
CRT TESTER & REACTIVATOR PROJECT KIT FOR COLOUR & MONO **£25.80** p.p. £1.80.
THORN 9000 FACIA INCL. CHANNEL SELECTOR, INDICATOR SET CONTROLS, ETC. **£5.50** p.p. £1.60.
PHILIPS 210, 300 Series Frame T.B. Panels **£1.15** p.p. 75p.
BUSH Z718, BC6100 SERIES SURPLUS LINE T.B. PANEL Z904, INCL. LOPT, EHT STICK, FOCUS ETC. 18" or 22" **£17.25** p.p. £1.80.
BUSH A823 IF PANEL (EXPORT VERSION) **£3.25** p.p. £1.00.
BUSH Z718 BC6100 SERIES IF PANEL **£5.75** p.p. 80p.
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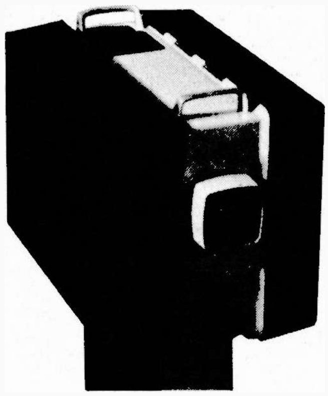

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	Open Gate, Min.	Modulated, Min.	Modulated, Typ.	Min. Horiz.	Min. Vert.	Watts	Volt-Amps.		
COLOR PROJECTORS									
PJ 5000	550	220	280	750	300	1200	1600	525 li./60 fps; 625 li./50 fps	(1)
PJ 5050	1250	500	650	750	300	1600	2150	525 li./60 fps; 625 li./50 fps	(1)
PJ 5800	550	200	280	750	600	1200	1600	875 lines, 60 fps	(2)
PJ 5850	1250	500	650	750	600	1600	2150	875 lines, 60 fps	(2)
PJ 5100	550	200	280	750	650	1200	1600	1023 lines, 60 fps	(2)
PJ 5150	1250	500	650	750	650	1600	2150	1023 lines, 60 fps	(2)
MONOCHROME PROJECTORS									
PJ 7000	1000	600	750	800	400	1000	1350	525 li./60 fps; 625 li./50 fps	(3)
PJ 7050	1700	1000	1250	800	400	1000	1350	525 li./60 fps; 625 li./50 fps	(3)
PJ 7055	3300	2000	2400	800	400	1500	2000	525 li./60 fps; 625 li./50 fps	(3)
PJ 7800	1000	600	750	800	650	1000	1350	875 lines, 60 fps	(3)
PJ 7850	1700	1000	1250	800	650	1000	1350	875 lines, 60 fps	(3)
PJ 7855	3300	2000	2400	800	650	1500	2000	875 lines, 60 fps	(3)
PJ 7100	1000	600	750	800	750	1000	1350	1023 lines, 60 fps	(3)
PJ 7150	1700	1000	1250	800	750	1000	1350	1023 lines, 60 fps	(3)
PJ 7155	3300	2000	2400	800	750	1500	2000	1023 lines, 60 fps	(3)

Line Power, All Projectors: 117 or 240 v., ±10%, 50/60 Hz

**Resolution measurements made with wide-band video input.

***Video Input Key: (1) NTSC or RGB, (2) RGB, (3) Wide-Band

****For use at other scanning rates, contact General Electric (U.S.A.) (VDEO) for special application/model information.

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TELEVISION

U-turn required

Start of simple economic lesson. If you devalue a currency, exports are made cheaper and imports are made more expensive. Conversely, if you revalue a currency (increase its value relative to other currencies), imports become cheaper and exports become more expensive. End of simple economic lesson. In practice there's a great deal more to it of course. To start with the effects take some time to work through, while the total cost of manufactured goods consists of domestic costs plus the cost of imported raw materials. Then again, revaluation may not in all cases produce cheaper imports: foreign exporters may choose to increase their prices and take a larger profit instead. The fact is however that countries with economic problems tend to devalue their currencies, while the governments of countries with strong economies seldom tolerate an over valued currency. Pressure has at various times been put upon those traditionally strong economies W. Germany and Japan to revalue. They haven't wanted to know! I can recall only one W. German revaluation, and that was by a minimal amount.

Exchange rates are not rigidly controlled of course. The dollar, pound and yen move freely, while W. European currencies move within a thing called the EMS. Nevertheless governments can and do influence the values of their currencies, and our present government has allowed the value of the pound to appreciate substantially. This must therefore be regarded as a deliberate part of its economic policy. Just what the aim is however is harder to see. Low cost imports help to keep costs down and thus have a moderating effect on inflation. But at a high ultimate cost – which is why governments normally avoid burdening themselves with an over valued currency. It's interesting to note that no previous post-war UK government could have maintained an over valued pound – the story we've become more used to is of a "flight from the pound". So what's different now? Oil of course. Plus high interest rates. It's the oil that's the main basis of international confidence in the pound however.

The intended effect of this revaluation seems to be to try to keep down costs and put the pressure on generally. But the ultimate cost could well be that much of the UK's manufacturing industry will simply close down. For two reasons: because it can't compete with cheap imports, and because its exports are unsaleable.

The effects are plain to see. In our own industry, Thorn have closed down their Nottingham PCB subassembly plant, the Dynatron factory has been closed, Rank and Toshiba are pulling out of their joint TV setmaking operation, and now Philips have announced the closure of their Lowestoft TV factory. There are rumours of other firms having second thoughts about continuing with TV manufacture in the UK. The reasons given are becoming monotonously familiar: a small, depressed home market, coupled with unprofitable exports, makes it impossible to maintain production at the sorts of levels that keep unit costs comparable to those of our competitors.

An extraordinary feature of all this is that we've been exhorted for so long to get the quality of our manufactures up to that of our competitors. A great deal of effort has gone into this, yet just as we've got it more or less right the government comes along and turns the financial conditions upside down. Another thing one recalls with some bemusement is that the aim of joining the common market was to give our industries the stimulus of a much larger market on our doorstep. The present government seems committed to the common market, but expects our industry to compete within it with one hand tied behind its back. One hoped for consequence of joining the common market was a boost in foreign investment in the UK. Like Toshiba investing in a joint setmaking enterprise with Rank for example. Rank and Toshiba now say that with the pound at its current level the exercise is no longer feasible.

The government seems to think that eventually the conditions will be right for establishing new industries – ones with a high value-added content, i.e. high technology. But new products don't suddenly appear out of the blue. They are generally the outcome of continuous development programmes, while bringing products to the large-scale production stage and investing in plant and training is a long-term business. The present policy of clobbering what's left of our manufacturing industry and hoping for some miraculous future resurgence is simply not realistic, and the moment when the government comes to realise the terrible mistakes it's making with the country's industrial base can't come too soon. One thing that the ever strong Japanese economy clearly demonstrates is the need for partnership between industry and government in encouraging economic development.

CORRECTIONS

New CTV Signals Board: The circuit diagram on page 600 (September 1980 issue) shows a connection line immediately above R19 going to the colour-killer override link (and then to the 12V rail). This connection should be erased, leaving only R17, R20 and the link connected to the 12V rail. Also on the same circuit diagram, connector F should be relabelled to read R-F1, G-F3 and B-F2. These errors are present on the circuit diagram only, the PCB being correct.

Monochrome Portable Project: It has been found that a certain amount of hum, which modulates the line scan, may be present on the 10·8V rail. If constructors experience this problem, the solution is to add an electrolytic capacitor between the "common" pin of IC3 and chassis, with the positive end connected to the i.c. A suitable value is 220μF, rated at 16V. It can be easily accommodated on the copper side of the PCB.

Teletopics

PLANT CLOSURES

Rank and Toshiba have decided that their joint TV manufacturing operations at Plymouth and Redruth in Cornwall are no longer viable. The joint operation was set up in 1978, after many months of negotiations. The intention was to increase production capacity from some 175,000 sets a year to 350,000 by 1981, with a substantial proportion earmarked for export. Production is understood to have reached 273,000 sets this year, but while the home order book has been healthy – despite the recession – the rise in the value of the pound has made exports virtually impossible. The operation made a loss of £1·1 million last year, and the loss this year is expected to be greater. Toshiba comment that the increased value of the pound – up 20% since the formation of Rank-Toshiba – has thrown their original calculations totally out and made it impossible to operate the plant fully and profitably. Job losses of around 2,700 are expected, in an area of high unemployment, and Rank are also now considering the sale of their distribution side, Rank Radio International. The joint Rank-Toshiba venture will end formally next March. It's understood that Toshiba will take over the Plymouth factory and will eventually resume production on a reduced scale.

During the same month Philips announced their intention to close the Pye Lowestoft TV plant over the next 18 months, concentrating production at the Philips Croydon factory. This will involve a loss of a further 1,100 jobs, again in an area with poor employment prospects.

It's been a bleak month for the UK's TV industry. Whilst TV receiver production for the domestic market appears to be just about viable, at the present value of the pound exports seem to be wholly uncompetitive. What production remains is being concentrated in fewer plants since full plant loading is essential for viable operation.

PICTURE ORACLE

Prominent amongst the exhibits at the ITCA (Independent Television Companies Association) stand at IBC-80 was a modified colour receiver displaying Oracle pages that included illustrations in the form of high-resolution still colour pictures. The pages were decoded from nationally-networked signals received off-air from the IBA's Brighton transmitter. This teletext enhancement system, called Picture Oracle, is at present in the experimental stage and has been developed as a result of investigations carried out by the ITCA. It was first put forward as a practical possibility at the March Viewdata 80 exhibition.

The equipment providing the new facility uses techniques developed by British Telecom (who provided the modified receiver used in the ITCA demonstrations) for their Prestel service. In its present form, Picture Oracle enables a high-resolution still colour picture occupying a screen area of up to a ninth of the total available space to be included in any specified Oracle teletext page. The picture can be of any reasonable aspect ratio and can be placed in any position on the screen with the associated text assembled around it.

Some ten pages of "data space" are required for picture transmission, which is done in the form of 8-bit words using differential pulse-code modulation, with a maximum of 24k bytes per picture (1 byte = 8 bits). The limit to the size of the picture included in the teletext page is mainly set by the time taken to transmit 24k bytes of data. With two lines in each field blanking period used for teletext transmission, as at present in the UK, it takes about two and a half seconds to transmit one page of Picture Oracle.

At the receiving end the teletext decoder requires a 24k byte RAM to store the data, and circuitry for handling the differential pulse-code modulation. The data can then be processed to assemble the complete illustration ready for display.

Amongst other developments on display was a system developed by Thames Television enabling two 7kHz (speech quality) or a single 15kHz (music quality) audio signal to be simultaneously carried by a standard 625- or 525-line TV transmission. The audio signals are inserted on spare lines in the field blanking interval, using pulse-code modulation. The main application envisaged at present is for electronic news gathering.

CURRYS EXTEND RENTAL OPERATIONS

Carousel Colourhire Ltd., the colour TV and video rental subsidiary of Currys Ltd., is now operating on a national basis with the Carousel service available in all Currys branches in addition to the five specialist Carousel Colourhire centres. This makes Currys the second largest TV rental company in the UK in terms of outlets (nearly 500).

INCREASED VCR PLAYING TIME

In the August issue we mentioned (see Video at the Shows) the new JVC HR7700 VHS VCR. Amongst other interesting features, this VCR has a timer capable of handling programmes of up to 6½ hours' length. As the longest VHS tapes available at the time were the E180 ones giving three hours' playing time, we commented that maybe JVC knew something we didn't about tape lengths. Part of the answer has now been revealed with the announcement that the E240 four-hour tape is to be test marketed by JVC in the UK. The cassettes will be in very limited supply initially, through selected dealers. They'll be made available generally only if the test marketing establishes that an adequate demand exists. As VCRs become more sophisticated and allow more programmes to be recorded in the owner's absence, the need for longer playing time tapes increases.

In the USA, increased playing time is obtained by reducing the tape speed rather than by using thinner and hence longer playing tape. It's common to find there VHS machines that can record and playback at three speeds – SP (standard play – two hours), LP (long play – four hours) and SLP or EP (super long or extended play – six hours). Betamax machines come in Beta I (one hour), Beta II (two hour) and Beta III (five hour) versions. To help the user, most machines incorporate circuits to ensure that prerecorded tapes are automatically played back at the correct speed. The complexity of some of these machines is pretty horrific – the JVC HR6700 for example has four video heads, two for two-hour recording and the other set for six-hour recordings. This is a level of complexity we in the UK can probably best do without – even though using an E180 cassette would give you 8 hours' recording while an E240 cassette would provide an incredible 10½ hours.

comprise the T24H chassis, for 14 and 16in. colour sets, and a new monochrome portable chassis (T18). The former is very similar to the T24E 20in. chassis, though with a different series regulator transistor and an additional driver stage in this circuit. The monochrome portable chassis is of interest in using a BU807 Darlington line output transistor and a TDA1044 field timebase chip.

Some sets fitted with the T24E chassis use the Mullard A51-570X tube instead of a Toshiba tube. With the Mullard tube an extra 5·6Ω resistor is required in parallel with R920 on the c.r.t. base panel to compensate for the tube's different heater current. The resistor is stood off the panel using 5mm sleeving.

An 0·0022μF capacitor has been added across R15 on the timebase panel of the T26A chassis to prevent random tripping of the protection circuit.

2C50 on the signals panel in the T22A and T26A chassis has been changed from 330pF to 470pF to take into account slight differences in the burst position on different transmissions. In addition a ferrite bead is now fitted on the base lead of VT2 in the SAWF driver circuit to prevent possible parasitic oscillation at about 500MHz.

SERVICE NOTE – PHILIPS

Colour flash and field jump on programme change have been reported with the KT3 chassis. We've seen this ourselves, though it doesn't seem to trouble viewers. Philips have now introduced modifications to overcome the problem however. The colour flash is reduced simply by changing the value of C3219 from 4·7μF to 1μF. This capacitor is associated with pin 14 of the TDA2523Q chroma reference oscillator/demodulator i.c. The field jump problem (a single field jump on programme change) has been dealt with by means of a more extensive modification. This involves a new version of the sync/line oscillator i.c., type TDA2571AQ, and six component changes in the peripheral circuit. The new version of the i.c. halves the time taken to restore sync after a break in the sync signal due either to channel change at the receiver or a transmission programme change.

PRERECORDED VIDEOCASSETTE DIRECTORY

The Home Video Software Publishing Co. (22 Cardiff Road, Luton, Beds) has published a directory that's claimed to list every prerecorded videocassette at present available in the UK. It's called the CiER Directory, and is priced at £4·99. The plan is to issue a bi-monthly "Video View Update" incorporating new tape and disc titles.

NEW LINE OUTPUT DEVICE

Mullard have announced a new device which amongst other applications is suitable for providing the switching action in line output stages. This device is referred to as a gate turn-off (GTO) switch, and combines the advantages of a thyristor in having a high blocking voltage and over-current capability and of a transistor in that it can be switched both on and off at its gate. The type number of the initial device is BTW58, and as Fig. 1 shows a line output stage circuit using it follows the well-known configuration used in transistor line output stages. A similar device has been used before in TV sets – Sony's gate-controlled switch, which has been employed as a chopper and line output device in Sony TV chassis sold in the UK.

The GTO is a four-layer device whose operation, like that of the thyristor, can be considered as analogous to a pnp and an npn transistor with one driving the other. When the gate of the npn section is driven positively, the device turns

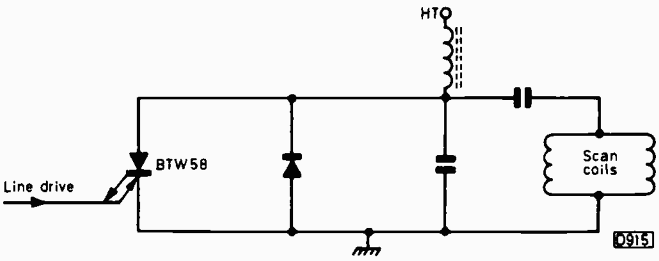

Fig. 1: Basic line output stage circuit using the Mullard BTW58 gate turn-off switch. The device is a four-layer pnpn device like a thyristor, but can be turned both on and off at its gate. It's also known as a gate-controlled switch.

on and by regenerative action remains on. By making the gain of the npn section of the device relatively large and the gain of the pnp section small, the device can subsequently be turned off by applying negative-going drive to the gate. This is made possible by careful control of the production processes – the latest ion implantation, neutron doping, photolithographic and process control techniques are employed. Gold doping is used to obtain a lower storage time and thus a faster, cleaner turn-off (less than 0·5μ sec) compared to either high-voltage transistors or thyristors.

NO MORE ULTRAs

Yet another brand name that goes back to the earliest days of TV before the war has gone – Ultra. Thorn took over Ultra's radio and television interests in 1962, and in recent years have used the Ultra trade mark for sets distributed through the wholesale side of the industry. In future Thorn will concentrate on its Ferguson range, which will now also be available through distributors. At any time now we might get back to "Fine Sets these Fergusons"...

THE GEC–HITACHI CHASSIS

The chassis now being produced by GEC, in conjunction with Hitachi, is of Hitachi design and will be familiar to those handling Hitachi sets. The chassis is conventional in most respects, with much of the circuitry in i.c. form, but has one or two unexpected touches. The tuner for example is a comparatively elaborate affair containing five transistors, two of which form a driver for the SAW filter. The most interesting feature of the tuner unit however is the use of a dual-gate MOSFET transistor as r.f. amplifier. This is of course ideal for a.g.c. application, the control voltage being applied to the second gate.

Elsewhere there's a single-chip decoder and a self-oscillating chopper. The output from the latter is short-circuited by a crowbar trip thyristor in the event of excessive voltages in the line output stage. A thick-film module is used for the field driver and output transistors, which operate in conjunction with a separate switching transistor. The latter acts as a switch connecting the field output stage to either 74V or 108V at different times during the course of the scanning period. The RGB output transistors also carry out colour matrixing and are mounted on the c.r.t. base panel.

SOLID-STATE CAMERA DEVELOPMENTS

Last month we described Sony's prototype "video movie" Cam-Corder in some detail. Hitachi have now come up with a similar device which they call the Mag Camera (magnetic tape camera?). It's not compatible with the Sony design of course. The cassette measures 112mm × 13·6mm × 67mm, uses ¼in. tape and gives two hours' recording time.

A pilot production line has been set up at GEC's Hirst

Research Centre at Wembley to produce the GEC MA357 charge-coupled image sensor. This will be used in a small solid-state monochrome camera which the English Electric Valve Co. is to produce at Chelmsford. The camera provides a 625-line picture with a resolution two-thirds of the full broadcast standard, and is aimed initially at the electronic news market. Previous GEC solid-state cameras have provided 150- and 300-line pictures. A solid-state colour camera is now under development.

PHILIPS' US MOVE

North American Philips has increased its share of the US colour TV market with the purchase of General Telephone and Electronics' (GTE) consumer electronics interests. GTE products are sold under the Sylvania and Philco brand names, and are produced in twelve factories in the USA. Philips' intentions are to widen its marketing arrangements and thus increase its share of the market: rationalisation of GTE's production facilities forms part of the plan. Other GTE consumer electronics interests were sold earlier this year to the French company Thompson-Brandt. The connection between North American Philips and Philips of Eindhoven is a complex one involving cross shareholdings in trusts.

VIDEO ROUND UP

Hitachi have introduced a portable VCR, Model VT7000, which at 5·9kg is claimed to be one of the lightest available anywhere. It's a VHS type machine.

The RCA CED videodisc system has now been demonstrated in Europe – at the Cannes Vidcom '80 exhibition. Stereo sound is to be added to the system in 1982, and will be available from the start with the European version.

Centronics (Victoria Way, Burgess Hill, Sussex RH15 9NU) have introduced a screen-image printer designed for use with viewdata, teletext or similar receivers to provide a printout of the on-screen display. The need for a printed copy is particularly relevant with Prestel, since the user has to pay for the amount of time the image is held on the screen. The printer's mechanism is based on the Centronics Microprinter, which requires no ribbon or toner. The unit provides a standard viewdata or teletext page in about 15 seconds, and can reproduce the full videotex alphanumeric and graphics character sets.

TRANSMITTER OPENINGS

Countisbury (Devon) BBC-1 ch. 39, HTV-West ch. 49, BBC-2 ch. 56, TV4 ch. 67. Horizontally polarised group E or wideband receiving aerials are required. The station has been built in co-operation with the National Trust.
Efail-fach (West Glamorgan) BBC-Wales ch. 39, BBC-2 ch. 45, HTV-Wales ch. 49, TV4 ch. 52.
Monksilver (Somerset) TV4 ch. 42, BBC-1 ch. 45, BBC-2 ch. 48, HTV-West ch. 52.
Oughtibridge (S. Yorkshire) BBC-1 ch. 55, Yorkshire Television ch. 59, BBC-2 ch. 62, TV4 ch. 65.
Swinister (Shetlands) BBC-1 ch. 55, Grampian Television ch. 59, BBC-2 ch. 62, TV4 ch. 65.
Tongue (Sutherland) BBC-1 ch. 39, TV4 ch. 42, BBC-2 ch. 45, Grampian Television ch. 49.
Washford (Somerset) HTV-West ch. 39, BBC-1 ch. 49, BBC-2 ch. 66, TV4 ch. 68. Group E or wideband receiving aerials are required.
Weisdale (Shetlands) TV4 ch. 54, BBC-1 ch. 58, Grampian Television ch. 61, BBC-2 ch. 64.

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BC108C	14	BC550	7	BF371	30	2N3702	11
BC109	11	BC557	7	BF457	23	2N3703	10
BC109A	14	BC558	7	BF458	24	2N3704	10
BC109B	13	BCY72	13	BF459	35	2N3705	10
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BA154	6	OA202	11
BA155	14	IN914	3
BA156	15	IN4001	4
BAX13	4	IN4002	4
BAX16	5	IN4003	4
BB105B	30	IN4004	5
BB105G	30	IN4005	5
BY126	10	IN4006	5
BY127	11	IN4007	6
BY164	45	IN4148	2
BY176	85	IN4448	10
BY199	10	IN5401	12
BY206	14	IN5402	14
BY210/800	22	IN5403	12
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10	47	7	63	10	9
10	100	8	63	22	12
10	220	11	63	47	16
10	470	18	63	100	19
10	1000	20	63	220	30
10	2200	30	63	470	38
10	4700	48	63	1000	53
25	4.7	8	63	2200	85
25	10	7	100	10	12
25	22	7	100	22	14
25	47	9	100	47	19
25	100	10	100	100	29
25	220	17	100	140	32
25	470	22	100	220	35
25	1000	36	450	1	23
25	2200	46	450	4.7	28
25	4700	80	450	10	28
40	2200	52	450	22	56
83	1	7	450	33	62
63	2 2	7			

MIXED DIELECTRIC

Volts (DC)	MFD	Price (p)	Volts (DC)	MFD	Price (p)
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600	1	38	1250	033	32
1000	01	20	1250	1	45
1000	047	29	1500	022	24
1000	1	32	1500	033	39
1000	22	48			

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BZY88 2V7, 3V, 3V3, 3V6, 3V9, 4V3 4V7, 5V1, 5V6, 6V2, 6V8, 7V5, 8V2, 9V1, 10V 11V, 12V 13V, 15V, 18V, 24V 27V	7

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1 1 25, 1 6, 2A	£1 07
2 5, 3 15A	£1 43
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100ma	45
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1, 1 25 1 6, 2 2 5 3 15, 5A	37

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ALL ENQUIRIES SAE PLEASE.

Practical TV Servicing: Getting the Colour Right

S. Simon

THE theory of correct colour reproduction on a TV screen has been dealt with many times in these pages. Basically, so much of each of the three primary colours red, green and blue so that a correctly graded picture is obtained.This is very nice with a new set and, more importantly, a new tube. Theory is one thing however, but expecting the colour display to hold good on a set that's seen a few year's service is quite another. You may carry out the instructions given in the appropriate service manual to the letter, but the results will often be disappointing.

Tube Drive Techniques

There are two methods of driving a colour tube. One, the system used in more up to date sets, is to combine the luminance (brightness) and the colour-difference signals prior to the tube, thus obtaining three primary-colour signals which can be used to drive the tube's three cathodes. The grids can then be linked together and used for biasing and flyback suppression purposes. In the other system, the luminance signal is used to drive the tube's three cathodes while the three colour-difference signals are used to drive the tube's grids. Mixing of the luminance and colour-difference signals is thus carried out by the tube itself, with the result that what the screen receives is the three primary-colour signals. This system became familiar to us with the Pye hybrid colour receivers for example. If the set has a group of three valves such as the PCL84 or PCF200 it's almost certain to use colour-difference tube drive, as it's called. With a few exceptions originating mainly from the Continent on the other hand, solid-state sets generally employ RGB drive. These are usually easier to set up.

RGB DRIVE

Three older chassis employing RGB drive are the Philips G8, the Rank A823 and the Thorn 3000/3500 series. Lots of other sets with a few years over their heads can be lumped together in this category – the Thorn 8000/8500/8800 series, Decca Bradford (10 and 30 series) and the GEC C2110 series spring to mind. We have to pick one to serve as a specific example however, so we'll go for the Thorn 3500 chassis. We will presume that the set is working but that the colour leaves something to be desired.

Tube Warm Up

The first thing to notice is the way in which the colour comes on. This is fairly important, since it shows (provided all the supply voltages are correct) which of the tube's three guns are healthy and which aren't.

If for example the initial picture is predominantly blue, changing slowly to magenta as the red comes in (or up if you prefer it that way), with the green delayed or hardly appearing at all, we have a fair idea of the score before we've even removed the back cover. We can then go on to check the tube base voltages to see whether there is any disparity in the supplies to the three guns.

Tube Base Voltages

So as not to leave anyone behind, we'll list the tube base pins and the voltages to be expected (in the 3000/3500 series). The pins are numbered 1 to 14 clockwise from the locating spigot, with 1 and 14 being the heater pins.

Pin 2 is the red cathode. The voltage here should be in the region of 160V.

Pin 3 is the red grid. The voltage here is nominally zero, and is set by the small preset (R450) on the upper rear edge of the timebase panel.

Pin 4 is the red first anode, where a voltage of some 400V or more is to be expected, depending on the setting of the appropriate preset on the convergence panel.

Pin 5 is the green first anode. The voltage here should be much the same as at pin 4.

Pin 6 is the green cathode, corresponding to pin 2.

Pin 7 is the green grid, which is connected to pin 3 (externally).

Pins 8 and 10 are not present – so as to make room for the focus shroud. Pin 9 carries the high-voltage focus supply.

Pins 11, 12 and 13 are the cathode, grid and first anode connections respectively to the blue gun.

These pin connections apply to the more common types of tube. There are variations in the voltages in other chassis, particularly the first anode and focus supplies, but for the moment we are concentrating on the Thorn 3500.

First Anode Supplies

Taking the example we gave of the conditions during the warm up period, the blue gun is clearly working well, the red one is slow but eventually makes a contribution, while the green one is doing very little at all. Our first check therefore should be at the electrodes of the green gun. The voltage at the first anode pin 5 should be roughly the same as that at pin 4 (red first anode), say 400V or so. If the voltage is very low the green gun can't function correctly and this is the thing we have to concentrate upon.

Swing up the convergence board and identify the three first anode presets and the three associated switches. Each switch has three contacts, in a row, the top to the preset control, the centre to the tube's base pin and the bottom to chassis. It's extremely common to find the voltages at these switch contacts low, due to the switch itself becoming leaky, so that even with the switch in the "on" position (centre and top contacts making) the switch is behaving as though it is almost "off", i.e. with heavy leakage between the centre and bottom contacts. If another switch is not available to prove the point, cut through the print just below the bottom contact to divorce the earth connection or remove the switch and link the upper and centre points. When a new switch has been fitted, adjust the control to obtain a green first anode voltage roughly the same as the red and blue first anode voltages. Then examine the picture, with the colour off. In all probability the monochrome picture will be anything but a nice shade of grey.

Adjusting the Dark Greys

The first anode controls are there to adjust the threshold operation of the guns, i.e. the voltage at which the guns start to operate. They are adjusted to obtain the correct dark grey shades therefore. Since the tube will have been in use for some years, the three guns are unlikely to be up to the same standard of emission. So the initial setting will probably not produce the effect you might expect, i.e. exactly equal first anode voltages will not produce a nice shade of dark grey. But we must have a starting point, so we start with the controls set to provide equal voltages and then trim them to obtain the required low-light shades (darkish grey).

Check the Cathode Voltages

This may leave the highlights anything but white, and it's here that we take our second set of readings – at the cathode pins 2, 6 and 11. These voltages will vary with picture content, so check them with the signal removed – pull out the i.f. input plug or whatever to remove the signal. Turn up the brightness to show a blank screen (if possible, or adjust the preset brightness or grid bias control to obtain one).

If there's a wide difference between the cathode voltages under these conditions, i.e. one is much higher than the other two, there's no hope of getting things right by adjustment and the cause of the incorrect voltage should be sought on the lower left video section where the three RGB output transistors are immediately obvious because of their heatsinks. They are clearly marked on the underside with letters to indicate their collectors, bases and emitters. It will be seen that the three bases are linked together, so there's no point in checking here except for dry-joints.

Drive Circuit Faults

The fact that the error is a high-voltage rather than a low-voltage one means that the h.t. feed to the collectors is present, so the first check should be at the emitter, where roughly 9·5V should be recorded. Almost certainly there'll be an error at one of the emitters. D.C. coupling is used between the two transistors that precede the relevant output transistor, and also between the output transistor and its emitter driver transistor, so the cause of the incorrect voltage conditions could be in any of these stages. We mustn't fall for red herrings however. We are not sure about the output stage yet. With the receiver switched off, the relevant output transistor can be checked, using the ohmmeter.

Switch the meter to the low ohms range. Apply the black probe to the base of the output transistor under test and the red probe to its emitter. A reading of around 30 Ω should be obtained. If a high reading is obtained, the transistor is open-circuit base-to-emitter. If a low (full deflection) reading is obtained, the transistor is short-circuit base-to-emitter. Note that while the transistor may appear to be in order, it could be breaking down under working conditions. Fitting a known good replacement is the only way to check this. The fault would normally have been located by now, but it might be necessary to check back to the preceding stage, which uses a pnp transistor. The reverse conditions to those obtained with the output transistor should be obtained therefore. Then if necessary go back to the npn transistor which precedes the pnp one.

Another common fault that needs to be considered at this point produces a far more readily identifiable effect. This is when one of the c.r.t. cathode voltages is low, with the result that the screen is flooded with the appropriate colour. The immediate suspect is the output transistor's collector load resistor, which can easily become open-circuit. In early models these resistors were separate wire-wound ones. One merely replaces the defective resistor therefore. In later models a thick-film resistor unit is used. This contains the three load resistors plus three bleed resistors. The obvious course of fitting a replacement thick-film unit is the correct one, but a "get you home" expedient is to fit a separate 12kΩ, 10W resistor from the common h.t. point to the relevant collector load choke to restore normal working until the rest of the thick-film unit disintegrates. Alternatively, the output transistor could be short-circuit collector-to-emitter, or it could be receiving excessive drive. If its emitter voltage is low, check the clamp diode connected to its collector, then check the voltages in the preceding stages as necessary. Once in a while the problem may be due to a leaky capacitor upsetting the d.c. conditions, but we mustn't get unduly side tracked.

Poorly Tube

This diversion has supposed that there's a fault in the c.r.t. drive circuitry. We've next to consider what action to take if the c.r.t. voltages are all correct and the only reason for the grey scale being incorrect is that the tube is not as healthy as we would like it to be. Why not reactivate the tube you say? Fine. Reactivate it. But you can't keep doing this, and once it has been done the count down to tube replacement starts. Some colour tubes take reactivation very well and will give about a year's good service afterwards. Others do not. So if the picture is at all reasonable, delay such doctoring as long as possible. We have to consider therefore the steps to be taken to get as good a picture as possible without recourse to reactivation.

Getting the Grey Scale Right

Having established that the voltages at the tube electrodes are right, we can vary them slightly in order to produce an acceptable grey scale. Behind the output transistors you'll find three presets which are there to enable the highlights to be adjusted, i.e. to make the whites white and the greys grey with as little colour tinting as possible. We are assuming that the purity is right, that there are no colour patches, and that the convergence is up to standard. When you've got the whites somewhere near white by adjusting the highlight presets, return to the dark greys and reset these, on a picture, using the first anode presets.

The balance between the optimum settings of the video gain presets (highlights) and the first anode presets (low lights) is not easy to achieve, and some time may have to be spent in order to obtain reasonable results when the tube is feeling its age.

COLOUR-DIFFERENCE DRIVE

If the set uses colour-difference drive we have another kettle of fish. Because they are so common, we'll take the Pye hybrid chassis as our example. This takes in the Invictas, Ekcos, Dynatrons and even the old Ferrantis.

It's essential to appreciate that with colour-difference tube drive the luminance signal, which provides the picture brightness and detail, is kept separate right up to the tube's cathodes. In these chassis it's applied to the red cathode direct and to the blue and green cathodes via two presets which are mounted at the top of the tube base panel. These two presets should provide the highlight adjustments (whites and light greys). Should. But when the sets have been in use for some years some other factors may have come to have a say in this. Tube deterioration is an obvious spanner in the works: deterioration of the CDA (colour-difference amplifier) panel is another.

The colour-difference signals are applied to the c.r.t.'s three grids, which should be held at a constant (clamped) voltage in the absence of colour-difference signals, e.g. on a monochrome transmission. To this end the colour-difference output pentodes are a.c. coupled to the tube's grids, which are clamped by the three triode sections of the PCL84 valves. The idea is that the clamp triodes are switched on by a clamp pulse once each line: they then return the three colour-difference signal coupling capacitors to a common clamp voltage source of about 100V. When the colour-difference signals appear, the c.r.t.'s grids are swung above and below this reference level as required. So in the absence of colour-difference signals what happens prior to the clamp triodes cannot affect the grey scale because the coupling capacitors provide a d.c. block. That's the theory. If you believe it, you've a rude shock coming to you. Let's accept the theory for the moment however.

CDA Panel Problems

There's a d.c. coupling path which is easy to overlook – the common earth return. This must be in good order if unintentional mixing is to be avoided, i.e. if the colour-difference output pentodes and the three clamp triodes rely on the same earth return path, this must be of minimal resistance in order to avoid voltages being developed across it and hence unintentional mixing. Now there are three spring clips at the rear of the CDA panel, and they don't always make good contact either with the housings in which they are captured (they can move freely in these housings) or with the main chassis metal bollards. Some time spent in improving these contacts (soldering the springs to the housings and cleaning the spring-to-bollard contacts) can be rewarding. Alternatively a separate lead can be soldered from the panel earth to the main frame. If this is not done, the grey scale will be spoilt by one side of the screen appearing green and the other blue.

Having got the earthing right, you may expect to get even illumination. This is where the rude shock comes in. You may not. Behind each PCL84 valve there's a 12kΩ (pentode anode) load resistor (wirewound), and near each of these a test point sticks up. These test-points are connected to the pentode anodes. Use your voltmeter to check that there's a voltage between each of these test points and chassis. You may find that there's no voltage at all at one of these test points, denoting that the associated load resistor is open-circuit if it's cold or short-circuited to earth if hot. If one of these resistors is open-circuit the effect will be the same as with poor earthing, i.e. uneven colour shading – quite apart from the partial absence of the particular colour concerned when a colour signal is present (a certain amount will get through since the pentode won't be completely cut off).

So the moral is to make a good earth bond and check the voltages before trying to set up the grey scale.

The underside of the CDA panel can deteriorate after a time, with the result that cracks develop, robbing some parts of the circuit of their supply voltages, while in addition dry-joints can abound where hot resistors have caused their soldered connections to decay. Careful observation, coupled with voltage readings at each end of suspect tracks, will show where these defects are – much can be done to improve matters by adding leads. Quite apart from all this mayhem, the PCL84 valves can develop internal leakage. The result is wildly different voltages from one valve base to another. Compare the voltages around the three PCL84s if this is suspected.

Luminance Output Stage

It's not much use trying to set up the grey scale if you can't see the raster properly. As the PL802 luminance output pentode looses emission, the voltage that can be developed across its anode load resistor falls and the voltages at the tube cathodes rise, thus driving the tube towards cut off. A healthy PL802 is a prime requisite therefore. One of the solid-state replacements can be used. If this doesn't produce the raster expected, check the voltage on the brightness control. If this is negative, check back to the beam limiter, where the positive supply may be absent.

Setting Up

Having overcome all these pitfalls, we can now "get it right in black and white". Check the c.r.t.'s first anode voltages (pin numbers as with the Thorn 3000/3500), and set these at say 450V. Inspect the screen and set the two presets on the tube base for something like reasonable whites and light greys. Then reset the first anode controls on the convergence panel for as nearly as possible correct dark greys.

Now vary the brightness and note how the overall hue changes from dark to light. A tube gun loosing emission will show a dark scene happily, but as the brightness is advanced will not respond to the same degree as the other two guns. Perfection is a hard taskmaster, and we next have to reset our controls on a picture of average brightness and accept that there will be a distinct colour shift on very dark and very bright scenes. This is not what we want, but it's something a goodly percentage of the population will accept without complaint.

Talking TV

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

NO, I don't mean talking *about* television, I mean talking television sets! Speech recognition and synthesis is the latest fad being developed by the chip makers. One of the first products to be demonstrated using these techniques was a drinks vending machine made by Matsushita. This employs an infra-red beam to sense the approaching customer (victim?) and then welcomes him with, as Matsushita say, "a soft, feminine voice" which goes on to list the available products, prices, etc.

The advantages of speech recognition/synthesis become apparent when considering advanced forms of remote control. In an industrial application for example a worker could issue instructions to a machine via a microphone while using his hands for some other purpose. The advantages of such techniques in domestic television are admittedly less obvious, but nevertheless interesting.

Toshiba, Sanyo, Sharp, Sony, Hitachi and Matsushita have all demonstrated voice activated/voice response television products which employ microprocessors to analyse and synthesize speech. The functions to which voice control have been applied are those normally found on infra-red remote control systems – channel change, volume, brightness and colour control etc. Such systems can also be applied to on-screen talking clocks, TV games, hi-fi equipment and so on. Some of the manufacturers just mentioned say they will have voice activated/response products on the UK market within a couple of years. So it would be as well to look at some of the principles involved.

Voice-operated Control

The first problem with any speech-operated system is to turn the operator's voice commands into an electrical signal which can be decoded and then used as an instruction to the system. Any practical speech system must be able to recognize the essential features of the words concerned, ignoring dialect or other regional variations.

The first process is to convert the analogue voice signal into a digital signal. Even here problems arise. If the voice bandwidth is taken to be 3kHz, then Nyquist's theory states that a sampling rate of at least 6kHz is needed. This in turn implies that the solid-state memory associated with such a system would need to be capable of handling 24kbits/sec, with a four-bit word microcomputer chip such as the TMS1070 used to control the process. In practice an eight-bit word microcomputer chip would probably need to be used to enable a task of this complexity to be accomplished. This in turn implies a 48kbit/sec storage capacity, which is not at present economically viable. With the speed at which this technology is moving however, the situation may well change in the not too distant future.

For the present, some form of differential modulation is required. These are non-linear however, so that more problems arise. The differential or delta modulation system is shown in Fig. 1. Basically, the analogue signal is sampled at regular intervals, but an output pulse is produced only when the signal is say positive-going. This means that the system is very economical in terms of bandwidth.

The encoding system checks whether the analogue waveform amplitude has increased or decreased at the sampling instant. It does this by comparing each time the sampled voltage with a voltage obtained by integrating the previous samples. A voltage increase results in a one output, otherwise the output is a zero pulse. The number of pulses per second required depends on the accuracy called for in measuring the rate of change of the analogue signal's amplitude. Human speech has peak amplitudes of low frequency and high-frequency components of low amplitude, making it ideal for delta modulation and coding. Overloading with delta modulation arises not from the signal level itself but from the signal's rate of change. An encoding rate of 32kbits/sec is capable of providing high-quality speech encoding.

The pulse train thus obtained is processed by the microcomputer and acted upon by some quite complex software (computer programming). The basic idea is to compare the digital input signal with one stored in the system's memory and then initiate the appropriate action. Integrated circuits for the purpose have been developed by

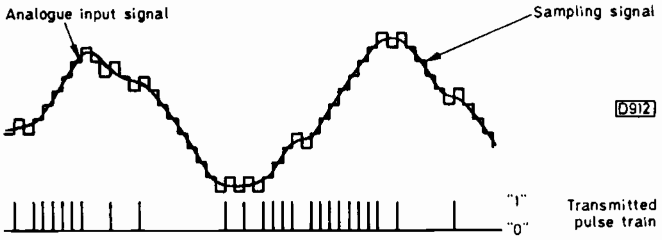


Fig. 1: The principle of delta (differential) modulation. The incoming analogue signal is sampled at regular intervals to form the basis of the digital signal. Whenever the analogue signal sample is found to be of higher amplitude than previously, a "1" pulse is transmitted.

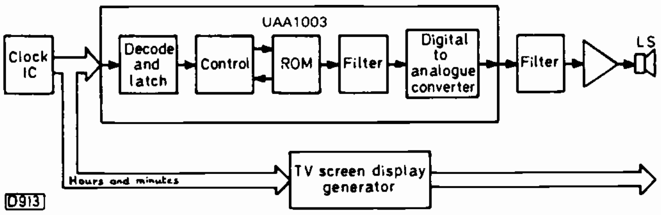


Fig. 2: The ITT UAA1003 speech synthesizer i.c. has about 20-25 words stored in less than 30k of ROM. Shown here used as a talking TV clock.

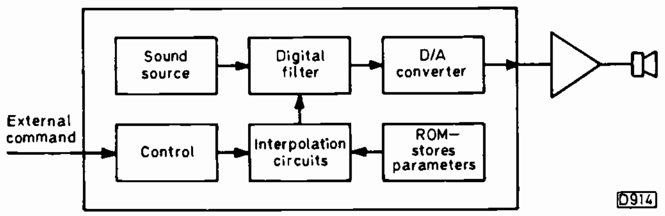


Fig. 3: Block diagram of a Matsushita speech synthesizer i.c. which gives 10-30 seconds of speech with 63 words.

Texas, Motorola and others, but none of the chip makers are very forthcoming about the precise techniques they use for signal processing. The main problem lies in achieving reliable recognition of a reasonable vocabulary spoken by several people.

Speech Synthesis

Information on the theory and design of the response parts of such systems is more readily available. The type of speech synthesis we are talking about is not a response recorded on magnetic tape, such as in a telephone answering machine, but a true synthesis of words and phrases from digital information stored in a solid-state memory. Once the component sounds used for words have been broken down and stored, they can be played back in any order to create almost any desired word. What is needed to achieve this is a sophisticated computer programme which records the address locations of each bit of a word and retrieves the required items on request. The digital signals are then converted into an analogue signal, filtered, amplified and fed to a loudspeaker.

Four main methods of producing synthetic speech are at present in use. Each has its pros and cons. Basically they fall into those systems which generate complete words or phrases and those which assemble words from bits or phonemes. The former are of the "synthesis by concatination" type, and tend to have limited vocabularies – of less than 200 words, which is certainly enough for a TV set. The latter can cope with an almost unlimited number of words and thus have a correspondingly large and expensive memory requirement.

The Toshiba talking television set, the ITT on-screen talking clock and some Texas Instruments speech synthesizers all employ concatinative synthesis, retrieving complete words and/or phrases from a memory, a computer programme being used to string the words together in the correct order.

The ITT UAA1003 chip is a 40-pin device with a vocabulary of around 24 words and a storage capacity of 30kbits. The basic arrangement is shown in Fig. 2. Various versions of this chip, suitable for telephone answering, talking clocks, warning devices etc. are available. There are also different language versions. The differences are programmed into the chip during manufacture by using different masks. The words produced consist of a number of staircase pulses with a period of 10msec. Each of these pulses can be built up to give between one and eight different amplitude values, with a maximum/minimum amplitude range of 1 to 16. This implies a four-word bit system.

Quite a range of replies can be generated by retrieving words from the memory in different sequences. The on-screen talking clock for example says "it's seven hours and five minutes" etc. In Fig. 2 the device is shown in use as an on-screen talking-clock – a separate device is used to generate the on-screen display. The words are stored in the ROM in digital form, and retrieved in sequence according to the control signal received from the clock i.c.

Direct synthesis systems are capable of giving a very high standard of speech output but tend to have a large and expensive memory requirement. Recent developments have made direct synthesis a more practical proposition however. These are formant synthesis, waveform digitization and linear predictive coding.

With formant synthesis "chunks" of words from a memory are retrieved and reassembled into words under the command of a microprocessor.

Texas Instruments have invested a small fortune in linear predictive coding. The synthesizer in many ways represents an electronic model of the vocal tract. A microcomputer performs calculations to alter electronically a digital lattice filter in the synthesizer section. The output from the word storage ROM passes through this filter, the speech parts being stored separately as voicing, amplitude, fequency and pitch instead of as complete sounds. The linear predictive coding technique predicts each new filter characteristic required from the previous one, thus producing the necessary modification to the output. This helps to reduce the system's memory requirements and the overall data rate – to 1,200bits/second in this case.

Waveform digitization has been adopted by Matsushita (see Fig. 3). This relies on digitizing and storing sound from an original tape recording and then recalling it on command. Various clever tricks such as signal compression and delta modulation reduce the data rate to around 1,000bits/second. This means that about 10k of ROM capacity can store about 10 words.

Outlook

Besides talking vending machines and television sets, talking calculators, microwave ovens and pin-ball machines have also been produced. Talking language translators and typewriters are being worked on, while CBM and Tandy have voice input/output domestic computer systems on sale in the USA.

Just think then of the noises and voices that may be coming from the workshop in a few years' time. They may well make you wish for the days of 405-line whistle!■

Long-distance Television

Roger Bunney

THE first signs of improved F2/TE activity this year occurred during September, and there's hope that F2 reception this winter could be almost up to last year's standard. All modes of propagation produced signals during the month, though tropospheric reception was limited to a short opening at the beginning of the month. There's a lot to comment on this time, so rather than giving a detailed log we'll mention just the reception highlights.

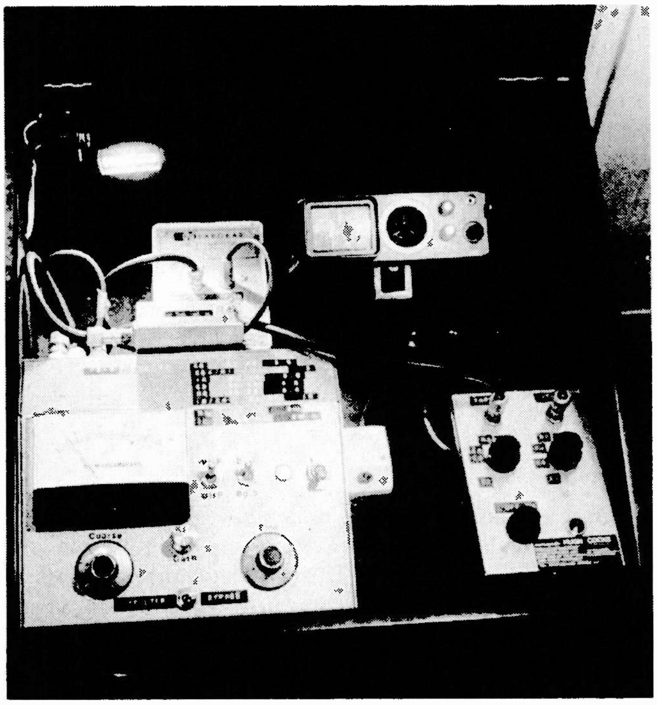
The very active tropospheric opening occurred during the period September 2-4th, when there was a high-pressure system over much of central Europe and the UK. The opening started at lunchtime on the 2nd, with reception of Swiss signals in Band III and at u.h.f. Signals from W. Germany put in an appearance during the evening, particularly in Band III. Tony Harris (Fareham) received La Dole ch. E34 at 400kW and the La Chaux-de-Fonds transmitter at only 18kW. Arthur Milliken (Wigan) also did well, with various French u.h.f. transmitters – good for his part of the world. The high-pressure system drifted eastwards the following day, when Ryn Muntjewerff (Beemster, Holland) logged Switzerland, East Germany, Norway, Sweden and Poland (TVP-2 ch. R25, the PM5544 pattern with "TVP-WAR" identification). Incidentally, all WDR (Westdeutcher Rundfunk) transmitters are now carrying a new identification in the central part of the test pattern.

On the 7th both Hugh Cocks and myself received ORF (Austria) ch. E5 at lunchtime, via tropospheric ducting. No other signals were present. Suspected Ghana ch. E2 has been noted on two occasions, via early evening TE: Hugh had very strong signals with relatively good video on the 9th from 1810-1900 BST, and also on the 22nd from 1530-1700 and 1830-1900, the picture this time suffering from "flashing and breakup". I noticed an increased m.u.f. at the time, with N. American communications signals present in the 40MHz band.

There was a good and prolonged SpE opening on the 12th, from lunchtime into the afternoon. I logged MTV (Hungary), TSS (USSR) and TVP (Poland) at very high signal levels, all on ch. R1. During the same opening Arthur Milliken logged MTV, TVR (Rumania), RAI (Italy) and SWF (W. Germany), all on ch. R1 or E2. A ch. R2 grey scale was also seen. Brian Fitch (Scarborough) received some of the above signals plus various Scandinavian stations during the opening. All this illustrates the varied skip distances experienced in different parts of the UK during an SpE opening.

MS signals have been received daily – the usual "pings".

More later on F2 reception. Such signals can be received using a simple aerial such as a dipole, so any active SpE enthusiast should be successful. This may be the last chance for many years to receive really long-distance v.h.f. TV signals.



Interior view of the bureau which contains Jim Cook's compact DX-TV system.

News Items

Spain: An illegal pirate station, "Radio y Television per Catalunya", has been closed down. It had been operating for two hours daily since mid-July, from a warehouse in the centre of Figueras, at u.h.f. A Catalanian TV service is planned to come into operation by June 1982.

Saudi Arabia: The 2·5GHz Arabsat programme, which would provide programmes for some 21 members of the Arab League, has been delayed and is unlikely to come into operation before 1983.

Canada: The Canadian Federal Government is threatening legal action against operators who are pirating satellite TV programme transmissions, particularly those in competition with licensed cable operators.

UK: An increasing number of 49MHz "cordless telephones" and walkie-talkies are being sold in the UK. Any DXer suffering from interference from such units in Band I should contact the Post Office Radio Services, particularly if the source of such radiation is known. The offending equipment comes from the USA.

EBU: A transmitter operating on ch. C at Tirana, Albania, with 100kW e.r.p. (horizontal polarisation) is now listed. Subscriptions for the 25th issue of the EBU's "List of European Television Broadcasting Stations" are now due – the cost is 450 Belgian francs. Send orders to the EBU, Technical Centre, 32 Avenue Albert Lancaster, B-1180 Brussels, Belgium.

From Our Correspondents . . .

Peter Lawrence (Eastwood, Notts) logged excellent Band I SpE signals during the summer months using a simple v.h.f./f.m. radio aerial. Signals received have included TVP (Poland) and several Scandinavian stations. Improvements to the installation are contemplated.

Following my note on domestic DX-TV receiving arrangements (September column) Jim Cook (Newcastle) sent details of his compact but highly effective unit (see photo). The whole selection of equipment is contained in a small bureau on wooden legs. Signal routing is shown in Fig. 1.

Robert Copeman and his brother-in-law Robert Allen (Sydney, Australia) have both received u.h.f. DX signals from the University of New South Wales, Kensington, near Sydney. Programmes and a test slide with the identification "VITU ch. 42, Television University, University of New South Wales" plus digital time readout beneath were received on August 19th. The transmitter power is 100W, with aerial gain giving an e.r.p. of 2kW. Broadcasts are irregular, in monochrome only, and consist of educational items with the slide between "lessons".

Jim Maden (Vereeniging, South Africa) reports reception of Swaziland ch. 21 at a distance of some 200 miles. The transmitter power is only 100W. Jim and Ian Roberts are both working on satellite reception in SA. We hope to be able to report on their efforts shortly – Ian already has a 4GHz experimental receiver terminal in operation.

Bindu Padaki (Madras) says that reports of Russian satellite transmissions at 870/920MHz are unfounded, only Stat-T at 714MHz being active. Bindu has received Bangkok, Bombay, Delhi and Karachi in recent times, via Band I SpE.

R. Mathews (New Milton, Hants) visited Stavanger (Norway) recently and comments that UK TV at u.h.f. is regularly viewed there, some ten per cent of houses sporting high-gain u.h.f. aerials of the multiple-director type. The aerials were pointing in various directions to take advantage of strong reflections from the high hills/mountains. Apparently System B/G/I standards converters are available so that UK sound can be received in addition to the local transmissions.

F2 Reception

Last winter was notable for really long-distance DX-TV reception via F2. Since F2 reception is related to sunspot activity, which is currently high, it's worth dwelling on this – in the hope that similar successes will be achieved this winter. We are at present at the peak of the solar cycle, which on average takes some 11·1 years. At the peak, sunspot activity is at a maximum and as a consequence signal reflection from the highest ionised layer above the earth, the F2 layer, is enhanced. What this boils down to is that when solar activity is extremely high, as at present, the m.u.f. (maximum usable frequency) for F2 reflection rises – in fact v.h.f. signals can be reflected over distances of several thousands of miles.

The electron density in the F2 layer is greatest when it's exposed to the maximum solar radiation. At night the F2 layer merges with the lower F1 layer, the electron density in the F2 layer at a given point above the Earth's surface being greatest at local noon during the winter (when the layer receives less heat and is thus in a less expanded state than in the summer).

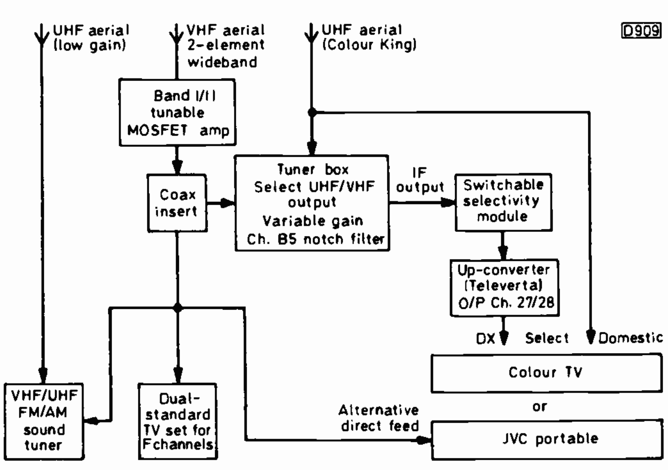
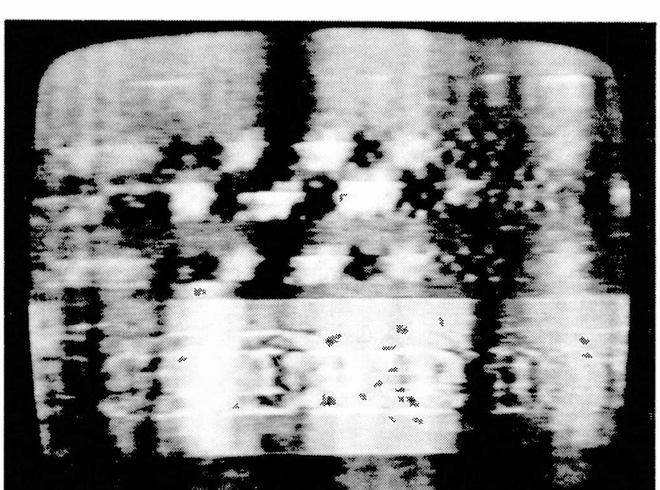


Fig. 1: Block diagram of Jim Cook's compact DX-TV system.

Toolcraft Goodwood test pattern used by TNQ-7, Queensland, Australia. Photographed locally in Townsville.

The m.u.f. for F2 reception is the highest frequency the F2 layer can reflect when an incident signal at a shallow angle reaches it. So F2 reception is a daytime phenomenon, with local noon somewhere along the path between the transmitter and the receiving site. A single hop at low v.h.f. will usually be around 2,500 miles minimum, and depending on the extent of solar activity double and even triple hops may occur. Propagation along north-south paths is more likely, but with the lack of African v.h.f. signals east-west propagation is more often experienced in the UK. During November-March the m.u.f. will on most days reach into the low 40MHz region during the peak sunspot period, and on good days will rise to the lower v.h.f. TV channels.

On days when the m.u.f. reaches 40MHz but is too low for TV reception an associated effect called transequatorial skip (TE) can produce low v.h.f. channel reception from Africa, particularly on ch. E2 (48·25MHz vision). What happens is that when the F2 layer breaks up at dusk small clouds of localised but intense ionisation can occur, giving distorted reception at v.h.f. across the Equator. Such propagation relies on several separate reflections, so that the resultant signal is often marred due to multiple images. Although this type of propagation is experienced mainly in tropical areas, the signals can arrive as far north as the UK.



A classic photograph illustrating the multiple images which are a characteristic of F2 reception. The photograph was taken by Anthony Mann in Western Australia, and shows reception of the New Zealand TV1 identification slide. There are four stars on the original slide, the shot showing three strong reflections and other weaker ones. The word in the lower section is "one". This single-hop F2 signal, at 45·25MHz, was received in early April 1980.

Some quite dramatic reception was experienced by DX-TV enthusiasts during the winter of 1979/80. Signals were received across several time zones, reaching plus eight to nine hours and recurring almost daily. The Australian TV ch. A0 (46·25MHz vision) was received on several occasions, while the BBC ch. B1 was received in Australia and elsewhere over a period of several months. Several N. American transmitters were received in the UK, on chs. A2 and A3.

During an F2 opening the first signals to appear in the UK will arrive in the early morning, about one-two hours after dawn, from the east – deepest USSR (the eastern seeboard) and China. Local noon will be along the transmitter-receiver path. The signals generally rise quickly above the noise level, the appearance of video sidebands quickly (ten minutes or so) changing to the first real pictures. These are often of relatively good quality, but rapidly degenerate into a "hash" of video information as a result of several transmitters on the same channel being present. Due to the vast number of Band I transmitters operating across the Russian landmass, it's very difficult to identify specific signals since at any one moment during an F2 opening a number of signals will be present. On days when the F2 ionisation is really intense, double- and triple-hop signals may be received simultaneously. Towards the end of the opening, when local noon has reached the receiving site, the signals from Russia will be coming from a distance of around 2,500-3,000 miles. Just before the end of the easterly reception the video quality can often improve and may make station identification possible. On a good day, easterly reception in the UK may occur from 0800-1300GMT: on poor days the reception may be from 0900-1030.

North American reception may occur if the m.u.f. rises to ch. A2 (55·25MHz vision). The signals will be received during the early afternoon period, on good days maybe as late as 1700GMT. Reception from Africa is limited because of the lack of transmitters, but may occur from 1100-1500GMT and may lead to TE reception between 1800-2000GMT. The 1979/80 peak produced several unidentified signals, particularly on ch. E2, with possible origins in the Middle East and Malaysia.

A further effect noted last winter was F2 backscatter – several enthusiasts received signals in Band I from unusual directions, for example Polish and Czechoslovakian signals arriving from the south west. This can occur when the electron density in the F2 layer is very intense.

The current sunspot cycle peak is perhaps the most intense ever experienced, providing TV signal reception at frequencies up to chs. A3/E4/B4. One hopes that the signals seen this winter will equal those of last year, but one thing one can be sure of is that it will be the last chance of such enhanced distant reception for ten years or so.

Postscript

During a recent visit to London I noticed in "Farmer Brown's Country Sandwich Bar", New St., WC2 a selection of vintage radio receivers and a Bush Model TV62 in a plastic case. This series of TV sets, manufactured in 1957-8, was used by myself and other DXers for many years because of the versatile, high-gain chassis. Most of the sets must by now be at the end of their life and ready for the scrap heap. Not the one at Farmer Brown's however – the price ticket said £75!

Letters

PRE-WAR TV

I read with nostalgic interest the article on the HMV Model 901 in the October issue. Though these sets were manufactured before the 1939-45 war, a great many of them were refurbished by EMI Sales and Service and some dealers when the TV service restarted after the war. My job at that time was instructing dealers' and EMI engineers on TV basics, refurbishing pre-war TV sets that had stood idle for about seven years, and how to fault find. Perhaps I can fill in some further details that might be of interest to readers.

There were two types of c.r.t., known as the carrot and the onion tubes because of their resemblance to these shapes. They were made at Hayes, the glass being hand blown – in fact every operation was very labour intensive. The cabinets were also made at Hayes. Timber arrived by barge on the Grand Union canal as whole trees sawn in slices along their length – each slice about two inches thick. These sliced trees were stood outside to season before being made into plywood. The plywood facing was of figured walnut, as shown in your photo, French polished by hand.

The mirror in the lid is surface silvered and must be cleaned with great care. I think you will find that the vision receiver chassis is made of 16 gauge copper, as are the screening cans. The tube has a protective glass covering it, and this is removable for cleaning. Take care when cleaning the tube face, because static generated when doing this can cause the whole fluorescent coat to fly off.

The only valves in the Marconi range anything like suitable for operation at 45MHz were the MSP4 and MSP41. Special capacitors had to be produced to handle these frequencies, and were made "in house" at Hayes.

The e.h.t. transformer was never satisfactory unfortunately, since there were no insulating or impregnating materials that were really suitable for these voltages. The power supplies were protected by GPO type slow-blow fuses, using "Woods metal" as the delay agent. They can be repaired with a warm soldering iron, and I still think they are better than the modern overload trip.

In its original form the t.r.f. receiver was aligned for double-sideband reception, so it should be realigned for today's vestigial-sideband transmissions – this can be done without component change. Before attempting this, check the coil formers. If they are made of black material they will certainly have shrunk and should be replaced. If they are made of a semi-transparent or whitish plastic they've already been replaced. This also applies to the sound receiver input coil former. Double-sideband alignment could be the reason for poor contrast, since the carrier signal will be too high compared to the sideband amplitude. The drive to the tube is about correct when the sync pulse amplitude is approximately 2V – provided the sync-to-picture ratio is correct.

If the coil formers have shrunk it won't be possible to turn the tuning slugs. These are pieces of brass tubing, which of course have the effect of reducing the inductance when screwed into the coil – there were no ferrites that could operate at 45MHz in those days.

It looks to me as if the aerial input earthing stub has been removed from David Looser's set, being replaced by a Belling-Lee type coaxial socket. This is o.k. provided there is no sign of instability at full gain. The original earthing stub is now probably unobtainable, but an alternative is to make a coil of the coaxial feeder consisting of three turns around the centre cardboard tube of a standard toilet roll. Arrange this coil so that it is as close as possible to the receiver's input socket.

Open-circuit coils and transformers were often caused by acid being deposited on the wire from the hands of coil-winder operatives – particularly if they'd been eating oranges!

The steel case that housed the tube was used to reduce the effects of stray magnetic fields. In those days the external fields from loudspeakers and mains transformers were quite severe. The ion burn may not have been because of long hours of use but instead be due to inadequate tube evacuation, particularly of trapped gases. There were no techniques, such as aluminization, to prevent ion burn in those days.

The brightness was originally such that the picture could be viewed quite comfortably in a room with incandescent bulb illumination, while the sets could be satisfactorily demonstrated in shops with strip lighting.

In its original form the mains socket was attached to the cabinet back so that when this was removed the power was disconnected. An e.h.t. shorting bar was also operated when the back was removed. There was also an earth terminal that never did seem to be used.

E. Kendall,
Ilminster, Somerset.

PRESTEL ADAPTORS

I was surprised that in your mention of Prestel adaptors in the October *Teletopics* there was no reference to the Labgear Model 7050 "Viewdapta", since this was the first such adaptor in the world to be developed and produced in quantity. Both this and our latest teletext adaptor (Model 7056) are available ex stock.

Labgear Ltd. was the first company in the world to develop and produce in quantity a teletext adaptor which would function with any UK u.h.f. TV receiver without modification (merely by plugging into the aerial socket). After a very successful production run of this Mk. I teletext adaptor (Model 7026) the company developed a greatly improved second generation teletext adaptor (Model 7056). This new model is smaller, lighter, of more cost effective design and provides many more functions than the original version. Infra-red remote control is provided not only for the selection of teletext pages but also to allow regular television programme switching and sound muting from the leadless remote handset. This bonus is of considerable value to the millions of owners of ordinary TV sets which have no built-in remote control facility.

Subsequently, as mentioned above, we were the first company in the world to develop and put into quantity production a Prestel adaptor.

S. R. Kharbanda, Managing Director,
Labgear Ltd., Cambridge CB1 2RQ.

Our apologies for this oversight – *Editor.*

VINTAGE PROJECTION TV

My recent articles on vintage projection TV produced some interesting letters from readers. It seems that some of these sets are still in service, and at least one (a Philips console) is the main domestic receiver. Conversion is of course necessary in order to receive BBC-2, but this seems to have been carried out with few problems. Most of these sets would have been converted previously from their original single-channel state to thirteen-channel reception, by using a Brayhead or Cyldon tuner, and especially in consoles there's no shortage of space for adding extra items. Relays have been used in some cases for system change, but anyone now contemplating conversion would clearly do best to convert to 625 lines only.

As the date for the close down of the 405-line v.h.f. service draws nearer, the future of this part of the band is worth considering. There have been many suggestions, for example for a special educational TV broadcast service. The line standard that would be used has not been suggested, but would almost certainly be 625 – it would be ironical if dual-standard sets had to be produced for such a service. Back to projection TV however.

I pointed out in the August issue that the frequency of the e.h.t. oscillator was critical – it should be maintained to within 7% either side of the specified 1kHz. The reason for this is twofold. First the life of the EY51 rectifiers in the tripler may be adversely affected – and replacing these is no easy task. Secondly the e.h.t. regulation suffers if the rectifiers are underrun due to the oscillator frequency being low. Methods of checking the oscillator frequency were given, using an oscilloscope and audio generator or just an audio generator coupled to the a.f. circuits along with a loosely coupled feed from the oscillator. Mr. Lamb of Westcliffe-on-Sea describes a much simpler method however.

As the e.h.t. oscillator gives an audible note from the back of the set, he merely compared this with note B1 on his piano. This has a frequency of 987Hz and is thus very close to the oscillator frequency. Taking this a little further, the semitones either side of B1 give a good reference for the outside tolerance points since semitones are about 5·9% higher or 5·7% lower than their predecessor. In this case the frequencies are 932Hz and 1,046Hz. So long as the oscillator's pitch lies between these it's within tolerance. So this serves as a simple test for projection receiver owners who possess a piano but no audio generator.

Mr. Lamb raised a further point that deserves a thought. He says he's susceptible to the flicker experienced with the majority of monochrome receivers. The intense image produced on the screen of the small projection tube has a high persistency however (a raster can be observed for some seconds after switching off), and this is sufficient to suppress most of the flicker.

The number of those affected by TV flicker could well be greater than supposed. It's certainly not uncommon to hear complaints of eye strain and headaches after a period of viewing. Some people are likewise affected by fluorescent lamps. Perhaps the phosphors used for c.r.t. screens could be selected for longer persistence, though the result would be flaring of moving objects if carried too far. It would be interesting to know whether tube makers have done any research on this question, and whether it would be possible to produce economically tubes with longer persistence for those subject to this effect.

Vivian Capel,
Bristol.

Video Camera

Part 3

Malcolm Burrell

THE video/field timebase and pulse generator PCBs produced by the magazine have now been tried and tested and the print patterns are shown this month, also the component layout for the video/field timebase board. Note that a very compact layout has been used for the latter, and this means that vertically mounted resistors must be inserted the way round shown in the layout diagram, otherwise you won't be able to get some of the capacitors into the holes provided. Holes are provided for mounting through-panel pins to which the head amplifier screening can, made of suitable tin sheet, should be attached. Screen above and beneath the board.

A few extra words on the video circuitry may be helpful. The TBA500 is a fairly complex device containing 50 transistors. Though the type number is shown as the TBA500P on the circuit, it doesn't matter whether the alternative TBA500N is used – the former is the type usually supplied. The difference between the two types lies in the polarity of the voltage applied to pin 6 for beam limiting – a feature that's not required in our application.

The CA3046 – there are alternatives, such as the TBA331 – simply contains five transistors. Fig. 7 shows the uses to which they are put in the camera. The video signal from pin 10 of the TBA500 i.c. is applied to the base of Q1, while the blanking signals are applied to its emitter. Q1 thus inverts the video signal and adds the blanking signals. The output is a.c. coupled to Q2, which acts as an emitter-follower. Q3 and Q4 are designed for use as a differential amplifier, but are here operated in parallel as an emitter-follower output stage. The video/blanking signal is fed via D1 and C11 to the parallel-connected bases of Q3/4. Negative-going mixed syncs are fed to the junction of D1 and C11. When the syncs appear therefore D1 is biased off and the sync pulses only pass via C11 to the bases of Q3/4. Q5 provides vidicon cathode blanking as described in Part 1.

The rest of the circuitry, which is on the third board, is shown in Fig. 8. The focus circuit and the vidicon supply arrangements have already been described. This leaves the line output and h.t. generator stages, both of which are driven by the output from pin 8 of IC9.

The line output stage operates in the conventional

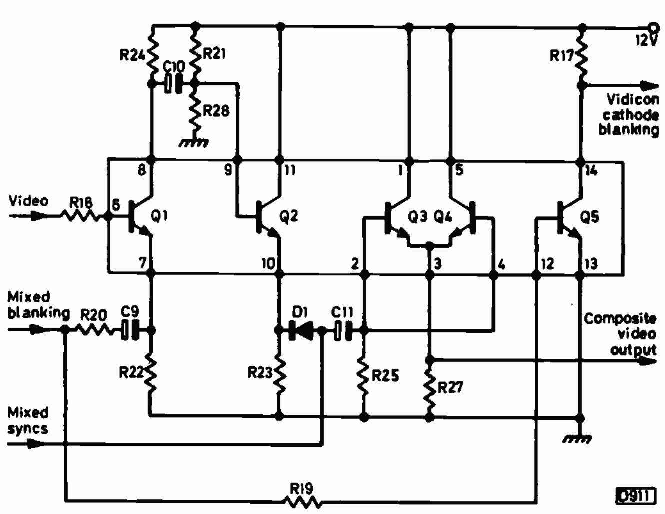


Fig. 7: Use of IC2 in the video section of the camera.

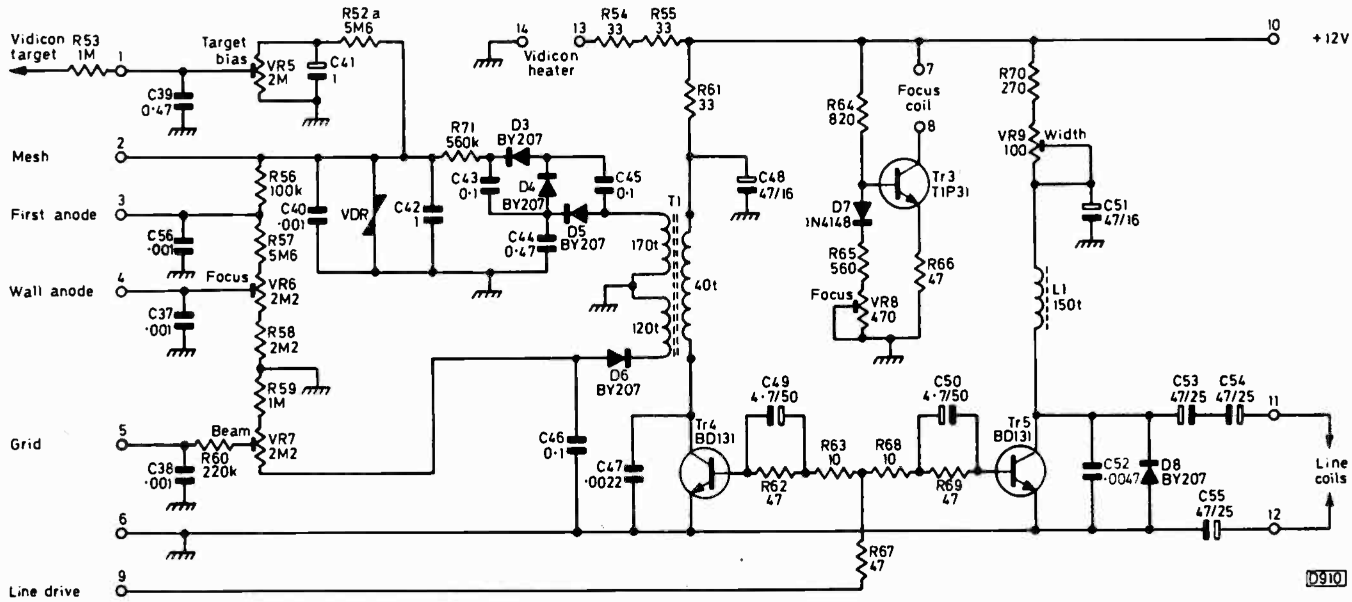


Fig. 8: The line output, h.t. generator and focus circuits.

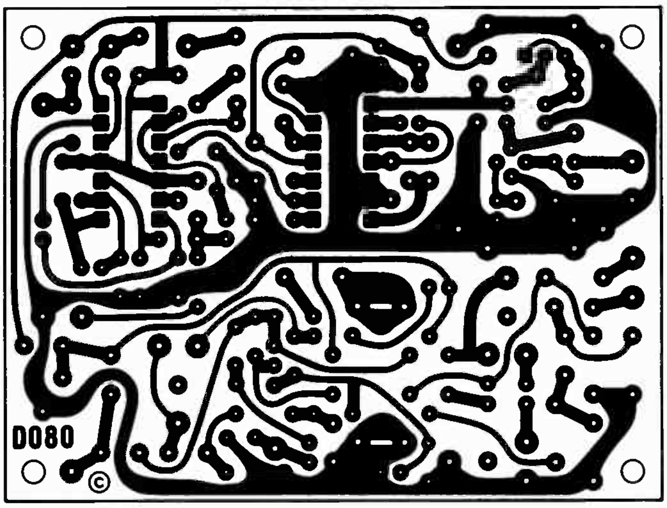


Fig. 9: Video/field timebase board print pattern.

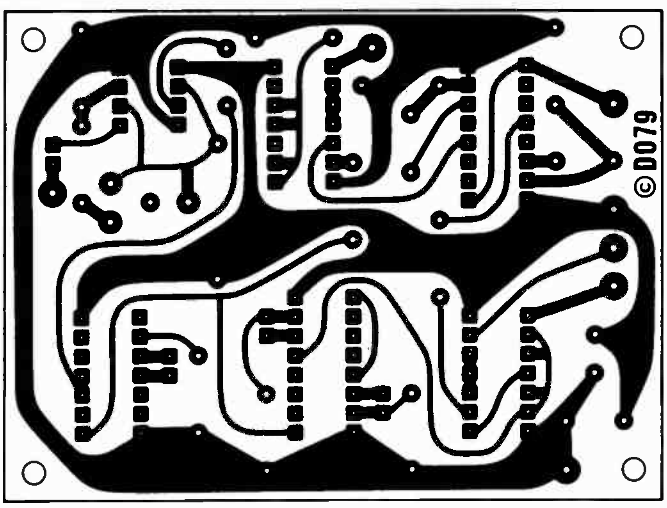


Fig. 10: Pulse generator board print pattern.

manner, with L1 providing a load for the output transistor Tr5. L1 is about 150 turns of 32 s.w.g. wire wound on a pot core. C52 provides flyback tuning, producing in conjunction with L1 a pulse of some 80V amplitude to drive the beam from the end to the start of the forward line scan. The amplitude of the flyback pulse is set by VR9. Scan-

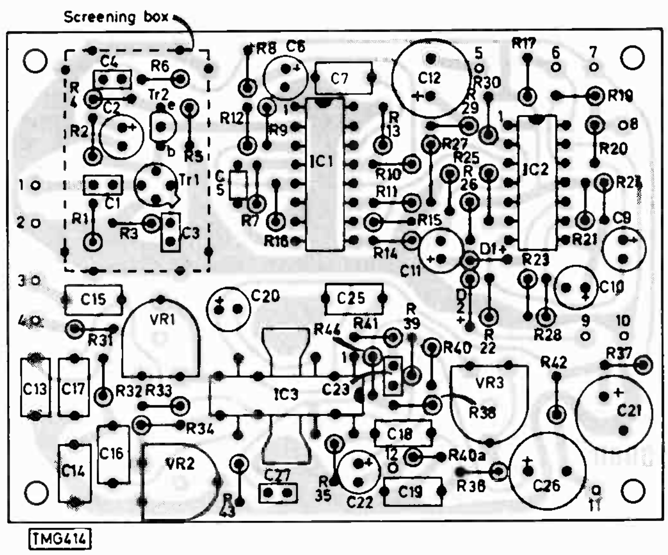


Fig. 11: Component layout, video/field timebase board.

correction is not required of course, C53/4/5 providing d.c. isolation to obviate the need for picture centring controls. The alignment magnets on the deflection yoke enable fine picture shift to be carried out – as with a conventional monochrome set. D8 provides the efficiency diode action.

As mentioned in Part 1, it was found best to use a separate stage to generate the h.t. supplies. This works in tandem with the line output stage, the same drive waveform being applied to the base of Tr4. The primary winding of T1 is tuned by C47, producing a "flyback" pulse in excess of 100V. The secondary winding raises this to a suitable level for feeding to the voltage doubler circuit D3-5/C43-5. Off load, the h.t. supply thus obtained would be in the region of 900V and would fluctuate considerably with beam current. For this reason, a VDR is included to provide a stable h.t. supply of 250V. A small pot core is used for T1. Many constructors dislike winding transformers, but it should take only an hour or so to wind T1. The primary consists of forty turns of 30 s.w.g. wire, with one hundred and seventy turns on the first secondary section, to the centre tap, and a further one hundred and twenty turns for the remainder.

D6 produces a negative supply of some –120V across its reservoir capacitor C46. This is used to bias the vidicon tube's grid.

Quatermass and the Navvy

Les Lawry-Johns

IT all started reasonably enough. "Have you a large cardboard box?" asked the young lady who was moving. Moving house that is.

So I toddled off downstairs to the basement, which is used only for storage purposes. You know what basement areas used for keeping odd things in look like. A bit of a jumble with only a narrow track for the chappie to get to and read the meters.

Somewhere over in a little used section was a large empty cardboard box, among many others that were filled with this that and the other. I made my way over to the box, and noticed a certain give in the floorboards. This became more alarming as I reached the box.

I attempted to lift the box, and was surprised to find it stuck fast. "We have ways of making you move" I snarled. My mighty muscles heaved, and up came the box complete with a large section of the floor. I stood there and stared stupidly at the hole in the floor. It was not a black hole. It was a white one. Hideous white fungus was everywhere. It had come through the floor boards and had been busily engaged in eating the box when I had surprised it. I remembered the girl waiting above. Should I invite her down? Better not.

I managed to find a box in the next basement room, and hurried up so that I could bid her farewell and hurry down again. I was then able to take a more objective look at the situation. So I peered, and whilst doing so realised that the world was relying upon me (though it was blissfully ignorant of the fact) to take decisive action to put an end to this menace that had started down in my cellar. I thought I could see the mass moving toward me, angry that I had robbed it of the box. I circled the hole warily. It suddenly made its move, and my foot went through the floorboards.

"Help" I screamed. "It's got me."

Honey bunch came to the top of the stairs.

"What are you on about now?"

"This plant from another world. It's grabbed my foot and I've got only one left."

It was a relief to hear her clattering down the stairs to my rescue. "Pull your foot up you idiot" was her helpful suggestion. So I pulled up my foot and another large area of the floor came up with it. "We can't fight it" I told her. "Better by far to burn the whole place down than to let it spread."

"Let what spread?"

"This evil fungus that grows larger by the second."

It's only cellar fungus. You always get it where there's dampness and no proper damp course. It's because we're on the side of a hill and the sand and gravel...."

I cut her short. "That's right. Ruin the only chance I'll ever have of being a hero. If that's only cellar fungus, how come it whipped the floor away from under my feet and left me only one?"

"Because there's wood worm everywhere, and what with that and the fungus this whole place will have to be cleared. It's even older than you are and either can be expected to fall to pieces at any moment."

I stood there in stunned silence. So this was my reward for all I'd done. I'd even sorted out a Christmas card for her from last year's box.

At that moment someone came into the shop carrying something heavy.

"You start moving the stuff into the next room. I'll be down to help you as soon as I can" I told her.

A Green Screen

The heavy object turned out to be an ITT colour set with the complaint that the picture – what there was of it – was green.

"Call back at five o'clock, I'll have it done by then" I promised. So off he went, leaving me with the set which had a bow front and a single sliding door. Vaguely familiar, but not the CVC5 I'd expected. As I took the back off I realised it was a CVC2, with three PCL84 valves for the colour-difference output stages.

I immediately made the first mistake. Instead of studying the displayed over bright, green screen to note that the field scan was shrunken and rolling like mad (which I assumed to be maladjustment), I started to take voltage readings on the PCL84 valve bases (with the set upended and the bottom cover off). The readings were queer, with negative voltages at the blue and red triode anodes while the green one was positive.

New PCL84 valves didn't help. Disconnecting the tube leads didn't help. All the resistors read right, and the capacitors were in order. Time slipped by, with the noises from below getting louder. Clearly honey bunch was getting agitated, moving things from one room to the other including colour tubes and old chassis which would have come in handy fifteen years ago. She was muttering something as she puffed and huffed, but nobody can accuse me of being an idle layabout.

"I'll be down just as soon as I get this set out of the way" I called, to give her heart. I could do the job in half the time but I can't be in two places at once.

I tried to get back to thinking straight about the CVC2. The three triodes act as identical clamps, and if all the circuitry checked out correctly how come the voltages were different? The penny dropped as I reached once again for an electrolytic to decouple the supply line. Sure enough, the voltages evened up and the grey scale was restored, as was the full scan.

I looked at the circuit diagram to identify the faulty electrolytic and found that the supply to the PCL84s comes straight from the main 700μF h.t. smoothing capacitor. This is in the very large can along with the 300μF reservoir capacitor. It was replaced in no time while I kicked myself for repeating the mistake I'd made quite recently with a Pye hybrid colour set. Will I never learn? The h.t. ripple gets rectified by the clamps you see. Or something like that.

Having restored the grey scale and set it up for nice viewing, noting that as ever on these sets the tube was as good as new, I then turned the colour up and found that it was already at maximum. Adjusting the tuning showed up the subcarrier dot pattern, so the tuning was near enough and we turned to the vertical left side decoder panel, which like the rest of the set is hand wired. I'd no sooner settled down to check the burst gate etc. than the colour flooded back, only to go again as the panel was touched. After some jiggery pokery the contacts on the bottom plug and socket were found to be quite loose, harmony being restored when they were tightened.

Which is more than I can say when honey pot came up from the cellar. I thought it was Al Jolson, about to sing Mammy. She didn't sing that.

"I've cleared that whole room without one bit of help from you and all that junk is going over the tip whether you like it or not."

"I'd better nip down to see that you've done it properly sweetheart."

She'd cleared it quite well really, for a woman that is, and now the full extent of the disaster was revealed. I was no longer afraid of the fungus. Just a bit of cellar fungus plus a spot of wood worm I thought. I'll see how far it's gone.

So I lifted the nearest floorboard to the hole and it came up quite easily. So easily that it pulled up the skirting board eight feet away and this caused the plaster wall to bow out and collapse in a cloud of dust on to what was left of the floor which gave way to leave me face down in the fungus.

At this moment honey bunch called down the stairs. "You're wanted in the shop. Hurry up."

I picked myself up, brushed myself down, and started up the stairs.

"What on earth have you been doing to my nice clear room. You look terrible, and what was all that noise?"

"The wall's collapsed on me and the rest of the floor gave way. We'd better declare this a disaster area."

"You're the disaster. Now help this gentleman, he's been waiting to see you."

The gentleman had a dark blue Philips 550 field service manual in his hand and immediately launched into his tale of woe.

"I always keep my set in good order myself, but there's something that's eluding me this time . . . ." And he went on and on about the steps that he had taken over the past two weeks. *Two weeks!*

I began to get impatient as he related how he had changed the BT106 thyristor and both BC147 transistors on the power panel despite the fact that he had about 200V on the h.t. supply fuses. So I turned the pages of his manual to the line output stage section and stubbed a dirty finger at the 800mA fuse. "Have you got 200V there, at both ends of this fuse?"

"Yes I think so. I can remember you telling me about a year ago to check here and at both ends of the 47Ω resistor over at the front end, so I'm sure it's there all right."

"If it's there, why bugger about with the power panel?"

"Well, I thought the waveform might be distorted by the trigger pulse circuit."

My cool was rapidly deserting me. Here was I at the cross roads of my life, with my world tumbling around me, and all this fool could think of was his trigger pulses. I made a last attempt at sanity.

"See that 10k Ω wirewound, start-up supply resistor on the timebase panel just there. Check that you've h.t. at one end and 18V at the other. If the 18V is absent, check the resistor by putting your finger on it. If it burns you it's all right, if it's cold it's not. If it's hot check for shorts. If the voltage is low check for leaks, here, here and there."

So off he went to check his voltages.

My friend surveyed the stricken cellar room.

"All this plaster has got to come off the walls. We've got to get down to brick. Every bit of wood has got to go, so we'd better start moving it." So we started.

No Sound

I had to go up because someone wanted me, and as I didn't like the idea of him heaving all that heavy stuff up the stairs and out the back I asked honey bunch to give him a hand. Up and down they huffed and puffed with loads of rotting wood and buckets of plaster and brick until there was a huge load near the back gate. Whilst I got on with the difficult job of finding what had happened to the sound on a Körting.

It was a hybrid of the 52665 variety, with a solid-state audio circuit. The speaker is fed from a small, separate panel on the top left side. This is coupled to the audio panel farther in. The speaker clicked nicely when checked at the plug and socket on the small panel, so we turned our attention to the output transistors. The voltages were there and were all correct, so we injected a signal at the input and received nothing. We injected a signal at the output and received nothing. We went back to the small panel and injected a signal at one end of the 470μF output coupling capacitor. Nothing. We injected a signal at the speaker side of the capacitor, sound loud and clear. We fitted a new capacitor and the sound was restored.

I then turned to see how they were getting on with their clearing up job. They'd cleared up the wood and rubble very well, and it was all out the back together with all my precious old chassis and spare bits and pieces which would have come in handy some day. Even my 1938 service manuals had been crammed into boxes and taken out, the HMVs, Marconiphones, Ekcos and Cossors. All consigned to the rubbish tip.

The next job was to get someone to take the lot away. I contacted the local contractor who said he would call late in the afternoon. When he came he was on his own as he was sort of doing me a favour and it wouldn't cost me very much.

He backed the lorry up to the rear gate, and we found that we would have to shovel all the plaster and stuff into a dustbin and then tip the dustbin into the lorry. The rest of the stuff could be carried the few feet.

As we were about to start, a set came in which needed urgent repair. So I nipped into the shop to see what it was all about and told honey bunny that the man out the back needed a hand but if she could do the repair I would go back out. This is how she became a navvy for half an hour or so.

The chap with the lorry said she was much better than the average workman he had with him during the day, and I said I didn't mind her working so hard if it helped him. So to the sound of much shovelling and heaving about (I had said they might as well shift all the old sets out in the shed while they were about it) I set about doing the urgent repair.

Line Output Transistor Trouble

With all this going on I wasn't thinking too well when I tackled the 8500. It didn't take long to find that the excess current being drawn was due to the line output transistor being short-circuit. I fitted a new BDX32 and checked around for any other shorts. Finding none I switched on. There was a funny buzz and the cut-out cut out. The new line output transistor was short-circuit.

It then dawned on me that I hadn't disconnected the e.h.t. rectifier, which is the easiest thing in the world to do since you just pull the plug out of the overwinding. It occurred to me that I'd done this sort of thing before. If only I'd the patience to insert a nice wirewound resistor in the h.t. feed to the line output stage like I tell everyone else to do I might have saved a few bob and quite a bit of aggravation. So we had to fit another BDX32 and then change the e.h.t. unit in order to restore normal working.

Talking about normal working, when I went out the back to see how the work was progressing I found it was all clear. Honey pot looked just like a red Indian. All red she was, and sort of puffing. She even forgot my name. Potter she called me.

Small-screen Monitor

Part 1

Luke Theodossiou

AFTER the publication of our monochrome portable receiver project in the May 1980 and subsequent two issues we received a number of letters from readers wishing to convert it for use as a monitor. Although this is perfectly feasible, we decided that a fresh design optimised for the application would offer several advantages over a simple conversion – for example better video performance and simpler construction. Some of the features of the original design have been retained in the present monitor project, but different field timebase and video circuitry have been adopted.

Since the present design is intended as a video monitor only, an audio amplifier has not been incorporated. This feature is easy enough to add if required however. One of several excellent yet simple i.c. designs can be used, powered from the unregulated side of the power supply – i.e. take the power supply from across the main reservoir capacitor C33.

Much of the circuitry has been featured in the magazine before in various articles. Rather than describing it in detail therefore we'll give a brief rundown on the circuit with a list of references in Part 2 on where more details of particular parts of the circuit can be found. The main exception is the field timebase, which uses a relatively new device – the TDA1044. We'll cover this in more detail later.

Fig. 2 shows the monitor circuitry on the PCB that's been designed for the project. This consists basically of the power supply, the field and line timebases and the video processing and output circuits. The only components external to this are the mains transformer, the on/off switch, the brightness and contrast controls, the c.r.t., the scan coils and the c.r.t. base board. Details of these will be given in the following issue, along with constructional, testing and setting up information.

It was decided to use an i.c. to provide all the video signal processing required before feeding it to the video output stage. This may at first sight appear to be rather an extravagant approach. All the functions required are provided by the chip and a minimum number of peripheral components however, and the whole lot occupies less board space than would be required for a discrete component design.

The TDA2150 i.c. used accepts a standard 1V peak-to-peak composite video signal. It allows for d.c. brightness and contrast control and field and line flyback blanking, and provides d.c. restoration and clamping (with very good black level stability). There are two video outputs, the second, negative-going 3V peak-to-peak composite video signal being used to feed the sync separator. When you look at the few components required in conjunction with the i.c., you'll see that its choice is well justified.

The video output circuit is of the class AB variety, with a cascode stage used in the lower section. The video gain is set by the ratio of R28 to R15, while the ratio of R28 to R29 determines the black level. Diode D4 in conjunction with R33 provides beam limiting. The very high performance of which this type of circuit is capable is by now well known: the frequency and transient responses are excellent, and so is the black level stability – and all this for less power consumption than the humble class A type of design.

The TDA9513 i.c. (IC2) provides the following functions: sync separator with noise suppression; field sync pulse integrator; phase comparator; a switching stage for automatic changeover of noise immunity and change of the slope of the phase control circuit; sandcastle pulse generator (this pulse is used for line blanking and clamping purposes by the video processor i.c.); line oscillator with frequency range limiter; phase control circuit; under-voltage protection circuit; and a high-current output stage capable of driving a Darlington line output stage.

The line output stage employs the BU807 Darlington transistor Tr4 which also incorporates an integrated efficiency diode. The line output transformer and line linearity coil (L1) are readily available components. Diode D8 is the boost diode, which provides around 26V on the boost capacitor C34. This voltage is also used as the power supply for the field timebase. The pulses present at the cathode of D8 are rectified by D5 to provide, across its reservoir capacitor C31, the video supply rail. A separate winding on the line output transformer is used to provide around 400V, after rectification by D6, for the c.r.t. first anode and focus electrodes. The e.h.t. is generated in the usual way, by an overwinding on the transformer and a rectifier. The transformer has integral mounting clips for the e.h.t. rectifier: the advantage of this over having an integrated rectifier is that the rectifier alone can be easily replaced should it fail.

The field timebase consists of the TDA1044 i.c. (IC3) and its associated components. This ITT device first put in an appearance in the Thorn TX10 chassis, in which it's used to drive a pair of complementary field output transistors. In our small-screen application it drives the field scan coils directly. Fig. 1 shows a block diagram of the device. It's very similar to the well-known and commonly used TDA1170, the main difference being that it incorporates an integral scan-correction circuit which can be externally adjusted for optimum field linearity. The components that achieve this are resistors R5 and R6 – their ratio determines the ratio of top and bottom correction, whilst their values determine the amplitude of the correction.

The *CR* combination C4/R12 forms the field oscillator

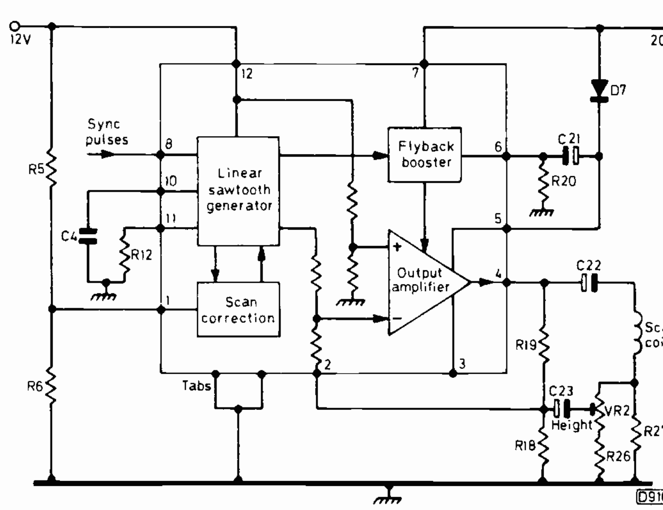


Fig. 1: Block diagram of the TDA1044 field timebase i.c.

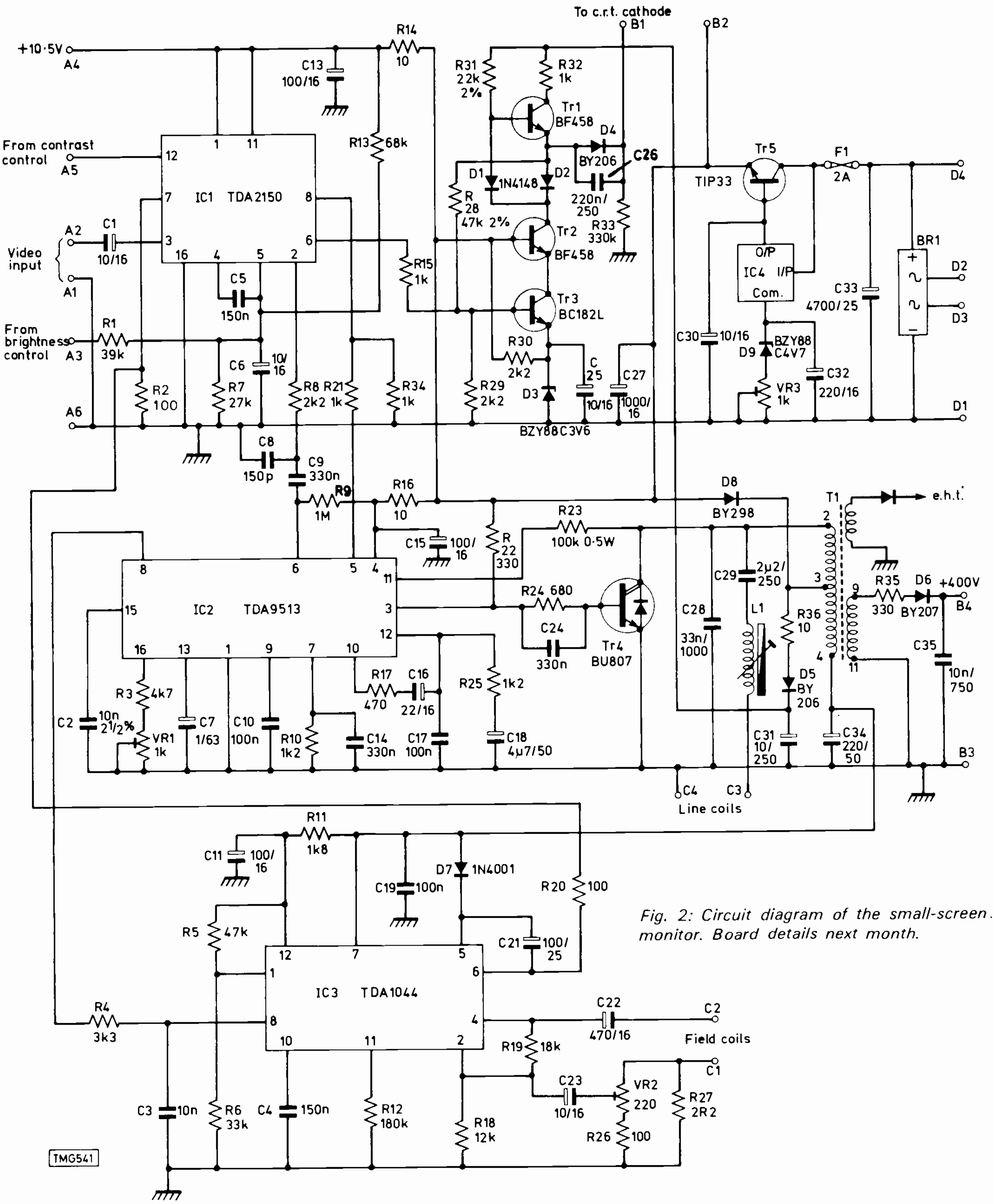


Fig. 2: Circuit diagram of the small-screen monitor. Board details next month.

timing network, whose values have been chosen to provide the correct frequency without the need for a preset control. The same principle has been adopted for the field linearity components R5/R6. If necessary, small changes to the values of R5/R6/R12 can be made by increasing them to the next higher standard ones as required and padding down with high-value resistors in parallel, but in all but the most critical applications the values shown will be found to provide very nearly the optimum possible results. The only exception to this is when an i.c. is just within its specification limits, particularly in respect to R12, but this situation is likely to be very rare.

The field flyback generator circuit allows the peak flyback pulse voltage to rise to around twice the supply line voltage. The flyback pulse is available at pin 6 of the i.c. and, after potting down by R20 and R2, is used for field flyback blanking in the video processor i.c.

The field scan current path to chassis is via R27. The sawtooth voltage developed across this resistor is tapped down by VR2/R26 and fed back to the power amplifier section of the i.c. via C23 to set the gain. In this way the amplifier's gain, and thus the height, can be varied.

Servicing the Decca 80/88/100 Chassis

Part 2

Eugene Trundle

IN Part 1 we dealt with the signal circuitry, which is common to all these chassis, and made a start on the timebase panel, covering the TBA920 line oscillator/sync chip and the line driver stage. We come next to the field timebase, where the smaller-screen (18 and 20in.) 80 and 88 chassis differ totally from the larger-screen 100 chassis. The former use a TDA1170 chip (IC301) for the purpose while the latter employs discrete component circuitry. We'll take the chip circuit first.

Single-chip Field Timebase

The TDA1170 is reasonably reliable considering the job it has to do. It can and does fall prey to several faults however. The symptoms may be overheating with impaired scan, no field scan, or intermittent field judder. Decca research discovered at an early stage that failure of the i.c. can be caused by c.r.t. flashover. The risk can be reduced by fitting a short wire link from the earthy end of C332 to the earthed copper land under the TDA1170 on the board. The chip can develop r.f. instability if C344 (0.1μF) in the field scan circuit fails: the visible result is line pairing. The similar effect of poor interlace however is likely to be due to a fault over in the field sync pulse integrator stage, where the 1μF tantalum coupling capacitor C318 should be checked.

Due to tolerance spreads, field foldover is possible with some combinations of chip and deflection yoke. In later production the scan coupling capacitor C341 was increased from 220μF to 330μF to eliminate this possibility. If this capacitor breaks down the effect is field collapse of course – a single horizontal white line. Diagnosis is made easy by the fact that the line is way off centre, being deflected by the d.c. flowing in the field scan coils. If not due to the chip or its supply line, a centred horizontal white line may be the result of the oscillator's timing capacitor C331 (0·15μF) being faulty.

The regulator transistor Tr302 (BC337) provides a 23V supply for the field output stage within the i.c. A couple of problems have been noted here. First the fusible resistor R342 (75Ω, 3W) in series with the transistor can be dry-jointed, leading to intermittent cramping of the field scan. Secondly a faulty regulator transistor can upset the 23V line, the symptom displayed being cramping across the centre of the picture.

Field Timebase – 100 Chassis

The discrete component field timebase circuit used in the 100 chassis consists of a multivibrator (Tr303/Tr305), a preamplifier (Tr306), two driver transistors (Tr308 and Tr309) and the output transistors (Tr802/Tr803). We've had virtually no trouble with the oscillator and the preamplifier stages, faults apparently being confined to the driver and output stages. The most common fault is R371 (2·2kΩ) burning up. Before replacing it, check D309, D311 and Tr309 in case they've been damaged. Use a ½W or 1W replacement resistor instead of the original ¼W type, this uprating being essential to avoid the thermal runaway effect from which the original suffered. The field output stage quiescent current is set by D309/D311/R371 and R355.

This fault sometimes occurs concurrently with failure of the output pair Tr802 and Tr803. These transistors are quite capable of going leaky by themselves however, sometimes taking Tr309 with them. The symptoms range from loss of scan to poor linearity, foldover or loss of the top or bottom of the picture. The latter symptoms often culminate in complete field collapse when the fusible 32V supply feed resistor R510 on the convergence panel springs open.

If R357 (220Ω, 1W) in the drive to the lower output transistor fails it's best to replace it with a 2W type. Burning of R355 is a different matter. This is usually accompanied by cramping at the bottom of the picture, and the action called for is replacement of diodes D309/310/311.

LINE OUTPUT STAGE/EW CORRECTION

When we come to the line output and EW correction circuits we again have to deal separately with the 80/88 and the 100 chassis. The former has a very simple line output stage, with a transductor used for EW correction: the latter has a line output stage incorporating a high-level EW diode modulator circuit.

100 Chassis

Dealing with the 100 chassis first, line output transformers manufactured by Mullard or Weyrad may be encountered. The Mullard type has a white encapsulant around the windings and is very prone to failure, with a burn mark on the overwinding adjacent to the 8·5kV output nipple. Replacements are of a modified and improved type. The tripler can and does fail, which can in turn lead to failure of the line output transformer – an unfortunate and expensive trait which this chassis shares with some of its ITT contemporaries! We have been told that the TBA920 line generator chip can also sometimes be taken out by failure of the tripler, but have yet to experience this ourselves. A preventive measure is to add a 1kΩ, ½W resistor between the anode of D312 and pin 10 of the chip – as in later production.

The scan-correction capacitor C508 (0·91μF, on the convergence panel) can cause a difficult-to-trace brushing effect on the picture (vertical ragged interference). Diagnosis is easier when C508 goes short-circuit, blowing the mains fuse. The first anode supply reservoir capacitor C501 (0·068μF) can go short-circuit with the same result. Still in this neck of the woods, the overall first anode preset control VR504 (2·2MΩ) is troublesome – which is perhaps to be expected, since high resistance in the face of high voltage seems to be a perpetual formula for trouble! The result is that the brightness level is upset, permanently or intermittently. This control was removed in later production, with R533 changed to 300kΩ (1W), R512 changed to 270kΩ (1·3W) and R534 changed to 470kΩ (1·3W) to compensate. A further modification is to uprate R505 in the audio supply shunt regulator circuit from 7W to 9W. We can recommend this change.

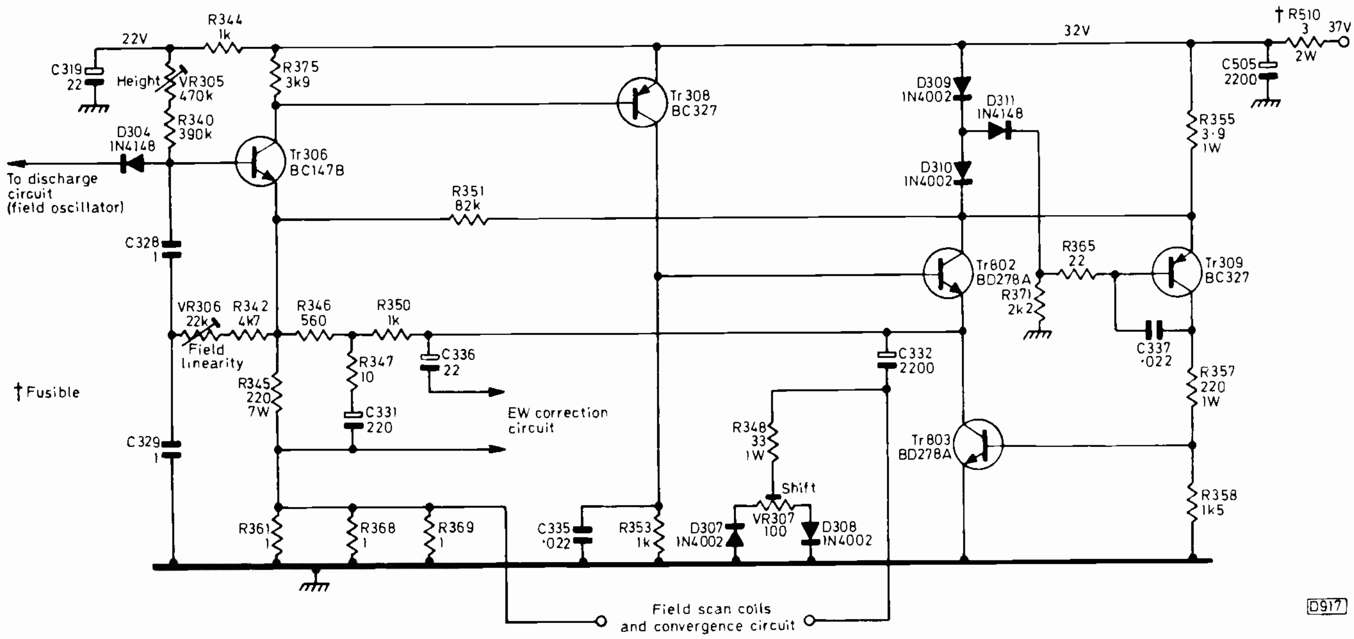


Fig. 2: The field timebase preamplifier (Tr306), driver (Tr308, Tr309) and output (Tr802, Tr803) stages used in the Decca 100 chassis. The class AB output circuit is similar to those used in the Thorn 9000 and Rank Z718 chassis, with Tr802 conducting throughout the scan and Tr803 conducting during the second half of the scan. At the start of the scan, Tr802 is saturated. The voltage thus developed across R355 exceeds the voltage at the base of Tr309, set by D309/D311/R371. Tr309 is cut off therefore, and with no current flowing in R357/R358 Tr803 is also held cut off. The drive to the base of Tr802, from Tr308, is negative-going. Tr802 is thus being driven towards cut off. Half way through the scan, the voltage across R355 falls below the voltage at the base of Tr309. Tr309 thus starts to conduct, in turn driving Tr803 on. The scan coupling capacitor C332 is charged via Tr802 and discharged via Tr803 during the course of the scan.

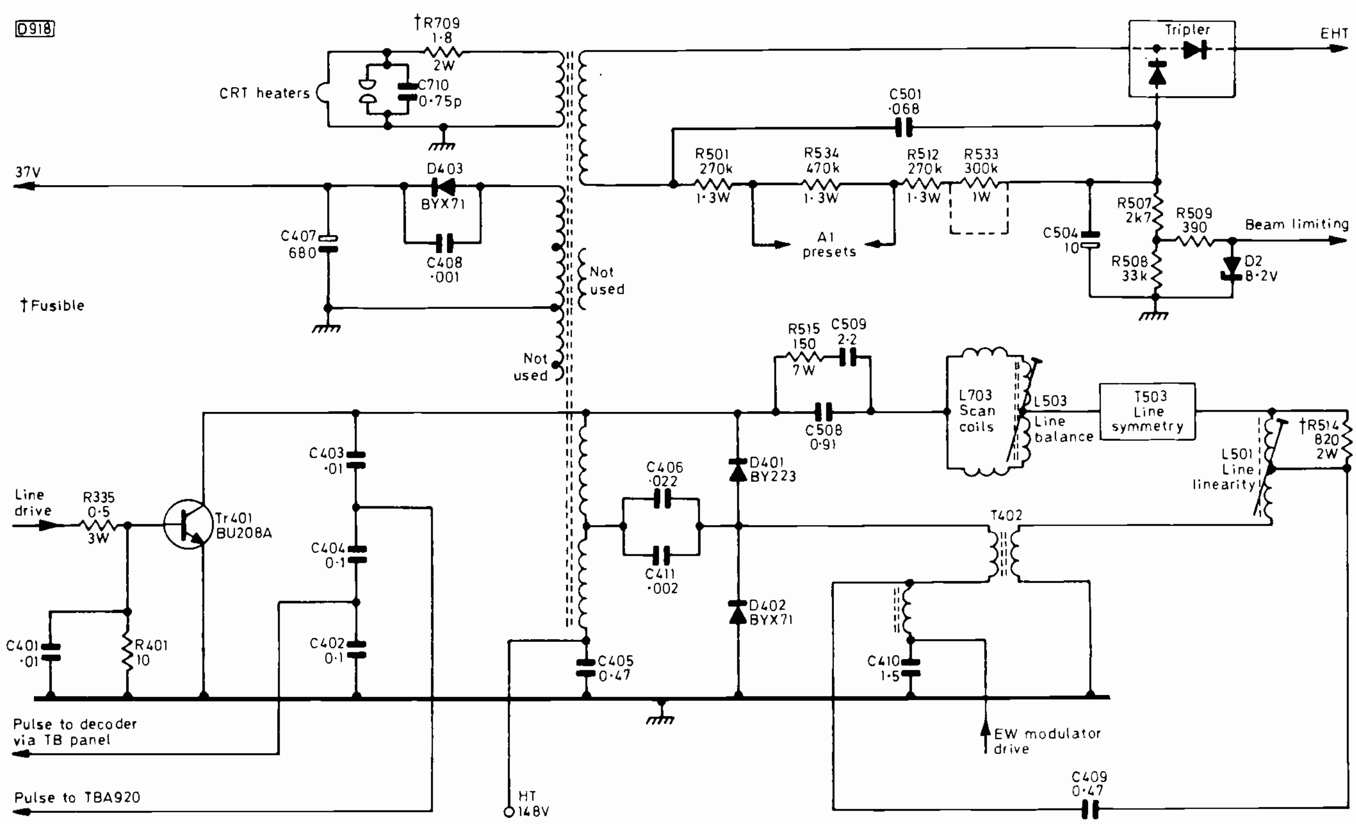


Fig. 3: The line output stage and EW modulator circuits used in the Decca 100 chassis. C402/3/4 provide the flyback tuning. The efficiency diode action is provided by the EW modulator diodes D401/2. With the 20AX system, greater scan correction is required at the centre of the screen than at the top and bottom. C409 is included to increase the correction at the centre, when it operates in series with C508. The EW drive waveform consists of a field-frequency parabola.

The EW correction circuit used in the 100 chassis is reliable at the waveform generator and early amplifier stages, but there are several stock faults at the output end. The driver transistor Tr312 (type 17351 – back to the timebase panel again) occasionally fails, causing excessive width or a narrow picture with severe pincushion distortion

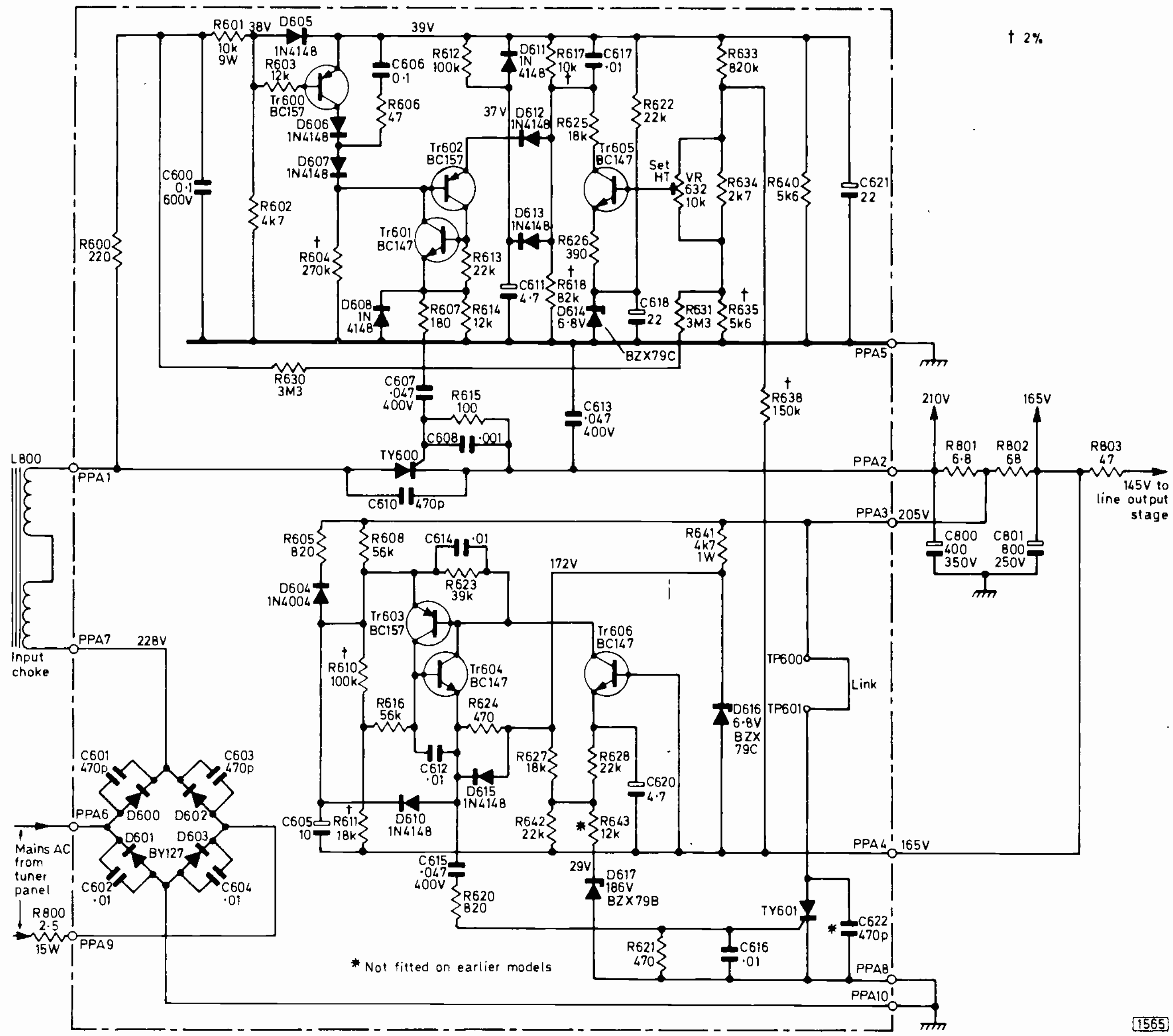


Fig. 4: The power supply circuit used in the Decca 80/88/100 chassis. TY600 is the regulator thyristor, whose gate is driven by 100Hz pulses from the firing circuit Tr601/2. The point at which these two transistors switch on is controlled by the comparator transistor Tr605, which sets the voltage at the emitter of Tr602, and Tr600, which provides a ramp at the base of Tr602 by periodically discharging C606.

Protection is provided by the crowbar thyristor TY601, which blows the mains fuse in the event of excessive h.t. voltage or excessive current demand. There are two firing mechanisms therefore. Excess current is sensed as the voltage developed across the h.t. smoothing resistor R802. D616 supplies a reference voltage for the emitter of Tr604 (via R624). This is obtained from one side of R802. The other side of R802 is linked to the base of Tr604 via R611 and R616. With a 50 per cent overload, Tr604/3 switch on and fire TY601. In the event of the h.t. voltage rising above 186V, zener diode D617 conducts. Tr606 then switches on, in turn firing TR603/4 and TY601.

at the sides. The latter symptom is more often attributable to a dry-joint at pin 3 or 4 of the modulator transformer T402 or failure of one of the modulator diodes D401 or D402 however. If all these points are in order, it's worth checking for poor contact in the plug-socket connections associated with EW raster correction, i.e. PTA3 on the timebase panel and PLB2 on the line output panel.

Whistling Components

A modern disease amongst TV sets is timebase whistle from the ferrite-cored wound components dotted about the line timebase. These Decca sets have their share of such components, but mercifully it's not often the line output transformer that's responsible – take your pick amongst the smaller wound components. We've found that piercing whistles can emanate from any of them, from the line driver transformer onwards, on both the 80/88 and 100 chassis.

80/88 Chassis

Faults are far fewer in the simpler line output stage used in the 80/88 chassis. The e.h.t. triplers are still troublesome, but the line output transformer is much more reliable. We've had odd failures of the tuning capacitor C401 (·0062μF, 2kV) and the 37V supply rectifier D400, though when the fusible resistor R400 springs open the field timebase chip is usually responsible.

Occasional cases of pincushion distortion have been traced to dry-joints on the EW correction transductor T301 (timebase board). In sets using the 80 chassis, striations at the left-hand side of the picture may be noticed with the Toshiba type 560AWB22-TC02 22in. tube. The cure is to fit a 220pF, 8kV capacitor in series with a 1·8kΩ, 1W resistor across the scan coils.

If the first anode supply reservoir capacitor goes short-circuit the mains fuse will again blow. This time it's C322 (0·068μF).

POWER SUPPLY

The power supply used in these chassis is probably easier to service than the line-rate switch-mode type – once it's realised that excessive current demand due to a fault elsewhere in the set will fire the crowbar, violently blowing the mains fuse.

Starting with a blown mains fuse then, first check the mains filter capacitor C8 (0·1μF), preferably by substitution since some of them seem to have an unwelcome self-healing capability! The next suspects are the BY127 bridge rectifier diodes D600-D603 on the power supply panel. The small BY127M types are not recommended for this application. If these and the thyristors TY600 (regulator) and TY601 (crowbar) test o.k., it's likely that the crowbar thyristor has done its job and fired. Replace the fuse, examine the line output transformer for burn marks, and disconnect the e.h.t. tripler, dressing the lead well clear. Then switch on again. If the fuse blows once more, the crowbar thyristor may be doing its job legitimately due to the h.t. voltage being excessive or excessive current being drawn from the supply. Try removing the supply to the line timebase by disconnecting the scan coil plug.

Normal working is sometimes restored simply by replacing the mains fuse. In this case the first suspect is the 186V zener diode D617, for leakage. Replace the diode, with a 12kΩ, $\frac{1}{4}$W resistor in series (R643 in later production) to prevent spurious operation of the crowbar thyristor, and ensure that C622 (470pF) is fitted in parallel with the thyristor (this capacitor is not present in very early production sets). Less often the crowbar trip sensing zener diode D616 or the e.h.t. tripler may be the cause of random fuse blowing as a result of the crowbar operating.

In contrast to the protection department, the h.t. supply circuit itself is quite reliable. We've known R633 (820kΩ) and the 6·8V zener diode D614 in the regulator circuit cause incorrect output voltage, and h.t. flutter/jitter to be due to faults in R604 (270kΩ), D608 (1N4148) and Tr600 (BC157). If the power supply fails to give any output at all, have a look at R601 (10kΩ, 9W) and R800 (2·5Ω, 15W). Both of these have a tendency to go open-circuit for reasons of their own.

A rattling buzz from within the set can sometimes occur and be annoying enough to generate a service call. Take a replacement input choke (L800) with you and don't mess about with the noisy one – you may stop the buzz, but it's almost certain to return.

REMOTE CONTROL

Some Decca models are fitted with the Deccasonic RC1 remote control system. It's a simple channel-change, volume control and mute system, but it regretfully contributes its quota of problems. Starting with the sound facility, if a TBA120S intercarrier sound i.c. of any make other than Motorola is fitted, the range of sound control will usually be incorrect. The following changes are required: increase R936 from 4·7kΩ to 12kΩ, and add an 820Ω resistor (R938) in series with the emitter of Tr911. These changes are also necessary when a Texas SN76620AN i.c. is used in the intercarrier sound i.c. position (IC103). Complete failure of the remote control over the sound level is usually traceable to the f.e.t. Tr906 or C917 on the remote receiver panel.

Reluctance to change channel on remote command will sometimes be experienced. If the other remote functions are correct, replacing IC904 on the remote control receiver panel with the higher gain MC14025BCP device will usually do the trick. If the set can be taken off channel one manually but not with the remote command however, check C760 (0·01μF) by substitution. Contrarily, spurious channel change may occur without any command being given. This is probably due to mains transients, and can be prevented by fitting a 2·2kΩ, $\frac{1}{2}$W resistor (R764) in series with the brown channel-change pulse lead from TP908 and increasing C920 to 47μF.

VCR OPERATION

Some receivers have no provision for VCR operation built into the channel selector system. In this case it's necessary to fit a link to earth the cathode of D300 on the timebase panel at PTC4 or PTUD10.

When used with some makes of VHS machine, rolling and field judder can occur on playback of previously-recorded BBC material and when setting the VCR's internal u.h.f. tuner. Assuming that the cathode of D300 has been earthed, the following steps can be taken to eliminate the problem: connect a 680Ω $\frac{1}{4}$W resistor and a 22μF capacitor in series between pin 12 of IC300 and chassis, fit a 220Ω, $\frac{1}{4}$W resistor in series with pin 10 of IC102, close to the leadout wire, and if necessary readjust the vision detector tank coil L107 very slightly.

MODIFICATIONS – 88 CHASSIS

The differences with the more recent 88 chassis are briefly as follows: no convergence circuits; a single overall first anode preset control (preset brightness control) is used, with background adjustments carried out on the decoder panel; and a different c.r.t. base panel to cater for the different tube pin connections. There are detail modifications to the timebase panel to improve the performance, as a result of which the type 80 timebase panel can be used in the 88 chassis but not vice versa.

SUMMARY

So much for the stock faults we've encountered over a period of several years. It's only fair to point out that unless you service many hundreds of these sets you are unlikely to meet many of the faults we've described – especially in later production sets.

A word of warning: never forget that the chassis is live regardless of the mains lead phasing, and beware of operating the sets for too long with the RGB leads to the tube base draped over the dropper resistor – this can happen with the chassis in the hinged up position.

Finally a bouquet for the Decca Service Department. We've never met a more efficient and helpful TV setmaker, and the technical advice, laboratory and spares departments are in our opinion second to none. Nothing seems too much trouble for the Decca service organisation, a view we feel sure is held by all the trade. Since the takeover of Decca by Racal there's been a question mark over the radio and television side of the business. Let's hope that this excellent organisation does not suffer the fate of being disbanded.■

Miller's Miscellany

Chas E. Miller

I recently collected for repair from a second-hand TV dealer a Thorn set fitted with the 1400 chassis. He'd thoughtfully stuck on the set a label describing the faults – "line across screen, no sound". This turned out to be the case, so as a first step I naturally decided to try a new PCL805 field timebase valve. When the chassis was swung open however the following highly original valve line-up was discovered:

Field timebase, PCF806
I.F. amplifier, PCL805
Video output, ECL80
Sync separator/line oscillator, PCC189!

The curious thing was that not only had the PCC189 worked moderately well as a line oscillator, but that neither it nor any of the other incorrect valves had caused the slightest damage through wrong connections etc. In fact when the proper valves were fitted the set worked disgustingly well!

Around the same time I encountered another old Thorn set, a 16in. dual-standard portable fitted with the 960 chassis, i.e. a modified 950. It was one of the earlier ones that employed an eccentric "wattless" heater dropper arrangement. There were in fact two separate heater chains in this version of the chassis, one fed by a $4{\cdot}33\mu$F mains voltage capacitor (the "wattless dropper") and the other in series with the earthy side of the h.t. supply. In later versions of the chassis a conventional heater chain fed via a dropper diode was employed. Enough of the original sets were made to leave a legacy of problems for the poor old service engineer however. The most common and most frustrating was the lengthy warm-up problem – I've known some examples take up to three-quarters of an hour to get going, and no amount of adjustment as per the service manual seems to improve matters!

Thorn at one time used to offer to modify these sets to the later circuit at their service depots, but didn't (with good reason) recommend this being undertaken in the field. It's possible to carry out this change however if you've the time and inclination, and in this particular case the otherwise excellent condition of the set encouraged me to have a go. I can't say that I enjoyed the experience exactly, but it was financially rewarding since the result was a very useful little set – there's a steady demand for mains portables in my area, for use as second sets and with TV games, and they command quite reasonable prices. Returning to the Thorn 960 chassis however, I've on many occasions had calls to attend to sets that "went down to a line" after being moved around the house. The point here is that careless retraction of the v.h.f. rod aerial can nearly bend the PCL805 in its socket so that only the heater pins make contact!

Off-colour Teuton

About six weeks ago a hybrid Telefunken colour set (Model 740T) was brought in with the complaint "intermittent colour changes". On test, the fault took the expected long time to put in an appearance, but when it did show up there was a definite loss of red. The trouble was that everything from the tube base to the i.f. panel was tap-worthy, and the fault condition seldom lasted for more than a few seconds. Eventually however the red disappeared permanently, and I was able to trace some bad but hard to spot joints around the red output transistor. When these were put right the red came up and I thought I'd solved the problem.

Only a couple of days later however the owner complained that the fault was recurring frequently. This time the red was disappearing every other minute, but putting a test prod anywhere on the i.f. panel brought it back. This was finally tracked down to slight mistuning of the PAL switch transformer (L328-30), making conditions very critical. I still hadn't won however, since no sooner had this been corrected than I got, again intermittently, the classic "green faces". This was due to nothing more than a dirty track on the small colour demodulator balance preset R372, in the signal feed to the R – Y demodulator, a dose of cleaning fluid soon sorting things out. The set's been back at its owner's house for nearly a fortnight now, so here's hoping....

Thoughts on Decca

It's funny how a news item can trigger off a train of thought and stir half-forgotten memories. The takeover of Decca by Racal made me hope that whatever the eventual outcome they would go on making the sorts of sets that I personally have admired over the years.

One of my first trade service contracts was with one of their main dealers. It was an old-established firm that had started out by selling pianos on hire purchase for Victorian parlours. When I started to do work for them the manager was a Mr. Jepson, himself a veteran from the days of wind-up gramophones. He was a real character, with a dry wit and an apparent imperviousness to electricity, the combination producing some alarming results. He would frequently rub the dust from an e.h.t. rectifier with a bare finger, while the set was working, being quite undisturbed by the blue glow of a corona discharge around his digit or by the threat of a d.c. shock. The first time I saw him do this I nearly had kittens, but I eventually got used to the performance.

A little more difficult to ignore was his habit of surreptitiously reversing mains plugs so that the set one was working on became live. This never inconvenienced him personally, since mains voltage was nothing to someone capable of resisting 10kV and more! These pranks aside, he was agreeable enough to work for, and when he wasn't actually trying to electrocute me he showed me much kindness. When the firm finally succumbed to financial pressures and was taken over by a national combine, he presented me with some valuable test gear and service manuals, the latter coming in very handy when, often years later, I had to repair some of the sets I'd installed for him. I'd better not start to particularise on these however: they'd make up a vintage spot of their own, and we already have....

Vintage Pyes

In my last vintage spot I dealt with the Ekco TMB272 mains-battery portable. Commenting on this, our editor reminded me that, whilst Ekco tended to retain the same basic electrical design in their sets over several years and many models, their then rivals Pye tended to change their designs almost every other day. It's a valid and interesting point – a glance through my old service manuals shows that a remarkable number of different Pye chassis were introduced over a short period of time. Furthermore one can't help but feel that whilst most manufacturers were striving to simplify their circuitry, Pye were often set on making their's more and more complex.

One distinction that cannot be denied them is of having introduced the first a.c./d.c. TV set, though there's evidence to suggest that this was not entirely intentional! The receiver in question was the 18T, which came in various table and console cabinet stylings. It employed 19 valves and a 9in. c.r.t., all made by Mullard. The sole semiconductor device was a crystal diode in the sound a.g.c. circuit. The signal circuits were of the t.r.f. type, initially for the London area only though a Birmingham version was later produced. During the war, Pye had produced for radar purposes an i.f. amplifier strip working at 45MHz (it was later taken up enthusiastically by amateurs building their own TV sets), and it may well have been the experience thus gained that prompted Pye to use what was in effect a civilianised version in the 18T (and the 16T Chas, the first post-war Pye, don't forget that! – Ed.). The valves used were the same too – the famous, or perhaps I should say notorious, EF50s.

For younger readers who've never met this "bottle" I had better explain that it was one of the first all-glass valves, though you'd not think so to look at it since it was encased in an aluminium screening can and had a diecast metal baseplate incorporating a locating spigot for the nine short pins. The latter were not always satisfactory as regards making good contact with the valveholders, and for some service applications had to be gold-plated to overcome the problem. This was a little extravagant for civilian use, and special holders were made for the r.f. strips in the 18Ts. These had very strong retaining springs to grip the valves in position, and were generally successful.

Perhaps Pye had a lot of EF50s in stock, because they used them in the 18T for plenty of jobs besides those intended by Mullard. Of a total of eleven in these sets, six were used as r.f. amplifiers, the rest being used for video output, sync separation, field and line oscillators and even field output! As an r.f. amplifier the EF50 had a reasonably high slope of 6·5mA/V, but needed careful decoupling to ensure stability. In addition, the internal capacitances were high enough to call for realignment of the stage if a valve had to be replaced. This was obviously undesirable, but the sets remained popular for many years.

The big drawback was the need for a completely different set of coils when the BBC opened its Birmingham area station. To be fair however even superhets were not immune to problems in this respect, since they usually had to have their r.f. and oscillator coils changed. Further expansion of the TV service made this sort of thing uneconomic, and true five-channel tuners then appeared in most models. All this lay well in the future at the time of the 18Ts however.

What was an advanced feature for the time in the 18T was the use of an efficiency diode in the line output stage (see Fig. 1). Instead of providing a high boost h.t. voltage however this merely produced a low (30V) negative supply to which the cathode of the line output valve was connected, thus effectively raising its anode voltage. Since the heater-cathode insulation requirement was so modest, an ordinary half-wave rectifier valve (PY31) could be employed. The negative line was handy in providing bias for the video amplifier and a supply for the brightness control. The flyback-derived e.h.t. was also something of an innovation, since at the time most sets used a mains transformer or a special r.f. oscillator to produce the e.h.t.

The e.h.t. in the 18T was only around 6·5kV, so the picture was never what you might call brilliant – but the sets did last. One of my customers maintained a console model as a second set till well after its twentieth birthday, with the

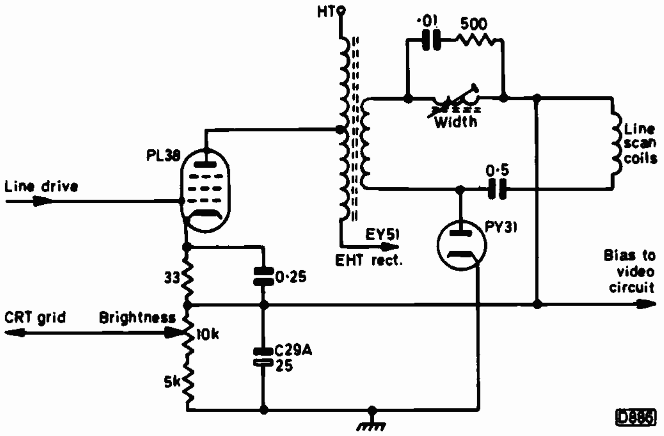


Fig. 1: The line output stage circuit used in the Pye 18T series. The PY31 efficiency diode produced –30V across its reservoir capacitor C29A.

original tube soldiering on. It must be admitted that by this time the r.f. gain had diminished so drastically that I had to fit an aerial preamplifier to get respectable sound and vision. About 85% of the set was still perfectly original though.

The h.t. was provided by a PZ30, the large double rectifier produced by Mullard for half-wave, full-wave or voltage-doubling circuits. In this chassis it was used as a half-wave rectifier, operating well within its capabilities.

The valve heaters were connected in a series chain, so on the face of it the chassis was suitable for use with either a.c. or d.c. supplies. At the time there was still a lot of d.c. around, mainly in those districts whose mains supplies dated back to the last century. Those living in such areas were debarred from using conventional TV sets unless an expensive rotary converter was used (I know – I was one of the unlucky ones!). It seems odd but Pye said rather primly in their service manual that "the 18T receivers were primarily designed for use on a.c. mains". When it became obvious that the sets would be used on d.c. the original design was modified, with a tapped smoothing choke for the h.t. supply, carrying an adjustable shorting link with "a.c." and "d.c." positions. In the former position the rectifier and choke operated as normal, but in the second the PZ30 was shorted across and a section of the choke was also shorted out to maintain the h.t. at around the same value.

It was still recommended that the input should not be below 230V, which was the total voltage required by the valve heaters and was great if, like me, your supply happened to be a miserly 210V. The unnecessary rectifier heater accounted for 52V however, so there seemed no reason why an enterprising engineer shouldn't short out part of or the whole of its centre-tapped heater.

Pye retained the a.c./d.c. shorting link system, in modified form, in many later sets, but using metal rectifiers for the h.t. supply reduced the total voltage supply requirement and removed the need for a lower mains limit. This was in the FV series, in which Pye dropped the EF50 in favour of the EF80, and a new favourite appeared – the ECL80. This was described by Mullard in their contemporary manual as "a combined triode and output pentode primarily (that word again!) designed for use in television receivers with the triode as a frame blocking oscillator and the pentode as the frame output valve". It was used in just that role in the following Pye Model FV1. It was also chosen, incredibly, as the frequency changer in the tuner unit – thus being asked to work at frequencies about a million times higher than those originaly intended. The fact that it did so perform says much for its design, but it still seems an odd candidate for this particular job.

The console Model FV2 was fitted with the dreaded MW41-1 metal-cone tube, with all its attendant problems, and was one of the first sets (the first?) to feature flywheel line sync, with an EB91 as the flywheel sync discriminator. There were three ECL80s here – frequency changer again, sync separator/field oscillator and multivibrator line oscillator. The FV4 was an amalgamation of the FV1 and FV2, with the exception of the audio amplifier – and there are no prizes for guessing which valve was chosen to take over this task!

All these sets had wedge shaped chassis that were difficult to work on, especially when dealing with components in the deep rear section.

Circuitry that had become steadily more complicated burst into full flower in the succeeding V4 series, with its innovatory automatic picture control. Pye had by this time discovered the ECC82 double triode, and threw in three of these, plus two of the inevitable ECL80s and nine crystal diodes. There were also nine EF80s, and one each of the following: EB91, PL81, PL82, PY81, EY51. Valve h.t. rectification returned, with two PY82s. The c.r.t. was supplied by either Mullard or Cathodeon, and a very dark Perspex screen was fitted to improve the picture contrast under high ambient lighting conditions. A look at the circuit diagram gives rise to the suspicion that the designers were given a brief to use as many components as possible – for there were in fact about 50 per cent more resistors and capacitors than in most contemporary receivers.

In service the line sync was not always perfect, despite the use of flywheel sync and a stabilising coil in the line multivibrator stage. The latter was resonant at 8·5kHz, and for accurate adjustment called for an a.f. signal generator and the then rare valve voltmeter. I find in my notes made at the time a simple but effective modification for obtaining stable line lock.

One great improvement over the FV series was the replacement of the ECL80 in the tuner. Instead, an EF80 was used as the mixer and one section of an ECC82 as the local oscillator. The result of all this was a very sensitive set indeed. In good reception areas you could remove the aerial connection and watch the a.p.c. system slowly restore the picture to a watchable, if grainy, level.

This brings us to early 1954, when the thirteen-channel VT2/VT4 etc. series came along. These, as they say, are another story, but the multiplicity of circuits and chassis was to continue.

VCR Clinic

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

A local TV engineer made a valid point the other day whilst I was discussing with him a couple of problems with Grundig SV4004 VCRs – the trouble with one of them was poor braking in the fast-forward mode. "It's not the repair that's the problem" he commented, "but knowing which part of the electronics can cause the various different symptoms." The editor has told me that he's received similar comments from others. It's perfectly true: but only experience, coupled with the odd hard slog – and reading *Television* of course – can make matters any easier.

What's this leading up to? A Ferguson 3V01 portable I collected from a dealer who was tearing his hair out. The replayed picture was covered with white spots, and there was a tracking error at the bottom of the screen. The dealer had cleaned the heads with AF Spray (which I find best) and had had no success. "Ah" I said with trained eye, "that's not head trouble, it's static discharge." Every video recorder has some method of earthing the static build up that occurs as the head drum whizzes around. Philips have carbon bushes inset into the top support, while JVC have some small brushes which wipe a phosphor bronze bush. A build up of dirt here will cause spots.

Telling the difference is not so simple – on some makes of VCR there's only a slight difference. On VHS machines, if the heads are low, worn or dirty the spots will be quite large in size and will cover the screen totally, leaving just a miserable semblance of picture in the background. Spots due to static are smaller, elongated and appear on the picture in a random fashion. There may also be black spots if you can see them.

I put the 3V01 on the bench and removed the bottom part of the case, the board, belt and flywheel. Then cleaned the dirty brushes. Put it all back together again and the replay was free from spots. There was still a tracking error at the bottom of the picture however – not so much a spotty tracking error, more a sort of distorted mirror image. It seemed that the head crossover point was high and wide. If the machine is replaying a known good tape, then the fault is a replay one – but is it a guide problem of something else?

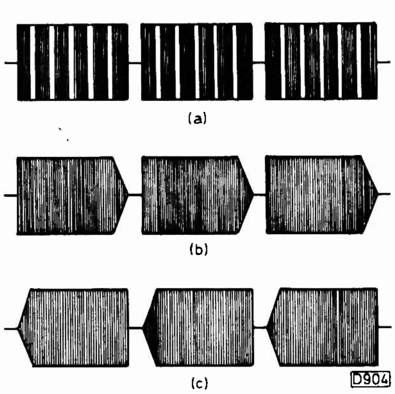


Fig. 1: (a) F.M. replay waveform, with bits of information missing, (b) F.M. waveform obtained with an exit guide error, (c) with an entry guide error.

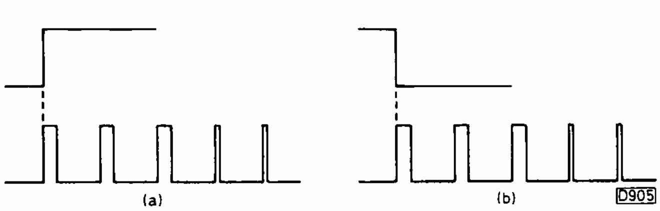


Fig. 2: Adjusting the timing of the head drum flip-flop signal. (a) Adjustment of R26, (b) adjustment of R24, Ferguson Model 3V01/JVC Model HR4100.

To check if it's the guides, very gently press each of the entry and exit guides to see whether the error clears during this process. If it does, invest in an oscilloscope and correct the guides while watching the f.m. video envelope (see Fig. 1). I put the scope on two points – TP7 on the replay f.m. preamplifier and TP1 on the audio/servo board. TP1 gives you the syncs, which can be used to trigger the scope as a reference.

The replayed f.m. signal had bits missing from it, while the envelope had vertical edges. This indicated a switching problem – had the problem been caused by the guides, the edges of the envelope would have sloped one way or the other (as shown in Fig. 1), indicating which guide was out. If you get the sort of guide errors shown, don't start adjusting anything till you've confirmed the diagnosis using a proper test tape or one you know is accurate to the VHS standard.

Back to our problem with the 3V01. The next most logical thing to do was to check the timing of the head drum flip-flop signal with respect to the video signal. This is adjustable and should be reset whenever the heads are changed. The procedure is given in the service manual, but let's give it in a little more detail. Leave one scope probe on TP1 for the replayed syncs, and put the other probe on TP3 (on the audio/servo board). TP3 is the drum flip-flop signal. Trigger the scope at the positive trigger input, and compare the positive-going edge of the waveform (see Fig. 2) with the syncs. Then adjust R26. This moves the waveform edge with respect to the syncs – if you are using the syncs to trigger the scope: if you are using the positive-going edge of the flip-flop waveform for triggering, the syncs will move. It doesn't matter which waveform you move, so long as the positive-going edge of the flip-flop waveform is left coincident with the third line sync pulse before the field blanking period. Next, compare the negative-going flip-flop edge with the syncs. Adjust R24 until the negative-going edge is coincident with the third line sync pulse before the field blanking.

Dead easy. If you've got a double-beam scope, that is. If not, run out and buy one. The 3V01 that was causing the trouble had been adjusted so that the flip-flop edges occurred about 14 lines before the field blanking. No wonder there was f.m. missing. Note that on the 3V00/HR3330 the relevant presets are R24 and R21. Oh, and the Grundig with poor braking in the fast forward mode: this was due to a dry-joint on a preset which seemed to have been thrown on to the board as an afterthought.

Intermittent Colour Fading

An HR3330 VCR came to me with a note attached saying that the colour faded intermittently on replay. The first step with a problem of this sort is to replay a known good recording, keeping an eye on the picture whilst doing six million other jobs. In the present case the colour didn't fade. The VCR might have been reluctant to show the fault whilst on the bench, but the likelihood was that the problem was occurring on record. So a three-hour recording was made. This sort of check is very educational, since you end up

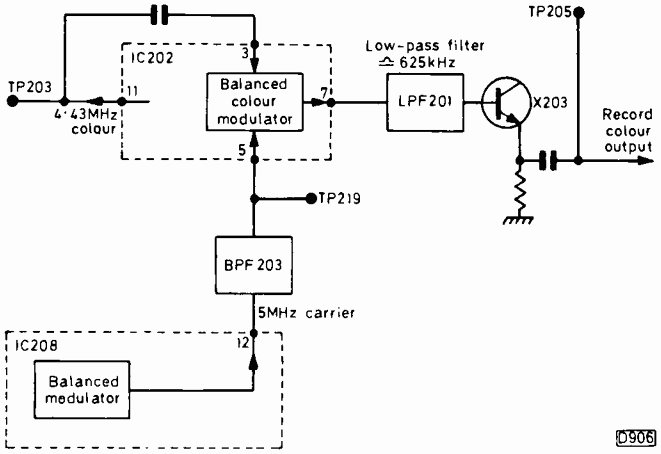


Fig. 3: Test points when checking for colour loss (HR3330).

watching all the schools' programmes for the day and learning all about those things you missed whilst making paper aeroplanes and suchlike.

During the subsequent replay the colour did indeed fade – after about an hour and a half. As a cross-check, confirm that the colour fades at the same place each time the replay is repeated. It did.

From this point on the checking procedure is as follows. Set the VCR to record/play as appropriate, and let it run or operate the pause control. On record, check the waveforms at TP203 and TP205. These two points are the input and output to the colour modulator (see Fig. 3). A colour signal was present at TP203, but not at TP205. For those of you who have not seen these two waveforms, the one at TP205 is of lower frequency – the burst has fewer cycles of waveform compared to the 4·43MHz colour signal at TP203. In fact the waveform at TP205 is at some 625kHz instead of 4·43MHz.

The next step is to check back through the circuit to discover where the signal is being blocked. A measurement at pin 5 of IC202 revealed that there was no carrier input to the balanced modulator. There should have been an 0·15V p-p 5MHz carrier signal at TP219, but all that was present was a small, residual signal of a few millivolts. Now the signal at TP219 comes via a bandpass filter, being generated in IC208, which includes an a.f.c. circuit (we've described this in previous articles). Loss of signal here could have meant that the a.f.c. circuit was at fault, the signal not being 5MHz. Luck was on my side for a change however.

It's fairly easy to measure the frequencies around the balanced modulator section of IC208, using a frequency counter, if you inhibit the head flip-flop by connecting TP222 to chassis. I didn't need to do this however since the fault was in the bandpass filter BPF203 – this was proved since there was signal input to the filter at about 5MHz, measured on the scope timebase (an a.f.c. fault would normally send the signal way off).

Fitting a replacement filter (type PU46041) cured the fault. To simplify the tale, I've omitted to mention the many times that normal working was resumed without tracking down the fault, as the filter was intermittent and very sensitive to vibration.

Drum Servo Setting – VHS Machines

In a previous issue (April 1980) I discussed the way in which the servo discriminator gain setting should be carried out in the JVC HR3300 VCR. Since then, experience has been gained with the Ferguson 3V00 and the JVC HR3330 and HR3660 machines.

Again the discriminator gain is set without power being applied to the recorder – except for an external voltage. The information given for setting up the Ferguson machine is fairly clear. Apply 1V to the output point TP15 (see Fig. 4). The drum motor is then supposed to rotate. Connect a digital voltmeter across points TP14 and TP16 (positive meter terminal to TP14, negative to TP16). The idea now is to stop the drum rotating – if indeed it's going round in the first place – and to adjust R52 so that the meter reads −5·1mV ± 0·5mV. There's no reason why the meter terminals should not be reversed to obtain a reading of +5mV.

JVC give the same procedure, but with only 0·5V applied to TP15 and the meter used to read −2·5mV ± 0·2mV. Under these conditions the drum most certainly doesn't revolve.

Do it the Beeching way instead. Apply 2V d.c. to TP15. Connect a digital meter across the discriminator inputs (TP14-16), with the positive meter probe to the positive input and negative to negative. The drum motor will then revolve, and the meter should read between −73·5mV and −75mV. When the motor is stopped by hand the reading will drop. Set it to −10·2mV ± 1mV. Do this a couple of times to ensure that when you stop the motor it's across commutator segments. This will correspond to the highest obtainable reading. Release the motor and let the reading rise to about −74mV. A slight variation is allowable.

Note that with the HR3660 the test points differ. TP12 is the positive discriminator input, TP15 the negative input, and TP14 the motor drive output test point.

Turning now to the ramp/sample-and-hold part of the discriminator (3V00/HR3330), trigger the scope's timebase off the video waveform and monitor the drum servo ramp waveform (TP9). Put the machine into the record mode and the waveform shown in Fig. 5(a) can be seen. If you now slow the head drum down by hand – very carefully – the sample pulse will travel up the following ramp slope and up over the top as shown in Fig. 5(b). Note that the sample pulse remains stationary on the display, the ramp moving. Having got the conditions shown at (b), let the drum go. The pulse will then overswing, and the aim is to obtain the situation shown in Fig. 5(c). It's most likely that on the first go the pulse will travel over a couple of periods of the ramp waveform before settling back on the slope. This is wrong. If it does so travel, adjust R49 slightly clockwise and try again.

The aim is to adjust R49 until the swing between the conditions shown in Fig. 5(b) and (c) is symmetrical. When R49 has been set correctly, the servo lock-up time has been optimised to be as fast as possible. Then, if the drum is slowed down until the sample pulse travels to the far left of

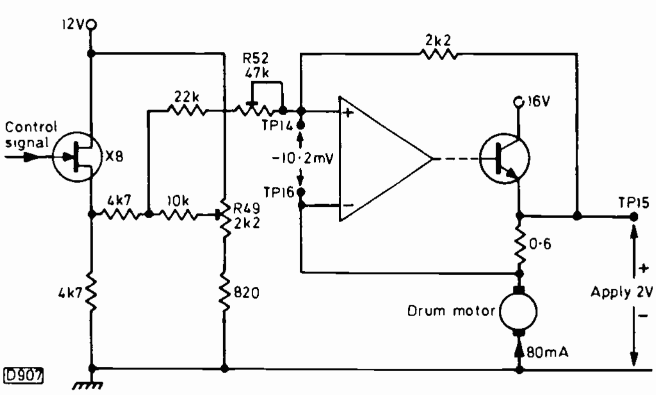


Fig. 4: Head drum servo discriminator gain setting. Test points refer to Models 3V00/HR3330.

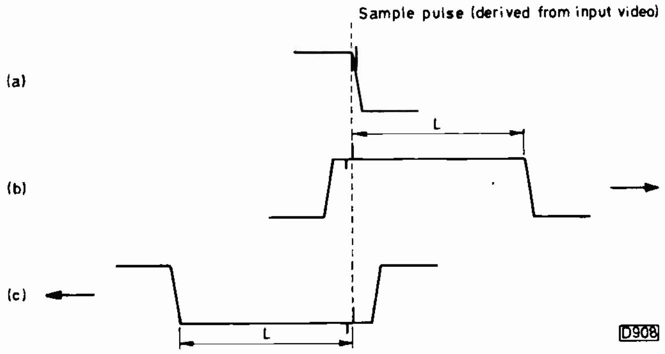


Fig. 5: Sample pulse/ramp positions.

the top flat section of the waveform, on releasing the drum the pulse should travel down the slope and along to the far right of the flat bottom edge of the waveform, without overdoing it or falling short of an equal distance *L*. This setting is correct. The servo then follows a critically damped oscillation, the pulse reversing, travelling up the slope to the top, reversing again and finally settling.

An Ailing Philips N1501

The start of this story of an ailing Philips N1501 came some months back when a friend of mine rang up. "I've just picked up an N1501 in fantastic condition" he said. So I asked him why he'd taken the trouble to ring me? Perhaps I shouldn't. "Well" he carried on, "I can't get it to tune in properly, and when I replay one of our test tapes there's a picture but no sound." Alarm bells rang somewhere. In my head I think. Dare I ask where it came from? "Belgium" was the reply, followed by "why are you laughing like that?"

Eventually the machine was brought over, and it was indeed very clean and little used. I had words with a friend at Philips Service as to the possibility of realigning it. This is not easy: the tuned transformers have to be changed, and the 5·5MHz in the modulator cannot be shifted to 6MHz without replacing at least one capacitor. So the machine was left awhile, pending further thought on the matter.

About three weeks later I had to scrap an N1500 due to an irrepairable head assembly fault. This gave me a spare tuner unit complete, and without delay it went into the N1501. All worked fine, and the results were well up to the N1500 standard – which even today is better than anything else on the market. My friend collected his N1501 and took it home. That evening there was a frantic phone call– to the effect that it was working fine, then the colour went and smoke came out and it will not unthread etc., etc. I didn't believe it: surely this couldn't be the same machine?

When I got it back it was a Saturday and World of Sport was on. I connected the VCR up, put a fire extinguisher within easy reach, and switched on. Would you believe it? The VCR recorded and replayed a treat, no smoke at all. I left it running in the record mode and made a cup of coffee. Sniff, sniff. This coffee smells funny. Then I saw the smoke. Pouring out it was, from the rear left.

The smoke was traced to one of the mains transformers, T2 – one with a thermal trip in it to prevent it burning . . . When removed, the transformer was a molten mass of nasty, bubbly plastic. A new transformer was fitted – well, not a new one as the aforementioned scrap N1500 was still around. Full operation was restored, and the machine ran for an hour or so without any signs of distress. So I put it in the lounge to use that evening. A couple of programmes were recorded and replayed: Mork and Mindy was all right, so was Wonder Woman. So the machine was left dormant.

Later, half way through the Dick Emery programme, my picture went spotty. What's this? A bang and smoke from the machine was the answer. Another mains transformer had bit the dust. I was getting a trifle annoyed.

Some weeks passed while another transformer was obtained at great expense. In it went and some checks were made on the associated circuitry. The 43V rectifier D153 was short-circuit, also the 25V series regulator transistor TS2 (2N3055). These matters were put right, but I wasn't going to risk loosing yet another transformer. So each output was connected in turn and checked. All o.k., but the voltages were lower than they should have been while the transformer was humming and getting warmer than it should. So the temperature link was disconnected and a fuseholder fitted. The current in the primary winding was high – I don't know the exact value as I disconnected the AVO while the needle was still accelerating up the scale.

Off came all the transformer connections again. Measure the no-load current. 40mA. Connect the secondaries feeding the 43V rectifier. Little change. Connect the secondaries feeding the 38V bridge rectifier. Little change. All d.c. voltages correct. What next? Panic. No, replace the white wire on tag 15 (i.e. connect the clock motor). Big flash, exit AVO cutout. Apparently a short-circuit in the clock system. So a clock motor was obtained from you know where, but to be sure a replacement was obtained and fitted. The VCR then worked properly once more, this time with a 100mA fuse in series with the transformer's primary winding. The machine ran on the bench, next to the fire extinguisher, for a few days. It was then promoted to the lounge – despite protests from my wife about burning the house down.

It was some days later when she remarked that the clock always told the same time. Despair set in. The clock was removed and inspected. Result: the motor was stalling when driving, or rather not driving, the clock mechanism. Now these clocks are expensive, so I removed the mechanism from the clock which I'd removed from . . . well anyway it did work this time and I've been using it for a while now. Does anyone want a Philips N1501 in good condition, on its third mains transformer, used only by a little old lady for recording church services . . .?

Now you may be left wondering exactly what the problem was on this machine. So was I. The failure of the power supply components was a red herring. These had failed when the second transformer had burnt out – the shorted primary winding turns and clock circuit short had presumably produced very high secondary winding voltages. As far as I can tell, the first clock motor was stalling because of damaged plastic cogs in the clock mechanism: the motor power is very low, and it doesn't take much to stop it. After a few hours the clock motor would heat up and develop a short-circuit. This is conjecture however as nothing was ever proved – except that the problem was due to the clock power supply and not the supplies to the electronics in the VCR. The clock motor is tapped across one of the primary windings, and even in the "off" mode would pass current with the result that the transformer would overheat.

When will he Learn?

Our editor had an off month last time and got one or two things a bit confused. Mainly that JVC HR3660 with no PG pulses. The reason the lower bearing had slipped was because of a missing circlip behind it in the lower drum cylinder. And it's the static discharge *bush* that's fitted under special factory conditions.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a 75p postal order (made out to IPC Magazines Ltd.), the query coupon from page 97 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.

PHILIPS 320 CHASSIS

The line output stage is taking excessive current, as a result of which the fusible resistor in the supply to the line output stage opens. Disconnecting the line output transistor removes the excessive current drain. A new line output transistor and transformer have been fitted, but the problem persists.

The most likely cause of the trouble is that the e.h.t. rectifier stick is overloading the line output stage. Remove the e.h.t. cap from the c.r.t. and if this clears the fault replace the stick. The deflection circuit can likewise be checked by disconnecting the scan coils. The first anode/focus supply rectifier or its reservoir capacitor could be defective, but we've not known these components to cause trouble.

PYE 368 CHASSIS

The picture pulls to the left and then rights itself – it also looks as if blown by a breeze. The trouble is intermittent, and all likely components in the video and sync circuits, also the main electrolytics, have been replaced.

There's a favourite though rather obscure cause of this trouble – check that the l.t. lead to the i.f. unit is not too close to the line linearity choke. It's a long sleeved wire that stretches right across the timebase board. If this is the cause of the trouble, a scope will reveal pulse pickup on the l.t. line.

DECCA MODEL 2230

The trouble is a grainy background to the picture. The colour also seems to be weak.

We'll start by assuming that the aerial is in order and that the set is receiving an adequate signal. At the rear of the tuner there's a small preset (r.f. gain). This should be set fully clockwise, but may be faulty or badly jointed to the panel to give rise to the effect described. If the control is working properly, adjusting it should produce further deterioration of the picture quality. If this is the case, the tuner unit is suspect and should be replaced.

BEOVISION 3400

The picture is blue-green with no red, though the colour-difference output stages seem to be in order.

Remove the colour from the picture. If the cyan picture then remains the c.r.t. is probably faulty, with a low-emission red gun. Retracking with the grey-scale potentiometers might help. If a good monochrome picture can be obtained however check transistors 4TR5 and 4TR7 in the decoder. These high-voltage transistors drive the R–Y demodulator and often go open-circuit emitter-to-base – betrayed by high collector and base voltages with zero volts at the emitter.

DECCA CTV25/2

A new tube has been fitted in this set, but there's an odd colour fault I can't cure. When checked with a colour-bar signal, all the colours are correct. On test card F however where there should be green in the lower part of the picture it comes up in blue. On a green scene such as a football ground green is present but is weak. The PCL84 colour-difference valves have been replaced, and the voltages around the G–Y preamplifier transistor are correct.

In the standard colour-bar signal the first bar is colourless. Thus even if the burst gating pulse is incorrectly timed the reference oscillator will lock correctly on to the burst. The test card on the other hand contains colours at the extreme left, and it seems that the reference oscillator in your set is trying to lock on to these. The root cause of the trouble therefore is that the burst gating pulses are arriving late. These are generated by Tr201 in conjunction with L200, which introduces the correct delay. It's difficult to deal with this problem without a scope, but as a start check the coupling electrolytics C203 (2μF) and C208 (0·5μF), then R205 (3·3kΩ) and L200. The positive pulse at L200 should coincide with the transmitted burst.

RANK A816 CHASSIS

When this set was obtained the only results it gave consisted of a loud hiss from the loudspeaker. After some checks the BU105/01 line output transistor was found to be short-circuit. A replacement was fitted, but I then found that there was no drive at its base. The two driver transistors seem to be in order, but the line timebase won't oscillate.

The line oscillator chip 3SIC2 and the first driver transistor 3VT16 receive a start-up feed from the h.t. line via 3R90 (15kΩ). Check this resistor and if necessary 3D9, which is included in the circuit to prevent the start-up supply being loaded down. If these components are in order and h.t. is present the SN76533N line oscillator chip is suspect.

THORN 3000 CHASSIS

The following fault is becoming more prevalent. When the picture content changes markedly, there's sometimes loss of colour – either complete, or more often loss of colour lock, horizontal bands of colour appearing across the screen. Changing channel invariably restores the colour, and the fault may not recur for several days.

Colour drop out on these sets is usually due to a fault or maladjustment in the pulse circuitry on the decoder panel, as a result of which the burst gating pulse gets delayed or misshaped. Suspect components are the pulse clipper diodes W315/W323, and the pulse coupling components R351 (220kΩ) and C334 (82pF). Make sure that the pulse width control R354 has not been turned too far clockwise, and that the line hold is correctly set.

ITT VC200 CHASSIS

On switching the set on a white screen is obtained but the picture takes some time to appear. The voltage at the collector of the video output transistor is high while the screen is blank, but falls to the normal level when the picture comes on. Replacing the BF257 video output transistor has not made any difference. The picture is also grainy, and there's hum.

The slow warm-up is probably due to R159 in the width circuit increasing in value or a lazy PL504 line output valve, thus delaying the rise of the 20V line which is obtained from the line output transformer. It would also be as well to check the 20V supply electrolytics C130/C132. The grainy picture could be due to a poor aerial signal or low-gain tuner, but first ensure that the a.g.c. control R38 works – if necessary check its connections to the i.f. strip via the print joints. If the hum persists after the other faults have been rectified, replace the smoothing block C84-7.

RANK A640 CHASSIS

We have a similar fault on a number of these sets (Bush TV161 series), namely a vertical line down the centre of the screen. The PCF80 line multivibrator valve has been replaced, also the line sync diodes 3MR1/2, using a matched pair, but the fault persists.

If the vertical line is a thick black bar with filmy flyback effects present, the fault is false line lock and we agree that 3MR1/2 are the prime suspects. A couple of 1N4148 diodes should do, ensuring that they are new and tested. If this fails, check the flyback pulse coupling resistor 3R2 (68kΩ) and the integrating components 3R68 (680Ω) and 3C3 (3,300pF). If on the other hand the vertical line is a white one, there's a defect in the drive waveform to the line output valve. The components to check in this event are the load resistor 3R15 (56kΩ) and the waveform shaping components 3R18 (120kΩ) and 3C14 (820pF).

ITT CVC7 CHASSIS

There's tuning drift and the picture is grainy. The tuning voltage stabiliser i.c. has been changed, but the only way in which tuning can be maintained is to constantly adjust the associated preset R41.

In this set tuning drift can be caused by leakage in one of the potentiometer hold-off diodes D1001-D1006 on the Feathertouch board assembly. In view of the grainy picture however, and assuming that the aerial signal is adequate, we feel it's more likely that the varicap tuner is faulty. The best course would be to check it by substitution.

SONY KV1810UB

The trouble with this set is pincushion distortion at the sides of the screen. The pincushion driver transistor Q586 seems quite happy, with 17V at its collector, 8V at its base and 7·5V at its emitter. Where do I go from here?

We assume that the pincushion amplitude and bias controls VR585 and VR586 are not working. The base and emitter voltages on Q586 are excessive – they should be 4V and 3·5V – which suggests leakage in the coupling capacitor C585 (4·7μF) or a problem in the pincushion bias network R589/VR586/R590/R591/C566. The transistor or its emitter resistor R594 (82Ω, 2W) could also be faulty.

RANK A823A CHASSIS

The initial problem with this set was a burn up on the power supply panel – under the thermistor. The panel was replaced, and the two decoder i.c.s on the adjacent panel changed, but there's a problem with the colour. It doesn't appear until an hour or so after the set has been switched on, or perhaps on changing channels. What action do you suggest?

First check whether the ident control 3RV4 is set correctly – rotate it slightly anticlockwise to see whether this restores colour. If not, the problem is likely to be in the chrominance module "Z" on the i.f. panel. Check for bad joints within the module, then if necessary replace the transistors and electrolytics. Alternatively the module can be obtained as a complete assembly.

GEC HYBRID COLOUR CHASSIS

The problem with this set is a form of cogging and bent verticals, affected by the video information. The sync separator and video circuitry have been thoroughly checked but to no avail.

This effect is commonly caused by poor earthing of the c.r.t.'s Aquadag coating on these sets. The h.t. smoothing should also be checked. If the beam limiter is correctly set, bent verticals can often be corrected by reducing the value of R505 (100kΩ) in the flywheel sync filter circuit.

ITT CVC5 CHASSIS

The picture suddenly goes grainy – as if a lace curtain has been drawn in front of it. The colour and sound are not affected. The fault may occur when the set is first switched on, or some hours later, and can usually be cured by a sharp tap on the top of the set.

The usual cause of this trouble is a break in one of the printed tracks. Find the tuner a.g.c. control (R118d) and follow the print from its slider to the point where it enters the i.f. strip. This is the usual trouble spot: it may be necessary to bypass the junction with 5A fuse wire.

RANK A823 CHASSIS

The set failed and it was discovered that the 10kΩ resistor in series with the e.h.t. feed to the c.r.t. had burnt out. This was replaced, but when the set was switched on the new resistor started to overheat after a minute or so. The set was tried with the e.h.t. lead disconnected, and all voltages, including the e.h.t., were found to be about right. With the e.h.t. lead briefly connected and then disconnected, a high charge is still present on the tube. I'm left suspecting a fault in the line output stage.

Your e.h.t. tripler is leaky – this will allow a pulse voltage to be applied to the virtual short-circuit which the c.r.t. capacitance (over 2,000pF) presents to the tripler. It's unlikely that there's any other defect in the line output department.

GEC 2033

There's a peculiar horizontal linearity fault on this dual-standard hybrid monochrome set – the centre of the screen is cramped compared to the left- and right-hand sides. I've replaced the line timebase valves and tried adjusting the linearity sleeve on the tube neck, but no improvement has been obtained.

The trouble could be due to the line output transformer or the scan coils, but there are one or two simpler things worth checking. First the scan correction capacitors – the 625-line one is C232 (0·11μF) – and secondly the components in the line drive waveform shaping network – R227 (39kΩ) and C225 (0·001μF).

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TELEVISION DEC. 1980

RANK A816 CHASSIS

The trouble with this set is lack of height – the vertical scan occupies only about a third of the screen. The sound is o.k.

If the vertical scan is linear, suspect the height control 3RV3 and its series resistor 3R56. A less likely suspect is the thermistor 3TH1, which is also in series with the height circuit and is mounted on the scan coil assembly. If there is nonlinearity or foldover, check that the supply to the field timebase is correct – 23V across 3C36 (2,500μF). Then suspect the direct-coupled transistors 3VT11-14, checking and replacing as necessary. The scan coupling capacitor 3C31 (1,000μF) and 3C35 (10μF) in the linearity circuit could also cause this effect. If 3VT14 has to be replaced 3C32 should also be renewed, using a 1·5μF type.

SONY KV1800UB

This set worked well for several years then produced the no sound or raster symptom, though the power supply seems to be o.k. and the tube heaters light up. The only thing I've been able to find is that Q851 and Q852, which are on a small panel to the right, are both short-circuit collector-to-emitter. Unfortunately the markings on them don't appear to be the type numbers.

These two transistors form a rather unusual e.h.t. regulator arrangement – they are connected between the emitter of the "horizontal converter" transistor Q802 and chassis to control the impedance at this point. The converter stage is between the line driver and output stages, and feeds the e.h.t. tripler. Q851 is type 2SA677 and Q852 type 2SD291. Failure of one probably overloaded the other, but we suggest you check the efficiency diode D802, and the electrolytic C852 (0·47μF) in Q851's base circuit, before switching on after replacing the two transistors.

ITT VC200 CHASSIS

With the aerial disconnected, a normal raster is present. Touch the aerial socket with a finger and a reasonable picture and normal sound are obtained. Connect the aerial and the sound is still present but the raster disappears. Disconnect the aerial and the tube remains blank, though momentarily short-circuiting the base and collector of the video output transistor will restore the raster. The i.f. module and the video output transistor have been replaced but the fault remains. The only thing I can find wrong is the voltage on the a.g.c. line, which is slightly positive instead of negative.

We suspect that the fault is a.g.c. lockout – the strange a.g.c. voltage you have bears this out. The usual causes are either the a.g.c. diode D2, transistor TX7, or the a.g.c. gating pulse coupler C65. The only sure way of checking these components is to replace them. The video driver transistor TX6 could also be to blame, but this is less likely.

TEST CASE

216

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.

No picture was the symptom reported on a Rank colour set fitted with the A823 chassis. The technician who called found that the h.t. fuse 8F3 was intact, but that one section of the power resistor (8R15 h.t. filter resistor plus 8R17 anti-breathing resistor in the feed to the line output stage) was open-circuit. This component is not very accessible, but after a struggle the technician had a new one in and connected up. To his dismay, when the set was switched on the new power resistor immediately showed signs of overheating – clicking and smoking.

A picture of sorts was present – undersized and distorted. So a voltage check was carried out at the downstream end of the afflicted resistor: the reading was way below the correct 200V. Theory suggested that excess d.c. was being passed by the resistor, so the h.t. fuse was removed and the meter, on a d.c. range, was connected in its place. The current was found to be about 100mA, much less than normal. The weary technician assumed that there was leakage in the h.t. smoothing electrolytic 8C10, but a d.c. check on 8R15 revealed no excessive current flow!

Understandably, the technician loaded the set into the van and returned it to the ranch. On the bench, the new power resistor already looked tired. So another was hooked into the set, with long leads. The set was switched on and within a minute or two the new resistor was scorching the bench, though the set was not presenting its power supply with an abnormally high load. A further test with the meter revealed the cause of the trouble, which was resolved by replacing one component. What was the test and which component did the trick? See next month for the answer and another item in the series.

SOLUTION TO TEST CASE 215
– page 43 last month –

We left our intrepid workshop staff scratching their heads over the Panasonic TC2204 colour set with its curious display. The observed picture suggested poor clamping of the drive to the green gun, with streaking and background colour changes, though a look at the drive waveform at the green cathode and electrode voltage checks showed nothing abnormal. The set uses RGB drive to the cathodes, but we should perhaps have paid more attention to our thoughts about hybrid sets using colour-difference drive – because the set's green grid (pin 14) was floating! Visual inspection showed that the feed resistor to the green grid (R358, 1·5kΩ) was physically broken. It may well have been so since delivery – the set had been installed quite recently. A new resistor, plus resetting of the grey scale, put things to rights.

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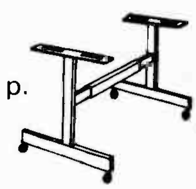

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175 + 100 + 100mfd	3500	**£1.75**
200 + 200 + 75 + 25mfd	CVC5	**£1.70**
200 + 200 + 150 + 50mfd	2047	**£1.70**
200 + 200 + 100 + 32mfd	169	**£2.20**
300 + 300 + 150 + 100 + 50mfd	2040	**£2.60**
1000mfd 63v.	3500	**50p**
2200mfd 63v. (PC)	G9	**80p.**
1250mfd 50v.	691	**45p.**
4700mfd 25v. (PC)	1590	**60p.**
2500 + 2500mfd 30v. (PC)	A823	**90p.**

PLASTIC FILM CAPACITORS

Mains Filter Capacitors 250v. AC working

0.047mfd	**26p.**	0.22mfd	**42p.**
0.1mfd	**36p.**	0.33mfd	**48p.**
1.0mfd (Three wire type)	**45p.**		

1000v. DC range

0.047mfd	**22p.**	0.22mfd	**42p.**
0.1mfd	**28p.**	0.47mfd	**54p.**

2kV Flyback suppression type

4700pF	**28p.**
5200pF	**35p.**
11,000pF	**48p.**

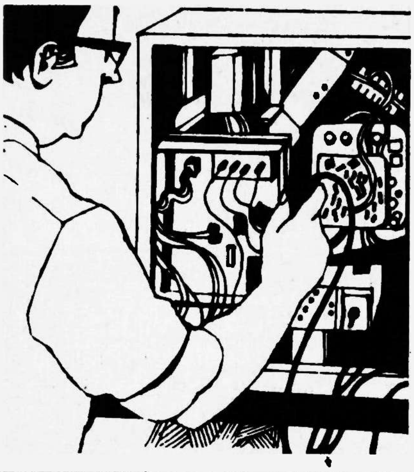
Scan correction type

0.91mfd G11.	**44p.**

P. E. WHITE

22 York Road, Camberley, Surrey GU15 4HR.

CASH WITH ORDER PLEASE
All the above prices are for single items.
PLEASE ADD 30P. PER ORDER TO COVER POSTAGE AND PACKING.
ADD VAT AT 15%



SMALL ADS

The prepaid rate for classified advertisements is 25p per word (minimum 12 words), box number 60p extra. Semi-display setting £4.80 per single column centimetre (minimum 2·5 cms). All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Television, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

NOTICE TO READERS

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

SETS & COMPONENTS

TV PANELS & MODULES

Designed and manufactured by **LEDCo.** Used by the leading TV rental and maintenance companies.

PHILIPS G8 SERIES

NEW!! Convergence Panel (Rear Mounted) for 550 **£27.60**
A.F.C. Module **£6.50**
Vision Gain Module **£8.28**

PHILIPS 570 – PYE 713-715-735 etc.

I.F. Filter/Gain Module **£11.45**
Detector Module **£10.30**

PYE HYBRID RECEIVER

Solid State CDA Panel
Ready Built **£21.00**
In kit form **£16.95**
Audio Module (LP1162 equiv) **£6.60**

All prices include VAT and 1st class postage. Quantity discounts and credit terms available. Ask for details.

LEDCo London Electronic Development Co.
21-23 Clifford Rd., London SE25 5JJ
Tel. 01-656 7014

COLOUR TUBES

Rebuilt with new electron gun, to British Standard. High temperature pumping.

Here is what you pay.		VAT
17-18-19 inch	£29	4.35
20 inch	£30	4.50
22 inch	£31	4.65
25 inch	£34	5.10
26 inch	£35	5.25

Guarantee 2 years.
Exchange basis.

CALLERS ONLY

TELESTAR TUBES
575c Moseley Road, Birmingham B12 9BS.
Tel: 021-440 5712.

TENDERS INVITED

For supply of 22" & 26" Colour TV receivers refurbished and prepared for use with V.H.S. cassette recorders on band 3 VHF system B (5.5 MHz sound offset).

Sets preferred to be of modular construction EG 3500 series converted to VHF. Other makes acceptable if continuity of supply can be assured.

Initial requirement 50 sets per month increasing to 100 per month.

Please send full details including price and earliest date for commencement of supply, to BOX No. 157.

EXTRA SPECIAL COLOUR TV OFFER. 22"/26" Bush double chip 1122/1126 chassis and good working order. Singles at £60.00. 3 for £150. Normal Workers with good tubes. Singles at £40.00. 3 for £100. Further discounts on quantity. Mail order add £10.00 p/p per set. All prices plus VAT. Only at Tritel North, 1043 Leeds Road, Bradford BD3 8ES. Tel: Bradford 0274 665670.

G6 SPARES. ELECTRONICS. SAE. Early radios. Sole. 37. Stanley Street, Ormskirk, Lancs.

COLOUR PANEL EXCHANGE SERVICE

BRC 3000/3500, 8000/8500
Philips G8, GEC 2110, Decca Bradford.

Free delivery in London area. Three month guarantee on all exchange panels.

Also Ex Equipment Panels for sale, all guaranteed in good working order. Example BRC 3500 Power, and Line scan **£19.55** each. Frame I.F. Video Decoder **£13.80** each inc. VAT.
Plus **£1.50** Postage.

Catalogue available, send S.A.E.

KAY JAY TV SERVICE,
34, Clauson Avenue,
Northolt, Middlesex.
Phone 864-0350.

TV DX.

High Quality Equipment Supplied by **THE** specialist in the DX field.

Some of my products:–

Band I sound/vision notch filter. Please state channel **£17.95.**
Band I/II tunable Mosfet preamplifier. 25dB gain. Very low noise/cross modulation figure. **£27.95.**
Band III tunable Mosfet preamplifier. 24dB gain. Highly suitable for use in locations near band II FM stations **£25.95.**
Tunable set side Uhf preamplifier. Highly suitable for areas where conventional preamplifiers will not work due to high level local signals. Mains **£24.95.**
Philips G8 selectivity modules. Gives extra IF selectivity to your TV **£1.10.**

TV DX receivers available. Please send sae for my product list to:

H. COCKS,
Cripps Corner,
Robertsbridge,
Sussex.
Tel 058083-317.

The above prices include post/packing. Callers welcome – Please telephone first.

REPOSSESSION of C.T.V. all makes available also S/S Mono very competitive prices for quantity, export a speciality. Sinclair & Chamberlain Ltd., 021-356 7171. Ext. 2.

LOOK!

THORN 3000/3500 & 9000 TRIPLERS
High Quality Silicon Replacement Units
T3500 only **£4.95** inc. P.P. Add 74p V.A.T.
T9000 only **£5.45** inc. P.P. Add 82p V.A.T.
Quotes for 50+. *1 Year Guarantee*

WING ELECTRONICS
15, Waylands, off Tudor Road, Hayes End, Middlesex.

TV WHOLESALE SUPPLIES LTD

THE SPECIALISTS FOR

Good quality colour and Mono TVs. Fresh stocks in every week. Why not call and see our selection of PX, re-possession and ex rental TVs.

★ COMPETITIVE PRICES
★ FULL TEST FACILITIES.
★ DELIVERY ARRANGED IF NECESSARY.
★ SPARES FOR MOST MAKES OF MODERN RECEIVERS.
★ PLUS REGUNN TUBES AT COMPETITIVE PRICES.
★ ALSO EXPORT OUR SPECIALITY.

TV WHOLESALE SUPPLIES LTD.
35 SHIPSTON ROAD, STRATFORD-UPON-AVON, WARWICKS.
TELEPHONE (0789) 4424.
Open 9.30 till 6.30 6 days a week.
On the main A34 Oxford road.

STS

FOR QUALITY USED T.V.s

200 EX RENTAL COLOUR AND MONO TVs ARRIVING WEEKLY

GOOD CLEAN CABINETS

Bush ★ Decca ★ GEC
Pye ★ Philips ★ Thorn
Grundig ★ Sanyo ★ ITT Etc

TROLLEY STANDS AND ALL SIZE REGUN TUBES.

DELIVERY IF REQUIRED

Call or phone now to:

SOUTHERN TRADE SERVICES
21 COLINDALE AVE., LONDON NW9
TEL 01-200-7337.

Southern Valve Co.,

2nd Floor, 8 Potters Road, New Barnet, Herts.

Tel: 01-440 8641 for current prices & availability, all popular valves stocked. **NO CALLERS**, SAE Lists. Cash with order. Same Day Postal Despatch. (Lunch 12.30-2p.m.)

Valves, Tubes, Aerials etc by LEADING-MAKERS. Send SAE Lists or Phone for current prices. Counter or MAIL ORDER. NO COD. Speedy Despatch assured. No order under £1.

Philip Bearman, 6 Potters Road, New Barnet, Herts.
Tel: 01-449 1934/5 (1934 Recording Machine).
Please phone for opening hours.

QUALITY REBUILT TUBES

HIGH TEMPERATURE PUMPING

COLOUR (2 year Guarantee)

90° up to 19"	**£31**
90° 20"–22"	**£33**
90° 25"–26"	**£36**
110° and PIL	**£38**

MONO (including thin necks) from **£12.**

All prices + VAT

Delivery UK Mainland £6.

4 year Optional Guarantee

Send or phone for full list and terms.

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

LLOYD ELECTRONICS

63 North Parade, Grantham, Lincolnshire

PL802/T Top Quality Solid State Valve • **£2·50** each.
Solid State C.D.A. Panel for 'Pye' 203/205 series • **£19** each.
I.F. Gain module for 'Pye' 713/731-series • **£9·50** each.
Replacement 'Rank/Bush/Murphy' Power Supply Panel (A823) **£17·50.**

VAT & P/P Included
QUANTITY DISCOUNTS

SUFFOLK TUBES LIMITED

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

SUPPLIERS OF MONO AND COLOUR TUBES TO MAJOR RENTAL COMPANIES.

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

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

BRITAINS LARGEST INDEPENDENT REBUILDER FOR 21 YEARS.

VALVE LIST

ALL VALVES FULLY TESTED

Five valves or over postage paid
Under five valves postage 6p each

DY86/87	15p	PC900	8p	PCL85/805	20p
EB91	12p	PCC84	8p	PL36	20p
ECC82	10p	PCC85	20p	PL504	25p
ECL80	8p	PCC89	8p	PY32/33	15p
EF80	8p	PCC189	8p	PY81/800	15p
EF85	8p	PCC805	15p	PY801	20p
EF183	10p	PCF80	8p	U191	15p
EF184	10p	PCF86	15p	6F23	15p
EH90	13p	PCF805	20p	6/30L2	15p
EY86/87	13p	PCL82	15p	30F5	10p
PC86	15p	PCL83	15p	30FLI	20p
PC88	15p	PCL84	15p	30PL14	15p

AND MANY MORE AVAILABLE

S. W. ELECTRONICS
114 Burnley Road, Rawtenstall, Rossendale, Lancs.

TV PATTERN GENERATOR

UHF output, plugs straight into aerial socket, provides cross-hatch and peak white patterns, size 100 × 75 × 40mm.

£17.75

price includes battery, P&P, and VAT.

Further details of this and our other products on request.

C. L. JERVIS,
15 Mercer Grove,
Wolverhampton, WV11 3AN.
TEL (0902) 736606.

TELETRONIC (NORTH EAST) LIMITED.

"SEE-VU" Works,
Strangford Road,
Seaham, Co. Durham.
Tel. (0783) 812142

Competitive – Reliable
REBUILT COLOUR TUBES
Hot pumped and Rebanded
Two year guarantee – Four Year Available
ENQUIRIES WELCOME

Ask for our list of sixty types JAPANESE 'IN LINES' and 20AX.

The North-East's largest rebuilder.
Established 1957

Mono tubes also available.

REBUILT COLOUR TUBES

19" £29.50, 20" £29.50, 22", 25", 26" £30, *one year guarantee*
Colour TV's from £55 working

MATRIX TV LTD.,
112 Essex Road, London N.1
01-226-1111.

EUROLEC VIDEO SERVICES
35 Sandy Lane South, Wallington, Surrey SM6 9RF.
Telephone: 01-669 2611. Telex: 893819 EURLEC G.

All prices shown include VAT at the current rate. Unless otherwise stated, all items have had some commercial use.

21" Racal video tape, new, low energy, **£10.00** per 10" spool, **£5.00** per 7" spool. Small quantity 1" high energy available. ¼", new, **£7.50** per spool. ¼" low density, **£5.00** per 7" spool. (Pse add 20p P&P per tape.) Carriage on 1" tape by arr.

16mm "C" mount TV lenses, with focus, **£10.00.** Other lenses in stock or on order.

New 9" RCA video monitors, metal cases, **£108.00** plus carriage. National 9" monitors, req slight mod for CCTV use, **£45.00** plus carriage. With circuit.

Camera auto sequential switching units, 240v AC from **£15.00.**

New CCTV cameras, British made, ¼ vidicon, 16mm lens, 1v p – p output. Data supplied. New, **£100.00.** First grade (used) **£70.00.** Second grade (low or marked vidicons) **£55.00.** Some items not up to above specs, complete with lens and vidicon, various makes, **£40.00.** (Note: All cameras advertised are solid state.) *These cameras are entirely suitable for use with VHS recorders and will produce good quality recordings.*

Sturdy tripods, extending three section legs, new and boxed, suitable for above cameras, **£22.00.**

Philips video cassettes, broken or damaged tape, **£3.00.** Ditto, VC 30 (LVC 60) from advertising houses, complete and in good condx, **£4.50.** Pancakes of video tape, suitable for rebuilding above, 1750 feet, **£3.50.** Pse add 10p P & P per item.

Imported E180 video cassettes, new but badly stored, hence slightly spotty pictures **£6.00** only. Regret all E 120 sold. (We have been told by customers who have bought these cassettes that the quality is greatly improved once the tape has been used a few times.)

JVC Umatic recorder player, 6000 E, RF out, **£400.00.**
Sony 1810 ditto, **£400.00.** Brand new 6000 E, list £1200, **£650.00** only. Used but sound Umatic cassettes, **£6.50** plus 20p P & P per cassette. Colour cameras, monitors and recorders normally available – enquiries welcome. CCTV installations supplied and/or fitted nationwide. We also offer a complete hire service of colour and monochrome eqpt.

Overseas enquiries welcome.
TERMS: Cash with order.
SAE pse all enquiries. Callers by appt only pse.

MAIL ORDER ADVERTISING

British Code of Advertising Practice

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

Mail Order Protection Scheme

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

(1) You have not received the goods or had your money returned; and

(2) You write to the Publisher of TELEVISION summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

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

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

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

COLOUR T.V.s

PHILIPS G8 COMPLETE

22" £55 26" £65

DISCOUNT FOR BULK BUYERS

TEL: 965 1230 & 961 3997

SMITH ELECTRONICS,

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

TRADE TELEVISIONS

Fill your Christmas Stocking with our TV goodies then you're ready for the Xmas rush. Quality sets, with good cabinets at sensible prices. (The rubbish is thrown out.) We supply working or not to your requirements, with discounts on quantity purchases.

*(*Bring this ad with you, it could be worth an extra 5% discount.*)*

W-I-D-E selection of makes & models to choose from, colour or mono.
Ex equip tubes & panels, e.g. Thorn 3500 etc. CTV tubes **£15.00** each, pic tested. Plus stands, legs & slot meters.

**VALID UNTIL 31st DEC. 1980, DOES NOT APPLY TO SPECIAL OFFERS.*

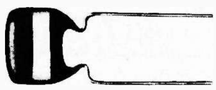
Call and see us soon, we have the stock, if you have the cash.

You won't be disappointed.

GENERAL FACTORS

UNION ST, DONCASTER.
TELEPHONE (0302) 49583-68416
Mon-Sat 9 to 5.30

Good Motorway access from most parts of the country.



250 V d.c. working (160 V a.c.)
POLYESTER CAPACITORS

Prices per pack of five
·01uF, ·022uF, ·047uF, ·1uF **35p.**
·22uF—·47uF **60p.**
1·0uF–2·2uF **£1·60.**

Postage & Packing 30p, no VAT

VELCO ELECTRONICS
9 Mandeville Terrace, Hawkshaw, Via Bury, Lancs.

TELFURB T.V. LTD.

No. 1 in

- ★ Used colour T.V.'s
- ★ Competitive prices
- ★ Technical expertise
- ★ Fully equipped premises.
- ★ Export

Phone or Call

51-53 HIGH STREET, WHEATLEY, OXFORD.
086-77-3849

SIDCUP TUBES

Good quality high vacuum colour tubes, all fitted with new electron guns and tested at 50 KV. Standard picture test and screen check all at low competitive trade prices.

17–18–19 ins.	**£22.50**
20 ins.	**£23.50**
22 ins.	**£24.50**
25 ins.	**£27.50**
26 ins.	**£28.50**

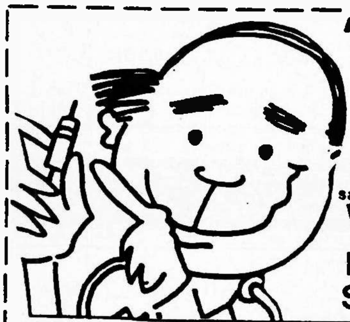
Guarantee 1 year.
2 and 4 year guarantees optional.
Extra carriage £5.00.

SIDCUP TV TUBES,
6, Norman Parade, Maylands Drive, Albany Park, Sidcup, Kent.
Phone: 302 7361.

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

TUBE REGUNNING PLANT complete with full training. Tel. 0742 583845.

DX–TV – THE SPECIALISTS. South West Aerial Systems, 10, Old Boundary Road, Shaftesbury, Dorset.



"Just what the doctor ordered"!

TUBE TEST INSTRUMENTS
TX80 PROFESSIONAL £48.85
TX50 LOW COST SERVICE TESTER £29.50
TX50 COMPLETE KIT OF PARTS £21.00
sae for full details.

WERNETH ELECTRONICS LIMITED
FREEPOST. PO BOX 9. MARPLE. STOCKPORT. CHES. SK6 6YE.

WERNETH ELECTRONIC PRODUCTS· WINNINTON ROAD·MARPLE·STOCKPORT·CHESHIRE·

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20 AX & P.I.L. TUBE

Colour Tubes	from **£25**
20 AX all sizes	from **£25**
Toshiba P.I.L. All Sizes	from **£20**
Top quality Regun 90°. All sizes	**£28**

RING: JEFFRIES 01-845 2036

IRISH TV DEALERS

Call now for a full range of colour and mono TVs. All sets sold working. Delivery can be arranged to any part of Ireland. Call write of phone:

TELESCREEN
Bellanaleck Quay, Near Enniskillen,
Co Fermanagh, N. Ireland
Tel: Florencecourt 388.

NOTICE TO READERS

When replying to Classified Advertisements please ensure:

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

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

FOR SALE

COLOUR TV PORTABLE PANELS UHF Varicap Tuner & Touchtune panel, Vis. & Sound IF, Sound output, Chroma Decoder on panel 250×200 m/m. Send Cheque/P.O. **£17.50** to 'Vision On', 171 South Ealing Road, London W5.

NEW BACK ISSUES of 'Television' available 90p each post free. Cheque or uncrossed P.O. returned if not in stock. Bell's Television Services, 190 Kings Road, Harrogate, N. Yorkshire. Tel: (0423) 55885.

QUALITY REBUILT COLOUR TUBES REBANDED
2 YEAR GUARANTEE
20"/22" only £28 + VAT
26" only £31.00 + VAT
Call and collect or delivery arranged.
TRITEL SCOTLAND
Peacock Cross Industrial Estate,
Burnbank Road, Hamilton.
Tel: (0698) 282141

MODERN TUBE REBUILDING PLANT. Process all T/V tubes £35.00. Can be seen in operation. 021-523-8181.

VETERAN & VINTAGE

"SOUNDS VINTAGE"
The only magazine for all vintage sound enthusiasts packed with articles by top writers covering gramophones phonographs 78s, wireless, news, history, reviews, etc.
Bi monthly. Annual subscription £6.00 (airmail extra). Send 75p for sample copy.
28 Chestwood Close, Billericay, Essex

BOOKS & PUBLICATIONS

FULL REPAIR data any named T.V. £5.50, with circuits, layouts, etc. £7. (AUST) 76 Church Street, Larkhall, Lanarks ML9 1HE.

EDUCATIONAL

BETTER JOB! BETTER PAY!

GET QUALIFIED WITH ICS IN:
COLOUR & MONO TV SERVICING
COLOUR & MONO TV ENGINEERING
COLOUR & MONO TV MAINTENANCE
PLUS: Telecommunications, radio, electronics, electrical engineering, technical communications, radio communications, etc., etc.,
NEW: Self-build radio courses with free kits
Train in your own home, in your own time with ICS, the world's most experienced home study college.
RETURN THIS COUPON TODAY FOR FREE BROCHURE!

ICS Int. Correspondence Schools
284B Intertext House, Stewarts Rd.
London SW8 4JJ. Tel: 01-622 9911
Name ....
Address ....
....

TELEVISION COMPUTER & RADAR SYSTEMS SERVICING

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

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

Each of the above Modules are 12 weeks in duration. Individual Modules can be arranged for applicants with suitable electronics background.
Tuition fees (UK & Overseas) £400 per Module. – Computer Module £500.

Next session starts January 5th.

(Also available 2½ year course in Marine Electronics & Radar.)

Prospectus from:

LONDON ELECTRONICS COLLEGE

Dept: TTB12, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.

MISCELLANEOUS

RIGONDA AGENTS. For all spares and repairs. Fast dispatch trade service available. 01-476 1928. Star Radio, 272 Barking Road, London E.13.

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

WANTED

NEW VALVES and CRT's required, PCL805, PL504, PL509, PY500A etc. Cash waiting. Bearman, 6/8 Potters Road, New Barnet, Herts. Tel: 01-449 1934/5.

T.V. SERVICE SHEETS wanted in clean condition. 25p each offered. Write Box No. 156.

PRE-WAR T.V.'s. WANTED, also, Bush Bakelite T.V., Screen Magnifying Lens and any early T.V. Literature, Pamphlets etc. Rugeley (088-94) 77612.

PLEASE MENTION TELEVISION WHEN REPLYING TO ADVERTISEMENTS

SERVICE SHEETS

G.T. THE TECHNICAL INFORMATION SERVICE
76 CHURCH STREET, LARKHALL, LANARKS ML9 1HE.
Over 200 different colour T.V. service manuals in stock.
1000's of other manuals in stock for immediate delivery.
PHONE:— 0698 883334
Any single service sheet £1 + large SAE.
S.A.E. for free newsletter + bargain offer, e.g. Service sheets from under 40p, etc. + quotations for any service sheets/manuals etc. + free price lists.
FREE £4 WORTH OF VOUCHERS send very large s.a.e. and £2 for our 2 GIANT SERVICE SHEETS & MANUALS CATALOGUES
NEW 1980 BRITISH COL. TV REPAIR MANUAL £5·50 post paid.
4 Colour T.V. Repair Manuals – 2 British, 2 Foreign for **£19**
All 6 McCourt British T.V. Repair Manuals Colour & Mono **£29**
British CTVs – Circuits & Layouts – updated in 3 huge binders **£37·50**
Open Weekdays 4–6 pm. Saturdays from 10 am.

SERVICE SHEETS, Radio, TV, etc., 10,000 models. Catalogue **24p** plus SAE with orders-enquiries. Telray, 154 Brook Street, Preston, PR1 7HP.

SERVICE SHEETS from 50p and S.A.E. Catalogue 25p and S.A.E. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex.

30,000 SERVICE SHEETS IN STOCK COLOUR MANUALS ALSO AVAILABLE
TV Monos, Radios, Tuners £1. Tape Recorders, Record Players, Transistors and Stereograms + S.A.E. from £1.25 each except Colour TV Circuits £2. Car Radios from £1.25. All Radiograms from £1.25.

State if Circuit will do, if sheets are not in stock. All TV Sheets are full length 24 × 12, not in Bits & Pieces. All other Data full lengths. Free Fault Finding Chart or TV Catalogue with order. Crossed PO's Returned if Sheets Not in Stock.

C. CARANNA, 71 BEAUFORT PARK, LONDON NW11 6BX. 01-458 4882. MAIL ORDER SAE.

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Television for ....
insertions. I enclose Cheque/P.O. for £ ....
(Cheques and Postal Orders should be crossed Lloyds Bank Ltd and made payable to Television)

NAME ....
ADDRESS ....
....

Send to: Classified Advertisement Manager,
TELEVISION,
GMG, Classified Advertisement Dept., Rm. 2337,
King's Reach Tower, Stamford Street,
London SE1 9LS. Telephone 01-261 5846.
Rate
25p per word, minimum 12 words, Box No. **60p** extra.

Company registered in England. Registered No. 53626. Registered Office: King's Reach Tower, Stamford Street, London SE1 9LS.

It's easy to complain about advertisements.

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STANDARD T.V. TUBE

HIGH QUALITY COLOUR AND MONO-CHROME REPLACEMENT TUBES AT COMPETITIVE PRICES.

- ★ Complete New Gun fitted to every Tube.
- ★ Two year Guarantee
- ★ Every Tube Electrically Tested.
- ★ Every Tube Picture Tested.
- ★ Supplier to Major Rental Companies.

18", 19"	£25
20", 22"	£27
25", 26"	£29

All prices quoted assume the return of your old glass rebuildable condition. Old CRT cash/cheque with order. Please add VAT at 15%.

S.STANDARD TV TUBE CO.
11-29, Fashion Street,
London E1

Tel. 01-247 3097

TELEVISION TUBE SHOP

NEW TUBES AT CUT PRICES

EUROPEAN TYPE Nos.

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A31-19W/20W	19.95	2.99
A31-120W/300W	17.95	2.69
A31-410W/510W	17.95	2.69
A34-100W	18.50	2.77
A38-160W	17.50	2.63
A44-120W	27.00	4.05
A50-120W	17.95	2.69
A59-23W	19.95	2.99
A61-120W	19.95	2.99

U.S.A./JAP. TYPE Nos.

9AGP4	21.82	3.27
190AB4/C4	23.00	3.45
230ADB4	28.50	4.28
230DB4/CT468	26.60	3.99
240AB4A	17.95	2.69
CT507 equiv	18.95	2.84
CT512	27.50	4.12
310DGB4/DMB4	23.00	3.45
310EUB4	19.95	2.99
310EYB4	18.75	2.81
310FDB4	19.95	2.99
310FXB4	17.50	2.62
310GNB4A	23.50	3.52
310HCB4	23.50	3.52
340AB4	19.50	2.92
340AYB4	30.00	4.50
340RB4/CB4	25.50	3.83
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Some Rebuilt Japanese & European Types Available from £14.00 + VAT £1.75

COLOUR TUBES
New and Mullard Colourex*

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330AB22	67.50	10.12
470FUB22B	97.50	14.63
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A47-343X	69.50	10.42
A49-191X	59.50	8.92
A51-161X	67.00	10.05
A51-220X	64.00	9.60
A56-120X	58.50	8.77
A63-120X	69.50	10.42
A66-120X	65.00	9.75
A66-140X/410X	70.50	10.57
A67-120X	65.00	9.75
A67-140X/200X	69.50	10.42
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Old Bulb Required for Colourex

ALL TUBES TESTED BEFORE DESPATCH & GUARANTEED FOR 12 MONTHS. 4 YEAR GUARANTEES AVAILABLE ON MOST TYPES

CARRIAGE
Mono £3.00 Colour £5.00
Mainland only. Overseas Rates on Application.

TELEVISION TUBE SHOP LTD.
52 BATTERSEA BRIDGE RD., LONDON, SW11.
Tel. 228 6859/223 5088

N.G.T. COLOUR TUBES

***First* Independent Rebuilder with**

B.S.I. CERTIFICATION

(Certificate No. 004)

2 year guarantee: 4 year option

All Colour Tubes are debanded, high temperature pumped and rebanded using new adhesives and new tension band.

19" **£30,** 20" **£32,** 22" **£33,** and 26" **£38.**

Exchange prices: add VAT at 15%

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120, SELHURST ROAD., LONDON S.E.25
Phone: 01-771 3535.

20 years experience in television tube rebuilding.

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SAS570	£1.00
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22/350	8p
33/350	8p
400/350	50p
33/450	10p
220/450	50p
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1000PF/12KV	10p
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220/16	.01/100
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330/25	.47/160
470/25	2.2/160
680/25	22/160
33/35	.47/250
10/40	1/250
22/40	3.3/250
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680/40	.1/400
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