NOVEMBER 1980

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TELEVISION

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TUNING TROUBLES

SOLID-STATE TV CAMERAS

VCR SERVICING

TELEVISION

November 1980

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this month

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

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

TRANSISTORS, ETC.

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.56	BC377	0.29	BD234	0.88	BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
AC117	0.38	AU107	2.76	BC204*	0.39	BC394	0.39	BD235	0.63	BF224 & J	0.22	BR101	0.53	MPSU06	0.76	ZTX502	0.22	2N3820	0.72
AC126	0.36	AU110	2.40	BC205*	0.39	BC440	0.52	BD236	0.63	BF240	0.32	BR103	0.64	MPSU55	1.26	ZTX504	0.28	2N3866	1.08
AC127	0.54	AU113	2.60	BC206*	0.37	BC441	0.59	BD237	0.68	BF241	0.31	BR303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
AC128	0.48	BC107*	0.16	BC207*	0.39	BC461	0.78	BD238	0.68	BF244*	0.51	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	0.20
AC128K	0.55	BC108*	0.16	BC208*	0.37	BC477	0.30	BD253	1.58	BF245*	0.43	BRY39	0.60	MPU131	0.59	2N697	0.46	2N3906	0.20
AC141	0.65	BC109*	0.16	BC209*	0.39	BC478	0.25	BD410	1.65	BF254	0.48	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.65	BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70	BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
AC142K	0.65	BC115	0.24	BC212L*	0.17	BC548*	0.13	BD436	0.71	BF257	0.44	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	0.17
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD437	0.74	BF258	0.52	BT116	1.45	OC36	1.25	2N918	0.54	2N4236	2.20
AC152	0.36	BC117	0.30	BC213L*	0.16	BC550	0.24	BD438	0.75	BF259	0.54	BT119	5.18	OC42	0.90	2N930	0.29	2N4289	0.32
AC153	0.42	BC118	0.24	BC214*	0.16	BC556	0.23	BD519	0.88	BF262	0.73	BU102	3.35	OC44	0.68	2N1164	8.29	2N4292	0.32
AC153K	0.52	BC119	0.34	BC214L*	0.18	BC557*	0.16	BD520	0.88	BF263	0.88	BU105	1.80	OC45	0.63	2N1304	1.40	2N4416	0.85
AC154	0.41	BC125*	0.30	BC225	0.42	BC558*	0.16	BD599	0.87	BF270	0.47	BU105/02	1.95	OC70	0.65	2N1305	1.29	2N4444	1.90
AC176	0.45	BC126	0.30	BC237*	0.16	BC559*	0.17	BD600	1.23	BF271	0.42	BU108	2.98	OC71	0.73	2N1306	1.49	2N4921	0.80
AC178	0.51	BC132	0.20	BC238*	0.15	BCY10	0.30	BD663BR	0.86	BF272A	0.80	BU126	2.91	OC72	0.73	2N1307	1.32	2N5042	1.85
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	BDX18	1.55	BF273	0.33	BU204	2.50	OC81	0.83	2N1308	1.53	2N5060	0.28
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BDX32	2.95	BF274	0.34	BU205	2.58	OC81D	0.95	2N1711	0.47	2N5061	0.30
AC187K	0.65	BC136	0.22	BC252*	0.26	BCY34A	1.02	BDY16A	0.63	BF336	0.63	BU206	2.59	OC139	1.30	2N1893	0.52	2N5064	0.63
AC188	0.52	BC137	0.30	BC253*	0.38	BCY72	0.27	BDY18	1.55	BF337	0.65	BU208	2.75	OC140	1.35	2N2102	0.71	2N5086	0.49
AC188K	0.61	BC138	0.35	BC261A*	0.28	BD115	1.35	BDY20	2.29	BF338	0.68	BU407	1.38	OC170	0.80	2N2217	0.55	2N5087	0.50
AC193K	0.70	BC140	0.38	BC262A*	0.28	BD123	1.50	BDY38	1.38	BF355	0.72	BUY77	2.50	OC171	0.82	2N2218	0.38	2N5208	0.59
AC194K	0.74	BC141	0.44	BC263*	0.26	BD124	1.85	BF115	0.48	BF362	0.49	C106D	0.80	OC200	3.90	2N2219	0.42	2N5294	0.66
ACY17	1.20	BC142	0.36	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF363	0.49	C106F	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF367	0.29	C111E	0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
ACY28	0.98	BC147*	0.12	BC286	0.40	BD132	0.68	BF121	0.85	BF451	0.43	D40N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
ACY39	2.02	BC148*	0.12	BC287	0.49	BD133	0.70	BF123	0.48	BF457	0.46	E300	0.42	OCP71	1.98	2N2401	0.80	2N5449	0.18
AD140	1.79	BC149*	0.13	BC291	0.27	BD135	0.37	BF125	0.68	BF458	0.49	E1222	0.47	ON236A	0.94	2N2484	0.35	2N5457	0.46
AD142	1.90	BC152	0.42	BC294	0.37	BD136	0.38	BF127	0.51	BF459	0.52	E5024	0.19	R2008B	2.72	2N2570	0.74	2N5458	0.40
AD143	1.76	BC153	0.38	BC297	0.36	BD137	0.40	BF137F	0.78	BF594	0.16	GET872	0.46	R2010B	2.79	2N2646	0.82	2N5459	0.58
AD149	1.42	BC154	0.41	BC300'	0.62	BD138	0.42	BF152	0.19	BF596	0.17	ME0402	0.18	R2322	0.75	2N2784	1.15	2N5494	0.85
AD161	0.66	BC157*	0.13	BC301	0.38	BD139	0.46	BF158	0.25	BF597	0.27	MF0404/02	0.18	R2323	0.85	2N2869	2.08	2N5496	1.05
AD161/162	1.22	BC158*	0.12	BC302	0.68	BD140	0.50	BF159	0.27	BFR39	0.30	ME6001	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
AD162	0.71	BC159*	0.14	BC303	0.64	BD144	2.24	BF160	0.20	BFR40	0.29	ME6002	0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	0.35	BC160	0.52	BC304	0.44	BD145	0.75	BF161	0.84	BFR41	0.30	MJ2955	1.30	TIC44	0.25	2N2905*	0.39	2N6122	0.80
AF115	0.35	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65	BFR50	0.29	MJ3000	1.58	TIC46	0.35	2N2906*	0.36	2N6178	1.07
AF116	0.41	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95	BFR52	0.33	MJE340	0.68	TIC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	0.42	BC168B	0.14	BC309*	0.16	BD157	0.81	BF166	0.50	BFR61	0.29	MJE341	0.72	TIP29A	0.47	2N29260	0.14	2N6211	2.74
AF118	0.98	BC169C	0.15	BC317*	0.15	BD158	0.75	BF167	0.38	BFR62	0.28	MJE370	0.74	TIP30A	0.50	2N2926Y	0.14	2SB337BP	4.28
AF121	0.68	BC170*	0.15	BC318*	0.15	BD159	0.68	BF173	0.35	BFR79	0.30	MJE371	0.79	TIP31A	0.51	2N2955	1.12	2SC458C	0.78
AF124	0.38	BC171*	0.15	BC319*	0.19	BD160	2.69	BF177	0.36	BFR80	0.29	MJE520	0.85	TIP31C	0.67	2N3053	0.48	2SC643A	2.25
AF125	0.36	BC172*	0.14	BC320	0.17	BD163	0.67	BF178	0.46	BFR81	0.30	MJE521	0.95	TIP32A	0.56	2N3054	0.66	2SC930D	1.50
AF126	0.36	BC173*	0.22	BC321A&B	0.18	BD165	0.66	BF179	0.58	BFR88	0.42	MJE2955	1.20	TIP32C	0.72	2N3055	0.72	2SC1061	1.45
AF127	0.88	BC174A & B		BC322	0.26	BD166	0.68	BF180	0.53	BFT41	0.48	MJE3000	1.95	TIP33A	0.77	2N3250	0.52	2SC1172Y	3.55
AF139	0.58		0.26	BC323	1.15	BD175	0.90	BF181	0.53	BFT43	0.55	MJE3055	1.22	TIP34A	0.84	2N3254	0.58	2SD234	1.48
AF147	0.52	BC176	0.22	BC327	0.16	BD177	0.58	BF182	0.44	BFW11	1.02	MPF102	0.40	TIP41A	0.72	2N3391A	0.38	3N128	1.60
AF149	0.45	BC177*	0.20	BC328	0.18	BD178	0.92	BF183	0.52	BFW30	2.58	MPS3702	0.33	TIP42A	0.80	2N3633	0.80	40250	0.98
AF178	1.35	BC178*	0.22	BC337	0.17	BD181	1.94	BF184	0.44	BFW59	0.19	MPS3705	0.30	TIP2955	0.77	2N3703	0.17	40251	1.14
AF179	1.36	BC179*	0.28	BC338	0.17	BD182	2.10	BF185	0.42	BFW60	0.20	MPS6521	0.36	TIP3055	0.58	2N3704	0.19	40327	0.67
AF180	1.35	BC182*	0.15	BC340	0.19	BD183	1.34	BF186	0.42	BFW90	0.65	MPS6523	0.36	TIS43	0.44	2N3705	0.17	40361	0.48
AF181	1.33	BC182L*	0.15	BC347*	0.17	BD184	2.30	BF194*	0.14	BFX29	0.38	MPS6566	0.44	TIS73	1.36	2N3706	0.16	40362	0.50
AF186	1.48	BC183*	0.14	BC348A & B		BD187	1.20	BF195*	0.13	BFX84	0.42	MPSA05	0.30	TIS90	0.23	2N3707	0.18	40410	0.94
AF202	0.27	BC183L*	0.14		0.17	BD188	1.25	BF196	0.14	BFY50	0.38	MPSA06	0.32	TIS91	0.28	2N3708	0.17	40429	0.88
AF239	0.73	BC184*	0.15	BC349B	0.17	BD189	0.71	BF197	0.15	BFY51	0.37	MPSA55	0.43	ZTX108	0.14	2N3715	1.70	40530	0.79
AF240	1.40	BC184L*	0.15	BC350*	0.24	BD222	0.91	BF198	0.29	BFY52	0.36	MPSA56	0.45	ZTX109	0.16	2N3771	2.09	40595	1.39
AF279S	0.91	BC185	0.36	BC351*	0.22	BD225	0.91	BF199	0.29	BFY53	0.36	MPSA93	0.56	ZTX213	0.23	2N3772	2.08	40603	1.13
AL100	1.30	BC186	0.25	BC352A*	0.24	BD232	0.91	BF200	0.25	BFY90	1.98	MPSL01	0.33	ZTX300	0.16	2N3773	2.90	40636	1.25
AL103	1.58	BC187	0.27	BC360	0.59	BD233	0.62	BF218	0.42	BPX25	1.62	MPSU01	0.61	ZTX304	0.26	2N3794	0.40	40654	0.89

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)	Type	Price (£)	Type	Price (£)
BRC1330	0.93	SN76008KE	2.56	TBA240A	3.98
CA810QM	2.44	SN76013N	1.56	TBA281	2.07
CA3005	1.86	SN76013ND	1.40	TBA395*	2.58
CA3012	1.45	SN76018KE	2.56	TBA396	2.40
CA3014	2.23	SN76023N	1.58	TBA400	2.20
CA3018	0.71	SN76023ND	1.40	TBA480Q	1.84
CA3020	1.89	SN76033N	2.20	TBA500*	2.21
CA3028A	0.80	SN76110N	1.20	TBA510*	2.21
CA3028B	1.09	SN76115N	1.62	TBA520*	2.98
CA3045	3.75	SN76116N	1.78	TBA530P	2.24
CA3046	0.70	SN76131N	2.10	TBA540*	2.88
CA3065	1.74	SN76226N	2.60	TBA550*	3.13
CA3068	1.90	SN70227N	1.61	TBA560C*	3.18
CA3130S	1.57	SN76228N	1.80	TBA570*	1.29
FCH161	2.40	SN76502N	1.92	TBA611B	2.58
FCJ101	3.32	SN76530P	0.97	TBA641	2.55
LM309K	1.98	SN76533N	1.38	TBA641A12	2.35
LM380N-14	1.65	SN76544N	1.85	TBA641B11	2.61
LM1303N	1.03	SN76546N	1.85	TBA651	2.12
MC1307P	1.82	SN76570N	1.81	TBA673	2.31
MC1310P*	1.84	SN76620AN		TBA700*	2.50
MC1312P	2.34		0.99	TBA720AQ	2.38
MC1327P*	1.86	SN76650N	1.46	TBA720Q	2.38
MC1330P	0.83	SN76660N	0.84	TBA750*	2.18
MC1350P	1.22	SN76666N	0.96	TBA800	1.65
MC1351P	1.42	TA7073P	3.51	TBA810AS	1.69
MC1352P	1.42	TAA263	2.20	TBA820*	2.80
MC1357P	2.92	TAA300	3.88	TBA940	3.52
MC1358P*	2.30	TAA320	1.10	TBA950	2.08
MC1458G	1.43	TAA350A	2.46	TBA990*	2.90
MC1496L	1.15	TAA370A	3.18	TCA270A*	3.55
MC3051P	0.58	TAA435	1.70	TCA280A	1.43
MFC4008	0.85	TAA450	3.39	TCA290A	3.46
MFC4060A	0.98	TAA521	1.10	TCA420A	2.10
MFC6040	1.11	TAA522	2.09	TCA440	1.67
MFC8020A	1.10	TAA550	0.35	TCA640	4.28
ML231	3.57	TAA560	1.83	TCA650	4.26
ML232	3.57	TAA570	2.20	TCA660	4.26
NE555	0.72	TAA611A	1.67	TCA730	4.10
NE556	1.34	TAA611B	1.89	TCA740	4.04
NE566	1.95	TAA621AXI	2.33	TCA750	2.63
SAA1024	5.70	TAA630Q	3.91	TCA760	1.62
SAA1025	10.35	TAA630S	4.18	TCA820	3.29
SAS560A	2.01	TAA661A	2.38	TDA440	4.16
SAS570	2.01	TAA661B	1.75	TDA1003	1.66
SC9503P	1.40	TAA700*	2.80	TDA1004	2.73
SC9504P	1.38	TAA840	3.38	TDA1005	3.04
SL414A	1.91	TAA861A	0.95	TDA1022	6.69
SL432A	2.52	TAA930A	1.43	TDA1024	0.97
SL450	5.10	TAA930B	1.43	TDA1034	2.96
SL901B	4.20	TAA960	3.20	TDA2610	2.66
SL917B	6.60	TAA970	2.81	TDA2640	2.86
SL918A	5.95	TAD100	2.66	ZN414	1.46
SN72440N	2.21	(Filter)	0.98		
SN76001N	1.67	TBA120A	0.90		
SN76003N	2.20	TBA120S*	0.99		
		TBA120SA	1.02		
		TBA231	1.1[illegible]		

* Indicates Q version is also available.

DIODES

Type	Price (£)	Type	Price (£)
AA113	0.17	BY114	0.80
AA119	0.21	BY118	1.10
AA129	0.28	BY126	0.20
AA143	0.18	BY127	0.21
AAY30	0.26	BY133	0.35
AAZ13	0.42	BY140	1.40
AAZ15	0.35	BY164	0.75
AAZ17	0.28	BY176	2.80
AY102	3.85	BY179	0.83
BA100	0.24	BY182	1.14
BA102	0.36	BY184	0.44
BA104	0.19	BY189	5.30
BA110	0.80	BY190	4.90
BA111	0.70	BY206	0.26
BA115	0.17	BY238	0.25
BA116	0.56	BYX10	0.30
BA121	0.85	BYX38/600	0.70
BA129	0.45	BYX70/500	0.53
BA145	0.19	ITT44	0.08
BA148	0.19	ITT210	0.63
BA154	0.06	ITT827	0.80
BA155	0.17	MCR101	0.48
BA156	0.12	MR854	1.10
BA157	0.25	OA5	0.88
BA158	0.28	OA10	0.58
BA159	0.40	OA47	0.20
BA164	0.14	OA81	0.19
BA182	0.27	OA90	0.13
BA201	0.13	OA91	0.15
BA202	0.14	OA95	0.20
BA203	0.14	OA200	0.13
BA216	0.08	OA202	0.13
BA219	0.11	OA210	0.89
BA243	0.45	TIL209	0.14
BA317	0.06	TIL211	0.18
BA318	0.07	TV20	2.25
BAV10	0.10	IN914	0.06
BAV21	0.18	IN916	0.06
BAW62	0.06	IN4001	0.06
BAX13	0.07	IN4002	0.07
BAX16	0.10	IN4003	0.08
BAX17	0.19	IN4004	0.08
BAY72	0.16	IN4005	0.09
BB104B	0.52	IN4006	0.10
BB105B	0.33	IN4007	0.12
BB105G	0.30	IN5400	0.15
BR100	0.40	IN5401	0.17
BY100	0.35	IN5402	0.20
BY103	0.35	IS920	0.09
		IS921	0.11

ZENER DIODES

400mW plastic	3.0-75V	14p each
1/1.3W plastic	3.3-200V	18p each
1.5W flange	4.7-75V	† £1.26 each
2.5W plastic	7.5-75V	67p each
20W stud	7.5-75V	£1.31 each
75W stud	7.5-75V	£7.95 each

VDR's, etc.

Type	Price (£)
E295ZZ	
/01	0.28
/02	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
R53	1.75
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.46
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
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200V	0.55	200V	0.68
400V	0.61	400V	0.74
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What makes for success?

Anyone with a longish memory, or say a collection of old Trader year books, must be struck by the large number of manufacturers that have come and gone in the radio and television field over the years – and their legacy of brand names. The Trader year book for 1939 lists no fewer than 22 TV brands, only two of which were marketed by a subsidiary rather than an independent company. Eight of the brand names are still in current use, though only four of the setmakers are still active as independent TV manufacturers. The peak of independent TV manufacturing activity occurred in the mid-late fifties, when you had a choice of some 36 brands, mostly produced by independent companies. That was the period when the coming of ITV gave a tremendous boost to television viewing, with an attendant boost in TV sales. Such a situation was unlikely to last long. Each market hiccup produced closures or mergers – though market upturns often produced a few newcomers, who usually came and went quite quickly. In the days of hand-built chassis you could get going quite quickly to exploit a market upturn. With todays' technology and production techniques however it's almost impossible to set up a production line as a speculative venture – the "in and out" businessman now buys his sets from an overseas source instead.

This sort of business picture is not exclusive to the world of radio and TV of course. Similar patterns are to be found in the car, domestic electrical appliance and other consumer industries – both in this country and in overseas markets. What must intrigue any industry watcher is just what makes for success? Why have some (a very few) firms remained intact through almost every change in market conditions?

There are of course some obvious text-book answers. Tight financial control. Careful stock policies. Careful buying. An adequate financial base. And investing in the right equipment and developments at the right time. These underlying factors seem to be rather more important than clever sales and bright publicity – because the canny trader will be wary of unknown products and will prefer to stock goods whose reputation he knows. There must be other factors however: if it was all that simple and easy nobody would ever go out of business!

Luck must be accepted as one factor. No one can get their forecasts wholly right, so that an element of chance must accompany all management decision making. Given a run of accurate forecasting and appropriate policy decisions however another factor can eventually emerge – sheer size! Once you've acquired a reasonable percentage of the market the luck factor tends to undergo a subtle change: you now have to be rather daft to get things badly wrong. This doesn't mean that large-scale disasters are impossible, just that they're less likely to occur.

The problem that emerged in the late seventies, and looks likely to be with us during the eighties, is that size too has taken on a fresh dimension. With competitive, free-trade markets (though, as we've said before, some are a lot freer than others) it's no longer enough to be big in one market or even in one geographical area. Firms that have been fairly dominant in one country or another have had queasy periods in recent years. Tandberg in Norway pulled out of setmaking, B and O in Denmark went through a sticky period, Telefunken in Germany have found profitability a problem, while ITT have decided to pull out of setmaking in France – just a few items from recent European industrial history.

It appears that to be a multinational is nowadays almost essential in consumer goods manufacture. Firms like Philips for example seem to survive undaunted as a result of their geographical spread. The Japanese firms have likewise established solid foundations through global operations (manufacture as well as marketing). Despite the fact that booms and recessions have an unfortunate tendency nowadays to occur on a synchronised basis world-wide, having your eggs split between a number of markets seems to be a reasonably reliable survival technique.

So if you are a managing director, trying to steer a company on a survival course, what options would you have? There are, interestingly, several possible courses. You can shift your operations from one industrial sector to another. Plessey for example were selling TV chassis to half the setmakers in the UK in the early fifties. Today, apart from some component interests, they leave the consumer electronics sector well alone. Or you can persue a policy of commercial spread. There was a vogue for "holding companies" some years ago, the idea being that if your activities were sufficiently diverse you'd be awfully unlucky to come unstuck on all fronts simultaneously. The logistics of trying to run such diversified, conglomerate operations seem however to have led to this approach going out of fashion. There have nevertheless been some striking success stories – ITT for example, with its massive interests in telecommunications, food, insurance, hotels, car hire and what have you! Or you can go for the global approach, with trading agreements if necessary. This seems to be the commercial logic of the Rank-Toshiba, GEC-Hitachi and the more recent Thorn-Sharp linkups in the consumer electrical/electronics fields (Rank as a whole falls within the conglomerate category of course, and as we go to press seems to be having second thoughts about whether to remain involved in the setmaking side of the TV industry).

There's no guarantee of continued success without nimble-footed management however. Such seemingly impregnable organisations as Olivetti, Volkswagen and Indesit have all gone through tricky periods. Who'd be prepared to guess the market leaders in 1990?

Correction: In the New CTV Signals Board components list (page 677 last month) the coil types for L1 and L2 were reversed – L1 is type PC501-L602 and L2 type 00D0-914-001. We also suggest that R16 is changed to 470Ω – this gives a slightly better match to the chroma delay line.

Cover photo: Our cover photograph this month was taken at the service headquarters of R. N. French, Ltd. (Audio Visual Rentals), Sedlescombe, East Sussex. Our thanks to them for their help and co-operation.

Servicing the Decca 80/88/100 Chassis

Part 1

Eugene Trundle

THE DECCA solid-state 80, 88 and 100 series chassis have been with us for several years now. They've proved worthy successors to the hybrid 10 and 30 series chassis they replaced. An earlier series of articles by Barry Pamplin (see April, May and June 1977) described in some detail the arrangements used in the 80/88/100 chassis and the problems found with early production sets. In the intervening years we've had an opportunity to get to know these sets and their habits better, and it's time to report on our experiences.

The 80, 88 and 100 chassis are basically similar but have been designed to drive different tubes. 18 and 20in. Toshiba SSI tubes are used in the 80 chassis, 20in. Mitsubishi, Mullard, Toshiba or Hitachi PIL type tubes in the more recent 88 chassis, while the 100 chassis is fitted with the Mullard/Philips 20AX tube.

Tuners and Control Units

As with most manufacturers' chassis, a variety of tuners and tuner control units have been used over the years. The simplest arrangement consists of a six-button press-and-turn selector assembly which is also used by other manufacturers. Being a cost-conscious design, this is prone to intermittency and drift. The trouble is easy to diagnose, and replacement units are not expensive.

In the touch-tuner circuit fitted to some models the 1N4148 isolating diodes (D702-13) are vulnerable to flashover, causing tuning troubles or a tendency to stick on the afflicted channel. The AV switching diode D300 (D312 in the 100 chassis) on the timebase panel can also suffer, latching the set on to channel 6 and sometimes destroying Tr713. There's a modification to prevent this: fit a 1kΩ $\frac{1}{2}$W resistor in series with connection PTC4 on the timebase panel (it's present as R379 on the 100 chassis), and another on the control panel in series with connection PTU D10. A 1N4003 diode, as fitted in later production, is more reliable in this position.

The LED indicators fitted to these units are quite reliable, but there's a version of the tuner control unit with piano keys and filament bulb indicators. We've had several failures of the special bulbs used in this, and the part number is not included in the manual – it's 62/0001A.

Most sets are fitted with the good old and well known ELC1043 type varicap tuner. Some recent models (22CV1098, 26CZ1099 etc.) use a fearsome looking multiband varicap tuner however. There are two versions of this: Telefunken (coaxial socket fitted) and Recagnie (no coaxial socket and mounted on subpanel). They are interchangeable. Neither is as reliable as the standard u.h.f. varicap tuner, being subject as they are to noise and drift, often intermittent. Of the two, the Telefunken version is to be preferred.

The a.f.c. circuit is very effective, but most models have no provision for defeating it when tuning. In either event in areas where the channels are closely spaced a capture effect is possible, the a.f.c. latching on to the wrong transmitter during station change. This can be prevented by desensitizing the circuit – simply increase the value of R2 on the varicap tuner panel from 2·7MΩ to 3·9MΩ.

We've had odd troubles with noisy rotary controls on the user control panel, especially volume, but more often our ham-fisted staff manage to break off the knob and shaft, necessitating a new potentiometer! The slider controls used on other models can become mechanically "lumpy", the only sure cure being replacement. There are two 8·2V zener diodes associated with the contrast control (they provide the beam limiting action). These occasionally fail, upsetting the contrast range or the beam limiting.

IF and Audio Board

The i.f. amplifier is quite well behaved, and there's little to go wrong here. Odd i.c. faults have been encountered, such as no vision or poor sync due to a faulty TCA270. The tuner a.g.c. preset control VR127 can be critical and difficult to adjust, in which case shunting its track with a 1kΩ $\frac{1}{2}$W resistor is recommended. The supply to the MC1349 i.f. amplifier chip is stablised by a 15V zener diode (D101): if this is on the high side of its tolerance, or goes open-circuit, the chip can be overrun. The recommended replacement zener diode is type BZX79C15, as fitted in later production.

Most of the problems that assail the i.f. panel are in the sound department. Sibilant distortion and buzz due to captions and text transmissions can usually be cured by careful adjustment of the sound detector quadrature coil L110. This adjustment is often very critical, and can be eased by shunting L110 with a 1kΩ $\frac{1}{4}$W resistor and changing the associated tuning capacitor C134 to 0·001μF. The de-emphasis capacitor C135 can be upped to 0·33μF to reduce the sibilant problem further – if it's increased much more, audio h.f. response is lost.

The TBA120S intercarrier sound i.c. can be responsible for distorted sound, but the cause of this problem is usually downstream. Volume control problems can arise in models fitted with remote control if an intercarrier sound i.c. of other than Motorola manufacture is used – see remote control section later.

Intermittent crackling, distorted sound with or without overheating, and low output have all been traced to the TBA800 audio chip (IC104) on various occasions. When it fails, it's prudent to check that the associated 25V shunt stabiliser (Tr801) circuit is operating correctly, as excessive supply voltage will quickly kill the i.c. A modification to increase reliability under flashover conditions is to fit a 4·7kΩ $\frac{1}{2}$W resistor in series with connection PIB2.

Sound distortion, often more noticeable at low volume levels, and perhaps appearing or worsening as the set warms up, is often due to the loudspeaker. In some models the speaker fixing is by means of spire clips (great fun to remove!) which may not be pushed home fully during assembly, leading to an annoying "tizz" at high volume levels.

The Decoder Panel

The decoder used in these chassis is a good design,

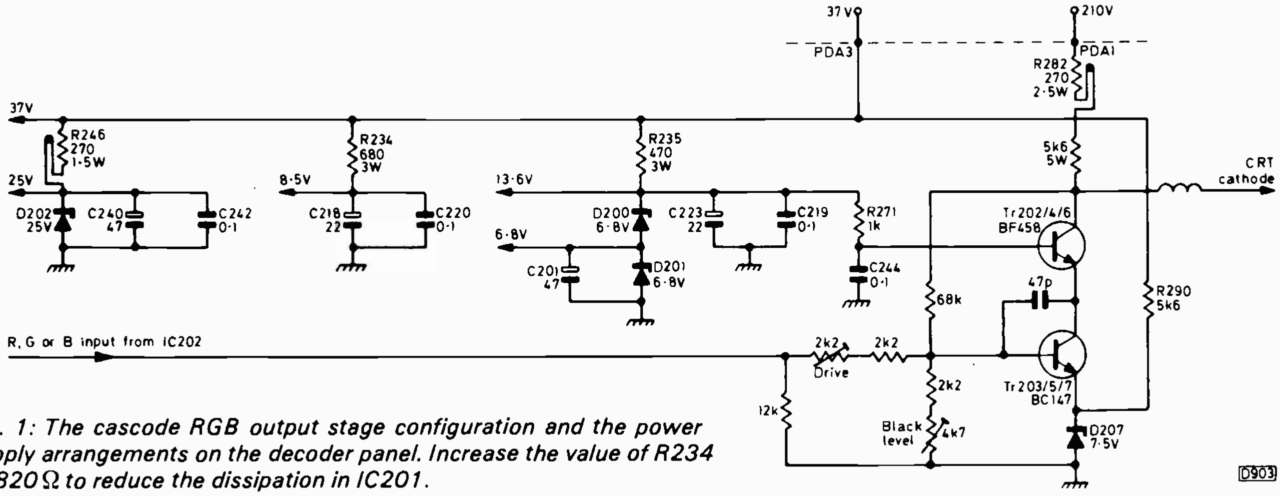

Fig. 1: The cascode RGB output stage configuration and the power supply arrangements on the decoder panel. Increase the value of R234 to 820Ω to reduce the dissipation in IC201.

capable of producing very good colour pictures, but Decca seem to have been unlucky with several components in this area. This has given the decoder a not altogether justified reputation for poor reliability. When we say decoder we mean the whole signal section not on the i.f. panel – the luminance and chrominance sections and the RGB output stages. This circuitry is all on the panel to the left of the c.r.t. base.

Let's start with the no-colour symptom. The pluggable chips make substitution easy, and IC200 (TBA396) and IC201 (TDA3950) are the ones to go for, with IC201 the favourite. On Mk. I panels (very early production) a TBA395 was fitted in the IC201 position, but most panels are of the Mk. II type with a TDA3950. Problems were experienced with this device however, in the form of an internal hot-spot. The effect was that the colour disappeared as the device warmed up. Replacements are checked by Decca and factory coded with a red, white or blue spot. Make sure that replacement devices are thus coded, and as a further precaution increase the value of the chip's 8·5V supply feed resistor R234 from 680Ω to 820Ω (3W) to reduce the dissipation in the device.

No or intermittent colour can also be due to the tantalum capacitors associated with IC201. C222 (1μF) which decouples pin 4 and C230 (4·7μF) which decouples pin 11 are suspect. On some very early models they were incorrectly polarised during assembly, but in all cases substitution is the only sure test. C218 (22μF) which decouples the 8·5V supply pin 2 has also been found guilty of causing the same symptom. Failure of C201 (47μF) which decouples the zener diode D201 will delete the colour should it go leaky or short, and the same effect occurs should R234 go open-circuit, removing the supply to IC201 (R234 is particularly suspect if black and marked "Osbourne"). Rarer causes of intermittent colour are the third chip (IC202, MC1327) on the board and C235 (0·001μF) which decouples pin 10 of IC201.

No or very poor colour, with Hanover bars and low, distorted V and U signals, has more than once been traced to shorts within the various tunable coils in the decoder – where the soldered connections have shorted to the copper screening can. L204 and L205, the chroma delay line's input and output coils, may be found open-circuit, giving similar symptoms.

Where a difference in saturation between BBC and IBA transmissions occurs, first check that the line phasing potentiometer VR301 on the timebase panel (100 chassis only) is correctly adjusted. If so, the burst gate window may be widened to accommodate errant transmissions with incorrect burst timing by changing R270 to 1kΩ $\frac{1}{2}$W and R273 to 1·5kΩ $\frac{1}{2}$W as in later production. These resistors are in the base circuit of the pulse shaper transistor Tr201.

Moving on to the luminance circuits, we've had a single case of an open-circuit luminance delay line, with obvious results. Lack of luminance, or limiting or cramping of the luminance waveform, giving rise to a poor grey scale, can be due to IC200 (TBA396).

The RGB output stages are of the cascode variety (see Fig. 1). No picture, with all three c.r.t. cathodes at or near 190V, suggests that the RGB output stages are cut off. In this case look at the fusible resistor R246, which may have sprung open as a result of leakage in the 25V zener diode D202 or the associated decoupling electrolytic C240 (47μF). Failure of C232 (22μF) which decouples pin 10 of IC202 can have the same effect, this time with low voltages at pins 8, 9 and 10 of the i.c. Another cause of no picture is when the 7·5V zener diode D207 is defective. This should hold the emitters of the lower transistors in the cascode pairs at 7·5V: if this voltage rises, all six transistors Tr202-7 will be cut off. If you are unlucky, D207 will fail in a less defined way, the outcome being varying brightness. This is betrayed by variation of the emitter voltages on Tr203/5/7.

Excessive or uncontrollable brightness on the other hand should lead first to a check on the 13·6V rail – at the cathode of zener diode D200. If the voltage is low, suspect D200. If the 13·6V supply is present and correct however, the luminance emitter-follower transistor Tr208 (BC157) and the conditions and setting of VR203 which sets the video bias level in IC200 are suspect – along with D207 again. Further suspects are the decouplers C216 (1μF), C231 (0·05μF), C232 (22μF) and C241 (1μF).

Where the excessive brightness is confined to one colour, the screen being suffused with red, green or blue, it's likely that the appropriate output transistor collector load resistor has gone open-circuit. Feel it: if it's cold, it's probably open-circuit; if it's very hot, the appropriate BF458 output transistor (Tr202/4/6) is probably short-circuit.

An absence of one colour is less common, and will usually be traced to failure of the lower half of the affected output stage (Tr203/5/7). The lockfit type transistor BC147 is more reliable than the alternatives fitted in production, and is the preferred replacement.

Prominent flyback lines on the picture, often with a change in brightness level, is usually attributable to a defective MC1327 i.c. (IC202). Flashover damage will probably have been responsible, and precautions against this can be taken in the form of a short wire link between pin 2 of plug PDA and the printed circuit land at the cathode of D204, plus a 1kΩ ½W resistor in place of test link TL212 (this resistor is R294 in later production models).

The Timebase Board

A familiar friend, the TBA920 chip, is used as the line oscillator and sync separator. This chip's reliability seems to depend on whose chassis it's fitted in and which manufacturing batch it belongs to! It fares quite well in the Decca chassis. Sometimes it will fail to perk up from cold, giving the dead set symptom. In this event, first suspect its start up resistor R324 (R317 in the 100 chassis). This should be 5·1kΩ (5·6kΩ or 6·8kΩ resistors were used in early models). Then make sure that the associated 12V zener diode D301 and decoupler C316/C307 (depending on chassis) are all right. If so, suspect the chip itself.

Erratic sync performance can be caused by the chip itself, but before condemning it check R301 (R302 100 chassis) which biases the sync input pin. If only the line sync is affected, the sync coupler – C305 in the 80 series, C309 in the 100 series – may be open-circuit. If the sync troubles are confined to the field timebase, the field sync integrator transistor Tr301 (BC147B) is suspect.

We've already mentioned the line phase control VR301, in connection with the decoder. This control is fitted on the 100 chassis only, and it's important that neither this nor the line hold control is used arbitrarily to centre the picture horizontally, since this will upset the timing of the burst gating pulse supplied to the decoder. When the purity is correctly set, the c.r.t. manufacturing tolerances should ensure that the picture is reasonably centred – whether this is so in practice is rather open to question!

The next stage on the timebase board is the line driver, which employs a BF458 transistor in the 80/88 chassis and a BF355 in the 100 chassis (Tr300 and Tr304 respectively). Neither of these types of transistor has distinguished itself from a reliability point of view, but failure is easy to diagnose compared with the other occasional affliction to which this stage is prone. The effect on the screen is a black line about 1½-2in. from the left-hand side of the screen. It's vaguely reminiscent of the ringing effect produced by an undamped line linearity coil. It's due to the line driver transformer's damping resistor becoming open-circuit – R317 in the 80 chassis, R330 in the 100 chassis. A quick check is to feel its temperature – it normally runs quite hot.

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Service Notebook

George Wilding

Intermittent Sound and Vision

The problem with an ITT hybrid monochrome set (VC200 chassis) was that the picture and sound would intermittently vanish, leaving a noise-free, unmodulated raster without even the slightest sign of hiss from the loudspeaker. The off periods might be a few seconds or minutes, rarely longer, and didn't respond to chassis or cabinet tapping.

The 20V supply for the low-voltage circuits is derived from the line output transformer, and the probability was that this was being intermittently lost. A check across this supply's reservoir capacitor C132 (100μF) confirmed this, so there was little to come under suspicion. First bet was the rectifier itself, D9 (BA157), and after fitting a replacement no further loss of signals was experienced. There was however a faint but annoying hum bar, which travelled slowly down the screen and was more noticeable on one channel than the others. Connecting a test electrolytic across the various h.t. reservoir/smoothing electrolytics failed to improve matters, but on shunting the l.t. smoothing capacitor C130 the trouble was completely cured. After removing this we tested it with an ohmmeter and found that it still had considerable capacitance. It probably had enough resistance to make it ineffectual however.

Remote Control Problem

We had a problem recently with the remote control on an ITT solid-state colour set – Model CD651. The channel changing worked perfectly when the remote control unit was operated outside the set, but was erratic with the unit plugged into the set, suggesting that the power supply to the unit wasn't constant. This model is fitted with the earlier CMC33 control assembly, which incorporates a zener diode (D2, ZPY10) across the transmitter supply. No further trouble was experienced after replacing this diode.

Insufficient Width

Insufficient width was the complaint with a GEC hybrid colour set. The reduced output from the line output stage naturally meant that the e.h.t. was low, so that the focus and the convergence were both well out as well. Reduced width in a valve line output stage can be due to many causes of course – low-emission valves, wrong value resistors, incorrect line drive waveform, a defective capacitor, a faulty line output transformer, or low h.t. Since advancing the brightness control beyond the normal setting failed to produce any marked increase in picture size, the odds were that the valves were o.k. Furthermore, as the h.t. comes from a half-wave rectifier circuit and there was no sign of a hum bar the odds were that the h.t. voltage was about right.

In view of the set's age, the main probability was an increased value resistor in the width circuit – in all types of hybrid chassis these resistors tend to increase in value due to heat from the nearby line output valve and boost diode. The plug-in timebase panel was removed therefore so that the relevant resistors could be checked. If you're not conversant with these panels incidentally, it's wise to indicate on the layout in the manual where the various single leads plug in – they are usually marked on the panel, but once this is clipped back in position it's not easy to see the connections. There are several resistors in the width circuit: the culprit turned out to be R540 (390kΩ), which connects the set e.h.t. control to the boost rail.

Replacing R540 and readjusting the set e.h.t. control produced a good picture, but unfortunately the line hold control was at one end of its travel. A new PCF802 line oscillator valve failed to produce line lock with the hold control in a midway position, so the line oscillator coil L501 had to be adjusted to get the correct conditions.

Very Poor Picture

The complaint of a very poor picture on a colour set fitted with the Thorn 3000 chassis turned out to be due to appallingly bad focus and inadequate contrast, the latter being the result of the rear mounted contrast control having been turned well down, possibly in a misguided attempt to improve the definition. The first step was to remove the back and adjust the focus control. We found that first class focus could be obtained, but with the slider at practically one end of its travel. The picture size seemed to be about right, implying that the e.h.t. voltage was correct, so our suspicion was directed at the resistors in series with the focus control – within the focus unit.

Within seconds however the focus suddenly changed to a very poor standard, then just as suddenly jumped back to the good standard we'd obtained on resetting the control. This alteration continued for some minutes. Now there didn't appear to be any changes in the picture size, but bearing in mind that the triplers in these sets do give trouble after some years' service we decided to fit a new one and try again. This produced perfect results, and with the slider of the focus control at about the centre of its range. We've replaced many triplers in these sets because of loss of e.h.t., but this is the first time we've had to do so for spasmodic variation of the focus voltage.

Power Factor

Power factor is something of concern mainly to power engineers, but an appreciation of what it means is nevertheless helpful. It can range (theoretically) from zero to unity, and indicates the phase disparity between the voltage and current in an a.c. circuit. If the circuit is purely resistive, the current flowing and the applied voltage will be in phase. This is unity power factor, and the wattage indicated by a meter will be the true wattage dissipation. If the circuit is purely capacitive or inductive however, the current and the voltage will be in quadrature. This is a power factor of zero. There will be no wattage dissipation, though an ammeter in series with the supply may show a substantial reading.

Capacitors can be made with almost negligible lead resistance and very high insulation resistance. Thus the resistive losses they introduce and the in-phase current they take are very low, i.e. they have a very small power factor indeed. Electrolytics however have considerable leakage, i.e. they have a greatly inferior power factor to that of other types of capacitor.

In a nutshell then, power factor is cos ϕ of the angle between current and voltage. It can also be expressed as true watts/apparent watts. In a good capacitor the angle between the current and the applied voltage will be almost 90°. The disparity between the theoretical 90° and the actual angle is sometimes referred to as capacitor's "phase difference".

Teletopics

OUT WITH EW CORRECTION!

A year or so ago, in a leader on the subject of colour c.r.t.s, we commented that "the need for EW correction is also in the process of being designed out". Well, we've now reached that point with the latest chassis from ITT – the CVC800 chassis. This is described by ITT as a "mini series colour television chassis", and is designed to drive 14, 16 and 20in. 90° tubes of the PIL variety. The tubes to be used in these chassis are in fact Hitachi ones, and are noteworthy in employing a newly developed saddle- toroid yoke so that no dynamic convergence or pincushion distortion correction circuitry is required.

The chassis will replace the CVC40/CVC45 series, and has a consumption reduced from the 65W of the earlier chassis to 50W under normal operating conditions. The i.f. section is much the same, with a SAWF and TDA2540 i.c., the main change in this area being the use of a single TDA1035T intercarrier sound/audio i.c. The discrete field timebase circuit has been replaced by a TDA1170 i.c., but the switch-mode power supply remains in discrete form. The latter consists of a BU126 in a series chopper circuit, the switch-mode transformer also providing the drive to the BU208 line output transistor. The line oscillator and sync departments are contained in a TDA2593 i.c., while the e.h.t. is derived from a diode-split line output transformer. The decoder is of interest since this is the third chassis, following the Thorn TX10 and Salora G, to use the Mullard/Philips TDA3560 single-chip decoder. The RGB output circuits are of the class AB variety, with the bottom section consisting of a cascode pair. A constant-current transistor is used to provide a stable bias voltage for the RGB circuits.

Models fitted with remote control will use the infra-red system, with the SAA1250/1251 transmitter/receiver i.c.s, described in our December 1979 issue. A small amendment is required to that article: the TEA1009 preamplifier i.c. is fitted in a 14- instead of an 8-pin pack in its final form, so that the pin numbers we gave no longer apply.

EXTRA FEATURES FOR CED

It seems that the RCA CED videodisc system, which is due to be launched nationally in the USA early next year, will be more versatile than was previously expected. Prototype players demonstrated recently incorporate pause, rapid forward and reverse visual search, and rapid forward and reverse access. For the visual search feature the disc is scanned at about ten times the normal speed, either forwards or in reverse, a "high-quality" picture being displayed on the screen. When using the rapid access feature the user watches an LED display in order to locate the required part of the programme. RCA's initial disc catalogue will have some 150 titles, with new releases monthly.

SATELLITE TV

Sinus Electronic (Box 48065, S-400 77 Göteborg, Sweden) are planning to hold a two-day seminar on satellite TV in mid-1981. The registration fee will be approximately $150, and the seminar the first of its kind held in Europe. Sinus Electronic are planning to market a low-cost domestic satellite TV receiver terminal, and it's hoped to be able to demonstrate this at the seminar. The main aim seems to be to prepare dealers for the coming of satellite TV.

It seems to us to be rather jumping the gun, since there are unlikely to be regular satellite signals for a couple of years at least. In the USA, the Communications Satellite Corporation (Comsat) has formed a subsidiary to buy and develop programming for a high-power satellite TV service. Plans to join with Sears Roebuck in the provision of receiver units (see April *Teletopics*) have now been abandoned, and Comsat is looking for another partner to deal with the consumer side of the operation. Which is all very well, except that the FCC has not yet started to consider giving approval to satellite TV services for domestic viewers in the USA – the present satellite receiver terminals in use by individuals are aimed at the low-power satellites used to provide relay linkups.

DUTCH TELETEXT SYSTEM

A couple of interesting features are now incorporated in the Dutch teletext service. First there's a "news subtitles" system – those wanting to get quick news reports without switching the programme off can call up news subtitles which appear in the corner of the screen. Allied to this there's a subtitling system for the benefit of the hard of hearing. Another feature is the "extended page". When a single teletext page is inadequate for carrying the required information, the viewer finds "to be continued": he then turns the page for the rest of the item.

VCR TRAINING

It was mentioned in this column a while back that Steve Beeching was considering running training courses for technicians interested in getting to know about VCRs and their problems. The first two-day, week-end course has now been held, and was to all accounts a great success. A second has been arranged for January 31st–February 1st next year, at the same venue – The Robin Hood Hotel, Beaumont Cross, Newark. The cost of the course is £25, which includes refreshments and a working lunch, and the number of places 20. Accommodation at the hotel is extra, but a special rate has been obtained – the hotel has only twin rooms incidentally. The courses are for those who are familiar with colour TV techniques but have little or no knowledge of VCRs.

GRUNDIG'S 2×4 PLUS

A new version of the Grundig 2×4 VCR was on show at the recent Cologne Photokina exhibition. Called the 2×4 Plus, the new machine has the additional features of still picture, slow motion and fast forward with picture. There are three extra push-buttons on the control panel, and the electronics required are incorporated on an extra board. The mother board has been altered to cater for this, so that it's not practical to modify the basic machine. The new model is likely to sell at about £50 extra when released in the UK.

Production of Grundig SVR standard machines has now been phased out.

STATION OPENINGS

The following relay stations are now in operation:

Ainstable (Cumbria) Border Television ch. 42, BBC-2 ch. 45, TV4 ch. 49, BBC-1 ch. 52.

Ashford-in-the-water (Derbyshire) ATV ch. 23, BBC-2 ch. 26, TV4 ch. 29, BBC-1 ch. 33.

Cwmfelinfach (Gwent) TV4 ch. 42, BBC-2 ch. 45, HTV-Wales ch. 48, BBC-Wales ch. 52.
Newton Abbot (Devon) BBC-1 ch. 40, Westward Television ch. 43, BBC-2 ch. 46, TV4 ch. 50.
Strachur (Strathclyde) Scottish Television ch. 23, BBC-2 ch. 26, TV4 ch. 29, BBC-1 ch. 33.

The above transmissions are all vertically polarised.

ZAERIX TAKES OVER MAZDA DISTRIBUTION

Zaerix Electronics (formerly Z and I Aero Services) have acquired from Thorn Brimar Ltd. their Rochester-based Mazda valve and tube marketing and distribution business. Zaerix are now the exclusive licensed distributors of Mazda valves, and have transferred the business to their London headquarters (46 Westbourne Grove, London W2, telephone 01-727 5641). The complete valve stock and testing facilities have been taken over, and Zaerix will be maintaining quality control procedures. The main Thorn tube business is not involved.

VIDEOCASSETTE EXCHANGE

We've had an interesting letter from our Chattanooga correspondent Thomas F. Buchanan Jr, who in the *Letters* column in our August issue offered to exchange videocassettes with readers in other countries. He reports that swaps have already begun, and that letters from anyone anywhere will be welcome so long as they are seriously interested and the swaps technically possible. He's using a Barco 2650 PAL/SECAM/NTSC receiver-monitor and a JVC 3300 PAL VHS recorder, and may add a multistandard VHS machine. PAL colour and monochrome cameras for optical standards conversion (not ideal but workable) are on order, and his NTSC equipment includes recorders in the CV reel, EIAJ reel, ¾in. cassette, VHS and Betamax formats – for those who can play NTSC tapes. The idea is programme exchange only, no payments, and the address 1632 Minnekahda Road, Chattanooga, TN37405, USA.

REMOVING CROSS-COLOUR EFFECTS

The use of a comb filter to separate the chrominance and luminance signals avoids dot crawl and cross-colour effects and enables the full luminance bandwidth to be used. As we mentioned last April, RCA are now using in the States a comb filter employing a special CCD MOSFET i.c. for the purpose in some of their sets. Other US setmakers use a more conventional glass delay line filter for the purpose, and it seems that this feature will be much more common in the 1981 ranges now being announced. While the principle is simple to apply with the NTSC signal, the frequency-offset used with PAL would present difficulties. We understand however that work on the development of decoder chips using digital techniques is in progress. This could eliminate several problems in one go.

CURRENT LIMITING

There's a neat current limiting arrangement in the power supply circuit used in the Rank-Toshiba T24E 90° colour chassis. Fig. 1 shows the series regulator circuit, the current limiting action being provided by Tr804 in conjunction with R812. Tr804 is normally cut off, with 112V at its base and emitter. Excessive current demand however will increase the voltage across R812, thus reducing the voltage at the emitter of Tr804 which then begins to conduct. The regulator transistor Tr801 is thus biased back, reducing the h.t. current. In the event of a serious fault, e.g. an h.t. short-circuit, Tr801 will cut off, the current path then being via

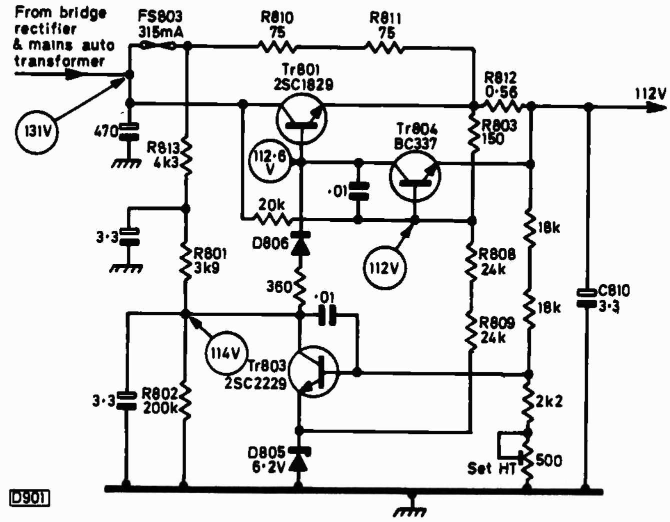


Fig. 1: The series regulator circuit used in the Rank-Toshiba T24E chassis, incorporating current limiting (Tr804/R812).

FS803/R810/R811 only. The fuse blows of course, shutting the power supply down. Similar arrangements have been used before, in Toshiba chassis for a start, but in view of the limited number of extra components required it's surprising that the idea has not been adopted more widely. It's probably not practical for portables, due to the loss of voltage across the sensing resistor.

Note that the regulator also provides "electronic smoothing", since the d.c. output voltage is below the peak-to-peak 100Hz ripple at the input. Hence the small value (3·3μF) of the electrolytic capacitor C810 at the output – it's a decoupler rather than a smoother.

VIDEOGRAPHY

We have received from BioScience (Harbour Estate, Sheerness, Kent ME12 1RZ) details of their interesting BioVideograph BV2 equipment, which is primarily intended as an audio-visual research and training aid. The basic idea is to add a further data channel to an audio-visual programme. This channel, which can handle two separate analogue data signals simultaneously, enables measuring instruments to display analogue data signals relevant to the programme being screened. The measurement signals are recorded with the programme, on the same videotape – using the second audio channel of a U-matic VCR – and are reproduced with correct synchronization.

PROGRAMMABLE TV GAMES ON RENTAL

Radio Rentals are planning to rent a sophisticated programmable TV games system at around £7 a month. This will be on a test marketing basis initially, in London and Birmingham. Since viewers tend to get bored with simple TV games, Radio Rentals feel that these are not really suitable for renting. If the programmable TV games system proves popular with customers, Radio Rentals will follow up with a keyboard and further equipment which will provide a home computer.

BBC's ELECTRONIC CLOCK

The clock seen on BBC-2 is now being produced electronically – the BBC-1 clock is expected to go electronic next year. The new BBC system, designed by Richard Russell of the BBC's Designs Department, does away with the need for cameras, slide scanners and a mechanical clock. The clock is displayed along with a channel identification which is produced by another new piece of BBC equipment, a logo generator. This is primarily intended to produce fixed patterns by reading data from a PROM (programmable read-only memory), but can also be used to produce simple animation by using a microprocessor to make alterations to the data held in a random-access memory. The main problem in designing the clock arose from the fact that when the hands make only a small angle to the horizontal the television line structure breaks up the edge of the hands to form a staircase. This problem has been overcome by feeding the hand signals through analogue processing circuitry which adjusts the rise and fall times of the waveform according to the angle of each hand: the microprocessor used in the system then selects the rise time that gives the best optical effect on the screen.

The BBC have reached agreement with Quantel Ltd. for the latter to incorporate the BBC's "Teletrack" system as an optional part of the Quantel digital production effects equipment. Teletrack allows successive TV fields to be stored so that the trajectory of moving objects in a picture can be displayed against a stationary background.

The BBC's new Television Graphics Microcomputer is to be manufactured under licence by Logica Ltd. This equipment, which is built around a low-cost microprocessor, enables a graphics artist to draw images electronically. These images, in up to 256 colours, are instantly displayed on the screen of a television monitor. The artist doesn't in practice have to draw a complete line – he can mark the two end points and tell the system to join them up with the required thickness. The microcomputer can also be instructed to draw geometric shapes such as circles, parabolae and ellipses. The completed graphic can then be stored on a floppy disc.

NEW FROM PYE

The Pye range now includes the projection TV system we described last month (page 673) – Pye call it the Telerama. Another recent addition is the "Tube Cube", Model 2001. This combines a 9in. TV set, three-band radio, cassette recorder and digital clock with LED display in a compact cube. A similar unit was being shown at the Philips trade exhibition earlier this year.

Letters

THE EMITRON CAMERA

I was interested to see a reference to the original Emitron cameras in Malcolm Burrell's article on "The Great Optical Illusion" exhibition (September issue). Readers may be interested to know that when these cameras were designed in the 1930s a quite different head amplifier was fitted, employing 7-pin British base valves with 0·3A heaters. These were naturally extremely bulky, and only just squeezed into the camera. They were the only valves available at the time with a comparatively low-current heater however, the normal receiver valves having 4V, 1A heaters.

I well remember the l.t. power supplies for the cameras and other units, incorporating 13V, 40A transformers! The original head amplifiers survived the war by a few years, and were replaced by the BBC in the early 1950s. During the refurbishing process, the camera cases were painted hammer grey in place of the original flat pale green finish.

I must agree with Mr. Burrell that the exhibition was fascinating indeed.

H. J. C. Gower, Chief Engineer,
Border Television Ltd.

PROBLEM WITH A METAL BRACKET

In a recent letter I mentioned a servicing problem that drew attention to wire as a possible cause of trouble. This time it's a metal bracket! The problem arose with an ITT set fitted with the CVC20/30 type chassis. Originally the set would get only ITV. You could adjust the tuning potentiometers for 50 per cent of their travel before ITV would go off, then tuning back would give a fleeting glimpse of BBC-1 or BBC-2 before the tuner locked on to ITV again. Not having a lot of time, I first swapped i.f. panels. This wasn't the cause, so a new tuner was fitted, curing the problem. Now on these sets the tuner is held in place by a metal bracket mounted on the chassis. Unfortunately the bracket in the set required four holes in the tuner panel, and the replacement panel had only two. It seemed that the bracket was there only to prevent the tuner falling out in transit, so I thought it would be in order to leave it off.

A few weeks later I had to return to the set because of a complaint of buzz on sound. It transpired that this had started after the previous call. Sure enough, even with the volume turned to minimum a loud buzz could be heard. I first suspected faulty smoothing on the supply line to the sound output stage, but when the chassis was lowered to the down position the buzz diminished. The problem was eventually tracked down to the position of the tuner: if it was held hard against the i.f. panel the buzz vanished. The importance of the mounting bracket now became apparent, its purpose being to keep the tuner up against the i.f. panel. This is also the reason why it's so awkward refitting the i.f. panel. Fortunately I'd kept the bracket at the workshop, so I modified it and refitted it in the set. It just shows that even metal brackets can be there for a reason!

Derek Snelling,
Clayhanger, Brownhills.

ASA HYBRID CTVs

With reference to the article on ASA hybrid CTVs in the September issue, we have on occasion found the no e.h.t. condition to be the result of a leak in the line output valve's screen grid decoupling capacitor C303 (25μF). The associated screen grid feed resistor goes open-circuit, and you may find the fusible h.t. feed resistor R349 open as well. Fairly obvious maybe, but worth noting.

A. Mole,
London W4.

TV LINE SELECTOR UNIT

Faced with the problem of making shading adjustments to a prototype, heat-sensitive CCTV camera we were assessing, we constructed a low-cost triggering unit to allow us to display a single video line or group of lines on an oscilloscope with a simple external trigger input. Your readers might be interested in the details.

The circuit is shown in Fig. 1. Tr1 acts as a sync separator. The field sync pulses are integrated by R1 and C1 and fed via the switching transistor Tr2 to the 555 timer i.c. This acts as a monostable, triggered by the field sync pulses, and generates an output pulse up to 20msec long depending on the setting of R2. The falling edge of this output pulse is used to trigger the oscilloscope display. To

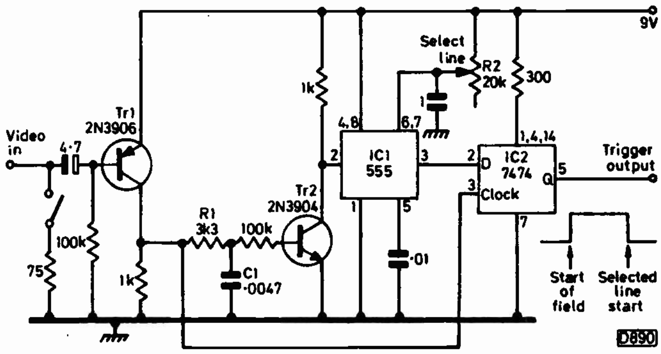
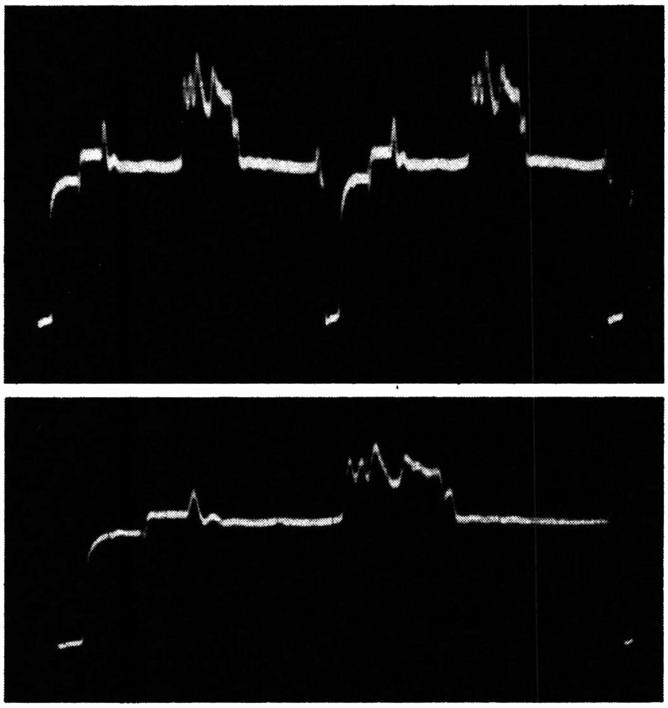


Fig. 1: Circuit of the TV line selector unit.



Photographs showing the results obtained with the unit.

prevent jitter, the 7474 D-type flip-flop IC2 synchronizes the oscilloscope trigger transition with the next line sync pulse – the high-low transition appears at the output of the 7474 when the next line sync pulse appears at its clock input.

The photos, taken with a 4sec exposure, show the excellent stability of the display. The current consumption is typically 30mA, depending on the setting of R2, so the unit can be battery powered. R2 is conveniently a multiturn potentiometer, which can be calibrated directly in line numbers. An output buffer was not found to be necessary for our particular scope (a Cossor 3100).

P. Newman and M. Tierney,
Department of Radiology,
Southern General Hospital, Glasgow.

SAGA OF A GEC HYBRID CTV

The following is the saga of an ageing GEC hybrid colour set. The customer lifted the enormous thing on to the bench and reported that the fault was only a minor one. Strange how these are the ones that burn the midnight oil. "There's no colour" he said, "but it can't be a major fault because when the station selector is adjusted there's colour all over the place. Oh, and the picture keeps levitating." With that he departed, leaving me to ponder over the fault description.

Once the set had warmed up, there was a good, though rolling, monochrome picture and plenty of audio from the speaker. Mistuning the set produced traces of colour. This led me to suspect that there was maybe an i.f. bandwidth fault, so I decided to check around the i.f. stages. In the process I carelessly knocked the a.g.c. preset P100 – restoring full colour. There was still a sync problem however, with both the field and line hold controls as critical to set as a two-legged stool. No faults could be found in the a.g.c. circuit, so P100 was set up as per the manual and attention turned to the sync circuit. The sync separator transistor TR109 and the preceding emitter-follower transistor TR108 were checked in circuit but read o.k. The coupling electrolytic was replaced, and the resistors in the circuit checked. The sync separator's collector resistors R500/1 are over on the timebase panel. They often change value and sure enough looked cooked up. They were confidently changed therefore and we thought that's it. Still no sync however. Panic! There just isn't anything else here however, so I decided to check TR109 out of circuit. It read perfectly of course, but having taken it out of circuit we decided to fit a new one. This time success. Meters can be liars it seems.

I then examined the picture. The brightness was found to be set at maximum, and the colour lacked "strength". I must have upset the beast however, because at that point the picture went off. The line timebase was still whistling away at me, so suspicion fell upon the tube base or the luminance output panel. Tapping the latter restored the picture, and the suspected dry-joint was not too difficult to find. The BC148 flyback blanking transistor had been replaced with a BC108 by a previous "engineer". It's electrically the same of course, but not very efficient when only two of the leads are soldered to the board. How it had managed to work up till then I can't imagine. So we soldered it up correctly, and changed R416 (18kΩ) which feeds the screen grids of the three PCL84s – it was but a charred image of its former self and had dropped in value somewhat.

There was still a brightness problem, and the colour wasn't right. In went three PCL84s as the old ones were probably soft, and a PL802/T went in the PL802 position. The result was a considerably better picture, though while trying to locate the back retaining screws I noticed that any bright captions produced a band of green across the screen. We'd replaced the valves on the output panel, so we next did the same with the electrolytics. Fault still present. The l.t. electrolytic block was suspect, but replacing this produced no improvement either (I should have known, as the whole chassis has to be removed to get at it). What next? Checked for a low resistance leak on the output board and the tube base, but nothing doing. Decide to leave it till the following day.

At switch on the next morning there was a large corona noise. Switch off quick. The 300pF fifth harmonic tuning capacitor C53 didn't look at all well. Replace and examine the picture. My eyes must have been tired the night before, because there was a noticeable green outline to the figures present. The overall convergence wasn't far out, so tube problems were suspected. Out came the trusted tube tester and, oh dear . . .

At this point the customer returned. Impressed with the stable, colourful picture, but not quite so happy when he heard about the tube being on its way out. I told him he was lucky to have got eight years' daily use from it – a couple of years better than average. But it wasn't much consolation, especially when he was presented with the repair charge . . .

J. W. Cheshire,
Sutton Coldfield.

Ben's Waterloo

Les Lawry-Johns

I HAVE to record an event which no doubt has a moral to it. I don't know what the moral is mind you, but it must have one somewhere.

As you probably know, we have a dog named Ben, who is a rough coated collie. Some of the kids who do not know us well call him Lassie, but Ben is not too keen on this.

Again, as you probably know, we have a cat named Spock, who is of dubious parentage but somewhere way back a Siamese must have had a hand in it because although she looks a typical tabby her paws seem to be more cushioned than most and she never seems to stop talking. If no one else is around she will talk to Ben, and use his extremely long nose as a rubbing post to give herself the comfort she seems to regard as her right at all times.

Now Ben has had an upset stomach for some time, so I suppose he wasn't feeling too good. Anyway after putting up with all this purring and rubbing at his expense he suddenly snapped at Spock who gave a yell and vanished from sight. I witnessed this almost unprovoked assault and lost my temper with Ben. I threw the front door open and threw Ben out on to the street. "Go and don't return" I bawled. Ben slunk away, and I slammed the door and locked it – it being early evening and the business of the day over.

"What was all that about?" asked honey bunch, making a belated appearance on the scene.

"Ben attacked Spock. She's gone and so is he. I will not tolerate violence . . . er, in animals that is."

She immediately opened the door of course and looked up and down for Ben who was nowhere to be seen. By this time I was feeling sorry for what I had done and a bit ashamed. So we got the car out and went in search. We sought him here, we sought him there, up hill and down dale, only pausing to take brief refreshment from time to time. At last, footsore and weary, we made tracks for home. At 11pm, as we slowed at the final corner, the local pub called the Waterloo was turning out. And there, coming out of the saloon bar and exchanging goodnights with the regulars, was Ben. We stopped and opened the rear door for Ben to jump in, as though we were a taxi he'd ordered. When Ben entered the shop, Spock rubbed her nose round his face. Peace was restored.

The Heavy Portable

A couple of years (or so) back we sold a small portable to a middle aged couple. It was a Marconi Model 4816 (Thorn 1590 chassis), so it weighed only a few pounds. The other day the husband popped in to say that it had gone wrong and would I call to fix it. I suggested he brought it in, but he said that as they hadn't a car it would be far too heavy to carry.

So I called at their house and inspected the set, which had blown its l.t. fuse. There was some discolouration around the sound output stage, and the wiper of the small preset that sets the output stage bias was missing. I asked if the set had been dropped? "Well not exactly, my brother-in-law caught his foot in the mains lead and pulled it off the table."

I didn't have with me the transistors required or the preset, so I picked the set up and was about to depart when his wife returned from the town carrying the shopping. A very small slight woman, she was carrying two enormous bags that were crammed full. They must have weighed at least twice as much as the portable. "I normally go shopping with her to carry the bags, but as you were coming I stayed in" he explained.

Incidentally, if you have a battle with the audio output transistors and are not sure of the setting of the bias preset (R70, sets with silicon audio transistors), turn it anticlockwise to drive the associated bias transistor (VT27) fully on, thus decreasing the resistance between the bases of the two output transistors – or hook a fixed resistor of 22Ω between the bases until the bias transistor has been sorted out. The fixed resistor may save another pair of output transistors if there's something wrong with the preset or the bias transistor.

The French Connection

Having picked up the portable, I had to make another visit in response to a phone call I had had from a female with a delicious French accent. "My television he has gone." So we arrived at the house and the accent proved to be matched by its owner. Long dark hair, dancing blue eyes and a figure that a man he could enjoy.

"You have come to bring my television back, no? I am so lonely without it. My husband he is away on the North Sea looking after Scottish fishermen as none of them can swim, no?"

I didn't quite understand this, but who was I to argue?

The set was a Decca Bradford (30 series) with the PL509 line output valve running red hot. I thought you'd rather hear about the set than the French lady, no?

There was at least 40V negative drive at the PL509's control grid, so the oscillator was clearly o.k. We next unhooked the tripler but the overheating continued apace. The capacitors proved to be innocent, but the transformer was warm to touch.

"Come and feel this" I invited her, and she did. "Ooh La La, it is a hot one is it not?" "You need a new one. This one is worn out" I told her convincingly. "You can put one in for me, yes?"

As it happened I was able to do so. For once I was carrying a Bradford line output transformer.

Troubles with a Deccola

There was only one outside call the next day – to see a set that was far too heavy to move unless it was really necessary. Again it was a Decca, but this time an audio suite about the size of a large sideboard – with a bow front.

Some years ago I'd replaced the original Garrard idler-wheel playing deck with a belt driven unit to bring it up to date, but I'd kept the amplifiers etc. just as they were – the response was really good and a joy to listen to. And so it should have been with its four EL34 output valves and fourteen loudspeakers (two woofers and the rest small units in rows at either side to get the maximum distribution).

The complaint was that radio was low on one channel but normal on the other, whilst on records there was nothing on one channel with the output low on the same channel as the radio. We decided to concentrate on the good channel on radio first, and find out where the gram input went. It didn't take long to find that both channels where normal up to the ADC cartridge head, and that this was simply not contacting on one pair of the bow springs. This was put right quickly enough, and the full splendour of the record playing side then burst out from the same side that was normal on radio.

The low output on the other channel finally proved to be a high resistor on an 8D8 valve base, and both channels now rocked the house. The final complaint was that the green area of the tuning indicator could not be seen properly. We thought that this would be due to another high resistor, to the target of the "magic eye", but when we removed the tuner unit from its shelf we found that the resistors were of the correct value, the general illumination being poor due to the EM80 feeling its age and the fact that the window was murky. Cleaning the glass on the inside made quite a difference, and replacement of the indicator was delayed for another time (when I find one).

Incidentally the owner of this large, ornate bungalow had had some trouble with the flat roof a while back. He was advised that the complete answer was to cover it with copper sheeting, which he had done at no small expense.

"Les. There seems to be something wrong with our radio reception."

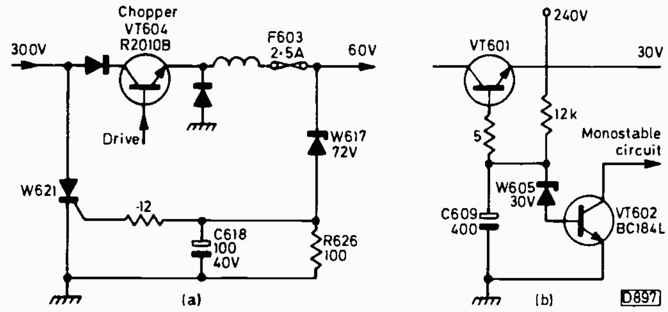


Fig. 1: Features of the power supply used in the Thorn 3000/3500 chassis. (a) The chopper and over-voltage crowbar trip circuit. If the chopper's output rises above 72V, zener diode W617 conducts, firing W621 which in turn operates the cut-out or mains fuse (early models). For some reason the crowbar thyristor was missing in the set that blew C618. (b) The 30V stabiliser circuit. The 30V reference zener diode W605 is connected to the base of the delay switch transistor VT602 instead of directly to chassis. The idea is that VT602 remains off until the 30V supply has been established. Since VT602 is in series with the emitter of one of the transistors in the monostable circuit that provides the drive to the chopper, the chopper doesn't come into operation either until the 30V supply has appeared. If VT602 goes short-circuit or leaky, the delay feature will be overridden. If W605 goes open-circuit, the series stabiliser transistor VT601 will be biased hard on by the 12kΩ resistor connected between its base and the 240V line. The stabiliser won't stabilise therefore, and the 30V rail will be at something like 40V.

Don't Panic: Run for your Life

It was an ordinary Thorn 3500, nothing to worry about. After all, if you don't know 3500s by now what do you know? One of the things I knew was that it was too big for one person to handle, and that the owner had fallen off his moped and injured his back so he couldn't help lift it. His wife has nasty arthritis so she couldn't help either. So the set had to be done on the spot, and there was no reason why it shouldn't.

"It went bang and smoke came up." Inspection of the power unit showed that F603 had blown and that C618 (100μF) in the over-voltage crowbar trip circuit (see Fig. 1) had exploded. R626 was also blackened and measured only 30Ω instead of the 100Ω shown in our manual, which happened to be for the 3000 chassis because we'd lent our 3500 manual to someone a few days earlier and it hadn't been returned (it still hasn't) and we'd forgotten to whom we'd lent it. For some reason or another, the crowbar thyristor itself (W621) had not been fitted.

The fact that a high voltage had appeared across C618/R626 meant either that the 72V voltage sensing zener diode W617 was short-circuit or that the chopper transistor's output voltage had risen above 72V. A meter check showed that W617 was short-circuit. Time to consider fitting the spare panel. Spare panel awaiting repair following previous day's panic.

Press on, it can't be that bad: we've all the necessary bits in the box, and with our brilliant diagnostic ability have nothing to fear. First check the chopper transistor VT604, just in case. Chopper dead short. Our eyes narrowed, and as they were already squinting we couldn't see at all . . .

Fit new chopper transistor, new 72V zener diode, new electrolytic and . . . no 100Ω resistor. Fit two 220Ω resistors in parallel and blow the consequences. Wind presets down just in case and switch on.

The set came on and looked good. But the chopper's output was 70V with the presets wound down, and any movement of them only sent the voltage higher (not by a lot, or the 72V zener would have started zenering). My mind started to go completely blank, and the brilliant diagnostic ability waned – as it always does when challenged.

Decide to check the 30V rail – see Fig. 1(b). Over 40V. Switch off and check 30V stabiliser transistor VT601. In order as far as an npn transistor should be. Check 30V reference zener W605. Open-circuit.

At this point I became a blubbering wreck. With W605 open-circuit, VT602 should be switched off, making the monostable circuit inoperative. So the chopper shouldn't be chopping since it shouldn't have any drive.

Steady on. The chopper is chopping, though VT602 is not being switched on. It must be leaky or something. Search for a BC184. Find a BC148. It'll have to do. Fit it and new 30V zener. 30V line now 30V and 60V line 50V. Wind it up to 60V and check picture. O.K. except for the need to make a few routine adjustments.

Rush home and tell honey dew about the awful time I've had.

"The radio in the kitchen keeps going off. Either you fix it or I take one out of the window."

Video Camera

Part 2

Malcolm Burrell

AN extremely high-gain, wideband low-noise amplifier is required to bring the video signal obtained from the vidicon tube up to a usable level. The first stage consists of an n-channel junction field-effect transistor (Tr1), which is d.c. coupled to the following pnp transistor (Tr2). Screening of this head amplifier is essential to prevent stray r.f. pickup.

The head amplifier's output is d.c. coupled to a TBA500 luminance signal processing i.c. which provides the rest of the video amplification. The final i.c. in the video section, IC2 (CA3046), is a transistor array used as an inverter and an emitter-follower, with sync/blanking/video signal mixing and a final emitter-follower output stage.

The signal mixing is rather crudely carried out, with diodes used to switch between the video and sync. The result is a 1V video signal plus a large amplitude sync pulse (about 0·75V) which, though non-standard, is adequate for a simple unit such as this. The separate vision mixer unit to be described in a later article provides more elaborate signal processing: its output circuit could have been incorporated to give the standard 7:3 vision/sync ratio, though this would have involved extra complexity in the camera. Due to the lack of d.c. restoration, some streaking can occur on "contrasty" scenes, but this should not be too much of a problem.

Vidicon Blanking

Most readers will be all too familiar with flyback blanking problems: lack of line flyback suppression in a TV set usually produces a bright, vertical foldover at the left-hand side of the screen, while lack of field flyback blanking gives rise to random sloping white lines that are usually more noticeable on dark scenes. The vidicon also needs flyback suppression, and since its output is negative-going a fault here will produce black flyback lines that are noticeable mainly on light scenes. Vidicon blanking is achieved by using one of the transistors in IC2. The action was described last month.

Field Timbase

The TDA1170 i.c. forms a compact field timebase,

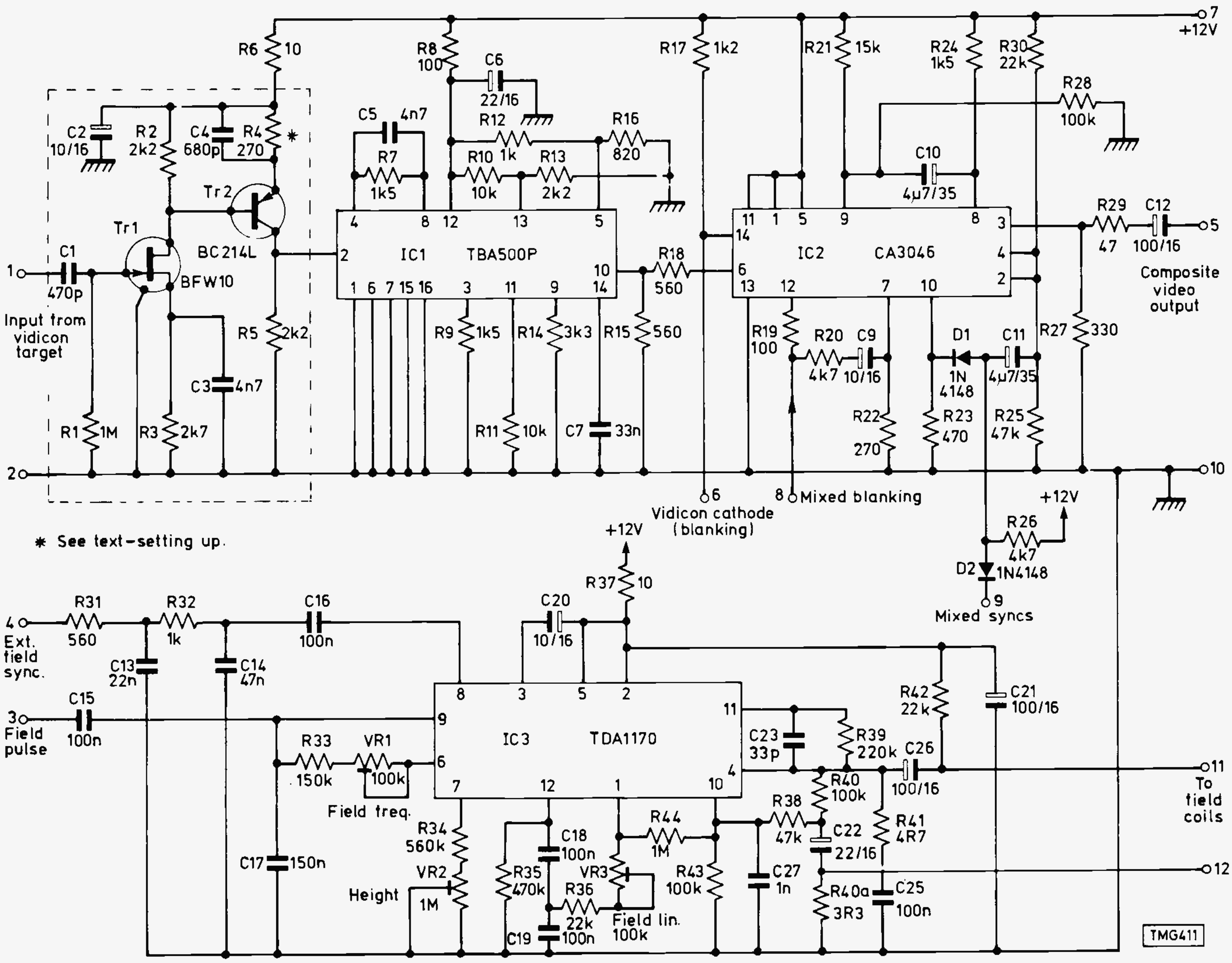


Fig. 4: Circuitry on the video/field timebase board.

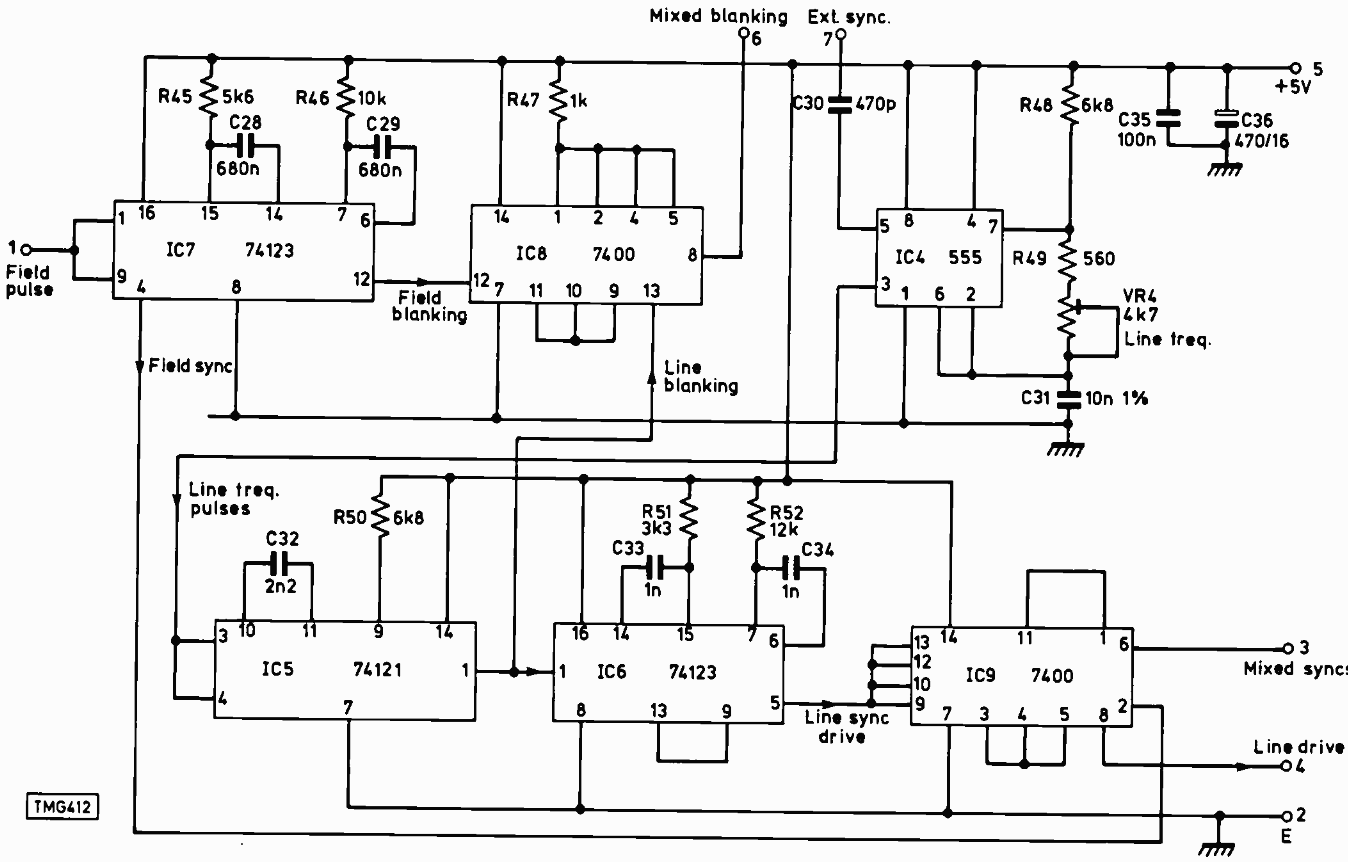


Fig. 5: Circuitry on the pulse generator board.

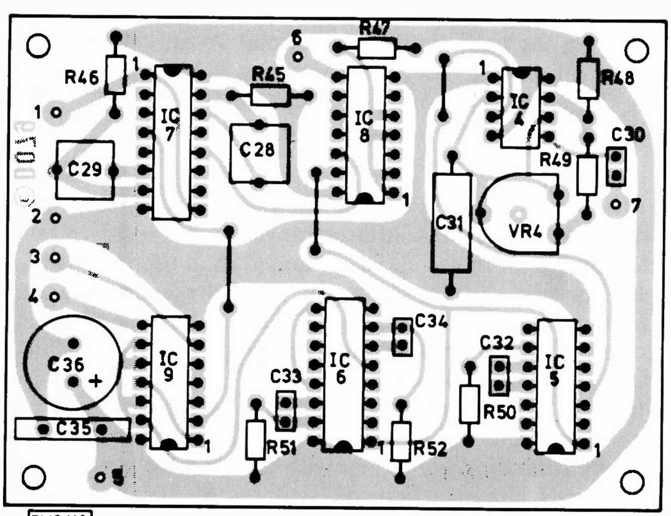


Fig. 6: Component layout, pulse generator board.

containing an oscillator, sawtooth generator and deflection output stage. VR1 sets the field frequency, VR2 the height and VR3 the field linearity. Under normal conditions, a sawtooth of about 6V peak-to-peak is developed across the field scan coils.

Pulse Generator Section

The sync/blanking and line drive pulse generator comprises IC4-9. It's a simple, random-interlace system, but provision is included for applying external sync pulses. If a ZNA134 sync pulse generator is used to provide these, a fully interlaced raster is obtained.

Within the camera, pulses are tapped from the field oscillator (from pin 9 of the TDA1170) and coupled to a dual-monostable i.c. (IC7) in the s.p.g. section. This i.c. produces the vertical blanking (pin 12) and field sync (pin 4) pulses.

The 555 timer i.c. (IC4) forms the basic line oscillator, with the frequency set by VR4. External sync can be applied to pin 5. The output, taken from pin 3, goes to the monostable IC5 which produces broad line blanking pulses at pin 1. These go two ways, to pin 13 of IC8, which combines the line and field blanking pulses, and to pin 1 of IC6.

The combined line/field blanking output from pin 8 of IC8 is taken to the vidicon blanking transistor in IC2 and also to the video/blanking mixer section of this i.c.

The dual-monostable IC6 produces the front porch delay for the line sync pulse, then the line sync/drive pulse itself. This appears at pin 5, and is fed to the quad NAND gate IC9. The latter drives the line output and h.t. generator transistors from pin 8, and also combines the field (fed in at pin 2) and line sync pulses, providing a mixed sync waveform at pin 6. The mixed syncs go via D2 on the video/field timebase board to IC2.

External field sync can be applied to pin 8 of the TDA1170 i.c. The field sync pulses are double integrated by R31/C13 and R32/C14, giving very rigid field lock.

As will by now be clear, when used alone the camera produces random interlace sync with a single broad field sync pulse. The latter may cause slight line hooking at the top of the picture on some TV sets.

Focus Circuit

A focus coil wound outside the deflection coils provides a powerful focus field for the tube. The constant-current transistor Tr3 drives this coil, the focus potentiometer in its base circuit giving adjustment of the focus current over the range 90-120mA.

VCR Clinic

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

As Mr. Lousy-Jones (sorry Les, but you did say it yourself!) often points out, it's very easy to be led astray. More so with VCRs perhaps than with TV sets. Take the JVC HR3330 which came in recently with an intermittent colour fault. Now my new test tape is, um, cleaner than the previous one, following complaints from "she who must be obeyed". It's a recording of The Blob, starring Steve McQueen, and anyway I like it. So we inserted this in the HR3330 and left it running. Some time later, just as The Blob was rampaging through a cinema, absorbing the audience, the colour started to break up. The visual effect was a red pulsating blob with horizontal blue flashes in it. The break up continued up to the point where the power lines were dropped on poor old Blobby. This came up in monochrome, with occasional blue horizontal flashes.

As readers of recent VCR fault articles in these pages should by now know, loss of colour is often due to something amiss in the phase-locked loop that produces the signal (well, one of them) for the frequency converter stage in the colour replay circuitry. This loop is synchronised by line sync pulses, and I'd already mentally diagnosed some sort of problem in this area. It turned out that this was correct – but for the wrong reason. As luck would have it, I was busy carrying out a receiver/monitor conversion at the time, so the HR3330 was left running in monochrome. Subsequently the whole picture broke up into horizontal lines, which is the symptom of the servo going out of lock.

The drum servo was later checked, though to no avail save to confirm that it was running fast, out of the locked condition. There didn't seem to be any particular reason for the servo fault, but I did find that lock was restored if the recorder was left to cool for a while. As a result I decided to squirt the servo i.c. (IC5) with freezer – it runs fairly warm. The effect was spectacular: lock was restored, and so was the colour. So IC5 was changed and the fault cleared.

The point of this little story is that had I not been so busy I'd had to leave the VCR running, I could well have spent a few hours chasing a non-existent colour fault. So you say, why did the colour go off first, leaving the picture stable? Well, the servo can run fast and still stay in lock. The timing of the line pulse and the frequency of the local replay colour carrier on the other hand had increased gradually but to such an extent that the phase correction and colour-killer circuits could no longer cope with the massive error.

Saga of a Philips N1502

The following tale is about a Philips N1502 that almost drove me to drink. The fault was very intermittent you see, but as the machine belonged to a school it had to be sorted out. The problem was that if the machine was left to carry out a timer recording it would sometimes fail to do so, though it usually behaved correctly.

Extensive running of the machine in the timer recording mode revealed that when the problem arose the forward/record keys would release just after the switch on time, the recorder then switching off again. The user would thus come back to find the keys released and no recording made. There was no problem with manual operation.

Our first thoughts were that the timer i.c. was faulty or that there were plug and socket problems. Both these possibilities were checked, but no problems were discovered.

The bare bones of the control circuit are shown in Fig. 1. You can see that the timer start switch earths one end of relay coil RE101 via the forward key SK202. Manual operation using the start key does the same thing. Monitoring the voltage at RE101 with the forward key pressed showed 12V which dropped to 0V when the timer operated. Under the fault condition however this 0V went straight back to 12V as the forward key released. Why? Believe me, it took many hours of investigation over a week or more to track down the real cause.

The forward and record keys are released by a solenoid which is driven by the monostable circuit TS113/4. Unfortunately this monostable is triggered by several sources. So my first aim was to isolate the source that was triggering this key release monostable under the fault condition – by disconnecting each in turn and running the recorder to see whether the fault then cleared. The difficulty was in deciding how long to run the machine on timer starts before it could be assumed that the fault had been cleared. The sources are:

(1) From the head and tape protection circuits via TS112.
(2) From the two-minute delay circuit, again via TS112, to switch off the machine if no keys are pressed.
(3) The mains failure protection circuits.
(4) The 45sec tape contact inhibitor circuit.
(5) Power supply, noise, etc.

Disconnecting D121 would eliminate several possibilities, so this was tried first. After some hours of repetitive timer starts the fault returned. So (1) and (2) had been eliminated. Next one end of C117 and of R137 were disconnected. Back come the fault some hours later. Over the following couple of days, in between other little jobs, R151 was lifted. Again the fault returned – eventually. This left only the path via C121. When this capacitor had been removed the fault stayed away, though it took a long time to be sure of this.

By this time I'd got fed up with resetting the keys and the timer, so I jammed the keys' switches SK201 and SK202 with a pair of inserts found attached to the servo board, next to the switches. Handy for the job they were. C121 was then reconnected, and the fault was back with us again. This time it was more regular, and even reset the keys if they were pressed and manual start was used. So I could start trying to trace the cause of the problem without having to keep resetting the timer.

It was now time to get out the trusty scope and check through the 45sec timer circuit. TS120 is normally forward biased via R148, and is thus turned "on". C118 is held discharged via D118 and SK202. When the recorder is started and the forward key pressed, reverse bias is applied to D118 so that C118 charges via R140. After about 45sec, TS117 turns on. So do TS118/9, with the result that TS120 turns off, its collector voltage rising to about 30V. Under these conditions, if the tape contact on the head drum assembly is shorted by the tape's stop foil TS120's collector voltage drops to zero. This negative-going transition switches TS113 on, and the keys are released.

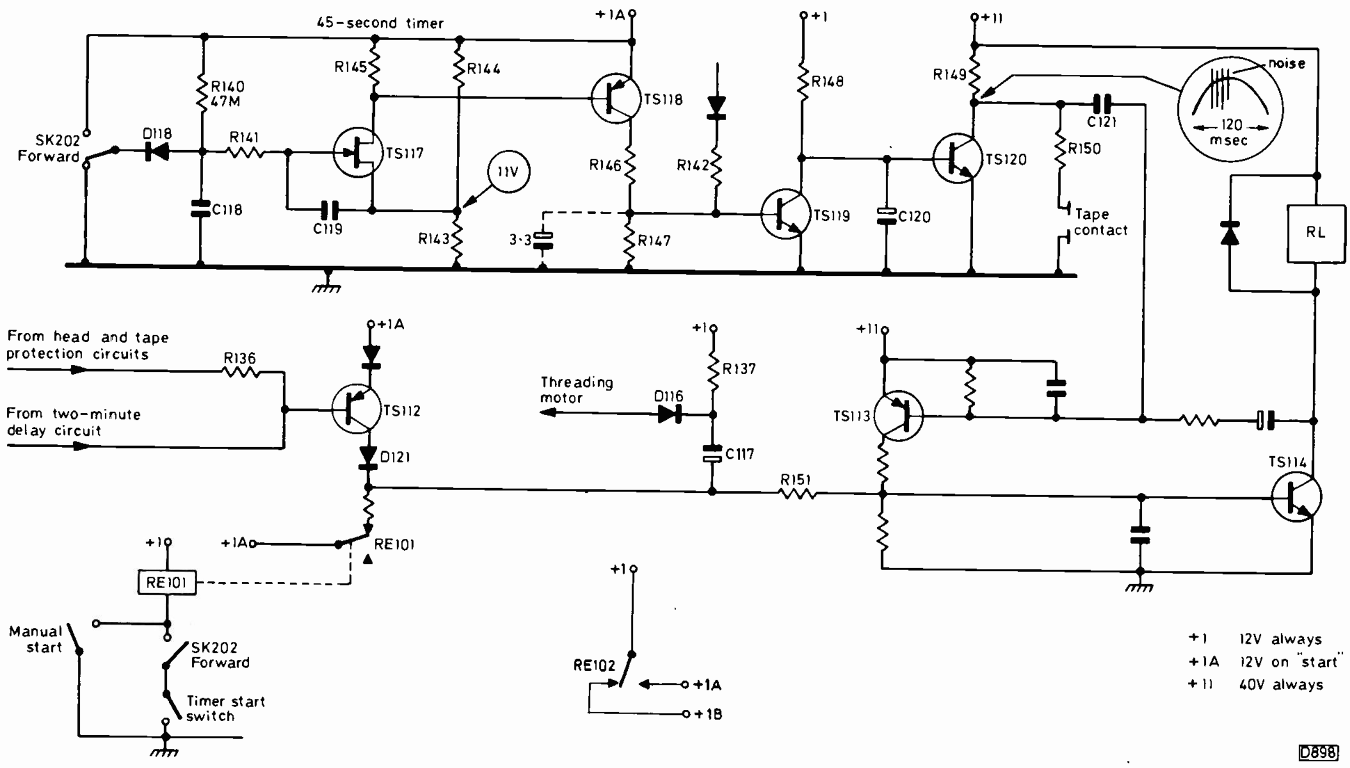


Fig. 1: Part of the control circuitry used in the Philips Model N1502. RL releases the keys.

O.K., so what's going wrong here? Rather a lot of patient investigation revealed the presence of a positive pulse, rounded and of some 120msec duration, at the collector of TS120. At a random point on this lump, as I shall call it, TS113 would suddenly switch on. What was causing the lump, and why did it trigger the monostable – half way through its period at that? Another thing I noticed was that if SK201 and SK202 were operated by the keys instead of the small inserts, the lump was not present on manual operation and only sometimes occurred on timer operation. For timer operation I was setting the timer to start in three minutes, with the forward and record keys pressed.

Now the +1A supply is not present until the machine operates. So I triggered the scope off the +1A supply, monitored the collector of TS120 on one channel and used the other channel for checking back. This was what I discovered.

The lump occurred because TS119 switched on and off very briefly. Nothing could be seen at the bases of TS118 and TS119, due to base-emitter zener action, and surprisingly nothing much could be seen at the collector of TS118 either. Let's consider the circuit action. To start with, there's no +1A supply and all the capacitors are discharged. Next apply +1A. The junction of R144, R143 and C119 goes to 12V. C119 charges, and for a brief period TS117 conducts. So do TS118 and TS119. There's our lump! This was proved by removing C119. TS117 is normally biased off, switching on only when C118 charges. TS117 will also conduct as C119 charges however.

With C119 removed, noise spikes could be seen. We could now understand the reason for the monostable being triggered. TS120's collector goes high for a brief period, and should any negative-going spikes occur during this period TS113 will switch on. The noise spikes were due to contact bounce in RE102, and the threading motor.

Perfectly reliable operation was obtained with C119 removed, but I replaced it and added a $3{\cdot}3\mu$ F electrolytic across R147. This capacitor prevents TS119 switching on during the brief period when TS117 does as C119 charges, and again reliable operation was obtained.

The remaining questions were why the problem didn't occur during manual operation and why more N1502s don't suffer from the same problem! It's worth pointing out that when monitored under normal timer start conditions there was usually no pulse at the collector of TS120, and that when it did appear it was small and short. The operation of the release monostable reset the keys, releasing RE101 and RE102. The +1A supply was thus removed, shortening the pulse. Under these conditions the pulse duration is around 30-50msec. Try finding an intermittent fault when you've only 50msec! Other N1502s? Well, since stumbling on this little problem we've found others that suffer from the same difficulty, and have responded to the same treatment.

Damage to Tapes

Here's another one that caused rather more trouble than usual. The machine was a JVC HR3660, which arrived with the complaint of tearing tapes or general damage to tapes. Nothing obvious was found, so the guides and drive mechanics were cleaned. The machine was then used for several recordings and replays as a more thorough check, but nothing seemed to be amiss.

It came to pass some time later that when a recording made on the machine was played back on an HR3330 there was some kind of problem. Every minute or so the replayed picture swayed from side to side, indicating a servo disturbance. The tape was next rechecked on the HR3660. At the points noted the picture was stable, but a small, instant change in audio pitch was noticed. The servo disturbance always occurred at the same places in the replayed tape, so the correct diagnosis made was that the disturbance was being recorded by the HR3660. Note that the HR3660 has fast-forward replay and slow-motion facilities, and has a very fast capstan servo lock up time.

As the disturbance was being recorded, the capstan servo was monitored in the record mode – see Fig. 2(a). The servo uses a crystal-controlled 32kHz oscillator to provide the reference signal. The 32kHz is counted down to 21Hz (48msec), from which a ramp or trapezoidal waveform is derived. The capstan speed is monitored by a printed circuit coil which is mounted within the field of a rotating ring magnet on the capstan flywheel. This coil produces a 126Hz signal which is amplified and limited to provide a squarewave. When the latter is divided by six, the result is 21Hz. This is shaped to provide a short pulse for sampling the ramp. The sampled ramp voltage is then stored in a capacitor, buffered and used to control the drive to the capstan motor. The replay servo – see Fig. 2(b) – is similar, but this time the reference signal is 25Hz (40msec). It comes from the same oscillator, after division by 128 instead of 152. For tracking purposes, the sample pulse from the control track is taken via a monostable circuit.

A check in the record mode showed that there was a dip in the motor voltage every 50-90 seconds or so – not regular. There were no changes when a standard tape was being replayed. What was causing this dip? The voltage across the storage capacitor was monitored, using a high-impedance scope input to prevent loading. No change in the position of the pulse on the ramp could be seen however. Retire for coffee and a rest.

After this we had another look at the pulse position, using one beam for this purpose while the other was used to monitor the sample and hold. This made it possible to see that the pulse would sometimes, without warning, arrive early, sample the ramp at 0V, and then return to normal. This was the cause of the capstan motor instantly slowing down. Why hadn't this been seen earlier? Well, it was a single error occurring on average once every 80 seconds, i.e. once in every 1,600 times – and you don't find that in a hurry!

Further comparisons between the sampled ramp (at TP6) and the 126Hz squarewave showed that a miscount was occurring in the divide-by-six counter, and that when the error occurred the ramp was sampled one count too soon. Since most of the servo circuitry is in IC4, it seemed at the time a good idea to change this. Wrong again!

A subsequent check on the 126Hz signal from the pickup coil suggested that it could be of low amplitude. I measured 5mV p-p, the manual says 0·05V, but you never can be sure... There was another HR3660 awaiting attention however, so a check was made on this one. The result was 10mV p-p.

I decided to increase the output from the pickup coil by moving it nearer to the magnet and flywheel, but there was unfortunately no adjustment. Everything was permanently fixed – or was it? Time for crowbar techniques.

The flywheel was removed, put in a vice and the shaft tapped using a piece of wood as a buffer, thus lowering the flywheel on the shaft so that it was nearer the pickup coil. After a couple of gentle goes the output from the coil was raised to a healthy 40mV p-p. This restored normal operation.

Tap, Tap Again!

We had a somewhat similar problem with another HR3660. The note that accompanied it said "no power". How wrong! A tape was tried on the machine, which sometimes threaded up and immediately unthreaded again and sometimes did nothing at all.

Having managed to persuade it to operate by inhibiting the stop solenoid, I had a look around the electronics on the servo board. Result: no head switching waveform. The two monostables that produce this waveform were dormant, due to the fact that there were no PG pulses to trigger them. These pulses come from a pickup head which responds to two little magnets mounted on the head drum flywheel.

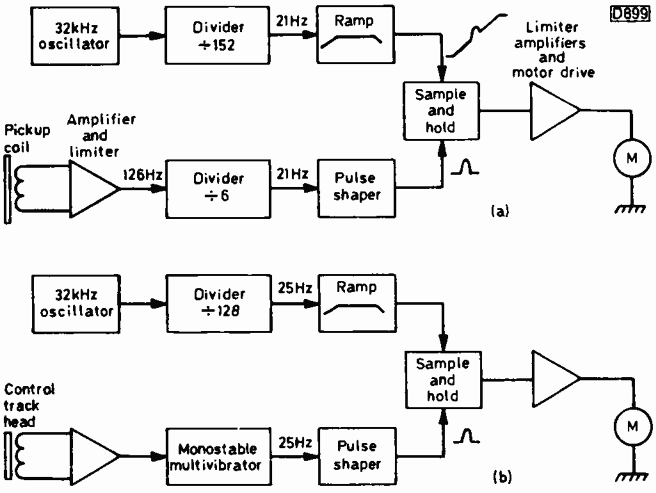


Fig. 2: Block diagrams of the capstan servo system, JVC Model HR3660. (a) Operation on record, (b) playback operation.

I looked at the flywheel, which seemed to be too far away from the fixed pickup head. Well, only a slight shift in the flywheel position should put that right. So I loosened an Allen screw and pushed. Oh dear, the whole head assembly moved – there was about 3mm play in the drum assembly. Anyway, we removed the flywheel, a static discharge bush and brushes (see Fig. 3). It appeared that the lower spacer bearing was missing, as there was a gap of about 3mm where there shouldn't be one. So a letter was sent to JVC pointing out that a spacer bearing was missing. They sent me one along with a letter saying that it couldn't be missing since the recorder wouldn't operate. That was true, it didn't. So I set about putting this new bearing in: removed all the bits and pieces again, then withdrew the video head assembly and shaft from above. I then discovered the truth.

The shaft is supported by two bearings, an upper and lower one. The lower one, which should have been flush with the bottom of the lower drum cylinder, was about 3mm out of place inside the cylinder. It was thus necessary either to move the lower bearing down, or to remove it and fit the new one. Now it came to pass that bearings in cylinders do not move easily, so a small screwdriver went down through the centre of the upper bearing on to the side of the lower bearing. Tap tap with the hammer and the lower bearing popped out – damaged of course.

The new bearing was fitted, very carefully, using a flat piece of wood to keep it level and ensure that it ended up flush and undamaged. Reassemble everything and back came the pulses, whose level was then adjusted with the appropriate preset, restoring normal operation.

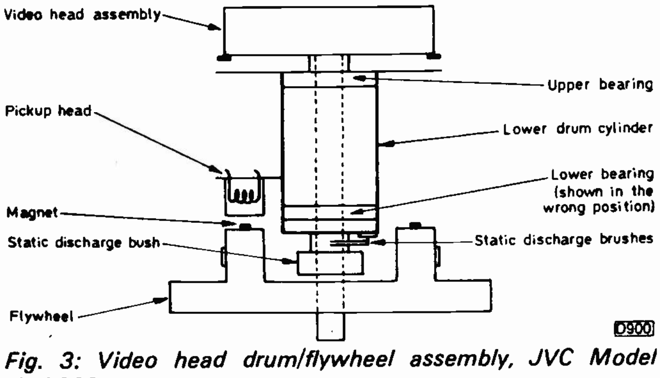


Fig. 3: Video head drum/flywheel assembly, JVC Model HR3660.

JVC have since pointed out that the phosophor bronze static discharge brush is very critically fitted on to the lower drum assembly, and should not be removed unless absolutely necessary. It's fitted under special conditions (using a specific force) which cannot easily be duplicated.

Incidentally these last few items shouldn't be thought of as being in any way typical of day-to-day VCR servicing problems. The thing is that various organisations send me machines that require rather careful consideration. Such problems do however help in illustrating various aspects of VCR operation.

Miscellany

Small failures can still cause a lot of frustration. Take for example the National NV8600 I once had. Though powered, there was no response to any of the keys – the cause being failure of the bulb in the cassette compartment. A similar problem arises with JVC/Ferguson/Akai machines: if the play key ejects when pressed, check the bulb before delving into the system control.

Picture wobble from side to side can be caused by several things – a long time-constant filter in the receiver's flywheel sync circuit, or a faulty servo motor or servo time-constant in the VCR. The latter turned out to be the trouble with an HR3660. After the usual checks on the motors, servo i.c. etc. the fault was eventually traced to the 10μF tantalum capacitor C43 in the drum servo circuit. It's in series with a 68kΩ resistor, providing a time-constant between the servo sample and hold circuit in IC4 and the motor drive preamplifier i.c. (IC5).

The problem with another HR3660 was intermittent poor replay, showing as black streaking on whites and multiple reflections (or ghosting) to the right of all verticals. When the fault was present, the f.m. replay signal was found to be low, with ragged edges. The latter indicated the presence of large quantities of high-frequency signal components. The culprit this time was a dry-joint on R54 in the replay equalisation network on the record/playback p.c.b.

Another recent problem concerned a Ferguson VCR. The customer had complained of difficulty in operating it, and sure enough if the machine was switched to play it would thread up and then unthread again – unless the operate switch was flicked to the timer position and back again that is. It was soon found that unless the power was removed by operating the mains on/off switch the drum and capstan motors were running continuously. In fact there was no motor control signal to the servos from the system control i.c., which had failed, and consequently nothing to switch the servo motor drive stages off in the stand-by mode.

One of my own customers purchased a power lead to enable him to run his portable VCR and GX77 colour camera from his car battery. He checked the battery polarity carefully, found that the negative side was earthed and assumed that all was o.k. When he plugged in however there was a bang and the 5A fuse in the lead was mutilated. The VCR was o.k., but the 800mA fuse in the camera had blown. Fortunately that was all, but why had everything blown in the first case? The car was a Simca model with a moulded plastic fascia, and at some time in the past this had been removed and the connections to the cigarette lighter reversed.

A warning to round off this little miscellany. There are some cheap, blank VHS tapes on the market: they seem to be noisy and very abrasive (in fact JVC issued an official warning about them recently).

next month in TELEVISION

● SMALL-SCREEN MONITOR

Our monochrome portable project earlier this year produced many requests for a monitor version. We considered an add-on unit, but decided to rearrange the design instead, though keeping many of the features of the original receiver. The result is a very compact, high-quality monitor which is both inexpensive and easy to build. With the exception of the mains transformer, front panel controls and c.r.t. base board, all the components are mounted on a single printed board measuring only 6½ × 5¼in. A 12in. tube was used in the prototype, but almost any 110°, 20mm. neck can be used. The compactness of the design, together with the use of d.c. brightness and contrast controls, makes the monitor's casing very versatile – it can be incorporated in a 19in. racking system for example, built into a spare receiver cabinet or on a chassis. With more and more personal computers coming into use, the monitor is an ideal way of providing a high-quality display. The monitor can also be used for surveillance applications in conjunction with the camera project currently being featured – or ineed in any application where a standard 1V peak-peak video signal is available.

● TALKING TV

The latest thing in chippery seems to be speech recognition and synthesis. Tell the set what to do – and it tells you whether it can! David Matthewson looks at some of the technology involved.

● SERVICING FEATURES

S. Simon on getting the colour right – how to set about getting decent colour on a set that's had several years' use. Chas. Miller on various problems and a look at vintage Pyes. More VCR faults, etc., etc.

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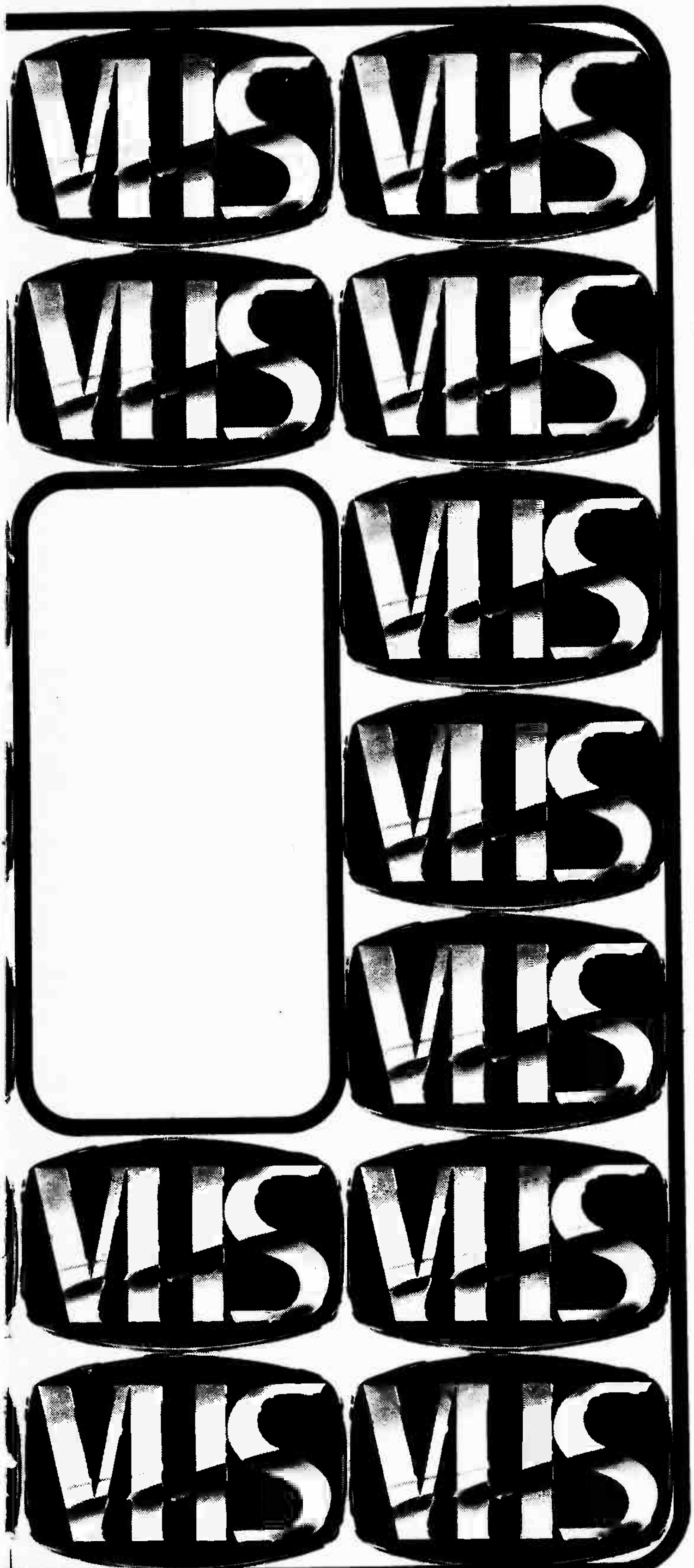


Long-distance Television

Roger Bunney

AUGUST was a good month for long-distance TV reception. Unusually, Sporadic E propagation continued to give excellent results right into the middle of the month, and even the Perseids meteor shower provided excellent signal "pings" and "super pings", particularly on the 12th, and at frequencies into Band III. Gwelo ch. E2 (Zimbabwe) gave really good strength signals on several occasions, via TE propagation (trans-equatorial skip) during the early evening. It was received as far north as Lahti (Finland) – by Petri Pöppönen on the 2nd.

The main points noted in my log – with supplementary comments from other enthusiasts – are as follows:

1/8/80 SR (Sweden) ch. E2; TSS (USSR) R1; RTVE (Spain) E2, 3, 4; RAI (Italy) IA; YLE (Finland) E2; Gwelo E2 via TE.

2/8/80 Improved tropospheric reception at u.h.f. noted on the east coast; Gwelo E2 via TE.

3/8/80 TSS R1, 2, 3; ORF (Austria) E2a, E4; RAI IA, IB; RTVE E2, 3, 4; CST (Czechoslovakia) R1; Gwelo E2 (TE).

4/8/80 RAI, IA, IB; SR E3, 4; RUV (Iceland) E4.

5/8/80 TSS R1; SR E2.

7/8/80 CST R1; RAI IA; NRK (Norway) E3, 4; RTVE E2, 3, 4.

9/8/80 Gwelo E2 via TE.

10/8/80 ORF E2a, 4; MTV (Hungary) R1; JRT (Yugoslavia) E3; RAI IA; CST R2; Switzerland E2, 3; Gwelo E2 (TE).

11/8/80 TSS R1; TVP (Poland) R1; West Germany E2; plus many unidentified signals.

12/8/80 Peak of MS activity from Perseids shower.

15/8/80 TSS R1; unidentified signals on chs. R1, 2.

16/8/80 NRK E2; TSS R1.

20/8/80 MTV R1.

23/8/80 RAI IB; ORF E4; RTVE E4.

25-27/8/80 Improved tropospheric reception from the low countries in central south UK. Swiss u.h.f. and Band III signals received on south coast.

The signals mentioned above were received via SpE propagation unless otherwise indicated.

On July 31st Brian Fitch received ORF (Austria) on ch. E3 in the early morning. There are several low-power relays using this channel, the highest power one being Birkfield, at 100W! We now know from Geoff Perrin that there is an Iranian transmitter operating on ch. E4 – the signals he's received are similar to those from the known Bandar Abbas ch. E8 transmitter. The mystery ch. E3 black/white chessboard pattern mentioned last month seems to be from an Italian "free" station – the "TV NOCOJ" caption came from Yugoslavia.

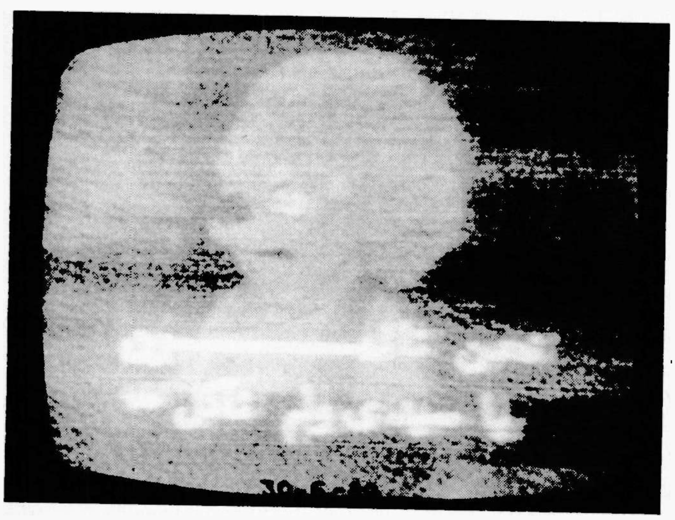
The signals from Gwelo on the 3rd and 9th were sufficiently strong, and with a high enough MUF, to provide fair quality reception of the accompanying 53·75MHz sound channel. David Norton reports (via Hugh Cocks) receiving "fairly strong" SpE Arab signals on July 11th at 1830BST, lasting for some fifteen minutes. The programme consisted of a film with Arab subtitles, but the sound could not be heard due to Lille being present on ch. F8a. David was using a Fuba Band III array at his Crowborough location. Hugh tells me incidentally that Lille and the other French TF1 v.h.f. transmitters transmit programmes only now, with no test transmissions – maybe a French reader can confirm?

During recent SpE openings several Italian f.m. stations have been received in the unusual Band I segment of 59MHz! Alexander Wiese (Munchen, West Germany) reports that ORF are now transmitting teletext information from 0830 local time at each half hour until the start of programmes.

Finally in this round up Graham Barker (Leeds) mentions two mystery signals. On July 29th he noted the RTP type checkerboard pattern on ch. E2, but from 0500-0545BST. And on the same channel he logged the RMA pattern on the 30th, but without any identification – again very early, and before RTP (Portugal) would be transmitting. Any suggestions?

News Items

Finland: The Tampere ch. E2 transmitter is to close down on September 1st, 1981 – bad news for SpE enthusiasts. It's being replaced by a ch. 53 transmitter at Teisko, some 40km from Tampere.



An unknown Arab station seen floating over Amman, Jordan (in the background) on ch. E3, at 1703 BST on June 30th. Photo from Ryn Muntjewerff (Holland).

This unidentified caption was received ar 2003 BST on July 14th by Nicholas Brown (Rugby). It put in its appearance on ch. E2 and is suspected of being of Scandinavian origin.

Italy: An independent "broadcasting authority" known as RAS is operating in the South Tyrol area bordering Austria. It organises the private radio/TV stations and in addition relays the ORF first chain, the German language Swiss service (SRG) and ZDF (W. Germany) in the South Tyrol area.
Japan: A 200mW solar-powered s.h.f. relay is now in operation atop Mt. Gomano-dan near Osaka.

Amateur TV

The activities of licenced radio amateurs don't usually come within the scope of this column. I've had an interesting letter on the subject from Michael Drury (Sittingbourne) however. It seems that while tuning his Bush TV161 below ch. 21 (into the 432-440MHz amateur band) on August 10th he received a blank PM5544 test pattern followed by various other patterns and the call sign G4IMO. The times were 1930-2100BST. Other amateur signals received in the Kent area came from G8PTH, G8EQZ and G8SUY. The interesting point about this reception is the use of a standard domestic tuner and a Colour King bowtie aerial without amplifier. I'd be interested in any further information on this type of reception using standard TV tuners.

Yugoslavian Band I Transmitters

From time to time we receive reports of reception of ch. E2 signals from Yugoslavia. This causes some puzzlement since there are no official listings of Yugoslavian ch. E2 transmitters in the EBU publications. Ryn Muntjewerff (Holland) has sent the following list of Yugoslavian Band I transmitters:
TV Zagreb (Croatia): Spot ch. E4, Trogir ch. E4.
TV Belgrade: Kopaonik ch. E3, Krasevac ch. E3.
TV Sarajevo: Jablanica ch. E3, Zlovrh ch. E4.
TV Ljubljana (Slovenia): Kamna Gorica ch. E4, Polhov Gradec ch. E4, Selca ch. E4, Nanos ch. E3, Podpeca ch. E2, Zerjav ch. E4, Kum ch. E3, Kuzelj ch. E4.
TV Titograd: Samalja ch. E4, Obosnik ch. E4, Ostrog ch. E4, Bandzovo brdo ch. E4, Tomasevo ch. E4, Pelister ch. E4, Ehola ch. E4 plus one other on ch. E4.

The transmitter powers are unknown, but many will be low, perhaps under 1W. The ch. E2 Podpeca transmitter has certainly been received in various parts of the UK during the past couple of years, while in 1972 I personally received an RUV (Iceland) 10W ch. E2 relay (which has since been moved to Band III). This does show that very low-power signals can be received over considerable distances via SpE.

International Mailbag

Rowan Fraser (Mona, Jamaica) has been DXing in the West Indies for several years. His first DX signal was from Quito (Ecuador) on ch. A2, and he has subsequently received signals from other South American transmitters and from Mexico, Cuba and the USA as far north west as Georgia and New Orleans. He's now using a "log-Yagi" array, the system being 16ft long and covering chs. A2-5.

Frank Lumen in Denver, Colorado has received signals from Edmonton (Alberta), Great Falls (Montana) and Corpus Christie (Texas) amongst other sources. He plans to use a five-element array to try for F2 reception from S. America this autumn.

An interesting letter has arrived from Fraser Kickox (Carlton, NSW, Australia) describing his work on satellite TV receiver units. The company he works for (Intersat Pty.

Abu Dhabi station identification slide (chs. E2, 5). Photo from Allan Latham.

Ltd.) was established to provide low-cost receiver terminals in the Australian/Pacific area to enable interested parties to receive the ABC (Australian Broadcasting Commission) TV output from the Intelsat communications satellite (3·7-4·2GHz). The terminals consist of a 15ft dish, a 120°K low-noise amplifier and receiver unit, and sell for around $A3,500 plus an installation charge if required. Intersat hope to produce some 5-6,000 of these relatively low-cost receivers over the coming year, and have also developed a low-cost 12GHz receiver for use with PAL/Secam transmissions. We hope to be able to provide further information on this in due course.

TV Interference

An interesting case of interference occurred here recently. It was typical of thermostat contact arcing, but continued throughout the day (24 hours) with repeated high-level splashing throughout Bands I/II. I investigated with a field strength meter (a non-a.g.c. type) and eventually traced the house, whose occupants were away on holiday. On their return, it was discovered that all the electrical apparatus in the house had been switched off. There was an unused, switched on shaver socket however, whose 1:1 isolating transformer, behind the panel, was hot and arcing internally.

DX Filter

Back in November 1969 I featured in these pages a DX filter. It was a relatively simple notch filter aimed at reducing interference on DX channels from local Band I transmitters. At my Romsey location for example the local BBC Band I channel is B3 (Rowridge), whose sound carrier is at 53·25MHz. This unfortunately gives rise to splatter on ch. IA and, to a limited extent, ch. R1. Using a receiver with a restricted i.f. bandpass response helps to reduce such adjacent channel interference, but for those enthusiasts using a conventional wideband i.f. strip the problem can be acute. Many enthusiasts have made the 1969 notch filter during the past decade, and have obtained excellent results – the unwanted carrier can be reduced by typically 30dB, with an insertion loss of say 8-10dB at 500kHz from the filter's notch. The sharpness depends on the accuracy of the coil winding and the setting of the preset potentiometer – for further details see my DX-TV book, published by Bernard Babani (Publishing) Ltd.

More recently there's been interest in using varicap diodes for the purpose (see the December 1979 column, in which I gave details of Chris Wilson's Band I varicap diode notch filter). More recently still I've been experimenting with some ferrite toroids, and have found an effective yet simple circuit whose tuning range covers 47-65MHz (chs. E2-4). The toroid selected is type T37-12 (9·53mm diameter) which is available from Ambit International. Construction is simple (see Fig. 1). Nine turns are wound on the toroid, with the mid-point tapped. Two varicap diodes are connected back-to-back across the ends of the coil, with a trimmer in parallel. The tuning voltage is applied to the junction of the two diodes – 0-9V or 0-12V should give coverage over the ch. E2-4 range. House the filter in a sturdy metal box, with standard Belling-Lee metal coaxial sockets for the input and output, and when construction is complete and the unit aligned apply Copydex to the coil winding to prevent movement.

To align the filter, adjust the tuning potentiomenter for maximum bias on the diodes, then adjust the trimmer to obtain a notch at the highest frequency required (say ch. B4 sound). By reducing the tuning voltage the notch will then tune down to a lower frequency. If the filter is required to tune over the range of the local Band I transmitter only, a lower tuning voltage can be used – with the trimmer again being set to the highest unwanted frequency at the maximum applied tuning voltage.

With the increasing use of imported Japanese sets giving v.h.f. coverage, or upconverter/u.h.f. receiver combinations, a wide tuning coverage may be useful in reducing adjacent channel breakthrough, e.g. ch. R1 signals spreading on to ch. E2 due to the wide i.f. bandwidth of such receivers.

The measured performance of the prototype unit is as follows – with a 50MHz signal applied, at 75 Ω input/output: notch depth 22dB, attenuation 500kHz away 10·2dB, 1MHz away 6dB, 2MHz away 2dB and 3MHz away 0·8dB.

The cost of the unit is modest, and all components can be obtained from Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG.

In conclusion, note that a notch filter will not remove co-channel signals, e.g. ch. B2 sound and ch. E2 vision, which are both at 48·25MHz. Perhaps the most successful method of reducing co-channel interference is by phase-reversal techniques. I'm currently working on a scheme to reduce VDU interference using a phase-shift system, and if this proves successful the circuit will be included in the column.

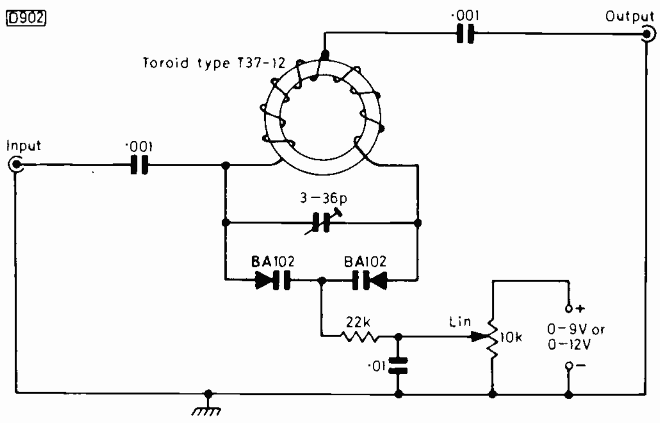


Fig. 1: Circuit of the toroid/varicap diode DX notch filter. The coil consists of nine turns of 26 s.w.g. enamelled wire spread around four-fifths of the toroid and centre-tapped at 4½ turns. The trimmer is a subminiature foil type.

TV Servicing: Tuning Troubles

S. Simon

LAST month we commented on the tuner unit used in the Thorn 8000 and other chassis, stressing the importance of good contact between the rotating spindle carrying the vanes and the earthed body of the tuner for correct tuning. The original grease used by the manufacturers to improve contact can over the years deteriorate, with the result that contact is impeded instead. The symptoms are either that the tuner will not oscillate at all, i.e. no signals, or that programmes cannot be accurately tuned. Spraying with a grease removing agent, such as Servisol Aero Klene, may help to improve contact, but this may be only a temporary cure. On no account spray with a lubricating switch cleaner, as this will get between the vanes and remain there. The only lasting solution is to remove the leaf springs, using a heavy-duty iron, and then thoroughly clean and retension them.

Other tuners have different defects. They may never need cleaning, or if they do it may have to be done in a different way.

The tuner used on the popular Decca Bradford series of hybrid colour receivers for example rarely requires a clean up job. It might still be responsible for inaccurate tuning however. When the lid is removed from this type of tuner, the screws holding the U clamps that secure the tuning spindle (two at either end) should be counted. If one is missing, be careful not to invert the tuner before the missing screw has been found, otherwise it may drop down and become one of those never to be found items that continue to mystify successive generations. Even if all the screws are in position, they will still require tightening since this is invariably the cause of the trouble.

Push-button Problems

We next turn to the most troublesome (probably) tuner of all – taking into consideration its popularity that is, and discounting some of the exotic continental designs. We refer to the tuner used in earlier Bush, Murphy and Co-op (Defiant) sets. The tuner itself is relatively trouble free: it's the mechanical arrangements that give the trouble. First the buttons themselves.

If one keeps a stock of new replacements, there's no trouble. It's a matter of moments to remove the tuner and fit new buttons. All too often however we find ourselves out of stock, and other remedies then have to be tried. The buttons suffer from two defects caused by wear. First, the end becomes enlarged so that it slips over the part of the spindle it's intended to push in, the result being that the button concerned is totally ineffective. If the button is removed, a close fitting washer or 2BA tab washer can be forced on to the spindle to provide the button with a larger contact surface. Treat the other three buttons similarly to avoid the need for further tuner removal.

The other defect is more awkward. The original hole in the plastic button is star shaped to enable it to rotate the spindle for tuning purposes. The star rapidly becomes a black hole however, with the result that it rotates freely without rotating the spindle. Only the intrepid will tackle this problem. The answer is to fill the button with Araldite and to coat the spindle liberally with grease. Then put the button on the spindle and allow the adhesive to set partially. Remove it (the button) and trim off the surplus adhesive. When the remaining adhesive has hardened properly, the button should be as good as new. It's easier to await the arrival of new buttons or to borrow some from a friend. So much for the buttons.

It's one thing to push the button in and turn the spindle. It's another to push the tuner levers into the required position every time. This duty is performed by nylon collars which are a close fit on the threaded part of the spindle. They should move in relation to the spindle only when the spindle is rotated. Any other movement will produce a tuning variation. It's a fact of life however that these collars develop cracks. This results in inaccurate tuning to start with, then as the collar becomes really loose it no longer answers the movement of the spindle at all. There's no easy answer to this one. New collars are readily available, but fitting them is anything but easy.

The mechanical part is secured to the tuner proper by three screws which are immediately obvious when the spindles and collars are being checked, the lid having been removed to enable this to be done. The mechanical section then divides into two parts, the front being secured by four screws. With this off, the spindles are free and the circlips can be removed to enable the new collars to be screwed on. Before refitting the front firmly, make sure that the return springs at the rear end are free. It's all too easy for one (or more) spring end to enter the spindle hole and be captured there, thus stopping movement of the spindle concerned. This means that the front plate will have to be removed again in order to release the spring, and this in turn means the possibility of another spring being captured in addition to the collars rotating to lose their channel tuning. This all adds up to considerable frustration if a little extra care has not been taken over the original reassembly.

If you add this sort of thing to the defects that other types of mechanical tuners suffer from, for example the snapped off cast collars as used on (say) ITT tuners, it's easy to see why the advent of the varicap tuner made such an impact.

Varicap Tuning Systems

Instead of the vanes of several sections of a variable tuning capacitor being rotated, the varicap tuner employs a number of variable-capacitance diodes which have the happy property of varying their capacitance in accordance with the voltage applied to them. The capacitance falls off as the voltage (reverse bias) is increased, and for use in a u.h.f. tuner we require a voltage range of 0-30V to cover channels 21-68. Great you may say, no more mechanical problems. All we need is a stabilised source of just over 30V, and a variable resistor connected from this supply to earth, the slider's setting determining the tuning point. Quite so, and in fact many monochrome portables use this extremely simple tuning method, the control knob simply being marked with channel numbers, or pointing to channel numbers printed on the fascia of the set.

Colour sets require very fine tuning however, while the public likes preset buttons. So the original varicap tuners were used with a fairly complicated semi-mechanical tuner head at the front of the set, the tuner itself being located inside, either on a separate panel or on the i.f. panel.

Alternatively the tuner head may be split, with the buttons at the front connected via a cableform to the preset resistors etc. at the side or rear. The obvious way to identify combined or separate units is to note whether or not the buttons, or button (separately marked tuner), carry out the channel adjustments.

For example, the early Philips G8 chassis had six square buttons at the front with the variable resistors at the rear (a long strip with a cover). This was soon replaced by a combined unit, with sloping buttons providing the channel adjustments once the unit has been hinged down. The unit is secured by two screws which need only to be slackened in order to remove it. Once this has been done the plastic housing can be separated for cleaning, taking care to refit the light spring which operates the a.f.c. switch when reassembling.

A handy tip worth knowing is that the plastic strips carrying the metal contacts have two side protrusions to operate either the top or bottom latches. These protrusions break off. When they do, it's a simple matter to change them over to suit either the top or bottom latches. This may sound vague, but becomes obvious once the unit is examined.

A common defect on the combined tuner head unit used in the Pye 693 and 697 hybrid colour chassis is one button becoming inactive or perhaps the whole unit becoming inoperative due to a broken leaf spring jamming the mechanism. The slider of the selector contacts these leaf springs when the buttons are pressed, and some strain is imposed on them. When they break off and fall clear, the one button concerned is inoperative. The presence of one or more broken leaves is not quite as obvious as you might think, since the unit might still seem to select a programme for a short time – always the one selected by the last good button pressed. This is due to the a.f.c. action. In short, if one of these units behaves peculiarly, check the leaves at the rear of the unit. The whole assembly need not be replaced – that's a costly business. Instead, obtain the basic selector unit from a component advertiser or dealer for a reasonable amount – but be sure to specify the 697 unit or you may obtain a totally unsuitable one.

Touch Tuning

The next development to come along was the touch-tuned channel selector unit. These have a small number of gaps, each in a high-resistance circuit: bridging any gap with a relatively low resistance initiates channel change. The low resistance should be a finger tip (intentional channel change) or any other agent (unintentional) that might provide a low-resistance path. This is the first point to note therefore: the contact surface must be clean, a condition that might not always be easy to fulfil when there are children with sticky fingers about. It's best to use a dry tissue to clean the gaps, rather than a liquid cleaning agent.

The second point requiring comment is that neons are often employed in conjunction with touch tuners to indicate the selected channel. All the neons are connected to one side of a common resistor (see Fig. 1). The other sides of the neons are taken to a point which has no potential until the associated touch pad is touched. The gas in the neon then strikes, and it glows to indicate the selected channel. The whole system operates in conjunction with an i.c.

Now this is all very nice provided that the i.c. is in good order, and more on this in a moment. It's also very nice provided that the neons have inside them only the gas they are supposed to have. Unhappily neons can have some

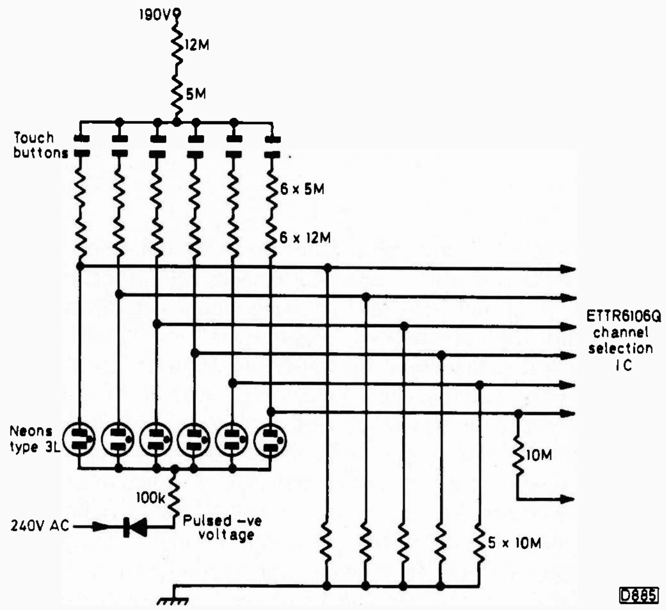


Fig. 1: Touch-tune channel selector circuit used in GEC Models C2113, C2119 and C2121. Note that R680 (not shown – from pin 16 of the i.c. to chassis) should be included where a replacement i.c. is coded with a red spot but shorted out where the i.c. is coded with a white spot. Later GEC touch-tuned models use a four-i.c. control unit. Different touch-button/neon circuitry will be found in sets from other manufacturers, e.g. Philips and Rank.

funny habits, amongst which are the ability to change channels on their own account. This can be confused with hanky-panky in the i.c., or conductive material in the touch gap.

So we have to follow the golden rule, which states that all non-essentials should be unhooked. Clean the gaps, then if necessary unsolder the neons. If this stops the random behaviour, and the chances are that it will, we have only to identify the neon that's causing the trouble – it usually has a tendency to flicker. Alternatively, connect them one at a time.

We now come to the i.c. itself. This is a MOSFET device, which means that it has an extremely high internal impedance (we're talking about the type of touch-selector system with neons used for example in GEC sets, rather than the type with small lamps used for example in certain ITT sets). On no account should the MOSFET i.c.'s pins be subjected to any potential different from any other or above the device's rating. The i.c. is supplied wrapped in conductive foil so that all the pins are at the same potential. The handler must rid himself of all static charges before handling the device, otherwise the device may be ruined even before it has been fitted. This is no idle threat: the static charges that can build up on our clothes can amount to thousands of volts. Such charges are normally discharged harmlessly, but if applied via a finger to such an i.c. it will be killed stone dead. So discharge yourself first to a known good earth, then test yourself by placing your finger close to a piece of suspended cotton: if the cotton moves before you touch it, you're still charged. The point is that you will probably have to change the i.c. if the touch gaps and the neons are in order.

Tuner Supplies

All this and we've yet to say aught about the tuner itself. The 0-33V tuning voltage required to operate a varicap tuner must be perfectly stable, otherwise the tuning will vary despite the best efforts of the a.f.c. circuit. The tuning voltage is usually derived from a fairly high-voltage line therefore, being taken via a resistor or resistors to a small voltage stabilising i.c., usually a TAA550. The actual tuning voltage for the particular channel is taken from a preset potentiometer via a switch or the previously mentioned touch tuner/i.c. arrangement. In addition the tuner also requires the usual 12V l.t. supply and an a.g.c. voltage. This latter may be roughly the same as the tuning voltage if channels low in the band are being used, so if the circuit is not to hand there's scope for confusion here. Note which voltage varies smoothly as the relevant station selector arrangement is activated, thus identifying the tuning voltage pin, but bear in mind that the a.g.c. voltage will also vary to a degree.

Quite a common fault is absence of the tuning voltage – just noise that doesn't vary. The supply resistor(s) may have failed, or the stabilising i.c., which may look like a diode, may have gone short-circuit. The latter is likely if the resistor(s) are warm to touch.

Grainy Pictures

It's quite common for varicap tuners to be responsible for a very grainy or noisy picture, the effect being perhaps intermittent. Quite often the effect can be made to come and go by applying pressure to the sides of the tuner, indicating that a poor connection (usually a dry-joint) is responsible. If this isn't the case, then applying a signal to the second stage in the tuner may produce more gain than when the signal is fed to the input socket, indicating that the transistor in the first stage could well (though not necessarily) be at fault. Replacing the small transistors used is a delicate though not too difficult operation.

A word of warning however. A very grainy picture doesn't necessarily mean that the tuner is at fault or that the aerial installation is defective. Quite often the tuner's output may be perfectly in order, the signals being lost in the filter stages at the front end of the i.f. strip. This is particularly so with Pye solid-state colour sets of the 713, 725 etc. type, including the Philips 570 chassis, where the tracks are on both sides of the filter unit and dry-joints abound, mainly on the through rivets on the printed coils and on the legs of the small capacitors. Once again an affectionate squeeze may prove where the fault lies, in the filter box or the tuner box, but this of course is only a hopeful gesture.

Normally however the i.f. strip is pretty reliable, and the tuner is the more likely cause of noisy signals – once the aerial and input socket have been cleared of suspicion.

A Misleading Condition

A final point about touch-tuning systems. These are normally arranged so that one particular channel always appears first when the set is switched on. A slight fault in the set may result in it switching off for a fraction of a second, as a result of which the channel changes. So it's essential to differentiate between random channel changing and a channel change due to the set switching itself off and on again. If the tuning always reverts to the switch-on channel, don't necessarily assume that the fault is in the touch-tuning circuit. In fact the fault may not be in the set at all if the channel change is accompanied by the rustle of decaying and building up e.h.t. A loose connection in the mains plug, a poorly fitting fuse in the plug or in the set, severe mains interference giving rise to a spikey mains waveform that triggers a sensitive protection circuit – these are all possibilities to be considered when channel changing is not all that happens.

Solid-state TV Cameras

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

THE solid-state TV camera has been under development for several years – the principles of solid-state image sensing, using charge-coupled devices (CCDs), were in fact described in some detail in the October 1974 issue of *Television*. But whereas the principles are quite straightforward, the development of practical devices capable of giving adequate performance has involved much research and effort.

Sony's XC1 Camera

At last things seem to be moving. In January this year for example Sony delivered to All Nippon Airways thirteen of their new XC1 CCD cameras. These are being installed in the cockpits of air liners to enable the passengers to watch takeoffs and landings on projection TV equipment in the main cabins. The cameras cost around £6,000 each, much the same as a comparable vidicon-based camera. The use of CCD image sensors however enables the cameras to handle up to a hundred times more light than a conventional camera, without image blooming or burn-in. In fact CCDs are totally immune to burn-ins (the damage caused by a very bright, intense light, either artificial or sunlight, which produces a black spot on the fact of a vidicon type tube). They can be affected by strong external magnetic fields though. The use of CCDs has enabled the size of the cameras to be reduced to 68 × 75 × 198mm, considerably less than that of a conventional vidicon unit.

The XC1 camera uses two CCD i.c.s, one to sense red and blue light values and the other for green. This results in a high sensitivity, since green light contains most of the light value in an average scene. Although the CCDs used have only 245 elements in the horizontal direction ("pixels" – picture elements – as they are known), the use of sophisticated circuitry in the cameras enables a test pattern with 280 lines to be resolved.

The Sony Cam-Corder

Having pioneered CCD cameras for the professional market, Sony have now set about applying these techniques to the domestic market. Perhaps the most striking and significant idea is Sony's "video movie" unit (see accompanying photo). This combined camera/VCR has already been demonstrated in both Japan and the USA, though only in prototype form (Sony suggest that another four years' development work is required before a product suitable for launching on the consumer video market is ready). The video movie unit incorporates a number of interesting features, and it seems more than likely that a product of this type will be readily available in the shops in only a few years' time – Kodak, Blaupunkt, Eumig and BASF are just four companies that have dropped hints about similar developments, though Sony are the first to have made the transition from paper to plastic.

There are considerable attractions in a video unit that has all the attributes of a super 8mm sound/cine camera with the added advantages of using reusable, low-cost tape while giving instant playback. Size and weight have been the main problems until now. The video movie "Cam-Corder" weighs only 2kg however, including a cassette and 9V rechargeable battery.

The single CCD device used in the Cam-Corder has 570 horizontal and 490 vertical sensing elements, giving a total of 279,300 pixels. The 10 × 12mm i.c. has an 8 × 9mm window through which the light passes to fall on the sensing elements. A striped colour filter is used for colour sensing – as with the Hitachi single-tube colour camera. The CCD arrangement, which we'll look at in greater detail in a minute, enables each element to be scanned, the process having something in common with the way a vidicon's target is scanned by the beam to produce an output at the target ring. The electronics required to drive the CCD are much more complex however.

Sony's Cam-Corder prototype employs an f1·6 14-42mm zoom lens with a macro close-up facility. A colour temperature filter is built in so that the camera can be used indoors or outdoors with ease. Some 70 lux of illumination is required to produce a decent colour picture, with a signal-to-noise ratio of 45dB. Sony quote a horizontal resolution of 250 horizontal lines, which is a very respectable performance. Fig. 1 shows the prototype unit.

The viewfinder in the prototype is of the reflex optical type, but it should not be too difficult to build in an electronic one that would give instant playback within the machine itself.

Sony claim that the VCR part of the Cam-Corder is the world's smallest VTR. Blaupunkt's "Mini-maz" longitudinal-scan VCR, which was demonstrated at the Berlin radio show last year, is of comparable size however. Sony's built-in VCR employs a conventional helical-scan, slant-azimuth recording system, with a lace-up pattern very similar to that used in their Betamax machines. The special cassette is loaded with 8mm high-energy metal tape, and gives a recording time of twenty minutes. At 56 × 35 ×

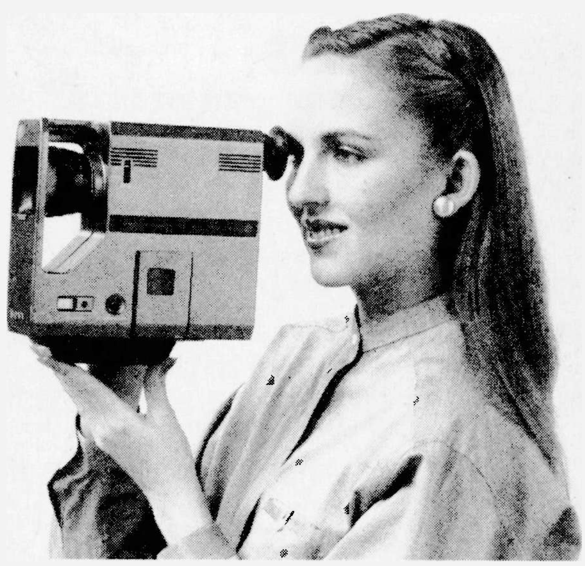


Fig. 1: Photograph of Sony's prototype Cam-Corder video movie unit, which incorporates a solid-state camera and miniature videocassette recorder.

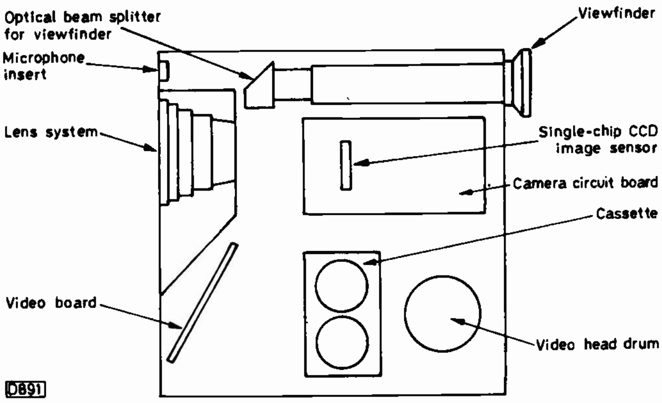


Fig. 2: Basic layout inside the Sony Cam-Corder.

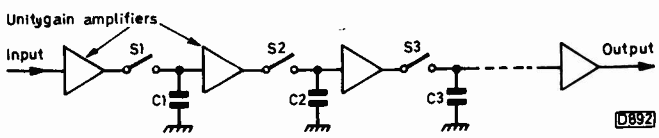


Fig. 3: Representation of the action of a charge-coupled shift register in terms of conventional discrete electronics.

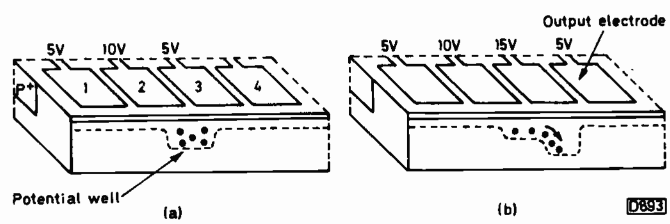


Fig. 4: The charge-coupled device operates by accepting charge packets which are kept separate and shifted through the device. (a) Establishing a potential well by adjusting the voltages on the electrodes. (b) Moving a potential well by applying pulses to the electrodes.

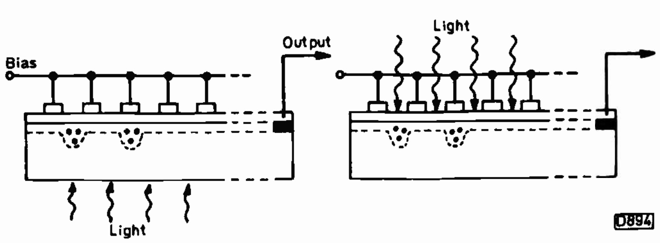


Fig. 5: To use a charge-coupled device for image sensing, the basic charge-coupled system has to be combined with a light-sensitive system – a silicon photodiode array. The imager can be arranged to be sensitive to light applied to either one face or the other.

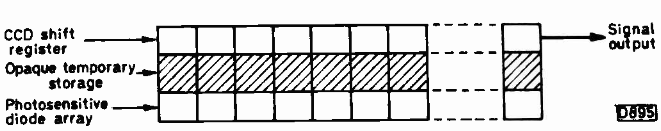


Fig. 6: The charge packets produced by the photodiode array are moved to an opaque temporary storage area and then finally to the shift register which provides the scanning action.

13mm, the VCR must be the smallest yet!

Fig. 2 shows the internal arrangements of the Cam-Corder. An LCD display is used in the digital tape footage counter.

Although there seems no reason why Sony's unit should not be equipped with standard video and audio outputs, Sony have chosen to produce a device called a "home editor" to enable the signals from the Cam-Corder to be either transferred to another VCR format or displayed via a domestic TV set. The prototype so far demonstrated is for

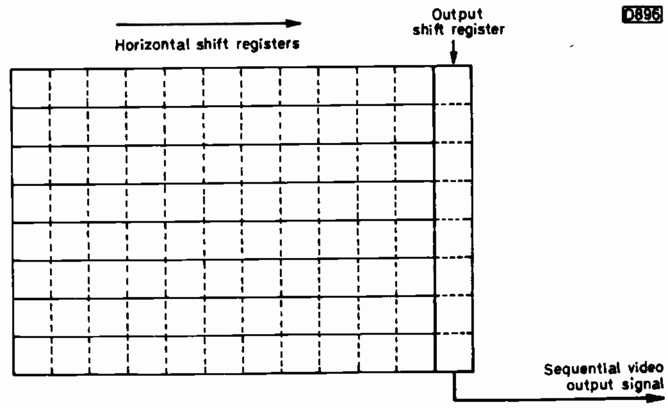


Fig. 7: Basic idea of using shift registers to scan the area of the imager and thus produce a sequential video output signal.

use with the NTSC colour system, but a PAL version would not be difficult to develop.

How a Charge-coupled Imager Works

So how does the CCD work? The previously mentioned article in *Television* was largely based on Fairchild's CCD201 monochrome CCD image sensor. Unfortunately, cost and poor resolution prevented it from becoming accepted.

The basic idea is that small charge packets, each corresponding to the illumination at one pixel, are systematically shifted through the device, leaving at the output terminal as a sequential video signal. A CCD i.c. can be envisaged as a series of switched capacitors (see Fig. 3), linked to a number of operational amplifiers of unity gain and infinite input impedance. If S1 is momentarily closed, the input signal will be stored as a charge packet in C1. If S2 is next momentarily closed, the packet of charge held by C1 will be transferred to C2. And so on down the line until the charge packet appears at the output. Obvious applications for devices operating along these lines are as digital shift registers and analogue delay lines. In fact a shift register action is what provides the scanning in the image-sensing CCD.

Converting this to semiconductor technology, the charge packets are stored not in capacitors but in areas of the semiconductor wafer known as potential wells. These are created (see Fig. 4) by applying pulses to electrodes that run along the surface of the device. Once a charge packet has been developed by photoconductive action, it can be transferred to the CCD part of the device (once per field) and then shifted along through the device by sequentially filling and emptying a series of potential wells. Say electrode two is biased at 10V. A potential well is created beneath it – see Fig. 4(a) – since it's more positive than the adjacent electrodes. A charge packet can thus be stored in this well. If 15V is next applied to electrode three, a deeper well is established beneath it and the stored charge packet migrates into this. The charge packet can thus be shifted, in one direction only, towards the output.

So much for sequentially shifting charges through the device to provide a scanning action. How are the charges induced in the device to start with? In principle the charge packets could be injected either electrically or optically. The obvious thing to do however is to use the silicon photodiode effect. Either front or rear exposure to light (see Fig. 5) can be used. The effect of the illumination is to generate charge packets, consisting of minority carriers. The light source in fact gives rise to electron-hole pairs, the charge being held for a period of time known as the optical integration time, which to avoid image smearing is much longer than the transfer time of the stored packets. This means that an opaque temporary storage area, with the same number of elements as the array of silicon photodiodes, is required (see Fig. 6). The charge packets under the photosensitive array are moved into the temporary storage array as a complete picture field, then shifted down into the shift register section and moved along to the output shift register (see Fig. 7) which enables them to be transferred out of the device as a sequential video signal.

The main problems with these CCD units (or CCIs, charge-coupled imagers, as they are also known) are caused by transfer inefficiency and dark current. The former is due to noise produced by the charge shifting process and the latter to thermally generated electron-hole pairs (most noticeable and annoying in the absence of light). Even so, this Sony device points the way of things to come.

Prospects

The reason for Sony demonstrating their Cam-Corder at this stage is to stimulate discussion between video manufactures with the hope of establishing a common standard for this sort of equipment during the 1980s and beyond. Many firms are working on CCD cameras for the consumer market. Nippon Electric intend to introduce one next spring, and RCA and Toshiba have also released some details of their work in this field. Hitachi are working on a MOS sensor camera, while Matsushita are working on an alternative approach based on a single sensor chip using a thin-film heterojunction as the photosensitive layer.■

Developments in TV Sound

Pat Hawker

IT HAS often been said that sound is the "poor relation" of television. All too often TV sets have used the simplest audio circuitry, with the sound signal subjected to video interference – particularly buzz-on-sound. Small, cheap loudspeakers have been the order of the day, often mounted in a far from ideal position. The best that can be said about the situation is that most viewers appear to have been satisfied.

At the 1980 International Broadcasting Convention however there were signs that greater engineering attention is being paid to the sound channel. Amongst the subjects discussed were high-fidelity TV sound, stereo sound, analogue and digital dual-channel systems able to carry a second language, and so on.

High Fidelity Sound

Lars Alåker, an engineer from Philips Norrköping, Sweden, described the steps taken in providing a TV audio system that really deserves the title "high fidelity". This is used in the Philips K12 chassis, which was first introduced on the Scandinavian market in 1978. It's reception there by the public was described as "positive", so much so that competitors are now incorporating improved audio in some of their models. Sets fitted with the K12 chassis appeared in the UK market late last year.

An important result of the Swedish work has been to show that good quality audio can be achieved using an intercarrier sound system – it has frequently been claimed in the past that only by going back to the old technique of separating the sound and vision carriers at an early point in the i.f. strip could a really worthwhile improvement be obtained. This has required careful design of the tuner, i.f. filter and amplifier and the demodulators. In particular, though a conventional synchronous demodulator i.c. is used for the vision signal, the 6MHz intercarrier sound signal is obtained from a discrete detector circuit designed to minimize interference between the video frequencies and the sound f.m. carrier. Such interference can take the form of phase modulation of the vision carrier; the generation of spurious 6MHz signals from video information at submultiples of 6MHz; or products produced due to mixing effects of the 4·43MHz colour subcarrier with video frequencies at around 1·57MHz. Care has been taken to filter out such unwanted signals, and it's claimed that even under the most unfavourable conditions the signal-to-disturbance ratio is better than 50dB.

The TDA2790 intercarrier sound i.c. is on the same board as the audio amplifier i.c., which delivers 10W into a 4Ω load with less than 1 per cent distortion. The audio section of the TDA2790 provides d.c. bass and treble as well as volume control. There are two loudspeakers, a 4in. bass unit which is mounted in a compact bass-reflex enclosure, and a 2in. tweeter. The chassis has output sockets for headphones, a tape recorder or an external loudspeaker.

Dual-channel Sound

For over twenty years investigations have been carried out in various countries into the provision of TV transmissions with a second sound channel, either for stereo sound or, if the crosstalk between the two channels can be kept sufficiently low, an entirely separate sound channel in a second language or as a "radio" channel independent of the TV transmission.

For many years it was argued that stereo was inappropriate for TV, due to the limited size of the TV picture. It was said that the "sound stage" would be too large for the picture area. The success of "simulcasting" (the use of a v.h.f./f.m. radio transmitter to provide stereo TV) has rather dented this belief however, with the result that for several years there has been renewed development work.

As seems to be inevitable in the broadcasting field, a number of different systems have been developed and are being proposed internationally by different organizations. Of these, the "f.m.-f.m." multiplex system (Japan and Sweden) and the "double-carrier" system (Germany) have reached the stage of extended trials. West Germany in fact is to open a

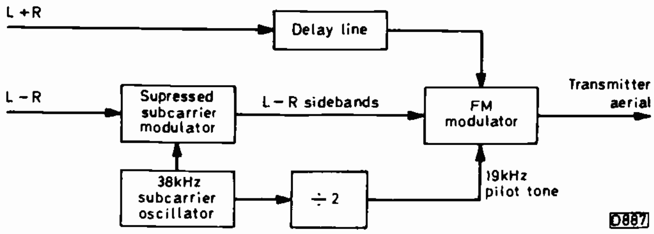


Fig. 1: The pilot-tone stereo sound system used for v.h.f./f.m. radio broadcasting: basic transmitter block diagram.

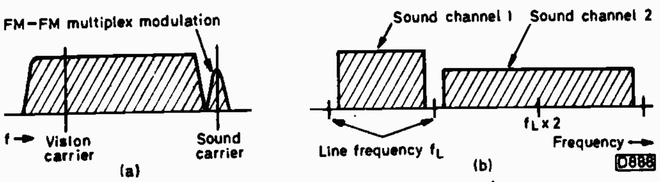


Fig. 2: The f.m.-f.m. dual-channel TV sound system developed in Japan. The second sound channel uses a frequency modulated subcarrier at 26·25kHz (twice line frequency on the 525-line System M).

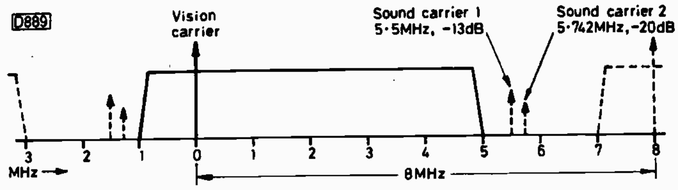


Fig. 3: The German double-carrier system as applied to System G – the second sound carrier is spaced 242kHz from the first.

public service using the double-carrier system at the time of the next German Broadcast Exhibition in 1981. In addition, consideration has also been given to the "pilot-tone" stereo system, as used for v.h.f./f.m. radio, and to various digital systems in which one or both channels would be multiplexed with the video signal. The latter approach could be more conveniently introduced with direct broadcasting from satellites.

The Pilot-tone System

If the pilot-tone stereo system was adopted for television, the pilot frequency would need to be carefully chosen to avoid interference from the vision signal. The main drawback to its use however is that the separation between the two sound signals, though sufficient for stereo, would not permit its use for a second language or independent sound.

For readers unfamiliar with the pilot-tone stereo system, the details are basically as follows. Two signals, L+R and L–R, are transmitted. A fairly simple decoder in the receiver processes these signals to give L and R outputs: (L + R) + (L – R) = 2L etc. The L + R signal is transmitted in the normal manner, but the L – R signal is applied to a 38kHz suppressed subcarrier modulator before being fed to the main transmitter modulator (see Fig. 1). Because of the use of suppressed subcarrier modulation for the L – R signal, a 19kHz "pilot tone" is added. The decoder doubles this to provide the missing 38kHz carrier required for demodulation.

The FM-FM System

The f.m.-f.m. system, as used in Japan since 1978, has a twice line frequency f.m. subcarrier carried on the sound transmission (see Fig. 2). While good results can apparently be achieved using separate-carrier receivers, it seems that the results obtained with an intercarrier receiver are of a lower standard to those obtained using the German double-carrier system. The signal-to-noise ratio in the second channel is appreciably lower than for the main channel. It may also be rather vulnerable to multipath effects.

The Double-carrier System

The double-carrier system was developed by the Institut fur Rundfunktechnik (IRT) in Munich, Germany. A separate f.m. sound carrier is transmitted at reduced power on a frequency which (for the Continental System G) is some 250kHz higher than the normal sound carrier (it's actually spaced 5·742MHz from the vision carrier – see Fig. 3). For System I the spacing could be 6·242MHz. Apart from the reduced carrier level, the modulation characteristics of the second sound channel are identical to those of the main one. It's claimed that the system is fully compatible with existing transmissions, that the quality of the second channel is "practically the same" as that of the first channel, and that existing transmitters and receivers can be modified at low cost. For the receiver, a small demodulator circuit would provide an output for a second audio amplifier which could be external to the receiver.

At IBC-80, a paper by Siegfried Dinsel of IRT claimed that the signal-to-noise ratio in good recivers can be 45-50dB, the stereo crosstalk better than 35dB, the crosstalk for independent sound channels better than 54dB, and the frequency response of both channels to 15kHz.

Note that the UK System I uses different vision-to-sound power ratios than those used with Systems B and G.

Digital Systems

A number of digital systems in which one or both sound channels is multiplexed into the video signal have been proposed, ranging from hybrid analogue-digital systems where, for example, digital sound would be transmitted during the sync periods, to all-digital systems in which digitalised audio channels would be time multiplexed into a single high-rate bit stream.

At IBC-80 a hybrid two-channel sound system was described by BBC engineers. It's intended primarily for satellite use, since this may give the opportunity to introduce a new non-compatible system. The BBC proposals use a digitally modulated subcarrier with differential phase-shift keying. The bit rate is 704kbit/s, with a sound subcarrier some 7MHz above the vision carrier while the main carrier is frequently-modulated with the video signal.

Work on an all-digital system that would include up to three high-quality audio channels (though intended primarily for digital video recording) was reported at IBC-80 by IBA engineers. It's likely to be some years before the all-digital approach is carried through the transmission chain to the domestic receiver – though such a system remains an ultimate possibility.

Prospects

For the present we are likely to hear rather more about the f.m.-f.m. and double-carrier analogue systems, though it should be stressed that there appear to be no firm plans or early intention to introduce dual-channel sound in the UK. For double-carrier sound careful thought would need to be given to the vision-to-sound power ratio used for the first sound channel. In Systems B and G, the sound is generally transmitted 10dB below the vision carrier, but West Germany has recently reduced this by a further 3dB to –13dB. In the UK the corresponding ratio is 7dB, though this ratio is not maintained accurately. This might make it preferable to reduce the power level of the second sound channel to –23dB (i.e. –16dB below first sound carrier level). There seems little reason to suppose that this would seriously impair performance.

The IRT claim that the component cost of modifying a receiver (not including the additional audio amplifier and loudspeaker) would be low (under £5), and require only readily available components. Costs for dual-channel transmission would not be unduly high, though the additional signal would have to be processed and distributed throughout the entire transmission chain.■

Fault Report

Robin D. Smith

GEC C2026H Series

We've sold a number of 20in. GEC colour sets – the C2026H series, with a PIL type tube – and have been well satisfied with them. Reliability has proved to be good to date. In fact we've had only two faults. The first was obvious – the main reservoir capacitor C506 (225 + 25μF) had leaked badly, causing arcing.

The second fault was a bit more interesting – flyback lines on the screen. A check on the c.r.t. base voltages revealed that the first anode supply was excessive. This is obtained by rectifying the line flyback pulses at the collector of the BU208 line output transistor. The output developed across the reservoir capacitor is fed to a potential divider (R623 with R624 to chassis) on the line timebase panel and then goes to the first anode preset control on the tube base. It didn't take long to discover that R624 (1MΩ) was open-circuit, a replacement curing the flyback line trouble.

Loss of Colour

We replaced the c.r.t. in a Bush set fitted with the A823A chassis and after going through the setting up procedure obtained a good picture. While giving the set a soak test however there was a flashover and the colour disappeared. It could be brought back by critical tuning, so we assumed that the trouble was due to a faulty chroma amplifier stage on the i.f. panel – a substitute i.f. panel proved this diagnosis.

The fault on the defective panel proved a bit tricky to find however. The voltages around the a.c.c. transistor 2VT7 and the first chroma amplifier transistor 2VT8 were incorrect (see Fig. 1), but the transistors themselves proved to be o.k. The associated resistors were all within specification, and the trouble was eventually traced to 2C46 (22μF) being open-circuit. Since this capacitor decouples the emitter of 2VT8, there would be considerable negative feedback. The resultant lack of signal was affecting the a.c.c. line, so that the voltages all round the circuit were wrong.

Line Output Stage Troubles

We've had a fair amount of line output stage trouble on ITT solid-state colour receivers recently. In each of the three cases below we ended up by having to replace the line output transformer.

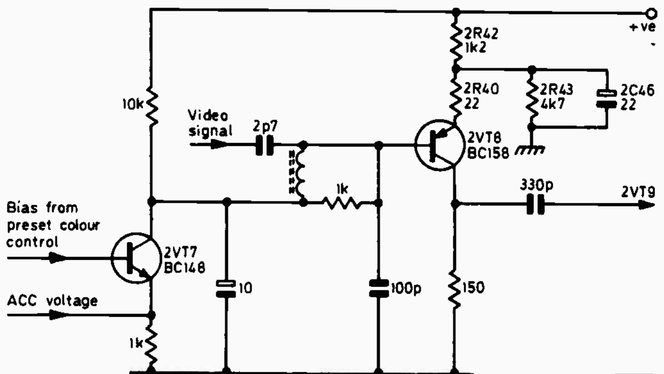


Fig. 1: Chroma gain control arrangement, Rank A823A chassis.

The first set was one fitted with the CVC20/3 chassis, the symptoms being no e.h.t. and the tube heaters out (they're fed from a winding on the line output transformer). Checks on the supplies from the line output transformer revealed that the HT5 line (to the RGB output transistors) was only 115V instead of 225V while the 24V supply was only 1V. A scope showed that the waveform at the collector of the line driver transistor was correct, but there was no waveform in the line output transistor's collector circuit – though the 125V d.c. supply was present. Careful inspection revealed a dry-joint at the transistor's collector. Resoldering this cured the trouble and the set was returned to the owner. A week later however the set was back, this time with the power supply tripping. Both the tripler and the line output transformer had to be replaced.

The next set was one fitted with the CVC25 chassis. This time the tube heaters were out and the e.h.t. was only 3kV. The set was not tripping however. A new tripler restored the e.h.t. and as the line output transformer was running warm we decided to play safe and replace this as well.

The third set was fitted with the CVC20 chassis. Again no picture, with the fusible resistor R101 in the drive to the EW modulator open. We could find no reason for this, so we soldered it up and switched on. This time we had 7kV e.h.t., though still no raster. The tripler was the culprit, and apparently R101 provides the line output stage with a degree of protection in the event of a defective tripler. Anyway we now had a picture, but tapping the chassis produced all sorts of complaints – flashing lines, cogging, inoperative contrast control etc. – all due to various dry-joints around the transformer's earth connections. A soak test didn't reveal anything else amiss, so back it went to the customer. Once again however it took only a week for the set to return. This time the set was tripping, a new line output transformer putting matters right.

Rank A823 Chassis

About a year ago we replaced the tube (low emission) in a set fitted with the Rank A823 chassis. For some time afterwards the customer stated that after switching on the picture behaved in a most peculiar manner, clearing up after five minutes. We paid several visits before we saw the fault, which can only be described as overloading with sync break up. After thinking about the problem and the set's history, we realised what was wrong. Before the tube had got so bad it had to be changed, we'd adjusted the preset i.f. gain control 2RV2 to get a better picture. With the new tube, this was no longer necessary, readjustment of 2RV2 clearing the condition. Why hadn't we done so on changing the tube? Well, the fault didn't show up with the relatively poor signal at the workshop: it did with the higher signal strength at the customer's home.

A couple of quickies on this chassis. A hum bar was traced to a dry-joint on the l.t. bridge rectifier 8BR1. Field collapse was traced to loss of the 40V supply due to the two rectifiers in the line output stage going open-circuit (5D10/11 or 5D12/13 depending on whether it's the earlier or later version of the chassis). This is the first time in all the years we've been servicing these sets that we've found the rectifier diodes to be the cause of the fault. We have on occasion however had field roll due to a dry-joint on the associated 750μF reservoir capacitor (5C38 or 5C39).

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 43 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.

THORN 1600 CHASSIS

There's sound but no raster, with the h.t. line way down at only 75V. Disconnecting the anti-breathing resistor (R158) in the feed to the line output stage increases the h.t. voltage to 195V, so the fault would seem to be in the line output stage. I've tried disconnecting all the circuits fed from the line output transformer, and have replaced both the transformer and the line output transistor, but the fault remains. Any other ideas?

The emitter of the line output transistor is returned to chassis via a shunt regulator circuit – VT17/18 and associated components. The fault could well be in this area therefore, the main suspect being the shunt regulator transistor VT18 (TIP31). Check other components as necessary however, including the 6·2V zener diode W32 and the set h.t. potentiometer R149.

SONY KV1300UB

The fault that has developed on this set is pincushion distortion at the sides of the raster. Is there any way of adjusting this?

The last time we came across this fault it was due to C521 (4·7μF) being open-circuit. This capacitor provides the input to the base of the pincushion modulator transistor Q505. Other possibilities are the transistor itself or the pincushion control VR504 – or dry-joints on this area.

THORN 3000 CHASSIS

The picture on this set shrank till it was only about 3in. high, though central in the screen. By altering the controls the top half of the screen can be filled but not the bottom half, which appears to be cramped. There doesn't seem to be anything drastically wrong, and I've tried replacing the field charging capacitors. All resistor values seem to be correct, but the voltages around the field output transistor are not quite right – 40V at the collector, 3·6V at the base and 2·4V at the emitter.

The voltages you quote reveal the cause of the trouble – the field output transistor has excessive base bias. Though it can be turned off by the drive waveform, it's reaching saturation before the scan has been completed. The usual cause of the trouble is the transistor itself. A 2N3055 can be used as a replacement.

PYE HYBRID COLOUR CHASSIS

The trouble with this dual-standard set is intermittent instability on u.h.f. – ITV only is affected, but the fault is present whichever selector is tuned to ITV. The fault can be cleared by changing channels, i.e. switching to another channel then back again.

Provided the aerial system is beyond suspicion, it seems that you have tuner trouble. It would be simplest to fit a new tuner, but you could try checking the feedthrough capacitors on the supply leads by bridging each in turn with a small r.f. decoupler, say 0·01μF.

TELPRO C501

The set first lost width, then the raster disappeared, followed by distorted sound. After replacing the line output transformer, the PL509 and PY500 valves and the tripler, a small picture with pincushion distortion appeared then faded away within seconds. The boost capacitor seems to be o.k., and the only clue is that R485 gets red hot.

R485 links the pincushion distortion correction transductor to the line scan circuit. It seems likely that the transductor has failed and is mopping up all the line scan energy. You can test this by removing the transductor altogether. Short out R481 (across the transductor's field windings) when making this test. If you then get a full-width raster, the transductor is faulty. These sets are electrically similar to the Decca 30 series.

TANDBERG CTV2-4

The first problem was distorted sound, followed by loss of sound. This was cured by replacing the feedback coupling capacitor C129 (22μF) in the tone control circuit, using a 60V type, but the replacement lasted for only a couple of months before the fault returned.

Since C129 is in the tone control network we can't see that it would cause complete loss of sound. It's certainly not a common trouble spot. If it goes short-circuit however it might be worth trying a higher voltage type or a tantalum capacitor. These sets are notorious for intermittent or no sound faults due to poor connections to the leads carrying the audio signal from the mother board to the front panel – the problem is with the crimping of the leads to the flying socket connections at the mother board end. It seems possible that mechanical disturbance when replacing C129 restored the sound – if it was completely lost. Plugs B, C and U are suspect: remake any faulty connections by soldering directly to the print side of the panel.

ANTUR 26in.

This set was bought through a trade outlet. I was told that it was fitted with the ITT CVC5 chassis, and that the only fault was poor focus. On testing it I found that there was plenty of width but the focus was very bad (low voltage at pin 9 of the c.r.t.). The set seems to be akin to the Combi model covered in your February 1979 issue, but someone had modified the line output stage, removing the overwinding from the line output transformer and converting it to tripler operation. I decided to modify the focus circuit as well therefore, disconnecting the lead from the original focus control R513 and instead using a v.d.r. from a Pye hybrid chassis, connecting this across the e.h.t. output from the tripler. Do you consider this a reasonable change, and for what voltage should the set boost control R517 be set?

The v.d.r. should work reliably, but if the original focus rectifier D502 and its reservoir capacitor C508 are still present it would be as well to remove them. The line output transformer for these sets is rare and expensive, which is probably why someone has converted it to tripler operation. The correct boost voltage can't, under the circumstances, be predicted, but everything should be o.k. if R517 is adjusted for just adequate picture width. These sets use a Continental ITT design, most of the circuitry being identical to that used in the CVC5 chassis.

PHILIPS G6 CHASSIS

I've overhauled this set but am left with one problem I can't cure. The top inch of the picture is bent towards the left of the screen but, unlike a weak sync problem, the raster is perfectly steady. All the voltages in the timebases seem to be normal, and none of the adjustments I've tried improve matters. The line and field sync are both good.

First make sure that the c.r.t. Aquadag coating is earthed at the c.r.t. base panel, and that the latter is earthed to chassis. Then note that there's a rather unusual link between the field timebase and the line oscillator stage – via the vertical correction control R4120 and R4085 (a field-frequency parabola is applied to both the grid and the cathode of the triode section of the PCF802 line oscillator valve). We suggest you try the effect of adjusting R4120, and of disconnecting R4081 and R4085 to delete the link.

It may be necessary to check the components in the vertical correction circuit if you wish to preserve this feature.

SANYO 12T224

There's high-speed field roll on this portable, though an acceptable picture shows through. The voltage at the collector of the sync separator transistor Q103 is low at 2-3V instead of 10·2V, its base and emitter voltages being correct. The base and emitter voltages of the field output transistors are slightly high and vary in sympathy with the field roll.

After integration, the field sync pulses are applied to the field oscillator via the 0·1μF capacitor C502. This could be breaking down, causing a reduced voltage at the collector of Q103 along with a drastic field frequency shift. If necessary, check the field oscillator transistor Q104 and the associated diode D106 and other small components. Q103 could be faulty, though we'd expect the line sync to be affected in this case.

TELEFUNKEN 709 CHASSIS

There seems to be rather a lot wrong with this set – no sound or vision, field collapse, and lack of width. Before this, the picture would first appear out of focus, then collapse to a small, square picture. The focus rectifier etc. appear to be in order however. Any suggestions about where to start?

Try to get a raster of sorts before worrying about the loss of signals and lack of width. First check that the 24V (U5) and 260V (U1) lines are present. If these are o.k., check for –48V at the top end of the height control. Loss of this supply could be due to failure of rectifier GR490 in the line output stage – this fault could also be responsible for the lack of width, due to excessive line output stage loading. The associated reservoir capacitor C491 (0·022μF) has been known to go short-circuit, loading the diode, while R431 (1·2MΩ) in the feed to the height control has been known to go open-circuit to give field collapse. If these supplies are all present and correct, use the old dodge to confirm that the field output stage is working – connect an 0·1μF capacitor from heater pin 4 of the PL508 field output valve to its control grid (pin 1) to see whether some sort of raster is then obtained. If so, the fault is in the preceding circuitry, which is a bit unusual. The things to check are the preamplifier transistor T421 and the two diodes GR421 and GR422 – all these items can fail. If no raster is obtained when the field output stage is checked as described, check the raster correction transductor TR480. This has a habit of arcing internally and going open-circuit, while at the same time a short develops between the line and field windings. Again the result will be low width as well as field collapse. If signals are still not present when the raster has been restored, make voltage checks in the i.f. strip.

PHILIPS 320 CHASSIS

On switching the set on some days ago there was a flash and some smoke. Investigation revealed that the spark gap on the line scan coils had broken down, shorting to chassis. A new one was fitted and the set worked well for three days, after which the same thing happened again. The spark gap was disconnected, and I then switched on to check the HT1 voltage. Before I had a chance to do so however the mains fuse blew.

The spark gap does occasionally give trouble. It's likely to have overloaded the line output stage and/or the power supply. We suggest you first suspect the thyristor in the power supply and its associated components. Replace it with an OT112 type, and also replace the BR101 silicon controlled switch. Fit a new spark gap, and replace the BU105 line output transistor with a BU205. Disconnect the e.h.t. stick rectifier, and set up the h.t., adjusting R5630 for about 155V. If the line output stage is working, you should get a reading of just under –1V at the base of the BU205. If this voltage is absent, the line oscillator i.c. could be faulty, but try wiring a 68kΩ resistor across R2407 before replacing it as it may be lazy in starting up. The only other common suspect here is the BF337 driver transistor. If all's well so far and the e.h.t. stick rectifier seems in order, reconnect it. If there's slight lack of width, connect the link across L2442 in the line scan circuit.

HITACHI SX CHASSIS

The trouble with this portable is that R712 (10Ω) and R714 (5·1Ω), which are in series with the line driver transformer, overheat and smoke. Freezing the line generator i.c. (IC5, type HA1166Z) restores the picture, but with the line timebase running at the wrong speed. What's the most likely cause of the trouble?

These sets are a bit unusual in that apart from the transformer and its feed resistors the line driver stage is incorporated in the line generator i.c., along with the line oscillator etc. Freezing a good i.c. shouldn't affect its operation, so the trouble is almost certainly due to the i.c. If the transformer has been allowed to overheat for too long however its insulation could have been impaired, so that both components may need to be replaced – the i.c. may well have caused overheating by producing a waveform of the wrong frequency and incorrect shape. Make sure that the waveform shaping components R711, C710 and C709 are o.k., and after replacing the i.c. set up R707 and R709.

EMO COLOUR SETS

We've a couple of these sets with the no colour fault, though the monochrome pictures displayed are quite acceptable. The obvious thing to do is to override the colour-killer, but the service data I have gives no advice on how to do this.

The colour decoder used in the Emo colour sets imported into the UK is a conventional, discrete component one. The ident signal produced by T2537/L2502 on a colour transmission is rectified by D2510 to produce a negative turn-off bias for the colour-killer transistor T2540, which is otherwise forward biased by R2624. To override the colour-killer therefore, simply disconnect one end of R2624. T2540 will then switch on, allowing the delay line driver transistor T2536 to conduct.

THORN 3500 CHASSIS

After replacing the tube (it had air in it) and the e.h.t. tripler, all we had was a reduced raster, about two inches wide with foldover at the bottom. The voltage across the beam limiter sensing resistor R907 is 6V instead of 1·3V. All the feeds from the line output and e.h.t. transformers have been disconnected in turn, but the 6V across R907 remains. The only way in which the 6V can be reduced is by disconnecting the line output transistor (which tests o.k. on a meter). The two transformers have been isolated from each other and operated singly but the fault persists. Unfortunately the set had been used for sound only until the tripler broke down.

Unfortunate indeed! It's almost certain that both transformers have failed – it's happened to us many times. The sequence is that the tripler fails, overheating the e.h.t. transformer T503 and damaging it. This in turn loads and damps the line output transformer T504, which also fails with shorting turns. When you've completed this repair, it would be as well to replace R907 which has been under heavy stress.

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TELEVISION NOV. 1980

TEST CASE

215

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 have lots of Japanese TV receivers in our care, a fair number of them out on rental. A recent 'phoned request was to attend to one of these, a Panasonic Model TC2204. Unfortunately the owner was unable to provide a clear description of the fault symptom, as it seemed to vary with picture content. A sort of greeny, stripey effect he said. Oh dear!

So we made the call with some trepidation. The trouble with Oriental sets we find is that there are seldom any common faults. Instead, almost every failure is unique – and this one promised to be horrible! The cricket turned out to be reasonable enough, but the studio programme on another channel had vague green horizontal bands across the picture, moving about with the highlights. As the scene changed, the background tint would alter from greenish to quite green.

With a monochrome test pattern displayed we were able to achieve a reasonable grey scale by adjusting R366, the c.r.t.'s green first anode preset, but when programme material was viewed the background colour changed – rather in the manner of early colour sets using colour-difference tube drive when the grid clamping had gone haywire.

Out came the oscilloscope with a flourish. There was no discernible difference in the drive waveforms at the c.r.t.'s three cathodes, and interchanging the cathode leads made not the slightest difference to the symptom. The cathode d.c. voltages were identical, and the first anode voltages comparable (green was a little lower than the others, due to our adjustment). The three grids, though each has a separate pin (tube 560CXB22-TC02), are strapped together, so we disregarded the possibility of anything amiss here. Back to the workshop!

When its turn at the bench came, we fired the set up and carefully studied the display. This confirmed the results of the field tests. Heads were shaken, and mutterings made about faulty c.r.t.s. In fact the tube was perfectly o.k., and the set was soon on its way back to the customer. What had ailed it and been overlooked by us? See next month for the answer and another item in the series.

ANSWER TO TEST CASE 214
– page 683 last month –

The fault described last month was on a JVC VHS machine – the trouble was bands of noise at the top and bottom of the picture. Initial checks were made on the servos and the heads, but these turned out be in order. The engineer dealing with the problem decided to investigate closely the path of the tape around the video head drum. There was no "bubbling" of the tape, and the tape appeared to be wrapped correctly. Closer examination however revealed that the tape guide on the left-hand side (the tape feed side) was not correctly positioned. This member normally locates, at the top and bottom, in a pair of vees cut into the locating bracket. In this case only the top of the guide pin was so located, the bottom end being a millimetre or so away from its notch. This was obviously causing the tape to run on to the head at a slight angle, preventing full tape-to-head contact throughout the field period. The trouble turned out to be due to a bent pin on a pivoting arm linked to the tape guide.

We should perhaps have found the cause of the trouble sooner, since this sort of thing was a common problem with the old Philips N1500 machines when dirt accumulated on the tape guides and head drum components – a thorough check and tape path clean up is recommended in any case where the symptoms suggest that servo or tape-to-head contact problems may be present.

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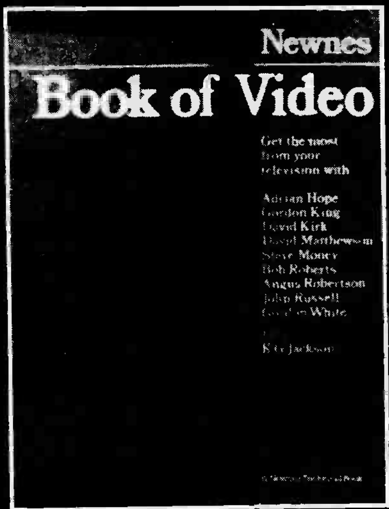

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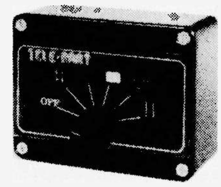

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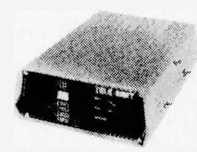

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A Power Supply can be supplied for the Telepart COLOUR BAR GENERATOR. This compact unit mounts by 2 screws into the Battery compartment and converts the unit to a bench instrument.

PRICE £5.50 (Subject to V.A.T.)

CARTERHILL LTD

"the best in rebuilt cathode ray tubes"

Have moved to larger premises at
UNIT 11, ALSTON WORKS,
ALSTON ROAD,
BARNET, HERTS.
TEL: 01-441 1667.

BUT WE OFFER THE SAME VERY HIGH QUALITY TUBES WITH HIGH DEFINITION & LONG LIFE

		EXCHANGE PRICE
19"	A49 – 191×	£28.00 + VAT
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20"	A51 – 110×	£29.00 + VAT
22"	A56 – 120×	£30.00 + VAT
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Prices include FREE delivery within 10 miles radius. Callers welcome.

T.V. ELECTROLYTIC CAPACITORS

600mfd 250v.	G8	£1.30
600mfd 300v.	G8	£1.50
600mfd 300v. (PC)	G9	£1.40
600mfd 300v.	A823	£1.40
400mfd 350v.	8500	£1.40
400mfd 400v. (PC)	9500	£1.76
470mfd 250v. (PC)	G11	£1.30
800mfd 250v. (PC)	G9	£1.50
200 + 300mfd 350v.	691	£1.80
400 + 400mfd 350v.	Decca	£2.30
150 + 150 + 100mfd	1500	£1.40
175 + 100 + 100mfd	3500	£1.75
200 + 200 + 75 + 25mfd	CVC5	£1.70
200 + 200 + 150 + 50mfd	2047	£1.70
200 + 200 + 100 + 32mfd	169	£2.20
300 + 300 + 150 + 100 + 50mfd	2040	£2.60
1000mfd 63v.	3500	50p
2200mfd 63v. (PC)	G9	80p.
1250mfd 50v.	691	45p.
4700mfd 25v. (PC)	1590	60p.
2500 + 2500mfd 30v. (PC)	A823	90p.

PLASTIC FILM CAPACITORS

Mains Filter Capacitors 250v. AC working

0.047mfd	26p.	0.22mfd	42p.
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1.0mfd (Three wire type)	45p.		

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0.047mfd	22p.	0.22mfd	42p.
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All the above prices are for single items.
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"**MAIL ORDER ADVERTISING**

British Code of Advertising Practice

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

Mail Order Protection Scheme

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

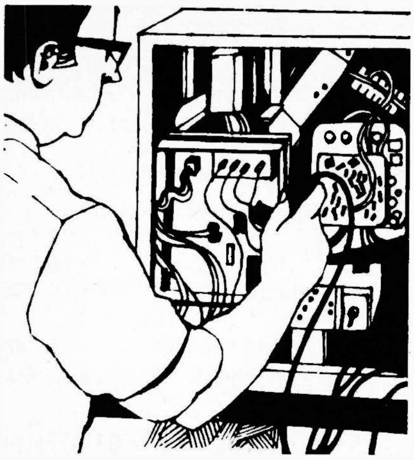
(1) You have not received the goods or had your money returned; and

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

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

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

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



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PHILIPS G8 SERIES

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

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PYE HYBRID RECEIVER

Solid State CDA Panel
Ready Built **£21.00**
In kit form **£16.95**
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The prepaid rate for classified advertisements is 25p per word (minimum 12 words), box number 60p extra. Semi-display setting £4.80 per single column centimetre (minimum 2·5 cms). All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, Television, Room 2337, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

NOTICE TO READERS

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

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

SUPPLIERS OF MONO AND COLOUR TUBES TO MAJOR RENTAL COMPANIES.

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

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

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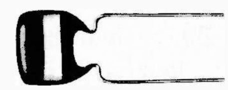
ALL VALVES FULLY TESTED

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

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

AND MANY MORE AVAILABLE

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



250 V d.c. working (160 V a.c.)
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Prices per pack of five
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1·0uF–2·2uF **£1·60.**

Postage & Packing 30p, no VAT

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9 Mandeville Terrace, Hawkshaw, Via Bury, Lancs.

"Just what the doctor ordered"!

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

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

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

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

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When replying to Classified Advertisements please ensure:

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

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

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19" £29.50, 20" £29.50, 22", 25", 26" £30.
ONE YEAR GUARANTEE
Colour TV's from **£55** working.
MATRIX TV LTD.,
112 Essex Road, London N1.
01-226 1111.

TV PATTERN GENERATOR

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

£17.75

price includes battery, P&P, and VAT.
Further details of this and our other products on request.
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TEL (0902) 736606.

COLOUR T.V.s

PHILLIPS G8 COMPLETE
22" **£55** 26" **£65**
Discount for bulk buyers
TEL: 965-1230.

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

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

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

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BETTER JOB! BETTER PAY!

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NEW: Self-build radio courses with free kits
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Address..
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TV & COMPUTER SYSTEMS SERVICING

18 MONTHS full-time Modular Diploma course to include a high percentage of practical work.

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

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

Next session starts January 5th.

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

Prospectus from:

LONDON ELECTRONICS COLLEGE

Dept: TT11, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.

WANTED

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

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

WANTED. Cossor Oscilloscope Model 3,000. Tel. Middlesbrough 465413. 16 King Street, South Bank.

I.T.T. 26" COLOUR TELEVISION MODEL TXV82 (Prestel/Teletext). Can collect. Please telephone 01-640 2446 stating price & condition.

FOR SALE

CEFAX & ORACLE Teletext adaptor. Largeam model 7026, as new price first **£200.00.** World standard Sinclair microvision T.V. **£100.00** o.n.o. D.X. T.V. 24" Ferguson with extra features £45 o.n.o. R. Wood, 40 Ashville Gardens, Pellon, Halifax, W. Yorkshire HX2 0DL.

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

VALVES

New and individually boxed
Mix of any 5 **£1.00**, 10 **£1.75**, 25 **£2.75.**

ECL80	PL82	30C15
EF85	PL83	30C17
EY51	PY33	30F5
PC86	R20	30L1
PC88	U25	30L15
PCC84	U26	30L17
PCC806	9D7	30P12
EF183	Boxes of 100	**only £15.00**
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All Prices include VAT. P&P 5-20 30p. 25 and over 50p
Linway Electronics,
843 Uxbridge Road, Hayes End, Middx. UB4 8HZ.

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

AS NEW CONDITION PHILIPS VCR 1500. Includes 6 tapes, 6 VCR heads and complete service data. Offers. Telephone Hinckley 220554 after 6.15.

ENTHUSIAST having clearout, colour panels £1, valves 10p. Many other bargains in new and used components. Send S.A.E. for lists. K. Bailey, 40 Seymour Close, Selly Park, Birmingham 29.

TELETEXT DECODER plugs into aerial socket of any TV. Ultrasonic remote control £199. Write: J. Hickman, 181 Teiznmouth Road, St. Marychurch, Torquay, Devon.

3000 PANELS. Guaranteed working. Line/Power £12.00. All others £5.00. p&p included. Other used parts available. 80, Merton High Street, London S.W.19. 01-540 9553.

VIDEOLUX LTD., SCOTLAND. Top quality rebuilt colour tubes at competitive prices. Supplier to major and national rental companies. 20AX, PIL & Japanese types available. 18, Mackintosh Place, South Newmoor, Irvine. Tel. No. (0294) 214860.

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

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

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

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

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

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

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

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COVERING COLOUR & MONO TELEVISIONS, RADIOS, RECORD PLAYERS, TAPE RECORDERS, ETC.

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COVERING FOLLOWING MAKES
PLEASE SEND S.A.E. FOR QUOTATION

ALBA, BRC, BUSH, DECCA, GEC, DEFIANT, MARCONI, EKCO, PYE, FERGUSON, DYNATRON, NATIONAL, HITACHI, INVICTA, ITT/KB, RGD, GRUNDIG, SOBELL, STELLA, SONY, MURPHY, PHILIPS, HMV, ULTRA & OTHERS.

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We supply circuit diagrams for televisions in Giant Binders, covering most British 'Single' and 'Dual Standard' models, consisting of 2 volumes on colour and 1 on black & white. Price **£14·50** each post free or all 3 for **£40·50** post free.

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BACK ISSUES OF FOLLOWING MAGAZINES AVAILABLE. CURRENT PRICE PLUS 25p POSTAGE PER COPY.
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BELL'S TELEVISION SERVICES

190, KINGS ROAD, HARROGATE, N. YORKSHIRE. TEL. HARROGATE (STD 0423) 55885

OPEN TO CALLERS DAILY 9.00 a.m. TO 5.00 p.m. (HALF DAY WEDNESDAY) PLEASE INCLUDE AN S.A.E. WITH ENQUIRIES

ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

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

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

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

TELEVISION TUBE SHOP

NEW TUBES AT CUT PRICES

EUROPEAN TYPE Nos.

	Price £	VAT £ 15%
A28-14W	18.95	2.84
A31-19W/20W	19.95	2.99
A31-120W/300W	17.95	2.69
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A38-160W	17.50	2.63
A44-120W	27.00	4.05
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9AGP4	21.82	3.27
190AB4/C4	23.00	3.45
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310EUB4	19.95	2.99
310EYB4	18.75	2.81
310FDB4	19.95	2.99
310FXB4	17.50	2.62
310GNB4A	23.50	3.52
310HCB4	23.50	3.52
340AB4	19.50	2.92
340AYB4	30.00	4.50
340RB4/CB4	25.50	3.83
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Some Rebuilt Japanese & European Types Available from £14.00 + VAT £1.75

COLOUR TUBES
New and Mullard Colourex*

12VARP22	62.50	9.37
330AB22	67.50	10.12
470FUB22B	97.50	14.63
A44-271X	65.00	9.75
A47-342X	69.50	10.42
A47-343X	69.50	10.42
A49-191X	59.50	8.92
A51-161X	67.00	10.05
A51-220X	64.00	9.60
A56-120X	58.50	8.77
A63-120X	69.50	10.42
A66-120X	65.00	9.75
A66-140X/410X	70.50	10.57
A67-120X	65.00	9.75
A67-140X/200X	69.50	10.42
A67-150X	75.00	11.25

Old Bulb Required for Colourex

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

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

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

DISPLAY ELECTRONICS

REGUNNED COLOUR TUBES

2 YEAR GUARANTEE

Up to 19"	**£29.50**
20"	**£31.50**
22"	**£33.50**
25"	**£35.50**
26"	**£37.50**

The above prices are for standard 38mm Delta Gun Types. Prices on application for P.I.L. Tubes etc. Some types available without pre-supply of glass at extra cost.
Carriage/Packing £5 up to 75 miles from works. £6.50 over. Please add 15% VAT

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2 YEAR GUARANTEE

20"	**£11.00**
24"	**£13.00**

Carriage/Packing £4.00 up to 75 miles from works. £5.00 over. Please add 15% VAT.

BUDGET CORNER

Buy any 5 mixed types Cash 'n Collect – Take 20% discount.

OR

Buy any 5 Mono mixed sizes Cash 'n Collect at **£8.50** (20") and **£10** (24").
PLEASE ADD 15% VAT.

CALLERS WELCOME

Late night Thursdays until 8pm Saturdays until midday.

N.B. Customers intending to collect orders are requested to telephone in advance:— even popular types may be out of stock for short periods.

V.D.U./RADAR TUBES

We have supplied British and Foreign Airlines with rebuilt V.D.U. Tubes for several years and also have Radar Display Tubes operating on British Airfields.

Home and export enquiries for Radar Display Tubes manufactured from new (with phosphors to specification) are invited.

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Following recent expansion of our production capability we are seeking wholesale stockists who have the facilities to hold stocks of tubes and who will give our customers the same service that they have come to rely upon at the factory.

WATERLOO ROAD, UXBRIDGE, MIDDLESEX

Telephone: Uxbridge 55800

Now at Bridgwater!

WELLVIEW

SERVES THE WEST

Exchange Colour

	our price	+VAT 15%	total price
A44/270X-271X	£27·00	£4·05	£31·05
A47/342X-343X	£27·00	£4·05	£31·05
A49/120X	£27·00	£4·05	£31·05
A51/110X	£27·00	£4·05	£31·05
A55/14X	£32·00	£4·80	£36·80
A56/120X	£32·00	£4·80	£36·80
A63/120X	£36·00	£5·40	£41·40
A66/120X	£36·00	£5·40	£41·40
A67/120X	£36·00	£5·40	£41·40
A67/200X	£36·00	£5·40	£41·40

New Mono

	our price	+VAT 15%	total price
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