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AUGUST 1980

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TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

CRT REACTIVATOR

SINCLAIR'S PORTABLE SCOPE

SERVICING TOSHIBA COLOUR SETS

VIDEO NOTEBOOK

FAULTS & FAULT-FINDING

TELEVISION

August 1980

Vol. 30, No. 10
Issue 358

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

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Requests for advice in dealing with servicing problems should be directed to our Queries Service. For details see our regular feature "Service Bureau". Send to the address given above (see "correspondence").

this month

OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 20

THE PROFESSIONAL CHOICE. NATIONWIDE

NEW SPARES

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

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

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

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

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

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

SPECIAL OFFER

SL901B	3.50
SL917B	5.00

DIODES

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

VALVES

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

SPECIAL OFFER

Philips PL802	2.55

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950 MK2 1400	2.00
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SN76023N	1.20
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SN76226DN	1.50
SN76227N	1.20
TBA341	0.97
TBA520Q	1.10
TBA530Q	1.10
TBA540Q	1.45
TBA550Q	1.40
TBA560CQ	1.50
TBA570Q	1.00
TBA800	1.00
TBA810	1.50
TBA920Q	1.50
TBA990Q	1.50
TCA270SQ	1.45
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Thorn 8500	4.75
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Korting	6.80

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TF7 4QX

Tel: Telford (STD 0952)
585799/584373

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TRANSISTORS

*denotes sold in packs of 5

	each		each		each		each		each		each		each		each		each		each		each		each
AC127	.54	AF239	1.00	BC119	.49	BC173	.19*	BC547	.14*	BD150B	1.29	BF123	.29	BF222	.25	BF450	.52	BU111Y	3.18	R1038	2.72	TIP126	.78
AC128	.58	AF279S	1.15	BC125	.20*	BC178	.26*	BC548	.14*	BD150C	1.09	BF154	.25*	BF224	.37*	BF458	.52	BU126	2.10	R1039	2.74	TIP127	1.49
AC141	.68	AL102	2.90	BC126	.20*	BC179	.28	BC549	.19*	BD163	.97	BF156	.55	BF240	.21*	BF459	.62	BU204	1.79	R2008	2.89	TIP2955	.85
AC142	.68	AL113	2.90	BC135	.23*	BC182L	.14*	BCX31	.30	BD166	.61	BF158	.39*	BF241	.21*	BFR41	.43	BU205	2.53	R2009	2.52	TIP3055	.64
AC153	.57	AU103	2.80	BC136	.20*	BC183L	.14*	BCX32	.29*	BD181	1.03	BF160	.59	BF255	.34*	BFR52	.41	BU206	2.76	R2010	2.89	TIS43	.36
AC176	.59	AU106	3.56	BC137	.20*	BC184L	.14*	BCX33	.29*	BD182	.80	BF167	.48	BF256	.83	BFR62	.40	BU208	2.88	R2029	2.45	TIS90	.35
AC187	.68	AU107	2.74	BC139	.39*	BC186	.38	BCX34	.35	BD183	1.04	BF173	.60	BF257	.49	BFR81	.38	BU208/02	2.98	R2030	2.55	TIS91	.35*
AC188	.68	AU108	2.74	BC140	.39	BC187	.33*	BCX36	.35	BD187	.87	BF177	.60	BF258	.49	BFT42	.51	BU326S	3.20	R2265	2.61	TIS92	.46
AD149	1.64	AU110	2.90	BC141	.38	BC212L	.15*	BCY70	.25*	BD201	.76	BF178	.35*	BF259	.49	BFW10	.80	BU407	3.72	R2305	.98	ZTX300	.15*
AD161	.75	AU111	2.90	BC142	.39	BC213L	.16*	BCY71	.34*	BD222	.46	BF179	.49	BF262	.64	BFX29	.49	E1222	.46	R2306	1.12	ZTX500	.17*
AD162	1.03	AU112	2.90	BC143	.39	BC214L	.16*	BCY72	.25*	BD225	.57	BF180	.49	BF263	.68	BFX84	.49	ME8001	.35	R2540	3.39	40636	1.40
AF115	1.04	AU113	3.05	BC147	.15*	BC237	.19*	BD115	.81	BD232	.63	BF181	.59	BF271	.49	BFX85	.43	MJE340	.77	TIP29	.55	2N697	.35*
AF116	1.04	AUY10	1.71	BC148	.11*	BC238	.17*	BD116	.96	BD233	.63	BF182	.50	BF273	.24*	BFX88	.49	MJE520	.71	TIP30	.77	2N2905	.38
AF117	1.04	BC107	.18*	BC149	.15*	BC239	.15*	BD131	.60	BD234	.60	BF183	.50	BF274	.27*	BFY50	.49*	MJE2955	1.74	TIP31	.37	2N3053	.29*
AF118	1.38	BC108	.18*	BC153	.20*	BC307	.19*	BD132	.72	BD237	.76	BF184	.49	BF324	.57	BFY51	.50*	MJE3055	1.03	TIP32	.41	2N3055	.77
AF125	.59	BC109	.18*	BC154	.20*	BC327	.22*	BD133	.69	BD238	.57	BF185	.49	BF336	.49	BFY52	.50*	OC28	3.17	TIP33	.62	2N3703	.16*
AF126	.61	BC113	.20*	BC157	.16*	BC337	.17*	BD135	.58	BD435	1.03	BF194	.19*	BF337	.49	BFY90	1.19	OC35	2.55	TIP34	.63	2N3704	.26*
AF127	1.04	BC114	.18*	BC158	.15*	BC338	.17*	BD136	.58	BD437	.75	BF195	.15*	BF338	.49	BSY79	.84	OC36	2.63	TIP41	.47	2N3705	.15*
AF139	.86	BC115	.23*	BC159	.16*	BC384LC	.29	BD140	.58	BD509	.77	BF196	.19*	BF355	.80	BRY39	.62	OC44	.52	TIP42	.50	2N3707	.19*
AF178	2.04	BC116	.20*	BC160	.39	BC461	.35	BD144	2.49	BD510	.65	BF197	.19*	BF362	.62	BU105/01	1.84	OC45	.56	TIP47	.44	2N5296	.91
AF180	2.12	BC117	.19*	BC170B	.27	BC462	.75	BD150A	.94	BDX32	2.86	BF198	.28*	BF363	.62	BU105/02	1.84	OC71	.63	TIP112	1.09	2N5298	1.03
AF181	2.14	BC118	.33*	BC171	.17*	BC463	.75			BF115	.59	BF199	.25*	BF422	.62	BU108	2.38	OC72	.63	TIP117	1.37	2N5496	.78
				BC172	.19*					BF121	.29	BF200	.38	BF423	.68	BU110	3.89	OC76	.46	TIP121	.78	2SC1172Y	3.88

THYRISTORS, SILICON SWITCHES, DIACS

	each		
BFT42	.51		
BFT43	.51	BT109	1.58
BR100	.29*	BT116	1.70
BR101	.42*	BT119	4.43
BRC4443	.95	BT120	4.45
BRY39	.60	C106D	.73
BT106	1.31	OT112	2.00
BT108	1.71	TIC46	.54*

BRIDGE RECTIFIERS

	each		each
B40	1.11		
BY164	.56	KBS01	.97
BY179	.83	WO2	.39
BYW21	2.58	WO4	.35
BYW24	3.05	WO6	.85
BYW61	4.09	BR1	.34
BYW62	4.18	BR2	.49
BYW64	5.24	BR3	.57
ITT3CD	.50	BR4	.56

DIODES AND RECTIFIERS

*denotes sold in packs of 10

	each		each		each		each		each		each
AA112	.16*	BA115	.14*	BAX16	.08*	BY206	.20*	BYX10	.18	IN4007	.10*
AA116	.18*	BA145	.21*	BY126	.13*	BY207	.26*	OA47	.12*	IN4148	.04*
AA117	.17*	BA155	.14*	BY127	.13*	BY210/400	.33	OA91	.12*	IN4448	.23*
AA119	.10*	BA156	.12*	BY133	.21*	BY210/800	.42	IN4001	.06*	IN5401	.16*
AA143	.13*	BA202	.12*	BY176	2.04	BY227	.36	IN4002	.06*	IN5404	.21*
AA144	.09*	BA219	.12*	BY182	1.15	BY251	.33*	IN4003	.06*	IN5408	.27*
AY102	2.03	BA316	.27	BY184	.58	BY255	.35	IN4004	.06*	ITT44	.05*
AY106	1.86	BA317	.31	BY187	.93	BY298	.66	IN4005	.06*	ITT2002	.25*
BA102	.48	BAX13	.05*	BY199	.39	BY299	.69	IN4006	.09*		

VALVES

DY802	.85	PCL82	.88
ECC82	.66	PCL84	.94
ECL80	.69	PCL85	1.02
EF80	.80	PCL86	1.15
EF183	.77	PFL200	1.05
EF184	.74	PL36	1.19
PC86	1.02	PL504	1.26
PC88	1.01	PL508	1.84
PC900	.92	PL509	2.99
PCC189	.69	PL519	3.42
PCF80	.89	PL802	3.22
PCF86	1.12	PY88	.86
PCF200	2.30	PY500	1.85
PCF801	1.49	PY800	.98
PCF802	.94		

INTEGRATED CIRCUITS

	each		each		each
BRCM200	4.41	SN72723L	2.21	TBA651	3.92
BRCM300	4.51	SN76003N	2.20	TBA673	2.88
BRC1330	1.05	SN76013N	1.70	TBA690	3.76
BTT822	6.88	SN76013ND	1.97	TBA700	2.12
BTT6018	2.59	SN76023N	1.61	TBA720A	3.48
C500	3.53	SN76023ND	1.98	TBA750	2.01
CA270AE	3.70	SN76033N	1.94	TBA800	2.30
CA270BE	3.56	SN76110N	2.11	TBA810AS	2.93
CA505	1.72	SN76226DN	2.58	TBA810S	2.93
CA758E	4.50	SN76227N	2.21	TBA820	1.96
CA920AE	2.58	SN76228N	2.43	TBA890	5.20
CA2121	2.38	SN76530P	1.94	TBA920	3.01
CA3089E	4.56	SN76532N	2.33	TBA940	4.08
CA3090Q	1.96	SN76533N	2.54	TBA9502A	2.61
ETT6016	2.90	SN76544N	1.85	TBA970	5.40
ETTR6016	2.90	SN76546N	3.81	TBA990	3.33
LM1351	2.08	SN76666	1.67	TBA1440G	4.39
LM1370	2.34	TAA350A	1.72	TBA1441	4.39
MC1307P	2.62	TAA550A	.31	TCA270	2.32
MC1310P	2.20	TAA550B	.31	TCA270S	5.40
MC1327AP	3.53	TAA550C	.31	TCA420A	2.69
MC1327P	1.56	TAA570	2.16	TCA440	2.61
MC1330P	.85	TAA591	3.65	TCA640	3.92
MC1349P	2.28	TAA611B	3.73	TCA650	4.51
MC1351P	2.08	TAA630S	5.16	TCA730	4.25
MC1352P	1.64	TAA661B	3.47	TCA750	3.20
MC1358P	1.67	TAA700	5.16	TCA800	3.58
MC7724CP	1.79	TBA231	1.70	TCA820	3.00
ML237B	2.59	TBA240A	6.17	TCA830S	2.80
SAA570	2.61	TBA325	2.07	TCA900	1.95
SAA700	5.16	TBA395	4.41	TCA910	1.95
SAS560S	2.36	TBA396	3.68	TCA940	1.95
SAS570S	2.38	TBA440C	4.37	TCE100P	4.68
SAS580	3.88	TBA440N	4.39	TDA440	4.35
SAS590	3.88	TBA480	2.30	TDA440N	4.35
SAS660	4.50	TBA500	3.47	TDA1170	5.03
SAS670	4.50	TBA510	3.47	TDA1412	1.55
SC9503P	1.80	TBA520	2.55	TDA2522	5.52
SC9504P	1.95	TBA530	2.38	TDA2530	3.63
SC9506P	3.55	TBA540	2.94	TDA2560	4.79
SL437F	7.91	TBA550	3.15	TDA2590	3.54
SL901B	5.24	TBA560C	3.10	TDA2600	3.86
SL917B	7.39	TBA570	2.35	TDA3950	3.39
SL918A	7.91	TBA641A12	3.51	TMS3848NC	5.77
SN16848N	2.62	TBA641B11	3.71	ZTK33A	.94
SN16861NG	2.62	TBA641BX1	4.30		

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Linearity Coil AT4042/04	1.43
Colour Crystal 4.433619 M Hz	1.69

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PHILIPS G8 (47R)	.49
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RR1 640	.72
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TCE 3000/3500 175+100+100 = 350v	2.43
TCE 3000/3500 1000 = 63v	.75
TCE 8000 700 = 250v	2.48
DECCA 400+400 = 350v	3.30
DECCA 200+200+100 = 300v	2.65
RR1/1TT 200 = 400v	1.87
PYE 200+300 = 350v	2.58
GEC 200+200+150+50 = 300v	3.79
RR1 300+300 = 300v	2.87
RR1 2500+2500 = 30v	1.43
RR1 600 = 300v	2.18
PYE 200+300+100+32 = 350v	3.97
TCE 150+200+200 = 300v	2.78
K.B. 200+200+200+50 = 300v	3.04
K.B 200+200+75+25 = 300v	2.93
PYE 800 = 250v	2.24
RR1 470+470 = 250v	2.85
GEC 300+300+100+50+150 = 375v	5.92
GEC 1000+2000 = 35v	1.38

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ITT CVC 20,30	7.13	TCE 9000	7.24
GEC 2028, 1040	6.44	RR1 Dual Standard CTV	8.28
GEC 2110	6.44	RR1 A823	8.39
GEC 2100	7.76	RR1 A823B	7.07
GEC 2200	6.44	RR1 Z718	6.38
PYE 691,693	6.21	GRUNDIG 5010/6010,B&O	5.69
PYE 731 (4 lead)	6.55	GRUNDIG 3000	6.61
PYE 731 (5 lead)	6.49	KORTING	6.61
PYE 713, 15, 17	7.24	SIEMENS TVK31, 51/2	6.61
PHILIPS 520,540,550	6.44	SABA/TFK/SITA/DORIC	6.38
PHILIPS 550 (long lead)	6.44	TANBERG TV2-2, TVC M6	6.55
PHILIPS G9	6.44	EUROTRAY	6.24
DECCA CS1730,1830	5.11	CONVERSION BRACKET A	.34
DECCA CS2030, 2230, TELPRO	6.44	CONVERSION BRACKET B	.34
DECCA CS1910,2213	6.44	TV18 EHT STICK	1.43
DECCA 80/100/Telpro	5.20		

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TELEVISION

The Next Video Step – Discs

A couple of months ago we were complaining about the failure of video manufacturers to agree to a common VCR standard. What is particularly irritating about the situation is the fact that the various current systems have a lot in common. Helical scanning to start with, and the use of the slant azimuth technique to enable the tracks to be laid down side-by-side with no guard band. In fact the two Japanese systems, VHS and Betamax, are virtually the same, though with variations in the tape path, the speed/track width specifications and signal processing, as a result of which they are not compatible. The Philips/Grundig V2000 system has the significant difference of being basically a $\frac{1}{4}$in. tape system however. So we now have two very similar and one rather different system.

We're about to get another dose of video incompatibility, this time with videodiscs. At least however the three disc systems, from RCA, Philips and JVC, are quite different from one another and do represent genuine alternative engineering solutions to the basic problem. With the RCA system we have capacitive signal storage and a stylus that tracks the disc within a groove; with the JVC system there's again capacitive signal storage, but this time the servo-controlled stylus rests on the surface of the disc; while in the Philips system there's optical scanning of the information which is stored using a form of pulse position modulation. There's no question of compatibility between such radically different techniques, and the decision on which system to adopt could be left to an industry body or to the market place. The former is unlikely to be set up, so it will be a matter of seeing who comes up with the most marketable package.

We've been present at demonstrations of two of the systems – Philips and JVC. RCA do not appear to be interested in the European market at present, and don't seem to have done much work on a PAL version of their disc system. We assume that this is the reason there's been no public demonstration of the RCA system in the UK.

The Philips videodisc has been around for some time – it was announced back in 1972, has been demonstrated on several occasions in the UK, and has been on the market in the USA for the past couple of years. We saw a PAL version at the Philips' trade show earlier this year, and must report that it gave excellent sound and pictures. The equipment was still a prototype PAL version, but we can't see that there should be any particular problem about going from prototype to mass produced units. The picture quality you get from a disc is inherently superior to that provided by domestic VCR systems.

We were also greatly impressed by the demonstration of the JVC disc system we attended. This time the equipment was to the NTSC standard, and was again a prototype. But there's no doubt that the system is capable of excellent results.

So which player are you most likely to have beside your TV set in say five years' time? The RCA solution is the cheapest though the least flexible. There are also no plans to introduce it in Europe for the present. The Philips disc system is due for release on the UK market in the middle of next year. It will be the most expensive system, since the optical scanning and the elaborate servo system needed to control the position of the laser beam are inherently costly. But it will be cheaper than videotape systems while giving superior quality, and will be the most flexible disc system. The JVC system is a late starter, but the plans are nevertheless to launch it on the UK market by the end of next year. We are told that it will be only slightly more expensive than the RCA system, and it's certainly an attractive solution. It has the highest information storage density of any of the systems, and a high degree of flexibility.

Whether the videodisc will catch on with the public is another matter. That visual programme material is not nearly as suitable as audio material for repeated playing has often been pointed out. You would not want to view your favourite movie night after night, that's for sure. But then you wouldn't want to read your favourite novel every six months, would you? That doesn't seem to have hampered the sales of paperback books, which are perhaps a closer analogy to the videodisc than the audio disc. If a wide enough range of material is available to disc viewers, the price is right, and the quality is as high as we've already seen, there's undoubtedly a market waiting to be tapped.

The interesting development recently has been the link between JVC and Thorn-EMI to promote the JVC system. Certainly so far as the UK is concerned, Thorn are in a very good position to exploit the possibilities of this new medium. When you call in to make a payment at your local DER or Radio Rentals branch, why not take home with you on loan a couple of videodiscs? It reminds us of the success years ago of the Boots' lending library. It would certainly be a way to get people used to the idea of videodiscs, and once the habit has been established the videodisc will be here to stay.

COVER PHOTO

Our thanks to Mullard Ltd. for this month's cover photo which was taken at the Mullard Application Laboratory, Mitcham. The engineer is shown working on the design and development of teletext and viewdata circuits.

CORRECTION

Monochrome portable timebase board (see June issue, page 427). The short length of track connecting pin 7 of IC2 to R8 and C11 is missing. The result of this will be impaired field sync performance. Join the two points together using a length of tinned copper wire.

Video at the Shows

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

A LARGER number of video products than ever before were on display at this year's trade shows. Let's look briefly at some of the new products and developments that were revealed.

Philips

Philips were showing and demonstrating the PAL version of their VLP video disc player. It's due to be launched in the UK next summer, with a retail price of around £400-£500 for the player and £10-£20 for the discs. A wide range of software is promised, including feature films and various instructional and DIY programmes. The sample on show was giving a very creditable performance, though only one sample disc, pressed in Eindhoven, was available. The pre-launch publicity is due to start this autumn. Another item from Philips is a projection TV system, Model CP2605, with a separate screen and projection unit. We didn't find the performance given by the sample on display, in semi-darkness, particularly impressive. The VR2020 VCR, with its flip-over cassette, was featured and performed satisfactorily. We were told that it has now gone into full production.

Toshiba

The Toshiba projection TV system, Model C4505B, with a combined screen and electronics unit, 45in. screen and very wide viewing angle gave a more impressive display. Infra-red remote control is a standard item, and the suggested price tag is around £2,250. Other items Toshiba had on show were their IK1850 domestic colour camera and a "super scan system" Beta format VCR. What was really significant however was the fact that Toshiba had two working prototypes of their two-hour LVR (longitudinal video recorder) machine on show, one working on the PAL and the other on the NTSC system. The pictures produced by these ultra high speed linear machines were very acceptable, especially in view of a predicted price tag of around £300. A demonstration is one thing of course, reliability in use under normal operating conditions another. We shall have to see. A launch date of autumn 1980 was originally planned but seems to have been postponed.

Toshiba also had three other future products on display – a flat-screen colour TV set, a voice-operated set (we shall have more to say on this in a later issue) and an add-on audio unit, using pulse-code modulation, for use with domestic VCRs. This latter unit, which is already on sale in Japan for use with NTSC equipment, allows the owner of a domestic VCR to use it to record very high quality sound on a video cassette. The technique is already being used professionally.

Hitachi

Amongst the Hitachi range of VCRs on show was the de luxe VT5500 which has an advanced timer allowing you to make up to five unattended recordings on up to twelve channels over a period of seven days. A battery back-up prevents problems during power cuts or when you pull the mains plug out by mistake . . . A tone cueing system gives rapid access to the beginning of a programme, whether in fast forward or rewind. This can be a very useful feature when several unattended recordings have been made on one tape.

Sony

Sony were demonstrating a very impressive domestic colour camera (type HVC2000P). For only £650 this camera, with its single $\frac{2}{3}$in. colour tube, was giving excellent results – even under very low lighting conditions. It boasts a range of features usually found on only much more expensive cameras, including a power zoom macro lens with auto iris, an electronic viewfinder, and auto fade to black. This latter feature automatically fades the video signal to a stable black level when the camera trigger is released. It also allows a clean fade up from black.

Sony's C7 and SL3000P Beta format machines were on show, both having what Sony call "clean cut editing". This ensures that when a pause is introduced during a recording the edit is almost noise-free. I gather that rather than a backwind edit, as used in various professional machines, very fast-acting solenoids and servos are employed. The results were certainly adequate for domestic use.

The final offering from Sony was a vision switcher for domestic use. This takes one monochrome and one colour signal, the former being locked to the latter, and provides synchronous mixes. More interestingly however, it also allows the monochrome signal to be artificially colourised and keyed into the colour signal. Sony's domestic video product manager David Hamid said that the i.c. used in this mixer was originally developed for various professional products, allowing Sony to sell the HVS200P switcher at a trade price of less than £50. Since it also incorporates a power supply for a colour camera, it must surely be a bargain.

Two other interesting items present at the Sony show were a prototype version of their optical video disc system and the SLT7ME Beta VCR. The latter is similar to the C7, but can record and play back PAL, NTSC and SECAM tapes – and also operate on a wide range of voltages and line frequencies.

JVC

JVC were demonstrating their new up-market all-singing, all-dancing answer to the Sony C7 – the HR7700. This VHS format machine will be available in the autumn and incorporates a number of advanced features, including full infra-red remote control, tone cueing to locate the start of

The HR7700, JVC's "all-singing, all-dancing" answer to the Sony C7 up-market VCR. Note the front loading.

unattended recordings, a picture viewing facility at ten-times the normal speed in both the forward and reverse modes for quick programme location, and a form of auto edit from pause ("edit start control"). One of the main features of this VCR is ease of setting up. It's also interesting that the digital timer/counter can be set to run for up to 395 minutes (6$\frac{1}{2}$ hours) – do JVC know something about tape lengths that we don't? The off-air timer covers 14 days and allows up to eight recordings on different channels to be made. It has a back-up facility to allow several days' operation with the VCR disconnected from the mains. The TV tuner uses several new i.c.s, giving auto channel search and memory – a feature first introduced by Grundig with their SVR4004 machine. There's a range of fast and slow speeds, as well as still frame and frame-by-frame advance. With the front loading arrangement and metal case, a colour set can be stacked atop the machine. A final useful feature is the inclusion of the video camera socket behind a flap at the front of the VCR – no more hunting around the back for it!

We'd hoped that JVC would have been showing their latest VR2200 portable VCR, but this was not to be. Thorn however revealed a very neat portable VHS machine (Model 3V24) with remote control, picture viewing at ten times normal speed in the forward and reverse modes, etc., etc. A launch date of around Christmas was promised. The Thorn 3V23 is a version of the JVC HR7700.

Another JVC machine on show was an economy version of the HR3330 – Model HR3320. With a suggested retail price of £579, this machine is basically the same as the HR3330 (which will remain in production) offered without the various accessories. It has a Ferguson equivalent in the 3V22, with an anticipated retail price of "around £500 including VAT".

Other video products shown by JVC included a neat 6in. battery/mains video monitor with built in loudspeaker – great for use on outside recordings.

Grundig

Grundig had several of their V2000 format VCRs on display – the 2×4 as it's called. This in fact was the first machine to the joint Philips/Grundig V2000 format to be launched in the UK, back in March – it's now available from selected Grundig dealers. Twenty two other European manufacturers are said to have promised to adopt this format, with its flip-over cassette that gives a running cost of around 30% of conventional domestic VCRs. The Grundig 2×4 enables up to four unattended recordings to be made over a ten day period. It also features an automatic programme finding system based on a cue tone system.

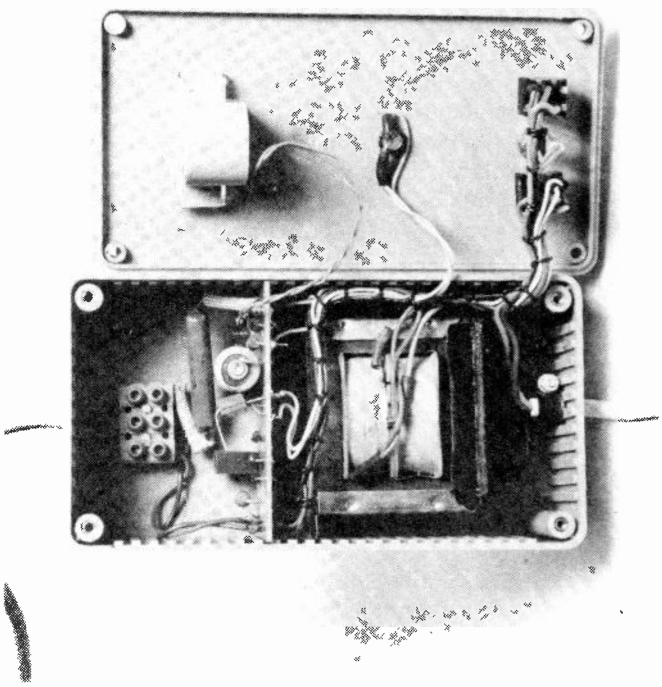
Adaptors

Finally, on a different note, Radofin were demonstrating not only a new teletext adaptor but also a unique Prestel adaptor. Both enable ordinary monochrome or colour sets to be converted to teletext or Prestel terminals by including the appropriate adaptor in the feed to the aerial socket. The VDX1000 Prestel unit is expected to sell for around £200. It gives a very good picture, particularly when you consider the demodulation/remodulation process through which the signal goes.

In contrast, Grundig were showing a sample add-on teletext unit which is designed to slot into the front of their 26in. CTV chassis. As the signal is fed into the TV chassis in RGB form, an excellent picture is obtained. The suggested retail price is around £150.■

The Minitest CRT Tester/ Reactivator

William Harrison



Internal view of the Minitest.

FOR field servicing it's clearly best to have a pocket-sized c.r.t. tester/reactivator, so I decided to see what could be done to meet this requirement. A heater transformer with a boost facility makes a reactivator much more effective, so I started off by finding the smallest box which would conveniently house the transformer. This turned out to be a 6 × 3¼ × 2in. ABS plastic box in the RS Components range.

The meter used is not critical and can be left to your choice. It must be shunted to give a full-scale deflection of around 50mA. The one I used was a tuning meter from a radio. Viewed end on it takes little space, and fitted the wrong way up it has a ready-made goodness scale. It has a 250μA movement and a 1·5kΩ resistance.

The circuit is shown in Fig. 1. In the reactivate mode, SW3 is switched to the 20% heater boost position and SW2 is left open. Thyristor Th1 then provides pulsed reactivation, being triggered by diac D3 which in turn fires when C1 has charged sufficiently via R2. The diode (D2) in the gate circuit slows the pulse: select one that gives a steady flash rate from the l.e.d. D4. For c.r.t. testing, leave SW3 in the 6·3V position and close SW2 to short out the thyristor. The meter will then give a reading indicating the condition of the tube. The meter can be calibrated by checking with known good and poor tubes. A good cathode should produce a reading of 30mA or more.

The approximate value of the meter shunt resistance (R4) required is given by meter resistance/multiplication factor, i.e. for a 1mA, 75Ω meter to read 50mA f.s.d., the shunt resistance required is approximately 75/50=1·5Ω.

The components used in the prototype were selected from the RS Components range. In view of previous experiences when the magazine has specified RS Components items however, we should perhaps mention that these cannot be bought direct from RS Components but must be obtained through a retailer.■

★ Components List

C1	0·1μF 250V polyester	D3	133 (RS 261-334)
C2	4·7μF 450V electrolytic	D4	RS 586-497
R1	22Ω 2·5W wirewound	Th1	C106 (RS 261-817)
R2	6·8MΩ ½W	T1	RS 196-224
R3	68Ω ½W	F1	500mA anti-surge with fuse holder
R4	To suit meter used.	SW1	RS 339-257
R5	3k9Ω 5W wirewound	SW2, 3	DPDT miniature toggle RS 316-989
D1	1N4007	LP1	250V miniature neon
D2	1N4148		ABS Box, RS 508-936

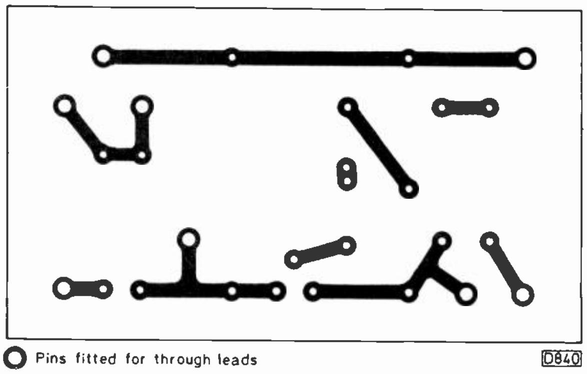


Fig. 2: PCB print pattern. Scale 1:1.

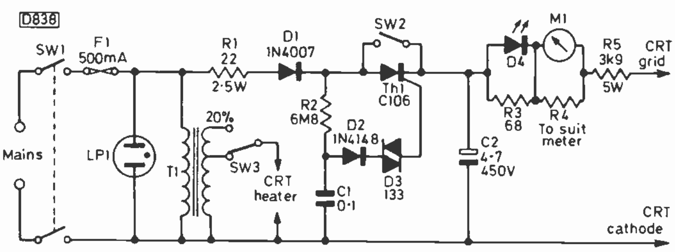


Fig. 1: Circuit diagram of the Minitest.

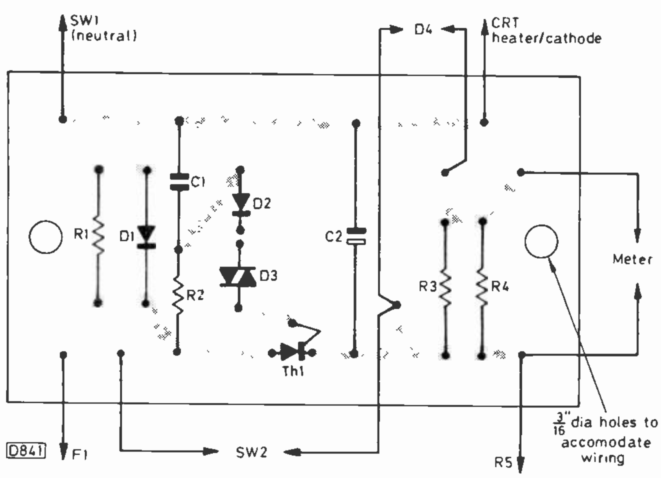


Fig. 3: Component layout on the board.

Faults and Fault Finding

Mike Dutton

The Pye 731 Chassis

The customer said that his 26in. Pye colour set (731 chassis) would work perfectly when first switched on, but after a time the raster and sound would suddenly disappear. So we connected a meter to the fuse in the h.t. feed to the line output stage and waited. When the fault occurred, the voltage rose slightly instead of dropping to zero as we expected. It seemed likely that the fault was on the line timebase panel, and on careful examination we discovered that the nut securing the line output transistor's collector to the board was not properly soldered (similar to the trouble with the field output transistors in the G8 chassis). No more trouble after resoldering the nut.

Another of these sets (actually a Dynatron this time) came in with the complaint that there was a bright white raster and none of the controls worked. This is not uncommon with these sets, and is usually caused by the TBA560CQ i.c. on the decoder panel. We replaced the i.c., but after a few hours the fault reappeared. Fit another and the picture returned to normal.

About a fortnight later the customer complained of the same problem. Another TBA560CQ restored the picture, but we decided to investigate a bit further. All the voltages in the area seemed to be normal, so we next checked for dry-joints. When the black electrolytic C353 (1,000μF) which stands up on the panel was moved the picture reverted to the very bright state. This capacitor smooths the d.c. supply to pin 11 of the i.c., but no voltage variation was apparent across it as the picture came and went. After replacing it, no amount of prodding or tapping would induce the fault. When checked with an Avo, the capacitor was found to have an internal disconnection when its legs were pulled. The TBA560s that had been changed were all faulty, so we came to the conclusion that when the capacitor went open-circuit spikes on the supply line would destroy the i.c.

We've found that when a bright screen is the symptom on these chassis the best method of attack is to measure the voltage at pin 5 (luminance input) of the TBA530. This should be about 1·3V. If it's high, operate the set-up switch on the decoder panel. If the voltage remains high, the chances are that the TBA530 is responsible for the trouble. If the voltage drops to around 1·3V however, suspect the TBA560 and its associated circuits. If the voltage at pin 5 of the TBA530 is correct, check the voltages at pins 2, 3 and 4 (colour-difference signal inputs from the TBA990 demodulator i.c.). These voltages should be about 7·5V. If high, it's likely that the TBA990 is the cause of the fault.

Disappearing Picture

The complaint with a two-year old Panasonic Model TC2201 colour set was that the picture would disappear after about twenty minutes' operation. The customer mentioned that a sharp tap anywhere on the cabinet would bring the picture back. We decided to remove the set to the workshop, where we could watch it.

After about half an hour the picture gradually faded out, and a few voltage measurements showed that with the fault present the beam limiter voltage at TP-P2 had altered considerably. A sharp tap on the cabinet would then bring the picture back and restore the beam limiter voltage to normal. We lifted the chassis up and traced the wiring from TP-P2 – which is not easy. We couldn't find any dry-joints, so the set was run again. This time we tapped gently over the print when the fault appeared and found that a resistor soldered on the print side of the panel had rather long leads. As the receiver warmed up, this resistor shorted to the beam limiter circuit and the picture faded.

After clearing this we soak tested the set and returned it to the customer. About six weeks later we had a phone call to say that the set was doing the same thing. Funny we thought. This time the picture was coming and going quite regularly, and would flick straight off instead of fading out. We removed the back and loosened the chassis. Move the chassis and the picture came and went! Move the wiring harness at the back of the chassis and the picture sprang to continuous life. Inverting the chassis revealed a lovely dry-joint on the end pin at the left of the chassis, nowhere near the site of the previous problem, and we could only conclude that we'd disturbed things during the first repair, producing this bad connection. Anyway the set's now working nicely, with an excellent picture.

Flyback Lines

The trouble with a Decca colour set (80 chassis) was flyback lines visible on dark scenes. Replacing the MC1327 colour demodulator/matrixing i.c. soon cured that, but a week later the customer complained that a line had appeared about a third of the way across the screen, from the left. It looked very much like corona discharge, but was the MC1327 once more. We put it in another decoder, but it didn't reproduce the fault, so we can only conclude that the trouble was due to a freak combination of component tolerances.

Sorting Out an Indesit

An Indesit hybrid monochrome set of the later variety (with varicap tuner) had been purchased from bankrupt stock. It had never been used, and had been standing for a fair while. We switched on and were greeted by a long, narrow horizontal white line, which went light and dark, across the screen. We decided to tackle the field collapse first, and took a few voltage measurements around the PCL805 field timebase valve. Everything seemed about right, so the scope was brought into action. This showed that the timebase was oscillating, but the waveform at the primary winding of the field output transformer was of very low amplitude. Disconnecting the scan coils and the feedback winding produced no improvement, so we came to the conclusion that the primary must have shorting turns. Fitting a replacement opened up the raster nicely.

We were now left with a narrow picture that kept going light and dark. Adjusting the width control didn't do anything, so we checked the two 4·7MΩ resistors in the width circuit (we've had trouble with them before). This produced no improvement, so we next replaced the pulse feedback capacitor (C420, 270pF, 1kV) and out came the width. When tested the capacitor turned out to be open-circuit: it's a very feeble type, a disc ceramic of a size more like that of an i.f. decoupler.

That left us with the brightness fluctuations. These came and went as the chassis was moved, and moving the wiring showed that the disturbance was greatest at the control panel. On removing this we discovered a dry-joint where the earthy side of the tuner output coaxial cable is connected to the print. This also acts as an earthing point for the controls etc. It seemed strange that only the brightness should have been affected, but there you are. After setting up the receiver we obtained excellent pictures and sound.

Tale of Two Telefunkens

Next a tale of two Telefunkens. The first a 709, with the complaint no picture or sound. When we switched it on, the raster came up but was blank and there was a very low hiss from the loudspeaker. A few voltage checks showed that the a.g.c. circuit was at fault – the voltage at test point M171 was slightly negative, instead of 12-16V positive depending on signal strength. The point is linked to the 255V h.t. rail via R175 (820kΩ), which measured completely open-circuit. The associated smoothing electrolytic C174 (12μF) measured o.k. Replace the resistor and up comes the picture – only to vanish again after a minute or so. This time the electrolytic was short-circuit, with a black mark on its side. After replacing it, the set worked fine. A previous engineer had made a neat job of fitting a c.r.t. boost transformer, and considering that this hybrid set was over eight years old the picture quality was very good.

The second Telefunken was of the much less reliable 711 solid-state variety. It was one of the earliest of these sets, and had been purchased some four years previously. During that time it had developed just about every stock fault. This time the complaint was that the set kept going off tune. It wasn't too difficult to trace this to the SAS570 tuner control i.c. loading the 33V tuning line intermittently.

A week later the complaint was that the set kept going on and off. The cause of this was obvious when we removed the back cover and switched on – R422 (68kΩ) in the h.t. regulator circuit was tracking across its outer coating, causing the power supply to jump about alarmingly. We switched off very quickly, replaced the resistor and everything was then fine.

Three days later there was a phone call to say that the set had gone completely dead, so this time we collected the set to check the power supply over. There was no output from the thyristor, though there was a.c. at its anode and a gating pulse in the right place. After a lot of head scratching we measured the a.c. input to the thyristor with a scope. It was very low on the peak-to-peak measurement, so we replaced the series diode D425. Everything then sprang to life. The diode is in series with the thyristor, and when checked out of circuit measured o.k. The set was soak tested for a week, and as everything seemed to be o.k. we returned it.

A month later the customer rang back to say that the set had failed again. This time there was a hole in the panel where the electronic filter circuit had been. We repaired that, and have heard nothing since . . .

How Dead?

As a postscript to this Telefunken 711 story, we were called to a "dead" ITT set fitted with the CVC9 chassis recently – dead turned out to mean plenty of e.h.t. but no raster or sound, due to an l.t. rail fault. The reference voltage for the l.t. regulator on this chassis comes from the 33V stabilised tuning voltage supply – and this was missing. We eventually found that the SAS570 tuning i.c. was short-circuit internally, and after replacing it the set sprang to life. In fact these tuning i.c.s quite often give trouble, but it always seems to be the SAS570 and not the SAS560.

Set Tripping

Another dead set complaint came with an early ITT CVC20 chassis. When we switched on there was the familiar pumping action of the power supply trip circuit. Our first move was to disconnect the tripler – we've had several faulty triplers on these sets. The set then came to life, with plenty of line whistle. With a new tripler fitted the trip circuit was back in operation however. On inspecting the board more closely we discovered a large number of dry-joints – all the metal tags securing the line output transformer to the board were dry-jointed, and on this chassis these form part of the earth path.

The beam limiter circuit was also checked, and here we found that the clamp diode D3 (1N4148) was leaky, with a reading of some 30 Ω each way. This was replaced, and up came the picture. The colour was intermittent, but this was cured by resoldering the earth strips inside the decoder module.

York Portable

A York portable came in with the complaint lack of line sync. We didn't have any service data, but the set had a familiar Hitachi look about it. Anyway the fault was indeed no line sync, so as a first step we checked the flywheel line sync diodes by substitution. This didn't make any difference, so as the field lock was solid we suspected that the feedback pulses to the flywheel sync circuit from the line output transformer were maybe missing. The scope was brought into action and the pulses were found to be present, though of low amplitude. As a first step the 1μF feedback capacitor was checked, but turned out to be o.k. We switched off therefore and checked the pulse winding F4 on the output transformer for continuity. It measured open-circuit on the print but o.k. at the transformer tag. When the print was resoldered we found that the line output transformer tag had never been pushed through properly. Remaking the connection produced solid line lock, and we can only assume that the low-amplitude line pulses we saw on the scope were produced by stray pick-up. It caused some confusion at the time though.

No Signals

A blank raster with no sound was the complaint with an ITT monochrome set (VC200 chassis). This is usually caused by a fault in the a.g.c. circuit or a dry-joint on the i.f. panel connections in these sets. A few voltage measurements revealed that there were no l.t. voltages on the i.f. panel or the a.g.c. circuits however. The supply is derived from a rectifier (D9) which is fed from a winding on the line output transformer, so we made some checks in this area. It didn't take long to discover that D9 was open-circuit.

Severe Instability

The complaint on a single-standard hybrid GEC monochrome set was severe instability. The customer said that the picture had been of poor quality for some while.

The fault looked like the sort of thing that happens when a decoupling capacitor in the i.f. strip goes open-circuit, but we couldn't understand why the picture should have deteriorated gradually. We checked a few voltages in the i.f. strip, and everything seemed low. Then, remembering the problem we'd had with the ITT VC200, we decided to check the l.t. rectifier circuit, which again is fed from the line output transformer. Bridging the reservoir capacitor C225 produced a grainy picture, and when the smoothing capacitor C224 was also bridged the picture returned to normal, with no background noise. These electrolytics are both 160μF, and when checked were found to be open-circuit. Presumably they'd gradually dried up over a time, causing the picture quality deterioration.

Awful Focus

Poor focus was the complaint with a Bush colour receiver (Z718 chassis), and when we switched on the focus was so poor we couldn't even distinguish the picture. The focus voltage was found to be only about 200V – on this chassis it's derived from the output of the e.h.t. stick rectifier, via a sealed unit. The whole assembly was replaced, but there was no improvement. We next disconnected the focus lead from the c.r.t. base panel, and found plenty of focus voltage on the flying lead. When the tube base and its plastic cover were undone the cause of the trouble was immediately obvious – there was a build up of green corrosion in the hole where the focus pin once was. The corrosion had formed a conductive path across the focus spark gap, which is moulded into the tube base. A good clean up and a new focus pin in the tube base panel restored the set to normal working order.

Blank Raster

The complaint on another Bush set fitted with the Z718 chassis was no picture. There was a healthy e.h.t. rustle when the set was switched on, and the tube heaters lit up. No screen illumination however. Measurement of the tube base voltages showed that the tube was cut off, with the collectors of the video output transistors all right up at the h.t. rail voltage.

We moved back to the TCA800 demodulator/matrixing i.c. and measured the voltage at pin 1 (luminance input). This was low, so we moved back a stage to the TBA560C i.c. The voltages here were all low, with only 0·5V on the supply pin 11. Investigation showed that the feed resistor 3R34 (10Ω) was open-circuit and the associated decoupler 3C61 (330μF) dead short. Replacing these components restored the picture, and after a small amount of convergence and grey-scale adjustment the set was as good as new.

Colour Problems

Yet another of these sets suffered from no colour. Removing the colour-killer link restored colour, but the reference oscillator was off lock. This turned out to be due to the a.p.c. balance potentiometer 3RV4, which had a faulty rivet connection at one end of its track.

Blue Edges

A Grundig Model 5011 was brought into the shop by an elderly customer who said there were blue edges on everything. He said his son had tried to adjust the controls for him, but now he couldn't get a picture. We switched on and tried to tune in on our aerial system, but it was immediately obvious that the tuning controls were worn out. After fitting a new panel we were able to tune in the BBC-1 test pattern.

The blue was severely bowed horizontally, and neither of the two blue horizontal convergence controls 11 or 12 had any effect. There are three diodes in the blue horizontal convergence circuit, and as the controls themselves seemed to be in good condition these were our first suspects. No luck, so next we tried stabbing test capacitors across those in the circuit. Bridging C724 (0·056μF) produced a marked improvement, and after replacing this and setting up the convergence a very good picture was obtained.

Loss of Colour and Line Sync

On another Grundig colour set, this time a small-screen (16in.) transportable, the fault reported by the customer was that after about an hour the picture would break up horizontally and the colour would go. True enough, the break up being due to the line frequency drifting. The fault was heat sensitive, and could be cured by freezing the panel around the TBA920 line oscillator i.c. We changed the i.c., also the polystyrene timing capacitor C422 (0·01μF), but the fault returned. Resistors were next checked, and after changing R424 (27kΩ) in the hold control circuit the fault had been cleared.

Doric Colour Sets

We've had two Doric colour sets (Rediffusion Mk. III chassis) in recently. The trouble with the first was intermittent colour. We didn't have the manual when we called, so we tried using a hair dryer and freezer. The circuit in the vicinity of the 7·8kHz ident amplifier and colour killer seemed particularly sensitive, and the fault was eventually cured by replacing 2C47 (5,400pF) in the ident amplifier circuit. This is a rather unusual arrangement incidentally (see Fig. 1), consisting of a feedback pair of transistors with the feedback from the second to the first taken via a parallel-T filter. 2C47 is one of the components in the filter network, and its value is very critical.

The second set suffered from grainy pictures. We thought

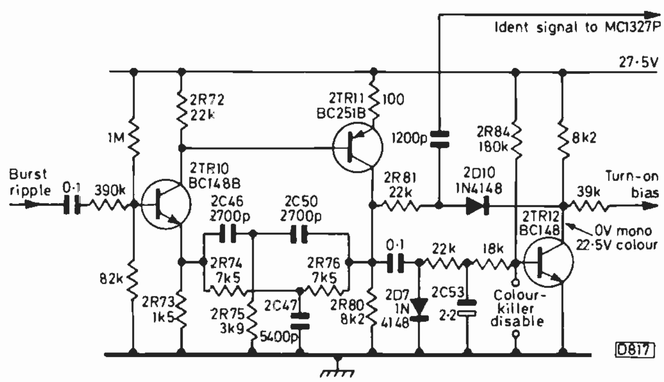


Fig. 1: The unusual ident stage used in the Rediffusion Mk. III chassis. Feedback from the collector of 2TR11 to the emitter of 2TR10 is via the parallel-T filter 2C46/2R75/2C50-2R74/2C47/2R76. The filter provides a sharp null at 7·8kHz, the negative feedback in the stage being minimum and the gain maximum at this frequency. The 7·8kHz sinewave thus produced during a colour transmission is fed to the MC1327P i.c. for ident purposes and is rectified by 2D7 to produce a negative voltage across 2C53 to cut off 2TR12 which thus produces the colour turn-on bias at its collector. On monochrome, 2TR12 is biased on by 2R84, the voltage at its collector falling to 0V. 2D10 is then forward biased, muting the output (amplified noise) from 2TR11.

this was due to the aerial, but a loan set worked o.k. We hinged the chassis down therefore and prodded around the tuner and i.f. cans. When the first i.f. can was removed the picture improved. We stripped it down and resoldered the joints and after this the set worked fine.

Hitachi Tip

It's not uncommon to find faulty tuning button units on the Hitachi Model CNP190. A handy replacement is the button unit used on later Rank monochrome sets.

An Unusual Short

A Thorn monochrome set (1500 chassis) had been given a major overhaul and installed as a decontrolled rental. The customer complained that the picture had disappeared after half an hour's viewing however. Removing the back, we discovered that the spring-off resistor in the feed to the line output stage had sprung. The valves were all new, so we thought it unlikely that these would be at fault. The boost capacitor and line output transformer harmonic tuning capacitor both checked o.k., so we resoldered the trip and switched on.

The line oscillator started up, but there was no spark at the top cap of the PL504. What was killing the line output? We decided to check the scan-correction capacitor, and to do so pulled one of the leads off the scan coils, checking across the capacitor with the Avo. It read perfect, so we switched the set on to take some more voltage readings. This time the set came straight on however. We had a little think and decided to take a closer look at the scan coils. When they were removed it was easy to see what had happened. The wire leading out from the coil to the tag is covered with a piece of sleeving which had worn away, the bare wire shorting to the tube's aquadag coating.

Vintage TV: Projection Systems

Part 2

Vivian Capel

ALL the projection receivers that appeared in the UK in the early 1950s used the Mullard optical unit described in Part 1. The MW6-2 tube required an e.h.t. voltage of 25kV, and this again was provided by a Mullard designed unit. There were some variations in detail between the versions used by different setmakers, but the Mullard tripler unit was common to them all.

EHT Generator

The e.h.t. generator consisted of an oscillator which controlled an output pentode. The latter was coupled to a transformer which fed the e.h.t. tripler. Voltage regulation was incorporated, the output from an extra winding on the transformer being rectified and used to bias the output pentode's control grid. This was essential in order to overcome the inherent poor regulation of the valve tripler and so maintain the focus throughout the range of brightness variation.

The design went through several phases. The initial one employed an octal based EBC33 valve as the blocking oscillator (triode), the two diodes in this valve being connected in parallel and used as the rectifier for regulation purposes. An EL38 was used as the output pentode. The tripler consisted of three EY51 e.h.t. rectifier diodes which were encapsulated, along with the associated capacitors and the output transformer, in an oil-filled can. The second version was much the same but used an improved regulation circuit. This sampled the h.t. as well, so that a measure of compensation was added to cater for h.t. voltage variations. These two versions were used in the very early projection models.

The Final Circuit

Much more common was the third circuit (see Fig. 1). In this an ECL80 (pentode section) was used as the blocking oscillator, the triode section of this valve being connected as a diode to act as the regulator rectifier (with C3 as its reservoir capacitor). The output valve was a PL820.

As the e.h.t. generator, though very similar to a line timebase, didn't drive a deflection circuit, it may be thought that the oscillator frequency was of little importance. It was not in fact synchronised, but it was still necessary to keep it running at close to the nominal 1,000Hz figure. Too high a frequency meant that the EY51 rectifiers in the tripler were overrun, leading to premature failure. Too low a frequency on the other hand resulted in underrun rectifiers and poor regulation.

Checking the Oscillator Frequency

The maximum permissible variation was 7% either way. To check this, the recommended procedure was to connect the output of an accurate a.f. generator to the X terminals of a scope, with a signal from the e.h.t. generator (a wire looped loosely around the ECL80 valve would do for this purpose) fed to the Y terminals. Adjusting the a.f. generator for a steady trace indicated the e.h.t. oscillator's frequency.

This test was rarely performed, especially in the field, since few TV engineers had an a.f. generator while scopes themselves were not all that common in those days. Many projection receivers did not give of their best therefore because the oscillator was running outside the specified limits.

The scope could be dispensed with by hooking a lead on to the set's volume control, looping the lead around the ECL80, and clipping it to the output of an a.f. generator. The generator was then adjusted for a zero beat note. This was my preferred method in fact. Quicker than bringing a scope into action, though an a.f. generator was still required.

In most models the 1kHz note could be heard from the back of the set. This provided a ready check on whether the e.h.t. unit was functioning. If the frequency was found to be outside the correct limits, a new ECL80 might do the trick. If not, the values of the capacitor (C1) and resistor (R2) in the blocking oscillator's single charging/timing network had to be fiddled with to get it right. The blocking oscillator transformer could also be responsible for incorrect

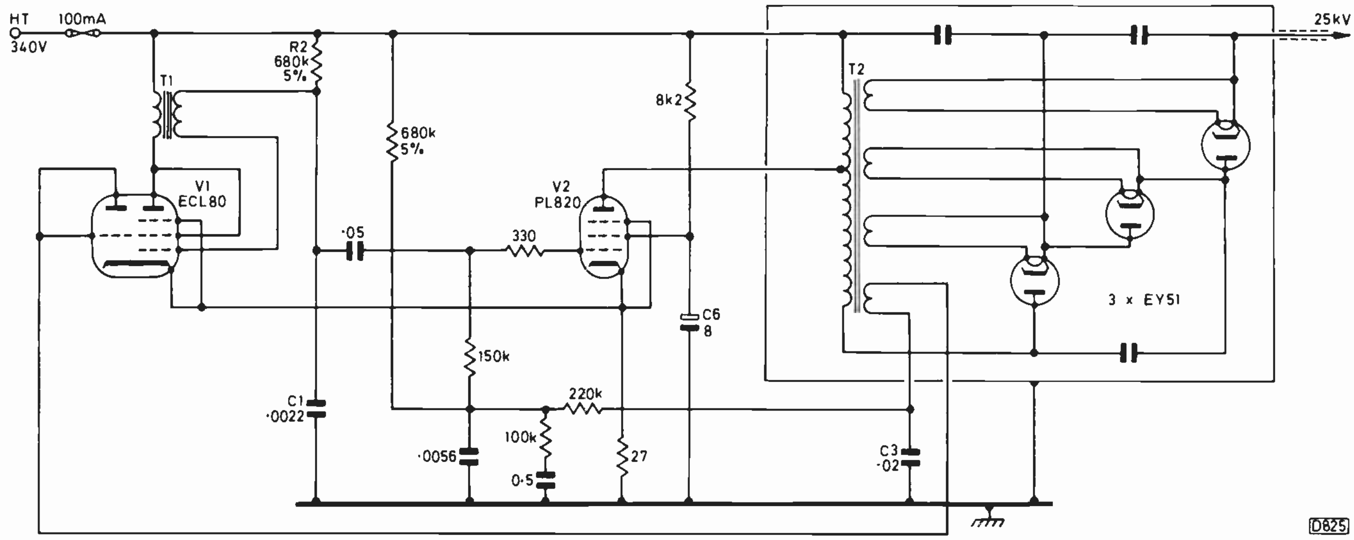


Fig. 1: The e.h.t. generator circuit used in the majority of the projection TV sets manufactured during the early 50s. In earlier versions an EBC33 was used as the oscillator/a.g.c. rectifier and an EL38 as the output valve.

frequency. In this case however the frequency was likely to be a long way out, or maybe the circuit wouldn't oscillate at all.

Output Stage

The output valve operated with around –60V on its control grid. Only the peaks of the sawtooth waveform from the oscillator could drive it into conduction therefore. As a result, the output current consisted of a series of sharp spikes – exceeding 200mA and lasting for about 0·3 of the total cycle period (i.e. 300μsec). During the remaining 700μsec, no current flowed.

When the current pulse ceased, the collapsing field around the transformer winding produced a high e.m.f. in the opposite direction. As the winding had a high Q and, unlike a line output stage, there was no efficiency diode to provide a damping effect, slowly decaying oscillations continued for about 15-20 cycles until the next pulse arrived. The transformer's overwinding produced an output pulse of 8-9kV for the tripler.

Triplers are common enough today, but were then something of a novelty, surrounded with an aura of mystery. Since the tripler and the output transformer were sealed in an oil-filled can, they were not serviceable. If one of the rectifier valves lost emission, the whole thing had to be replaced – and as there were three valves the chances of this happening were high. Tripler changing was a common job therefore, though it was a simple matter. The only thing you had to be careful about was introducing the e.h.t. connector to the tube cavity in the confined space available in some models under the optical unit. If your finger found the cavity first, the stored 25kV could make you withdraw it rather fast. Fortunately there was no variation in transformer/tripler assemblies, simplifying the spares situation. Wouldn't it have been nice if this could have been the case with line output transformers?

I've a hazy recollection that an allowance was made for returned triplers, but am not too sure about this now. Repairing a unit today would involve removing the lid (not an easy task since it was soldered in place all round the perimeter), draining off the oil, replacing the faulty rectifier(s), refilling and replacing the lid.

Fault Finding

Fault finding consists of first making the usual valve electrode voltage checks. With a PL820 output valve there should be 210V at the screen grid and 1V at the cathode: with an EL38 there should be 345V and 3V respectively. The voltage at the control grid of the output pentode should be around –60V d.c. or 50V a.c. Lack of an a.c. reading indicates a defunct oscillator.

Reduced height and width could mean excessive e.h.t. if the h.t. was normal. Possible causes are a fault in the regulator circuit or the oscillator frequency being too high. Poor regulation with or without low e.h.t. can be due to a low-emission output valve, incorrect oscillator frequency, a dried up screen grid decoupling electrolytic (C6) or a faulty tripler.

CRT Protection

An essential feature of these projection receivers was c.r.t. protection circuitry – otherwise, in the event of collapse of either the field or the line scan, even momentarily, the 25kV beam would not simply burn a brown line on the phosphor but take it right off the screen. Circuitry varied from model to model, but the basic idea was to operate the tube under cut-off conditions in the absence of deflection currents. The field and line scan waveforms were rectified to produce a positive bias for the c.r.t. grid, i.e. for the brightness control circuit, so that the c.r.t. came into operation as soon as the timebases got going.

This complicated servicing somewhat, since failure of either the field or the line scan would produce the no raster symptom. A clue as to where the trouble lay could be obtained by measuring the tube's grid voltage. Setmakers' manuals gave values for either line or field failure. There were also faults that partially but not completely removed the positive bias obtained from the timebases, thus giving a grid voltage reading different from that quoted in the relevant manual. Stopping the field and line timebases in turn however usually gave an indication of which one had most effect on the voltage discrepancy.

Focusing

Another difference with many projection sets lay in the focusing arrangements, which again varied from model to model. Some sets used a focus valve to control the current flowing through the focus coil. Refinements included compensation for h.t. and e.h.t. variations, also high peak whites in the video drive.

Letters

VIDICON BURN IN

I read with interest the article on domestic video cameras in your January issue. One point that wasn't mentioned was vidicon tube image burn ins. A camera using a vidicon pickup tube should be treated with great care in this respect – even if it's left looking at a 25W bulb for more than a few moments burn in will occur. Small burn ins can be erased by pointing the camera at a white card with medium illumination, but more serious burns ins are impossible to remove.
G. Cooper,
Airdrie, Lanarkshire.

Editorial comment: The recommended procedure for removing a vidicon burn in is as follows. Point the camera, powered up, at a white card, wall etc. which is illuminated with an even light of around 100-1,000 lux. Defocus the camera, and leave the lens wide open at 100 lux or at f5·6 with 1,000 lux illumination. All but the worst burn ins should be removed if the camera is left for about five hours.

G11 QUERY

In your May issue, Dewi James raises the question as to why the line driver transistor's feed resistor R3106 in the Philips/Pye G11 chassis burns up for no apparent reason. The cause of the trouble is leakage inductance in the driver transformer – a different transformer is used in later chassis.
J. Kennedy,
Cullybackey,
Co. Antrim.

COLD CHECKS

Other readers might be interested in the following tips on doing cold checks on components using an Avo Model 8.

In the case of thyristors, first check for anode-to-cathode leaks in both directions with the meter set to high ohms. If no leaks are found, set the meter to low ohms, then make the thyristor's anode positive (black lead) and its cathode negative (red lead). A quick short-circuit between the gate and the anode should produce a reading of approximately half-scale deflection, and this reading should remain when the anode-gate short-circuit is removed. A similar test works with triacs, and has held good for all such devices I've come across.

To test small-value capacitors (non-electrolytic), adopt the arrangement shown in Fig. 1. With the meter set to high ohms, connect the capacitor between points A and B, i.e. the collector and base of the transistor. The result should be a large deflection falling to infinity. If the meter continues to give a reading the capacitor is leaky; if no reading is obtained to start with the capacitor is open-circuit. To avoid false readings, keep your fingers off!
George KcKenna,
Prestwich,
Ayrshire.

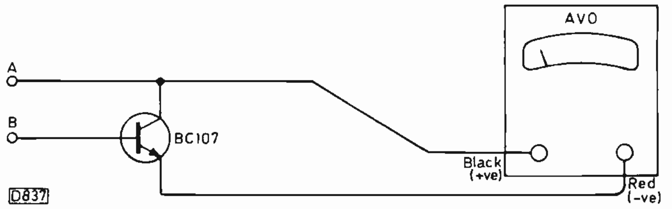


Fig. 1: Method of checking small-value capacitors (non-electrolytic) using an Avo Model 8.

VIDEOTAPE SWAPS

I'd like to make contact with UK/Eire readers who might be interested in exchanging videotapes. Though the US TV system differs from the European ones, I'm obtaining multi-standard video equipment which should allow me to use videotapes recorded overseas without difficulty. In return, I'd be happy to prepare videotapes of whatever subjects I can provide. My area is served by a cable TV system providing over twenty channels, so a wide range of programming, including pay-TV movie channels, is available here. Not wishing to fall foul of your laws or mine, the aim would be programme exchange only, with no payments – I might add that I'm a physician, and have no connection with the video business.

Anyone overseas with NTSC equipment would be able to view US tapes directly of course. For others I shall be able to prepare optical standards transfers, in the PAL format, with some loss in quality (optical standards conversions will have to be in monochrome initially however). My interest is in obtaining UK/Irish material not available here, such as Edinburgh Festival events, Welsh choir performances, "Last Night of the Proms", Irish theatre, etc. I hope anyone interested in such exchanges will contact me.

At present I've a Barco multistandard receiver-monitor, but I'll delay buying a multistandard VTR until I know which standard would be most suitable for such exchanges. I suspect VHS or $\frac{3}{4}$in. tape will be the most practical, or maybe Betamax. For those who can use them, I can provide NTSC tapes in EIAJ reel, $\frac{3}{4}$in., Betamax and VHS formats. The Philips and other European systems are not generally available in the US.
Thomas F. Buchanan, Jr.,
1632 Minnekahda Road,
Chattanooga, TN37405,
USA.

PUZZLES

An ITT set (CVC9 chassis) I had in for service recently had several faults, most of which were due to dry-joints. One that eluded me for a while however was a hum bar which affected the raster and distorted the colour. The 20V rail was responsible, but the smoothing capacitors all turned out to be o.k. Next suspect was the bridge rectifier. When one diode was removed, the fault almost disappeared. The fault was still present after replacing all four diodes however. I'd not suspected the regulator since its output was spot on at 20V and the AD161 was nicely warm. To cut a long story short however, I eventually found that the line remained at 20V when the base of this transistor was disconnected, replacing the transistor clearing the fault. It seems that although the transistor had apparently failed, its emitter-collector resistance was just right to keep the l.t. supply voltage correct.

Now for a bit of a puzzle. I've recently moved my workshop into a large aluminium caravan, which seems to be having a most peculiar effect on the purity of some of the sets being adjusted in it. After adjusting the purity with the set facing the mirror, I find there's considerable error present when the set is turned around – mostly in the form of a mauve strip down the sides of the picture. Sometimes

this will go on switching the set on again from cold, thus degaussing the tube. The most remarkable effect however was on a GEC hybrid set which after setting up was turned on its side for some attention to the bottom of the cabinet. On doing this I found that the red and green had changed places, looking exactly like out-of-phase ident. Suspecting that the pot over the ident coil had come adrift, I investigated but found nothing amiss. I then found that as the set was turned from the horizontal to the vertical position and back, so the red and green would change over then back again. Any ideas?
Peter Nutkins,
Charmouth, Dorset.

A WRITE OFF?

I recently acquired an Ekco Model CT107 colour receiver (Pye 691 chassis) that had been on fire and written off as scrap. Since I've been retired for some years, after a life time in the electronics industry, I'd plenty of time in which to repair it – and thought that maybe other readers would be interested in the details.

The only thing that was obviously wrong on first inspection was that the focus unit had burnt up and charred the top of the cabinet. As a first step I cleared some of the burnt parts of the focus unit, hung it outside the cabinet and switched on. The result was a horizontal line across the centre of the screen, though there appeared to be signals, and the brightness and contrast controls worked. The sound was just plopping on and off slowly.

A new focus unit was bought and fitted, and the field collapse turned out to be due to both BD124 field output transistors having failed. These were replaced with BD222s, which produced a picture though with very little red. The latter trouble was simply due to R508 (390kΩ) from the red c.r.t. first anode control to the tube having broken, while the sound fault was due to a dud AC176 in the sound module. Replacing this with another BD222 produced normal sound, and after adjustment the colours were fairly normal.

Before the fire, there had apparently been two faults on the set. First very little colour, even with RV9 (set a.c.c.) at maximum. This fault had disappeared after the fire – at least for a couple of days, after which it was back with me. The colour killer was working (correct voltage at TP17), clearing the burst channel and reference oscillator circuit of suspicion, so attention was turned to the coupling capacitors in the chroma amplifier channel. C128 (100pF) turned out to be the culprit. It tested o.k. on a capacitance meter, and on refitting it the colour was back – but only for another couple of days. With the set working, C128 was bridged with another 100pF capacitor. This restored the colour, which remained after removing the bridging capacitor. As the original capacitor was obviously playing about however I replaced it. This provided a permanent cure.

The second fault was a moving horizontal band, about an inch deep, going up or down and sometimes stationary. I tried bridging all the l.t. smoothing electrolytics, then a new bridge rectifier, then the h.t. smoothing electrolytics, but no luck. The fault was eventually traced to the electrolytic that decouples the cathode of the line output valve. An 80μF capacitor was found in this position, and tested o.k., but the circuit showed 200μF and on fitting a 220μF replacement the fault had gone.

There was not enough green in the picture, and the green drive control (RV26) had no effect. The G–Y preamplifier transistor VT30 was responsible, with an emitter-to-base short. There was plenty of green after replacing it. Next one of the PCL84s was replaced, as the voltage readings on it were wrong. Later the red suddenly went down, and when the red PCL84 was tried in the blue and green positions the fault followed it in these colours. So another PCL84 went in.

Next the beam limiter wasn't working, the screen flashing up all the time, especially with high brightness settings. This was due to the clamp diode D39A (OA47) in the beam limiter circuit being short-circuit. A replacement restored normal beam limiter action – though the flashing still returns occasionally if too high a brightness setting is used.

The convergence was set up, but one of the potentiometers (RG horizontal amplitude) was found to be erratic in operation. It was o.k. after spraying with Servisol however (the back was accessible).

There were more problems in store however. First, smoke suddenly appeared from the back of the set after switching on. One of the coil leads in the degaussing circuit had come off the panel, so that all the current flowed through the resistor. Resolder the lead and we're back in business.

After all this the picture suddenly disappeared (sound o.k.). The trouble was traced to the line output transformer – no continuity between the anode cap of the PL509 and the cathode cap of the PY500. Goodness, not another £20? Check the connections at tags 8 and 9, but they looked o.k. There are two green rubber covered leads from the back of the panel to the transformer. Pull on them: one firm enough, the other not quite so firm near the transformer. Gingerly cut the insulation about a quarter of an inch from the transformer, and find that the wire had burnt away. Fortunately there was $\frac{1}{4}$in. of wire still protruding from the transformer, so a new lead was soldered on and the insulation slid down over the joint. Switch on and find normal picture: lucky! Clean up soot and deposit while the transformer section was adrift.

The top of the panel with the rectifiers etc. on had burnt and broken, so a new panel for the top part was made and bolted on, tidying this area up generally.

After all this I have an excellent picture, since the tube is still very good. I guess the set would have been quite truthfully considered "beyond economic repair" had the time spent on it to be taken into account.
H. Owens,
North Ferriby,
N. Humberside.

FEEDBACK

The response to my plea for help in the May issue was truly amazing. Offers came by phone and post from as far afield as Gosport. It seems that my father encountered a number of problems that all those who contacted me had experienced, and in the end decided to build a Forgestone Model 400 instead. The original fault with this was an intermittently yellow picture. A bit of thumping on the decoder board would usually restore correct colour, but there was little consistency about where to thump. Subsequently the vision and sound signals went. The latter problem was simply an open-circuit resistor in the power supply. The original fault was traced to the thick-film resistor unit in the RGB output stages – the common feed point to the B and G output transistors kept going high-resistance intermittently. I managed to bridge this point with a wire link, and the set has given no further trouble.

May I once again thank you and all those readers who contacted me.
Derrick Staynor,
Boreham Wood, Herts.

The Magic Set

Les Lawry-Johns

ONE of our problems recently has been a running battle with the GEC C2121 (and others of that ilk). I'm dreading the next one in case it's anything like the last few.

Take Mr. Rockbottom for example. Some time ago we had cleared a simple case of "stuck on 3" by thoroughly cleaning the touch sensors. When he appeared the other morning we thought it would be a repeat performance, since he does have this habit of gnawing chicken legs whilst watching TV and does occasionally forget to keep one finger clean for touching the sensors when a change of channel is required.

"It's not muck in the buttons this time Les" he puffed. "I've cleaned them out thoroughly with the wife's gin."

"Pity she's not a meths drinker Mr. Rockbottom, but let's have a look at it."

So up on the bench it went, where the sensors proved to be as clean as a new pin. On switching on neon 3 lit up as it should do, but on touching sensor 2 neon 1 came on and whatever you did it went back to 1.

To my unscientific mind it seemed that the ETTR6016 i.c. on the preset control panel was faulty, so we earthed ourself with a length of braid under our metal watch strap since we can't afford an ankle chain.

We carefully took a new chip out of its foil, and noted that it was the last of the quil type. When we'd fitted it we had a completely different set of conditions. It no longer lingered on 1. The two right side neons flickered on and off all the time, though the left side channels could be selected – but not reliably.

"Faulty chip" I thought.

Since the other chips in stock were of the in-line rather than the quil type I decided to fit a quil-to-dil holder to facilitate further mucking about. This done, I fitted the first one. This gave totally different results, but anything other than those required, and I was becoming slightly confused since neon 3 wouldn't light up at all.

I next declared war upon the neons. First I changed neon 3. This then lit up at switch on, but when I touched sensor 2 neons 5 and 6 flickered and neon 2 refused to light. So I changed neons 5 and 6 and everything worked beautifully. All channels could be selected and would stay selected.

Later that day Mr. Rockbottom returned. We put the set on the counter to show him how clever we'd been. Hooked it up and invited him to change channels.

"It won't change" he said in a rather flat voice.

"Of course it will" I assured him cheerfully, but with a cold chill creeping up my spine. I leaned over and touched the sensors. Every channel selected impeccably. "There you are."

"It won't change for me."

I impatiently charged round to the front of the counter and ran my finger along the sensors. Nothing happened. It remained on 3. I charged back to the rear of the counter to look for the large scissors so that I could snip my arteries and put and end to it all, but decided to give it one more go. I leaned over and touched the sensors. It changed perfectly.

Then the light dawned. The only thing different was the mat in front of the counter. It had been changed that morning, and was one of those rented things that are changed every two weeks. They are damp when laid, being impregnated with all sorts of odd chemicals to absorb the dirt etc. from customer's shoes.

"Wait just a second Mr. Rockbottom. It's the mat you're standing on. It's robbing you of your vital energy. Get off it quick." Mr. Rockbottom leapt off the mat like a scalded cat.

"Has it damaged me?"

"I don't think so. We can soon test you though." So I rolled the mat up and we now stood on the lino tiles which cover the wood floor (just in case you asked).

"Now we can change channels with impunity, you see."

Mr. Rockbottom was torn between a desire to see his set working properly and fear that his vital energy had been sapped, never to return. He plucked up courage and cautiously touched the sensors. They all worked, and his confidence returned.

"Will it work all right when I get it home?"

"Provided your wife hasn't just shampooed the carpet, Mr. Rockbottom."

There's a Hole in my Bucket

The next nightmare came in with the complaint that it was making a noise but precious little else. On test it almost came on, with a sizzle and then a bonk, a sizzle and then bonk again, repeatedly. A meter check showed that the h.t. was building up to about 80V and then collapsing.

My diagnosis was a faulty zener diode on the power board, and proved that my ability to get things wrong every time was still holding. When the power board was removed from the centre section (complete with main electrolytics) my eagle eye spotted what anyone else would have spotted before taking it out: it was damp, as though it had been sprayed.

It had been sprayed, and there was a hole in the centre of the reservoir electrolytic to show who had sprayed it. Normally a hole in the reservoir is enough to set the local populace panicking for the hills. Anyway, changing the electrolytic was no trouble, but getting rid of the electrolyte was another matter.

Lifting the components from the print and cleaning around them took no great effort, but PL17 (multi-way plug) proved more difficult: the nylon spacer had to be lifted and carefully cleaned, as did the socket, since these two items, situated where they are, took the full brunt of the attack.

When all was done the power unit was refitted and functioned well. The same could not be said of the sync however, since the picture rolled and pulled on every change of scene. This had not been reported, but couldn't have been caused by the leaky reservoir since replacement of the TBA920Q (IC401) was necessary to restore order.

The Hatchet Man

The next one to come along seemed straightforward enough at first. The tube had simply lost emission, and flared all over the place as soon as the brightness was advanced to anything like a viewing level. The tube base voltages were all correct, with about 20V on the grids, 120V on the cathodes and 400V on the first anodes.

Since the owner (Bert) was well known to us, we thought we would try reactivating the tube before taking it out. Much to our surprise however the reactivator showed that all three guns were fully up to normal emitting standard without applying boost to the heaters.

"How long has it been like this Bert?" we asked.

"Soon after I hit the glass with an axe."

"Why did you hit it with an axe Bert? Was the programme that bad?"

Bert explained that he'd been playing cowboys and indians with his kids, and had been about to dismember one of them when the head flew off the axe and hit the front of the TV, actually at the bottom right side of the tube, slicing a chunk of glass off. Just what this had done to the tube's vacuum or the shadowmask I'm not quite sure, but most of the electrons leaving the cathodes didn't seem to be reaching the screen.

This posed something of a problem, since the tube now had no exchange value and couldn't be rebuilt. We had a tube in stock however, and it didn't take long to fit.

"There we are Bert. Cover it up next time you play indians."

The next day Bert was back. The screen had gone dark during the evening, and couldn't be brightened. So we checked the tube base voltages, but couldn't fault them because the picture was quite bright and remained so. We left it on test for a few hours and still it couldn't be faulted.

Bert took it home. Bert brought it back. This time the picture was dark and remained so. The cathode voltages were o.k., as were the first anode voltages, but the grids showed a negative voltage instead of the 20V or so positive that they had previously. The negative voltage was due to faulty beam limiter action as a result of R701 (180k Ω – see Fig. 1, page 443, June issue) increasing in value to some 5MΩ or so.

I've a feeling Bert thought we should have attended to this before changing the tube, even though we explained to him that he could previously turn up the brightness but it produced only flaring on a dull picture whereas when the resistor had gone high you couldn't turn the brightness up at all. Oh well.

Return of Mr. Charge

We'd not seen Mr. Charge for some time, so when he turned up the other afternoon we had quite a chat. I wasn't so pleased to see what he had with him though. It was his daughter's GEC. Funny how you can go off people ever so quickly. We didn't let is show however, and as it turned out it wasn't so bad.

"She let her nibbo tip a cup of something in the back. We let it dry out, but clouds of white smoke come out of it when you turn it on."

This turned out to be something of an exaggeration, but there was a wisp of smoke from the right side. After a tussle we removed the right side line output panel, and found signs of burning around the interconnecting plug and the socket on the front edge. Once again we had to lift the nylon spacer and carefully clean the panel. Cut away the affected bit of the panel and nylon and it seemed ready for use again.

While we had the panel out it seemed prudent to check for shorts. We found one from the emitter of the line output transistor to chassis, so without hesitation we clipped one end of the 47V zener diode D51 which is in series with the BU108. D51 didn't read short-circuit of course, and the original short was still present. After a little swearing it proved to be the 24V rectifier D601 (BYX70) that was responsible.

Upon reassembly everything seemed to work all right and I thought Mr. Charge would be on his way again.

"I'll put this one in the boot" he said, "and get the other one out of the back of the car."

"What other one?" I asked. It was late and I felt a bit jaded.

"Our own main set. I think the tube's at fault – it goes out of focus about every ten minutes or so."

Not another GEC, please not another one!

It turned out to be a Thorn 3500, so at least it would be a change. Switching on revealed that the grey scale was a mile out, with practically no blue. This proved to be nothing more than slight leakage through the first anode switch, and we soon had a normal picture except for some slight misconvergence. It was while I was attending to this that the focus went out and quickly reverted again. All I really saw was the screen becoming a blur, then before I could say cut off my tools and call me Mabel it was back again.

"There you are" said Mr. Charge, "what more do you want?"

I grinned back weakly at his grinning face.

So I changed the tripler and it did it again five minutes later. I changed the focus unit and it did it four minutes after. I left meters connected all over the place, and all I saw was a slight flick of the first anode voltages when the fault next tried to occur but didn't. Why didn't it? Because the meters were doing something.

So I changed R790 (1·2MΩ, in series with the first anode controls, on the earthy side) on the convergence panel, for no better reason than the flick on the meters, backed by the thought that perhaps the leakage through the blue gun switch hadn't been continuous – because if it had been continuous the present fault (R790 going intermittently open-circuit) couldn't have had the effect it did since the leak would have taken the place of R790. Be that as it may, the variation was no longer present. We had a similar problem with a 3000 not so long since (it's R727 on the 3000 chassis), didn't we . . .?

Book Review

Television Principles and Practice, by J. S. Zarach and Noel M. Morris, published by The Macmillan Press Ltd., at £12·50 (hardback), £5·95 (paperback).

There is no doubt that a handy reference book to which you can turn when in doubt about something or when you need to refresh your mind on some perhaps obscure aspect of a subject is a great help. Books that provide a reasonably thorough reference source on domestic TV receiver techniques are none too common, though there have been several good ones over the years. One of the first was Cocking's famed *Television Receiving Equipment*, which ran for some twenty years starting in 1940. There is sadly little it can tell us nowadays, so much has the subject changed over the years. Wharton and Howorth's *Principles of Television Reception* came along to fill the need very usefully in 1967. Geoffrey Hutson's books have been helpful indeed, and now as the latest in the line comes *Television Principles and Practice* by J. S. Zarach and Noel M. Morris (published late last year).

The price is a bit daunting, at £12·50 for some 300 pages (hardback edition), but the production is excellent, with colour diagrams to illustrate convergence and a large number of clearly drawn circuits. We hope it says something for the soundness of the book when we say that we only wish there was more of it – there are lots of TV byways we'd have liked the authors to have thrown light upon. The fact is however that you could write almost endlessly if you tried to take in everything. A line has to be drawn somewhere, and by and large the authors' judgement about what to include and what to leave out would be very hard to fault.

The book can be commended to readers of this magazine since it deals with practical circuitry throughout, as found in everyday commercial sets, and provides useful notes on servicing matters.

How up to date is it? Well, it doesn't cover the very latest generation of TV i.c.s, and has nothing to say on combined line output stage/power supply arrangements. We can perhaps afford to wait for something on this in a later edition. The present one takes in valve techniques as used in the final generation of hybrid receivers, discrete transistor circuitry, and the "TBA" generation of i.c.s. On the tube side, it takes us up to the PIL tube but not the 20 and 30AX. In fact it covers the sorts of sets and circuits most of us will be handling for the time being, and does so with precision and clarity.

We can recommend the book as a reference source and as an introduction for those new to TV techniques. In view of the price however you might consider it best to examine a copy before making up your mind.

J.A.R.

Servicing the Beovision 3400 Series

Part 2

Eugene Trundle

IN Part 1 we looked at the signal and power supply sections of the chassis. Now on to the timebases.

The Field Timebase

The field timebase circuit (see Fig. 2) is on No. 2 panel, below the c.r.t. neck. Sync pulses from the TAA790 sync/line oscillator i.c. pass through an integrator/clipper circuit to the gate of SCS1 (BRY39), which is a conventional sawtooth oscillator. The sawtooth generated across 2C64 is amplified by 2TR4 which drives 2TR5 and by emitter-follower action feeds a sawtooth waveform into the base of 2TR3. This stage functions as a Miller integrator, converting the field sawtooth into a parabolic waveform at its collector – primarily for EW correction in the line deflection stage, but also potted down by the vertical linearity control 2R42 and mixed with the sawtooth input to 2TR4 for linearity correction. A second integrator (2R53 and 2C27) further modifies the parabola, reinjecting it into the base of 2TR4 via 2R45 for field scan correction. Feedback from the output stage is applied to the base and emitter of 2TR4, to the base of 2TR3 via 2R130 and to the base of 2TR5 via 2R49 and 2R57.

The carefully-shaped waveform thus produced passes via the inverting amplifier 2TR5 to the driver stage 2TR6. The output stage itself is a conventional complementary pair, consisting of 2TR9 as one half and the Darlington pair 2TR7/0TR1 as the other. 2D5 and 2D6 provide the offset voltage and determine the no signal current in the output stage. The supply voltage for the output stage comes from the 32V line via 2D8.

Flyback Action

So far so good, but what are 2TR8 and all those diodes for? To achieve a fast flyback at the end of the forward field scan, it's necessary to connect the "hot" end of the scan coils to a higher potential than 32V. This is achieved by 2TR8, the flyback switch, which is turned on by 2TR6 during the flyback, connecting the output stage to the 54V line. 2D8 is then reversed biased, isolating the 32V line. 2TR8 and 2D8 can thus be likened to a two-way switch, with 2TR9's collector alternately connected to 32V (scan period, 2D8 on) or 54V (flyback, 2TR8 on and 2D8 off).

Finally, 2D9. This acts as a bypass round the output stage during flyback. As we've seen, when the flyback commences, the hot end of the field scan coils suddenly rises to 54V. This appears on the negative plate of 2C38. During the forward scan period, this capacitor acquires a charge via 2D8 and 2R65 from the 32V line. The two voltages add, so that the positive plate of 2C38 rises to 54V. This brings 2D9 into conduction, diverting the stored scan coil energy from the output transistors.

To tie up the loose ends, the 54V line is derived from the I+74V supply via 2R55 and the shunt stabilizer transistor 2TR10. 2D11 clips off the flyback pulse to obtain a sawtooth for feedback and NS correction and, via the invertor 2TR11, corner convergence and EW correction.

Field Faults

We've had no trouble to date with the SCS oscillator, and only one case of a leaky and low-capacitance coupler 2C25, resulting in greatly reduced vertical scan with poor linearity. 2TR4 and the integrator 2TR3 are often suspected but seldom guilty, because when (as is usually the case) the fault is farther downstream in the timebase the distorted or absent feedback signals upset the waveforms and d.c. voltages hereabouts. If the 2TR3/4 section is in trouble, the transistors and high-value resistors are the most likely suspects.

Unfortunately, all eight transistors in the field timebase are d.c. coupled and very interdependent. This can result at worst in wholesale destruction and at best in difficult fault diagnosis.

Before continuing with the field timebase, we must emphasize that a check on the K+32V line is essential, since for correct operation it's important that this voltage is just right.

2TR5 is quite reliable, but 2TR6, 7 and 8 can be vulnerable to some faults in the output stage and should be checked if one or both of 2TR9/0TR1 are replaced. If 2D5

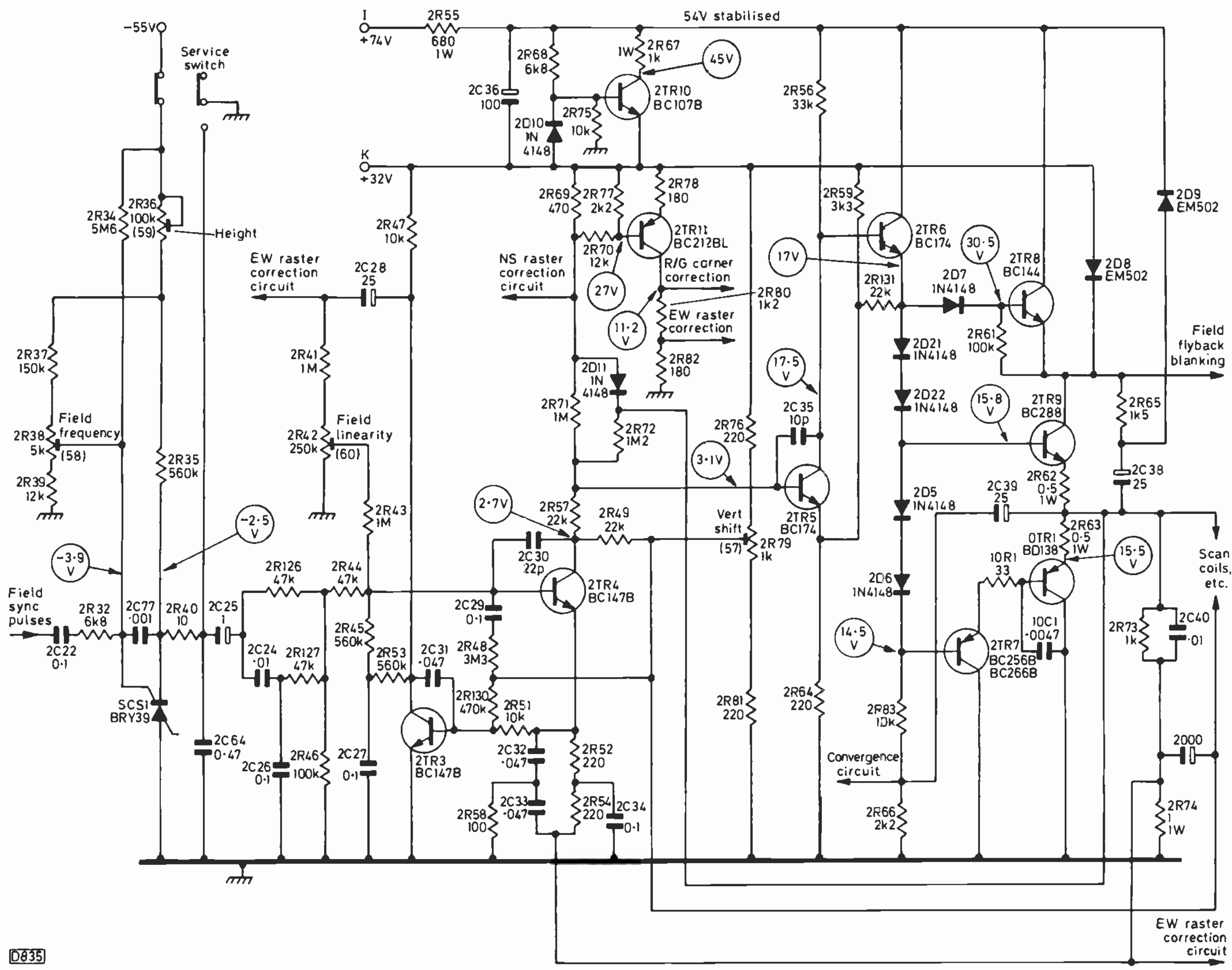


Fig. 2: The field timebase circuit used in the Beovision 3400 chassis.

and or 2D6 go leaky or short-circuit, crossover distortion occurs with a cramping of the scanning lines halfway down the scan, giving the impression of a brighter horizontal line through the middle of the picture.

Most of the problems in the field timebase centre around 0TR1 and 2TR9. A common symptom is field collapse, with 2R62 and 2R63 overheating. This will be due to these two transistors having gone leaky or short-circuit. It's important to replace them with the correct types, BD138 and BC288, making sure that 0TR1's collector is isolated from chassis, and also checking their close neighbours 2TR6, 7 and 8 for any ill-effects.

If height or linearity problems occur, a very rough rule of thumb is that the two transistors below the mid-point – 2TR7 and 0TR1 – handle the second half of the scan (bottom of the picture) while the two above are more likely to be responsible for faults in the upper half of the picture. The mid-point voltage should be just half the 32V supply line voltage, and this is a good guide to the health of the timebase.

Failure of the flyback switch 2TR8 will affect the top of the picture, the symptoms varying from severe top foldover to imposition of teletext on the picture. Faults here usually upset the voltage on the 54V line, but make sure the I+74V supply is present and correct before getting too involved with 2TR8!

Repeated failure of the output pair may be due to a gremlin in 2TR7, a faulty 2D9, or excessive voltage on the K+32V rail. On one memorable occasion, sudden and unpredictable failure of 0TR1 and 2TR9 was traced to intermittent leakage in the polystyrene anti-parasitic capacitor 10C1.

Spitz und Sparken

There are a lot of volts in the 3400 chassis, and now that we're moving on to the high-power stages a word of warning, based on bitter finger-sizzling, cuss-shouting experience, is appropriate. We've already mentioned the shock hazards on the front chassis. The main chassis bristles with them. There's a very prominent 10W resistor alongside the 12HG7 on the left of the c.r.t. neck, with a cool 290V on its end. Blown fuses mean no discharge path for reservoir capacitors: when you switch off and get hold of the fuse to replace it, you'll probably emerge from the set in a mighty hurry. The e.h.t. generator cannot muster quite the 7mA of the 3200 series, but should be treated with as much caution – like most valve receivers, there's no discharge path for the e.h.t. voltage held in the capacitance of the c.r.t. glass, and the charge is retained long after the set has been switched off. The unusual colour coding of the conductors in the mains lead can often mean that the chassis is live to earth or the aerial socket – check it with a neon or meter before starting work.

NEXT MONTH: THE LINE TIMEBASE

Video Notebook

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

I had a chance recently to play with one of the first Grundig V2000 series VCRs to be sent to the UK. It's a nicely styled machine, with front loading and solenoid operation, using a microprocessor based control system for the tuning, deck control and timer functions. The extended clock facilities enable the start and stop times, the day and the channel to be programmed in four times. On trial, it worked well one Saturday evening, faithfully gathering *Mork and Mindy, Wonder Woman, All Creatures Great and Small,* plus *J.R.* for the wife, while I went stock car racing.

The tape counter is mechanical, which is a bit of a let down, but it's supported by a programme find facility. This operates in the fast forward and rewind modes, while the tape is still threaded. You can select stop, which initiates unthreading, and then fast forward or rewind to get rapid operation in these modes. Alternatively you can go from play to fast forward or rewind, in which case the tape remains threaded, giving a partial still frame picture when halted. Coupled with this is an auto stop function when the machine senses the start of a recording. This provides good access to recordings on tape when searching. In addition, the counter can be used to stop at 0000, and can be utilised to mark a particular point on the tape.

The replayed pictures weren't too bad. My only criticism is that the chroma noise is rather high – noticable in mid-grey areas where there's no colour. I suppose you can expect some sacrifice in the signal-to-noise performance however considering the longer playing time on what is in effect $\frac{1}{4}$in. tape (as a result of the turn-over cassette system).

Having had some fun with the outside, I was allowed to probe inside – or as my friend at Grundig said, "It's o.k. providing we don't get it back in a Tesco carrier bag . . ." The head assembly is covered by a screening plate which was a bit stiff to remove – but tight is best. I watched the recorder thread and unthread, and thought that the motion looked familiar. Not many domestic VCRs thread anti-clockwise, and have head assemblies as part of the entry and exit guides – only the Sony Betamax system before. Having made this comment, I'll wait to see whether Grundig have adopted the Sony Betamax tape path. It looks like it.

AV at Work Show

I recently attended the *AV at Work* show at the Wembley Conference Centre. The main exhibits were visual aids equipment – projectors and suchlike – but there was some video equipment, and very interesting it was.

A couple of exhibitors had on display new Panasonic "industrial" machines, i.e. the recorders had no tuners. The NV8200 record/play version had stereo audio inputs, each with Dolby, and push-button controls. There was also a replay only version. The NV8200 can be used with an NV9500 U-Matic editing machine via an editing interface and the Panasonic edit control unit. Two NV8200s can be used together with two interfaces and the edit controller to form a VHS editing suite. It's costly however. The quoted price for the NV8200 is £750 per machine, the edit interfaces were quoted as £230 each while the controller was a staggering £950 – all prices plus VAT. What's more, only assemble edits can be carried out, and the small print points out that chroma patterning will occur at the edit point. I think a much lower cost control unit could be designed as an assembly editor – the £950 control unit is orientated to the U-Matic system. Deliveries start about now.

One videotape manufacturer's stand had a number of VCRs to demonstrate their tape. These machines included a Philips VR2020 (V2000 system) – these machines are only just beginning to arrive in the UK. The VR2020 exhibited the same amount of chroma noise as the Grundig machine, so there's perhaps room for improvement here – it was promised that the new system would provide the same quality of reproduction as the N1700 system.

There were quite a few projection systems of various sizes. These are always difficult to set up and maintain at optimum performance under exhibition conditions. The Grundig Cinema 9000 gave very good pictures however. It could also be used with their new plug-in teletext adaptor and remote control system. The performance of the adaptor is excellent – the text is clear and stable, helped no doubt by Grundig's video drive i.c. in their 26in. TV set and projection system. The price of the adaptor is expected to be about £150 plus VAT.

The Sharp 9300 VCR was also on display. It's a very cheap machine to buy and offers a multiplicity of control functions and timer facilities – in fact it was very popular at the show. Sharp are also producing some video cameras. One is a high-performance colour camera using three Saticon pickup tubes, the other a small single-tube portable camera for use with VHS machines – I was impressed by the picture quality this produced.

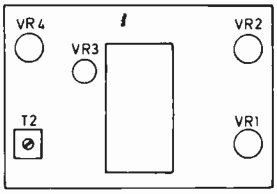
JVC's CCTV systems were demonstrated in a studio set-up, with mixing desks and high-performance cameras, the recordings being made on the U-Matic standard. Most of this equipment is beyond the domestic video price range.

A good show, half way between the *Home Video Show* and *Tradex.*

VHS Modulator Adjustment

In the April issue I mentioned Beeching's rule when adjusting the modulator in VHS machines. This produced some mumbles and moans, to the effect of what a load of rubbish – not least amongst some of my own (supposed) friends. Well o.k., if you want it the hard though more accurate way, read on – especially those engineers in certain rental companies, who are disconnecting the VCRs' a.f.c. circuit on the tuning side in order to get rid of the buzz. This is a bit like putting the cart before the horse: it detunes the teletext signal, and the video.

As I originally pointed out, the problem of crackle is due to teletext breakthrough, and in the worst cases buzz from peak whites. In the record monitoring mode, the detected signal contains teletext. Because of the record bandwidth, this signal is not replayed. There's some signal peaking on the way to the modulator however, and as a result of this the level of the teletext signal is increased. As a result, the video carrier is over modulated. This causes inter-modulation of the audio carrier, to such an extent that



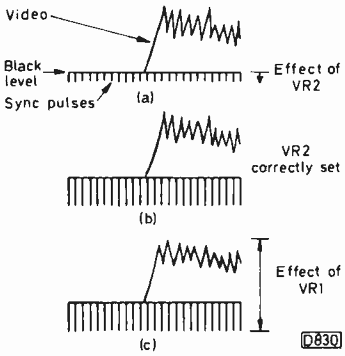


Fig. 1 (left): Layout of the preset controls in the u.h.f. modulator used in JVC VHS VCRs. VR1 sets the video modulation level, VR2 the black level, VR3 the audio deviation, VR4 the audio carrier level and T2 the audio carrier frequency.

Fig. 2 (right): Correct adjustment of VR2.

the f.m. limiting within the receiver may be unable to cope with it.

Thanks to JVC I now have the modulator circuit. Adjustment is as follows. You need a TV set – preferably a video receiver/monitor. Connect an oscilloscope to display the detected video signal, detuning the set slightly if there's too much 6MHz carrier on the video. Prepare the VHS machine in the record mode, with the modulator exposed – Fig. 1 shows the presets. Tune the TV set to the recorder in order to monitor its output.

Turn VR1 (video modulation level) very carefully anticlockwise. This will reduce the video signal amplitude. Reduce it by only a very small amount. Next turn VR2 (modulation black level) anticlockwise. You will see the syncs squash into the black level. Reverse this preset, stopping at the point where the sync pulses are in correct proportion to the video (ratio 7:3), or when the syncs have stopped increasing with respect to the video and the whole signal starts to increase. This is the correct setting for VR2 (see Fig. 2). Now increase the signal with VR1 to obtain a contrast level comparable to off-air reception, or slightly less if intermodulation is still present. Finally, adjustment of the audio carrier frequency (T2) and level (VR4) may be required on the individual TV set. Having got rid of any buzzes and crackles, the audio deviation (VR3) may be adjusted if the level is low.

The theory of this is that VR1 sets the video modulation level and VR2 sets the modulation centrally on the carrier so that neither the syncs nor the peak whites over modulate it.

Poor Replay, Akai VS9500

The trouble with an Akai VHS machine (VS9500 – basically the JVC HR3330) was very noisy pictures on replay. First I tried replaying one of my own entertaining test tapes. The replay video signal was of low level and covered with low-frequency noise which smeared the picture – or what there was of it. There was no colour.

A quick check on the replay f.m. carrier output from the preamplifier confirmed that the level here was correct and that the heads were thus o.k. – I say confirmed since there were no signs of head failure (white spots, with black edges over a colour picture). The f.m. signal was next followed through the luminance board. The output from the first limiter and drop-out compensator IC4 (AN316) was fine – about 0·5V p-p at TP7. So this stage was o.k. The next stage is a double limiter and high-pass filter (IC7 and IC8). The output from this is mixed with a direct signal from TP7 in IC9, appearing at TP10 at a level of 1·2V p-p. Again everything was working well.

The following stage (IC10) is a limiter and precision delay-line demodulator. The output at TP11 looks on a scope as if it's still an f.m. carrier. In fact it's the demodulated signal shrouded in residual carrier (which is filtered out in a later stage). The output at TP11 was decidedly suspect however, and it was one of those cases where replacing the i.c. was a simpler course of action than speculating on the possible cause of the trouble. The difficulty was that whereas the normal output at TP11 is video shrouded in residual carrier, what we had was video shrouded in noise, and it would be confusing to try to determine which was which. The clue was that the output level in the fault condition was low. Anyway, replacing the i.c. (SN76670N) cured the fault.

No Picture

A JVC HR3660 VCR came from one of my regular clients with the fault "no picture, sound low". When the machine was switched on and put into the "operate" mode a high-speed whizzing noise came from within – the video head drum was revolving at a spectacular rate. It seemed likely that the fault was due to one of the transistors in the motor drive department (see Fig. 3). The main power transistor X1 can be unplugged, and when this was done the drum still went round, though much slower. The easiest thing to do next was to remove and check the driver transistor X6, which turned out to be short-circuit between its base and collector. This meant bad news for the switching transistors X9 and X5, which had also died. Replacing these three transistors restored normal operation, and although the motor had been running via reverse conduction across the base-emitter junction of X7 this transistor had not suffered.

Substitute transistors can be used with care. A BC337 is all right for X6, while almost any switching transistors can be used in positions X9 and X5 – with the proviso that X5 must have high gain in order to saturate, its collector load being R60 (4·7kΩ), with a 100kΩ base bias resistor (R58).

The sound problem was sorted out quite quickly by increasing the modulator audio modulation level (VR3).

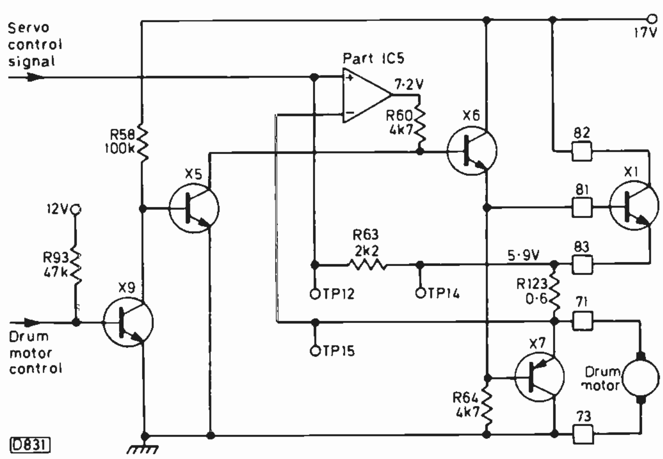


Fig. 3: Simplified circuit of the video head drum motor control amplifier used in JVC VCRs. If the drum motor runs slowly, the feedback action results in the driver transistor X6 conducting more heavily. As a result, the conduction of X1 increases, increasing the current supplied to the drive motor, while the current drawn by X7 in shunt with the motor decreases. X1 and X7 form a complementary-symmetry class B pair. The operation is not quite that of the usual audio type circuit however. The power transistor X1 is in series with the motor, controlling the current fed to the motor: X7, shunting the motor, provides active damping.

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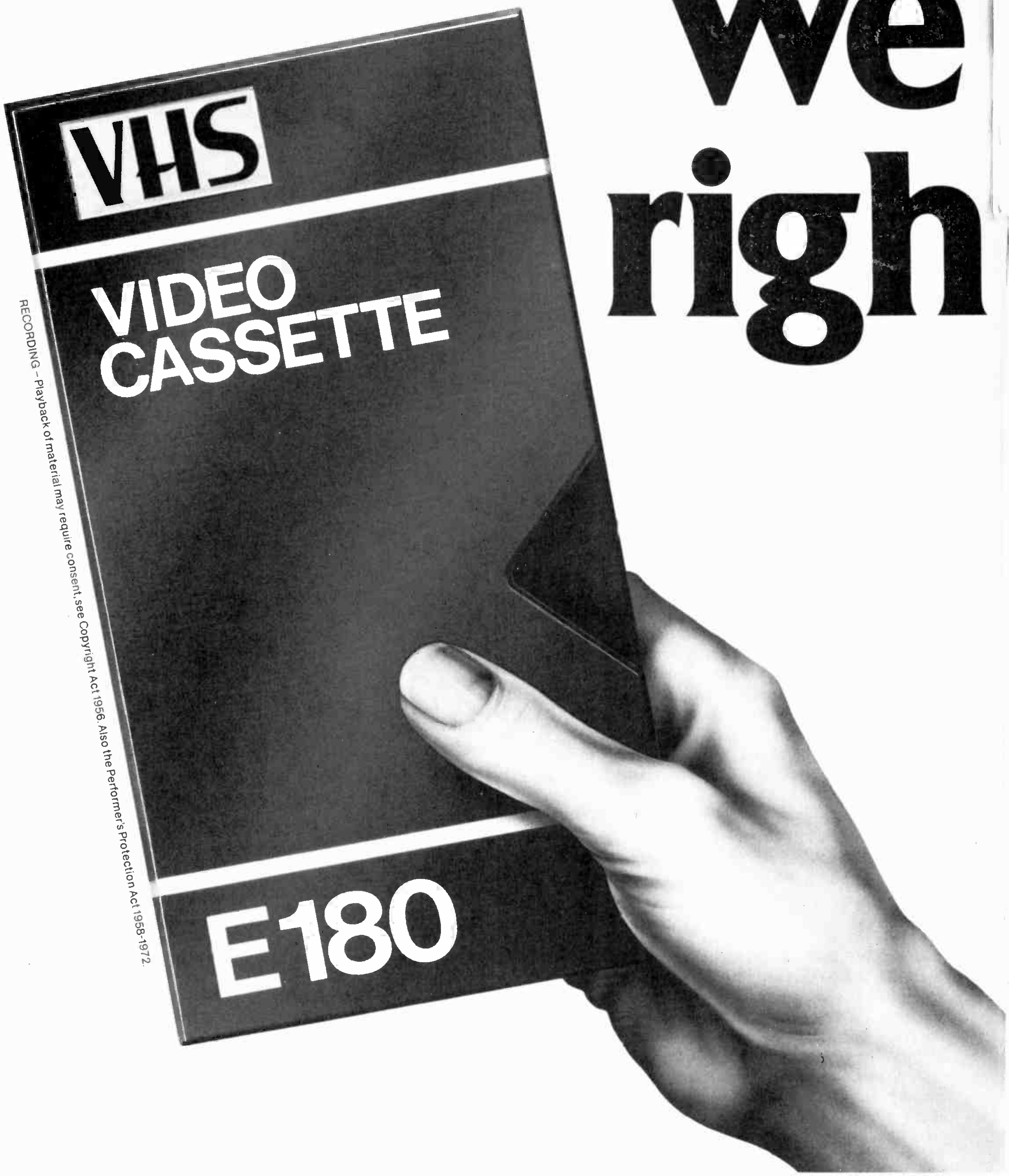


Advertisement produced co-operatively by: Akai, Ferguson,

Servicing Toshiba Colour Receivers

D. Snelling

THIS article deals with the earlier Toshiba colour sets marketed in the UK – Models C81B, C400B and C800B. We'll take them in that order.

MODEL C81B

This is an 18in. model fitted with a 90° tube, and is now about six years old. It proved to be a very reliable set, at least for the first few years. The circuitry employed is quite straightforward. A bridge rectifier feeds a conventional series regulator circuit which provides a 105V stabilised output. The fourth transistor (Q803) in this department provides current limiting. There's a transistor (2SC1172) line output stage with e.h.t. tripler, the only complication here being an e.h.t. regulator circuit. The decoder is of the PAL delay-line type, with RGB drive to the tube. I.C.s perform most of the major i.f. and decoder functions. Serviceability is poor unfortunately, due to difficulty in gaining access to many parts.

Layout

Looking at the chassis from the rear, the panel on the extreme left, mounted end-on, is the i.f./sound panel. This can be swung out for access to the print side after releasing the two clips nearest you. Facing you on the left is the decoder panel, which can also be swung out after releasing the three clips along its right-hand edge and removing the plug connecting the drive leads to the c.r.t. Mounted end-on behind this is the power supply panel. This will also hinge forwards, but to do this usually involves unsoldering several wires. The panel running along the base of the chassis is the sync and field and line oscillator section. To the right of this are two more panels. The larger one is the line output panel, containing the e.h.t., width and beam limiting circuits. The smaller one, above and in front of the line output transformer assembly, is the X-ray protection board.

The latter is simply an over-voltage protection circuit which monitors the h.t. line. If the h.t. voltage rises to an excessive level the circuit trips, removing the supply to the line oscillator and preamplifier stages.

The power transistors are mounted in all the inaccessible spots. The sound output transistor is behind the i.f. panel, the h.t. regulator is behind the power panel, the field output transistor is behind the line output panel (a particularly tricky one this), while the line output and e.h.t. regulator transistors are on the extreme right of the chassis.

The three fuses on the small panel in the centre are the two mains fuses (live and neutral) and the h.t. fuse.

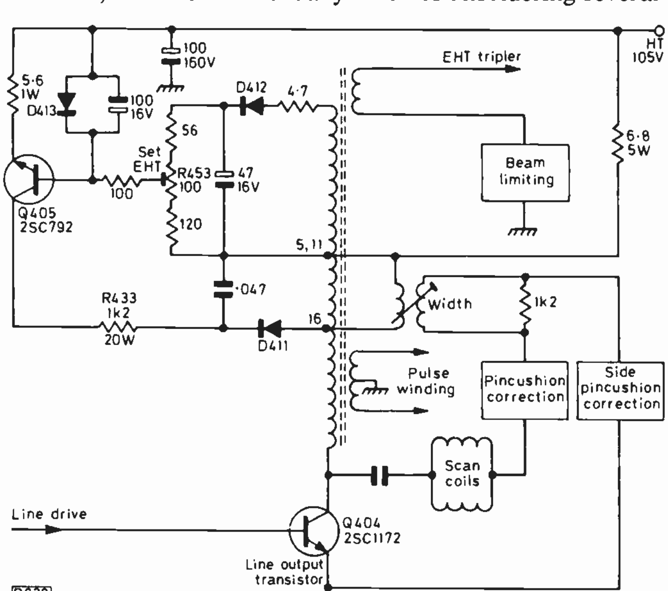


Fig. 1: Simplified circuit of the line output stage used in the Toshiba Model C81B, showing the unusual e.h.t. regulator system. The e.h.t. regulator transistor Q405 conducts during the line flyback, when D411 switches on. It then acts as a constant-current source: the bias voltage is produced by D412 and set by R453. When Q405 conducts, current flows via R433, D411 and winding 16/11,5 of the line output transformer, loading the transformer to provide the stabilising action.

Adjustments

Most of the adjustments are marked and will be found on the appropriate board. A word of caution regarding the height control: this is cunningly situated behind the fuse panel, and it's all too easy to get a shock.

The i.f. and decoder coils have cores with small square holes, and finding a suitable trimming tool is just about impossible. The best course is to file one of the soft plastic hexagonal ones to a square cross-section.

The c.r.t. first anode presets are on the tube base panel, while the pincushion correction controls are on the scan coil assembly (the slider top left and the hole top right).

The h.t. control R851 should be set for 105V at TP91 on the power panel. Set the e.h.t. for 27·5kV at zero beam current. This is done by adjusting the three jumper leads on the line output panel – the leads connect to the three flyback tuning capacitors C441/C442/C463. Should the e.h.t. regulator on the same panel require adjustment – following component replacement in this area – connect a meter on its 500V range to the collector of the regulator transistor Q405 and adjust R453 first for the maximum reading then for 5V less.

There's a service switch near the bottom of the decoder to give field collapse for setting up the first anode presets, while by removing one or both of the jumper leads on the right of this panel the red and blue guns can be switched off.

Faults

By far the most common faults on these sets as they get older are dry-joints on the decoder and i.f. panels, due to the type of print used. Close examination of these two boards will reveal several print runs on the component side, and the trouble is caused by the connections between these and the print side. These dry-joints can be very elusive, and are usually impossible to provoke. They are best dealt with by applying fresh solder to each joint on the components side, keeping the soldering iron in contact for several seconds, then repeating the process with the corresponding joints on the print side. If this doesn't seem to have cured your fault, repeat the procedure at least once before looking elsewhere. In ninety nine cases out of a hundred the following faults can be attributed to these connections: intermittent low gain, intermittent picture (a.g.c.), intermittent sound and intermittent buzz on sound (be careful with this one, as the problem can be cured by adjusting the quadrature coil L603 but will reappear within a few weeks) – check the i.f. panel for these faults; for intermittent colour, intermittent red or green or intermittent phasing of the bistable, check the connections on the decoder panel. The latter fault can also be caused by the ident diode D509 (1N60).

Other faults are few. If the sound goes and the output transistor Q603 proves to be faulty, check its feed resistor R693 (330Ω, 1W) as this usually goes as well. You'll find it mounted on a tagstrip to the right of the mains transformer.

A blown h.t. fuse F803 (1A) is normally due to failure of the line output transistor Q404 and/or the e.h.t. regulator transistor Q405 (2SC792).

If any of the three fuses goes and checks for short-circuit rectifiers or transistors prove negative, before going any farther remove the cover from the mains transformer. The cause of the problem will probably then be apparent – a burnt patch on the transformer. Considering its size and price (£25), it's surprisingly prone to failure.

Apart from the dry-joints previously mentioned, problems on the i.f. strip are usually limited to the intercarrier sound i.c. Q602 (TA7073AP). Decoder faults normally consist of loss of one of the primary colours, due to failure of the relevant transistor (Q505/6/7, type 2SC1168) or the demodulator/matrixing i.c. Q504 (TA7141P). Some of the PAL delay lines can be a bit fragile however, so avoid knocking them.

Apart from output stage transistor failure, the line and field timebases are trouble free. The only other problem we had here was a slight leak in C406 (3·3μF) in the flywheel line sync filter circuit – this caused loss of line lock on channel change, and was worse when the set had warmed up. Replacing it and resetting the hold control L404 cured the trouble. Note that the line driver transformer T402 also feeds rectifiers which provide 24V and 180V supplies.

Should it be necessary to change the tube, you'll find that the mounting nuts are not the usual 2BA ones but 10mm. They are also very tight. The correct spanner is essential here – pliers just won't do. You'll also require some double-sided adhesive tape, as the scan coil assembly is stuck to the tube with this.

The only other thing to note is that the aerial socket is a weak point on these sets. Remove the aerial plug with care, as replacement sockets from Toshiba are expensive (£10).

MODEL C400B

This 14in. portable model is a totally different design. The circuitry is again conventional however, with a series regulator providing a stabilised 107V h.t. line, a transistor (2SC1170B) line output stage and RGB tube drive. Greater use is made of i.c.s. The chassis is based on the mother/daughter board principle.

Access is gained by removing the five large back screws and the screws securing the aerial socket. Take care when removing the rear cover as part of the power supply is mounted on it, so the cover can be withdrawn only to the extent of the connecting wires. To remove the cover completely, disconnect the five connectors to the power supply inside the back cover. If you need to operate the set with the rear cover removed, rotate the cover through 90° and place it at the side of the set.

Looking at the chassis from the rear, all the daughter boards will be seen to be to the left of centre. From left to right these are: i.f., a.f.c., sound, chroma (burst gating, colour killer, reference oscillator and a.c.c.), chroma again (this time demodulator, matrix and ident), and in front of this the video output module. The large heatsink to the right of these is for the field timebase i.c. – both oscillator and output. The sound output transistor is mounted on a heatsink to the left of the sound module. The right of the chassis is taken up with the line oscillator and output stages. To gain access to the power panels in the back cover, remove the screw and two nuts that secure them.

All the main controls are again marked. There are no controls for e.h.t., line shift, field shift or pincushion correction. The e.h.t. should be correct when the power supply preset R851 has been set for 107V (measured at terminal 19 of power board 1). Note that the voltage at the collector of the line output transistor is 130V, due to the action of the boost circuit. This line is also used for the RGB output transistors.

The panels are rather cramped together, and working on them in situ is very difficult. Extension leads are available however (part numbers 23177998 and 23177997) to enable the set to be operated with one of the panels on the bench.

The main faults on this set are limited to failure of the power transistors and are easy to locate. Some of the panels use double-sided print like that in the C81B. The print on the video panel is beginnning to give rise to problems – intermittent red or green. The cure is as for the C81B, see earlier.

The aerial socket is again a weakness, and is particularly serious in this model since, being a portable, the aerial plug is likely to be removed and inserted regularly. When changing it, a high-wattage iron is necessary as the aerial lead is connected to the tuner with a phono plug which for some reason has its screen soldered to the tuner case. As this aerial socket comes mounted on a large plastic panel, it's even more expensive than that for the C81B.

MODEL C800B

This 18in., 110° model replaced the C81B. It's similar to the C400B in using a mother board with daughter boards, and in fact the following panels are interchangeable between the two sets: a.f.c., sound, chroma (both), i.f. and video. The differences between this model and the C400B are in the field timebase, which uses discrete transistor circuitry instead of the i.c., the line timebase (2SC1172B output transistor), and the use of touch tuning. Also the power supply panels are mounted on the main chassis and not fixed to the back cover.

Our comments on the C400B apply in general to this model also. One fault not common to the C400B is connected with the channel selector. The touch tuning system was designed before the era of one or two i.c.s for the job, and in consequence is rather complex, using 23 transistors and 20 diodes. To aid fault location in this area, here is a list of the transistors and their functions:

Lamp drives: QA09, QA10, QA11, QA12.

Switching: QA01, QA02, QA03, QA04, QA21, QA22, QA23, QA24.

Stabilised 15V supply: QB01, QB02.

A.F.C. defeat and sound mute: QA18, QA29, QB03, QB04.

A.F.C. and tuning voltage: QB05, QB06.

Faults in this area tend to be intermittent. The best approach is to work out in which area the fault lies, then change all the appropriate semiconductor devices.

We've had one or two cases of intermittent field collapse on this model due to dry-joints on the double-sided print of the mother board, by the field output transistors.

Finally, whilst the l.t. supply in the C81B is derived from the line driver transformer, in the C400B and C800B it's derived from the line output transformer. Also whilst a sinewave oscillator is used as the line generator in the C81B and C400B, in the C800B a multivibrator circuit is employed. No sound or raster in the C800B has been traced to capacitor trouble in the multivibrator circuit (C408, 0·0043μF).■

Test Report: Sinclair SC110 Portable Oscilloscope

Eugene Trundle

IT'S some time since we last reviewed an oscilloscope in these pages. Most people kitted themselves up with a new scope for colour work back in the prosperous days of 1968-73, so there's probably not been a great demand for scopes for servicing in recent times. Test equipment generally has a long life, and most of those scopes bought ten years or so ago will still be going strong. Another factor is that many sets are now modular in construction, while service engineers have got to know the short-cuts better. It's surprising in fact how much servicing work can be done without resort to the scope.

Many good scopes have been marketed over the years, and for a long time it's been the case that "you pay your money and take your choice", with the bandwidth/sensititivy per £ being similar between most of the makes and models available. Recently however I heard of a new and revolutionary scope, and felt I just had to borrow one and try it out.

The thing's called a "low-power portable oscilloscope", and when a big parcel arrived here I took it from the postman and at once concluded that Sinclair had forgotten to include the instrument in the box, it was that light. We've got the instruction manual and packing I thought, but in no way is there a 10MHz oscilloscope inside! It was though – smaller than many a transistor radio, and about the size of the wife's current handbag.

Basic Specification

The SC110 is in fact like no other scope I've ever seen. It's vital statistics are: 10MHz bandwidth, 10mV/division sensitivity, and 0·1μsec-0·5sec/division sweep times. This means that it can do what most full-size, bench-type scopes can do. All the controls and the viewing screen are grouped together on one face, and as it runs off internal dry batteries the only external lead is the probe. This enables it to be sat on (or in!) the receiver being serviced. The carrying handle doubles as a prop, setting the instrument at the right angle for observation.

Although the instrument is obviously designed with TV and related servicing in mind, it seems suitable for general applications. A 12-position gain switch with 1-2-5 sequence controls the Y amplifier, with push-button a.c.-d.c.-ground coupling and a Y shift control. The trigger department is surprisingly comprehensive, with an inbuilt sync separator for triggering from the TV line or field syncs, a.c. or d.c.-retained signals from the Y amplifier, or an external source. A variable trigger level control may be set for positive or negative triggering, and push-buttons are provided for selection of bright line or economy operation, the latter conserving battery power by turning off the beam in the absence of triggering signals.

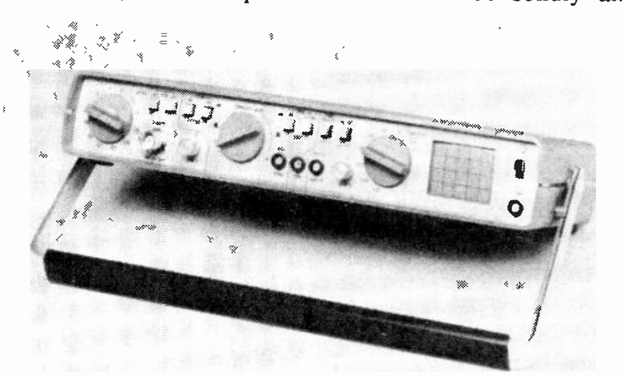
The timebase has another 12-position rotary switch in conjunction with a pair of push-buttons to select the wide range of sweep speeds provided. An external X facility is available on a front-panel mounted socket, with a fixed sensitivity of 500mV/div. X shift is by a front panel-mounted potentiometer, and a further socket provides a 1kHz squarewave for probe compensation adjustment. Not all large bench-type scopes provide this facility! Presets at the rear of the instrument provide control over intensity, focus etc. All the control buttons are multi-function, and with seldom used controls tucked away at the rear a well-laid out and easy to operate control panel has been achieved.

The c.r.t. is necessarily small. It gives a reasonably intense blue-white trace of good but not spectacular focus. There are five horizontal and four vertical divisions, each 6mm. I don't know what manner of heater it has, but it leaves television-type quick-heat tubes standing! The warm-up time is so short that it's imperceptible, and to all intents and purposes the display is instant at switch-on.

How did it Fare?

The SC110 is an instrument for field servicing – unless your workshop is phone-box size! For field applications I found that I could carry the scope in the tool box and hang it from my neck on site! Often there's room for it to sit inside the TV under repair, or on top of the cabinet at eye-level, where the small screen is no disadvantage as the eye subtends the same angle to the nearby screen as it would to a larger screen at a greater distance. All these fine words don't make the SC110's tube any bigger however, as a colleague pointed out to me!

I've always found that a good test for an oscilloscope is a chroma signal corresponding to the standard colour bars, with a switched white reference. The reference indicates any bandwidth or probe-compensation problems and, when it's switched out, the trigger circuit is sorely tested in trying to get a grip on such line-rate chroma components as it can. The SC110 fared reasonably well (and better than some!) on this test, and composite video could be solidly and



The Sinclair SC110 single-trace portable oscilloscope. The main controls are the Y sensitivity range switch (left), the trigger level (centre) and the timebase speed switch (right).

reliably locked at line, field or subcarrier rate by selection of the appropriate trigger mode and level.

Except at very high frequencies, the Y amplifier was capable of providing a full screen height display without clipping or distortion, and the calibration accuracy of the Y amplifier was found to be within $1\frac{1}{2}$% on the review model.

Many types of waveform were examined with the SC110, and bright locked traces were easily obtained. The instrument has been cunningly designed to economise on energy, by shutting down redundant sections of its internal circuitry. Thus battery consumption varies greatly with the type of waveform being displayed – from 350mW awaiting trigger in the economy mode, through 900mW on bright line, to 1·3W with everything going full bore to display a 10MHz sinewave three divisions high. When one considers that the heater in an ordinary monochrome TV tube dissipates 2W, that's not bad! To retain the full versatility of the instrument, I feel that the best power source is either disposable batteries or rechargeable ones. After a month's fairly hard use the original disposable batteries are still going strong.

A carrying case is available, but I feel that this would be less necessary if the three main knobs were a little more deeply recessed into the front of the case. All test gear for mobile and field use is vulnerable to accidental damage, and these knobs could get abraded or sheared off in the rough and tumble of life on the road. The controls and buttons are amenable to manipulation by all but the fattest fingers, and the small screen is unavoidable in such a compact scope.

Conclusion

Because of its nature and small screen size, this scope is really suitable only for field use. Electrically its performance is very good however, and it fills a yawning gap in the oscilloscope market. If you are updating or re-equipping the field service vehicle, the SC110 is worth serious consideration. Its price tag of £160 including VAT is certainly an attraction.

The SC110 is available from Sinclair distributors. The trade name Thandar is now being used for Sinclair's test equipment.

Apart from the carrying case, optional extras includ a.c. adaptors/chargers and ×1 and ×10 probes.■

Long-distance Television

Roger Bunney

DUE to the industrial disputes which have delayed publication of the magazine, the period under review is rather longer than usual and covers the best weeks of the year for Sporadic E reception – mid-May to mid-June. SpE certainly provided the most interesting reception during the period.

Though high-pressure systems prevailed during much of May, the hoped for increase in tropospheric propagation was not experienced here at Romsey. For those in more favourable locations however there were several lifts and signals propagated via tropospheric ducting. West German and French u.h.f. signals were received along the south and east coasts on the 9th and 10th of May, Hugh Cocks noting DFF (East Germany) ch. E6 via tropospheric ducting. Brian Fitch received many West German u.h.f. signals at Scarborough on these dates. Tropospheric reception continued to be above average over the 12–14th, peaking on the 17th with a good opening, widely reported, in both Band III and at u.h.f. Further good tropospheric signals were received on the 19th and 21st, the BFBS (British Forces Broadcasting Service) in West Germany being received at Lowestoft on the 21st (chs. 23 and 48). Gareth Price noted their PM5544 test pattern at 1430, which suggests that the signal is transmitted all night. He also logged ch. E30 Sweden (Goeteborg) in the late hours of the 18th. Lowestoft seems to be a good location for such reception, with a sea path in the best directions. A comparison of the logs sent in by Gareth and Cyril Willis (near Cambridge) shows a remarkable similarity on the above dates, though strangely both missed a second reception of BFBS that was seen by Brian Fitch at 0715 on the 21st (ch. 60).

The only F2 activity has been Gary Smith's report of a smeary ch. E2 signal received from the SSE on the 13th.

The bulk of reports have been of SpE reception of course. Reception here at Romsey came from several directions: RTVE (Spain)/RTP (Portugal)/RAI (Italy) to the south, SR (Sweden)/NRK (Norway) to the north and TSS (USSR) to the east. There were no really exotic signals unfortunately. Worth mentioning however were very short-skip signals from Denmark (chs. E3 and 4) on the 23rd and June 1st and, also on the latter date, very strong DFF signals on chs. E3 and 4 during the evening. On the same day Hugh Cocks phoned to say that he was receiving a suspected Dubai ch. E2 signal at his East Sussex location – apparently Charlie's Angels, with a five minute break consisting of arabic speech.

The first SpE opening of the season came on May 4th, with Spanish TV on all Band I channels. The 7th produced four hours of RTVE and Scandinavian signals at good strengths. For most enthusiasts, the first big opening occurred on the 10th, with a varied selection of signals from YLE (Finland), NRK, RAI, RTVE, ORF (Austria), JRT (Yugoslavia), Switzerland and most of the Eastern Block countries. Graham Barker (Leeds) received many signals in colour during this opening, using a 22in. Körting v.h.f./u.h.f. receiver (see later). There was evidence of SpE propagation on most days following May 10th, though the first week of June was very quiet, here at least. There's not space to list all the openings up to the time of writing (June 11th), but several items of general interest are worth mentioning.

Hugh Cocks logged Jordan ch. E3 on May 18th via double-hop SpE, at good strength. May 28th produced very unusual short-skip SpE, with RTE-1 Gort (Eire) received in Herts, Sussex and East Kent during the 1545–1600 period. Chris Wilson (Potters Bar) probably received the shortest skip signals, but as an interesting sidelight in two locations SpE back-scatter was experienced from the ch. E3 Liege transmitter in Belgium. Nicholas Brown (Rugby) suggests that care must be taken with programme identification during the afternoon period – he's noted regional variations with RTVE during the 1300–1400 time slot. Several DXers have noted more frequent and varied RTP identifications – Graham Barker observed "RTP 1 Borrosa" and Reg Roper (Torpoint) "RTP Porto". Reg also excelled on June 3rd with the "Izana" identification from the Canary Islands on ch. E3 at 1220 – well done! TVR (Rumania) has been received twice during the past six weeks – on May 11th it was seen on both chs. R2 and 3. It's three years since I received TVR here at Romsey.

Finally two unusual signals. Hugh Cocks reported a "fuzzy" signal from the NE on May 18th, during the mid-morning period. He measured the frequency, which was 46·75MHz, the programme being a news one. This was during an SpE opening. Any comments? The other signal was received here on June 5th at 0840 – a 405-line BBC colour bar pattern on ch. 36! I thought that something funny was going on within the receiver system, but the signal remained when all the amplifiers were switched off. A different set (a Ferguson 12in. portable) was then tried and the signal was still present. The signal switched off abruptly at about 0845. This is interesting indeed, especially as the signal was switched off rather than fading out. Suggestions would be welcome! As a postscript, Brian Fitch mentions that the "TV REKLAM" caption often seen on the R channels comes from MTV (Hungary).

Australian Conditions

Anthony Mann, writing from Perth, Western Australia, reports that F2 conditions there are better than at the same time last year. There have been several good openings, with signals from E. Australia and New Zealand. Perhaps the most notable reception was of the 1kW ch. A0 NEN9 Tamworth relay on May 8th, with 46·260MHz offset. This is a distance of some 2,000 miles. Signals over north/south paths have been lacking, though nightly TE openings continue farther north (Darwin).

News Items

United States: The FCC has decided to permit broadcasting of visual information (weather, news, sport) during the early hours when TV is otherwise off the air, but the audio channel is to consist of background music – or nothing at all. The new service for the "graveyard hours" is to be confined to "normal dark or off-air hours, defined as the period between sign-off and sign-on". Advertising will be allowed.

Australia: Ethnic TV on ch. A0 in Sydney and Melbourne is to start in October this year, at 10kW e.r.p., for a period of two years. The parallel u.h.f. service, using higher powers, will continue indefinitely. The government is considering a 12GHz satellite TV service to cover the remote parts of the continent.

Japan: Terrestrial 12GHz fill-in transmitters are now in operation in the Tokyo area – very small shadow areas can be filled in with these transmissions by siting the transmitters atop tall buildings etc. The transmitters provided translated signals from the local v.h.f service, at 300mW/channel, and have a seven-channel capability. The receivers use a 40cm. dish, with down conversion, feeding a u.h.f./a.m. signal directly to the aerial input of a standard set. The cost of such receiving installations is understood to be well under £100, so they could well form the basis of inexpensive experimental satellite receivers for use elsewhere. We are checking up on this!

TV programmes in Japan are now being regularly transmitted with stereo sound. At least 23 stations are offering this, and 800,000 receiver/adaptors are understood to have been bought up to the end of last year. The second channel uses f.m.-f.m., with the subcarrier at the second harmonic of the line frequency and 10kHz deviation.

Portugal: PAL colour transmissions started on March 7th.

Poland: Additional ch. R4 and 5 transmitters have been brought into operation following further improvements at the Warsaw TV centre.

India: Bindu Padaki (Madras) reports that Russian satellite transmissions at 870-920MHz have been seen. Further information is awaited! He also mentions that the Sri Lanka transmitter network is being extended – with PAL colour.

Commercial Corner

Hugh Cocks (see advertisement in the classified section) can supply various items for DX-TV reception, including a tuneable u.h.f. preamplifier for set-side use – this is intended for use by DXers who live near a high-power transmitter and need to be able to reduce adjacent channel interference. Send s.a.e. for list.

Graham Barker (22 Low Gipton Crescent, Gipton Estate, Leeds LS8 3LL), who works in the TV supply trade, can supply various colour TV sets with v.h.f./u.h.f. tuners. These he says are "ideal for TV-DXing". They include various W. European models, and are understood to be in good working order. For stock details send s.a.e. or phone 0532 653006.

I've just revised and expanded my TV-DX book, which is now published by Bernards (BP52). The new edition is due for publication in the autumn.

From our Correspondents . . .

Delayed publication means that I've a record number of letters from DXers. Unfortunately only a few can be mentioned. John May has been using a Panasonic Model TR5030G (see review later) and comments that it's given him good DX reception, with system B sound and vision and, perhaps to make me envious, TVR ch. R2! On the Whitsun holiday weekend he took the set to the Dover East Cliffs where he resolved Belgian and Dutch u.h.f. signals and Budapest ch. R1 (using the receiver's own whip aerial!).

R. Kamat (46 Vulcan Road, Leicester) is interested in DX but isn't too happy about the technicalities of adapting TV sets for the purpose. He'd like to hear from any experienced enthusiast living nearby.

Chris Wilson has been experimenting with a Philips N1500 VCR. He's modified it to accept the i.f. output from his DX equipment on record, providing a normal u.h.f. output on playback. Another modification is to switch off the main drive motor, leaving the heads rotating to give a still frame effect. He says that fast-fading SpE signals confuse the machine from the sync point of view, though weak tropospheric signals lock very well. Another finding is that colour recordings made using a restricted bandwidth give satisfactory playback.

M. Bryska (Blouberg, South Africa) is considering starting satellite TV reception. He says that when he lived in Stanley, Tasmania in 1956 he received perfect TV signals from Melbourne and watched the Olympic Games. This hit the newspaper front pages at the time!

A Correction

Pierre Godou (Rennes, France) has pointed out that the photo we showed in the May 1980 column, suggesting that it was China ch. X received in Finland, is in fact an identification slide used by Izana, Canary Islands, on ch. E3. It was received during an F2 opening. We apologise for this error.

Teletext Interference

In last month's column I mentioned the problem of interference in Band I from teletext-equipped Philips/Pye colour receivers. The solution apparently is to fit ferrite beads on the red, green and blue leads to pins 2, 3 and 5 of plug/socket 66A – at the teletext decoder end. This plug/socket links the teletext decoder and RGB interface panels in these sets. Three 10 × 5mm. beads are required (Mullard type FX4005).

The Panasonic TR5030G Dual-Standard TV Set

Most established DXers use elderly UK dual-standard TV sets, modifying them for long-distance TV reception, i.e. for 625-line reception in Bands I and III etc. The advantage of this is that the narrow 405-line i.f. bandwidth can be used. It's clear from enquiries that many newcomers are interested in long-distance TV reception but are unwilling to undertake this sort of thing. In such cases we usually recommend obtaining an up-converter, so that incoming long-distance v.h.f. signals can be converted to u.h.f. and fed into a standard TV receiver. This is a simple and effective solution. During the past couple of years however an alternative possibility has come on the market. Various Japanese setmakers have introduced in the UK small-screen sets with both v.h.f. and u.h.f. coverage and in addition switchable intercarrier sound, thus providing reception of both System B/G (5·5MHz sound/vision spacing) and System I (6MHz sound/vision spacing) signals. This type of set is obviously an attractive proposition for the "non-technical" enthusiast – as well as for those intending to travel in Western Europe. I decided to obtain (on loan) one of these sets in order to see how it performed from the DX-TV point of view. The set was a Panasonic Model TR5030G, with 5in. screen. It's only fair to say at the outset that the receiver was not designed for DXing, i.e. for weak signal reception under extreme conditions. There is also the problem of i.f. selectivity when such a set is used for DX reception in Band I.

Operation of the set is simplicity itself, and from first switch on no adjustments were necessary. It might be useful to check the a.g.c. preset however, optimising its working range in accordance with local transmitter strengths. The quality of the displayed picture is good, all the test card frequency gratings being resolved. I was particularly impressed with the sound quality, considering the small speaker. The u.h.f. gain compared favourably with the receivers I use for DXing. At v.h.f. the gain seemed better in Band I than Band III – though the local v.h.f. transmitters at some 25 miles distance could be easily resolved using just the receiver's own non-extended whip aerial.

The selectivity at u.h.f. compares favourably with other current production receivers. In South Hampshire we can receive an acceptable, entertainment-quality picture from London ITV on ch. 23, using an XG21W aerial. This presents a severe selectivity test, since the local Rowridge transmitter operates on ch. 24 at 500kW e.r.p. Over several weeks' use however the gain and selectivity of the set at u.h.f. proved to be very acceptable.

Fortunately the 1980 SpE season started while I had the set for evaluation. This enabled me to assess the Band I performance with strong adjacent channel signals present. With CCIR System B signals the selectivity was again good, even with signals simultaneously present on adjacent channels. For the normal intended use therefore the receiver performs well. The tuning readout is a bit cramped, but the controls are easy to use.

For DX use, the main concern is i.f. selectivity. Problems were not surprisingly encountered when receiving a weak u.h.f. signal on a channel adjacent to a strong local signal. "Spread" of strong local signals, particularly to the h.f. side of the local channel, caused difficulty. Most of the time signals just above the noise level are available here on chs. 43 and 46, while Hannington in N. Hampshire produces local signals on chs. 42 and 45. The set was unable to resolve just above noise level signals in the presence of adjacent local signals, but when the distant signals rose above their normal level it was possible to lock them.

In Band I the most difficult problem was caused by the local BBC 405-line signal. This produced a severe interference spread. SpE reception in Band I was something of a problem due to the multiplicity of channels in the E2-4 spectrum – for example ch. E2 vision is at 48·25MHz while ch. R1 vision is at 49·75MHz. Inevitably there was some overlapping when such signals were present simultaneously, since the i.f. system is a wideband one. The result is floating signals. For example, if Sweden is being received on ch. E2 and a Russian ch. R1 signal appears, the stronger signal will lock while the other will float with it. The signal that locks will vary as the signal levels change. Clearly a problem!

The spread of the local BBC 405-line signal is an annoying but constant source of interferrence to weaker DX signals. Fortunately a single or double notch filter can be used to remove the local signal – even a simple home-made version can provide a 30dB notch, with a loss of around 2dB at 500kHz from the notch centre. The problem of closely spaced channels, for example the E2/R1 situation, is more difficult to deal with. One solution is to use a tunable notch filter – I've been experimenting with a simple varicap tuned type with a v.h.f. toroid, and will provide more information on this shortly.

Apart from the selectivity limitation outlined above, the receiver performed well for DX purposes. There was the added bonus of being able to hear the sound with system B signals! One aspect that impressed me was the stability and excellent sync locking. Even with fast-fading SpE signals, firm hold was retained. The sync with low-level signals was similarly impressive.

In conclusion then the TR5030G represents good value for normal domestic use. For the enthusiast looking for a DX receiver and unwilling to modify an old dual-standard set, the TR5030G will give good service provided the limitations I've outlined are understood. For this application we are of course putting the set to a far more demanding use that that envisaged by its designers.

My thanks to National Panasonic (UK) Ltd. for their help.

TV Servicing: Beginners Start Here . . .

Part 35

S. Simon

ONE of the most common thyristor regulated TV power supplies is that found in the Thorn 8000-8800 series of chassis. It has some features that are quite different from the thyristor power supplies we've covered in the past few issues however, so it's worth taking a look at it and the problems it presents for the serviceperson . . .

The 8000 first appeared almost ten years ago, in sets fitted with a 17in. c.r.t. It was in fact originally designed as a small-screen partner for the 3000-3500 chassis we've previously described. The original 8000 was slightly modified to become the 8000A, with changes to the power supply (and the sound output stage), and it's important to appreciate that the power supply units fitted in these two versions of the chassis are not interchangeable. Look for the letter A on the number plate at the upper left of the chassis and on the rear cover.

The chassis was further modified for use with larger tubes, becoming the 8500. This can be identified by the thick-film focus unit on the right-hand side and the absence of the vertical power resistor on the left – apart from the more obvious fact of the larger (19in.) tube. The power resistor changed its appearance and moved to a horizontal position on the inside, above the main electrolytic capacitors. Further development resulted in the 8800 chassis, which is capable of driving a 22in. tube.

One of the first points of interest about these chassis is that a single transistor is used in the audio output stage, that it's operated from the h.t. line, and that it's mounted on the power supply panel – at one end, with a winged heatsink. It's numbered VT701, and at the other end of the panel the 25V series regulator transistor VT702 is mounted in a similar manner.

Another point of interest about these chassis is the combined i.f./decoder panel, which can be swung out and can be removed with ease. Initially designed for the 8000, it served with minor alteration throughout the series and overlapped into the subsequent 9000 chassis with its Syclops combined power supply/line output stage.

Also of note are the different focusing arrangements that were used. Earlier models have a control similar to the three first anode presets. These are all mounted on the tube's base panel, the first anode controls in a vertical row on the left-hand side and the focus control on its own at the top right. The reason for using this arrangement is that the type of tube fitted requires a focus voltage of roughly half that at the first anodes. The tubes used in later versions of the chassis need a focus voltage of some 4·5kV, and the control then takes the form of a square plastic housing, with a protruding control knob, mounted on the right-hand side of the chassis.

Practical Servicing

Let's look first at the power supply circuit used in the original 8000 chassis (see Fig. 1). There are in fact two regulated supplies, 25V which is provided by the series regulator transistor VT702 and 180V which comes from the thyristor W703 – there's also an unregulated 45V supply which goes to the field timebase.

The neutral side of the mains goes to chassis via the on/off switch, whilst the live side is taken via the switch to a thermal cut out (the first weak link) and then to the 2A anti-surge fuse F802. The supply then goes four ways, to the 12Ω surge limiting section (R721) of the power resistor, to the mains transformer T702, to the degaussing circuit, and to the mains filter components R803/C801. With the 8000A chassis the mains filter consists of a single 0·22μF capacitor, and later two 0·1μF capacitors in parallel. These with the fuses and some other components (degaussing etc.) are mounted on a small panel which is separate from the main power supply panel.

As is usual in sets that are a few years old, the mains filter capacitor(s) are the prime cause of a blown mains fuse – both in the set (F802) and in the supply plug if this fuse is rated at 5A.

Little need be said about the components used in the degaussing circuit. They are all standard items.

The mains transformer feeds the full-wave l.t. rectifier circuit (W801/2), a secondary winding supplying the 6·3V required by the c.r.t. heaters. The diodes produce 47V across their reservoir capacitor C715, the output being taken via the l.t. fuse F801. The mains transformer should not be confused with the mains input choke which, in the 8000A/8500/8800 chassis, replaces R721. In these chassis the mains transformer is moved more to the centre, with the choke on the lower left side.

Most of the faults to which this power supply is prone are of the run of the mill type, involving the power resistor or the thyristor for example, but even with such simple faults there are differences that have to be taken into account between these various chassis.

The Power Resistor ("Dropper")

The power resistor in the original 8000 chassis was mounted on the extreme left-hand side, and the two bottom sections were the surge limiter R721 (12Ω). This supplied a.c. to the thyristor, generally via a BY127 diode which is necessary if the thyristor is of the BRC4443 type since this doesn't have such a high reverse voltage rating as the BT types used later. It's this 12Ω section that will most often be found open-circuit. While there need be no contributory cause for its failure, i.e. it might simply have aged, it's nevertheless essential to check the thyristor and the h.t. line generally for short-circuits. Although the cut out should be the first thing to operate in the event of an overload, in fact it can be R721 that reacts first, objecting to the last straw on its back.

The upper section of the dropper in the 8000 chassis is the h.t. smoothing resistor R709 (47Ω). If it goes open-circuit the h.t. reservoir capacitor C706 will be left fully charged and eager to discharge. Do this through a resistor before handling the tags.

The 8000A's dropper is in the same position, but since R721 is replaced by a choke it consists of R709 plus R727 and R729. The latter are separate wirewound resistors on the 8000's power board. Replacement power resistors usually have a 12Ω, a 47Ω, a 56Ω and a 1kΩ section. They can be used in the 8000 simply by leaving the 56Ω and 1kΩ sections unused. For use in the 8000A chassis the 12Ω section is left unused.

The power resistor in the 8500 and 8800 chassis consists of 50Ω (R709), 40Ω (R727) and 1·5kΩ (R729) sections. It's situated inboard of the chassis frame, above the main electrolytics. The position of the power supply board is also changed, from the centre section to the left-hand side, above the mains choke, with the mains input and degaussing panel just above.

The removal of R727 and R729 gives the power supply panel a neater and cooler appearance – these resistors are a bit of a problem on the 8000, the heat from them causing deterioration of the panel leading to intermittent connections, dry-joints and just plain open-circuits. Incorporating them into the separate power resistor removed these problems, rendering the chassis immediately more reliable. So the 8000 is far more prone to breakdown than the 8000A, whilst the 8500 and 8800 are quite reliable chassis, at least from the power pack point of view.

When servicing these sets then, it's most important to bear in mind these differences between the chassis.

Dead Set

Right, now to approach the dead set symptom. As usual, we first establish that the mains is being applied to the receiver and that it's reaching the transformer simply by observing the tube heaters. If there's no heater glow, check the mains input at the red button trip, the 2A (later 3·15A) mains fuse and at the on/off switch – in order of convenience. The on/off switch itself is suspect in these sets. If the supply is intact at both sides of the switch but is not present at the fuse, almost certainly the thermal trip is at fault.

If it's open-circuit, press it in and note the reaction. If there's a slight delay and a noise before it cuts out again, check for shorts and proceed on the assumption that the cut out is doing its job. If it won't hold in at all, fit a replacement.

If one side of the fuse is live but not the other, check its condition. If there's no sign of heavy discolouration, fit another (3·15A anti-surge) and check for possible fault conditions. If the fuse is blackened or metallised, check the mains filter capacitor(s) which will normally be of the 600V d.c. type, coloured blue-white. Also check the thyristor. This is unlikely to be at fault if there's a BY127 diode in series with it, but likely to be defective if the diode is not present. The main reservoir capacitor C706 is also not above suspicion. If a short is found here, R721 (8000 chassis) will also probably be open-circuit. In the 8000 chassis, it's far more likely that the fuse will be found intact and that R721 will be found open-circuit (tube heaters alight but no h.t.).

The plot thickens when a.c. is present at all these points and up to the anode of the thyristor. You will recall that a thyristor fires only when a trigger pulse is applied to its gate and its anode is positive with respect to its cathode, and that it then continues to conduct until its anode voltage falls below its cathode voltage. It then switches off until another trigger pulse comes along. The trigger pulse is produced by the circuitry around transistors VT704/5/6. The first point to note is that this circuitry can't operate until the 25V supply has appeared. Thus no l.t. supply means no h.t. either. So we next have to prove that the l.t. fuse F801 (800mA) is intact, and that the l.t. regulator is functioning – before delving into the trigger pulse circuitry.

The LT Supply

The l.t. rectifiers W801/2 produce about 47V across their reservoir capacitor C715. This is smoothed by R728/C714 and fed to the field timebase, and is also fed to the series regulator transistor VT702. The latter has about 35V at its collector, and produces a stabilised 25V supply at its emitter. The circuitry here is quite conventional. C705 and R732 couple any 100Hz ripple at the output to the base of the control transistor VT703 to provide electronic smoothing. The circuit is fairly trouble free, apart from C705 which tends to dry up, introducing 100Hz ripple at the output.

HT Regulation

Once the 25V supply has been established, the trigger pulse generator circuit can get on with its job of producing pulses to trigger the thyristor. The circuitry here is rather different from that we've encountered in previous thyristor regulated h.t. supply circuits. To start with there's no diac or silicon controlled switch. Instead, VT704/5 provide the switching action. When they switch on, the pulse produced across R718 is fed via R714 and C709 to the gate of the thyristor. The other important difference is in the charging arrangement.

The charging capacitor which triggers the switch is C712. It's charged from the 25V d.c. line instead of from the mains a.c. supply as in the examples we've looked at previously. Also the control transistor VT706 is in series with the charging capacitor instead of in parallel with it. You'll see that C712 charges via R723, VT706 and R722, so VT706 controls the charging of C712. VT706's base is returned to the 180V rail via the potential divider network R724/5/6, so that its conduction is in turn determined by the h.t. voltage. R725 is adjusted for the correct h.t. supply of 180V.

When the voltage developed across C712 rises above the voltage, set by R716/7, at the base of VT704, this transistor switches on. VT705 in turn switches on, and the trigger pulse is produced. VT704 switches on when the voltage at its emitter, i.e. across C712, reaches 8V. In this circuit we also have to open the switch and reset the charge on C712. This is done by linking the junction of C712 and VT704's emitter to the junction of diodes W705/6. These switch on during the negative-going excursion of the mains waveform, and in consequence VT704 switches off and the charge on C712 falls to just below chassis potential – to approximately –0·7V (the voltage across W706 when it's switched on).

If this lot is functioning, we should have about 180V on the h.t. line. As far as the thyristor is concerned, the usual remarks apply. Slight leakage in this device tends to try to defeat the action of the control circuit, and the result is a fluttery picture, rapidly varying in size. Initially this may look like rapid field jitter, casting suspicion on the field timebase. If the thyristor has to be replaced, don't omit to refit the ferrite beads on its legs. Failure to do this can result in radiation, which may appear as a vertical white line on the screen.

The Audio Output Stage

Earlier on we mentioned the presence of the audio output

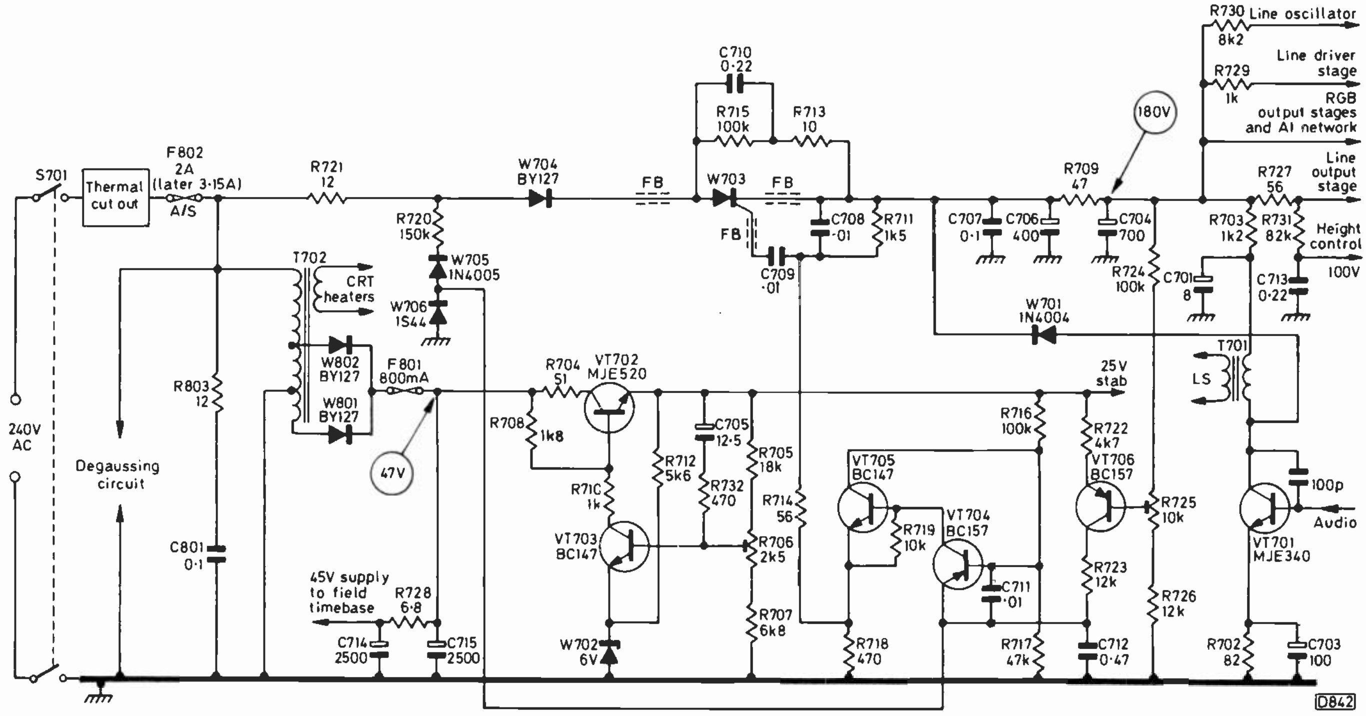


Fig. 1: Power supply circuit used in the Thorn 8000 chassis. The same basic circuit is used in the later 8000A, 8500 and 8800 chassis. Important modifications to note with these are the replacement of R721 by a choke and the different power resistor ("dropper") arrangements used – see text. There were resistor value changes in the audio output circuit, and the mains filter components vary from chassis to chassis. W704 is not always fitted but is worth including to protect the thyristor. Later production versions of the 8000A, 8500 and 8800 include an overvoltage circuit.

transistor on the power panel. This device has a fairly high voltage rating but is nevertheless prone to breakdown, as is diode W701. This latter item is included to protect the transistor in the event of the voltage at its collector rising above the h.t. voltage. How could it rise to such a level?

Note the presence of the audio output transformer T701. This matches the high-impedance output stage to the low-impedance loudspeaker. If the speaker is disconnected or open-circuit, there's no damping across the transformer's windings. Large audio signal swings could produce high back-e.m.f. voltages across the transformer's primary winding due to undamped ringing, and these "spikes" could easily spell the end of the transistor.

In the event of a no sound fault therefore, first check the continuity of the loudspeaker's speech coil, with the clips off, then check VT701 and W701. Some types of replacement transistors may have their base-emitter legs reversed, in which case they will fit on the reverse side of the heatsink. Note a couple of modifications to this circuit to provide increased reliability: R703 increased to 1·8kΩ and R702 to 100Ω.

If W701 goes short-circuit, VT701 will follow suit, C703 will go in the blink of an eye and the whole set will be shut down by operation of the thermal trip, a blown fuse or the demise of R721. Thus trouble in this department may give the same symptom as a short-circuit reservoir capacitor rather than simply no sound. If you find a short-circuit between the h.t. line and chassis, unhook one end of W701 to check whether the short-circuit is in this neck of the woods. We stress this point because it's unusual in solid-state sets to find an h.t. short-circuit originating in the audio output stage, which is normally run from an l.t. line.

Line Output Stage Supply

Another handy tip on the 8000/8000A chassis is that the h.t. supply to the line output stage goes via a small choke (L406). It's convenient to disconnect this if the line output transistor is suspected of being short-circuit – a very common occurrence in the 8000 chassis if the original BU105/02 type of transistor is fitted. This fault can occur on its own or with help.

The EHT Rectifier

One item that's often willing to lend a hand in hastening the demise of the line output transistor is the e.h.t. rectifier – a stick unit in these chassis instead of a tripler. This plugs into the overwinding on the line output transformer, so it's a simple matter to clear it of suspicion. There's no point in fitting a new line output transistor only to see it ruined immediately. If in doubt, disconnect the e.h.t. plug from the line output transformer and ensure that the line output stage is then running normally. Then switch off, fit the plug, switch on and be prepared to switch off if there's no sign of e.h.t. or if some distress is indicated. A safer method is to employ a heavy wirewound resistor of some 200 Ω or more. Connect it in series with the h.t. supply to the line output stage, to limit the current flow in the event of a fault still being present. If the timebase then functions and is willing to produce some degree of e.h.t., remove the 200 Ω resistor.

Overvoltage Trip

Later versions of the 8000A, 8500 and 8800 chassis incorporate an overvoltage trip circuit (power supply panel PC846, with subpanel PC837 attached to it). This uses a crowbar thyristor and has two modes of operation. In the event of the regulator thyristor going short-circuit, the crowbar thyristor fires and opens the thermal cut out. In the event of excessive h.t. for any other reason, the crowbar thyristor produces a trip action by discharging C712. This panel can be used in the 8000A, 8500 and 8800 chassis but not in the original 8000 chassis.

Improved Omnidirectional DX Aerial

Roger Bunney

THE first time I presented a design for an omnidirectional Band I DX aerial in these pages was back in July 1969. The array was centred on ch. E3 (55MHz), and used crossed dipoles which were phased and matched together to give a 75Ω output. The system was very successful, and was adopted by many enthusiasts – indeed some employ it as their only outdoor array. Its advantage is the pickup through 360°, with coverage of the main Band I DX channels. Another use to which it has been put by some enthusiasts is as a search array.

Despite the wideband coverage, the performance is restricted above and below the 55MHz centre frequency, the fall off being increased by the quarter-wave cable sections used for phasing and matching. These sections must be cut to 55MHz as well, and in consequence there will be some mismatching at the ends of the bandwidth.

The improved version described this time is in fact the Mk. III version. The Mark II version has also been described previously in these pages. It used a variation of the Antiference Trumatch system to increase the bandwidth (note that this is a registered patent design of Antiference's).

Adding a Reflector

The Mark III version has a reflector system spaced at 0·3 wavelength beneath the crossed dipoles. The idea was originally described by J. M. Osborne in an article in *Wireless World*. The system reduces pick-up from beneath the dipoles, and at the optimum frequency spacing – around the 0·3 wavelength figure – will give a polar response of the standard bent sausage variety (see Fig. 1). At frequencies equivalent to a lower spacing the polar response will tend to be more circular, while above 0·3 wavelength the response will be of a more pronounced sausage type.

Ferrite Coupler

In designing the Mark III version thought was also given to the possibility of avoiding the frequency/bandwidth restriction introduced by the cable harness. Instead of the harness, a Labgear CM6011/OS wideband ferrite aerial combiner/splitter has been used to combine the two separate dipole/reflector systems in phase while maintaining good matching at 75Ω over the bandwidth. The CM6011/OS is ideally suited to this application, providing relatively good isolation between the inputs with low loss.

Aerial Design

The dipole/reflector systems consist basically of two separate arrays mounted at 90° along the same axis (see Fig. 2). A 6ft. mast was used for the prototype. This, being of one inch outside diameter, matched the normal Band I hardware. The booms are also 1in.

One obviously has to select a specific frequency for the 0·3 wavelength spacing. I selected 58MHz, biasing the arrangement towards the upper part of Band I. The sausage lobe response was required for several reasons, mainly to reduce local interference levels. Traffic (ignition) interference is also markedly reduced.

The 6ft. mast used in the prototype will provide 0·3 wavelength spacing from about 55MHz upwards, and from my own experience with 58MHz spacing I've found that the performance is adequate down to ch. E2 (48·25MHz vision).

Construction

Construction is simple, the only point requiring attention is accurate drilling to get an exact 90° angle between the two systems. True to tradition, my own efforts produced angles other than this, though the few degrees of inaccuracy could fortunately be corrected by using a small circular file and gentle pressure. I do recommend completing the drilling with the aerial clamped in a large vice. Once the drilling has been completed, the elements can be cut to size and fitted in

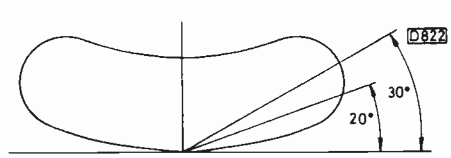


Fig. 1: Polar response of the omnidirectional array at a spacing of 0·3 wavelength between the dipoles and the reflector assembly.

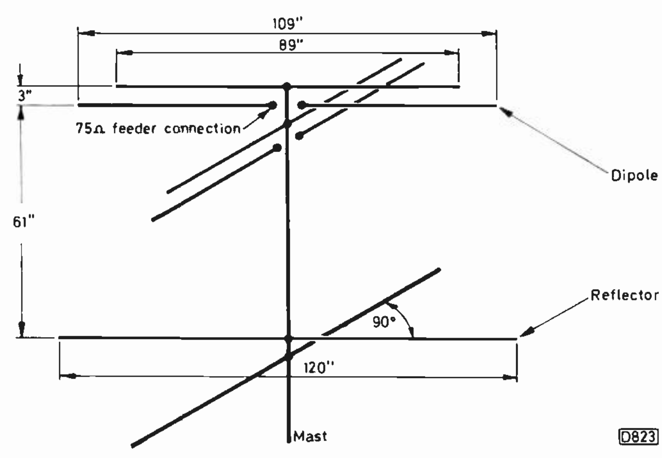


Fig. 2: Exploded view. The two arrays have the same dimensions and are mounted at 90° to each other – the dimensions given are for a wideband (48-68MHz) version.

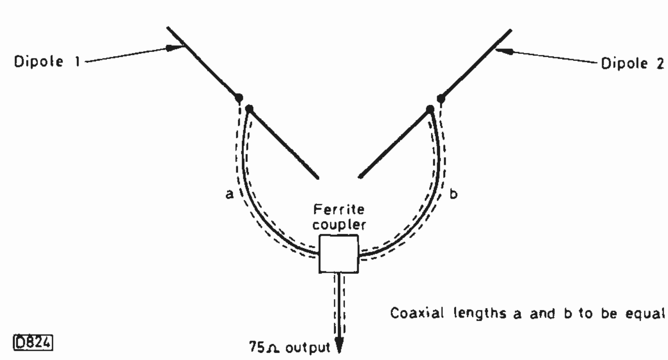


Fig. 3: Using a ferrite coupler to combine the outputs from the two dipole assemblies.

their respective positions. Fit equal lengths of low-loss coaxial cable to each dipole, terminating these at the ferrite combiner. Take the output from the combiner to the preamplifier or receiver via low-loss cable. See Fig. 3.

Directional Response

Directional selectivity can be obtained by using separate coaxial feeders between the two dipoles and the receiving installation, selecting either dipole by means of a switch to give bi-directional coverage. A simple aerial selector switch can be bought or a standard radio slide switch (two pole, two way) can be used. Such switching is useful during SpE openings, but during the winter months when there's little SpE activity it's best to operate with the omnidirectional response. If care is taken with the run of the cables to the receiver, it should be possible to use the Labgear/Antiference wideband combiner, thus giving omnidirectional coverage for MS reception when signals can appear from any direction. For this application the feeder cables must be of similar lengths and terminated with coaxial plugs, connecting these either to the aerial switch (with flying coaxial sockets attached to the switch) or in the same way to the combiner.

Erecting the Aerial

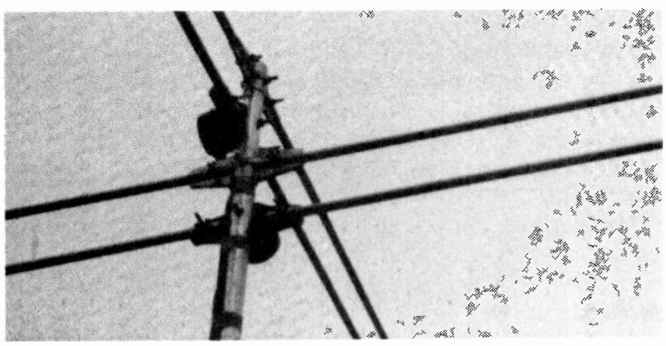
The array can be clamped to another mast, for example one fitted to the side of the house or a chimney. If a mast longer than 6ft. is used, this can form the mounting to the bracket/lashing. It's best to mount the system as high as possible – aim for a height of 30ft. or more to give the lobes a reasonable chance of clearing all local obstructions and likely sources of interference.

I use 3ft. feeders from each dipole, with the combiner mounted some 3ft. down from the dipoles. A vertical mast extender gave my array a more professional look when it was fitted to the 2in. extender, as the accompanying photo shows. In my own installation, some 7ft. of 2in. mast is held firm by the wall brackets.

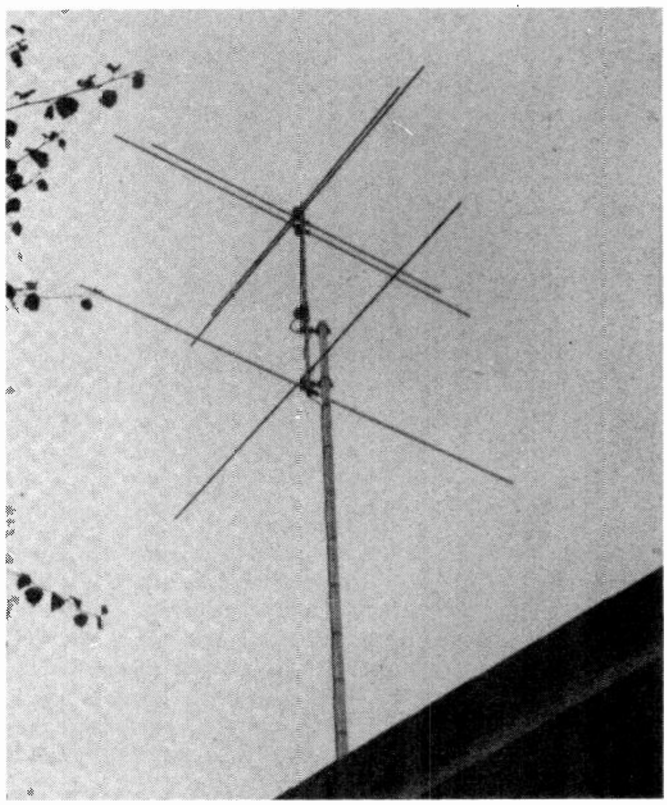
Performance

Testing a new DX aerial is a rather subjective process. On the first night of its use (at reduced height) there was over an hour of strong Sporadic E reception! An improvement that was quickly noticed was reduced interference from sources beneath the array, also that NOS (Holland) ch. E4 could on most days be resolved via tropospheric flutter enhancement.

During the period when the aerial was being tested, Sporadic E and MS signals were well received, and Dutch tropospheric signals on ch. E4 could be resolved – these are the only real tropospheric signals that are available on a daily basis here (apart from BBC Band I signals of course). F2/TE signals are not well received on such an array if it's mounted at a low height. The early evening TE signals from the south are particularly height conscious. It's obvious that these signals only just make it to the UK, so the higher the aerial the better. During the opening on October 10th last year, with an MH311 aerial at 55ft., a ch. E2 narrow-band aerial at 51ft., and the Mark III at 35ft., the strongest signal was obtained on the MH311, a lower strength signal being obtained from the two-element narrow-band aerial and virtually nothing from the Mk. III. So keep the aerial high!



Wideband dipole mounting details. Note that the cable entry to the insulator should be from underneath.



General view of the Mk. III prototype.

The omnidirectional Mk. III array is a simple yet effective aerial for serious TV-DX reception, and is particularly useful as a standby search system. Those unable to erect a large, rotational system for one reason or another will find it the ideal solution to their problem.

Availability

The dipole system used is a much modified version of the Antiference Trumatch system. I'm grateful to Antiference for providing information on their system back in the early 70s. Since then, we've carried out considerable experimentation on aerials for DX use. The final result of this is the aerial presented in this article: an efficient, relatively simple design giving wideband coverage of Band I. One problem the constructor may encounter is where to get components? As a general rule the large aerial manufacturers won't supply constructors with components, but an alternative source may be a local aerial rigger – they often have to dismantle redundant Band I installations. South West Aerial Systems (10 Old Boundary Road, Shaftesbury, N. Dorset SP7 8ND), with which the author is associated, can supply the above and other aerials for Band I DX use. A leaflet describing the six aerials in the range is available from the above address (please include s.a.e. with enquiries).■

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a 75p postal order (made out to IPC Magazines Ltd.), the query coupon from page 563 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

RANK A774 CHASSIS

The picture is very grainy when the set is switched on. If the aerial is disconnected and then plugged in again, the picture will sometimes either return to normal or go very dark. In the latter event, reducing the contrast control setting will produce a nearly normal picture. The two transistors in the a.g.c. circuit have been replaced, and the voltages around them are normal, but when the picture is grainy and the meter is connected to the base of the a.g.c. amplifier transistor 3VT2 a normal picture is obtained.

The fault is usually caused by either of the two a.g.c. transistors. We've had some mystifying faults in this area however. These have usually been cured by replacing 3D3 (1N4148) which is in series with 3VT3. Other culprits have been the a.g.c. gain control 3RV2 and the controlled i.f. transistor 2VT1 (inside can B).

PHILIPS G8 CHASSIS

The problem with this set is picture jitter – mainly on the right-hand side. It occurs after the set has been on for about two hours, and is accompanied by a black line streaking from right to left. Sometimes the set will work correctly all evening however. I've tried the usual cures for jitter – replacing the thyristor and the trigger diac, and have adjusted the h.t. as specified in the manual.

We suggest you check by substitution the two 7·5V zener diodes and the two BC147 transistors in the power supply. The 4EX581 trigger diode which Rank recommend as a replacement for the diac in their thyristor regulated power supply (A823 chassis) does well in the G8 in place of the BR100, and may cure your problem. If this change is tried, increase the value of R1382 to 47Ω.

BUSH CTV25

On a balanced picture everything is normal, but when a strip of words or captions appears there's a horizontal band of shaded colour in line with it – particularly if the words are bright or white. A band of shading will also follow every movement of a person with a shiny forehead. PL802 luminance output valves don't seem to last long. One lasted for about a year, then the brightness went high. The same thing happened about nine months after fitting a replacement, only this time the flyback blanking transistor in its cathode circuit also had to be replaced. The only things I can find wrong are the voltages around the luminance emitter-follower transistor 6VT1 which drives the PL802 – its base voltage is low and its emitter voltage high.

The PL802 could well be upset by incorrect drive conditions. It seems that 6VT1 is leaky, though its base coupling capacitor 6C1 (8μF) should also be checked. The streaking can be caused by grid current in a gassy tube upsetting the clamping action of the PCL84 triodes. A new tube is the only permanent cure for this, though reactivation often helps. First make sure that the c.r.t. Aquadag coating is earthed at the tube base panel, and that the latter is grounded to chassis.

THORN 1590 CHASSIS

There's a raster and noise from the audio channel, but no signals. The first time this happened, replacing the first i.f. transistor VT2 restored normal operation. A week later however the fault returned. The contrast control still has some effect.

A check on the voltages around the i.f. transistors VT2–5 should lead to the cause of the trouble. Bear in mind that the voltages in the first two stages will be affected by any fault in the a.g.c. circuit. The 0·01μF miniature ceramic disc decoupling capacitors used throughout the i.f. strip are not to be trusted. Since VT2 had to be replaced, we'd start by checking its emitter decoupler C9.

PYE 169 CHASSIS

A new line output transformer was fitted to this set, which then ran for a few minutes, giving a very good picture. The picture then suddenly vanished, and R90 overheated grossly. The drive to the line output valve seems o.k. (–50V), and the boost voltage is over 900V though the e.h.t. is low. I'm reluctant to return the line output transformer to the supplier, as it seems to be in order.

R90 is connected across the scan correction capacitor C74, and would carry the full scan current if C74 went open-circuit. We suggest you check this capacitor therefore, then check the scan coils by disconnecting them. If these checks fail to put matters right, the transformer probably has a shorted turn.

DECCA 30 CHASSIS

After two-three hours viewing the brightness slowly diminishes, the raster disappearing completely a few seconds later. The sound remains unaffected. If the set is left to cool down, the picture is restored. The fault will reappear some time later however. I've managed to cure the fault twice during the last year by replacing the PL509 line output valve, though the cure was not completely effective.

We suspect that the line drive waveform is incorrect – triangular instead of rectangular. This has the effect of over driving the valve without materially altering the width. Suspects, in order of likelihood, are: the line oscillator's anode load resistor R444 (33kΩ); R453 (330kΩ) in the width circuit; and the PCF802 line oscillator valve.

ITT VC300 CHASSIS

The trouble with this portable is five vertical black bars across the screen – the intensity of the bars declines towards the right-hand edge. They seem to be due to a ripple on the line scan waveform, but I can't see how to remove this.

The cause of the trouble seems to be the flyback blanking circuit. The waveform at the collector of the line output transistor T14 is fed via a 1·5MΩ resistor to the base of the blanking transistor T5, and is then a.c. coupled to the c.r.t. grid, D10 providing a clamp action at this point. The normal harmonic ripple appearing at the collector of T14 should be removed by the limiting action of T5 and D10. These components and, if necessary, the peripheral components should be checked.

THORN 9000 CHASSIS

About ten minutes after switching on, the bottom half of the screen darkens, the line timebase becomes unstable with a sideways jitter, field lock is lost (picture rolling from bottom to top), a fizzing noise appears on sound and the colour darkens or runs to monochrome and back. The picture can be stabilised by switching channels or running a finger up all the six switch buttons. After a further ten minutes or so the instability clears and there's no further trouble.

This trouble can be caused by a faulty TCA270 video demodulator i.c. The best way of checking it is by substitution. Also check the tuner and signals panels for dry-joints by tapping and probing. If the fault persists, the a.g.c. reservoir capacitor C125 (47μF, changed to 100μF on later models) is suspect.

RANK T20A CHASSIS

Occasionally when there's a still picture with captions a vertical jitter sets in, lasting till the picture content changes. Unfortunately the problem doesn't last long enough for investigation.

We suspect the TBA950 sync separator/line generator i.c. Before trying a replacement however, ensure that the a.g.c. control (2RV1) on the i.f. panel is not misadjusted.

THORN 1590 CHASSIS

Changing channels is almost impossible without retuning each button every time. The push-button unit is obviously at fault, but the manual gives little information on it. Is it possible to service this unit?

Check the bar against which the buttons bear. It's soldered at each end, and sometimes comes adrift. If all is well here, remove the plastic cover and lubricate the earthing fingers on the tuning capacitor shaft, using switch cleaner. If this fails to remedy the problem, a replacement tuner can be obtained and fitted.

ITT CVC5 CHASSIS

The trouble with this set is a hum bar which moves either up or down the picture, taking about ten seconds to do so. The bar is an inch or so deep.

This is quite a common fault on hybrid ITT colour chassis, and is usually due to hum on the 20V l.t. line. Likely culprits are the AD161 regulator transistor (on heatsink at left-hand side), the l.t. bridge rectifier D52d, the 10μF tantalum capacitor C263d which smooths the reference voltage, the 500μF l.t. reservoir capacitor C262d, and the regulator driver transistor T45d (BC170B) – in that order. It would also be worth checking that the h.t. smoothing blocks are well earthed.

PHILIPS 320 CHASSIS

The set functions very well – once you can get it to switch on. It sometimes takes as many as twenty tries before a raster is obtained. Everything on the power supply panel seems to be o.k., and I've tried replacing the thyristor h.t. rectifier.

If the full h.t. appears across the main smoothing electrolytic C4626 each time you switch on, it's possible that the line oscillator i.c. is lazy. If the h.t. is not present, it would seem that the thyristor is not being triggered. Suspects are the BR101 trigger diac, the trigger pulse coupling capacitor C5624 (0·22μF), and the BC147 control transistor Tr5602.

INDESIT T24EGB

Arcing occurred between the output of the e.h.t. stick rectifier and the casing of the field output transformer. After this we found there was sound and a full raster, but no picture. Disconnecting the aerial produces heavy snow on the screen, plus a faint but very unstable ghost like picture. The only defect we've found is a dud diode (D402). Can any small diode be used in this position? Any help in getting the picture back would be appreciated.

D402 is one of the flywheel line sync discriminator diodes. The effect of this being defective would be a change of line speed, making it impossible to set the line hold. BA129 diodes are shown in this position on the circuit, but a BA154 is a suitable substitute. The fact that a weak picture can be obtained with no aerial signal, but nothing can be obtained with the aerial connected, suggests an a.g.c. fault. We suggest you check the three transistors concerned, TR202/3/4, and the diode (D203). If these are in order, check the video driver transistor TR201. If the fault persists, it would be helpful to know whether the a.g.c. gating pulses are present at C216.

ITT CVC9 CHASSIS

The field sync diode (OA91) in the cathode circuit of the field oscillator valve has gone open-circuit three times in the past six months. Could a small surge limiting resistor be added in series with the diode, or a different type of diode tried?

The germanium diode used in this position is rather vulnerable to flashover, and tends to fail if the c.r.t. is prone to this. We suggest you fit a more robust silicon diode. Suitable types are the 1N4002 or BY206.

PHILIPS G11 CHASSIS

The problem we have with a couple of these sets is repeated failure of the BU208A line output transistor. Replacements usually last no longer than a week, sometimes for only a couple of evenings' viewing. The picture itself is good and gives no sign of anything being amiss.

The line output transistor runs with little to spare, and failures do occur – though they shouldn't with the regularity you're experiencing. We suggest you check the screened lead which couples the line drive waveform from the TDA2590Q line oscillator i.c. on the timebase panel to the line driver stage on the line output panel – 2F1/2 and 3A15/16 – as this can cause the symptoms you describe unless both ends are securely connected (especially the centres). It would also be worth checking the scan-correction capacitor C3135 (0·91μF), especially if the sets are of some age.

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TELEVISION AUG. 1980

GRUNDIG 6011GB

There seems to be some displacement of the horizontal lines, giving a ragged effect to all edges. In addition, the cut-out keeps tripping – usually after the set has been on for 15-20 minutes.

The fault conditions described are quite common with these sets, and are usuallly caused by failure of diode Di504 (1N4004) or its parallel resistor R504 (39Ω) in the width stabilising transductor circuit.

PHILIPS TS7 CHASSIS

The trouble on this portable is that D22 had burnt out and the associated resistor R238 had gone open-circuit. Replacing these components restored the picture, but after about half an hour the resistor began to overheat. The l.t. rail has been set up correctly, and I can't find any shorts. Is the line output transformer suspect?

The line output transformer could be at fault, but we'd check one or two other things before condemning it. D22 is the boost diode, and R238 is in series with its reservoir capacitor C228 (33μF). The latter could be leaky. It would be worth checking the line output transistor carefully out of circuit. Also check the various diodes fed from the line output transformer (D19/D20/D24) and their reservoir capacitors (C223/C225/C231).

TEST CASE

212

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.

We've always held the ITT VC200 monochrome chassis in very high regard, and feel that it's about the best of the hybrid single-standard designs, certainly one of the most durable. Although many of them are getting quite old, we've rarely scrapped one and have a large number of them out on rental. Over the years our engineers have become familiar indeed with the single-board chassis and its idiosyncracies. We were quite unprepared for Mrs. Williams' set therefore!

The saga started when this rental customer phoned to say that the set, a Model SV054, had a problem she described as a "distorted picture". One of our field technicians was soon ringing Mrs. Williams' doorbell. He found that the raster had wasp-waisted sides, the effect gradually moving down the raster to betray the presence of 50Hz mains-rate modulation on the line scan. It seemed that a replacement multiple electrolytic smoothing capacitor ("dustbin" in our vernacular) was required, the type used in the VC200 chassis being 200+200+75+25μF (C84–7). Not having the necessary component with him, our technician scooped up the set and brought it into the workshop to have the capacitor fitted.

The set was put on the bench and the new electrolytic block fitted. The hum modulation was as strong as ever however. Next C88, which decouples the supply to the sync separator, was suspected. In went a new 50μF can, but again there was no difference. A heater-cathode leak in one of the valves perhaps? All the valves in the set were changed – twice! After further lengthy but abortive tests and checks, the set was put on one side to await the attention of the senior engineer.

Having eliminated the u.h.f. signal input as a possible source of the trouble, this engineer, being a Spock-like character, reasoned that as the hum was at mains rate it must be coming from either the h.t. line or the heater chain.

As a first step, the multiple electrolytic's earth bonding was double checked – and found to be o.k. Following this, he decided to disconnect the top end of the valve heater chain (at R105) while the set was running. This showed that in the few seconds between open-circuiting the heater chain and the valves cooling to the point where the picture disappeared, the raster was straight-sided and square. The engineer had sometimes seen this effect when the line output valve's grid-leak resistor was high-resistance or open-circuit. Experiments in this area were next carried out therefore. No faults were found with the resistors or the VDR in the width/drive network. Intriguingly enough however, it was discovered that by lowering the impedance of the PL504's control grid circuit – by increasing the line drive coupling capacitor's value by a factor of ten (to 0·1μF) – the hum-on-raster effect could be virtually eliminated.

By now the engineer had realised where the trouble lay, and was able to suggest a suitable remedy. In retrospect, the effect of open-circuiting the heater chain and reducing the impedance of the PL504's control grid circuit gave vital clues. So what was happening with this VC200, and how was the cure effected? See next month!

ANSWER TO TEST CASE 211
– page 508 last month –

For a semiconductor device to turn on, in this case the h.t. rectifier/regulator thyristor, a current must be able to pass through it. Obvious enough, but something that can be misleading on these Pye sets. You see, in most chassis an open-circuit power resistor section will be shown up when you find a voltage at one end of it but not at the other. In this case, there was no voltage at any of the resistor's four tags, leading to the mistaken conclusion that something must be amiss with the thyristor or its triggering circuit. You'll recall that this was not so however. The answer is simple when you know what to look for. The point is that the first section of the power resistor, the 3·3 Ω surge limiter section, comes between the cathode of the thyristor and the reservoir capacitor. When it goes open-circuit therefore, as on this occasion, the thyristor can't fire and there's no voltage at any of the tags of the power resistor.

Had the scope been applied to the cathode of the thyristor, all would have been revealed – an identical waveform to that on the gate. In the words of the song, all dressed up and nowhere to go!

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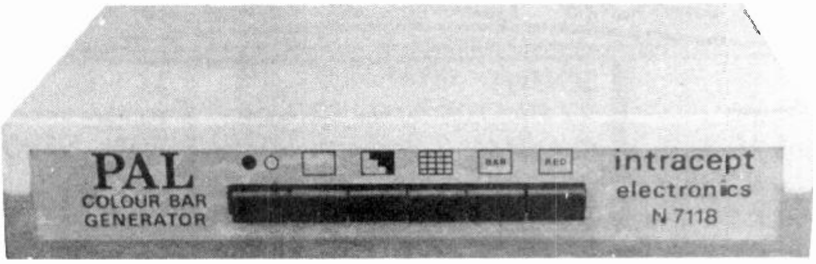

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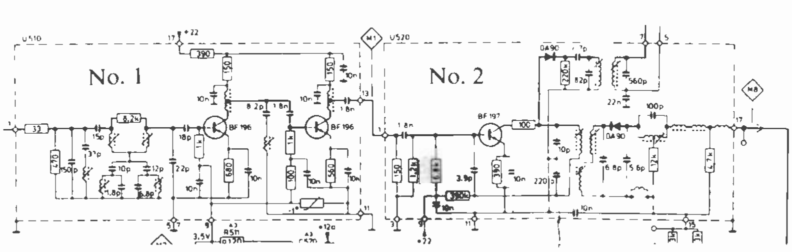

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