AUGUST 1979

Australia $2.75, New Zealand $

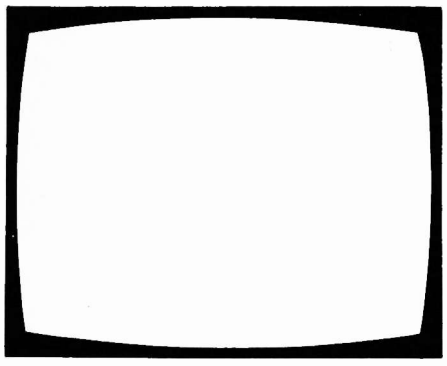
TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

MONOCHROME MONITOR CONVERSION

TV IC FAULTS

SIMPLE SYNC PULSE GENERATOR



TELEVISION

August 1979

Vol. 29, No. 10
Issue 346

OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 20

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

SUBSCRIPTIONS
An annual subscription costs £9.50 in the UK, £10.50 overseas ($21 Canada or USA). Send orders with payment to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

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

BACK NUMBERS
Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at 70p inclusive of postage and packing.

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

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
+ £4.00 P.&P.

MONO TUNERS
6-button integrated all at £6.00
U.H.F. P/Button D/S £4.50. U.H.F. P/Button S/S £4.50. Rotary £3.00 + £1 P&P.

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

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

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

VALVES (MONO & COLOUR)

PCL82	0.10	PCF802	0.10	PCC86	0.10	EY86/7	0.10	30PL1	0.25	PL509	1.00
PCL83	0.25	PCF805	0.25	PC97	0.20	EY8/7	0.10	30PL13/4	0.10	PY500	1.00
PCL84	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30P12	0.10	GY501	1.00
PCL85	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	30FL1/2	0.25	PL508	0.50
PCL86	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC82	0.10	PCH200	0.50
PFL200	0.10	PCC189	0.10	EF183	0.10	PL504	0.25	ECC81	0.10	PCF200	0.50
PCF801	0.10	PCC86	0.10	EF184	0.10	PL81	0.10	ECH81	0.10	CEY51	0.15
30C1	0.10	30C15	0.10	6BW7	0.10	6/30L2	0.10	ECL80	0.10		
30C17	0.10	30C18	0.25	ECC85	0.10	U26	0.10	ECL82	0.10		
PL83	0.10	PL84	0.10	EH90	0.10						

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	6.50	6.50	6.50	—	—	6.50	1.50	6.50	—	—
GEC/Sobell	6.50	7.50	—	—	—	6.50	—	—	—	7.50
Philips	6.50	9.50	—	—	—	7.50	—	—	—	6.50
Decca	6.50	12.50	12.50	—	—	6.50	2.00 (19" only)	8.00	—	6.00
Thorn 2000	6.50	7.50	7.50	6.50	6.50	7.00	—	8.00	15.00	6.50
Pye	7.50	7.50	9.50	—	—	6.50	—	—	—	7.50
Baird	6.50	8.50	8.50	—	—	6.50	—	—	—	6.00

Postage & Packing £1.25

S/STANDARD COLOUR SPARE PANELS

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

Postage & Packing £1.25

Korting and other foreign panels available on request.

COLOUR TUBES

19"	£18.00
19" A49, 192	£20.00
20"	£20.00
22"	£22.00
25"	£18.00
26"	£28.00

Plus P&P £4.

NEW
Rebuilt tubes available on request.

COLOUR TUNERS

Bush	£6.50
GEC	£6.50
Philips G6 S/S	£6.50
Thorn 3000	£6.50
Pye 691/697	£7.50

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 £7.00. Both British & Foreign makes. Please ring or write.
P&P per Lopt £1.

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

G8 PANELS
SPECIAL OFFER
CHROMA £12.00

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

MAIL ORDER T.Vs. IN GOOD WORKING ORDER

COLOUR

Pye	19"	£60.00	22"	£65.00	26"	£75.00
GEC	19"	£60.00	22"	£65.00	26"	£75.00
Bush	19"	£80.00	22"	£80.00	26"	£90.00
Philips	G6	—	22"	£63.00	26"	£70.00

Many other makes & models available.
Please ring or write for information.

PERSONAL CALLERS WELCOME.

MONO

20" & 24" S/S	£16.00	Pye, GEC, Bush etc.
20" & 24" D/S	£14.00	Pye, GEC, Bush etc.
19" & 23" D/S	P/button £12.00	Pye, GEC, Bush etc.
19" & 23" D/S	Rotary £8.00	Pye, GEC, Bush etc.

Please note there is 15% V.A.T. on all the above prices. Plus £8 P&P. England, Wales & Scotland for colour T.V.'s. Inland N. & S. Ireland P&P £15. P&P £5 for mono T.V.'s to England, Wales & Scotland. Inland N. & S. Ireland £7 per set.

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	1.00
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	0.73
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
8HA0002	1.90
8R100	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
OCB1	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	2.00
1500 18" 19" stick	2.37
1500 24" 5 stick	2.48
Single stick Thorn TV	
11.16K 70V	0.75
TV20 2 MT	0.75
TV20 16K 1BV	0.75

IC's

SN76013N	1.20
SN76013ND	1.00
SN76023N	1.20
SN76023ND	1.00
SN76226DN	1.50
SN76227N	1.20
T8A341	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 B000	2.42
Thorn B500	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

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

TELEVISION SALE
DISCOUNT FOR QUANTITY

Please note all mono sets sold as 100% comp.
No broken masks, no broken panels etc.
Colour sets sold with good c.r.t.s and 100% comp.

Working Mono £3.00 extra.
Working Colour £15.00 extra.
Supplied in 1's or 100's.

MONO Rotaries 19" & 23"

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

D/S P/B 19" 23"

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

D/S P/B 20" 24"

Bush	10.00
GEC	10.00
Philips	10.00
Pye	10.00
Thorn	10.00

S/S 20" 24"

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

S/S COLOUR

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

MAINS DROPPERS

Mono

Bush 161	60p
Philips 210 30+125+2K85	50p
Philips 210 118R+148R	48p
Thorn 1400	75p
GEC 2018	58p
Decca 2K5+90+100 +167+5	72p
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)

TRANSISTORS, ETC.

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.56	BC377	0.29	BD234	0.68	BF222	†0.51	BPX29	1.62	MPSU05	0.66	ZTX500	†0.18	2N3819	†0.47
AC117	0.38	AU107	2.75	BC204*	†0.39	BC394	0.39	BD235	0.63	BF224 & J	†0.22	BR101	0.53	MPSU06	0.76	ZTX502	†0.22	2N3820	0.72
AC126	0.36	AU110	2.40	BC205*	†0.39	BC440	0.52	BD236	0.63	BF240	†0.32	BR103	0.64	MPSU55	1.26	ZTX504	†0.28	2N3866	1.08
AC127	0.54	AU113	2.60	BC206*	†0.37	BC441	0.59	BD237	0.68	BF241	†0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	†0.20
AC128	0.46	BC107*	0.16	BC207*	†0.39	BC461	0.78	BD238	0.68	BF244*	†0.51	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	†0.20
AC128K	0.55	BC108*	0.15	BC208*	†0.37	BC477	0.30	BD253	1.58	BF245*	†0.43	BRY39	0.60	MPU131	†0.59	2N697	0.46	2N3906	†0.20
AC141	0.65	BC109*	0.16	BC209*	†0.39	BC478	0.25	BD410	1.65	BF254	†0.48	BRY56	†0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
AC141K	0.70	BC113	†0.22	BC211*	†0.36	BC479	0.33	BD433	0.65	BF255	†0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	†0.17
AC142	0.60	BC114	†0.22	BC212*	†0.17	BC547*	†0.13	BD435	0.70	BF256L*	†0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	†0.17
AC142K	0.65	BC115	†0.24	BC212L*	†0.17	BC548*	†0.13	BD436	0.71	BF257	†0.44	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	†0.17
AC151	0.31	BC116*	†0.25	BC213*	†0.16	BC549*	†0.15	BD437	0.74	BF25B	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
AC152	0.36	BC117	†0.30	BC213L*	†0.16	BC550	†0.24	BD438	0.75	BF259	†0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	†0.32
AC153	0.42	BC118	†0.24	BC214*	†0.18	BC556	†0.23	BD519	0.88	BF262	0.73	BU102	2.85	OC44	0.68	2N1164	8.29	2N4292	†0.32
AC153K	0.52	BC119	†0.34	BC214L*	†0.18	BC557*	†0.16	BD520	0.88	BF263	0.88	BU105	†1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
AC154	0.41	BC125*	†0.30	BC225	†0.42	BC558*	†0.16	BD599	0.87	BF270	0.47	BU105/02	†1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
AC176	0.45	BC126	†0.30	BC237*	†0.16	BC559*	0.17	BD600	1.23	BF271	0.42	BU108	†2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
AC178	0.51	BC132	†0.20	BC238*	†0.15	BCY10	0.30	BD663BR	0.86	BF272A	0.80	BU126	†2.91	OC72	0.73	2N1307	1.32	2N5042	1.65
AC179	0.55	BC134	†0.22	BC239*	†0.22	BCY30A	1.06	BDX18	1.55	BF273	†0.33	BU204	†2.50	OC81	0.83	2N1308	1.53	2N5060	†0.28
AC187	0.56	BC135	†0.21	BC251*	†0.25	BCY32A	1.19	BDX32	2.95	BF274	†0.34	BU205	†2.78	OC81D	0.95	2N1711	0.47	2N5061	†0.30
AC187K	0.65	BC136	†0.22	BC252*	†0.26	BCY34A	1.02	BDY16A	0.63	BF336	0.63	BU206	†3.09	OC139	1.30	2N1893	0.52	2N5064	0.63
AC188	0.52	BC137	†0.30	BC253*	†0.38	BCY72	0.27	BDY18	1.55	BF337	0.65	BU208	†4.88	OC140	1.35	2N2102	0.71	2N5086	†0.49
AC188K	0.61	BC138	†0.35	BC261A*	†0.28	BD115	1.35	BDY20	2.29	BF338	0.68	BU407	†1.38	OC170	0.80	2N2217	0.55	2N5087	†0.50
AC193K	0.70	BC140	0.36	BC262A*	†0.28	BD123	1.50	BDY38	1.38	BF355	†0.72	BUY77	2.50	OC171	0.82	2N2218	0.38	2N520B	†0.59
AC194K	0.74	BC141	0.44	BC263*	†0.26	BD124	1.85	BF115	0.48	BF362	†0.49	C106D	0.80	OC200	3.90	2N2219	0.42	2N5294	0.66
ACY17	1.20	BC142	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF363	†0.49	C106F	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF367	†0.29	C111E	†0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
ACY28	0.98	BC147*	†0.12	BC286	0.40	BD132	0.68	BF121	0.85	BF451	0.43	D40N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
ACY39	2.02	BC148*	†0.12	BC287	0.49	BD133	0.70	BF123	0.48	BF457	0.46	E1222	0.47	OCP71	1.98	2N2401	0.80	2N5449	†0.18
AD140	1.79	BC149*	†0.13	BC291	0.27	BD135	†0.37	BF125	0.68	BF458	0.49	E5024	†0.19	ON236A	0.94	2N2484	0.35	2N5457	†0.46
AD142	1.90	BC152	†0.42	BC294	†0.37	BD136	†0.38	BF127	0.51	BF459	0.52	GET872	0.46	R2008B	†2.92	2N2570	0.74	2N5458	†0.40
AD143	1.78	BC153	†0.38	BC297	0.36	BD137	0.40	BF137F	0.78	BF594	†0.16	MC140	†0.36	R20108	†2.79	2N2646	0.82	2N5459	†0.58
AD149	1.92	BC154	†0.41	BC300	0.62	BD138	0.42	BF152	†0.19	BF596	†0.17	ME0402	†0.18	R2322	†0.75	2N2784	1.15	2N5494	0.85
AD161	0.66	BC157*	†0.13	BC301	0.38	BD139	0.46	BF158	†0.25	BF597	†0.27	MF0404/02	†0.18	R2323	†0.85	2N2869	2.08	2N5496	1.05
AD161/162	1.22	BC158*	†0.12	BC302	0.86	BD140	0.50	BF159	†0.27	BFR39	†0.30	ME6001	†0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
AD162	0.71	BC159*	†0.14	BC303	0.64	BD144	2.24	BF160	†0.20	BFR40	†0.29	ME6002	†0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	0.35	BC160	0.52	BC304	0.44	BD145	0.75	8F161	0.84	BFR41	†0.30	MJ2955	1.30	TIC44	†0.25	2N2905*	0.39	2N6122	0.60
AF115	0.35	BC161	†0.58	BC307*	†0.17	BD150A*	†0.51	BF163	†0.65	BFR50	†0.29	MJ3000	1.58	TIC46	†0.35	2N2906*	0.36	2N6178	1.07
AF116	0.41	BC167B	†0.15	BC308*	†0.14	BD155	†0.90	BF164	†0.95	BFR52	†0.33	MJE340	0.68	TIC47	†0.45	2N2926G	†0.15	2N6180	1.39
AF117	0.42	BC168B	†0.14	BC309*	†0.18	BD157	0.51	BF166	0.50	8FR61	†0.29	MJE341	0.72	TIP29A	0.47	2N2926O	†0.14	2N6211	2.74
AF11B	0.98	BC169C	†0.15	BC317*	†0.15	BD158	0.75	BF167	0.38	BFR62	†0.28	MJE370	0.74	TIP30A	0.50	2N2926Y	†0.14	2S8337BP	4.28
AF121	0.68	BC170*	†0.15	BC318*	†0.15	BD159	0.68	BF173	0.35	BFR79	†0.30	MJE371	0.79	TIP31A	0.51	2N2955	1.12	2SC45BC	0.78
AF124	0.38	BC171*	†0.15	BC319*	†0.19	BD160	2.69	BF177	0.36	BFR80	†0.29	MJE520	0.85	TIP31C	0.67	2N3053	0.48	2SC643A	2.25
AF125	0.38	BC172*	†0.14	BC320	†0.17	BD163	0.67	BF178	0.46	BFR81	†0.30	MJE521	0.95	TIP32A	0.56	2N3054	0.86	2SC930D	1.50
AF126	0.36	BC173*	†0.22	BC321A&B	†0.18	BD165	0.66	BF179	0.58	BFR8B	†0.42	MJE2955	1.20	TIP32C	0.72	2N3055	0.72	2SC1061	1.45
AF127	0.86	BC174A & B		BC322	†0.28	BD166	0.88	BF1B0	0.53	BFT41	0.48	MJE3000	1.95	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.55
AF139	0.58		†0.26	BC323	1.15	BD175	0.90	BF181	0.53	BFT43	0.55	MJE3055	1.22	TIP34A	0.84	2N3254	0.58	2SD234	1.48
AF147	0.52	BC176	0.22	BC327	†0.16	BD177	0.58	BF1B2	0.44	BFW11	1.02	MPF102	†0.40	TIP41A	0.72	2N3391A	0.38	3N12B	1.60
AF149	0.45	BC177*	0.20	BC328	†0.18	BD17B	0.92	BF1B3	0.52	BFW30	2.58	MPS3702	†0.33	TIP42A	0.80	2N3633	12.70	40250	0.98
AF17B	1.35	BC17B*	0.22	BC337	†0.17	BD181	1.94	BF184	0.44	BFW59	†0.19	MPS3705	†0.30	TIP2955	0.77	2N3703	†0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC33B	†0.17	BD1B2	2.10	BF185	0.42	BFW60	†0.20	MPS6521	†0.36	TIP3055	0.58	2N3704	†0.19	40327	0.67
AF180	1.35	BC182*	†0.15	BC340	0.19	BD1B3	1.34	BF186	0.42	BFW90	†0.65	MPS6523	†0.36	TIS43	†0.44	2N3705	†0.17	40361	0.48
AF1B1	1.33	BC182L*	†0.15	BC347*	†0.17	BD184	2.30	BF194*	†0.14	BFX29	0.38	MPS6566	†0.44	TIS73	†1.36	2N3706	†0.16	40362	0.50
AF1B6	1.48	BC1B3*	†0.14	BC34BA & B		BD187	1.20	BF195*	†0.13	BFX84	0.42	MPSA05	†0.30	TIS90	†0.23	2N3707	†0.18	40410	0.94
AF202	0.27	BC1B3L*	†0.14		†0.17	BD1B8	1.25	BF196	†0.14	BFY50	0.38	MPSA06	†0.32	TIS91	†0.28	2N3708	†0.17	40429	0.88
AF239	0.73	BC1B4*	†0.15	BC349B	†0.17	BD1B9	0.71	BF197	†0.15	BFY51	0.37	MPSA55	†0.43	ZTX10B	†0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	†0.15	BC350*	†0.24	BD222	0.91	BF198	†0.29	BFY52	0.36	MPSA56	†0.45	ZTX109	†0.16	2N3771	2.39	40595	1.39
AF279S	0.91	BC1B5	0.36	BC351*	†0.22	BD225	0.91	BF199	†0.29	BFY53	0.36	MPSA93	†0.56	ZTX213	†0.23	2N3772	2.58	40603	1.13
AL100	1.30	BC1B6	0.25	BC352A*	†0.24	BD232	0.91	8F200	†0.25	BFY90	1.98	MPSL01	†0.33	ZTX300	†0.16	2N3773	3.90	40636	1.25
AL103	1.58	BC1B7	0.27	BC360	0.59	BD233	0.62	BF218	†0.42	BPX25	1.62	MPSU01	0.61	ZTX304	†0.26	2N3794	†0.40	40654	0.89

Alternative gain versions available on items marked*. For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)	Type	Price (£)	Type	Price (£)
BRC1330	†0.93	SN7600BKE	1.56	TBA240A	†3.98
CAB10QM	2.44	SN76013N	1.56	TBA2B1	†2.07
CA3005	1.85	SN76013ND	1.40	TBA395*	†2.58
CA3012	1.45	SN7601BKE	1.56	TBA396	†2.40
CA3014	2.23	SN76023N	1.56	TBA400	†2.20
CA301B	0.71	SN76023ND	1.40	TBA480Q	†1.84
CA3020	1.89	SN76033N	2.22	TBA500*	†2.21
CA302BA	0.80	SN76110N	1.20	TBA510*	†2.21
CA3028B	1.09	SN76115N	†1.62	TBA520P*	†3.40
CA3045	3.75	SN76116N	1.78	TBA530P	†2.24
CA3046	0.70	SN76131N	†2.10	TBA540*	†2.88
CA3065	1.74	SN76226N	†2.60	TBA550*	†3.13
CA306B	1.90	SN70227N	†1.61	TBA560C*	†3.18
CA3130S	1.57	SN7622BN	†1.80	TBA570*	†1.29
FCH161	†2.40	SN76502N	†1.92	TBA611B	2.68
FCJ101	†3.32	SN76530P	†0.97	TBA641	2.55
LM309K	1.98	SN76533N	†1.38	TBA641A12	2.35
LM380N-14	1.65	SN76544N	†1.85	TBA641B11	2.61
LM1303N	3.08	SN76546N	†1.85	TBA651	†2.12
MC1307P	†1.82	SN76570N	†1.81	TBA673	†2.19
MC1310P*	†1.94	SN76620AN		TBA700*	†2.50
MC1312P	2.34		†0.99	TBA720AQ	†2.38
MC1327P*	†1.86	SN76650N	†1.48	TBA720Q	†2.38
MC1330P	†0.93	SN76666N	†0.96	TBA750*	†2.18
MC1350P	†1.22	TA7073P	†3.51	TBA800	1.65
MC1351P	†1.42	TAA263	†2.20	TBA810AS	1.69
MC1352P	†1.42	TAA300	†3.85	TBA920*	†3.80
MC1357P	†2.92	TAA320	1.10	TBA940	†3.52
MC1358P*	†2.30	TAA350A	†2.48	TBA950	†2.78
MC145BG	1.43	TAA370A	3.18	TBA990*	†2.90
MC1496L	1.15	TAA435	†1.70	TCA270A*	†3.55
MC3051P	0.58	TAA450	†3.39	TCA280A	1.43
MFC400B	0.85	TAA521	1.10	TCA290A	3.46
MFC4060A	0.98	TAA522	2.09	TCA420A	1.98
MFC6040	1.11	TAA550	0.45	TCA440	1.67
MIC1P	2.58	TAA560	1.93	TCA640	2.76
ML231	†3.57	TAA570	†2.30	TCA650	2.76
ML232	†3.57	TAA611A	1.67	TCA660	2.76
NE555	0.72	TAA611B	1.89	TCA730	3.54
NE556	1.34	TAA621AXI	2.33	TCA740	3.04
NE566	1.95	TAA630Q	3.91	TCA750	2.53
SAA1024	†5.70	TAA630S	4.18	TCA760	1.52
SAA1025	†10.35	TAA661A	2.[illegible]	TCAB20	3.29
SAS560A	†2.[illegible]	TAA661B	1.75	TDA440	†4.16
SAS570	†2.01	TAA700*	†2.80	TDA1003	1.52
SC9503P	†1.40	TAAB40	†3.38	TDA1004	2.73
SC9504P	†1.38	TAAB61A	0.95	TDA1005	3.04
SL414A	1.91	TAA930A	1.43	TDA1022	6.89
SL432A	2.52	TAA930B	1.43	TDA1024	0.97
SL450	5.10	TAA960	†2.25	TDA1034	1.98
SL901B	†4.20	TAA970	†2.48	TDA2610	2.86
SL917B	†5.60	TAD100	†2.66	TDA2640	2.86
SL918A	†5.95	(Filter)	0.98	ZN414	1.45
SN72440N	†2.21	TBA120A	†0.90		
SN76001N	†1.67	TBA120S*	†0.99		
SN76003N	2.22	TBA120SA	†1.02		
		TBA231	1.12		

* Indicates Q version is also available.

DIODES

Type	Price (£)	Type	Price (£)
AA113	0.17	BY114	0.60
AA119	0.21	BY118	1.10
AA129	0.28	BY126	0.20
AA143	0.18	BY127	0.21
AAY30	0.28	BY133	0.35
AAZ13	0.42	BY140	1.40
AAZ15	0.35	BY164	0.75
AAZ17	0.28	BY176	2.80
AY102	3.85	BY179	0.83
BA100	0.24	BY1B2	1.14
BA102	0.36	BY1B4	0.44
BA104	0.19	BY189	5.30
BA110	0.80	BY190	4.90
BA111	0.70	BY206	0.26
BA115	0.17	BY23B	0.25
BA116	0.56	BYX10	0.30
BA121	0.85	BYX3B/600	0.70
BA129	0.45	BYX70/500	0.53
BA145	0.19	ITT44	0.08
BA148	0.19	ITT210	0.53
BA154	0.06	ITTB27	0.80
BA155	0.17	MCR101	0.43
BA156	0.12	MRB54	1.10
BA157	0.25	OA5	0.88
BA15B	0.28	OA10	0.58
BA159	0.40	OA47	0.20
BA164	0.14	OA81	0.19
BA170	0.18	OA90	0.13
BA1B2	0.27	OA91	0.15
BA201	0.13	OA95	0.20
BA202	0.14	OA200	0.13
BA203	0.14	OA202	0.13
BA216	0.08	OA210	0.89
BA219	0.11	TIL209	0.14
BA243	0.45	TIL211	0.18
BA317	0.06	TV20	2.25
BA31B	0.07	IN914	0.06
BAV10	0.10	IN916	0.06
BAV21	0.18	IN4001	0.06
BAW62	0.06	IN4002	0.07
BAX13	0.07	IN4003	0.08
BAX16	0.10	IN4004	0.08
BAX17	0.19	IN4005	0.09
BAY72	0.16	IN4006	0.10
BB104B	0.52	IN4007	0.12
BB105B	0.33	IN5400	0.15
BB105G	0.30	IN5401	0.17
BR100	0.40	IN5402	0.20
BY100	0.35	IS920	0.09
BY103	0.35	IS921	0.11

ZENER DIODES

400mW plastic	3.0-33V	14p each
1/1.3W plastic	3.3-180V	18p each
1.5W flange	4.7-75V	£1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each
75W stud	7.5-75V	£7.95 each

VDR's, etc. (†)

Type	Price (£)	Type	Price (£)
E295ZZ		/01	0.28
		/02	0.28
E298CD			
/A25B	0.25		
E298ED			
/A25B	0.22	ECL80	0.82
/A260	0.22	EF80	0.60
/A262	0.22	EF183	0.75
/A265	0.22	EF184	0.75
/P268	0.22	EH90	0.94
E298ZZ		EL34	3.08
/05	0.25	EY51	1.20
/06	0.22	EYB6/B7	0.67
E299DD/P116-		PCC84	0.61
P354	all 0.23	PCC85	0.79
E299DH		PCCB9	0.74
/P230	0.72	PCC189	0.94
R53	1.75	PCF80	1.20
VA1015	0.92	PCF86	0.87
VA1026	0.79	PCF200	2.32
VA1033/34/3B/		PCFB01	0.74
39/40/53		PCF802	1.20
	all 0.20	PCF805	3.37
VA1055a/56a/		PCFB08	2.00
66a/67a		PCLB2	0.93
	all 0.23	PCLB3	1.12
VA1074	0.20	PCLB4	0.65
VA1077	0.31	PCLB6	1.27
VA1091	0.29	PCL805/85	1.00
VA1096/97/9B		PD500	3.75
	all 0.20	PFL200	1.40
VA1103	0.32	PL36	1.20
VA1104	0.46	PL81	0.94
VA110B/09/10/		PLB4	0.79
11/12	all 0.24	PL504	1.50
VAB650	1.20	PL508	1.85
2322 554		PL509	3.10
02221	0.59	PL519	3.10
2322 662		PL802	3.25
98003	0.88	PYB1/PB10	0.60

BRIDGES

Rating	Price (£)	Rating	Price (£)
1½A 50V	0.27	2A 100V	0.36
100V	0.28	200V	0.40
200V	0.32	400V	0.47
400V	0.40	600V	0.53
600V	0.50	B00V	0.60
B00V	0.58	1000V	0.87
3A 100V	0.52	6A 100V	0.66
200V	0.55	200V	0.68
400V	0.61	400V	0.74
600V	0.67	600V	0.80
B00V	0.80	B00V	0.88
1000V	1.20	1000V	0.95

10A and 25A ranges also stocked.

VALVES (†)

Type	Price (£)
DYB6/B7	0.75
DYB02	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EYB6/B7	0.67
PCC84	0.61
PCC85	0.79
PCCB9	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCFB01	0.74
PCF802	1.20
PCF805	3.37
PCFB08	2.00
PCLB2	0.93
PCLB3	1.12
PCLB4	0.65
PCLB6	1.27
PCL805/85	1.00
PD500	3.75
PFL200	1.40
PL36	1.20
PL81	0.94
PLB4	0.79
PL504	1.50
PL508	1.85
PL509	3.10
PL519	3.10
PL802	3.25
PYB1/PB10	0.60

RESISTORS

Carbon Film (5%) (†) — *Mixes of a minimum of*

	1Oe of one value	*50pc*	*100pc*	*500pc*
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.45	£5.40
¼W 10Ω-10MΩ (E24)	3p	25p	95p	£1.45	£5.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.80	£6.40	£28.90

Wirewound (5%)

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

Presets (†)

0·1W (Vertical and Horizontal)
100, 220, 470Ω, 1, 2·2, 4·7, 10, 22, 47, 100, 220, 470kΩ, 1, 2, 5, 5MΩ
all 14p each

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

FUSES (all packs of 10)

20mm Time Delay (BEAB)		20mm quick-blow (BEAB)	
40mA	£3.68	100mA	68p
50, 63mA	£2.55	200, 250, 315, 500, 630,	
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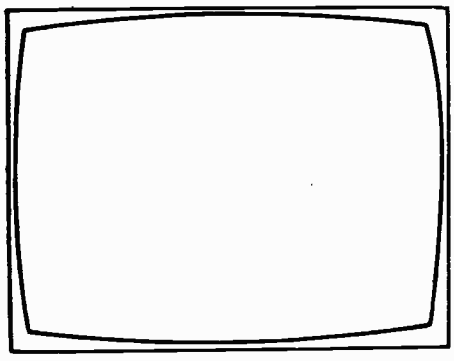

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CORRECTION

In Part 1 of *Renovating Körting Hybrid Colour Receivers* in our June issue mention was made of the consequences of the h.t. rectifier going short-circuit. One of the mains fuses blows of course, and it's common for one of the resistors in the 265V line to go open-circuit. Mike Phelan draws our attention to the fact that it's usually R606 that goes open-circuit first, though it may be R605 as stated. In earlier sets R605 and R608 are not fusible types incidentally.

The Extraordinary CRT

It's an interesting fact that the cathode-ray tube, which was amongst the very earliest thermionic devices, seems likely to be amongst the very last in everyday use. Receiving valves are largely things of the past, while timebase valves now belong in the service department. The development of the CRT continues apace however, and one cannot see any likelihood of its demise. Solid-state displays have been talked about, and demonstrated, but anything likely to compete on cost and performance grounds with the modern colour tube seems forever to be "at least ten years away".

The early experiments with cathode-ray tubes were carried out in the last century. By the turn of the century, crude CRTs could be made. An early CRT, the Wehnelt hot-cathode tube of 1905, is on display at the IBA's Television Gallery. By 1910, Alexander Campbell-Swinton had come to appreciate the possibilities of the CRT as a pick-up and display device for television, and put forward suggestions for such a TV system. It was a while however before the type of tube we know today appeared. The tubes of the 1910-30 era were gas focused devices (relying on residual gas to focus the beam), the vacuum pumps of the period producing only a poor vacuum. By the time of the start of the BBC's TV service in 1936 however the modern type of tube had arrived. It was a triode device with external focusing and a deflection angle of around 50°. The usual sizes were 9 and 12in., and the e.h.t. was about 5kV.

Post-war developments during the 1950s saw some important innovations. The deflection angle went to 70°, then 90°, then 110°; multi-electrode gun assemblies with electrostatic focusing were introduced; the e.h.t. rose to 20kV; improved phosphors became available; and the advent of the aluminised screen considerably improved the brightness and contrast (by reflecting all the phosphor light emission forwards) while overcoming the problem of ion bombardment.

Meanwhile, colour had come. The principle of the shadowmask tube had been suggested in the 1930s, but development (by RCA) had to wait until proposals for an acceptable, practical colour broadcasting system were put forward. A regular colour service was started in the USA in 1954, and the receivers were fitted with 21in. shadowmask tubes. Early developments included the use of improved phosphors, but essentially the same tube confronted us with the advent of colour transmissions in the UK in 1967. As you all know, it had three guns mounted in a triangular formation, a dot-phosphor screen, a massive convergence system in two sections (radial and lateral), plus purity magnets and a large metal shield on which the degaussing coils hung. It also needed both NS and EW raster correction circuitry.

The first versions in the UK had a deflection angle of 90°: when the 110° version came along in the early 1970s the convergence and raster correction circuitry required were even more complex, but the degaussing shield had disappeared inside the tube. At much the same time however the first major breakthrough in large-screen tube design occurred (we put it that way because the innovating Sony Trinitron was at the time mainly a small-screen tube) – the RCA PIL tube with its in-line guns, phosphor-striped screen, and slotted shadowmask. The design of the yoke to provide self-convergence in conjunction with the in-line gun arrangement meant that no dynamic convergence system was required, while some simple manufacturer preset magnets provided static convergence and purity correction. Sets using this tube first appeared in the UK in 1975, and meanwhile the Philips/Mullard 20AX system had come along.

Over the last few years the pace of development has quickened to a striking extent. We've had quick warm-up cathodes, the hi-bri technology which increases the shadowmask's transparency, the contoured line screen, the super-arch mask, pigmented phosphors, soft flash to reduce flashover damage, redesigned focus arrangements, and increased use of an earlier development, the black-stripe screen. The latest generation of tubes require no NS raster correction circuitry, which is all part of a parallel development in yoke technology, while the need for EW correction is also in the process of being designed out. With the new Philips 30AX tube, the static convergence and purity system disappear inside the tube in the form of a small internal magnetic ring.

It's all a long way from Wehnelt's hot-cathode tube of 1905. The latest colour tubes are compact and have all the various correction arrangements required built in. They are amazing feats of precision engineering, and a solid-state alternative seems as far away as ever. Is there any farther to go along this path? Well, single-gun colour tubes using the beam-indexing principle are now understood to be a practical proposition for small screen tubes, so we can't be too sure.

Monochrome Monitor Conversion

Luke Theodossiou

SECOND-HAND monochrome sets can be purchased for only a few pounds from specialist outlets such as those advertising in *Television*. By suitable modification they can be converted for use as monitors capable of providing good-quality pictures at a fraction of the cost that would be required to purchase the equivalent commercial unit. The purpose of the present article is to identify the requirements for monitor use and suggest practical circuits which can provide the necessary performance.

The most important modification is that required to the video section of the receiver, and this is where the greatest benefit can be obtained for the least outlay.

The circuit suggested for use in this area is shown in Fig. 1. The heart of the system is an SGS-Ates or Telefunken TDA2150 or TDA2151 i.c. This i.c. was designed as the luminance/chrominance control combination of a three-chip PAL decoder: in our application, only the luminance section of the i.c. is used. It provides d.c. controls for both brightness and contrast, performs the necessary blanking operation during the line and field flyback periods, and inserts into the video signal an "artificial" black level.

Two video output circuits are suggested. Fig. 1 shows a class A output stage which can be used for economy: Tr1 is the output transistor and R7 its 7W load resistor. Alternatively, the class AB output stage shown in Fig. 2 can be used: this type of circuit is preferred because of its good transient response and low power consumption. Here R9 forms the load at l.f. At higher frequencies Tr2 forms an active load, with R10 limiting the current in Tr2. Both designs are similar in other respects, though the class AB version should be used where optimum performance is required.

Both output circuits are arranged as virtual-earth amplifiers, with the 3·3V zener diode D1 in the output transistor's emitter circuit matching the black level of the output from the i.c. The gain is determined by the ratio of R4 to R5. The black level at the cathode of the c.r.t. is set by the ratio of R5 to R6. By keeping the value of R5 fixed and altering the values of R4 and R6 the optimum c.r.t. drive conditions can be obtained.

The usual beam limiter diode (D2) is included in the feed to the c.r.t. When the voltage across R8 (at maximum beam current) exceeds the voltage at the collector of Tr1, D2 is reverse biased and the signal becomes a.c. coupled to the c.r.t.'s cathode. This removes the d.c. component from the signal, thus reducing the beam current.

Pin 2 of the i.c. provides an inverted video signal (positive-going sync pulses) whose amplitude is fixed at three times the amplitude of the input feed to pin 3 of the i.c. It can be used to obtain the feed to the sync circuitry.

A sandcastle pulse input is specified for pin 8. It's used for two purposes here: first to blank the tube during the line flyback period, and secondly to produce the clamping pulse (in conjunction with the capacitor connected to pin 4). The narrow (high voltage) part of the pulse is not required in this

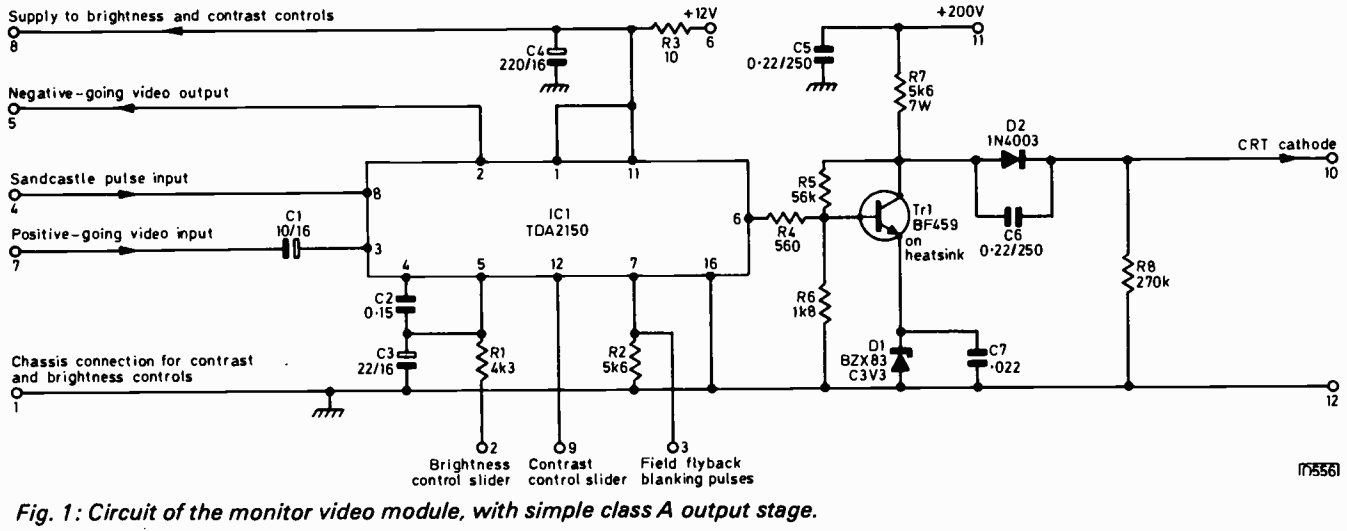

Fig. 1: Circuit of the monitor video module, with simple class A output stage.

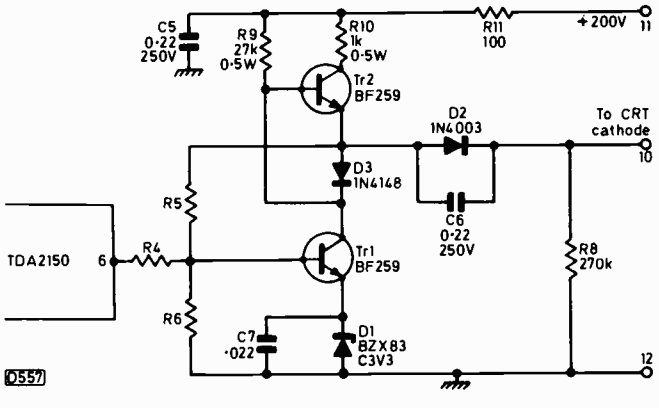

Fig. 2 (left): Circuit of the preferred class AB video output stage.

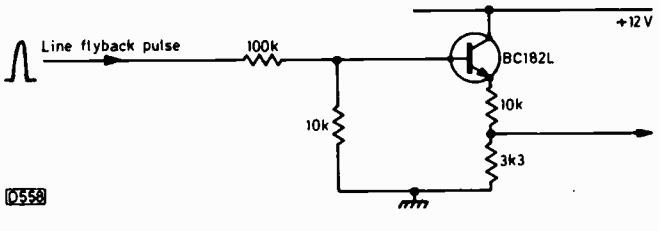

Fig. 3: Pulse squaring circuit.

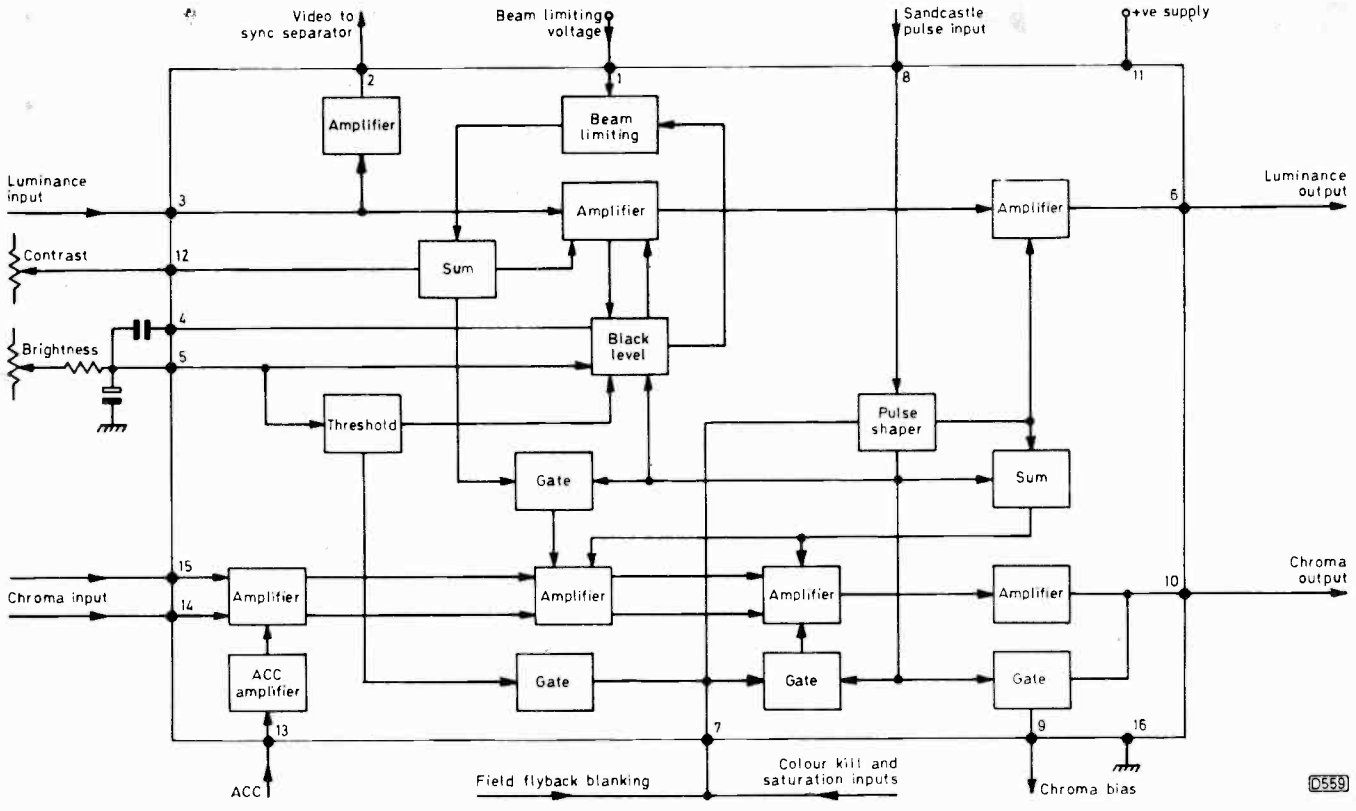

Fig. 4: Block diagram of the TDA2150 luminance/chroma i.c. Only the luminance section is used in our application.

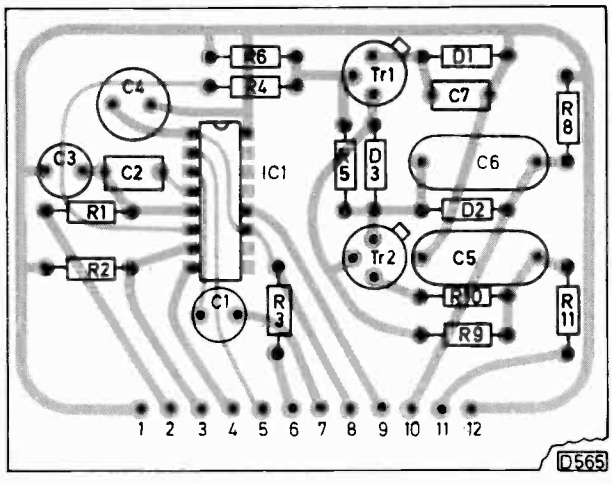

Fig. 5: Video module component layout.

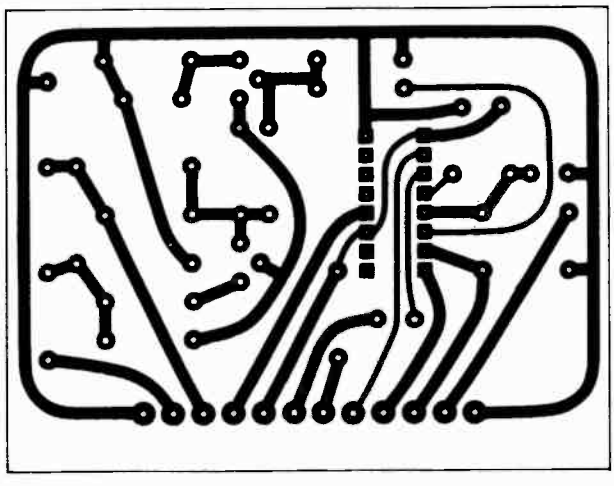

Fig. 6: Video module print pattern.

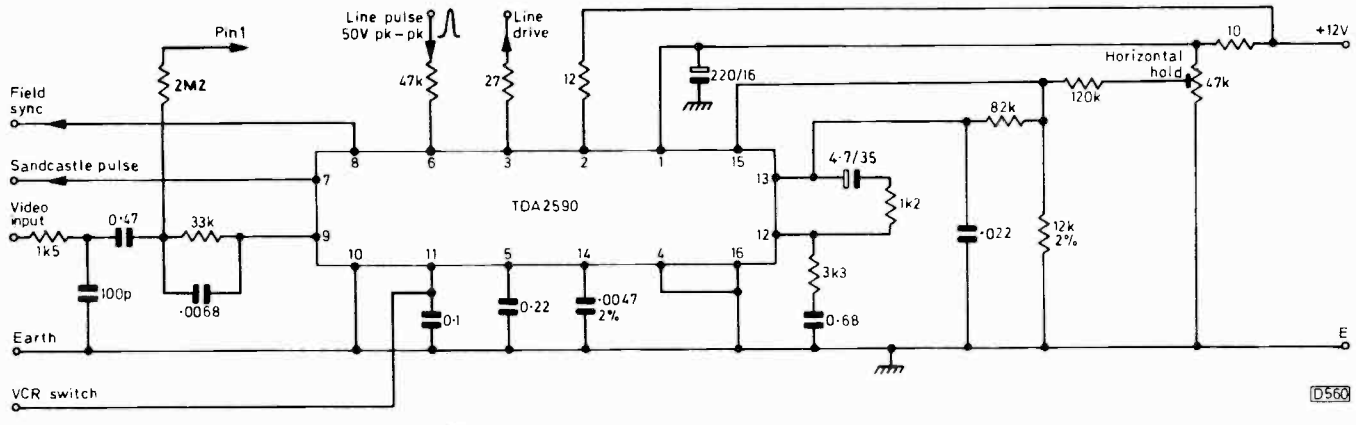

Fig. 7: Line oscillator/sync circuit using a TDA2590 i.c.

monochrome application. Since monochrome sets don't have a sandcastle pulse, the squaring circuit shown in Fig. 3 can be used to feed this pin. Alternatively, if the TDA2590 line oscillator/sync separator combination i.c. is used, a suitable sandcastle pulse is available at pin 7 of this i.c.

Another area where improvement can be relatively easily

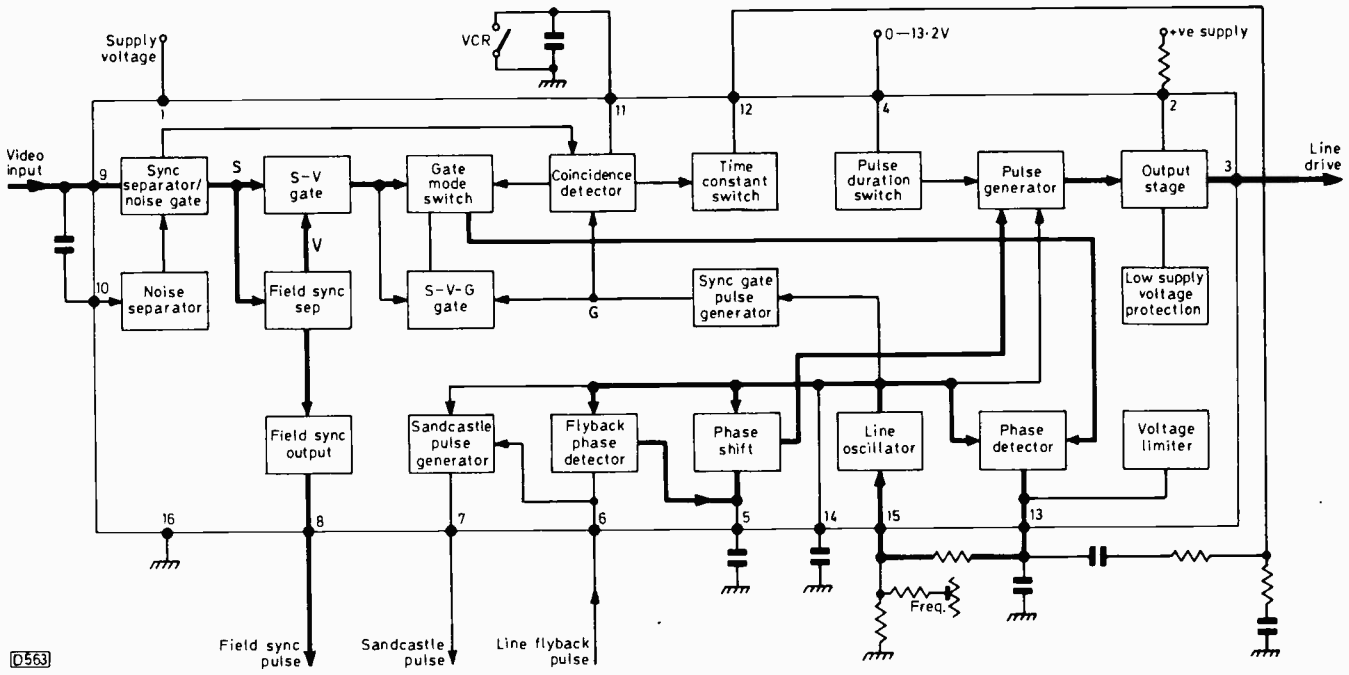

Fig. 8: Block diagram of the TDA2590 line oscillator/sync separator i.c.

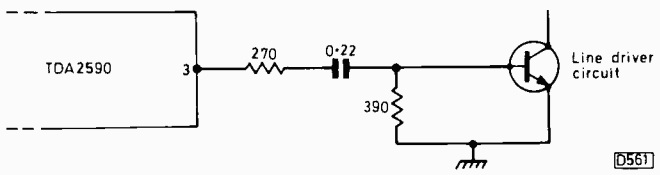

Fig. 9: Connections to a transistor line driver stage.

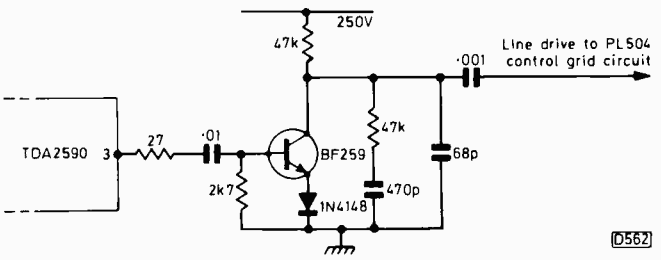

Fig. 10: Driver circuit for a valve line output stage.

obtained is in the sync separator/line oscillator departments. This function can be taken over by a TDA2590 i.c., which is the successor to the well known TBA920. Fig. 8 shows a block diagram of this i.c. whilst Fig. 7 shows the recommended external components.

By shorting pin 11 to chassis, the filter characteristics of the flywheel sync circuit are changed to suit the requirements of VCR operation. This is a very desirable feature nowadays in a monitor.

The constructional arrangements that can be used for the TDA2590 and its associated components are completely non-critical, and Vero board or similar material can be used. The TDA2590's output stage can drive either valve or transistor line output stages – interfacing circuits are shown in Figs. 9 and 10.

In most applications the input to the monitor will consist of a composite video signal which contains the audio information on the frequency-modulated 6MHz "intercarrier". If you wish to make use of the sound component of the signal, the easiest approach is to feed it to an i.c. which demodulates it and amplifies it to a level sufficient to drive a loudspeaker.

A suitable chip, much favoured by setmakers at present, is the TDA1190. The circuit shown in Fig. 11 indicates the external components required. Due to the very high gain between the input and output, the layout is somewhat critical. The device is inherently stable however, so no real problems should be experienced provided there are no earth loops.

The coil can be wound on a standard 4mm. former, and should be screened. It may be convenient to include the two associated capacitors in the can. The coil consists of 50 turns of 38 s.w.g. enamel-covered wire: the core should be a 6mm. long grade 500 ferrite type. ■

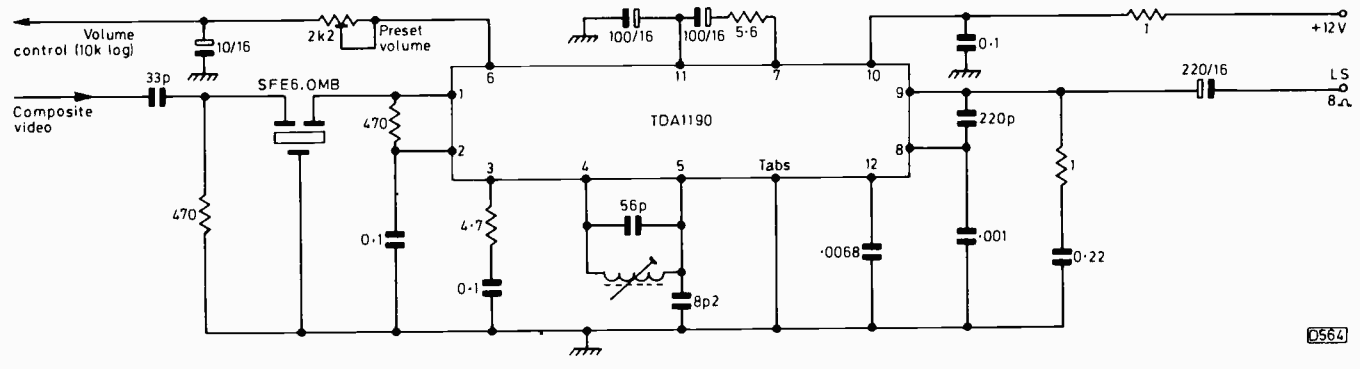

Fig. 11: Complete sound channel using a TDA1190 i.c. The volume control is returned to chassis.

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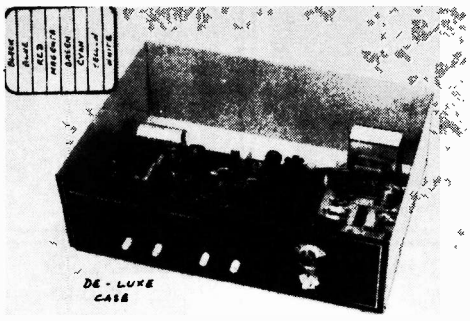

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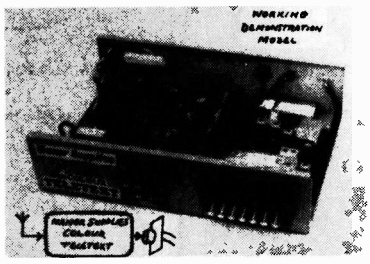

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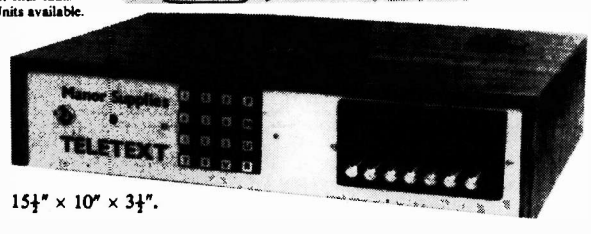

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Very slim, only 6mm thick.

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METAC ★ PRICE

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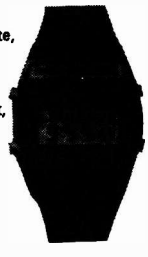
M9

SEIKO Alarm Chrono

LCD, hours, mins., secs., day of week, month, day and date, 24 hour Alarm, 12 hour chronograph, 1/10th secs., and lap time. Back light, stainless steel, HARDLEX glass.



List Price £130.00

METAC PRICE

£105.00

M10

SEIKO Chronograph

LCD, hours, mins., secs., day of week, month, day, date, 12 hour chronograph, 1/10th secs. and lap-time. Back light, stainless steel water resistant, HARDLEX glass.

List Price £85.00

METAC PRICE

£68.00

M11

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M12

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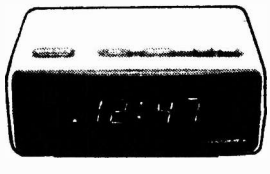

Features and Specification: Hour/minute display. Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on/off control. Display flashing for power loss indication. Repeatable 9-minute snooze. Display bright/dim modes control. Size: 5.15" x 3.93" x 2.36" (131mm x 11mm x 60mm). Weight: 1.43 lbs (0.65 kg). AC power 220V.

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£15.95

Guaranteed same day despatch.

M14

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£9.95

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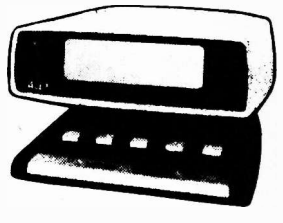
M15

DIGITAL LED CLOCK



Automatic brightness control. Weekend alarm cancel.

Features and Specification: Hour/minute display. Large LED display with p.m. and alarm on indicator. 24 Hours alarm with on-off control. Display flashing for power loss indicator. Repeatable 9-minute snooze. Automatic brightness control. Weekend alarm cancel.

£10.95

Guaranteed same day despatch.

M16

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News in Brief

V2000 VCR SYSTEM LAUNCHED

Philips and Grundig are both introducing VCRs using their new, jointly developed V2000 system at the coming (August 24th-September 4th) Berlin Radio Show. The heart of the system is a new compact cassette (approximately 7 × 1 × 4¼in.). This uses ½in. tape, with two ¼in. video tracks one above the other. The maximum playing time this provides is four hours per track – there are four versions of the cassette, giving 2 × 1 (total 120 mins), 2 × 2, 2 × 3 and 2 × 4 hours playing time. To change from one track to the other, the cassette is simply removed, turned over and re-inserted in the machine – as with an audio cassette.

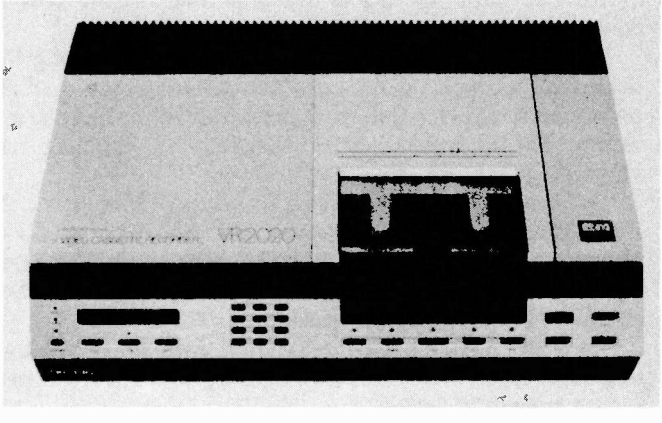
As a result of the greatly increased playing time, the new system provides much reduced tape cost per hour – 10 Dutch guilders compared to 46 guilders per hour for the N1700 system. Tape consumption is reduced to 0·56 square metres/hour compared with 3m²/hour for the N1700 system. The cost of the machine itself will be some 30% higher than the current N1702.

The latter fact is no doubt due to the use of some highly sophisticated technology. To achieve the necessary information packing density for example, a system called dynamic track following (DTF) is employed. There's no control track, as in previous VCR systems. Instead, a series of pulses is laid down on the track. If the head-track alignment varies, the cross-talk pulses picked up produce difference-frequency signals which are detected and used to provide correction. This is done by mounting the heads on piezo-electric plates to which the correction signal is applied: the effect of this is to move the head in the direction required. Neat indeed! In addition, there's servo control of the head speed and the tape speed and vertical position.

The sophistication of the basic mechanism is complemented by the sophisticated control arrangements, which include a microprocessor to store the control programme; an infra-red remote control system; and search tuning. The VCR can be programmed to switch on, record and switch off on several occasions up to sixteen days in advance. There are various built in protection arrangements to prevent incorrect operation of the machine.

The usual slant-azimuth technique is used to avoid luminance cross-talk, and in addition a comb filter (128μsec delay line plus adder circuit) is used to remove chroma cross-talk. The new Philips dynamic noise suppression (DNS) system provides improved sound, and the system allows for stereophonic sound (not used on initial models).

Both Philips and Grundig emphasize that their current N1700 and SVR machines will continue in production for the present.



The Philips VR2020, which uses the V2000 VCR system.

SCANNING THE HEADLINES

Matsushita (National) has decided to end development work on its VISC video disc system and join in development of the JVC VHD (Video Home Disc) system instead . . . The trade price of the Grundig and ITT SVR videocassette recorders (see review in last month's issue) has been reduced by £140 . . . Both Sony (UK) and Matsushita Electric (UK) have become members of the British Radio Equipment Manufacturers Association . . . The French TV manufacturer Thomson-Brandt has acquired a majority shareholding in leading W. German setmaker NordMende. Since NordMende have a subsidiary in the UK, it's expected that Thomson-Brandt products will be introduced on the UK market shortly. The aim is to set up the "second largest brown goods company in Europe" – second only to Philips. Thomson-Brandt claims 35 per cent of the French TV receiver market, with production at around a million sets a year . . . Yet another colour projection TV system has been released on the UK market, this time from Sharp. The aluminium film screen provides a 72in. picture, and features include Soft-Touch channel selection, a separate panel giving auxiliary input and output connections to a VCR or video system, and remote control. Meniscus lenses mounted on the three colour tubes correct minute aberrations in the focusing mirrors, giving a very sharp screen image . . . RCA's TV Auto Programmer system was previewed at a recent trade show in Las Vegas, USA. The system consists of a microcomputer, memory and digital clock, and enables the viewer to programme up to 22 separate sets of programme instructions, say three a day, covering a week. The set then automatically switches on, changes channel when required, and switches itself off. All for a mere $40 on the price of the basic set. Several Japanese setmakers are understood to have similar systems in the pipeline . . . The latest development from LEDCo is their Model 915 panel, which has been designed as a direct replacement for the rather troublesome i.f. gain/selectivity module used in the pre-G11 Pye solid-state TV chassis. The circuit consists of a BF199 driving a SAWF to define the bandwidth, followed by an MC1349 to provide the i.f. gain. We intend to review this in a subsequent issue.

STATION OPENINGS

The last of the BBC's high-power u.h.f. transmitters has now come into operation, bringing BBC-1 (Scotland) to about 100,000 viewers in the Dumfries and Galloway areas. The service is on channel 22. Seven relay stations which previously transmitted the BBC-1 (North East) programmes in south-west Scotland will be changed over to the new BBC-1 (Scotland) service.

The following relay transmitters are now in operation:

Allesley Park (Coventry) BBC-1 ch. 22, ATV ch. 25, BBC-2 ch. 28. Receiving aerial group A.

Creake (Norfolk) BBC-1 ch. 39, BBC-2 ch. 45, Anglia Television ch. 49. Receiving aerial group B.

Hagg Wood (Home Valley, Yorkshire) BBC-1 ch. 55, BBC-2 ch. 59, Yorkshire Television ch. 62. Receiving aerial group C/D.

All the above relay transmissions are vertically polarised.

Midsummer Madness

Les Lawry-Johns

I WAS busy making out a list of spares needed to top up the shelves, making sure to get the order code right for each item and frightening myself thinking of the probable cost, when this young lady walked in.

"We're doing a survey of small radio, television and electrical businesses, and I wondered whether you'd mind answering a few questions?"

"Not at all my dear. Fire away. I bet a pretty girl like you has to answer a few questions herself in the course of a day or, er, oh well, carry on."

So the questions came thick and fast. What type of appliances do we sell? What brands? Which sell best? What percentage of our turnover is the result of sales as opposed to service, and so on. Then came the question which stopped me dead in my tracks.

"Would you say you're slack in the summer?"

I looked at her for quite some time, gravely pondering the question and a suitable answer, during which time her face became bright pink.

"I wouldn't say we are more slack in the summer than in the winter, but. . . . ." At that moment my beloved's voice floated down the stairs.

"He's slack all the year round, don't let him fool you."

Seeing that she had an ally, the young lady regained her composure and put a tick against No Slack Period.

The rest of the questions were dealt with without embarrassment, and she departed in good spirits.

Hardly had she gone when another female appeared, carrying an orange Indesit T12LBG, orange apparently being the favoured colour for these popular portables.

Apparently it had failed altogether, but prior to this it had suffered from intermittent loss of signals, the screen remaining bright but blank. The cause of the non-operation wasn't too difficult to trace, since the voltages appeared low (not absent) – the 15V line was only about 7V. Since there was no sign of overheating we suspected an open-circuit electrolytic and were inclined to pounce on C902 (see Fig. 1). It wasn't until R908 was bridged however that the whole thing came alive (the low voltages had been due to the start-up circuit). A new 620Ω, 18W resistor was fitted and a nice picture was obtained with a piece of wire stuck in the 300Ω aerial input (too lazy to fit the 75Ω adaptor).

This didn't last long however. The sound and vision signals then suddenly cut out, leaving a bright screen. We spent some time checking through the i.f. stages, getting nowhere because we hadn't studied the circuit of this and had assumed that the collectors are fed from a positive rail with the emitters returned to chassis. Close inspection revealed that there should be a −11V negative rail as well, for the emitters, and that this was absent. Switching the set off and then on again after a brief period restored the signals, and the negative voltages were present. These vanished quickly, so we were left to find out where they went.

Their source proved to be the line output transformer, negative-going pulses being rectified by D909 to provide the negative line. When D909 was sprayed with freezer it obligingly came to life, as did the i.f. strip. A new diode put a stop to these pranks and the Indesit settled down nicely. For a while.

It then again cut out completely, and investigation showed that the voltage on C904 was sky high, with nothing on the collector of the pump transistor TR902. This time R909 (27Ω, 5W) had become open-circuit. R909 and R908 (on the lower centre heatsink) are both suspect on this chassis, and even if they are not faulty it's prudent to check their contacts as these tend to corrode over a period.

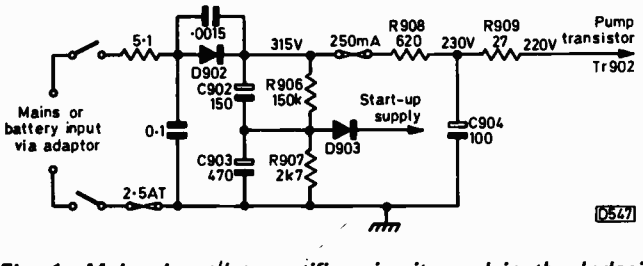


Fig. 1: Mains input/h.t. rectifier circuit used in the Indesit T12LGB portable. R909 is a fusible type in later production. A problem we've had on occasion is the h.t. filter capacitor C904 going open-circuit: the symptoms are a small picture after a slow tube warm up, with the l.t. line low at about 7·5V. R906/7 provide a 5·8V start-up supply to get the line oscillator going.

Double Filter

We've had a few all solid-state Bush monochrome sets in lately (Model TV309 etc., A816 chassis) with varying troubles. One in particular is worth mentioning, to save a few minutes for our all too busy readers.

Dick Dix brought one in the other day with a shattered supply fuse.

"Won't take a minute Dick, it's bound to be the mains filter capacitor."

The fuse is on the control panel, together with a hefty 0·47μF 1kV filter capacitor. There was a dead short across the capacitor, so out came the panel and off came the capacitor – only to find that the capacitor was in mint condition and that the short was still across where the capacitor had been.

The mains leads go from this panel over to the right side of the main board, and there of course resides 3C67 which is an 0·1μF 600V type of the more suspect kind. This was the culprit, and it was speedily replaced with a more reliable one of 1kV working.

It was then necessary to refit the front control panel which needn't have been removed in the first place. Next time we'll swing out the main panel first and check the 0·1μF capacitor instead of wasting time on the control panel. If I remember, that is.

While this was going on, Dick was practicing his deplorable French on the cat. "Ze cat sat on ze mat" he pronounced slowly and with perfect diction. Spock was clearly not impressed. She stretched out one leg and yawned.

"Wait a minute Dick" I said helpfully. "Shouldn't it be Ze cat zat on ze mat?" Dick looked thoughtful and was about to try again when my beloved came on the scene (she never misses any conversation that's going on, even if she's ten miles away and it's whispered).

"Neither of you have the slightest idea of you're own language never mind French. Anyone knows it's, La cad, sad on la mad."

We both looked at her with renewed respect.

"Tray bong" she said and vanished as quickly as she had come.

"Well I never" said Dick, "Well I never".

Seeing me refitting the rear cover of the Bush, his thoughts came back to the job in hand.

"Was it what you thought it was?"

"Well, yes and no really. About six months ago, a chap brought one of these in for the same thing. I thought it was on the control panel and took it out only to find it was over the other side after all, and I've just done the same thing."

Dick shook his head in awe.

"You must have a mind like a computer. It's a pity you can't put it down on paper like some people do."

Laura Lovett's Dicey Decca

When Laura phoned to say she had frame collapse I was ringing her bell before she had put the phone down. After all, Laura's frame was not a thing to be taken lightly and if aid was needed mine would be first. As soon as she answered the door I could see that it was not her frame that had collapsed. It was just as I remembered it from last week, when she kept going red.

"Sorry to bother you again so soon. It's getting naughty lately isn't it?"

"The neighbours will start talking if I keep on popping in like this" I suggested. . . . .

"Oh, I don't think there's much fear of that. Not with you anyway. Now if it was that young telephone engineer, they'd have grounds to talk."

I never did like Laura very much really, and I could feel in my bones that this was going to be a more expensive repair than when she went red which was only a faulty green output transistor. These women needn't think they can twist me round their little finger like they can some of these telephone louts.

It was a Bradford chassis with valved timebases. I switched it on and within a short time the picture came up as right as ninepence.

"Oh dear" said Mrs. Lovitt, and went red. "I hope I haven't got you here on a wild goose chase. It really did go down to some lines across the middle, honestly it did."

"It's probably a touch of the tantrums" I diagnosed with knowing nod.

"I think it's wonderful the way you engineers can put your finger on it right away."

"Some of us are better at it than others" I admitted. So off came the back cover. Tap the PL508.

"That's it" she said excitedly.

Off set, out PL508, in with another, switch on.

"Still the same."

"You have to give it time to warm up, it's no good rushing things." We gave it time but it didn't open up so I tapped it and it did. Moving the PL508 produced the same performance, so I had to conclude that we had a poor contact on the print side of the panel. Set off, remove panel plugs, release the top three clips and remove panel.

Taking my glasses off so that I could see properly, I peered at the panel in the vicinity of the PL508's base and immediately spotted the poor contact.

I remembered from last time that the nearest mains socket was nowhere near the set. Actually the nearest socket was in the bedroom (believe it or not), through a sliding door in the wall where the TV lived. "Can I go through and plug the iron in?"

"I'll put it in for you, you had trouble finding it last time."

(Editor's note. We had better condense the rest of this story. Suffice it to say that the job was completed to everyone's satisfaction.)

Meanwhile

I was feeling a little fragile when I got back to base, and was not at all in the mood to tackle Mr. Gagg's G8 which, according to him, had nothing wrong with it really. It was just that it kept jittering from time to time, changed colour once or twice an hour, while the picture would become grainy on the odd occasion.

"It's four o'clock now" said Mr. Gagg. "Shall I call back at 5?"

"Make it 5.30 and bring twenty quid with you. You might get some change, but don't bank on it".

"What could be wrong to cost all that money this time?"

"I'm not sure, but the jittering could be a faulty thyristor, the changing colour a duff BF337 transistor, and the grainy picture could be a tuner unit fault which could mean an exchange tuner unit as they are difficult to repair – for me anyway."

"Good Lord, I didn't think it would come to all that. Last time when it packed up altogether it cost me only a few pounds, yet this time when it's still working it's going to cost a lot more. Funny."

"Not really funny Mr. Gagg. Last time it was just that long black thing with tags on it, and they don't cost very much. Anyway, I might not have to replace the tuner unit, but if you definitely want it ready by 5.30 the chances are I will".

"Well that bit of it's not too bad. Just do the jittery picture and the change of colour. That'll make it easy for you won't it?"

"Thanks Mr. Gagg, we'll do just those bits then. See you later."

As soon as he had gone, the landlord from one of the local pubs popped in carrying a radio-cassette deck (Sony stereo) which had apparently drunk (unwillingly) a pint of bitter and a glass of sherry. By its appearance, it had absorbed considerably more than this.

"Don't you keep it covered?"

"Are you supposed to?"

Believe it or not, he wanted it for six o'clock that evening.

As he was going, in came a lady from over the way.

"I'am fed up with buying two 996 batteries at a time, at over a pound, for this radio. Can you fix me up with a mains adaptor? I'll be back when I've done some shopping."

Incredibly, she was followed by a chap with a Philips battery operated record player.

"Can you fix me up with a mains unit? I'm fed up with buying six SP2 cells at 17p a time."

Oh dear, I thought. I wish I hadn't lingered at Laura's. After all it was only a dry-joint that had been troubling her.

I really was out of favour with the Gods that day, because the 'phone rang and it just had to be her.

"My frame's all wobbly and I'm afraid it will fall. You must have left it loose." I swear I hadn't touched the frame on which the set stood. It just rolled out and back on its casters and seemed firm enough. Can't argue though.

"O.K. I'll shoot over as soon as I shut the shop."

"What was that all about?" asked my little sun flower who had just finished putting little crosses all over a picture of a football pitch.

"I've got to go out again when we shut the shop. Laura Lovitt's legs are loose. Er, I mean her frame feels fragile. Er, oh I don't know, I'm proper fed up. I wish I was a telephone engineer."

The Monoscope

Malcolm Burrell

AT ONE time the monoscope was one of the most popular methods of generating a test card signal. Some broadcasters preferred to use a slide, but where space was limited or cost permitted a monoscope was usually to be found. It had no optical system, and required little if any setting up, making its use as a picture source in factories particularly attractive.

The monoscope tube is basically a small cathode-ray tube with a bulb diameter of about 5in. A specially prepared target, on which the test card or caption image is printed, was mounted inside the tube. This target had different secondary emission characteristics from the target base. When scanned by the electron beam, a signal voltage was developed and passed to a small pip on the tube's blank faceplate. This was then amplified and processed in the normal manner.

The picture definition was about 400 lines, allowing frequency gratings of up to about 5MHz to be used. The grey scale was limited however, and had to be accomplished by being printed in a similar manner to a printed photograph, i.e. as a fine dot detail which is inadequately resolved – if you expand the monoscope's picture, it's just possible to see the granular appearance of the "grey" areas.

Many monoscope cameras were probably made, some rack mounted and others portable. The Marconi BD617B shown in the photographs was a portable version first made in the early 1950s, for 405-line use. By altering the value of the line sawtooth amplifier's anode load however the unit can be made to operate at 625 lines. The unit shown is fitted with a monoscope tube that gives a Polish test card – it's driven by interlaced pulses from the pulse generator described in the May 1977 issue of Television.

The camera, in a metal case, measures 8½ × 16¼ × 26in. and weighs about 75lb. It uses twenty eight valves. Most of the small components are mounted on tagboards and are individually labelled with their circuit reference numbers. Access is gained by removing the side covers, which are secured by spring fasteners. With both removed the top of the tube housing can be taken off and the tube withdrawn. This is mounted vertically, with the faceplate uppermost, at the rear of the unit inside a Mumetal shield.

At the rear of the case there are sockets for video output, sync input if a composite output is needed, a separate video output for a monitor, a three-cord mains connector, and a multiway socket for blanking, line drive and field drive from a sync pulse generator.

The operating controls are mounted on the front, including a meter to indicate the mains input voltage and a multiposition on-off switch which selects the correct mains tap on the mains transformers.

Circuit

A 310V mains transformer supplies two 5V4 full-wave rectifiers, with two 6AS7s, a 6AU6 and a 0D3/VR150 neon stabiliser to produce a stabilised h.t. of 250V.

The field drive pulses feed a sawtooth amplifier driving a 6SN7 strapped as a single triode for the field output to the scan coils via an output transformer. There are no linearity controls, only vertical centring and height, mounted on the front panel.

The line drive pulses feed a basically similar circuit with a 6BG6 line output valve. Again there are only line width and centring controls on the front panel. Pulses from the line output stage are also fed to a clamp-pulse generator to operate the black-level clamp after the video amplifiers. Both line and field pulses are fed to the scan failure protection circuit. There is no line or field oscillator.

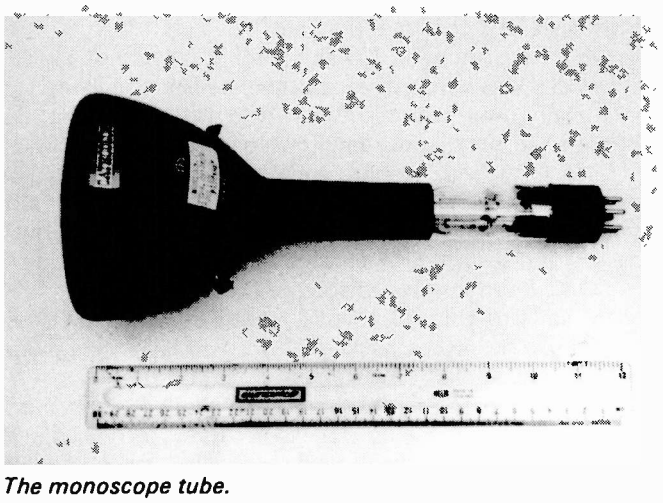
The video output from the tube is connected by a short screened lead to the head amplifier, which consists of three 6AU6 valves on a rubber-mounted subchassis to absorb microphony. The video signal is then passed to a further chain of these valves and is finally clamped, blanked and has the sync pulses added to provide a suitable signal for distribution.

An invertor stage is incorporated to enable tubes with either positive or negative patterns to be used. This is activated by an internal push-pull switch.

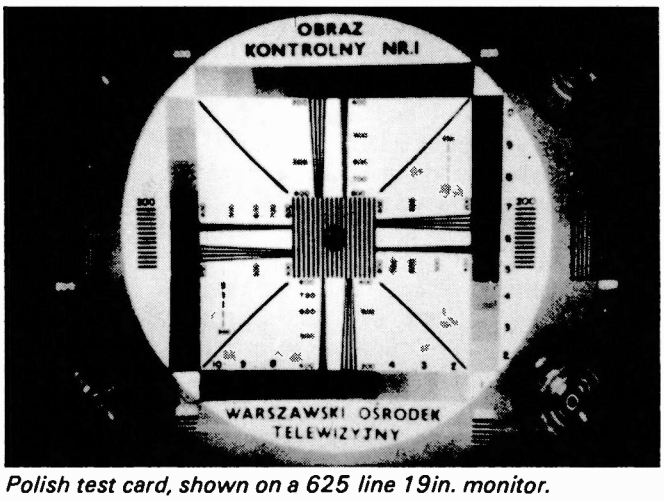
The monoscope tube needs about 1·1kV e.h.t. Since this would place the target at an unmanageable potential, the final anode is connected to the "earthy" end of a bleeder network which also supplies the first anode, focus and cathode electrodes from a shunt-stabilised negative supply derived from a mains transformer.

Basic Operation

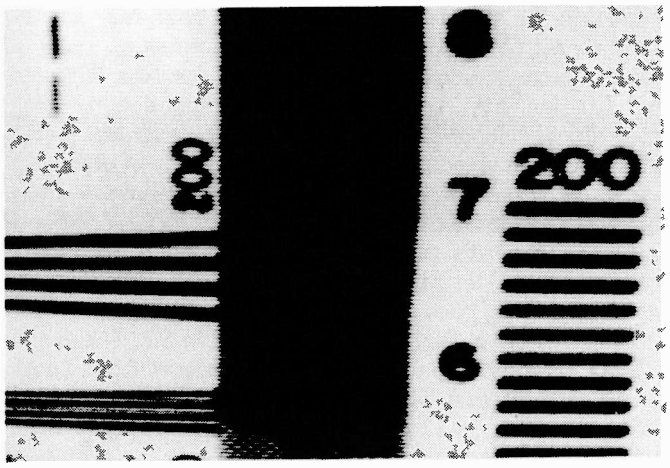
With all controls except the gain at minimum (unless previously undisturbed) the unit is connected to a source of



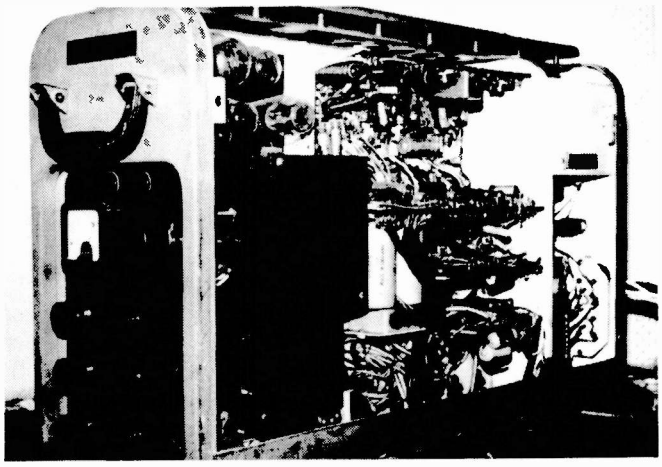
The monoscope tube.



Polish test card, shown on a 625 line 19in. monitor.



Enlarged view of the grey-scale blocks, showing the granular structure.



View of Malcolm's Marconi BD617B monoscope camera, with one side removed to show the internal construction.

sync and drive pulses. The mains switch is operated and set so that the needle on the meter lies in the green portion on the dial, i.e. correct mains voltage. Observing the picture on a monitor, the beam control is advanced after a short warm-up time. A picture should be seen. The focus, height, width and centring controls are adjusted as well as the black level control to give the best formed picture.

The unit is a reasonably stable source of TV pictures though, as with many other ageing devices employing valves, it seems happier the more it's used.

Conclusion

The disadvantage of a monoscope compared to a slide scanner is that the tube has to be replaced if a different pattern is required. Manufacturers were able to supply tubes with patterns to suit individual requirements, and the monoscope was a useful device where a cheap, reliable caption or test card source was required. It cannot produce a colour picture however, nor compete with the stability and convenience of an electronic pattern generator. For these reasons the monoscope is virtually obsolete, though some are still in use in various parts of the world – particularly in the USA, where RCA occasionally have a production run of replacement tubes, mainly providing variations on the famous American "Indian Head" test card pattern. The humble monoscope is in fact rapidly disappearing into television's history.■

Long-distance Television

Roger Bunney

AT LONG last Sporadic E (Sp.E) signals are being received for reasonably long periods in the UK. There have been signals throughout Band I, and a report of Band III reception! At this stage it's difficult to assess any emphasis in the direction or distance of the signals however. With the apparent absence of the usual mid-April early Sp.E opening, and the somewhat late start to the season, I feel that this year isn't going to be too good for such propagation. So far the season has been reminiscent of the 1966-7 period. The suggestion that there's a negative correlation between Sp.E reception and sunspot activity is my own, but seems to be born out by my loggings over 16 years.

The first Sp.E opening this year occurred on May 14th, during the afternoon, with RAI (Italy) and an RTVE (Spanish) signal on ch. E2. A lull over the next few days ended with an excellent opening from mid-morning onwards on the 21st. YLE (Finland) ch. E2, TSS (USSR) chs. R1 and R2, and SR (Sweden) chs. E2 and E3 were all received here at Romsey, whilst elsewhere RAI, RTVE, ORF (Austria), Switzerland, ARD (W. Germany) and RTS (Albania) were received. Of greater importance however was the logging by Mike Allmark (Leeds) of an Italian ch. ID (ch. E5, Band III) signal from 1641-44. Two metre band loggings confirm the presence of Italian signals and help localise the area and hence identification of the transmitter – Martina Franca (220kW e.r.p.). Congratulations on this achievement!

There was further Sp.E reception at Romsey on the 22nd, with TSS, SR, NRK (Norway) and RTVE; unidentified signals were received on the 24th; and on the 29th JRT (Yugoslavia), RTVE and unidentified signals. Reception on the 22nd and 23rd elsewhere produced YLE, MTV (Hungary), CST (Czechoslovakia) and TVP (Poland).

Several enthusiasts have reported reception from May 21st onwards of weak, long-duration Sp.E signals from RUV (Iceland) on ch. E4, with programmes initially and the PM5544 test pattern from midnight to 0300. Weak ch. E3 signals are also present for a time. I logged the pattern on the 24th, but from 2240 onwards. Mike Allmark has suggested that these signals are in fact received via Auroral E propagation. Keith Hamer comments that DXers wanting to log RUV should try from midnight onwards on chs. E3/4 with the aerials pointing to the NW, the European transmitters then being off-air.

Other signals received during May have included Gwelo, Rhodesia ch. E2 via F2 (Hugh Cocks) and French and W. German stations on the 13/14th via tropospheric propagation. Kevin Jackson (Leeds) noted u.h.f. lightning scatter signals earlier, on April 12th.

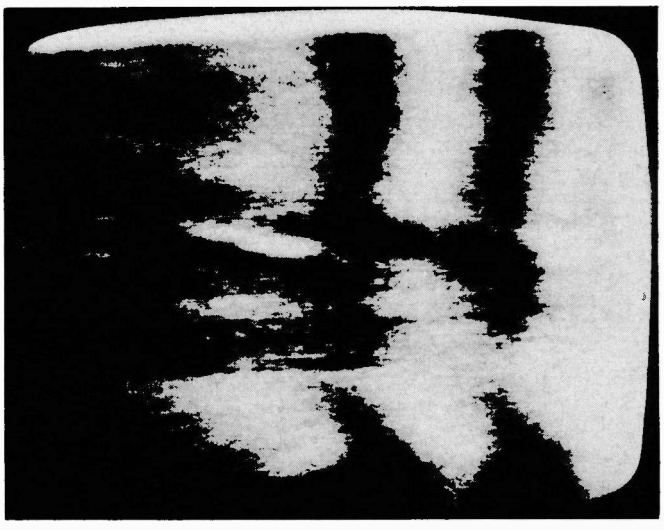
F2 propagation to W. Europe has left much to be desired unfortunately, but there are those in more fortunate climes. Briefly, Anthony Mann reports reception at up to 50MHz between S. California and New Zealand every day during the month to mid-April, with TVQ0 and ABMN-0 being received in California. An Hawaiian 50·104MHz beacon was received at Perth, W. Australia on April 18th, while short-skip F2 produced long hours of both NZ and E. Australian TV. Rhodesian army communications at 40MHz were monitored, along with Indonesian, Chinese and Russian TV. April 2nd produced sound and vision from Seoul ch. A2 (AFKN-TV). Reception at up to 59·24MHz occurred on April 14th, with many of the above signals and various NHK (Japanese) radio links – these operate between 55-65MHz at powers up to 50W. Robert Copeman confirms that ATV0 will be moving to ch. 10. The other ch. 0 transmitters will remain in operation however, so a good chance of widespread ch. 0 TV remains! TVQ0 in fact has been received in San Diego and Florida recently. Finally Ian Roberts reports from South Africa that the first TE/F2 propagation at u.h.f. occurred on March 20th – 432MHz Amateur band signals between Salisbury, Rhodesia and Greece.

Kevin Jackson has heard from AVT0 that his reception could have been from them though it's more likely to have come from ABMN0. We can't yet for certain confirm reception of Australian TV in the UK therefore.

Going back to my own reception – and that of three other enthusiasts – of the mystery "TFL" signal on ch. A2 in July 1978, John Combs, with the help of another DXer Mark Lewis, has now come up with an almost certain identification of the transmitter! TFL should in fact be CFL, standing for the Canadian Football League: the item recorded was not a station identification but a promotion for a football match between the Edmonton Eskimos and the Ottowa Rough Riders, to be screened three days later by the CTV network. The time, at 10.30 (the game was screened at 9.30 Ottawa time), places the transmitter in the Atlantic Time Zone where there are only two CTV stations, a low-powered relay in Newfoundland (thought unlikely) and a high powered (25kW e.r.p.) station at Moncton, New Brunswick (CKCW-TV). Mark will be in the area in the near future and will be playing the recording to CKCW engineers in order to obtain final confirmation. The distance from Romsey is 2,713 miles, and triple-hop propagation is suggested. In view of RUV reception at the same time however it could have been enhanced double hop.

Interference

The Federal Communications Commission is carrying



The first time ch. B1 (BBC-1 TV) has been photographed in Australia. The photo was taken by Anthony Mann in Perth on February 21st, using a modified (System A) receiver. BBC-1 was on programme at the time: note the smearing and the white blanking bar at the top.

out tests on domestic computers following reports of interference to TV reception. Howard T. Head, writing in *Broadcast Engineering*, reports that his own computer has a clock frequency of 14.32MHz. Multiplied four times, this comes to 57·27MHz, i.e. ch. A2. The computer's internals are on a simple PCB with no screening, and harmonics and garbage are freely radiated. Although the FCC is only carrying out tests, there could be a clamp down on such badly designed equipment. Might I suggest that the Home Office investigates certain industrial installations that apparently produce v.h.f. radiation with no restrictions?!

News Items

Sri Lanka: There are now two-hour daily programmes, mainly news and sport, from the commercial u.h.f. network: a non-commercial network at v.h.f. is due to start operations next year. The main transmitters are atop the 2,300m high Pidurutalagala mountain and give, in conjunction with two relays, coverage over the whole country.

USA: A 500W commercial radio station (WBN0) in N.W. Ohio is to exploit solar energy to provide 90% of its power requirements. The experimental station will not be cost effective to start with, but a dramatic reduction in costs is expected in the mid 1980s.

World Radio Administrative Conference: The Asian Broadcasting Union proposes that the 40-68MHz and 174-223MHz bands be used for TV broadcasting exclusively, with the 223-230MHz band made available for TV if necessary.

Sunspots: The peak of the present cycle is expected to be either late this year or during 1980, with an expected smoothed peak of 180.

Research

Kevin Jackson has sent us a report from S. Canivenc, F8SH, 6 Rue de Pont-Hele, 22700 Perron-Guirec, France who is carrying out research on Sp.E propagation. Enthusiasts are requested to send him details of openings as soon as possible after the event – this is a useful piece of research, and readers are asked to co-operate as and when possible. Report sheets are available and are self-explanatory (and in English!). The final column is for additional comments such as Russian interference over the ch. E2 signal etc. Please send reports to S. Canivenc, not to the magazine.

From Our Correspondents . . .

James Phillips, who has been active for twelve years in the DX-TV field, suggests that newcomers may find it easiest to commence by using a standard u.h.f. receiver with a v.h.f.-u.h.f. upconverter and a modified u.h.f. tuner to provide a degree of selectivity plus preamplification between the converter and the set's tuner. Satisfactory selectivity on closely adjacent channels can apparently be achieved in this way.

Gareth Price (Lowestoft) has sent in an excellent photograph of the Lopik ch. E27 test pattern he receives when there's "only the slightest lift" in conditions. This is received using a Fuba XC391 aerial and Labgear 29dB masthead amplifier.

Commercial Corner

There has long been a need for receivers intended

specifically for DX reception – many would-be enthusiasts lack the confidence to adapt standard receivers for the purpose. Hugh Cocks has now formed a business specialising in the supply of receivers modified for DX-TV use. At his hill-top location in East Sussex, he's able to test the sets on "fringe but constant" signals from France, Belgium, Holland and W. Germany. Both colour and monochrome sets can be supplied to individual requirements, and there are Bush TV161 sets in good working condition switchable to the French or W. European 625-line standards (Systems L and B/G) with wide/narrow vision i.f. bandwidth switching as well. See the classified adverts section for further details.

Aerial Masts and Planning Permission

In the March 1978 *Television* Keith Hamer and Garry Smith provided a lot of practical information on assembling and erecting aerial masts. A point that should be born in mind however is that planning permission may well be required even for an ordinary domestic aerial, though it would hardly be practicable to enforce this. Where the installation is visibly larger than the usual domestic type of aerial however permission is normally required. This certainly applies to the average DX-TV installation with its Band I, Band III and u.h.f. arrays.

There are three approaches to providing a DX-TV aerial installation: to attach it to the chimney or wall using standard brackets; to use a scaffold-pole mast, probably guyed; or a lattice structure, either guyed or free-standing but with a permanent concrete foundation. Councils require a planning application in all three cases, consideration of the application being given on the grounds of appearance, local planning policy (if any), the possibility of interference and the views of local residents. If there are no grounds for refusal, limited permission lasting for say two-three years will probably be given, after which a further application is required. The aim of such a time restriction is to ensure removal of the mast if local interference is proved, if there are objections, or if deterioration makes the structure unsafe.

Local policy can change however. I originally applied at my present location for permission to erect a 30ft. self-supporting mast to carry television aerials for receiving purposes only. Some two years later I was allowed a 10ft. extension, and in late 1975 successfully applied to raise the lattice to 50ft. – with the aerials atop the mast. A further increase in height is precluded by the size of the garden, but this apart I would no longer receive favourable consideration of a further increase in height since the area is to become part of the Romsey Town Conservation Area, though I have continuing use of the existing mast on "established use" grounds. The conservation area means that in addition to the local planning authority there's now also a "district society". This vets all applications and gives its views to the authority which, though not obliged to accept them, in practice gives them sympathetic consideration.

Readers may recall the problems I've had in recent times due to industrial electronic interference. To reduce this problem, a friend some distance away recently gave me permission to use his chimney to mount a Band I aerial which would be linked by cable to my own house. This required approval from the District Surveyor (the cable would cross over the public highway) and wayleave permission from two property owners, one being a "building trust". Despite obtaining permission to cross the public highway (that's a story in itself!), the trust, which is linked to the district society, refused permission, not wishing to allow "yet another wire" within a proposed conservation area. Without their agreement, the whole scheme foundered.

In another case a reader reported problems due to being in an area with restrictions on any outside aerials. Permission had been given to some radio amateurs however, who wrote to the local authority on our reader's behalf, quoting this precedent. Permission was subsequently given to erect two aerials "for the purposes of experimental television reception".

I've examined the application forms issued by the Hampshire and the East Sussex authorities. Though different in layout, they require similar information – basically your address, the type of mast (call it a radio mast, not a radio tower) and its construction, its site, how it's to be held up, the ownership of the land, etc. It seems important to state that the mast will carry *receiving* aerials only, of the sort used for *domestic* TV reception, calling v.h.f. aerials 405-line ones and u.h.f. aerials 625-line ones. Point out that there will be no interference to any properties and, after approaching all immediate neighbours, that there have been no objections to the mast in principle (assuming that there haven't). Don't strike out too far on such a public relations winning exercise, or you will almost certainly come across someone who does object.

The reason for giving a brief non-technical description of the aerials is that this will be understood by the lay members of any planning committee – if you were to describe the aerial as "a multiple-director high-gain XG21W wideband u.h.f. aerial" it would sound large, horrible, and probably be refused permission! It's a nice touch to include any technical specification of the mast however, e.g. BS standard construction, and that it will be covered by an insurance policy against any damage in the unlikely event of it collapsing.

Depending on local requirements, it may be necessary to construct the mast in stages, a building inspector checking at a certain stage. Hugh Cocks' latest mast was delayed for a short time while he waited for the groundworks to be inspected. Since applications are published in the local press, a local lattice mast however small is likely to receive attention (in my case, a small headline "TV Mast for Romsey"!). A local reporter may give it some welcome or unwelcome publicity.

Eventually a letter will hopefully arrive with "development approved" or "approval conditional". In the former case the mast can be erected for indefinite use. The latter, which means that a further application for continued use will be required before a certain date, is more likely today however.

Anyone thinking of purchasing a large aerial system or supporting structure is advised to contact the local planning department to check on the situation and, if in any doubt, on how to make the application. Such departments are generally helpful, and initial contact may help speed up the processing of the application once made. Should the application fail, the cause for refusal will be stated and an appeal can be made.

I'd be pleased to hear from readers on the experiences, and if any helpful advice results will pass this on. I'm no planning expert, but will attempt to help any reader who foresees difficulties. Don't take the word of an aerial company or installation firm which claims that a specific system is acceptable to the local authority – the authority can enforce its removal at your expense! Note that planning policy varies from one authority to another: a policy rigidly enforced in one area may not apply in another.

Miller's Miscellany

Chas. E. Miller

Snow Joke (ouch!)

The view from my window as I write this is almost perfect monochrome, with the hedges and trees etched black against the snow. With still no real promise of a thaw, I am reminded that snow upon the ground often results in snowy TV pictures. In the town where I previously lived a blizzard could cause reception to drop off sharply in certain areas where the signal strength was never too good. At my own premises, ITV and BBC-1 would virtually disappear, leaving me with a (poor) BBC-2 picture. On one occasion this was certainly due to the weight of the snow bending the aerial out of the horizontal, but at other times it seemed that icing up was the culprit. It's also more than likely that the latter fault was affecting the transmitter aerial too – but you try explaining this to hundreds of irate customers whose favourite programmes have been marred!

The cold weather also aggravates the old problem of low mains voltage, as more and more electric heaters are switched on. True, the later TV chassis are protected against quite wide mains voltage variations, but how many of the older chassis are still in use? And how many of these are, unfortunately, located in the worst affected districts? One thing, I doubt if the situation can become as bad as it was in the sixties, when at one of my workshops it was common to have only a 190V supply, and the electric fires were equipped with large crocodile clips to enable an appropriate length of element to be shorted out!

On Wheels

I've started pushing a pram again, and before any of you leap to false conclusions let me hasten to explain that this does not proclaim the arrival of an addition to my family! No, it's simply that the accumulation of snow and ice has made even the short walk from my driveway to the workshop a very hazardous undertaking, especially when carrying a heavy set. To combat the danger I have acquired the chassis of one of those prams which has a clip-on body. Minus the latter, the framework is exactly the right height to allow a colour TV to be slid onto it from the van, and then to be pushed in complete safety to the workshop door. It's efficient, and cost me nothing!

Pricey Items

Which brings me to the subject of some very expensive equipment indeed. I've been presented with a glossy catalogue (which itself must have cost a lot to produce) of tools for the Electrical and Electronic Industries. If you're still using sharpened knitting needles to adjust iron dust cores, how about a radio and TV trimmer kit? It'll set you back only a cool £25·50 – plus VAT of course! Or if you're tired of carrying your tools around in an old fish box, why not order a prestige TV Servicing Kit? If the price of £210·50 (plus VAT) seems on the high side, bear in mind that it includes items that all of us use every day on TV repairs, such as a 6in. adjustable spanner and a set of files. You could buy the empty case and fill it with your own tools of course – unless you feel that £105·50 (plus) could buy an awful lot of old fish boxes. Seriously though, a quick estimate of the value of your personal tool kit will probably surprise you – unpleasantly so if it had to be replaced in one go. It's worth finding out the insurance cover available for theft or loss.

Hit it Again, Sam

In the above mentioned catalogue there is also an Electronic Servicing Kit (£215·50+) which contains among other items a telephone hammer. While agreeing that the damned thing can be a nuisance at times, I must say that as yet I have not felt incensed enough to take a hammer to it! And how truly British is the conception of the aggrieved subscriber exercising self-control whilst selecting the appropriate tool for the job, checking its balance between finger and thumb, and sizing up to the target. Then POW!, and another telephone bites the dust! (Thinks: does the Post Office know about these tools?)

Return of the Prodigals

Nearly five years ago I bought a batch of second-hand colour TV sets, amongst which were a 19in. Ekco set and a similar sized Decca one. The latter was used as a loan set for some time, until it developed a habit of flashing over inside the line output stage can in a truly frightening manner. The cause was excessive e.h.t. voltage, due to an obscure fault which rendered the "set e.h.t." control inoperative. Even long chats with the helpful Decca service department failed to provide an answer to this, so eventually a codge was called for.

This took the form of reducing the normal h.t. rail by about 20V using a Radiospares dropper section mounted in the lid of the line can, where it conveniently took the place of a metal stand-off and where the sandwich of aluminium could safely dissipate the heat produced. This effected a complete cure, and the set was used for another six months or so before being disposed of at an auction sale.

Imagine my surprise when it turned up as a repair job early this year, from a gentleman who had bought it at yet another sale. The fault this time was bad vertical lock, and I didn't actually recognise the set until I removed the back and saw the dropper section still comfortably ensconced. Lord only knows how many owners had had it since I got rid of it, but the tube was still original and the set gave a very acceptable picture!

The Ekco on the other hand must have been the unluckiest set ever to have been in my workshop. It started out with a comparatively minor fault – field collapse – but when this had been rectified, and before the set could be resold, the tube neck was mysteriously broken. Some months elapsed before a replacement tube was obtained and the set could at long last be sold. It gave good service for a year, then the line output transformer burnt itself out. While in the workshop awaiting a spare, the poor old Ekco became the victim of an amazing coincidence – a visitor managed to trip over and kick the neck off the tube!

When at last another replacement had been fitted, the set performed well enough until just prior to last Christmas. Then the sound module failed. I warned the owner that there could be more trouble to follow, bearing in mind the age of the set, and ended up taking it in part exchange. It gives me no pleasure to reveal that for once I was perfectly accurate in my forecast – the first time I switched the set on the line output transformer caught fire again! This can't be the start of a repeat cycle can it? It's not possible, but maybe I'd better fit armour around the tube neck just in case . . .

Guide to Coarse Servicing – Part 2

"We've got to take that colour set back to Farmer Giles" said Ike Hodge to his faithful assistant Willy. "Put it on the van while I make out the bill."

This latter job seemed to exercise him considerably, for he was still sitting with pen poised over his invoice book when Willy returned from his task. In answer to his minion's surprised expression, Ike explained:

"Never rush yourself when you're working a farmer's bill out. Remember he'll always expect what he calls 'luck money', or in other words a discount. So you have to be one jump ahead. Watch carefully what happens when we get there, 'cos I shall ask questions later."

And so he did. "You noticed he asked me to make out the cheque for him to sign? Why do you think her did that?"

"I dunno" replied Willy, puzzled. "I wondered about that at the time."

"I'll tell you then. It's really a left over from the pre-decimal money days. It was so long winded having to write out an amount like say twelve pounds thirteen shillings and nine pence that you might knock off the odd money, or at least round it down to a straight ten shillings. Another thing is that it's psychologically easier to ask for a 10% discount if the other person's making out the cheque. I was ready for that too."

"I know" said Willy brightly, "you'd already put 10% on!" He looked hopefully at Ike, expecting praise for his perspicacity, only to be sadly disappointed.

"That's one of the most unethical suggestions I've ever heard!" Ike exclaimed. "I wouldn't do a thing like that, for the simple reason that I'd still be out of pocket!"

"How do you make that out?" demanded Willy, perplexed.

"Listen and I'll work it out so that even you can understand. Suppose I wanted £100, to use round figures, and I added on your 10%, that is £10. What would that give me?"

"£110 of course."

"Exactly. And 10% of £110 is £11, which would leave me getting only 99 quid. But . . . if I added on 12½%, the total would be £112·50, so that even after knocking off 10% I'd still draw over the hundred mark, which pays me for all the time I've wasted working it out in the first place. The golden rule is always to put on more than you intend to take off – remember that, and you can't go far wrong." He paused for breath.

"Anyway, I don't agree with discounts on principle. You get factory workers coming in here asking for 'em – what do you think they'd say if their bosses asked 'em to work for 10% less wages? They'd be out on flipping strike."

"You're a genius" said Willy admiringly.

"I know" Ike admitted modestly. "Anyway, let's get back to the workshop. We'll call in at that filling station in the High Street. They're knocking a few pence off petrol this week."

After they'd bought the fuel and set off again for base Ike bemoaned the fact that it was necessary to run a vehicle at all.

"Daft trade to be in this is" he complained. "I should have been a watch repairer. They get all their work brought in to them. We have to collect sets, then repair them, then cart them back again and risk not getting paid. You can't go and get a watch back if you're not prepared to pay for it there and then."

"Have you had many bad payers?" asked Willy.

"Did when I first started. That's natural. You always get the other dealer's rejects to begin with. I'll always remember one, a bloke called Gannet. He needed a new tube in his set, a round 14in. type, so you can tell how long ago that was. All the same, the job cost the best part of twenty quid, which was a lot of money in those days. When I took the set back there were only the kids in, and they said their mum would call round to pay at the weekend. She didn't of course, and as luck would have it I mentioned this to the bloke who used to bring the Sunday papers and who was also a part time debt collector. "Pity you didn't ask me before you did the job" he said. "You don't stand a chance of getting your money. Gannet's a professional bilker. I've seen one van delivering furniture there at the same time that another's been snatching the old lot back. Your one hope is to stand outside the gates of the factory where he works on paynight and try to screw it out of him while he's got it".

"Well, I didn't reckon much on this idea. If I put Gannet's back up he might have offered to pay me so much a week, and that's fatal."

"How come?" asked Willy.

"Say he'd offered to pay ten pence a week. It would have taken four years to get my twenty quid, so what use would that have been? But at the same time I wouldn't have dared refuse, because if I had and I then tried to take him to court for the money all he'd have had to do was to stand up, look innocent and say 'but your Honour, I offered to pay Mr. Hodge but he refused'. That would've put me in the wrong. And even if I'd got an order for payment, it might well have been for the ten pence a week, so I'd have had all the court costs for nothing."

"So you lost the twenty quid–"

Ike snorted. "You must be joking. Time was on my side, so to speak. The set was a rotten old ..... (he mentioned a well known brand name which has long succumbed to "badge engineering") so I knew it wouldn't go for long. Sure enough, about a month later Mrs. Gannet phoned up to complain that the picture had shrunk from the top and bottom. I went and had a look at it, but didn't mention the outstanding twenty quid at all. In fact, I was as nice as pie to her. I told her that it was nothing much, but that I'd have to take in into the workshop for a few hours. Once I'd got it safely back here I wrote them a letter to say I'd return it as soon as I'd got my money."

"What did they do?"

"That's the funny part about it. I didn't hear a word from them, not for three months. Then out of the blue came this phone message from one of the kids. 'Mum says will you bring the telly round at tea time, 'cos she doesn't want to miss Crossroads. She's got the money for you.' This struck me as very odd."

"You mean that she'd want to watch Crossroads?"

"Apart from that, what had she been doing for the last three months? As far as I knew she'd been without a set, so why this sudden hurry?"

He chuckled. "I figured it out in the end. At that time the

local relay company was giving three months' free trial of their sets. Gannet must have had one and the time was due for the snatch back to take place. So he had to pay me."

"What happened when you took the set back?" asked Willy. "Were they upset about the way you'd conned them?"

"You can't upset people like the Gannets" said Ike sombrely. "Like I said, they're professionals. That's what all those do-gooders who moan about customers' rights will never understand."

He unlocked the workshop door and pushed it open. On the floor was an all too familiar type of envelope. "Blasted electricity bill again!" commented Ike bitterly. He picked it up and threws it into the rubbish box. "They can wait until the red one comes in. Must think I'm made of money!"

(More Awful Disclosures Soon!)

A VCR with No Colour

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

A local cinema club here has three N1700 VCRs running twelve hours a day non-stop. The fault I was called out to was no colour from one of them. It seemed likely that something was amiss in module U515 (see Fig. 1) since this is responsible for most of the colour signal processing. An obvious first check was to measure the colour-killer output voltage at pin 9. This should be less than 1V with a monochrome signal and more than 6V with a colour one. The voltage was in the low state.

The colour-killer voltage from pin 9 of module U515 is applied to pin 5 of the chroma filter module U514, so the next move was to disconnect the link between these two pins – there's a solder bridge for the purpose. This restored perfect colour, so there didn't seem to be much wrong. A replacement U515 module should do the trick – but didn't. Back to square one. The best course seemed to be to take the machine back to the workshop, so I informed the management of my intention. They were busy watching an off-air cartoon rather than their own material. Too much of a good thing gets you that way I suppose.

Back at the workshop I discovered that the colour-killer output remained in the low-voltage condition in both the record and replay modes. Remembering that we'd got perfect colour on disconnecting the colour-killer output, we assumed that the reference oscillators were probably in order – if the 8·86MHz oscillator was off lock, the burst detector would not operate normally and the colour-killer would close down. Try a quick buzz round with the scope. No joy, all waveforms present and correct – as also were the pin voltages, except for pin 9 of course.

Oh puzzlement (or something to that effect)! Brief recap: all waveforms correct, all voltages correct except for the colour-killer output, and changing the module makes no difference . . .

Take a closer look at the block diagram of the module. The colour-killer section receives its input from the colour a.g.c. section, which is in turn fed from the burst detector. The latter is fed with the reference signal and the gated bursts, as in normal colour receiver practice. Suppose the timing of the burst gate pulse is incorrect? This would be likely to throw the whole thing out. So we decided to display the burst gate pulse input at pin 10 and the chroma signal input at pin 15 on a double-beam scope. Result: confirmation that the gating pulse was displaced.

The pulse is produced in module U513E, which contains a gate pulse shift control (R7). Resetting this restored module U515 to normal operation, with the voltage at pin 9 around 7V.

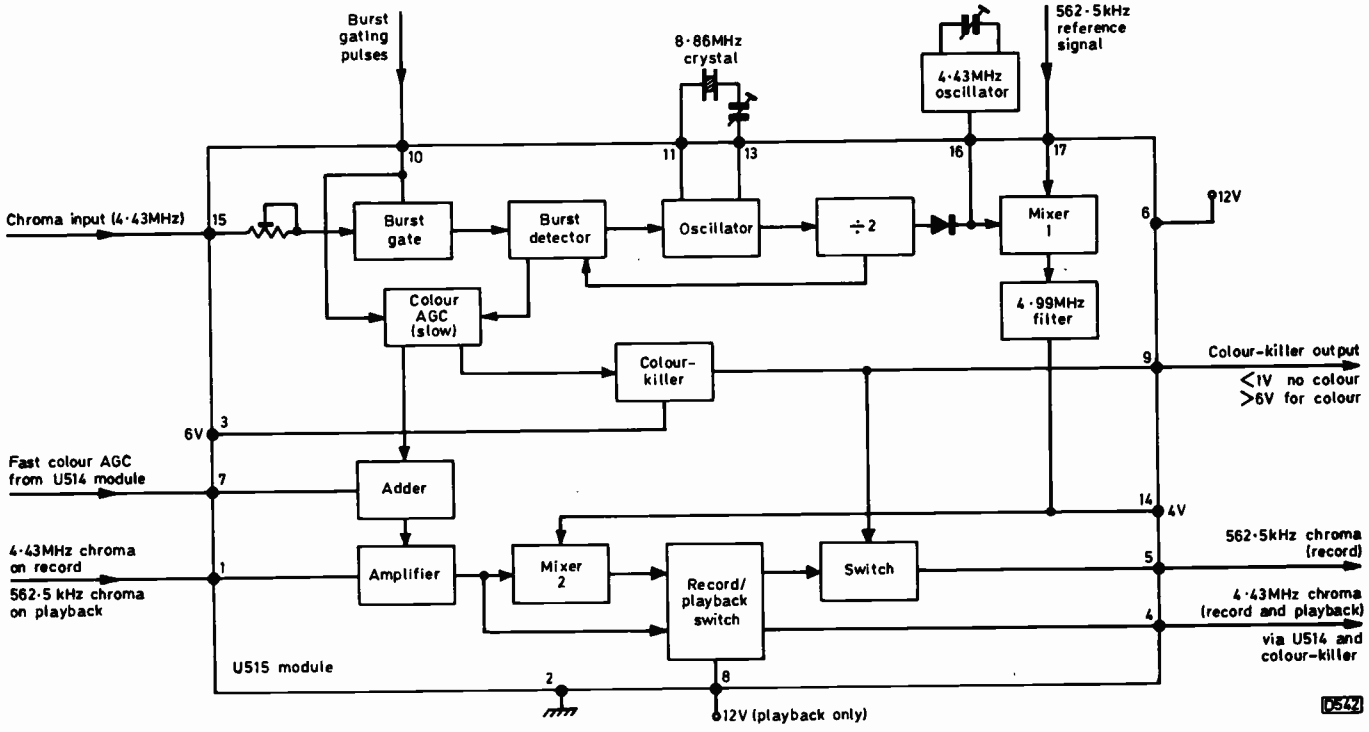


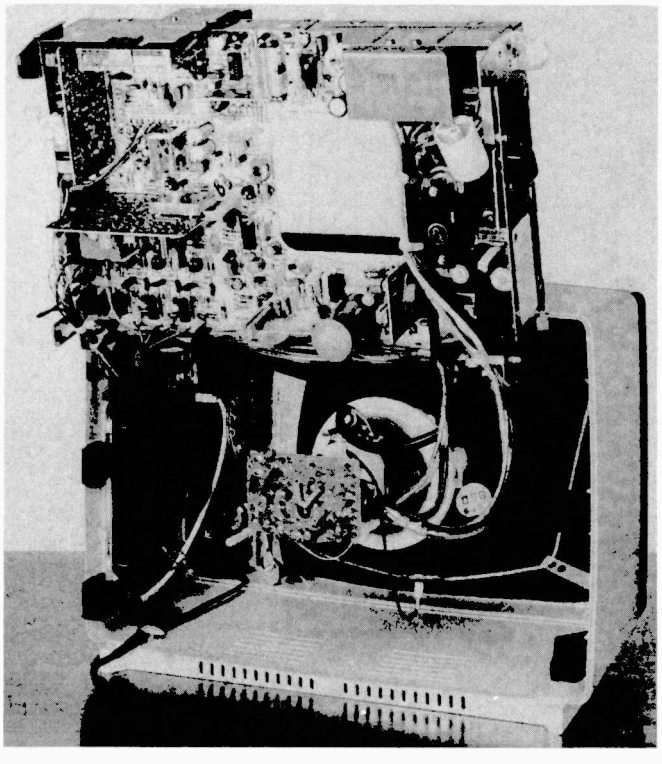
Fig. 1: Block diagram of the U515 chroma signal processing module used in the Philips N1700 VCR.

The New Colour Chassis

LAST month we described the basic technical features of some of the latest colour chassis introduced by UK set-makers, including the Decca 70 series chassis. We've since had an opportunity to examine this latter chassis in some detail, and following this some further points are worth making.

First, we were rather surprised to learn that the chassis has been designed to drive all types of tube, from 14in. to 26in., both 90° and 110°, and of the PIL, 20AX or 30AX variety. Initially, it will be used with the smaller 90° tubes, but the intention is to phase it in as a replacement for the 80 and 100 series chassis during the coming year. For the larger screen sizes a new, beefier but pin compatible field timebase i.c. will be used, and the line output transformer and flyback tuning capacitor changed to obtain a higher e.h.t.

The accompanying photographs show the neat arrangement of the chassis. The main printed panel is made of random glass material, which has a pale yellow appearance, to reduce losses from breakage. To assist with fault location, sections of circuitry on the board are joined together by plug-in links: by removing these, areas of the circuitry equivalent to separate boards can be isolated. The cabinet and back of the 14in. portable are made of white Noryl SE90, a new moulding material that's flame retardent, mechanically strong even at extremes of temperature, resistant to ultra-violet light and gives a high gloss finish. The black front edge is painted on using an electroformed mask. The cabinet shape is designed to allow hot runner moulding, a modern technique that enables thinner walls to be used – important in reducing weight as well as in the economics of the cabinet. The tooling time needed for moulded cabinets is in fact long, and determined the timing of the introduction of the new chassis.



The Decca "Companion" 14in. model, showing the 70 series chassis in its service position.

The main circuit features were described last month. There are nevertheless several small points of interest. First there's the varituning feature used in the portable. This consists of a customer tuning knob, marked with a u.h.f. dial, linked by a slow-motion drive to one of the four tuning potentiometers. When button 1 is selected, the customer has rotary tuning over the entire u.h.f. spectrum. The a.f.c. characteristic of the receiver is designed to make the rotary tuning operation simple and accurate. DX enthusiasts will obviously find this feature of interest.

Operation under fringe area conditions has been given careful attention, with a board layout arranged to achieve a high degree of r.f. stability, a TDA2571 used for the sync operations, and an interesting colour-killer circuit. The TDA2571 includes noise-cancellation to give clean line sync pulses, and a countdown circuit which derives the field sync pulses from the line sync pulses. The latter feature eliminates the loss to field sync sometimes experienced in areas with strong negative ghosts.

Colour-killer Circuit

In most sets the colour-killer circuit comes into operation when the burst is either absent or of low amplitude. As a result, the colour can come and go under weak signal conditions. To avoid this trouble, the colour killer is arranged to operate in the usual manner with normal or high signal levels, but is disabled when the signal is very weak, allowing the colour to be retained during fading. A demonstration with a colour-bar generator and signal attenuator showed the effectiveness of this arrangement. The circuit is simple (see Fig. 1). The colour killer can be over-ridden by connecting pin 16 of the TDA2522 chrominance i.c. to chassis. Accordingly, a switching transistor is connected across the 1μF electrolytic which normally decouples this pin. The transistor is linked to the a.g.c. circuit, so that under high-gain conditions it switches on and over-rides the normal colour-killer action. This can result in coloured noise on a monochrome picture of course, but simply turning down the saturation control takes care of that.

AV Operation

Consideration has also been given to the use of the set with VCRs and video games systems. Depressing tuning buttons 1 and 2 together switches the set over to AV operation (on sets fitted with this facility, which is optional). In addition to the usual alteration to the time-constant of the flywheel line sync circuit, the field sync circuit is switched, as shown in Fig. 2. This alters the sync input to the field timebase from the countdown pulse system in the TDA2571 to direct field sync, in order to take into account any inaccuracy of the sync pulse timing – particularly noticeable with some video games. Under normal operating

conditions, the countdown field sync pulses from pin 1 of the TDA2571 pass via the 2·2kΩ resistor 3R5 on the field sync subpanel (this is fitted only on AV versions of the set, 3R5 being shorted out on non-AV versions) to the field timebase. When the AV switch is operated however, 3Tr2 and 3Tr3 come on. 3Tr3 shorts pin 1 of the TDA2571 and the earthy end of 3R5 to chassis, and 3Tr1 and 3Tr2 form a two-stage amplifier for the direct field sync pulses present at pin 5 to the TDA2571.

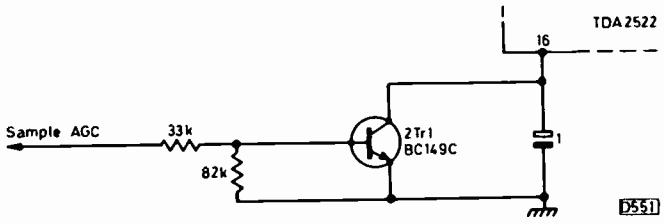


Fig. 1: Circuit used in the Decca 70 series chassis to override the operation of the colour killer under weak signal conditions.

GEC's PIL Chassis

GEC also have in production a chassis designed to drive 90° PIL tubes. This was introduced last year and there are two GEC sets, Models C2026H and C2036H, both fitted with 20in. c.r.t.s, the latter featuring infra-red remote control. There are also 18 and 22in. versions. It's understood that most of these sets are supplied to rental organisations. The chassis employs modular construction, and the power consumption is quoted as 85W.

The heart of this chassis is a parallel switch-mode power supply à la CVC20 chassis – bridge rectifier, –300V rail,

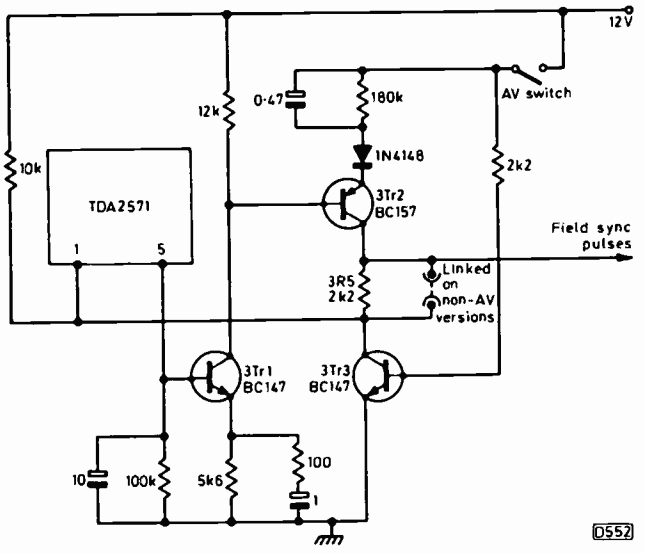


Fig. 2: Switching the field sync pulse feed to direct sync for AV operation, Decca 70 series chassis.

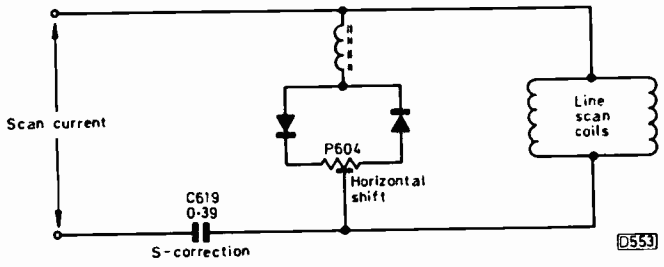
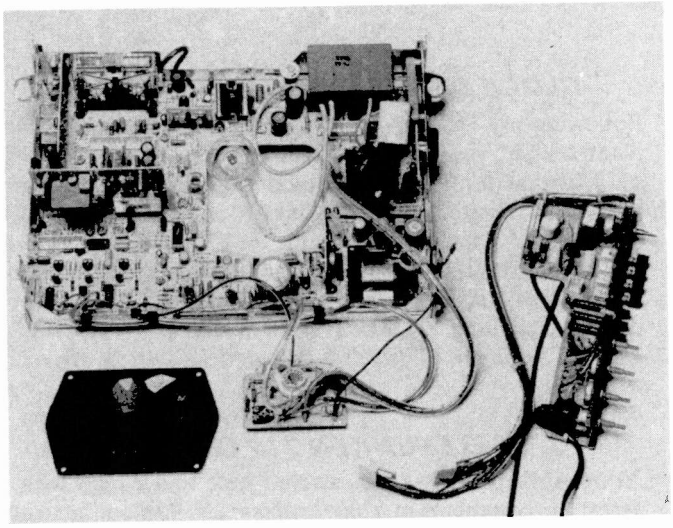
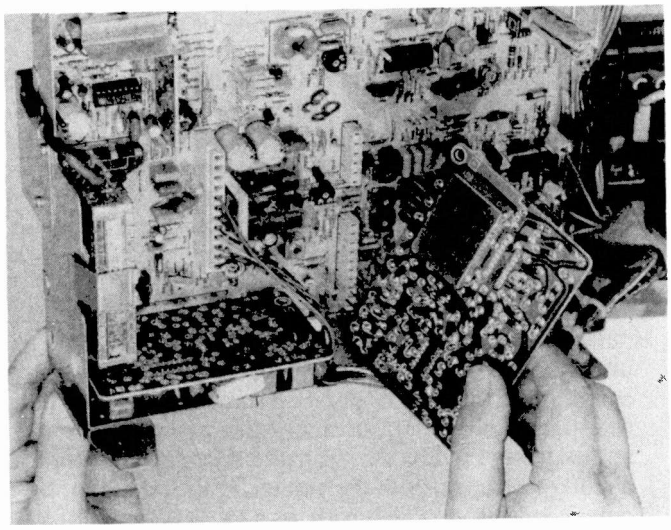


Fig. 3: The simple horizontal shift control circuit used in the GEC PIL tube chassis.



The Decca 70 series chassis which is designed to drive, with only minor changes, all tube sizes up to 26in. The speaker at the bottom left is a 4×6in. one, giving an idea of the compact layout of the chassis.



The tuner and the i.f. and decoder boards, as well as the integrated circuits, all plug into the mother board of the 70 series chassis. This photograph shows the decoder board withdrawn from its socket.

TDA2640 control i.c. and BU126 chopper transistor. The line timebase is completely separate, consisting of a TBA920 sync/line oscillator i.c., a driver stage, and a BU208 driving a diode-split line output transformer. A driven transductor is connected in series with the line scan coils to provide EW correction. The field timebase consists of a TDA1170 i.c.

On the signals side, a conventional varicap tuner drives the now almost mandatory TDA2540 i.f. i.c., via *LC* filters and a BF199 preamplifier stage. The sound channel consists of a TBA120U intercarrier sound i.c. driving, via a BC148 preamplifier stage, a TBA800 audio i.c. The current Mullard three-chip (TDA2560, TDA2522, TDA2530) decoder is used, driving complementary-symmetry (BF470/BF469) push-pull RGB output stages.

Another neat and simple chassis. The simple horizontal shift control circuit, which operates by introducing a d.c. component in the line scan circuit, is shown in Fig. 3. The BC147 field sync pulse amplifier stage used in previous GEC solid-state chassis is retained in this one. In the event of weak field sync, don't forget to check its 4·7μF emitter decoupling capacitor (C352 this time). ■

Letters

FIELD ROLL – REDIFFUSION Mkl CHASSIS

I read with interest the suggestions you offered for solving the problem of field roll in a receiver fitted with the Rediffusion Mk. I chassis. There is however an official modification to cure this fault, as follows:

(1) Replace the a.g.c. amplifier transistor's 180Ω emitter resistor R054 with a 2·2kΩ, ¼W 5% resistor.

(2) Cut the print track between the collector of the video distribution transistor TR005 and pin 3 of plug/socket 01, bridging the gap with a 1kΩ, ¼W 5% resistor.

(3) Reassemble the receiver, switch on and check that the level of the composite video signal at the "hot" end of the contrast control is 2·2V peak-to-peak. If necessary, adjust the a.g.c. preset potentiometer RV001.

The problem is well known with this chassis, and varies with local signal conditions.

J. Sinclair, C.Eng., M.I.E.R.E., Rediffusion Consumer Electronics Ltd., Chessington, Surrey.

CLOCK MODIFICATION – N1500 VCR

Readers who have converted Philips N1500 VCRs to operate at half the original speed may be interested in the circuit shown in Fig. 1. This has been devised to extend the operating time of the clock. The thyristor method previously suggested enables the clock to be set for recording times of over 70 minutes and up to the end of the tape, but the useful facility of being able to set it for periods of 5-70 minutes is lost.

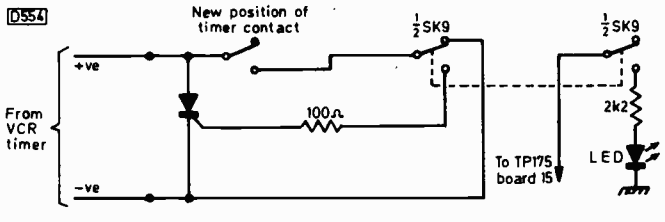


Fig. 1: Suggested circuit for extending the operating time of the clock in the Philips N1500 VCR.

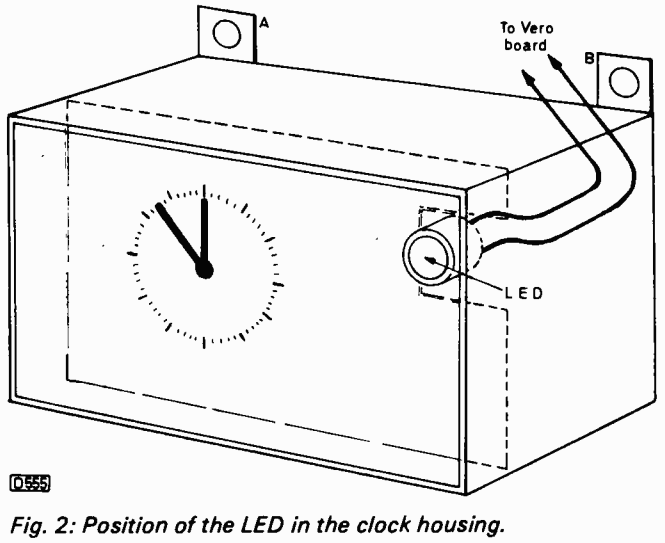


Fig. 2: Position of the LED in the clock housing.

Switch SK9 was used so that the case need not be drilled. In the original design SK9, a double-pole pushbutton switch, operates the colour-killer circuit. This feature is rarely if ever required however – in fact Philips subsequently dropped the manual colour killer facility from their VCRs. Short together and insulate the original connections to SK9. It can be seen from the circuit that when SK9 is in the up position the clock operates as before; when it's in the down position, the machine plays to the end of the tape. To draw the operator's attention to this mode of operation, a green LED was fitted into the clock housing as shown in Fig. 2 – it's mounted where there's a convenient rectangular hole on the right side of the clock's internal upper plate. The thyristor and other components are mounted on a small piece of Vero board fitted above the clock case.

The clock can be removed after loosening the screws at A and B – take care that the nuts don't fall into the electronics below when doing this.

Keith R. W. Scull, Newport, Gwent.

CLOCK MODIFICATION – N1502 VCR

Following my letter (April issue) on converting the Philips N1502 VCR, your readers might be interested in the Philips modification for two hours' recording time on the digital time clock. First, remove the link from pin 23 of IC321 to positive C. Then reconnect the link between pin 23 of IC321 and positive A (the 12V rail). I neglected to point out in the previous letter that an N1700 head drum has of course to be fitted to the converted machine.

Clifford Springer, Cliffords Radio and Television, Bristol.

TELEFUNKEN 711 CHASSIS

Your April issue has just arrived here and I read with interest the comments in *Your Problems Solved* on the trouble of pincushion distortion on a set fitted with the Telefunken 711 chassis. I agree that the most likely cause of the trouble is that the bridge coil L564 has shorting turns – this can be confirmed if the voltage at test point M602 is −1·5V instead of 4·7V – but would like to add that in our experience the main cause of L564 shorting is one of the EW modulator diodes, D563, going short-circuit.

Another interesting fault in the EW correction circuit leads to width variations. The culprit is C594 (0·0047μF), the integrating capacitor connected between the collector and base of transistor T594 – it develops a leak, and the voltage at both the base and the emitter of T594 is then 3V.

I've also found shorting turns in the focus transformer Tr563 to be the cause of lack of width – the d.c. resistance between pins 2 and 3 should be 500Ω.

Some other faults we've had on this chassis. First, a 50Hz buzz that increases in volume with brightness – this is usually due to the mains choke L401. Secondly intermittent operation of the c.r.t. heaters: on some sets, the connections near the mains tap adjustment or the mains transformer are not soldered. Finally, the 4A mains fuse Si421 blowing after about 15 seconds, with the voltage at the emitter of the line output transistor T562 high at 45V instead of 28V (test point M551). The h.t. voltage remained normal on disconnecting the scan coils, but the linearity coil L563 was faulty though measuring correctly.

Binay Maharaj, Pietermaritzburg, Natal, South Africa.

Faults Encountered

Dewi James

WHAT with moving house recently we've not had much time to report on the various faults that come our way. Things now being somewhat more settled, it's time to take up the pen once more.

ITT Model FT110

An ITT Model FT110 came our way recently. It's not a very common set, being a continental made one with a 110° delta-gun tube. So when one does turn up we have to resort to first principles. This one was dead (aren't they all these days?) – no sound, no raster, tube heaters cold, even the touch tuner lamps not lighting up. There was a whistle from the line oscillator/switch mode power supply module however. Now this chassis uses a somewhat unusual arrangement in which the line oscillator drives a pulse-width modulator which, via a driver stage, drives what's called the converter stage. The latter consists of a BU208 transistor loaded by a transformer whose secondaries feed rectifiers which provide stabilised supply lines for various sections of the receiver, including the 163V line to the line output stage. The outputs from the module were all present and correct, but there was no voltage at the collector of the line output transistor (another BU208), due, it was discovered, to an open-circuit connection at pin 10 of the line output transformer. Why no sound? Well, the supply for the audio output stage is derived from the EW modulator circuit.

A peculiar fault that's worth noting on this chassis is a small picture with inability to adjust the 163V rail correctly. This is usually due to the 33V reference zener diode D706 in the pulse-width modulator circuit.

Hitachi NP6C Chassis

A recent Hitachi set (Model CTP203, NP6C chassis) made an unaccustomed appearance in our workshop the other day, the complaint being that from time to time it failed to come on. Our field engineer had paid two visits to the set, but on both occasions it had behaved itself. He had checked the mains plug/socket etc., but in it had to come and sure enough one morning it failed to work. Thinking that discretion is the better part of valour, we consulted the Hitachi flow chart. As a result we replaced the two transistors (TR901 and TR902) in the start-up multivibrator circuit, and the two reference voltage modules CP901 and CP902 (both type HM9102) in the regulated power supply circuit. Well, you need a bit of luck sometimes.

Pye 731 Chassis

Getting back to the more usual run of things, and the Pye 731 chassis: we've some of these out on rental, and there are one or two problems they regularly present. Take for example the set that comes in dead. You take a quick voltage check along the h.t. dropper section (see Fig. 1) and find no h.t. So you delve into the power supply proper. Wrong: if R978 (3·3Ω) is open-circuit, there's no h.t. on either side, so check it with the resistance meter – you've been warned!

A fairly common cause of low h.t. on these sets is R911 (390kΩ) in the power supply regulator control transistor's base circuit changing value. Excessive or low brightness can be caused by either R642 or R643 which feed the c.r.t.'s first anode presets – depending on whether they go high or low in value. Sometimes they're damaged when one of the presets burns up, taking with it the associated 470kΩ series resistor. For low or no sound check the 330μF electrolytic C257 in the audio output stage, the TBA750Q intercarrier sound channel i.c., then the feed resistor R249 (18Ω) in the supply to the sound circuits.

Philips G9 Chassis

The Philips G9 chassis gives us a few headaches from time to time when C138 (2,200μF) becomes faulty. It decouples the emitter of the BU208 line output transistor. The symptoms vary, sometimes a dead set because the line oscillator fails to get going, more often a small, narrow, wavy picture. Keep an eye on the associated 200mA fuse FS137. This sometimes blows at the same time, adding no sound to the list of symptoms.

Pye/Philips G11 Chassis

One or two faults on the Pye/Philips G11 chassis are now becoming apparent – apart from the mains bridge rectifier diodes going short-circuit and blowing the 3·15A mains fuse. A dead set can be the result of the transistors (T4086 and T4085) in the beam limiter circuit, or R3106 (820Ω) becoming open-circuit. The latter is the feed resistor to the line driver stage. R4059 (15kΩ) on the power supply panel can be responsible for an intermittently pulsating raster due to h.t. voltage variations. Intermittently open-circuit print in the CRT first anode control unit 1617 can result in one or more of the guns switching off.

Finally we've noticed over a period of time, and by some lucky coincidence, that damage to the TDA2600 field timebase i.c., causing no field scan, can be the result of an intermittent mains supply, i.e. a faulty mains socket and/or plug. So next time you have to replace this i.c., it would be worth checking this plug and socket.

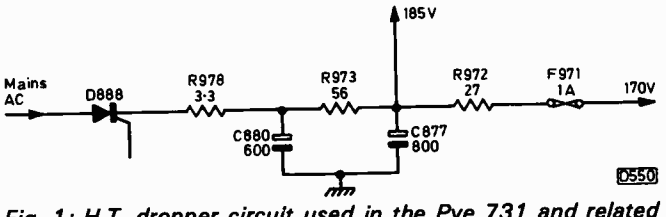


Fig. 1: H.T. dropper circuit used in the Pye 731 and related chassis. If R978 goes open-circuit, there's no voltage at either end – because the reservoir capacitor C880 comes after it in the circuit. So check R978 with the meter switched to the low ohms range.

Simple Sync Pulse Generator

Malcolm Burrell

SYNCHRONIZING pulses are essential to TV as we know it, providing the timing references to keep the transmitter and receiver scanning in step. Most of the cheaper closed-circuit TV cameras which provide a video-frequency output generate their own sync pulses internally and cannot always be adapted to run from an external sync source to facilitate picture mixing or provide, with other equipment, special effects.

To provide sync pulses to the full broadcast specification using conventional techniques would involve a circuit almost as complex as the colour pattern generator project described in the last three issues. The ZNA134 sync pulse generator i.c. was chosen for use in that project because it simplified matters. It's expensive however, and as it was felt that some readers would prefer a cheaper solution we have produced a simple random-interlace unit which employs the minimum number of cheap components. The resultant pulse timings may be a little more approximate, and a single, broad field sync pulse is generated instead of the usual chain with equalising pulses. With care however good results should be obtained.

There is no reason why the unit should not be constructed as a separate item to drive other video equipment. Note however that the outputs of the basic circuit are at TTL level and are not designed to drive 75Ω loads. It can feed a few unterminated 75Ω loads for experimental purposes, but if terminated lines are to be used the arrangement shown in Fig. 2 is suggested. This involves the use of additional gates to buffer the outputs and provide the necessary current drive.

The circuit of the basic sync pulse generator is shown in Fig. 1. IC1 is a 555 timer i.c. which produces a squarewave output with a mark-space ratio of about 1:1, at 15kHz. VR1 enables the frequency to be adjusted. This i.c. drives the monostable IC2 (74121) which produces the line flyback blanking pulse. One output line from this goes to the NAND gate IC7a, where it's mixed with the field flyback blanking pulse to give a mixed blanking signal. The other output line goes to pin 1 of IC3 to trigger one of the monostables in this dual-monostable i.c. This gives the front porch timing to trigger the second monostable in the chip, the output at pin 5 being the line drive pulse. This is fed to the unit's line drive output via the inverter IC6a. The output from IC6a is also fed to the NAND gate IC7c where it is mixed with the field sync pulses to give the mixed syncs signal.

Another 555 timer, IC4, operating at 50Hz, is used in the field sync section. VR2 provides frequency adjustment. The output triggers both monostables in IC5. One of these monostables provides the field drive pulse, the other the field flyback blanking pulse.

To set up the unit, view the outputs using a monitor or, alternatively, drive a known good video source. Set VR1 for correct horizontal locking, then VR2 for vertical lock. Some receivers may show some ripple on the raster: adjust VR2 so that this is as slow as possible.

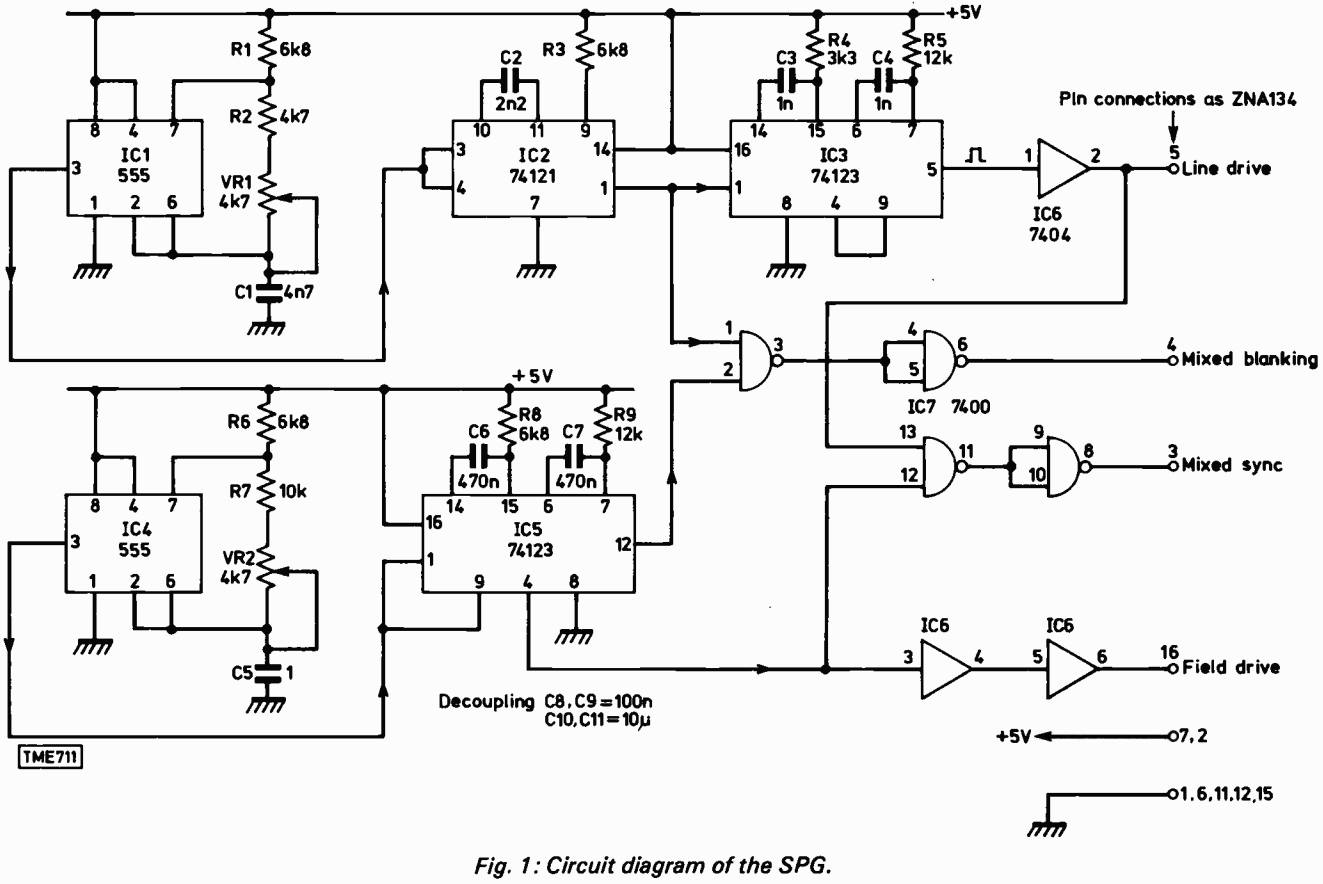


Fig. 1: Circuit diagram of the SPG.

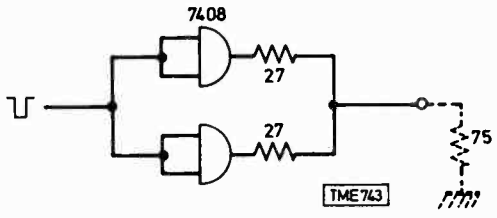


Fig. 2: Suggested interface circuit for driving 75Ω loads.

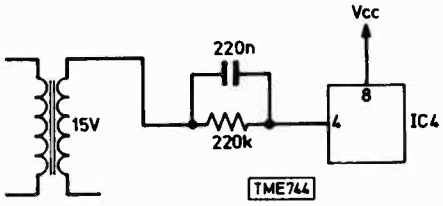


Fig. 3: Suggested mains locking circuit.

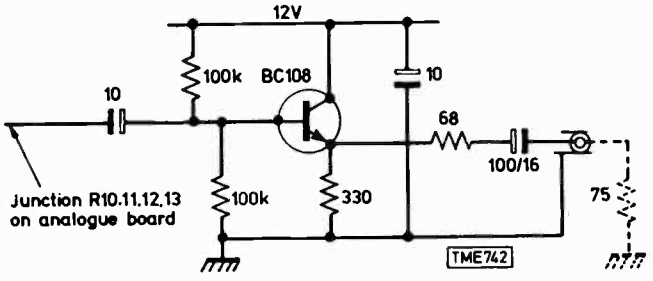


Fig. 4: Interface circuit for the author's Colour Pattern Generator (May-July 1979) for providing a video output signal suitable for driving 75Ω loads.

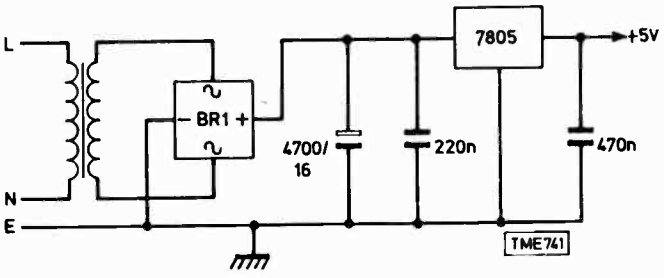
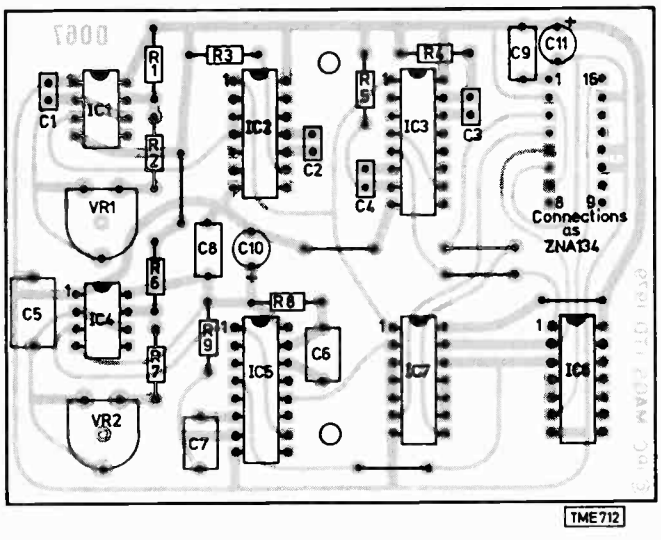


Fig. 5: Suitable mains power supply for the SPG.



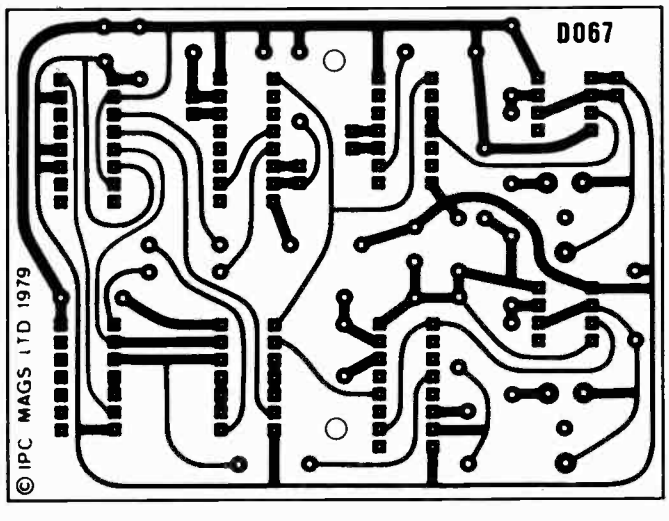


Fig. 6: Print pattern for p.c.b. (immediately above) given as 1:1, and component location diagram for the unit (above of print pattern).

Mains locking is undesirable if this unit is used in the colour pattern generator, since one would normally like to see all the defects in a picture. For other purposes however mains locking may be desired. If so, IC4 can be triggered from the 15V a.c. on the secondary of the mains transformer using the circuit shown in Fig. 3. This will eliminate any moving ripple in pictures.

The unit can be constructed on Veroboard or the PCB shown. Note that the unit is designed as a plug in replacement for the ZNA134 in the colour pattern generator (May-July 1979) and previous projects – the simple test card generator (May-June 1978) and diagnostic pattern generator (August-September 1978).

Readers wishing to obtain a video output from the colour pattern generator can use the circuit shown in Fig. 4 in place of or in addition to the modulator. ■

★ Components – basic SPG

Resistors:

R1	6k8
R2	4k7
R3	6k8
R4	3k3
R5	12k
R6	6k8
R7	10k
R8	6k8
R9	12k

All 0·25W, 5% carbon film

VR1	4k7
VR2	4k7

Subminiature horizontal

Integrated circuits:

IC1	555
IC2	74121
IC3	74123
IC4	555
IC5	74123
IC6	7404
IC7	7400

Capacitors:

C1	4700pF	ceramic
C2	2200pF	ceramic
C3	1000pF	ceramic
C4	1000pF	ceramic
C5	1μF	polyester
C6	0·47μF	polyester
C7	0·47μF	polyester
C8	0·1μF	ceramic
C9	0·1μF	ceramic
C10	10μF 35V	tantalum bead
C11	10μF 35V	tantalum bead

TV Servicing: Beginners Start Here . . .

Part 23

S. Simon

IT'S time we tip-toed into the shallow end of colour TV servicing and took a look at some of the problems we are likely to meet here. We've already cut our teeth on hybrid monochrome sets, and last month considered the use of the multimeter in checking expected voltages and resistance readings. It seems a logical step therefore to start with some common hybrid colour chassis and to see what our meter can tell us about them. There are two advantages in starting with hybrid colour sets. First, these are the ones you are most likely to meet, simply because they are generally the older ones. Thorn must be excluded from this comment, since they never made a colour receiver with a valve in it (unless you class the c.r.t. as a valve). The second advantage is that hybrid sets don't require a regulated power supply, and are in this respect rather more simple. We thus enter the shallow end . . .

As there are so many of them around, it would be no great surprise if the first such set you encountered was one from the Pye group. The brand names used include Ekco, Dynatron and Invicta, and amongst the very early models a few Ferranti sets, in addition to Pye of course. The earliest versions are not so commonly met now, but as you could come to grips with one we'll start off with a brief description of their main features. First, they were dual-standard models, which means that a lot of complicated switching is used on the tuner unit, the i.f. strip, the line timebase and the convergence unit. Since they will all now be used for u.h.f. reception only, there is no need to dwell upon the switching. Another feature is the use of a valve e.h.t. rectifier, with an additional valve (a PD500) used to stabilise the e.h.t. under varying brightness conditions. To understand why this was considered necessary is to understand a goodly part of the basic operation of a colour receiver, so we'll ponder upon this for a moment.

Grey Scale

A monochrome c.r.t. has a single gun assembly which emits a single beam of electrons, the number of electrons actually reaching the screen being determined by the bias, i.e. voltage difference, between the cathode and the control grid. Since electrons carry a negative electrical charge, the more positive we make the grid with respect to the cathode (or the more negative we make the cathode with respect to the grid, depending on how you look at it) the greater the number of electrons attracted from the cathode area and passing through the control grid towards the screen. On their way towards the screen, the electrons are suitably concentrated by the other tube electrodes so that the beam reaching the screen produces a finely focused spot. All this we know by now, don't we? The result with a monochrome screen is that the screen glows, i.e. radiates white light. As the beam is varied from zero to maximum beam current, so we get varying degrees of light radiation from black (no light) through the greys to peak white. It's important for the control of the beam to be linear, so that we get accurate representation of the various degrees of grey, i.e. a good grey scale.

Colour

With a colour set we want colour as well, but we still require black and white and the varying degrees of grey, and it's important to appreciate that for good colour reproduction an accurate grey scale is essential. When it comes to colour, our starting point must be that white light consists of a mixture of coloured light radiation, as we all know from the action of a prism. We can get white light by adding together proportions of the three primary colours blue, red and green – the approximate proportions are 10, 30 and 60 per cent respectively.

If we want a correctly (well nearly) coloured picture therefore we must have a c.r.t. screen which is coated with separate blue, red and green phosphors, and we must be able to activate them separately. In practice this involves the use of three separately controlled beams, and arranging the phosphors in patterns – groups of dots in older tubes, a sequence of stripes in more recent tubes with in-line guns – with some method to ensure that each beam lands on the correct phosphors only. The method used is a shadowmask, which is mounted just behind the face of the tube and acts as a screen to ensure that the electrons in the three beams strike only the correct colour phosphors. All this calls for a high degree of precision – in the mounting of the mask, and in coating the face with the blue, red and green light-emitting phosphors.

With a dot-phosphor screen the shadowmask is perforated with tiny holes; with a striped-phosphor screen there are groups of small vertical slits in the shadowmask. Either way, in performing its screening (shadowing) action the mask intercepts much of the beam current. Thus with a reasonably bright picture much of the beam current will be wasted.

EHT Regulation

With the three guns turned on hard on a bright scene, the total beam current will be considerable, placing a burden upon the e.h.t. system which must be protected by some method of beam limiting if overloading is to be avoided. Also, as we've seen from considering monochrome sets, a fall in the e.h.t. voltage (the greater the e.h.t. current, the greater the voltage developed across the impedance of the e.h.t. system and the lower the e.h.t. voltage available at the tube's final anode) results in a larger, poorly defined picture – unless steps are taken to ensure that the e.h.t. voltage remains reasonably stable so as to avoid these very distracting variations in picture size.

One way of stabilising the e.h.t. is connect a shunt stabiliser valve across the e.h.t. supply. The idea is shown in

Fig. 1. The current flowing via the e.h.t. rectifier V1, the e.h.t. overwinding on the line output transformer and resistors R1 and R2 consists of the e.h.t. current from the tube, i.e. the total beam current, and the current in V2. As the beam current increases, so an increasingly negative voltage is developed across R1 and R2. This voltage is applied to the grid of V2, so that the current path via this valve is reduced. At maximum beam current therefore V2 will be driven towards cut off, opposing the tendency for the e.h.t. voltage to fall. As the beam current falls, so V2 will conduct more heavily to provide the required stabilising action. The circuit is arranged so that when V2 is cut off the beam limiter comes into operation to prevent any further increase in beam current.

This arrangement gives good e.h.t. regulation – at the expense of a bulky unit to house the two valves (GY501 e.h.t. rectifier, PD500 stabiliser) and contain the X-rays emitted from their glass. This latter hazard is something to remember and is the reason that some sort of switch or cutout is fitted to shut down the supply to the line output stage when the screening cover is removed.

The usual physical arrangement of the unit is for the line output transformer to be at the bottom, the e.h.t. overwinding being connected directly to the top cap of a GY501 mounted upside down, with the top cap of the upside down PD500 fitting into the base of the GY501 and the base of the PD500 being accessible at the top of the assembly. A point to remember is that the GY501's heater, fed from a one-and-a-half turn winding on the the line output transformer with a series resistor in its base housing, is at 25kV. The PD500's heater is included in the set's series heater chain – thus if a set comes in with the symptom "no heaters glowing except for the tube", the PD500 must if necessary be included in the series heater chain check.

Use of a Tripler

This e.h.t. supply system, used in many first generation colour sets, was succeeded by the more familiar solid-state tripler. So the stabiliser valve has gone, replaced by the lower impedance tripler arrangement with a small pulse capacitor to tune the system (fifth harmonic tuning) and provide a sensibly level e.h.t. voltage with the varying current demand. This latter approach, combined with an efficient beam limiter (call it a signal voltage limiter if you like), results in a reasonably constant picture size.

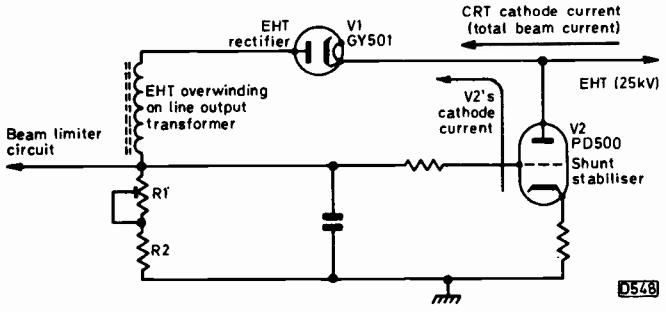


Fig. 1: In early colour chassis using a valve e.h.t. rectifier it was common practice to include a shunt triode to stabilise the e.h.t. voltage. The basic arrangement of the circuit is shown above. The idea is that as the c.r.t. current increases, so the current passing via the shunt triode decreases, and vice versa. As a result, the load on the e.h.t. rectifier is kept constant, and the e.h.t. voltage remains stable – thus avoiding the annoying picture size variations that occur when the e.h.t. is not well regulated. When the shunt triode is driven to cut off, no further stabilising action is possible. The beam limiter circuit then comes into operation to reduce the c.r.t.'s beam current, usually via the brightness control circuit. With the lower impedance e.h.t. tripler system used, in conjunction with fifth harmonic tuning, in later chassis a separate e.h.t. regulator circuit is not required. On a few early sets the e.h.t. generator circuit is completely separate from the line output stage.

Single-standard Sets

Removal of the dual-standard switching and the bulky e.h.t. unit resulted in sets with a much trimmer appearance. The first single-standard Pye colour chassis was the 691, which was used in 19, 22 and 26in. models. If you purchase a second-hand Pye group colour set, the chances are that it will incorporate the 691 chassis. The subsequent 693 is similar (different tuner and some other detail) while the later 697 has a redesigned line timebase/power supply unit in the form of a vertical printed panel on the right-hand side – replacing the "metal box". The circuit itself remained pretty well the same however, so this can be regarded as evolution rather than revolution.

Renovating a Pye 691 Chassis

Let's assume that you have obtained a set fitted with the 691 chassis, and that you are approaching it as an unknown quantity with a view to renovating it. It will probably have a mains lead with a fused plug at one end and a two-pin socket (not necessarily) at the other end for connecting to the receiver. First the mains plug – if there is one. The fuse fitted should be a 5A one, the brown lead (old red) should connect to this terminal, and the blue lead (old black) should connect to the neutral terminal. Use the multimeter, switched to the low ohms range, to check the continuity of the leads. If these are intact, check the condition of the set's mains fuse, which should be a 2A anti-surge or 2·5A anti-surge one (FS1, Fig. 2). This fairly low value is common in hybrid sets since the valves do not draw current until they warm up. The current that's taken when the set is first switched on is that passing through the degaussing coils (which demagnetise the shadowmask tube), that consumed by the h.t. electrolytics as they charge, and that taken by the solid-state sections of the set since these operate as soon as the set is switched on. On the Pye hybrid chassis, the solid-state sections include the audio stages, the vision and sound signal stages, the colour signal decoder, the tuner and field timebase.

Blown Mains Fuse

If the 2A fuse is missing or is blown, don't apply the mains unless you are prepared to lose the new fuse in order to see the manner in which it fails. This in itself can be very instructive, since it will give you a rough idea of the nature of the fault. For example, if the fuse holds until the line timebase valves warm up and then pops off, you know that the trouble is associated with the line output stage. If it fails immediately and in no uncertain manner, you have the task of locating the cause which need be no more than a shorted mains filter capacitor (C301) or perhaps a shorted h.t. rectifier diode (D49).

With these sets however there's an unpleasant alternative. The transistor supply lines are obtained from a bridge rectifier (D51) of the BY164 type, which is supplied from a winding on the mains transformer T19. If this rectifier develops an internal short (and it can do) an overload is imposed on the mains transformer which heats up. Since the valves take time to warm up, they are not drawing current. The 2A fuse in the mains input will allow a lot of

current to flow in the transformer before the valves come into operation and the fuse blows. The current can be sufficient to damage the transformer beyond repair. Even when the faulty rectifier is located and replaced, the damaged transformer will continue to blow fuses. Later transformers (supplied as replacements and as fitted in later models) have a thermal cut out (TH) incorporated to prevent this sort of disaster. The cut out consists of a small plastic housing inserted between the primary winding and yoke, containing a Vee of spring wire soldered at the apex with the two lead outs in the transformer supply circuit. The transformer heats up, the solder melts, and the supply is broken before the windings can be damaged. Most 691 receivers have the older type of transformer however, and the general rule is: if the sound isn't present as soon as the set's switched on, switch off and find out why. Leaving the set on may well cost you a mains transformer.

Incidentally, on the 691 chassis the transformer is under the power unit together with the smoothing choke. The latter is the one with only two leads to it.

Also note that whereas the hybrid colour sets produced by other set makers have valves for the sound and field timebase stages, the Pye chassis are transistorised in these departments, hence the immediate sound.

If the fuse blowing is proved to be due to a shorted h.t. rectifier (BY127 or similar), a replacement is unlikely to restore the h.t. supply. This is because the heavy current due to the defective diode not only had to flow through the fuse but also through the surge limiting resistor R306 (5·6Ω) and the VA1104 thermistor R305. One or both of these is likely to have failed in the process. The panel on which they are mounted may also be found to be in a deteriorated condition, as a result of heat over a long period. The thermistor may in fact not be found at all, as it has a habit of parting company with its leads and simply dropping out.

These items are toward the top of the power panel, together with the heater circuit diode D48 and its series thermistor R304 (tubular VA1026) and surge limiting resistor R303 (22Ω). This latter item is likely to be found open-circuit if trouble is experienced with the heater supply – say a heater-cathode short in the PY500 valve, an event which is all too common and results in the demise of the PL509 also since this precedes it in the heater chain and thus receives, with R303, a lethal wallop. More of this later.

Similar remarks regarding the surge limiters etc. can be made about other hybrid chassis, such as the GEC ones where the condition of the top right side dropper and panel are often the cause of non-operation.

Open-circuit Heater Chain

One of the most common faults on Pye group hybrid colour sets is that although the sound appears as soon as the set is switched on one waits in vain for a picture to appear. Examination may well show that although the tube's heaters are glowing no valves are warming up at all. Logically one would think that the first step is to ascertain where the break in the heater chain is, and of course this has to be done. This is not the first step that the prudent engineer takes with hybrid colour sets however. Having switched the set off, he switches the meter to the high ohms range, clips one lead to chassis, and applies the other to the top cap of the PY500 efficiency diode or the PL509 line output valve (see Fig. 3). If the reading is much under say 200kΩ, there's cause for investigation. If there's a very low reading, our prudence has paid off and we are on the right track.

Next remove the top cap lead of the PY500 and check again at the valve itself and at the disconnected clip. If the valve shows a short it's obviously faulty, with a heater-cathode short-circuit – the top cap is the cathode lead out. If the short is at the clip however it can be assumed that there's a short from the boost line to chassis, and that a capacitor is directly or indirectly responsible for this.

The lead from the PY500 will be found to go to the line output transformer, where a round disc type capacitor resides (C219). This is the fifth harmonic tuning capacitor, which has a value of 180pF and a voltage rating of 8kV or more. If it's faulty, it will usually show a blackened appearance. In any case it's no hardship to disconnect one end to see if the short is then still present. Incidentally, when remaking these soldered joints ensure that they are well rounded in order to discourage sparking. The chances however are that this is not the easy answer.

The next item to look for is a large 0·47μF 1kV capacitor. It may be blue, blue and white, or just white, and it's fitted between the two plastic panels of the transformer. This is the boost reservoir capacitor (C218). Disconnect one end and check it for shorts. If it's shorted, the search is at an end and the only question is what other damage has been done? Remember that the basic fault is "sound, no vision", which means that the fuse has not failed. In fact the chances are that the fuse would have failed if there had been a short from the boost line to chassis, due to the heavy current that would have flowed through the PY500.

We are seeking a break in the heater chain however, but the check (from the boost line to chassis) is one which should always be made whether it's fruitful or not – it can save both time and confusion if the PY500 or PL509 (or both) is found to have an open-circuit heater. The heater pins are 4 and 5 in each case.

The CDA Panel

There are many occasions when these two heaters are intact and the break must be looked for elsewhere. If this is so, we come to another interesting section which is known (loosely) as the CDA (colour-difference amplifier) panel. This is the strip on the left side with four valves on it. If the heater chain is open-circuit and the line output stage valves are intact, the chances are that the fault is on this panel – and not necessarily due to a defective valve heater.

The panel is secured at the rear by some spring clips which, incidentally, also act as the earthing contacts to the main frame and must therefore make good electrical as well as mechanical contact. Failure to make good contact causes peculiar colour effects, for example, one side of the picture inclined to be blue, the other green, on what should be a monochrome (colourless) picture.

If this panel is upended to show the underside of the valve bases, it's easy to check from pin 4 of one to pin 5 of another or whatever the run may be. However, one's eyes may well be drawn to the fact that some areas of the panel are discoloured due to the effect of the heat from the valves over an extended period. This can cause cracks to appear, and these may break one or more of the printed tracks. In fact this could well be the cause of the open-circuit heater chain.

Panel deterioration is a common cause of several other fault conditions on these sets, ranging from "no picture" to "wrong colours", or even "no sound or vision signals" in later models with varicap tuners where the tuning voltage supply comes from the h.t. line via the CDA panel.

No attempt should be made to solder over the broken

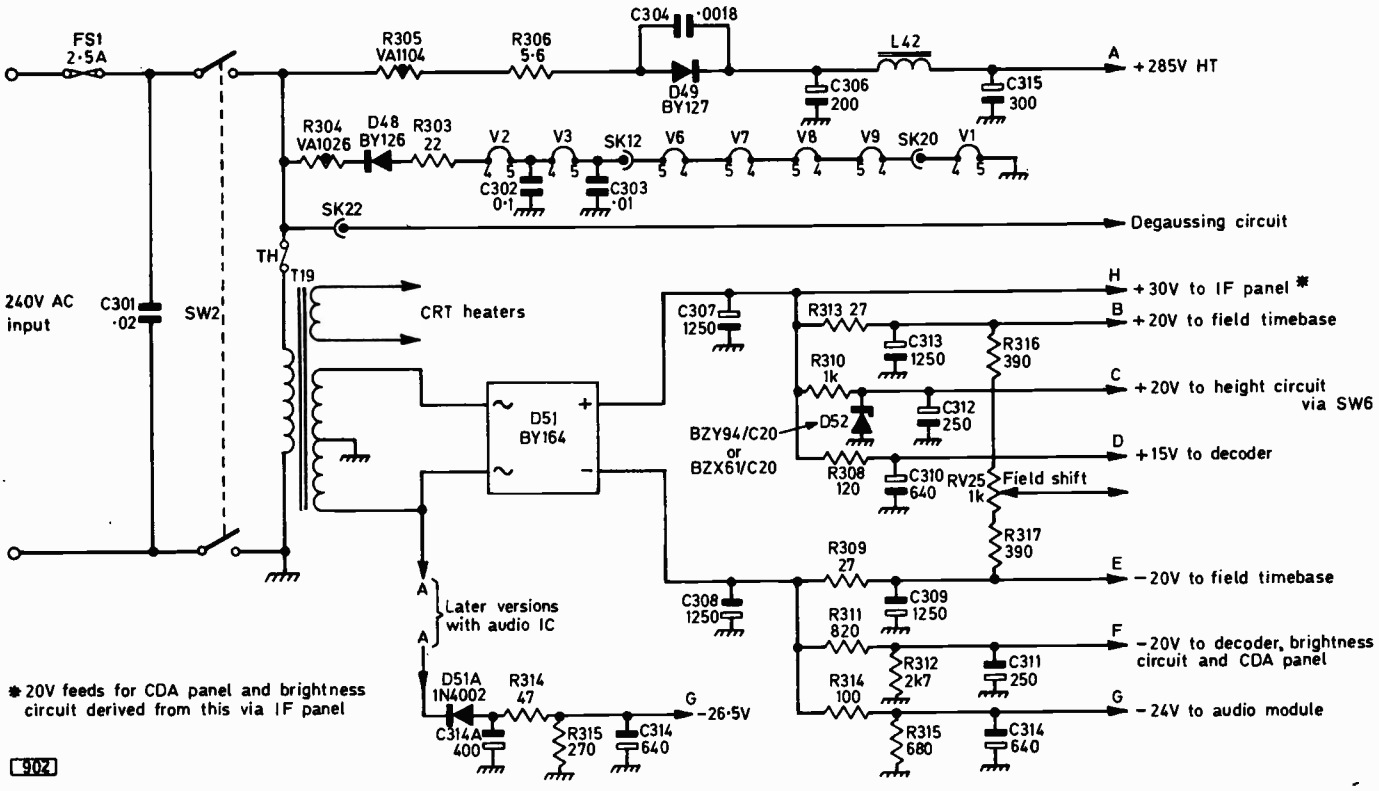


Fig. 2: The power supply circuitry used in the Pye 691/693/697 series of hybrid colour chassis. Note that there were a few minor modifications during the long production run of these sets. The circuit is typical of those found in hybrid colour receivers, with a half-wave rectifier providing an h.t. rail at about 290V, a diode dropper in the valve heater chain, and a mains transformer to feed the l.t. supply system.

tracks. Join them with wire, from one soldered contact to another, and make it neat and tidy with no chance of shorts occurring between bare leads or soldered contacts.

Back to the Mains Fuse

Earlier we said that if the supply fuse is found blown a new one will not necessarily blow immediately the set is switched on again, but only when the valves have had time to warm up. Normally one would not fit another fuse to find this out. One would make the resistance check previously mentioned from the PY500's top cap to chassis, and if a low reading was found the cause would have to be established and cleared before any attempt was made to operate the set.

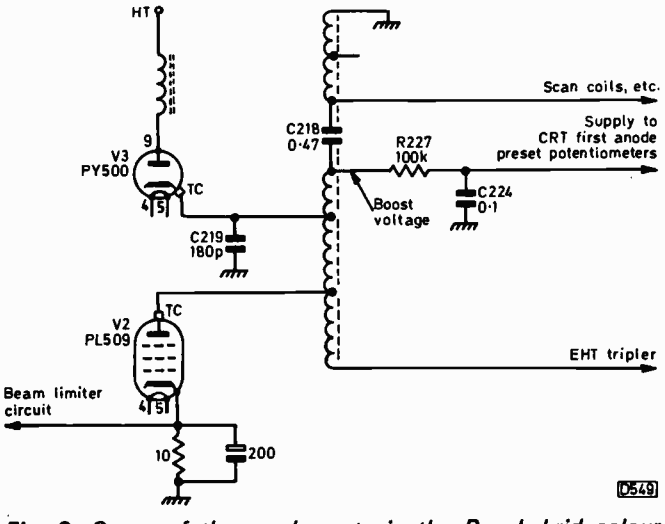


Fig. 3: Some of the weak spots in the Pye hybrid colour chassis line output stage. Note that a heater-cathode short in the PY500 boost diode or a short in either C219 (the fifth harmonic tuning capacitor) or C218 (the boost reservoir capacitor) will connect the PY500 across the h.t. supply, blowing the mains fuse. An important check in this event therefore is a resistance measurement from the top cap of the PY500 or PL509 to chassis. A reading of at least 200kΩ should be obtained if no fault is present.

We have already outlined a couple of possibilities or rather probabilities. There are others however. The chief one among these is the result of a shorted capacitor in the boost line feed to the tube's first anodes – three first anodes, because the colour CRT has three guns. If you look at the circuit (Fig. 3) you may think that a shorted 0·1μF capacitor (C224) would not cause a low reading from the top cap of the PY500 to chassis because of the presence of the 100kΩ resistor R227. Quite so, provided R227 is actually 100kΩ. If C224 shorts, R227 will not remain at 100kΩ for very long ("first there was a smell of burning, then the set went off"). This is a very frequent complaint which, since it's been commented on many times in this magazine, will hardly come as news to regular readers.

On the 691 series R227 is mounted under the power pack. On the later 697 chassis with the vertical printed panel it's about a third of the way down, roughly in the centre. If C224 has shorted, the resistor will present a burnt appearance. If its colours are clearly discernible (brown, black, yellow) the capacitor is unlikely to be at fault.

A Start on Colour Receivers

We haven't said very much about colour television as such so far. If you've digested what we have said in this short opening preamble however you'll be able to tackle about 50% of the faults which afflict Pye hybrid colour receivers. If this surprises you, ponder upon the nature of the other 50% which cannot be outlined so easily, and on the number of other makes and models which have totally different habits and circuitry. We have a long way to go.

Teletext Decoder Update

Adding colour and other options to the Television teletext decoder

Part 3

Steve A. Money, T.Eng. (C.E.I.)

HAVING described the operation of the circuitry on the new options board for the Television teletext decoder, it's time to consider the constructional arrangements.

Construction

Assembly of the options board should be a perfectly straightforward process. First the through-board wire links should be inserted, then the integrated circuits and other components added. On completion, check that all the top soldered joints on the i.c.s have been completed. Finally make a careful check on both sides of the board for solder bridges between tracks and joints that have not been soldered.

The only component that may present mounting problems is the colour reference crystal. Because of the close spacing between the options and the display boards, if the crystal is mounted on the component side of the board the top of its can may touch the tracks at the back of the display board. The crystal can must be mounted so that its base lies flush on the board, and it's advisable to fix a strip of insulating tape over the appropriate area of track on the back of the display board.

An alternative approach is to mount the crystal on the track side of the options board, where there is plenty of room and no possibility of its can coming into contact with any other parts of the decoder. In this case the can should be mounted clear of the board, so that the leads can be soldered to the tracks. The oscillator trimmer capacitor C11 can also be fitted to the track side of the board – this will provide easier access to the trimmer for adjustment.

Display PCB Changes

When the options board is included in the decoder it will be necessary to make some minor modifications to the display board. Resistors R2, R3 and R4 in the output video mixing network of the display board should be removed and diode D1 replaced by a wire link so that the dot video signal from the output of IC6c is brought out to pin 3 on the display board.

New Motherboard

As mentioned earlier, a new motherboard has been designed to accommodate the additional options board. The assembly of this new motherboard will follow much the same pattern as that of the original board.

It will be noted that the transistor buffer stage providing sync drive to the display board has been dispensed with. This sync signal is now derived from a 7404 buffer on the options board.

The +5V feed for the options board can be obtained from the spare +5V stabiliser circuit on the power supply module.

Interconnections

Most of the connections to the new motherboard are the same as for the original motherboard. The exceptions are the extra power feed to the options board and the wiring for the reveal and page hold switches.

The video signal from pin 9 of the options board is fed via a twisted pair of wires – the second wire of the pair being at 0V – to pin 3 of the i.f. board where it picks up the sound signal. From this point the twisted pair goes on to the text side of the text/picture switch on the front panel. A separate twisted pair should be used to carry the picture video to this switch, and the signal from the pole of the switch should be fed via a further twisted pair of wires to the modulator video input. Using separate pairs of wires in this way tends to reduce crosstalk between these signals. This would otherwise cause picture breakthrough on a text display or vice versa. If desired, coaxial cables can be used instead for these video signal links.

Page Hold Switch

There are occasions, especially when viewing multiple page sets, where it's desirable to be able to freeze the current page display on the screen until it has been read. This can be achieved by inserting a page hold switch into the system as follows. Remove the wire link on the motherboard joining pin 25 of the input card to pin 25 of the memory card. Connect the pole of the page hold switch, which should be an SPDT type, to pin 25 of the memory board. Pin 25 of the input board goes to the normally made side of the switch, whilst the normally open contact is connected to +5V. With the switch in its normal condition, the write pulses from the input board are passed to the page memory and allow the page display to update each time the selected page is received. When the page hold switch is operated, the write pulses from the memory are removed and the write input to that board is held at the 1 level, thus preventing any new information being written and therefore freezing the existing page display.

Alignment

The presets and the trimmer capacitor on the options board should initially be adjusted to the midscale position. With all the boards installed, and assuming that the decoder had been working correctly with the original set of boards, a

text display should appear on the screen when text is selected and a signal is being received.

This display will normally have a strong yellow bias if the colour circuits are running. If this is so, adjust the R–Y bias level until the display colour tends to change to blue. At this point adjustment of the B–Y bias can be made to give more or less white symbols where the text should be white, as in the first words of the header row.

Assuming that the display is now producing some colour, one of the test pages, such as 197 on Ceefax or 751 on Oracle, should be selected. The two bias levels can now be adjusted alternately until the best colour display is obtained on the screen.

Colour saturation will not be 100%, since the balance of the R–Y and B–Y signal matrixes is only approximate. It will usually be found that red is the most difficult colour to get right. It's usually found that for a good looking red the colour bias needs to be set so that white symbols are a very pale yellow. The colours produced will not in fact be strictly accurate, but should be perfectly acceptable for a text display.

If no colour is obtained initially, the first step is to check that the subcarrier oscillator is running. If an oscilloscope is available, this can be easily done by merely connecting the scope to the monitor point in the oscillator circuit. A 4.43MHz signal should be present here. If this is not so, adjustment of the trimmer capacitor will usually start the oscillator up. If an oscilloscope is not available, the oscillator signal can be checked by coupling the test point through a small (5 to 10pF) capacitor to the video input of the modulator. When picture is selected severe crosshatch patterning should now appear on the picture if the 4.43MHz oscillator is running.

Assuming that the 4.43MHz signal is present, if there's still no colour try adjusting the line sync filter monostable timing since it may be that the PAL switch is not running correctly. If this does not work there is a fault on the options board and an oscilloscope will almost certainly be needed to trace this.

In general, if the options board has been assembled correctly and there are no faulty components colour should be obtained first time and only the bias adjustments will need to be made to get the proper colour display.

Box Mode

As mentioned in Part 1, the new options board decodes the box mode control signals but due to lack of board space the switching circuits for the video and text signals could not be included on the board.

The two commands for the boxed display mode, start box and end box, each produce a pulse at output 1 of the 7442 decoder i.c. This pulse, which goes to 0 during a box control code, is used to clock a D-type flip-flop (upper IC8) which in turn produces a box control output signal. The D input of the flip-flop is driven by a delayed bit 1 signal. A box control signal from the Q output of this flip-flop is brought out to pin 16 of the edge connector, and this will be set at 1 by a start box code and reset to 0 by an end box code.

At the start of each line scan the box control flip-flop is reset so that each scan starts with the picture mode.

Though lack of space prevented the inclusion of the video switching circuits for box mode operation on the options board itself, it's quite convenient to mount these circuits on a small separate board which can be located near the channel switching board on the front panel of the unit. A suggested circuit for the box mode video switch is shown in Fig. 4.

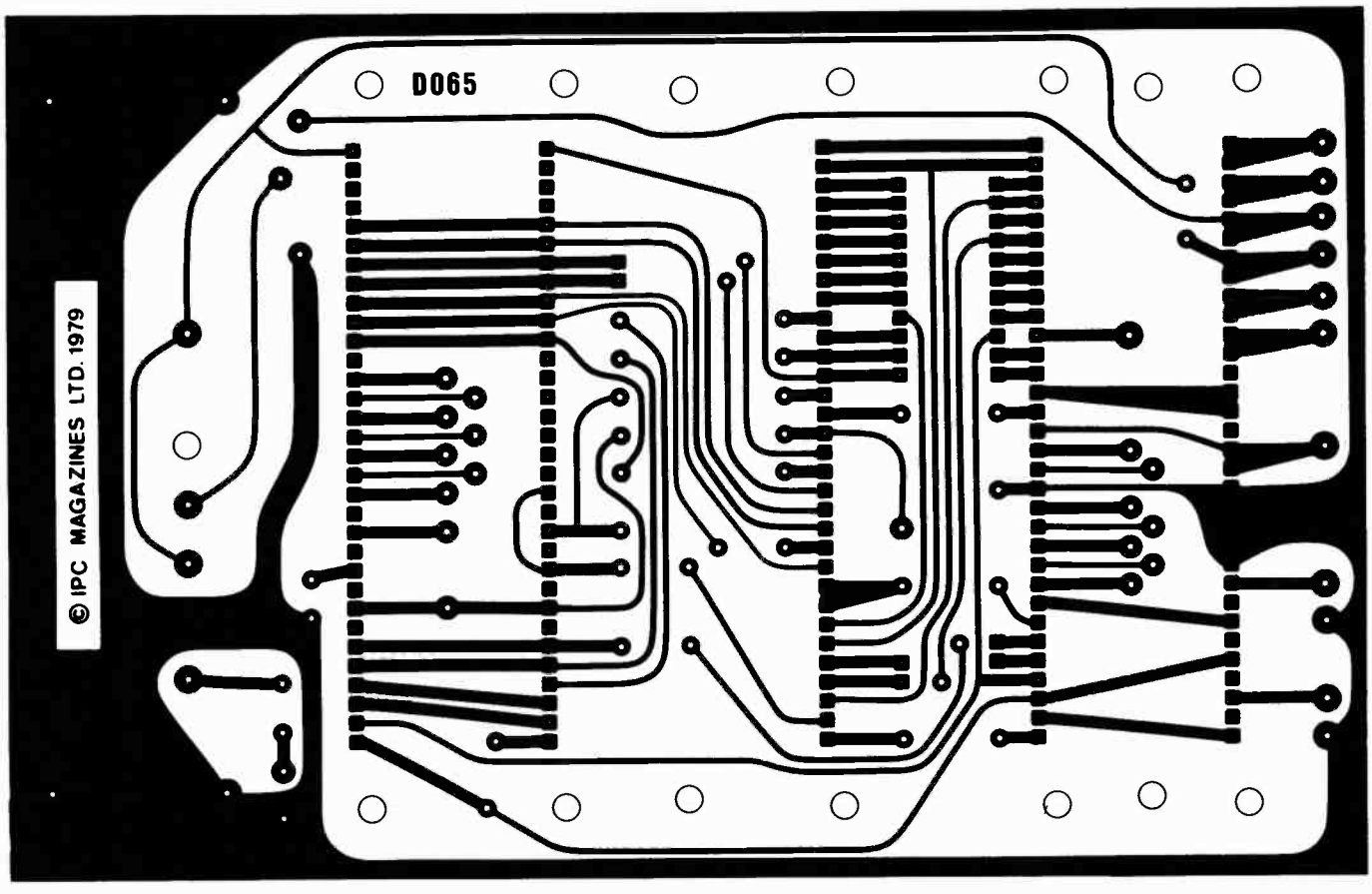


Fig. 2: Copper pattern for the new mother board, D065. A finished p.c.b. is available to readers from Readers' PCB Services Ltd.

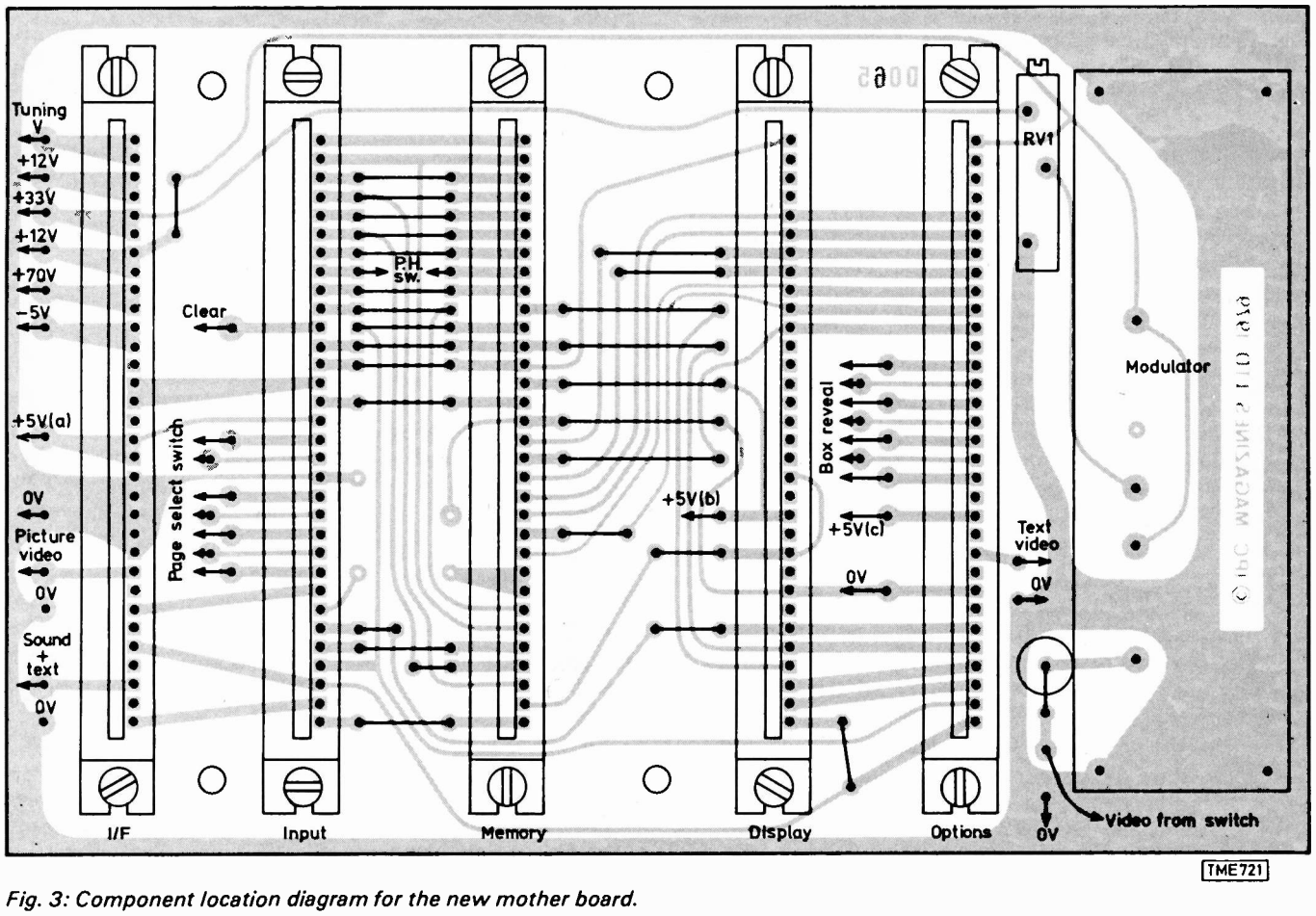


Fig. 3: Component location diagram for the new mother board.

When boxed operation is used, the switching between picture and text will be governed by electronic switches rather than by the existing manual switch. Analogue gate devices suitable for this purpose are the CMOS types 4016 or 4066. These devices each contain four separate analogue switch circuits and each analogue switch can be turned on or off by a logic signal applied to the 4016 or 4066 device. It's convenient to arrange the four switches as two pairs, with the switches in each pair connected in parallel. One pair of switches controls the picture video signal, whilst the other pair controls the text video. The system is arranged so that either one or other of these signals passes through to the common output line and thence on to the modulator. A CMOS 4011 quad two-input NAND gate i.c. controls the action of the two analogue switches.

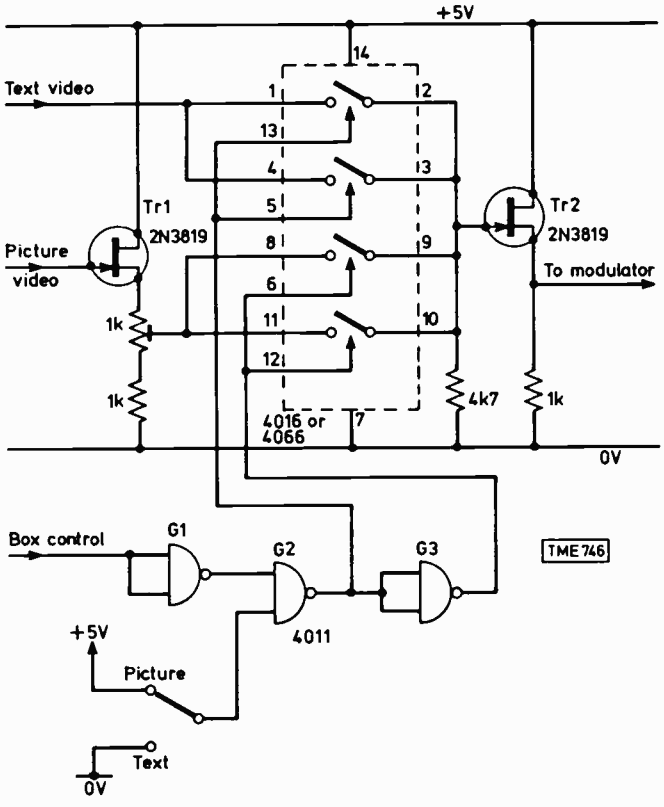


Fig. 4: Suggested circuit for the "box" option. It uses a CMOS switch i.c. for changing over from picture video to text and back again when the box control command is present.

Two logic signals control the action of the video gate. First there's a picture/text control which selects the display mode and in effect performs the same action as the existing picture/text switch on the front panel. Secondly there's the box control signal which, when the picture mode is selected, will control the insertion of text into the picture for a boxed display.

The picture/text control line can be driven by the existing picture/text switch on the front panel by rewiring the switch to produce an output of either 0V or +5V to select the desired mode. The original picture video input is tied to the +5V line, whilst the original text input to the switch is connected to 0V. The pole of the switch will now give the required picture/text logic signal.

When the picture/text line is set at 0 (text mode), gate G2 is held closed and its output will be at 1 irrespective of the state of the box control input. This causes the text video switch to be turned on so that text video is passed to the modulator. Gate G3 output will be held at 0, thus turning off the picture video to produce a text display on the screen. When the picture/text line is at 1 and box is at 0, gate G2 is open and its output goes to 0. This turns on the picture video and turns off the text, giving a picture on the screen. When the box control line goes to 1 it will cause the video

switch to change over, thus producing text within the picture on the screen.

For proper operation in the boxed display mode, the picture and text video signals should ideally have the same amplitude and d.c. bias levels so as to avoid differences in the brightness of the picture and text parts of the display. In fact the picture signal tends to have a lower d.c. voltage level than the text video. This is corrected by feeding the picture signal through a source-follower (Tr1) before it's applied to the video switch. A preset in the source load allows the d.c. level to be adjusted to match that of the text in order to obtain acceptable results on the screen. Some experimentation may be needed here for optimum results.

The colour subcarriers for picture and text will not be synchronised in the boxed mode, so the text colour may vary. It will generally tend to be white, but at times colour patterning may occur on the text. To avoid this, it may be best to suppress text colour when the box mode is selected. This can be done by connecting a transistor across R29 (see Fig. 5), with its collector going to the junction of R29, C8 and its emitter to ground. The base of the transistor may be driven through a 4·7kΩ resistor from the picture/text control line. When picture is selected, the transistor will be turned on and will effectively short-circuit R29, thus stopping the colour reference oscillator of the LM1889. The transistor should be an npn type. ■

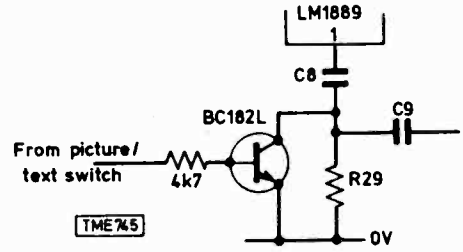


Fig. 5: Suggested circuit for suppressing text colour during box mode. This is to avoid interference between the two colour subcarrier signals.

The options board layout, pattern and components list will be published in next month's issue. In addition, a modified signal board circuit will be given which includes a modified data recovery section. This is of the adaptive slicer type which can prove beneficial in some reception areas where the slicing level has to be adjusted in the original design to ensure error-free data on all three channels.

Service Notebook

George Wilding

No Raster – Thorn 1590 Chassis

There was sound but no raster on a Ferguson portable fitted with the 1590 chassis, and as expected the cause was no e.h.t. The line output transformer supplies a couple of rectifier diodes (W13 and W14), and as it's common for these to go short-circuit or their associated reservoir capacitors C110/C111 to become leaky, thereby loading the line output stage (quite often blowing the mains fuse), we decided to check them. This time they were all o.k. however.

There was l.t. at the collector of the line output transistor, but as it remained cold it was either defective or without drive. It's difficult to test line output transistors in situ with any confidence, so our next step was to check the voltages in the preceding driver and oscillator stages. The collector of the driver is fed from the boost line however, and as this comes from the line output stage which was not operating the collector voltage was bound to be less than normal. With the emitter connected direct to chassis, the only conclusive test in the driver stage was at the transistor's base. All we could record here was 0·05V instead of the correct 0·3V.

The base drive comes from the oscillator transistor's 18Ω emitter resistor, so it appeared that either the driver transistor had a base-emitter short or the oscillator transistor wasn't passing the normal current. With the 18Ω resistor across the base-emitter junction of the driver, the former possibility was difficult to check. So both junctions of the oscillator transistor were checked in situ. It appeared that its base-emitter junction was short-circuit, but on removing the transistor and checking it out of circuit normal readings were obtained across both junctions. On checking between the collector and emitter however a complete short was found. Normal voltages and a normal picture were restored on replacing the oscillator transistor.

An Automobile Tip!

On occasion, switching on the ignition on our Ford Zephyr produced no green indicator light and the engine would fail to start. On rarer occasions the green light might come on but turning the key farther would fail to operate the starter. A defective ignition switch of course, but before obtaining and fitting a replacement we decided to unplug the connector at the rear, remove the switch by the ring at the front, lift up the paxolin backplate and liberally apply some switch cleaner. Since when, and after much use, we've had no further starting trouble!

Occasional Loss of Colour

The complaint with an 18in. Hitachi set (Model CEP180) was occasional loss of colour, and although there was colour on all channels when we switched on it was rather weak. The set has a mechanical tuner, with a top flat knob giving channel selection and a larger round knob underneath for fine tuning – similar to a rotary v.h.f. tuner. The setting of the fine tuning knob to bring in the colour was found to be very critical, at first suggesting that the chrominance gain and/or response had drifted off. On further manipulation however it was found that tuning in the colour became much easier after vigorously moving the fine tuner to and fro, suggesting poor earthing of the tuning capacitor's moving vanes. It's fairly easy to get at the tuner in these sets and, after removing the lid and the copper screening, we applied a few drops of switch cleaner to all the rotor earthing contacts. On replacing the tuner and trying once again, we found that the fine tuning was now normal while the saturation level had improved.

Bridge Rectifier Trouble

I've mentioned bridge rectifier trouble with the Waltham mains/battery monochrome portable before, due to the tendency of the small diodes used to short and blow the mains fuse. Another case came our way recently, but caused a certain amount of confusion. The mains input fuse was blown, and sure enough on removing the back two of the diodes were seen to be burnt up. We normally change all four, but on this occasion had only two diodes with us. So in they went, and normal results were obtained on switching on. For only a minute or so however, after which the sound and picture simultaneously disappeared. The fuse had held, but the tube heater, which is across the 11·8V rail, was not alight. There was normal a.c. input to the bridge, but no d.c. output. Why? In situ tests seemed to indicate that all diodes were in order, but we then realised that you can't simply test the diodes in a bridge by making in situ forward and reverse resistance tests. On further examination both the earth return path diodes in the bridge were found to be open-circuit.

Unusual Flyback Blanking Circuit

We were intrigued to notice the flyback blanking arrangement used in the Hitachi NP6C colour chassis. The colour-difference signals are fed to the bases of the RGB output transistors in this chassis – which employs a cathode-driven in-line gun tube – while the final luminance output stage (see Fig. 1) drives the emitters of the RGB output transistors. The final luminance stage provides a suitable point at which to apply flyback blanking therefore,

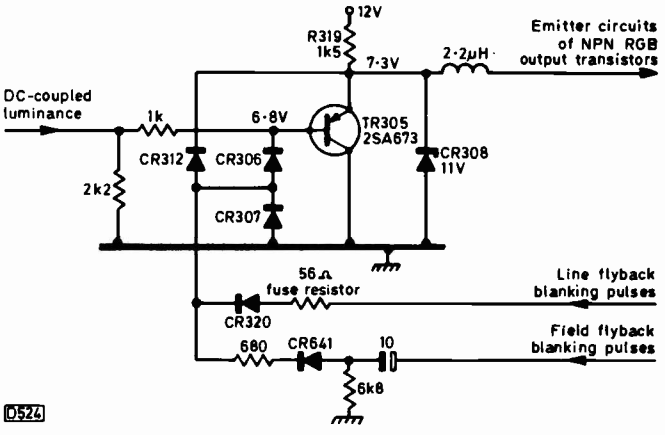


Fig. 1: The unusual flyback blanking circuit used in the Hitachi NP6C chassis. The positive-going flyback pulses cut off the luminance emitter-follower TR305. As there is then no voltage drop across R319, the emitters of the npn RGB output transistors are driven positively, in turn cutting off the c.r.t. cathodes.

as shown. But what a mass of diodes! Since the final luminance amplifier transistor TR305 is a pnp type, positive-going flyback blanking pulses are required at its base to cut it off. The field flyback pulses are fed in via CR641 and CR306, with CR307 removing the negative-going overswing, while the line flyback pulses pass via CR320 and CR306 – CR320 is not present in earlier versions of the chassis. The pulses are also fed to the emitter of TR305 via CR312: in fact, the base and emitter are short-circuited by the flyback blanking pulses, cutting TR305 off. This technique protects TR305's base-emitter junction. Since the RGB output transistors are npn types, the result will be to raise their emitter voltages as well, biasing them back. The flyback bias is limited to 11V by the zener diode CR308.

Intermittent Luminance

The luminance signal on a Körting hybrid colour receiver would occasionally disappear, leaving the brightness at near maximum level. The chassis uses colour-difference drive, with the two-stage luminance output circuit mounted on the tube's base panel. Clearly, the latter was likely to be responsible. The first stage consists of a conventional common-emitter transistor amplifier which develops the high-voltage swings required to drive the tube's cathodes, the second stage consisting of an emitter-follower to provide a relatively low-impedance drive. As anticipated, when the fault was present the emitter voltage in the latter stage was very low. The h.t. supply to the panel was present and correct, so it seemed likely that the emitter-follower transistor was defective. It tested all right on an ohmmeter when checked out of circuit, but clearly had an intermittent internal open-circuit. Anyway, a replacement completely cured the trouble.

Faulty Push-button Mechanisms

Twice recently we've had trouble with faulty mechanical push-button tuners on Rank sets. In one case two of the push buttons had to be retuned after every channel change, while in the other the whole unit had jammed up. The cause in both cases, and indeed the only common trouble with these units, is cracks leading to the break up of the plastic fittings on each of the push rods. The only cure is to dismantle the mechanical section of the tuner and replace the fittings, but when ordering make sure you include the four associated circlips, which have to be removed during the repair. You may be able to reuse the old ones, but they never seem to fit as well as they should, and even if only one is unserviceable the whole job is held up. Changing the fittings is a tricky operation: the golden rule is to remove the entire mechanical section from the tuner and not to attempt the repair without doing this.

The Picture Got Darker

The fault report on a Pye hybrid colour receiver (697 chassis) was that the picture gradually got darker. The width remained constant however, so it could be assumed that the e.h.t./line timebase department was in order. On inspection, we found that after half an hour only the picture highlights were able to overcome the excessive bias on the c.r.t. The PL802 luminance output pentode seemed above suspicion, since we've only ever known it to have the opposite effect, raising the overall brightness level from a low level at switch on. Nevertheless a new one had to be tried, but as expected there was no improvement.

Now the tube can be over biased in three ways: low first anode voltage, excessive cathode voltage, or low grid voltage. A leak in C224, which decouples the boost feed to the first anode presets, would reduce the first anode voltage of course, but we usually find that when this happens on these sets (as it does!) the associated filter resistor R227 rapidly falls in value to cause loss of e.h.t. quickly followed by a blown mains fuse. A glance down the timebase panel revealed that R227 was as new, so attention was turned to the d.c. working conditions of the PL802. As a quick check, to make sure that there was not excessive cathode bias, we simply shorted pin 9 (cathode) of the valveholder to chassis. Naturally the brightness level rose, but not to the normal level. We next advanced the beam limiter control, which affects the control grid circuit: it appeared to be operational, but was clearly not the basic cause of the trouble. The screen grid and anode voltages were correct, so the luminance output stage was cleared.

On to the c.r.t. grid circuitry then, where the voltages were of course found to be low. After some checking we discovered that R393, an 8·2kΩ wirewound resistor, was open-circuit. This resistor supplies the reference voltage for the cathode of the three clamp triodes – there should be 107V at the cathodes. Clearly then the fault was low c.r.t. grid voltages due to incorrect clamp action.

The odd thing was that although R393 had a break in its element – or at least had one when tested – there had apparently been sufficient resistive continuity across the break at switch on to produce a reasonable picture. Anyway, replacing R393 produced full and constant brightness.

Poor Colour – Thorn 3000 Chassis

Poor colour was the complaint on a Thorn set fitted with the 3000 chassis. Although transmissions had not yet started from the BBC-2 channel selected, on switching on we noticed that the raster was faintly tinted pink. On switching to BBC-1 however, which with laudable convenience was displaying the colour-bar signal, it was found that there was complete absence of red. Odd. Now weak or occasionally complete loss of output from one c.r.t. gun in this chassis is often caused by low first anode voltage, in turn caused by leakage across the relevant gun switch or within the associated 0·001μF decoupling capacitor. Being an easier step to take first however we checked the voltages at the collectors of the three RGB output transistors. The green and blue output transistor collector voltages read normally at about 160V, but the collector of the red output transistor read only about half this voltage, which one would normally expect to produce red flooding of the picture. Unless the first anode voltage was also very low, it appeared that the emission of the red gun was very poor.

The most likely cause of the incorrect red output transistor collector voltage was a change of value in its 12kΩ collector load resistor R250, or in the associated 56kΩ chassis-connected resistor R249. In situ ohmmeter tests produced a much higher resistance reading across R250 than across its equivalents in the green and blue output stages (as it's impossible to measure the value of most resistors accurately in circuit, it's often better to make comparative tests), so R250 was removed and, surprisingly, found to be completely open-circuit. A replacement restored normal red output transistor collector voltage, and it was found possible to obtain a tolerable output from the red gun. An acceptable picture was obtained after some readjustment of the various presets on the video board, but it was obvious that a replacement tube would be needed in the near future.

With an ageing tube it is especially important that the relevant presets are correctly adjusted. Quite often slight readjustment can make a great deal of difference. So what to do on the 3000 chassis?

The set clamp pulse phase coil L205 rarely if ever needs adjustment, and really calls for the use of a single- or double-beam scope for optimum setting. It's best to leave it alone therefore.

The set porch bias control R221 sets the bias at the base of the luminance emitter-follower VT206, and thus at the d.c.-coupled RGB output stages, during the line flyback blanking period. To adjust, collapse the raster with the set-white switch and turn off the first anode switches. With an Avo Model 8 or similar 20kΩ/V meter on the 25V range connected to the base of VT206 (jumper wire nearest VT202), adjust R221 for a reading of 10·7V.

The clamp pulse amplitude control R230 sets the d.c. level at the collectors of the output transistors. Again switch the set-white and first anode switches off, and with the meter connected to the tube's green cathode (pin 6) adjust R230 to obtain 160V. Check that the voltages on the red and blue cathodes lie between 155-165V.

There's a preset brightness control (R906) on the small beam limiter board atop the line timebase panel. Whilst most engineers find it satisfactory to adjust this after first setting the user brightness control to mid-travel, the complete drill is to turn the beam limiter control R903 – slightly to the right of and below the preset brightness control – fully anti-clockwise, put the user brightness control to mid-travel, turn the colour and contrast controls to minimum and connect the meter on its 250V d.c. range via a 15kΩ stand-off resistor to the c.r.t.'s green cathode. Operate the set-white switch and note the reading. Return the switch to normal, and adjust R906 to obtain the same reading.

As in all types of receiver, the beam current limiter control should be set carefully to avoid overloading the tripler and line output stage, and degrading the picture and convergence. The drill is to turn the brightness, colour and contrast controls to minimum, then note the voltage across R907 with the meter on the 2·5V d.c. range (R907 is the large resistor mounted to the right of and above the preset brightness control). Turn the brightness and contrast controls to maximum, and adjust the colour control for best results. Finally adjust R903 for a reading of 0·5V above that initially obtained.

A very important preset which is often overlooked is the c.r.t. grid biasing control R450, mounted in the top right-hand corner of the field and sound panel. Correct grey-scale tracking starts with adjusting this for zero voltage at the tube's commoned grid pins 3/7/12, with the meter on the 100V d.c. range and the set-white and first anode switches off. Although a lower meter range would give a greater needle deflection, this should not be used in order to avoid increased meter loading.

Next, operate the first anode switches and adjust the associated presets to make the collapsed lines just visible. Restore the field scan, and further adjust on a monochrome picture – ideally colour bars or the test card, with the colour control at minimum.

Set the three video gain presets to mid-travel, and if necessary trim for good highlights (correct grey on the second bar from the left in the grey-scale wedge). If necessary, trim the first anode presets for good reproduction of the third bar from the right.

Careful attention to this procedure, especially in older sets where some drift in component characteristics and tube ageing has occurred, will markedly improve the picture and extend the life of the tube.

Test Report: Datest 2 In-circuit Transistor Tester

E. Trundle

A COUPLE of years ago we reviewed the Datest 1 in these pages, and came to the conclusion that it's a good if slightly expensive semiconductor tester with comprehensive facilities. Since then Datong Electronics have designed the Datest 2, which is specifically for in-circuit testing of semiconductor devices. Some of the features of the Datest 1, such as the op-amp and diode testing capability, and the built-in transistor sockets, have been dispensed with. The result is a simplified instrument which is very easy to use and rather less expensive than the Datest 1.

Modus Operandi

A rugged diecast box houses the Datest 2, which contains six i.c.s and six transistors on a glass/epoxy PCB. The circuit is powered from an internal 9V battery, type PP3, from which it draws 13mA.

A pair of tweezer-type probes are supplied for connection to the collector and emitter of the device under test, with a third pointed probe for the base. If required, the latter can be plugged direct into the case, which then forms a hand-held unit.

Three LEDs make up the readout, indicating good/bad and the polarity of the device under test. The same indicators are used for low-battery warning.

There's a choice of test current, "high" at 100mA and "low" at 10mA. The average current in the device under test is way below this however, as the test currents are pulsed at a repetition rate corresponding to about 70Hz, with a duty cycle of 2%.

As well as bipolar transistors, field-effect transistors, thyristors and triacs can be tested.

Because the instrument is specifically designed to work in the presence of shunt resistance, it follows that a device with high internal leakage may, if o.k. in other respects, check out as good.

The principle on which the tester operates is that a working transistor should invert the polarity of an input pulse. This makes the operation virtually independent of the characteristics of the device under test. Pulses are applied to both the collector and base, the latter being pulsed on during every second collector pulse. This technique results in the ability to work in the face of very low shunt resistances.

Evaluation

The Datest 2 was tested on a variety of equipment in the TV and audio departments. No problems were encountered in checking bipolar and field-effect transistors in tuners and signal stages. In circuits where the devices are direct-coupled – our favourite testing grounds are exotic Bang and Olufsen high-power audio amplifiers – most devices could be checked: the odd occasion where junctions are in parallel with others, i.c. fashion, can prevent the tester operating however. In our B and O amplifier for instance, one of the output pair would test all right but not the other. Apart from T10, which forms half the field output stage in the ITT CVC20 chassis (other in-circuit testers have fallen foul of this one!) all the TV audio and field amplifier transistors we tried were amenable to being checked with the Datest 2.

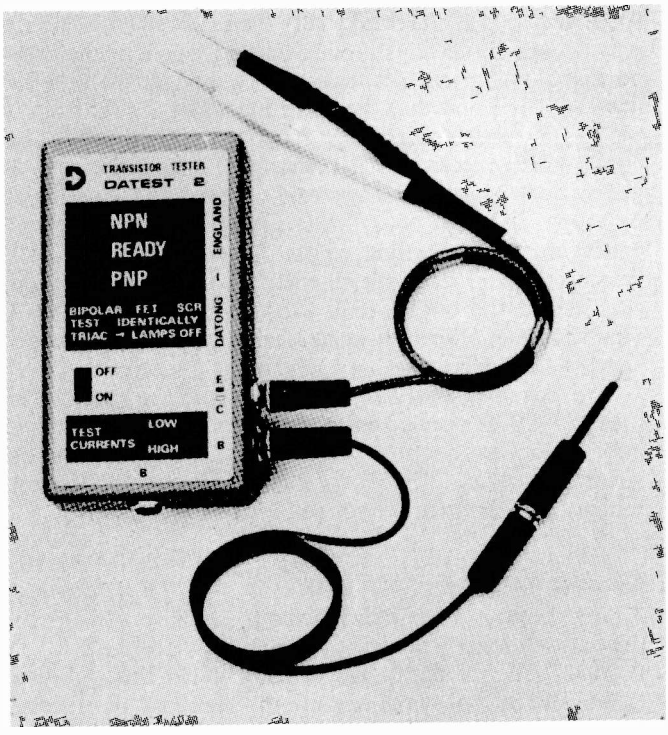
The low duty cycle pulse system used in this tester is very much better with shunt resistance than with shunt capacitance. This is also to the good – very seldom are large values of shunt capacitance found across transistor junctions in ordinary equipment. We found that our tester would operate in the face of about 22μF shunt capacitance in the high-drive mode. With parallel resistance, the instrument beat its specification – shunting resistors of little over fifteen ohms were tolerated across reasonably high-gain devices. When the Datest 2 is nearing its limit of shunt impedance, it indicates good and bad alternately as if unable to make up its mind or commit itself!

We couldn't find any triacs, but in-situ thyristor tests were carried out successfully. Most thyristor faults in TV power supplies are of a more subtle nature than can be revealed by a go/no go test however! We found that the Datest 2 gave clear indications with silicon line output transistors after disconnecting the base – some testers don't like these devices.

We searched hard to find a transistor (apart from line output types) whose in-circuit shunt resistance was low enough to prevent the Datest 2 from operating. We found one or two, but had to cover a lot of ground.

To Buy or Not to Buy?

Two questions are at issue in deciding whether the Datest 2 is worth buying – the instrinsic value of an in-circuit



The Datest 2 with its test probes. The base probe tip can be plugged into jack B and the tester used as a hand-held probe.

semiconductor tester as such, and the relative merit of the Datest 2 amongst the competition.

On the first question, it cannot be denied that most technicians can live without a transistor tester, making more accurate diagnoses by analysis of electrode voltages under working conditions. The increasing use of digital and analogue i.c.s in entertainment equipment is also eroding the usefulness of this type of tester. There's no doubt however that in a non-functioning circuit using several transistors any faulty semiconductor can be quickly located using this type of tester, especially by less skilled personnel.

If one accepts that a transistor tester of this type is necessary or desirable, the Datest 2 is a very good example. The simple exterior and very simple test procedure belie the technology inside the box. There's no reason why the instrument should not give many years of trouble-free service – if it doesn't get put away with a battery inside and forgotten! The Datest 2 is available from Datong Electronics Ltd., Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE, at £39.50 plus 15% VAT. ■

TV IC Faults

John Coombes

GREAT care is required when working on integrated circuits. It must be made clear from the start that there's no room for errors. Don't short-circuit any of the pins together, and be careful when making voltage and resistance readings. The first thing to check is whether the supply voltage is reaching the i.c.

Servicing Techniques

When removing an i.c. that's soldered into the circuit, do so neatly and keep the i.c. as cool as possible. A solder sucker or braid helps, and it's worth spraying the i.c. with freezer from time to time to keep it cool – you may have to put it back. I.C. inserters and extractors for DIL packs are available – in the RS components range for example. The inserter automatically aligns the pins, which can be helpful if they are bent. Some chassis, such as the Rank Z718, have plug-in i.c.s, making replacement much easier. Take care not to bend or snap the pins off – the latter can result in some very odd faults. Make sure the i.c. is inserted the right way round, and always replace any heatsinks or the i.c. will be ruined. After replacement, check that all the pins have been soldered and that there are no solder shorts from one pin to another or solder blobs shorting adjacent print tracks.

It's worth checking with the manual in case there are any instructions or warnings regarding the use of the multimeter or scope. I.C. test clips for DIL packs are available (RS again) and make testing easier. Voltage readings are the greatest help in deciding whether an i.c. is faulty, though readings at the output pins will depend of course on the inputs. Life can also be made easier by using the scope to check waveforms. Another useful aid is freezer.

The following summary covers most of the common i.c.s found in TV chassis up to recent times – there's insufficient information to be able to comment on the very latest generation of i.c.s. The i.c.s are listed in groups according to function, e.g. intercarrier sound i.c.s, decoder i.c.s, etc.

Tuning Voltage Stabilisers

The three i.c.s commonly used to stabilise the supply to the varicap tuner's preset tuning controls are the TAA550, ZTK33 and SN76550. All can fail to do this, producing tuning drift. Symptoms are intermittent loss of signals or weak signals or loss of colour. On the Philips G8 chassis the fault usually develops when the receiver is hot, so that the application of freezer will temporarily cure the trouble. Note that there are 30-32V, 32-34V and 34-36V versions. The TAA550 and SN76550 are colour coded (red, yellow and green respectively) while the ZTK33 carries the suffixes A, B or C.

IF Strip ICs

MC1330: Widely used synchronous video demodulator i.c. Can be responsible for no sound or vision (blank raster), possibly with spurious sound; poor sound and vision; pulling on captions; video smearing.

MC1349: Vision i.f. gain i.c. used in the Decca 80 and 100 series chassis. Can be responsible for severe ringing.

M5183P/SC9431P: Vision i.f gain i.c. used in the Mitsubishi Models CT180B, CT202B and CT203B. Can be responsible for no raster, no sound, or a noisy picture.

SC9503P: Synchronous vision demodulator i.c. used in the Rank Z179 chassis. Can be responsible for a blank raster or intermittent loss of vision.

SC9504P: Vision i.f. gain i.c. used in the Rank Z179 chassis. Can be responsible for low gain or a very grainy picture.

TBA440: Vision i.f. gain/detector i.c. used in some German sets. Can be responsible for no sync, no colour or a blank raster.

TCA270: Widely used vision synchronous demodulator i.c. Can be responsible for loss of or weak sync (check output at pin 10), a blank raster, or a weak picture.

Jungle ICs

The "jungle" i.c. is a video signal/a.g.c./sync processor.

TAA700: Can be responsible for loss of vision or no line sync.

TBA550: Can be responsible for loss of vision.

Intercarrier Sound ICs

M5143P: Used in the Mitsubishi models previously mentioned. Can cause no or distorted sound.

MC1358PQ: Can cause intermittent, distorted or no sound. Also caption buzz and noise.

TAA350: Early device providing gain only. Can be responsible for no sound. Commonly caused caption buzz on earlier versions of the Rank A823 chassis, on which it can also be responsible for distorted sound.

TAA570: Can be responsible for no sound, possibly intermittent, or very low sound.

TBA120S: Can cause no, low or distorted sound, and caption buzz.

TBA480: Can cause no or intermittent sound.

TBA750: Can cause loss of sound, possibly intermittent, low sound, and caption buzz.

Audio

The TBA800 has been quite widely used and can be responsible for no, low or distorted sound. Körting hybrid sets use either discrete audio circuitry, a TBA800 or a TAA640. Both these i.c.s can be responsible for loss of sound on these sets. Note however that the fault can be the result of a flashover in the tube. If you fit a new, say regunned, tube it's a good idea to remove the sound board. If the new tube produces continuous flashovers, fit another.

Timebase ICs

TBA720: Used as the line oscillator in Philips and Pye solid-state monochrome chassis. Can be responsible for no sound or raster due to no line drive. With this i.c. it's most important not to attempt voltage or waveform checks in the oscillator section. Check only the supply line, never at pins 12 or 13 or adjacent to these pins. Note also that there are two versions, the TBA720Q and TBA720AQ: these cannot be interchanged without making circuit alterations.

TBA800: Audio i.c. used as the field output stage in some monochrome portables. Can be responsible for field collapse.

TBA920: Widely used sync separator/line oscillator i.c. Can be responsible for no sound or raster due to no line drive; loss of line sync; no field sync.

TBA950: Sync separator/line oscillator i.c. Can be responsible for no sound or raster due to no line drive; loss of sync (maybe intermittent); incorrect line speed.

Tuning ICs

ETTR6016Q: CMOS i.c. used in GEC touch-tuning system. Can stick on one channel or jump from one to another erratically.

SAS560S/SAS570S: Combination for use with touch-tuning systems. Can be responsible for erratic channel changes or sticking on one channel. On ITT hybrid sets can be responsible for no raster or sound with the selector stuck in one position, since the 20V rail is removed when one or both go short-circuit.

TBA625A: Provides a stabilised 5V rail for the Telecommander remote control system used in some Saba sets. Can cause erratic or random channel selection when it fails to stabilise the supply.

Decoder ICs

MC1327P: Widely used chroma demodulator/RGB matrixing/PAL switch device. Can be responsible for loss of luminance, loss of one colour, no colour (possibly intermittent), Hanover bars at the right or the left of the screen, or white streaking. On the Decca 30 chassis you can get a reddish or magenta cast on switching on, persisting for a short period before correct colours appear. This can also be due to RGB output stage defects however.

SL901: Chroma demodulator/RGB matrixing i.c. used in the Rank A823 series chassis and Z179 chassis. Early types are fitted in a 20-pin pack, later ones suffixed B have a 24-pin pack. Often causes a negative picture. Other faults for which it can be responsible are loss of luminance, loss of one colour (maybe intermittent), and loss of the B – Y or R – Y signal. Note that one of the causes of a faulty SL901 in the A823 chassis is a flashover on the power supply due to a dry-jointed thermistor or a burn right through the panel. This causes a chain reaction, ruining the SL901 and the associated SL917. The decoder backs on to the power supply panel, and the tell-tale signs are a black burn mark on the right side of the decoder, on the print side.

SL917A: Chroma/burst signal processor used in the Rank A823A and A823B chassis. Can be responsible for no colour, intermittent colour, a purple and green picture or a smeary picture (rare). See note above.

SL918: Chroma/burst signal processor used in the Rank Z179 chassis. Can be responsible for loss of colour or intermittent colour.

SN76226: Chroma and luminance signal processing and black-level clamp i.c. used in the Thorn 9000 chassis. Also contains the sync separator. Can be responsible for no raster with the sound normal and e.h.t. present. To check, switch the set off and remove the i.c. If the raster returns on switching on again the i.c. is faulty.

TAA630: Chroma demodulator/PAL switch i.c. used in the Körting hybrid colour chassis and early versions of the Philips G8 chassis. Can be responsible for no colour.

TBA510: Chrominance signal processing i.c. Can cause intermittent loss of colour (Grundig sets).

TBA530: Widely used RGB matrixing i.c. The usual fault is a bright red, green or blue raster, possibly intermittent. An RGB output stage fault can also cause these symptoms of course.

TBA540: Widely used reference oscillator i.c. Can be responsible for loss of colour (maybe intermittent), odd colours, and Hanover bars.

TBA560A: Luminance/chrominance signal processing i.c. Can be responsible for flyback lines in Telefunken models.

TBA560C: Widely used luminance/chrominance signal processing i.c. Can be responsible for a blank raster, uncontrollable brightness, or no colour.

TBA970: Luminance signal processing i.c. used in many Grundig receivers. Can cause loss of luminance (maybe intermittent), and no beam limiting action.

TBA990: Chroma demodulator/PAL switch i.c. Can be responsible for loss of one colour or an all red, green or blue raster.

TCA800: Widely used chroma demodulator/PAL switch/matrixing i.c. Can be responsible for loss of colour, loss of one colour, or loss of R – Y or B – Y.

Note that a faulty i.c. causing excessive brightness in the Saba H chassis will result in the set switching itself off shortly after being switched on, due to the excess current trip coming into operation. ■

Your PROBLEMS solved

Requests for advice in dealing with servicing problems must be accompanied by a 50p postal order (made out to IPC Magazines Ltd.), the query coupon from page 549 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.

INDESIT T24LGB

There's sound but no raster. All the line timebase valves have been replaced, but to no effect. Both the PY88 and PL504 are glowing red, and the voltages on the PL504 are wrong – 10V on the control grid, only 120V instead of 205V on the screen grid. The coupling capacitor to the control grid is o.k. however.

While the line output transformer is a common cause of no e.h.t. on this model, the trouble this time seems to be lack of drive to the line output valve, since the voltage at its control grid should be –40V. It seems likely that the PCF802 oscillator valve has stalled due to a fault in the flywheel line sync circuit, and we suggest you check the discriminator diodes D402/3 and the 2·7MΩ resistors R414/5 connected to pin 9 of the PCF802. If the fault persists, check the capacitors in the oscillator circuit – C415/6/7.

THORN 1500 CHASSIS

There is patterning over the whole screen area on all channels – not too bad, but enough to be distracting. Also, when changing channels channel two cannot be obtained – no sound or vision. The tuner assembly has been checked but I can find no mechanical reason for this. The only clue I can offer is that on two occasions the picture was very grainy on this channel only, as if the signal strength had been halved, with some slight flickering: pressing the button two or three times brought the picture back to normal, apart from the slight flicker that's always present.

Check that the vanes of the u.h.f. tuner are not shorting out at any point on their travel. Check also for poor contact of the earthing leaves on the tuning gang shaft. For the patterning, check the earthing screens on the i.f. strip, especially the plate that screws into the top of one i.f. can.

BUSH CTV25

When the picture comes on, people's faces are usually green: a few pushes on the tuner button will produce the correct colour. When the programme changes to adverts however back come the green faces, which again can be removed by pushing the tuner button.

It seems that the bistable in the decoder is not switching correctly. There's a preset in this circuit, 5RV3: turn it slowly anti-clockwise until the correct colours are resolved each time the signal is interrupted. Do not turn it beyond the reliable locking point. If the control cannot be set to cure the fault, replace the bistable transistors 5VT5/6 and check the supply decoupler 5C51 (100μF), the clipper diode 5D8 (OA90) and the associated components as necessary.

PYE 368 CHASSIS

The width reduced by approximately two inches at each side while the set was being viewed, giving a tall image. To compensate for the latter effect, I reduced the height. All valves in the line timebase have been replaced, and adjustment of the preset width controls tried, but without success. Increasing the brightness control setting increases the size of the raster, but the picture is then totally out of focus with a black section in the middle – the same effect occurs when the set is first switched on. The picture is otherwise very good.

The lack of width with poor e.h.t. regulation suggests lack of line drive, while the fact that it occurred suddenly suggests capacitor trouble. The most likely cause of the fault is C111 (0·047μF), which couples the line drive to the line output valve. Otherwise, check the controls, the high-value resistors in the width circuit (R145/R155/R156), then suspect the line output transformer.

PHILIPS G8 CHASSIS

The trouble with this set is a narrow vertical orange strip on the left-hand side of the screen. There seems to be some ghosting associated with this.

This symptom usually arises when there is a fault in the application of flyback blanking to the decoder board. Check the connection from F5 on the timebase panel to D9 on the decoder panel for continuity. Then if necessary check the flyback blanking transistors T4488 and T4524 on the timebase board, and for breaks in the print, including the edge plugs, on both boards. On the earlier separate decoder board there could be a faulty component in the blanking circuit, for example C7213 (1μF). If the combined signals board is used, check C3216 (1μF), D3218 and the TBA560C chrominance/luminance processing i.c.

TWO OLDIES

I'm having sync problems with a couple of old monochrome sets. The first is a hybrid GEC dual-standard set, Model 2012. The trouble is that after about twenty minutes the line hold slowly goes, on both systems, and cannot be restored until the set has been off for some time. The other set, a Bush Model TV115, has a similar sort of fault, but this time it's the field hold that's lost after about ten minutes.

The GEC set uses a PCF802 as a sinewave line oscillator. Check the valve by substitution, and if necessary the 820pF feedback capacitor C170 wired between pins 1 and 2. The field hold trouble with the Bush set is probably due to the ECC82 field oscillator valve V10 or the 680kΩ resistor R76 which is in series with the field hold control.

GRAETZ KORNETT 1100

I've been unable to obtain any data on this W. German monochrome set. There are two ten-pin valveholders, but one of the valves is missing. The other is a PFL200. Trying a PFL200 in the other ten-pin socket produces sound and a picture, but no line of field lock. The same happens when a PCH200 is tried.

Graetz is part of the ITT organisation on the continent. You should be able to obtain data from Graetz at Phortsheim, W. Germany. The other ten-pin valve should be a PCL200, which incorporates the sync separator, and when this is fitted a stable picture should be obtained. As this is a W. German set, it will be designed to operate from a 220V supply. A resistor of about 60Ω should be added in the heater chain to loose the additional voltage when operated at 240V. An RS Components dropper section is ideal for this purpose.

PHILIPS G6 S-S CHASSIS

The trouble with this set is occasional field jitter. With the contrast turned up high the fault is present almost continually, but with the contrast turned down, giving a dark picture, the fault hardly ever occurs. The jitter is downwards, about ¼in. deep, and starts on a change of picture.

Since the fault is affected by the contrast control setting, it could well be in the a.g.c. circuit, which can be responsible for this effect. The main suspects here are the reservoir/smoothing electrolytics C2041 (40μF) and C2040 (also 40μF). Another suspect is C2047 (12·5μF) which decouples the screen grid of the luminance output valve, also the black-level clamp transistor T2146 in its control grid circuit. Any of the valves in the field timebase can cause this trouble – there are three, the ECC81 multivibrator (V4002), the cathode-follower V4003a (half a PCC85) and the PL508 field output valve. Another common cause of the fault in the field timebase is when R4092 (33kΩ), one of the anode load resistors in the multivibrator circuit, changes value.

PLESSEY D-S MONOCHROME CHASSIS

The trouble with this Defiant set is no screen illumination. A good arc can be obtained from the top caps of the line output stage valves, but the line output valve gets red hot a minute or so after switching on. Capacitor C387 was replaced, but as the previous one was obliterated I'm not sure whether I've used the correct value. The sound is o.k.

The value of C387, which provides coupling between the line oscillator and output valves, is rather critical. It should be 0·047μF. If this is correct we suggest you check the 100μF electrolytic C395 which decouples the anode of the PY800 boost diode, then suspect the line output transformer of having shorted turns.

PHILIPS 170 CHASSIS

There's no line hold on 625 lines, though 405-line operation is correct. Until recently I was able to cure this trouble by switching to 405 lines and then back, but this no longer works.

There are two ECC82 valves (V401/2) in the line generator circuit. The most common cause of this trouble is simply that one or both has aged. There are several resistors that can increase in value however in this area, and we suggest you check R420 (470kΩ), R405 (220kΩ) and R417 (430kΩ). Also check the 625-line hold control R416 which may have developed a break in its track, and the operation of the system switch.

THORN 3500 CHASSIS

The set has been reconverged, but when the picture content is dark the colours go out of convergence and there's pincushion distortion at the top of the raster. There's also a very intermittent fault, the picture and sound going off for about a second, accompanied by an h.t. flash noise. The fault occurs once every four months or so.

The convergence and geometry variations with brightness could be due to low e.h.t. (possibly a faulty tripler) or a low-emission c.r.t. The intermittent loss of sound and picture will probably be cleared by replacing the following: the chopper driver transistor VT602, W609 (use two 1N4002 diodes in parallel) which is in series with the chopper transistor, the 30V supply reservoir capacitor C607 (1,000μF, 64V) and the 30V supply reference diode W605.

PHILIPS 320 CHASSIS

I'd appreciate any guidance on tackling a "no results" fault on one of these sets. There's no sound or raster.

This solid-state chassis uses a thyristor to produce a stabilised 163V supply at TP15. The thyristor regulator circuit is preceded by a bridge rectifier, and if this is in order you should record 210V at its output. The most common cause of the fault however is failure of the thyristor or an associated component. If the thyristor is defective, replace it with a BT100A/02, which is more reliable than the original BT100A/500R. Apart from the thyristor and fuses, suspect components include the 10Ω surge limiter resistor R4639, the series choke L4635, and the thermal cutout R4465 if fitted. A dry-joint on the trigger pulse coupling capacitor C5624 is another cause of no h.t. sometimes encountered. Once you've restored the h.t. supply, set it to 158V for increased reliability – adjust with R5630. If this results in slight lack of width, connect the link across the width choke L2442 in the line output stage. A point to note when dealing with these sets is that the chassis is live.

BUSH TV161

We've two of these sets with the same problem, optimum sound and vision cannot be tuned in together, though both the sound and the picture are perfect. The sets are used on 625 lines only.

First ensure that the contrast is set well down, consistent with an acceptable picture. Tune in a test card, adjusting for best resolution of the frequency gratings. Then tune the sound discriminator coils 2L27/8/9 (two cores) for buzz free sound, resetting the balance control 2RV2 if necessary. If further adjustment is required, tune the sound take-off circuit 2L23/4.

ITT CVC2 CHASSIS

For some time I've been troubled by varying loss of colour on this set. The only way I can obtain a colour-killer bias is to trigger the ident transistor TXd15 by linking its base and collector. The transistor has been changed, also the emitter and collector decoupling electrolytics in this stage and the burst amplifier transistor, but the problem remains. After triggering the ident transistor the colour may remain for anything from five minutes to three days.

This set is getting old, and its performance will be deteriorating. An unofficial modification to increase the output from the ident amplifier stage is to short out the undecoupled emitter resistor Rd87 (4·7Ω). Cd57 (0·0022μF) which tunes the input to this stage is also worth replacing. Other capacitors worth checking are Cd44 (50μF) which decouples the collector of the burst gate pulse generator transistor, Cd45 (2μF) which decouples the collector of the burst amplifier transistor, and Cd62 (0·03μF) which tunes the ident output circuit (if it's of the polystyrene type).

TELEFUNKEN 711 CHASSIS

The initial problem was no sound or raster. The 4A mains fuse was blown, and D425, which is in series with the regulator thyristor, was short-circuit. These were replaced, giving sound and a full raster. After about ten seconds however the raster collapses. This becomes a pulsating operation, with the raster on for two seconds then off for two seconds, the sound remaining on all the time. I've checked the transistors in the power supply circuit, also the reservoir electrolytic, and tried a new tripler in case a fault here was overloading the set in some way.

Diode D425 was omitted in later production, and Telefunken recommend its replacement with a wire link to overcome the first problem mentioned. The pulsating effect is due to the protection circuit coming into operation. If you check the h.t. (U1) line you will find it varying in sympathy with the fluctuations. The idea is that the h.t. line is automatically shut down when the line output stage draws excessive current: this is monitored by rectifying the flyback pulses at tag 4 of the line output transformer to provide a reference voltage for the monostable circuit (T552/553) which is non-operational under normal conditions. If the picture is normal before the pulsating starts, the fault is probably in the protection circuit. This can be proved by lifting one end of R557 to see whether a normal, stable picture is obtained. If all now seems satisfactory, check the transistors in the protection circuit (T551/552/553) for leakage and replace as necessary. Finally, check that the h.t. voltage is correctly set at 190V by monitoring test point M421 and adjusting the voltage by means of the preset R429.

TEST CASE 200

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.

A second-generation Decca CTV25 (the version with the e.h.t. tripler in it) had developed a couple of faults which marred its otherwise remarkably good record of ten years' service. The first symptom consisted of a small reduction in field scan amplitude accompanied by a slight audible sizzle, and was to start with very intermittent. The effect was most noticeable at the top of the picture – by careful adjustment, it's possible to achieve good field scan geometry on this set right up to the top of the screen. Initially the set would run for anything up to several days without the fault occurring, then there would be a session lasting for a few minutes, with the top of the picture flicking up and down by about 10mm. At this stage the fault was so intermittent that the owner didn't find it troublesome. After a few weeks however it became much more frequent, especially after switching the set on from cold. The sizzle also became more apparent and, after a while, the picture would slip a field or two, though it could be steadied by adjusting the field hold control. At this stage the owner decided to seek help.

In spite of its age, the receiver was very clean inside and the tube still displayed bright, healthy colours. It was clear that the field locking was much weaker than it should have been, and it was concluded that a couple of new field timebase valves (ECC82 oscillator, PL508 output) would put matters right. The intermittent field contraction started again almost as soon as the set was switched on with the replacement valves fitted however, while the field locking was still very weak.

One or two resistors in the field timebase looked as though they had been running warm, since they were discoloured, but on checking them the values were found to be reasonably within tolerance. The line locking was strong, so it was decided that the sync circuit was probably operating normally and that the weak field sync was due to the field sync pulses being distorted prior to reaching the oscillator. This proved to be true, and the technician soon had the field lock strong again. The other symptom remained however. It was then noticed that a small spark, which coincided with the scan variations and the sizzle, was being reflected somewhere on the left-hand side of the chassis. What was the cause of the weak field locking, and the amplitude jitter with sizzling? See next month for the solution and another item in the series.

SOLUTION TO TEST CASE 199
– page 495 last month –

In hybrid colour sets using PCL84 colour-difference output stages, such as the Pye 691 chassis, a common cause of change of colour horizontally across the screen is increase in the value of one or more of the high-value resistors in the triode clamp anode circuits – high-value resistors have a tendency to increase in value after some years' operation. It will be remembered however that this was not the cause of the trouble on this occasion. Because of the high impedance of the circuit however, similar symptoms can be produced by other slight changes in circuit conditions. The anode of the output pentode is coupled to the clamp triode's anode by a 680pF capacitor (C370), and as the pentode anode is at a substantially higher d.c. voltage that the triode anode a slight leak in this capacitor would have virtually the same effect as a change in the value of the triode's 8·2MΩ anode load resistor.

The technician disconnected C370 at the triode anode side and, with the set switched on, measured the voltage between the disconnected end of C370 and chassis, using a high-resistance voltmeter. The presence of a response on the meter proved that the capacitor had a slight leak, and replacing the capacitor solved the problem.

Editorial note: As mentioned in *Service Notebook* last month, the B–Y output pentode's 12kΩ anode load resistor R392 can also be responsible for the symptom on this chassis.

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by Carlisle Web Offset, Newtown Trading Estate, Carlisle. Distributed by IPC Business Press (Sales and Distribution) Ltd., 40 Bowling Green Lane, London EC1R 0NE. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £9.50, Overseas £10.50 per annum payable to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

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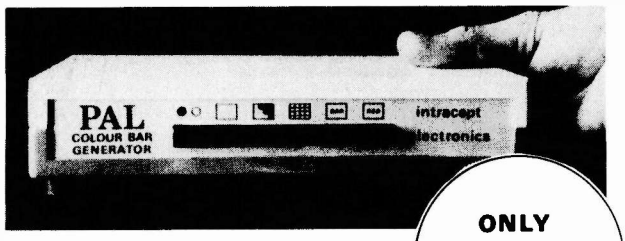

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PCL84	£0.08	PCF806	£0.08	PC900	£0.08	DY802	£0.08
PCL85	£0.08	PCF808	£0.08	EF80	£0.08	PY800/1	£0.08
PCL86	£0.08	PCF80	£0.08	EF85	£0.08	PL36	£0.20
PFL200	£0.08	PCC189	£0.08	EF183	£0.08	PL504	£0.20
PCF801	£0.08	PCC86	£0.08	EF184	£0.08	PL81	£0.08
30C1	£0.08	30C15	£0.08	6BW7	£0.08	6/30L2	£0.08
30C17	£0.08	30C18	£0.20	ECC85	£0.08	U26	£0.08
PL83	£0.08	PL84	£0.08	EH90	£0.08	30PL1	£0.25
30PL13/4	£0.08	30P12	£0.08	30FL1/2	£0.20	ECC82	£0.08
ECC81	£0.08	ECH81	£0.08	ECL80	£0.08	ECL82	£0.08
PL509	£0.95	PY500	£0.95	GY501	£0.95	PL508	£0.45
PCH200	£0.45	PCF200	£0.45				

PLEASE NOTE – 25p Postage and Packing

SPEAKERS
£0.75 each
State oval or round with order.
Postage and Packing £0.25

COLOUR TUBES
(FULLY TESTED)

19"	£17.00
19" A49/192	£18.00
20"	£18.00
22"	£20.00

Plus Postage/Packing £8.00 per tube

MAIL ORDER COLOUR TELEVISIONS
(GOOD WORKING ORDER)

GEC	19"	£55.00	22"	£60.00	Postage/Packing Per set G.B. £8.00
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OTHER MAKES AND MODELS AVAILABLE – All prices inclusive of V.A.T.

Cash with order please to:-

Scarborough T.V. Trading Ltd.
Ridings House,
Depot Lane,
Seamer Road,
Scarborough,
North Yorkshire.
Tel. 0723 68087

OR

N.W. Electronics (Bfd) Ltd.
Bolingbrooke Buildings,
Bolingbrooke Street,
Bradford 5.
Tel. 0274 390121.

COLOUR TUBES
STANDARD TUBES
METAL BAND TUBES

Rebuilt with new Electron Guns to British Standard 415/1972. Clause 18.2.

SUFFOLK TUBES LIMITED
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CROYDON, SURREY
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Britain's Largest *Independent* TV Tube Rebuilder

VIEW WELL WITH WELLVIEW TV TUBE REBUILDS

Exchange Mono

	our price	+VAT	total price
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A44/120WR	£9·30	£1·16	£10·46
A50/120WR	£9·30	£1·16	£10·46
AW59/23W	£11·00	£1·37	£12·37
A61/120WR	£11·00	£1·37	£12·37

Exchange Colour

	our price	+VAT	total price
A44/270X-271X	£27·00	£3·37	£30·37
A47/342X-343X	£27·00	£3·37	£30·37
A49/120X	£27·00	£3·37	£30·37
A51/110X	£27·00	£3·37	£30·37
A55/14X	£32·00	£4·00	£36·00
A56/120X	£32·00	£4·00	£36·00
A63/120X	£36·00	£4·50	£40·50
A66/120X	£36·00	£4·50	£40·50
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18 month full guarantee (Established ten years).

Send cash or cheque together with old tube with your order.
Carriage=£3·75 including VAT

ALSO YOUR VALVE SUPPLIER NEW AND BOXED
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EF184=63p	PCC89=70p	PCF802=96p
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PL509=£2·75	PL519=£2·86	PY88=69p
		PY500a=£1·50

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

★ Complete New Gun fitted to every Tube.
★ Two year Guarantee
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★ Supplier to Major Rental Companies.

19", 20"	£22
22"	£25
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Tel. 01-247 3097

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300 mixed ¼ and ½ watt resistors £1.50
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10 assorted TV **Convergence Pots** £1.00
20 assorted **TV knobs,** includes push button, chrome, control types etc. Mostly Thorn and ITT £1.00
10 assorted Valve Bases, B9A, ceramic, EHT, etc. £1.00
20 assorted **Sync Diodes** blocks for various TVs £1.00
25 assorted **Pulse Caps** high voltage £1.25
10 **Spark Gaps** £1.00
20 assorted **Zener Diodes** 1 watt and 400MW £1.50
100 **Mixed Diodes,** includes zener, power, bridge, varicap, germanium, silicon etc. All full spec. £4.95

NEW
4·433 C.T.V. Crystals
Long Leads £1.00 each
3 for £2.50

New Improved Transistor Packs
100 New and **Marked Transistors** including, BC148, BC154, BF274, BC212L, BF200 and lots of others only **£4.95**

200 Transistors as above and including 2N3055, AC128, BD131, BFY50, BC238, BC184L only **£9.95**

Why Buy Expensive Triplers! Repair your old 5 and 3 sticks **at a Fraction of the Cost.** **10** Replacement Rectifier Sticks (Thorn). **£1.00**

Special TV Bargain Parcels
Lots of useful parts including damaged panels, tuners, components etc. 10lb for £7.50

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Includes BA nuts and bolts, nylon, posidrive, self-tapping "P" clips, cable markers, clamps, fuse holders etc. **£1 per lb.**

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3500 Series **Scan Coils,** new and boxed, complete with convergence yoke, purity assembly, static controls, leads and sockets £5.25
3500 Focus units with metrosil £1.50
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4 Knobs black with chrome caps to fit ITT, Thorn, GEC and most small diam. shafts **60p** per set
1500 bias caps 160μf 25V 10 for £1.00
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950 bottom panel complete with i.f.'s switch etc. £3.00
950 line transformer (not Jellypot) £2.50
Convergence Pots with knobs. 5Ω, 10Ω, 20Ω, 30Ω. B of 1 type £1.00. 8 of each £3.50

SAVE THAT TUBE.
Fit our **C.R.T. Isolating Transformer.** Ideal for HTR./Cath. Shorts. 200-220-240 inputs. 750-900 MA outputs with thermal cutout. Made for **Thorn 4000** C.T.V. but works O.K. on other sets.
£2.00 each 3 for £5.00

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Bush CTV 25 Quadrupler Remo type Q25B. equiv. to ITT. TU25 3QK. with mounting brackets. **£4.25 each. 3 for £10**
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I.C. for above £1.00
Hitachi Miniature Transistor Tuner, spindle fixing. As fitted to various portables, ITT, Mentor, etc. £6.30

SPECIAL OFFER
GEC transistor rotary tuners with slow drive, AE Skt. and leads **2010** Series £2.50

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White Ceramic TV Resistors 20Ω 16W, 180Ω 11W, 13Ω 11W. 10 of any one type £1.20 10 of each type £3.00
2·2k fusible, vertical mounting **Screen Feed** resistors 9 watt 8 for £1.00
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Bias Caps
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Avoid Lethal Shocks Buy our specially designed **EHT Probe,** removes high voltage charges from tubes, caps, etc. Heavily insulated with lead and earth connector **60p** each
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PL509/PY500 ceramic bases 10 for £1.00
20mm Antisurge Fuses. 800MA, 1A, 1·25A, 1·6A, 12 for £1.00
2A, 2·5A, 3·15A 100 for £7.00
TH1 thermistors 6 for £1.00
TH3 thermistors 10 for £1.50
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Cassette Motors self regulating, 9V, make unknown type 9FM 90p

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2" Round 8Ω	60p
2¼" Round 8Ω	70p
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6" × 4" Elliptical 8Ω	£1.25
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400MW. 4·3V, 4·7, 6·8, 7·5, 30V, 10 of one type 80p, 10 of each type £3.00
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Gen. Purpose Diodes

IN4000	30 for £1.00	IN4003/10D2	20 for £1.00
IN4002	25 for £1.00	IN4148	20 for £1.00

ULTRASONIC TRANSDUCERS

Transmitter and receiver. 40 kHz 14 mm diam. **£4.25 pair**

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Buy a "SENTINEL" **Smoke and Gas Detector.** Uses TGS105 plug in sensor, housed in 3½" diameter diecast box. 24V. Convertible to 12V. Will activate lamp or relay.

With Data and Circuit **£16.95**
Suitable 24V Relay **£1.00**

De Luxe Fibre Glass Printed Circuit Etching kits
Includes 150 sq. ins. copper clad F/G. board. 1 lb ferric chloride 1 dalo etch resist pen. Abrasive cleaner. Etch tray plus instructions.
Special Price £4.95.
1 lb F.E. C1 To mil. spec. **£1.25**
5 lb FE. C1. To mil. spec. **£5.00**
150 sq. in. **Single sided** board **£2.00**
150 sq. in. **Double sided** board **£3.00**

500 Watt Dimmer Switch
Toroidal mains suppression, fused with satin aluminium knob, white.
ONLY £4.25.

Send **40p P. & P.** on all above items; send Cheque or P.O. with order to:–

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149a Brookmill Rd., Deptford, London SE8

(Mail Order address only. Callers by appointment)
Trade enquiries for quantity welcome.

Surplus stocks purchased for cash.

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THOUSANDS OF MONO TV'S IN STOCK

All makes – all sizes from **£1.15.** Square screens from **£6.90.** Clearance of 25" D/STD CTV'S (Philips 500 and GEC 2028 only). Checked complete **£16.10** each, add £8 p/pkg. Earlier model S/STD (Philips 511, GEC 2040, Pye Hybrid etc) Singles tested tube & checked complete **£39.10.**

Quantities from £27.60 each
Singles working £48.30 each
Add £6 p/pkg

More recent S/STD CTV'S always in stock (Pye Varicaps, Bush Integrated, Thorn 3500/8000, Decca Bradford, GEC 2100, Korting, Grundig, Luxor, Japanese etc). Sold with tube tested from **£46,** working from **£64.40.**

Ring for quotations

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RANK BUSH MURPHY 184 SERIES ETC

Decoder (Single IC) or Line Board	**£13.80**
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Convergence Panel	**£6.90**
Tuners	**£6.90**
Complete EHT Stack	**£20.70**

GEC HYBRID 2040/1 SERIES AND PYE HYBRID CHASSIS

Decoder or DCA (Inc. Valves)	**£13.80**
I.F. Panel or Convergence Panel	**£9.20**
Line Panel	**£16.10**
Tuners	**£6.90**

PHILIPS 511

I.F. Panel	**£9.20**
Tuners	**£6.90**
Lopt	**£9.20**

Any above add £1.60 postage & packing

RING FOR QUOTATIONS ON OTHER SPARES

COLOUR TUBES
(fully tested)

25"	**£18.40**
19"	**£20.70**
22"	**£25.30**
26"	**£29.90**

Plus £4.00 p/pkg.

MONO PANELS/ TUNERS

Most types **£3.45**
£1 p/pkg.

ALL PRICES ARE INCLUSIVE OF VAT.

VEGA MONOCHROME TUBES
(Brand new USSR Manufacture in Maker's Box with 12 months Guarantee)

20" Size	**£15.53**
24" Size	**£17.83**

Add £2.50 p/pkg.
Discounts for orders over five.

MULLARD COLOUREX/MAZDA NEW LIFE TUBE REBUILDS
(Callers only)
One year guarantee.
Any size only **£30.65** plus old glass.

SPECIAL OFFER

20"/24" Single/STD PYE/EKCO/ PHILIPS TYPE 230 (Plastic back) Re-furnished with good cabinet and brand new USSR tube (12 month guarantee).

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Tel: (0698) 282141

LONDON
Kingsley House Off Avonmore Rd. (Opp Olympia) Hammersmith Rd. LONDON W14.
Tel: (01) 602 2982

LONDON
395/397 Albany Road Off Walworth Road LONDON SE5
Tel: (01) 703 4040

WEST
Unit 4a Bulwark Industrial Estate, Chepstow, Nr. Bristol.
Tel: Chepstow (02912) 6652

MIDLAND
48/52 Pershore Street, Birmingham 5.
Tel: (021) 622 1023

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Watling Street Hockcliffe, North Dunstable (on A5)
Tel: Hockcliffe (052521) 768

MAIL ORDER SEND CWO (CHEQUES OR UNCROSSED PO'S) TO ANY BRANCH

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THE REBUILT COLOUR TUBE SPECIALIST
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WITH LOW PRICES

ALL TUBES 12 MONTH GUARANTEE

17 to 20"	**£28**
22"	**£30**
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Old glass + cash or cheque with order please. (Advance replacement) £10 refundable on receipt of old glass. Orders dispatched same day. £3.50 carriage mainland. Some personal delivery, Manchester area.

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M28 6XM

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PYE – BUSH – PHILIPS – FERGUSON –KORTING DECCA ETC.

UHF/VHF Mono from **£18.00** each
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All Sets Tested & Cabinets Polished.
Over 2,000 sets in stock.
Visit our warehouse and see for yourself.

Delivery can be arranged.

T.V. WHOLESALE DISTRIBUTORS LTD.
E.D.I. House, Kylemore Park West Industrial Estate, Dublin 10. Tel. 364139 or 791995.
Irish stockists for the new 'Tyne' colour sets.

QUALITY USED TV's AT GIVE AWAY PRICES

S.S. MONO FROM £12
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PRICES PLUS V.A.T.

ALL WORKERS, FRESH STOCKS WEEKLY, QUANTITY DISCOUNTS, DELIVERY ARRANGED.
TRY US YOU WILL NOT BE DISAPPOINTED.

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We have moved to our new Warehouse where we have much bigger stocks.

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HIGH TEMPERATURE PUMPING
Colour (2 year guarantee) from **£30**
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Send or phone for full list and terms
OPEN SATURDAYS
WELTECh PICTURE TUBES
5 Masons Avenue, Wealdstone, Harrow, Middx.
01-427 5063.

S/S Colour **£30**, Mono Push Button **£3**. Plus VAT. Phone Southend 559895. Any time.

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Philips G8 47Ω	43p
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Philips 210 118-148-LoopΩ	63p
Philips 210 30-125-2K85Ω	74p
Philips GT23 6-124-84Ω	74p
Thorn 3500	74p
Thorn 1500 350-20-148-1500-317Ω	90p
Thorn 1400	80p
Thorn 8000 56-1K-47-12Ω	90p
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Bush TV165-166 171-175-176-178 70p
Murphy V1910 1913-1914-2014-2310-2311-2312 2314 70p
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TV Condensers: – 200 + 200 ± 100 mfd 300V				45p each
150–100–100–100–150M 325V				£2.00
150–150–100M 300V				£1.60
175M 400V 100–100M 350V				£2.05
400–400M 350V				£2.65
All	2500–2500m 30V	80p	2500–2500m 63V	£1.45
Can	4700m 25V	85p	1500m 70V	80p
Cond	2200m 40V	65p	1000m 63V	63p
	BDX32	£1.98	PL802T Special	£3.50
100–300–100–16m 300V				£1.70

Post Free, Cash with order, VAT paid.
Durham Supplies
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TELEVISION AERIALS

The full range of quality BASC aerials, amplifiers, lashing kits, cables, masts, rotators and accessories can be supplied at extremely competitive prices, normally from stock. Representative examples are shown. For quotations on specific items, or general and technical application queries, please write sending S.A.E. with all enquiries. Full price lists on request.

TELENG "Superverter" Upconverter	£27.52
JAYBEAM JBX21 High Gain UHF Aerial	£38.06
VORTA "True Sound" 6 element High Gain VHF/FM Aerial	£16.39
LABGEAR CM7025 High Gain UHF Amplifier (29dB in Group 'A')	£15.60
Matching Power Supply for above unit CM6001	£11.95

All prices include VAT post and packing.
WE are happy to advise on specific installations and associated problems. An improved version of the high performance UHF amplifier (JULY Television) incorporating dual input switching is anticipated shortly, providing a 2nd ITV channel in most areas.
Please write for details (SAE). BASC: Aerialite, Antiference, Jaybeam, Maxview, Wolsey. Premier Industries.
SOUTH WEST AERIAL SYSTEMS
10 Old Boundary Road, Shaftesbury, Dorset.
Tel. (0747)-4370.

COLOUR PANEL EXCHANGE SERVICE

BRC 3000 – 3500 8000 – 8500
Philips G8 and GEC 2110 series.

Free delivery in London area on Exchange Panels. Large stock of BRC 3500 series spares. New and S/H BRC Panels for sale. Immediate exchange on repairable panels.

Catalogue available on request.
KAY JAY TV SERVICE
34, Clauson Avenue, Northolt. Phone 864 0360.

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	30FL1	20p
PC88	15p	PCL84	15p	30PL14	15p

AND MANY MORE AVAILABLE

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

REBUILT COLOUR AND MONO TUBES IN

South Wales

All tubes are guaranteed for 12 months. Colour tube guarantee extendable to 4 years.

Colour	Price examples
18", 19"	**£31.00**
20", 22"	**£33.00**
25"	**£35.00**
26"	**£36.00**

20AX and P.I.L. tube prices available on application.

Mono

20"	**£11.00**
24"	**£12.00**

Add V.A.T. @ 15% to all the above prices.

Prices are based on a sound tube for tube exchange.

For further details, contact:

C.R.T. Services

Telephone: Newport (0633) 412112
And Llanwern 2112

COLOUR TUBES

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

Here is what you pay.

17-18-19 inch	**£29.00**
20 inch	**£30.00**
22 inch	**£32.00**
25 inch	**£34.00**
26 inch	**£38.00**

Guarantee 2 years.
Exchange basis.
Prices negotiable for contracts.
Old Colour tubes purchased.
Carriage £5·00.

TELESTAR TUBES
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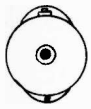

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3000 Panels Ex-equip. now available.

3 amp 1¼ Fuses	2p
Long wires 300 Mixed Carbon Film Resistors 5 of each type ¼ Watt 1R to 2 Meg – ITT	£1.50
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470/25V	8p
470/40V	10p
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470/100V	15p
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4/350	5p
1000/25	10p
4.7/100	6p
2.2/100	6p
1000/10	5p
8/350	5p
1/250	5p
1/100	5p
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1/350	5p
220/10	5p
680/100	10p
220/16	5p
47/63	5p
33/63	5p
2.2/63	5p
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100/450	30p
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Triplers TS2511TDT THORN **£2.50**

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THORN 8500 Focus Unit
DECCA 8500 Focus Unit
(Large or small) **£1.00** each

4 Push Button Units
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4 Push Button Unit 8500
THORN **£3.50**

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10 Different Types

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ON/OFF **10p**

Mains ON/OFF Push Button
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6R+1R+100R **35p**

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700M/250V THORN **35p**

175+100+100
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400+400.350V DECCA **80p**

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100+200 325V **40p**

200+200+100+32 350V **10p**

150+200+200.300V **70p**

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& BUSH **75p** each

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BC 350 E1222
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New 49.00 21.900MHz

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New 49.00 21.900MHz

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New **50p**

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BB 103 VHF
BA 182
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W005M Bridge **15p**

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IN4005 **4p**
IN4006 **5p**
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BT 119 **95p**

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BC148B BF198
BC149C BF274
BC195 BSY79
BC108 BC327
BC107 BC213LA
BF594 BC212LT
BC158 BF195
2N2222 BC182L
2N390 BF594
2N4355 BC183
T1591 BC238A
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2 WOODGRANGE CLOSE, THORPE BAY, ESSEX.

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Callers by appointment only.