JANUARY 1981

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TELEVISION

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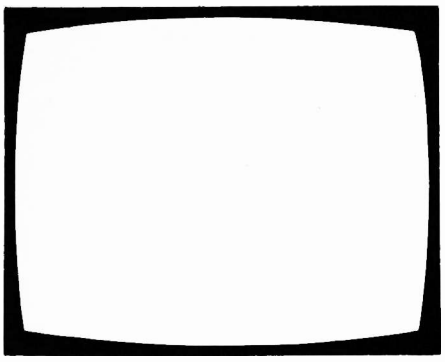

TELEVISION

January 1981

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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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An annual subscription costs £10 in the UK, £11 overseas ($24.20 Canada or USA). Send orders with payment to IPC Services, Oakfield House, Perrymount Road, Haywards Heath, Sussex.

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

this month

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	each		each		each		each		each		each		each		each		each		each		each
AC127	.54	AF239	1.00	BC119	.49	BC173	.19*	BC547	.14*	BD150B	1.29	BF123	.29	BF222	.29	BF450	.52	BU111Y	3.18	R1038	2.72	TIP126	.78
AC128	.58	AF279S	1.15	BC125	.20*	BC178	.26*	BC548	.14*	BD150C	1.09	BF154	.25*	BF224	.35*	BF458	.52	BU126	2.10	R1039	2.74	TIP127	1.49
AC 141	.68	AL102	2.90	BC126	.20*	BC179	.28	BC549	.19*	BD163	.97	BF156	.55	BF240	.29*	BF459	.62	BU204	1.79	R2008	2.89	TIP2955	.85
AC142	.68	AL113	2.90	BC135	.23*	BC182L	.14*	BCX31	.30	BD168	.61	BF158	.39*	BF241	.29*	BFR41	.43	BU205	2.53	R2009	2.52	TIP3055	.64
AC153	.57	AU103	2.80	BC136	.20*	BC183L	.14*	BCX32	.29*	BD181	1.03	BF160	.59	BF255	.34*	BFR52	.41	BU206	2.76	R2010	2.89	TIS43	.38
AC176	.59	AU106	3.56	BC137	.20*	BC184L	.14*	BCX33	.29*	BD182	.80	BF167	.48	BF256	.82	BFR62	.40	BU208	2.88	R2020	2.45	TIS90	.35
AC187	.68	AU107	2.74	BC139	.39*	BC186	.38	BCX34	.35	BD183	1.04	BF173	.50	BF257	.49	BFR81	.38	BU208/02	2.98	R2030	2.55	TIS91	.35*
AC188	.68	AU108	2.74	BC140	.39	BC187	.33*	BCX36	.35	BD187	.87	BF177	.60	BF258	.49	BFT42	.51	BU326S	3.20	R2265	2.61	TIS92	.46
AD149	1.64	AU110	2.90	BC141	.38	BC212L	.15*	BCY70	.25*	BD201	.76	BF178	.35*	BF259	.49	BFW10	.80	BU407	3.72	R2305	.98	ZTX300	.15*
AD161	.75	AU111	2.90	BC142	.39	BC213L	.16*	BCY71	.34*	BD222	.46	BF179	.49	BF262	.64	BFX29	.49	E1222	.48	R2306	1.12	ZTX500	.17*
AD162	1.03	AU112	2.90	BC143	.39	BC214L	.16*	BCY72	.25*	BD225	.57	BF180	.49	BF263	.68	BFX84	.49	ME8001	.35	R2540	3.39	40636	1.40
AF115	1.04	AU113	3.05	BC147	.15*	BC237	.19*	BD115	.81	BD232	.63	BF181	.59	BF271	.49	BFX85	.43	MJE340	.77	TIP29	.56	2N2905	.38
AF116	1.04	AUY10	1.71	BC148	.11*	BC238	.17*	BD116	.96	BD233	.63	BF182	.50	BF273	.20*	BFX88	.49	MJE520	.71	TIP30	.77	2N3053	.29*
AF117	1.04	BC107	.18*	BC149	.15*	BC239	.15*	BD131	.60	BD234	.60	BF183	.50	BF274	.27*	BFY50	.49*	MJE2955	1.74	TIP31	.37	2N3055	.77
AF118	1.38	BC108	.18*	BC153	.20*	BC307	.19*	BD132	.72	BD237	.76	BF184	.49	BF324	.57	BFY51	.50*	MJE3055	1.03	TIP32	.41	2N3703	.16*
AF125	.59	BC109	.18*	BC154	.20*	BC327	.22*	BD133	.69	BD238	.57	BF185	.49	BF336	.49	BFY52	.50*	OC28	3.17	TIP33	.62	2N3704	.26*
AF126	.61	BC113	.20*	BC157	.16*	BC337	.17*	BD135	.58	BD435	1.03	BF194	.19*	BF337	.49	BFY90	1.19	OC35	2.55	TIP34	.63	2N3705	.15*
AF127	1.04	BC114	.18*	BC158	.15*	BC338	.17*	BD136	.58	BD437	.75	BF195	.15*	BF338	.49	BSY79	.84	OC36	2.63	TIP41	.47	2N3707	.19*
AF139	.86	BC115	.23*	BC159	.16*	BC384LC	.29	BD140	.58	BD509	.77	BF196	.19*	BF355	.80	BRY39	.62	OC44	.52	TIP42	.50	2N5296	.91
AF178	2.04	BC116	.20*	BC160	.39	BC461	.35	BD144	2.49	BD510	.65	BF197	.19*	BF362	.62	BU105/01	1.84	OC45	.56	TIP47	.44	2N5298	1.03
AF180	2.12	BC117	.19*	BC1708	.27	BC462	.75	BD150A	.94	BDX32	2.86	BF198	.28*	BF363	.62	BU105/02	1.84	OC71	.63	TIP112	1.09	2N5496	.78
AF181	2.14	BC118	.33*	BC171	.17*	BC463	.75			BF115	.59	BF199	.25*	BF422	.62	BU108	2.38	OC72	.63	TIP117	1.37	zSC1172Y	3.88
				BC172	.19*					BF121	.29	BF200	.38	BF423	.68	BU110	3.89	OC76	.46	TIP121	.78		

THYRISTORS, SILICON SWITCHES, DIACS

	each		each		each
BFT42	.51				
BFT43	.51	BT109	1.68		
BR100	.29*	BT115	1.70		
BR101	.42*	BT119	4.43		
BRC4443	.95	BT120	4.45		
BRY39	.60	C106D	.73		
BT106	1.31	OT112	2.00		
BT108	1.71	TIC46	.54*		

BRIDGE RECTIFIERS

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

DIODES AND RECTIFIERS

*domestic sold in packs of 10

	each		each		each		each		each		each		each
AA112	.16*	BA115	.14*	BAX16	.08*	BY206	.20*	BYX10	.18	IN4007	.10*		
AA116	.18*	BA145	.21*	BY126	.13*	BY207	.26*	DA47	.12*	IN4148	.04*		
AA117	.17*	BA155	.14*	BY127	.13*	BY210/400	.33	DA91	.12*	IN4448	.23*		
AA119	.10*	BA156	.12*	BY133	.21*	BY210/800	.42	IN4001	.06*	IN5401	.16*		
AA143	.13*	BA202	.12*	BY176	2.04	BY227	.36	IN4002	.06*	IN5404	.21*		
AA144	.09*	BA219	.12*	BY182	1.15	BY251	.33*	IN4003	.06*	IN5408	.27*		
AY102	2.03	BA316	.27	BY184	.58	BY255	.35	IN4004	.06*	ITT44	.05*		
AY106	1.86	BA317	.31	BY187	.93	BY298	.66	IN4005	.08*	ITT2002	.25*		
BA102	.48	BAX13	.05*	BY199	.39	BY299	.69	IN4006	.09*				

VALVES

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

INTEGRATED CIRCUITS

	each		each		each
8RCM200	4.41	SN16848N	2.62	TBA641B11	3.71
8RCM300	4.51	SN16851NC	2.62	TBA651	3.92
8RC1330	1.05	SN72723L	2.21	TBA673	2.88
8TT822	6.88	SN76003N	2.20	TBA690	3.76
8TT6018	2.59	SN76013N	1.70	TBA700	2.12
C500	3.53	SN76013ND	1.97	TBA720A	3.48
CA270AE	3.70	SN76023N	1.61	TBA750	2.01
CA270BE	3.56	SN76023ND	1.98	TBA800	2.30
CA505	1.72	SN76033N	1.94	TBA810AS	2.93
CA758E	4.50	SN76110N	2.11	TBA810S	2.93
CA920AE	2.58	SN76226DN	2.58	TBA820	1.96
CA8121	2.38	SN76227N	2.21	TBA890	5.20
CA3089E	4.56	SN76228N	2.43	TBA920	3.01
CA3090Q	1.96	SN76530P	1.94	TBA940	4.08
ETT6015	2.90	SN76532N	2.33	TBA9502A	2.61
ETTR6016	2.90	SN76533N	2.54	TBA970	5.40
LM1351	2.08	SN76544N	1.85	TBA990	3.33
LM1370	2.34	SN76546N	3.81	TBA1440G	4.39
MC1307P	2.62	SN76666	1.67	TBA1441	4.39
MC1310P	2.20	TAA350A	1.72	TCA270	2.32
MC1327AP	3.53	TAA550A	.31	TCA270S	5.40
MC1327P	1.58	TAA550B	.31	TCA440	2.61
MC1330P	.85	TAA550C	.31	TCA640	3.92
MC1349P	2.28	TAA570	2.16	TCA650	4.51
MC1351P	2.08	TAA591	3.65	TCA730	4.25
MC1352P	1.64	TAA630S	5.16	TCA750	3.20
MC1358P	1.67	TAA661B	3.47	TCA800	3.58
MC7724CP	1.79	TAA700	5.16	TCA820	3.00
ML2378	2.59	TBA231	1.70	TCA900	1.95
SAA570	2.61	TBA240A	6.17	TCA910	1.95
SAA700	5.16	TBA395	4.41	TCA940	1.95
SAS560S	2.36	TBA396	3.68	TCE100P	4.68
SAS570S	2.38	TBA440C	4.37	TDA440	4.35
SAS580	3.88	TBA440N	4.39	TDA440N	4.35
SAS590	3.88	TBA480	2.30	TDA1170	5.03
SAS660	4.50	TBA500	3.47	TDA1412	1.55
SAS670	4.50	TBA510	3.47	TDA2522	5.52
SCP503P	1.80	TBA520	2.55	TDA2530	3.63
SCP504P	1.95	TBA530	2.38	TDA2560	4.79
SCP506P	3.55	TBA540	2.94	TDA2590	3.54
SL437F	7.91	TBA550	3.15	TDA2600	3.86
SL901B	5.24	TBA560C	3.10	TDA3950	3.39
SL917B	7.39	TBA570	2.35	ZTK33A	.94
SL918A	7.91	TBA641A12	3.51		

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RR1 640	.72
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TCE 1400	1.16
RR1 A823	1.00
GEC 2110/12R5 + 12R5	.66
TCE 3000	.93

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150 • 100 • 100 • 100 • 150 • 325v	3.16
TCE 1500	
150 • 100 • 150 • 300v	2.21
TCE 950	
100 • 300 • 100 • 16 • 300v	2.01
TCE 3000/3500	
175 • 100 • 100 • 350v	2.43
TCE 3000/3500	
1000 • 63v	.75
TCE 8000	
700 • 250v	2.48
DECCA	
400 • 400 • 350v	3.30
DECCA	
200 • 200 • 100 • 300v	2.65
RR1/1TT	
200 • 400v	1.87
PYE	
200 • 300 • 350v	2.58
GEC	
200 • 200 • 150 • 50 • 300v	3.79
RR1	
300 • 300 • 300v	2.87
RR1	
2500 • 2500 • 30v	1.43
RR1	
600 • 300v	2.18
PYE	
200 • 300 • 100 • 32 • 350v	3.97
TCE	
150 • 200 • 200 • 300v	2.78
K.B.	
200 • 200 • 200 • 50 • 300v	3.04
K.B.	
200 • 200 • 75 • 25 • 300v	2.93
PYE	
800 • 250v	2.24
RR1	
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GEC 2110	6.44
GEC 2100	7.76
GEC 2200	6.44
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PYE 731 (4 lead)	6.55
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DECCA CS1730,1830	6.11
DECCA CS2030,2230,TELPRO	6.44
DECCA CS1910,2213	6.44
DECCA 80/100/Telpro	5.20
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TCE 4000	6.72
TCE 8000	5.62
TCE 8500	7.99
TCE 9000	7.24
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RR1 A823	8.39
RR1 A8238	7.07
RR1 Z718	6.38
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GRUNDIG 3000	6.61
KORTING	6.81
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SABA/TFK/SITA/DORIC	6.38
TANBERG TV2-2, TVC M6	6.55
EUROTRAY	6.24
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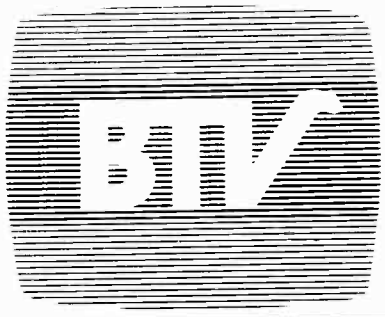

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6 button integrated all at **£4.00**
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+ £5.00 P & P

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All D/Standard Lopts at **£4.00** + £1 P&P.
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PCL85	0.10	PCF805	0.25	PC97	0.20	EH90	0.10	30PL13/4	0.10	GY501	1.00
PCL86	0.10	PCF806	0.10	PC900	0.10	DY802	0.10	30FL1/2	0.25	PL508	0.50
PFL200	0.10	PCF808	0.25	EF80	0.10	PY800/1	0.10	ECC82	0.10	PCF200	0.50
PCF801	0.10	PCF80	0.10	EF85	0.10	PL36	0.25	ECC81	0.10	EY51	0.15

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

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Bush/Murphy	5.00	5.00	6.50	—	—	5.00	1.50	5.00	—	—
GEC/Sobell	5.00	5.50	—	—	—	5.00	—	—	—	7.50
Philips	5.00	7.00	—	—	—	5.00	—	—	—	5.00
Decaa	5.00	9.00	9.00	—	—	5.00	2.00 (19" only)	6.00	—	5.00
Thorn 2000	5.00	5.00	5.00	6.50	6.50	7.00	—	—	—	—
Pye	7.00	6.00	7.00	—	—	5.00	—	6.50	10.00	5.00
Baird	6.50	8.50	7.00	—	—	5.00	—	—	—	5.00
								—	—	5.00

Postage & Packing £1.25

S/STANDARD COLOUR SPARE PANELS

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

Kotring and other foreign panels available on request.

Postage & Packing £1.25

COLOUR TUBES

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

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

COLOUR TUNERS

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

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

COLOUR LOPTS
Most Lopts available from £5.00. Both British & Foreign makers. Please ring or write.
P&P per Lopt £1.00

MISC.
S/Output transformer from £1.50.
F/Output from £1.25.
Scancoils from £5.00.
P&P £1.00
Other spares available on request.

THORN 1500 TUNERS
NEW SPECIAL OFFER AT £8.00
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£2.50 each
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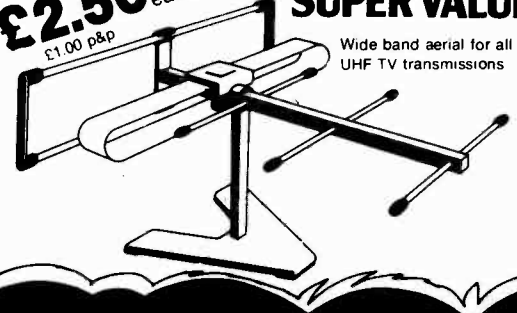

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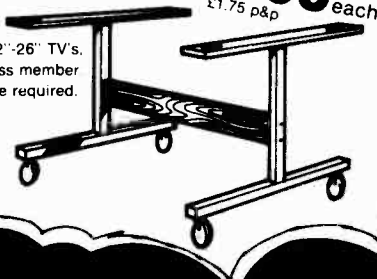

Fits 22"-26" TV's.
wood finished cross member
State size required.

TV scores with quality

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NEW SPARE SELECTION

TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £	TYPE	PRICE £
AC107	0.24	AF170	0.92	BC173	0.12	BD132	0.36	BF199	0.14	OC25	1.00	2N2219	0.40
AC113	0.22	AF172	1.00	BC177	0.12	BD133	0.37	BF200	0.28	OC26	1.00	2N2646	0.40
AC115	0.23	AF178	1.00	BC178	0.12	BD135	0.30	BF216	0.12	OC28	1.30	2N2926	0.15
AC117	0.30	AF180	1.00	BC178A	0.12	BD136	0.30	BF217	0.12	OC35	1.00	2N3053	0.21
AC125	0.23	AF181	1.00	BC179	0.12	BD137	0.30	BF218	0.12	OC36	0.90	2N3054	0.60
AC126	0.23	AF186	0.90	BC182L	0.09	BD138	0.31	BF219	0.12	OC38	0.90	2N3055	0.60
AC127	0.22	AF239	0.46	BC183L	0.09	BD139	0.40	BF220	0.12	OC42	0.45	2N3442	1.00
AC128	0.22	AU113	1.40	BC183LA	0.10	BD140	0.37	BF221	0.21	OC44	0.60	2N3702	0.15
AC131	0.13	BA130	0.08	BC183LB	0.10	BD144	1.39	BF222	0.12	OC45	0.50	2N3703	0.12
AC141	0.24	BA145	0.14	BC184L	0.09	BD145	0.50	BF224	0.18	OC46	0.39	2N3704	0.18
AC142	0.24	BA148	0.21	BC186	0.21	BD177	0.50	BF256	0.37	OC70	0.39	2N3705	0.18
AC141K	0.31	BA155	0.08	BC187	0.21	BD178	0.50	BF258	0.30	OC71	0.39	2N3706	0.14
AC142K	0.31	BAX13	0.05	BC209	0.11	BD203	0.40	BF259	0.30	OC72	0.39	2N3707	0.14
AC151	0.21	BAX16	0.08	BC212	0.09	BD204	0.70	BF260	0.25	OC74	0.39	2N3708	0.14
AC165	0.21	BC107	0.11	BC212L	0.09	BD222	0.73	BF262	0.28	OC75	0.39	2N3772	2.00
AC166	0.21	BC108	0.11	BC213L	0.09	BD233	0.36	BF263	0.25	OC76	0.39	2N3773	2.50
AC168	0.22	BC109	0.11	BC214L	0.09	BD234	0.34	BF271	0.27	OC77	0.50	2N3819	0.30
AC176	0.22	BC113	0.11	BC237	0.09	BD237	0.44	BF272	0.27	OC78	0.23		
AC176K	0.28	BC114	0.11	BC238	0.09	BD238	0.44	BF273	0.16	OC81	0.26	**VALVES**	
AC178	0.23	BC115	0.11	BC240	0.31	BDX22	0.73	BF336	0.30	OC810	0.14	DY87	0.52
AC186	0.26	BC116	0.11	BC249	0.35	BDX32	1.98	BF337	0.29	OC82	0.26	DY802	0.64
AC187	0.23	BC117	0.12	BC251	0.22	BDY18	0.80	BF338	0.29	OC820	0.20	ECC82	0.52
AC188	0.23	BC119	0.24	BC257	0.20	BDY60	0.80	BF479	—	OC83	0.30	EF80	0.50
AC187K	0.30	BC125	0.15	BC262	0.18	BF115	0.30	BFT	0.27	OC84	0.30	EF183	0.70
AC188K	0.30	BC126	0.15	BC263B	0.20	BF121	0.29	BFT	0.27	OC85	0.28	EF184	0.70
AD130	0.58	BC136	0.15	BC267	0.19	BF154	0.12	BFX84	0.27	OC123	0.25	EH90	0.75
AD140	0.68	BC137	0.17	BC281	0.24	BF158	0.19	BFX85	0.27	OC169	1.20	PC86	0.85
AD142	0.80	BC137	0.23	BC300	0.27	BF159	0.24	BFX	0.30	OC170	1.20	PC88	0.85
AD143	0.70	BC139	0.23	BC301	0.27	BF160	0.23	BFY37	0.22	OC171	0.92	PCC89	0.65
AD145	0.70	BC140	0.24	BC302	0.30	BF163	0.30	BFY50	0.21	OA91	0.07	PCC189	0.70
AD149	0.64	BC141	0.27	BC303	0.27	BF164	0.30	BFY51	0.21	BRC4443	0.65	PCF80	0.80
AD161	0.42	BC142	0.27	BC307	0.11	BF167	0.30	BFY52	0.21	R2008B	1.50	PCF86	0.72
AD162	0.42	BC143	0.27	BC307A	0.11	BF173	0.21	BFY53	0.27	R2009	1.30	PCF801	0.70
AD161)		BC147	0.10	BC308A	0.12	BF177	0.26	BFY55	0.33	R2010B	1.50	PCF802	0.78
AD162)	1.00	BC148	0.10	BC309	0.14	BF178	0.24	BFX	—	R2265	1.50	PCL82	0.70
AF106	0.42	BC149	0.10	BC337	0.12	BF179	0.28	BHA0002	1.90	R2305	0.38	PCL84	0.75
AF114	0.37	BC153	0.12	BC338	0.15	BF180	0.30	BSX20	0.23	R2305		PCL86	0.81
AF115	0.37	BC154	0.12	BC487	0.20	BF181	0.34	BSX76	0.23	BD222	0.37		
AF116	0.37	BC157	0.12	BC547	0.10	BF182	0.30	BSY84	0.36	R2540	2.50	PCL805	0.82
AF117	0.40	BC158	0.12	BC548	0.11	BF183	0.29	BU105	1.00	S2802	—	PLF200	1.00
AF118	0.45	BC159	0.12	BC549	0.11	BF184	0.27	BU105 02	1.50	SCR957	0.65	PL36	0.90
AF121	0.37	BC160	0.26	BC557	0.12	BF185	0.29	BU105 04	2.00	TIP31A	0.38	PL84	0.74
AF124	0.43	BC161	0.26	BCX33	0.10	BF186	0.32	BU126	1.40	TIP32A	0.36	PL504	1.15
AF125	0.30	BC167	0.11	BD112	0.39	BF192	—	BU205	1.20	TIP3055	0.53	PL508	1.50
AF126	0.30	BC168	0.11	BD113	0.65	BF194	0.15	BU206	1.60	TIP31B	0.39	PL509	2.45
AF127	0.30	BC169	0.11	BD115	0.32	BF195	0.13	BU208	1.60	TIS90	0.23	PL802	2.55
AF139	0.40	BC171	0.10	BD116	0.47	BF196	0.13	OC22	1.10	TIS91	0.25	PY88	0.75
AF150	0.27	BC171A	0.10	BD124	1.30	BF197	0.13	OC23	1.30	TV106	1.09	PY500A	1.60
AF151	0.30	BC172	0.10	BD131	0.36	BF198	0.12	OC24	1.30	MJE340	0.50	PY81 800	0.65
										MJE520	0.45		

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

E.H.T. Trays Colour

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

E.H.T. TRAYS MONO

950 MK2 1400 1500 18" 19" stick	2.50
1500 24" 5 stick	2.85
Single Stick Thorn TV 11, 16K 70V	0.75
TV 20 2 MT	0.75
TV 2016K 18V	0.75
BUSH 718	1.30

MAIL ORDER TV BARGAINS

PYE 691	22" @ £55.00
PYE 691	26" @ £55.00
PYE 697	22" @ £65.00
PYE 697	26" @ £65.00
BUSH 184	19" @ £70.00
BUSH 184	22" @ £70.00
BUSH 184	26" @ £70.00
GEC 2040	19" @ £55.00
GEC2040	22" @ £55.00
GEC 2040	25" @ £55.00
GEC 2040	26" @ £65.00
KORTING	22" @ £70.00
KORTING	26" @ £80.00
THORN 3000	19" @ £70.00
THORN 3000	25" @ £60.00
Good working mono's Pye, GEC, Bush etc.	
20" & 24" S/S	£15.00
20" & 24" D/S	£14.00
19" & 23" D/S P/Button	£12.00
19" & 23" D/S Rotary	£ 8.00

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

TYPE	PRICE £
IC's	
BTT6018	1.00
CA3605	1.20
MC7/c MC14016	0.50
SN76003N	1.40
SN76013N	1.20
SN76013ND	1.00
SN76023N	1.20
SN76023ND	1.00
SN76110N	1.00
SN76226DN	1.50
SN76227N	1.20
SN76532N	1.30
SN76550N	0.30
SN76666N	0.70
TAA570	1.38
TBA120AS	1.00
TBA120S	0.75
TBA120SQ	0.75
TBA395	2.20
TBA341	0.97
TBA520	1.40
TBA520Q	1.10
TBA530Q	1.10
TBA540	1.30
TBA540Q	1.45
TBA550Q	1.40
TBA560C	1.50
TBA560CQ	1.50
TBA570	1.00
TBA570Q	1.00
TBA800	1.00
TBA810	1.50
TBA920	2.00
TBA920Q	1.50
TBA990Q	1.50
TCA270SQ	1.45
TCA270SA	1.45
TCA270Q	—
TCA1327B	1.00
TCA800	2.00
TDA1010	—
TDA1327B	1.00
SBA750	1.75
SC9503P	1.20
SC9504P	1.20
SL901B	3.50
SL917B	5.00
DIODES & THYRISTORS	
OA47	0.06
OA81	0.06
OA90	0.06
OA91	0.07
BA130	0.10
BA145	0.16
BA148	0.18
BA154	0.18
BA155	0.10
BAX13	0.08
BAX16	0.10
BY126	0.10
BY127	0.10
BY164	0.40
BY179	0.57
BY226	—
BY227	0.12
BYF206	0.14
1N4001	0.04
1N4002	0.05
1N4003	0.06
1N4004	0.07
1N4005	0.07
1N4006	0.08
1N4007	0.08
1N4148	0.05
1N4751	0.14
1N5401	0.12
1N5403	0.12
1N5404	0.14
1N5405	0.14
1N5406	0.14
1N5408	0.25
BR100	0.22
BR101	0.28
BT106	1.19
BT108	1.23
BT109	1.09
BT116	1.60
BT120	1.60
2N4444	0.90

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25 mixed **TV Presets** £1.00
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20 assorted **Sync Diodes** blocks for various TVs £1.00
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20 assorted **Zener Diodes** 1 watt and 400MW £1.50
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12 assorted **I.C. Sockets** £1.00
20 Gen. purp. **Germ. Diodes** £1.00

GRUNDIG
UHF/VHF Varicap Tuners.
Fit **1500 GB, 3010 GB.**
Brand new £12.50

PUSH BUTTON KNOBS

Type 1 15mm long × 11mm diam. Brushed Aluminium Finish **10 for £1**

Type 2 10mm long × 10mm diam. Chrome Finish **10 for £1**

Both types fit standard 3½mm square shafts as used on most music centres etc. **100 for £7** **1000 for £50**

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

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

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

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TO220 (TIP 33 etc) **10 for 60p**
TO77 (BD131 etc) **12 for 60p**
Pack of each **£1.50**
All include Mica insulators and relevant washers.

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DIL 14 pin 10 for **£1**
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Dil to Quil 16 pin **10 for £1**

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7' lead with Fig. 8 Plug. **75p, 3 for £2**

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Assembly (single knob type) **60p** **3 for £1.50**

ITT Spun Aluminium Control Knobs. ¼" diam. ¼" shaft **5 for £1**

SAVE THAT TUBE.
Fit our **C.R.T. Isolating Transformer.** Ideal for HTR./Cath. Shorts. 200-220-240 inputs. 750-900 MA outputs with thermal cutout. Made for **Thorn 4000** C.T.V. but works O.K. on other sets.
£3.00 each 2 for £5.00

Pye 697 Line + Power Panels. Damaged with some components missing but ideal for spares. Good value. **£2.20 each** **3 for £6**

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Thyristors, **SS106.** Like **BT106.** **60p** each **3** for **£1.50** **10** for **£4.00**

3A 100V **Diodes** 8 for £1.00
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Bush CTV 25 Quadrupler Remo type Q25B. equiv. to ITT. TU25 3QK. with mounting brackets. **£2 each.** **3 for £5**

GEC single standard, hybrid chassis. convergence panel. Brand new, complete with plugs and leads £2.50

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SPECIAL OFFER
GEC transistor rotary tuners with slow drive, AE Skt. and leads **2010** Series £1.50

Line linearity coils, **50p each, 3 for £1**
4 Knobs black with chrome caps to fit ITT, Thorn, GEC and most small diam. shafts **60p** per set
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R2010B **£1 each**

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"Siemans TV 18 KV". Fit most portables 50p each 3 for £1.00

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2N3055H **60p** each **3 for £1.50**
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BC108	BC559	
BC154	BC212L	
AF289	BF245	
BCX45	BFY57	
BF506	BCY43	

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Long Leads £1.00 each 3 for £2.50

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2·2k fusible, vertical mounting
Screen Feed resistors 9 watt 8 for £1.00
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330μF 25v 10 for £1.00
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4,500μF 35V cans 80p each
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4,700μF 40V Cans 80p; 3 for £2.00

VIDEO O.P. TRANSISTORS
BF257A **10 for £1.00**
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Buy our specially designed **EHT Probe,** removes high voltage charges from tubes, caps, etc. Heavily insulated with lead and earth connector **60p** each
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TBA 800Q **60p 3 for £1.50**
TH3 thermistors 10 for £1.50
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Convergence Pots with knobs. 5Ω, 10Ω, 20Ω, 30Ω, 50Ω, 100Ω, 200Ω, 1K. 8 of 1 type £1.00. 8 of each **£7**

Decca Bradford Tuners. 5 button (4 push, one tune) **£2.75 each, 5** for **£10.50.** Also fit **Indesit** mono TV.

EHT Cable **30p** per metre 10 metres **£2.50**
Anti Corona Caps **3 for £1.00**
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Rediffusion/Doric Mk 13 5 stick **Triplers** can be modified for other sets £1.00

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400MW. 2·7V, 4·3V, 4·7, 5·6, 6·2V, 6·8, 7·5, 27V, 30V 10 of one type 80p. 10 of each type £6.00
1·3W. 12V, 13V, 18V, 10 of each type £5.50
10 of one type £1.00
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DIACS BR100 6 for £1.00
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IN4000 30 for £1.00 IN4003/10D2 20 for £1.00
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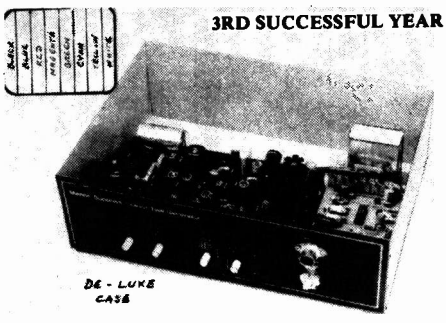

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★ Push button controls, battery or mains operated.

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BACKED BY YEARS OF EXPERIENCE

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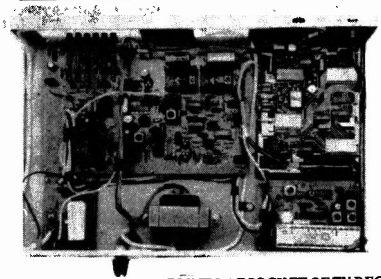

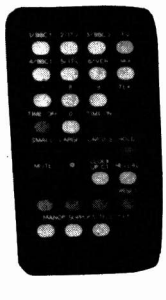

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Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC107	0.48	AU103	2.40	BC192	0.56	BC377	0.29	BD234	0.68	BF222	0.51	BPX29	1.62	MPSU05	0.66	ZTX500	0.18	2N3819	0.47
AC117	0.38	AU107	2.75	BC204*	0.39	BC394	0.39	BD235	0.83	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	8R303	1.06	MPSU56	1.32	2N404	1.30	2N3904	0.20
AC128	0.46	BC107*	0.16	BC207*	0.39	BC461	0.78	BD238	0.68	BF244*	0.51	BRC4443	1.76	MPSU60	0.82	2N696	0.46	2N3905	0.20
AC128K	0.55	BC108*	0.15	BC208*	0.37	BC477	0.30	BD253	1.58	BF245*	0.43	BRY39	0.60	MPU131	0.59	2N697	0.46	2N3906	0.20
AC141	0.65	BC109*	0.16	BC209*	0.39	BC478	0.25	BD410	1.65	BF254	0.48	BRY56	0.44	OC26	1.90	2N706A	0.33	2N4036	0.94
AC141K	0.70	BC113	0.22	BC211*	0.36	BC479	0.33	BD433	0.65	BF255	0.58	BSS27	0.92	OC28	1.49	2N708	0.29	2N4123	0.17
AC142	0.60	BC114	0.22	BC212*	0.17	BC547*	0.13	BD435	0.70	BF256L*	0.49	BT106	1.50	OC29	1.60	2N914	0.32	2N4124	0.17
AC142K	0.65	BC115	0.24	BC212L*	0.17	BC548*	0.13	BD436	0.71	BF257	0.44	BT109	1.99	OC35	1.25	2N916	0.46	2N4126	0.17
AC151	0.31	BC116*	0.25	BC213*	0.16	BC549*	0.15	BD437	0.74	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*	0.18	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	1.65
AC179	0.55	BC134	0.22	BC239*	0.22	BCY30A	1.06	BDX18	1.55	BF273	0.33	BU204	2.50	OC81	0.83	2N130B	1.53	2N5060	0.28
AC187	0.56	BC135	0.21	BC251*	0.25	BCY32A	1.19	BDX32	2.95	BF274	0.34	BU205	2.68	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	£N5064	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	0.36	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	0.35	BC267*	0.20	BD130Y	1.56	BF117	0.45	BF363	0.49	C106F	0.43	OC201	3.95	2N2221A	0.26	2N5296	0.68
ACY19	0.95	BC143	0.38	BC268*	0.28	BD131	0.58	BF120	0.55	BF367	0.29	C111E	0.46	OC202	2.40	2N2222A	0.41	2N5298	0.71
ACY28	0.98	BC147*	0.12	BC286	0.40	BD132	0.68	BF121	0.85	BF451	0.43	D40N1	0.64	OC205	3.95	2N2369A	0.40	2N5322	1.16
ACY39	2.02	BC148*	0.12	BC287	0.49	BD133	0.70	BF123	0.48	BF457	0.46	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	1.78	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	0.86	BD140	0.50	BF159	0.27	BFR39	0.30	ME6001	0.18	ST2110	0.49	2N2894	0.45	2N6027	0.55
AD162	0.71	BC159*	0.14	BC303	0.64	BD144	2.24	BF160	0.20	BFR40	0.29	ME6002	0.18	ST6120	0.48	2N2904*	0.40	2N6107	0.71
AF114	0.35	BC160	0.52	BC304	0.44	BD145	0.75	BF161	0.84	BFR41	0.30	MJ2955	1.30	TIC44	0.25	2N2905*	0.39	2N6122	0.60
AF115	0.35	BC161	0.58	BC307*	0.17	BD150A*	0.51	BF163	0.65	BFR50	0.29	MJ3000	1.58	TIC46	0.35	2N2906*	0.36	2N6178	1.07
AF116	0.41	BC167B	0.15	BC308*	0.14	BD155	0.90	BF164	0.95	BFR52	0.33	MJE340	0.68	TIC47	0.45	2N2926G	0.15	2N6180	1.39
AF117	0.42	BC168B	0.14	BC309*	0.18	BD157	0.51	BF166	0.50	BFR61	0.29	MJE341	0.72	TIP29A	0.47	2N2926O	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	2SB3378P	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	0.38	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	0.86	BC174A & B		BC322	0.28	BD166	0.88	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	BC34BA & B		BD187	1.20	BF195*	0.13	BFXB4	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	0.36	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	1.85	SN76013ND	1.40	TBA395*	2.58
CA3012	1.45	SN76018KE	2.56	TBA396	2.40
CA3014	2.23	SN76023N	1.58	TBA400Q	2.20
CA3018	0.71	SN76023ND	1.40	TBA480Q	1.84
CA3020	1.89	SN76033N	2.20	TBA500*	2.21
CA3020A	0.80	SN76110N	1.20	TBA510*	2.21
CA3028B	1.09	SN76115N	11.62	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	2.68
FCJ101	3.32	SN76530P	0.97	TBA641	2.55
LM309K	1.98	SN76533N	1.38	TBA641A12	2.35
LM380N-14	1.65	SN76544N	1.85	TBA641B11	2.61
LM1303N	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	1.48	TBA720Q	2.38
MC1330P	0.83	SN76660N	0.64	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	TBA920*	2.80
MC1357P	2.92	TAA300	3.85	TBA940	3.52
MC1358P*	2.30	TAA320	1.10	TBA950	2.08
MC145BG	1.43	TAA350A	2.48	TBA990*	2.90
MC1496L	1.15	TAA370A	3.18	TCA270A*	3.55
MC3051P	0.58	TAA435	1.70	TCA280A	1.43
MFC400B	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	4.26
ML231	3.57	TAA560	1.93	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	2.53
SAA1024	5.70	TAA630Q	3.91	TCA760	1.52
SAA1025	10.35	TAA630S	4.18	TCA820	3.29
SAS560A	2.01	TAA661A	2.39	TDA440	4.16
SAS570	2.01	TAA661B	1.75	TDA1003	1.68
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	6.89
SL432A	2.52	TAA930A	1.43	TDA1024	0.97
SL450	5.10	TAA930B	1.43	TDA1034	2.98
SL9018	4.20	TAA960	3.20	TDA2610	2.86
SL917B	5.60	TAA970	2.81	TDA2640	2.86
SL918A	5.95	TAD100	2.66	ZN414	1.45
SN72440N	2.21	(Filter)	0.98		
SN76001N	1.67	TBA120A	0.90		
SN76003N	2.20	TBA120S*	0.99		
		TBA120SA	1.02		
		TBA231	1.15		

* Indicates Q version is also available.

DIODES

Type	Price (£)	Type	Price (£)
AA113	0.17	BY114	0.60
AA119	0.21	BY118	1.10
AA129	0.28	BY126	0.20
AA143	0.18	BY127	0.21
AAY30	0.28	BY133	0.35
AAZ13	0.42	BY140	1.40
AAZ15	0.35	BY164	0.75
AAZ17	0.28	BY176	2.80
AY102	3.85	BY179	0.83
BA100	0.24	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	MRB54	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

BRIDGES

Rating	Price (£)	Rating	Price (£)
1½A 50V	0.27	2A 100V	0.36
100V	0.28	200V	0.40
200V	0.32	400V	0.47
400V	0.40	600V	0.53
600V	0.50	800V	0.60
800V	0.58	1000V	0.87
3A 100V	0.52	6A 100V	0.66
200V	0.55	200V	0.68
400V	0.61	400V	0.74
600V	0.67	600V	0.80
800V	0.80	800V	0.86
1000V	1.20	1000V	0.95

10A and 25A ranges also stocked.

VALVES

Type	Price (£)	Type	Price (£)
DY86/87	0.75	PCC84	0.61
DY802	0.75	PCC85	0.79
ECC81	0.78	PCC89	0.74
ECC82	0.95	PCC189	0.94
ECC83	0.78	PCF80	1.20
ECH81	0.83	PCF86	0.87
ECL80	0.82	PCF200	2.32
EF80	0.60	PCF801	0.74
EF183	0.75	PCF802	1.20
EF184	0.75	PCF805	3.37
EH90	0.94	PCF808	2.00
EL34	3.08	PCL82	0.93
EY51	1.20	PCL83	1.12
EY86/87	0.67	PCL84	0.65
PCL85	0.79	PCL86	1.27
PCL805/85	1.00	PD500	3.75
PFL200	1.40	PL36	1.20
PL81	0.94	PL84	0.79
PL504	1.50	PL508	1.85
PL509	3.10	PL519	3.10
PL802	3.25	PY81/P810	0.60

RESISTORS

Carbon Film (5%) — *Mixes of a minimum of 10 of one value; 10pcs of any value:*

	Ea value	50pc	100pc	500pc
¼W 5.6Ω-330kΩ (E12)	3p	25p	95p	£1.48	£6.40
¼W 10Ω-10MΩ (E24)	3p	25p	95p	£1.48	£6.40
1W 10Ω-10MΩ (E12)	5p	45p	£1.95	£3.40	£15.25
2W 10Ω-10MΩ (E6)	9p	80p	£3.60	£6.40	£26.90

Wirewound (5%)

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

Presets (†)

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

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

FUSES (all packs of 10)

20mm Time Delay (BEAB)		20mm quick-blow (BEAB)	
40mA	£3.68	100mA	68p
50, 63mA	£2.55	200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 56p
100mA	£1.86	2A circuit breakers	
160, 200, 250mA	£1.44	metal	£1.52
315, 500, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all £1.19	plastic	£1.48

LABGEAR (Details of full range on request)

TELETEXT ADAPTOR 7056
VIEWDATA ADAPTOR 7050
Prices & Details on request

COLOUR BAR GENERATOR
CM6052/DB. VHF/UHF gives standard 8 band colour bars + variable tuning + front panel on/off switch + sync trigger output + blank raster + red raster + crosshatch + greyscale stepwedge + colour bar + centre cross + dot pattern + centre dot. £213.21

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Metallised Paper

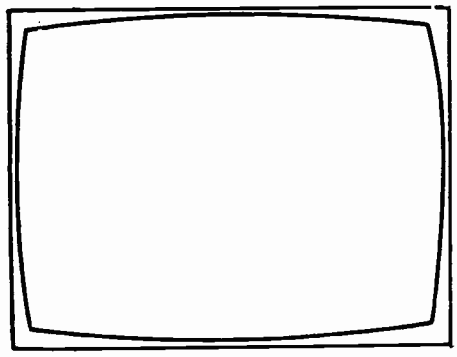
2n2F	1500V DC	60p	10nF	500V AC	80p
2n2F	600V AC	24p	15nF	300V AC	30p
3n6F	1700V DC	60p	22nF	300V AC	32p
4n7F	1500V DC	60p	100nF	1000V DC	20p
10nF	1000V DC	22p	470nF	1000V DC	60p

H.V. Disc Ceramic (†)

1kV	1.5nF	18p	8kV	250, 270, 300pF	39p
3kV	1.5nF	20p	10kV	1nF	67p
8kV	10, 22, 47, 82, 100, 120, 150, 180, 200, 220pF	30p			

CONVERGENCE POTENTIOMETERS
5, 7, 10, 15, 20, 50, 100, 200, 500Ω †38p each
Spindles for above 5p each

VHF to UHF CONVERTER CM6022/RA. "Televerta" for DX-ing or uhf receiver use on relay systems. Eire etc. †£28.37



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Crystal-gazing

Crystal-gazing and futurology are by and large harmless enough exercises. In fact the only harm comes when someone actually takes notice of what the crystal gazer says. The damage then done tends to be proportional to the distance ahead that the crystal gazer claims to be able to see.

One can be reasonably sure about the likely situation six months ahead. A year hence is a fair bet too for prophesy. A couple of years ahead and the view gets more murky. Few would claim to be able to suggest in much detail exactly what lies ten years ahead. The cynic can say that things will be much the same only more so, barring catastrophies, but while this is undoubtedly true it doesn't get one very far.

For some, the thirties was a time when the future held out great hope. I seem to recall seeing at an impressionable age books and comics that provided a glowing picture of what was to come. We'd all live in skyscrapers, and apparently spend our days travelling by air or by super-speed train from one metropolis to another – in perpetual sunshine of course. The picture was usually rather lacking in detail about what people were actually up to most of the time, and the images of the hardware of the future were inclined to be somewhat unconvincing – streamlined versions of what already existed. Like the streamlined biplanes that landed on the tops of those skyscrapers!

Well, we now have quite a few skyscrapers of sorts – of sorts people have discovered they don't like living in. In fact the one profession which does seem to have been taken in rather by futuristic visions is that of architecture. Even if most of us don't have to live in high-rise buildings, we still have to live amongst buildings that may have looked exciting on the drawing board but once built look tatty and uninviting, especially on a wet day (that's the bit the architect doesn't show his client!).

There are dangers then in getting carried away by visions of the future. And the dangers can be expensive. Unwanted tower blocks have had to be demolished, and what sort of return have we got on our investment in supersonic travel? It's interesting to note that the sorts of things that tend to make the greatest difference in everyday life are not the sorts of things that visionaries dream of: they are things like refrigerators, washing machines, vacuum cleaners and typewriters.

One has the feeling that there's a moral of sorts here, for the UK at any rate. We've many splendid engineering achievements to show. But do they add up in economic terms? We spend a great deal of money on research and development, but precious little of it seems to be spent on everyday things that can be sold on the mass market. Compare this with the Japanese economy. What an uncanny knack they have for spending their resources on developing products that people actually want and can use! Maybe they have better crystal balls, or maybe they pay more attention to the short-term prospects revealed.

One crystal gazer who's reported recently is André Baumes, Grundig's managing director. Commenting on commitment to the 21st century, he sees the family "looking at a flat screen, probably around 60 inches across, and with a control panel which will control just about everything from the TV screen to the video recorder, disc, teletext, Prestel, cinefilm transfer unit" and so on. In the shorter term, he expresses "great optimism" on projection TV. "With a projection TV, you can have a marvellous atmosphere, like being in a cinema. You place your hi-fi speakers on each side of the screen, and you get the best cinefilms in the world played back via a transfer unit with really good sound."

We don't place much trust in our own crystal ball. Right now however it does suggest to us that the VCR, about which we've expressed reservations in the past, is on the point of establishing itself as a standard item of domestic electronic equipment – simply because the Japanese can provide them at such incredibly reasonable prices. They could become so well established so soon that the coming videodiscs will not get much of a look in. On the other hand if discs really do turn out to be as cheap as anticipated, the video disc and tape could coexist as audio discs and tapes do. Teletext, being cheap to provide and cheap to build into sets, looks a reasonable bet, but viewdata – well, how many people have any need to be able to plug into a vast store of computerised information (and access will never be all that cheap)? As for projection TV, one thing's certain – most of us will continue to live in cramped conditions which totally preclude "a marvellous atmosphere, like being in a cinema." Oh yes, and the crystal ball unfortunately shows all the hardware coming from afar – brought to us in a streamlined biplane against a background of the rising sun . . .

PRICE INCREASE

We regret the need to increase the cover price of *Television* again, to 70p from next month's issue. The new price is not unreasonable when compared to such everyday items as a pint of beer or a packet of cigarettes, and every effort will be made to continue to provide our readers with an authoritive service on which they can rely.

CORRECTION

In our article on solid-state TV cameras (November 1980) it should have been said that the *cassette* used in the prototype Sony Cam-Corder, not the VCR itself, is 56 × 35 × 13mm.

Teletopics

VCR CLEANING

A joint statement has been issued by the companies marketing VHS machines in the UK – Akai, Ferguson, Hitachi, JVC, Panasonic and Sharp – commenting on the increasing number of products now available for cleaning the audio and video heads in VHS VCRs. VCR users are advised that such products have neither the approval nor the recommendation of the VCR manufacturers. "In our opinion" the statement continues, "the use of such head cleaning equipment – either in cassette or kit form – is unnecessary with any VHS machine since the composition and action of the tape itself cleans the heads during use. In laboratory tests it has been found that the head cleaning products currently available are not only ineffective but may cause damage to either the video heads or the tape used in the recorder. The video heads in VHS machines should be cleaned only by qualified service engineers, after they've established the need for this."

The video head cleaners currently available are of two types: first cassettes containing either mildly abrasive or chamois leather tape, and secondly kits containing chemicals and an applicator. Cassettes with abrasive tape are considered ineffective and could also be harmful, possibly causing excessive wear of the video heads and roughening the surfaces of the tape transport mechanism. Cassettes with chamois leather wipe the surfaces of the audio and video heads, the capstan and pinch wheel and the cassette loading arms, but do not deal with the cavities around the video heads. Some cassette cleaners of this type are used in conjunction with a cleaning fluid which is sprayed on to the chamois leather. The VHS companies consider this to be potentially hazardous since the fluid could harm components within the machines or, should a cassette be inserted shortly after cleaning, fluid remaining on the heads could act as an abrasive to the tape, damaging both the tape and the heads. The use of kits with chemicals and an applicator necessitates partial dismantling of the machine in order to obtain access to the head drum: it is not advisable for non-qualified users to undertake this sort of thing.

Sony agree that cleaning is not something that should be done by users. They say that if the heads are clogging the problem should be dealt with by the appropriate service department.

Network Marketing Ltd., who distribute the Allsop 3 VHS cassette cleaner, comment that this cleaner is effective and non-abrasive in its action – the alcohol cleaning fluid also acts as a lubricant to reduce the risk of abrasion, and would have evaporated during the time between unloading and reloading a cassette. They agree that it doesn't deal with the cavities around the video heads, but say they don't claim that it does and that no cleaning tape would effectively do this.

It would seem to us that any cleaning should be undertaken only by those who, if at all uncertain, can obtain advice direct from the VCR distributors.

WHO'S WHO

In the face of stiffening world-wide competition in the consumer electronics field, the major European manufacturers have been busy consolidating their positions. We reported last month that Philips in N. America have taken over the GTE-Sylvania consumer electronics interests in the USA. In 1978, the last year for which figures are readily available, Philips world-wide were second only to Matsushita (Panasonic) in the league of colour receiver manufacturers. Since GTE-Sylvania were also in the top ten, this takeover considerably strengthens Philips' position. W. Germany's largest colour set manufacturer, Grundig, is also in the top ten and nowadays operates jointly with Philips. In a further move to consolidate their position, Philips have acquired the ownership of the Marantz trademark in all markets except N. America. This acquisition includes 100 per cent of Marantz of Europe and its subsidiaries, the whole of Marantz Australia, most of the Superscope manufacturing organisation in Taiwan and a 43 per cent interest in Marantz Japan – the latter is expected to be increased to 50 per cent.

France's largest indigenous TV manufacturer, Thomson-Brandt, acquired the W. German setmaker Nordmende some while back and has more recently acquired Saba from GTE-Sylvania. Models fitted with the new Saba Q chassis have been introduced on the UK market recently.

In the UK, Rediffusion have reached agreement with Sharp to produce small-screen colour sets based on Sharp designs at Rediffusion's factory in County Durham.

SECOND GENERATION PORTABLE VCR

JVC have introduced a new portable VCR, Model HR2200E, which weighs just 11½lb and uses 50% less components than their previous VCRs. A newly JVC developed high precision brushless quartz locked direct drive motor drives the head drum and transports the tape steadily while the VCR is being carried, a microprocessor providing full logic control. Advanced features include variable speed playback, edit start control which automatically aligns separately recorded segments to avoid distortion, and a shuttle search facility allowing programmes to be viewed in both the forward and reverse modes at ten times the normal speed. The machine can be powered from the mains, a car battery or its own rechargeable nickel-cadmium battery pack. It's complemented by the TU22E unit which acts as a tuner/timer (with ten day preset capability), a.c. power adaptor and battery charger, or the AAP22E power adaptor/battery charger unit.

TV TELEPHONE

Zenith in the USA have introduced a TV set they call the "Space Phone". It can be connected to the telephone line to receive incoming calls, the viewer answering from his arm chair by operating the "Space Command" button on his remote control handset. The receiver incorporates a microphone to pick up the user's voice. If the set is connected via a phone unit it can also be used for making outgoing calls.

RANK-TOSHIBA

The unwinding of the Rank-Toshiba joint TV set manufacturing operation will involve Rank in buying out Toshiba's share for a nominal sum and taking responsibility for running down the Plymouth and Redruth plants. This stage is due to end next March, when Toshiba will take over the main Ernsettle plant and continue the production of Toshiba brand sets. Production is expected to resume at the reduced rate of around 100,000 sets a year, and Toshiba are unable to say what percentage of the workforce they will be able to take on.

Rank Radio International is to continue in operation for

the time being – and in fact three new Bush Models have just been announced, the BC7205, which is fitted with a 20in. 90° tube, and two models fitted with the T26 chassis (30AX tube). The latter are the 22in. Model BC7310 and 26in. BC7410, which feature "Infracolour" remote control and a DIN socket for connecting an external tape recorder, amplifier or headphones.

Meanwhile, if anyone reads this column they may have noticed that a sidehead plus three lines of text disappeared from the bottom right-hand column on page 66 last month. The heading read "Service Notes – Rank", and the text read to the effect that details of the latest Rank chassis have been released (the T24H and T18).

MINI VCR

Technicolour Audio-Visual are marketing in the USA a compact portable VCR that weighs only seven pounds and uses a cassette only slightly larger than a standard audio one, giving half an hour's playing time. Helical scanning is used, but the cassette is not compatible with the VHS or Beta formats. The VCR is aimed at competing with film equipment rather than other VCR systems. It's made by Funai Electric in Japan, the tape and cassette being produced by Fuji. Any home colour or monochrome video camera can be used with it.

ITT80 CHASSIS

ITT's latest chassis, the ITT80, is designed to drive the new generation of 20 and 22in. 90° PIL tubes. This means that, as in the recently introduced CVC800 chassis (for 14/16/20in. 90° tubes), no EW raster correction circuitry is required. There are two main sections, the CVC820 power supply/timebase board and the CVC850 signals board. The circuitry is basically similar to that used in the CVC800, though there are numerous detail differences, including the use of complementary-symmetry RGB output stages.

STATION OPENINGS

The following relay transmitters are now in operation:

Dentdale (Cumbria) TV4 ch. 53, BBC-1 ch. 57, Border Television ch. 60, BBC-2 ch. 63.

Ellon (Aberdeenshire) BBC-1 ch. 39, Grampian Television ch. 42, BBC-2 ch. 45, TV4 ch. 49.

Forest Row (Sussex) BBC-1 ch. 48, BBC-2 ch. 54, Thames/London Weekend Television ch. 62, TV4 ch. 66.

Hedleyhope (County Durham) BBC-1 ch. 40, Tyne Tees Television ch. 43, BBC-2 ch. 46, TV4 ch. 50. Horizontal polarisation.

Kenmore (Tayside) Grampian Television ch. 23, BBC-2 ch. 26, TV4 ch. 29, BBC-1 ch. 33.

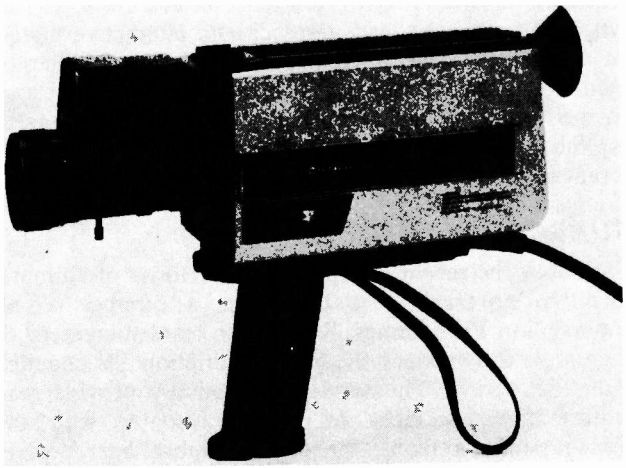
Lydbrook (Gloucestershire) BBC-1 ch. 40, HTV-West ch. 43, BBC-2 ch. 46, TV4 ch. 50.

Slad (Gloucestershire) HTV-West ch. 23, BBC-2 ch. 26, TV4 ch. 29, BBC-1 ch. 33. Horizontal polarisation.

Polarisation is vertical unless otherwise stated.

HITACHI'S LATEST CAMERAS

At a suggested retail price of £399 including VAT, Hitachi have introduced what must be one of the cheapest colour video cameras now available – one which should appeal to both the newcomer and the established video enthusiast. The camera, Model VKC750, complements the GP4 series, which is made by and distributed via Hitachi Denchi Ltd. As in the GP4, a single tri-electrode pickup tube is used, with separate electrodes for each of the primary colours. This, together with the use of advanced i.c. circuitry, has enabled the weight to be reduced to 4lb, with a battery consumption



The new Hitachi Model VKC750 single-tube colour camera – the suggested retail price is only £399.

of only 5·8W. The built-in double-image optical viewfinder is linked to a 2·8:1 zoom lens with a focal length of 13·5–37·5mm. There's a colour temperature control button which operates in conjunction with a balance meter, and a high-low sensitivity switch. Pictures can be obtained under lighting conditions ranging from 100 lux to 100,000 lux. A LED indicator in the viewfinder indicates when recordings are being made, whether the light is insufficient, and low battery power.

Meanwhile Hitachi have produced, for the Japanese market initially, what's claimed to be the world's smallest home colour video camera, Model VKC1000. The secret of the reduced size and weight (2¼lb including a 6× power zoom lens) is the use of a single-chip MOS image sensor i.c. instead of a pick-up tube. The initial price (in Japan) is expected to be around £690. The horizontal resolution is 260 lines, the vertical resolution 350 lines and the minimum signal:noise ratio 46dB. The use of a solid-state sensor gives quick start, the image appearing in less than half a second after switching on.

THORN SOFTWARE

A new company, Video at Home, has been set up within the Thorn TV Rentals organisation to supply the group's rental outlets with software (prerecorded video cassettes) for VHS VCRs. Besides feature films such as Jaws, The Muppet Movie, Psycho, Saturday Night Fever, Genevieve etc. there'll be a wealth of musicals and sport. The cassettes will be available to buy or rent from all Thorn TV Rentals outlets (DER, Radio Rentals, Multi Broadcast and Focus), the initial catalogue including over 80 titles. Customers will also be able to join a video club – the year's subscription will enable the member to rent or buy cassettes at a reduced rate. Thorn Rentals expect to have over 100,000 VHS subscribers by the end of the present financial year, and anticipate supplying over a million blank tapes through their 1,200 branches next year.

Thorn-EMI Video Programmes and publishers Longman have announced the development of a new system for learning foreign languages at home, using a personal computer. Languages available initially will be French, German and Spanish, with Italian to follow – these are the result of a joint project to create programmes for exclusive use on the Atari 400 and 800 personal computers. Distribution will be in the USA initially, with UK distribution to follow. Each course consists of five twin track cassettes (containing both computer programmes and audio tracks), together with a learner's manual. The audio

material is under programme control, and is thus synchronised to the text, graphics and interactive material on the screen. The machine's interactive capabilities are used to the maximum, the learner having to provide answers, check answers, make choices, play games, assemble text and check understanding. The course is arranged so that learners can progress at their own speeds.

SUBSCRIPTION TV

Following the recent statement in the House of Commons that the government is to license a number of pilot subscription TV schemes, Rediffusion have announced that they hope to introduce the first subscription TV channel in Hull this spring. The service will initially provide recent feature films – eight or nine a month, with three transmissions a night, the cost to subscribers probably being in the region of £4-5 a month. The service operates in conjunction with cable networks of course.

BRITISH VIDEOGRAM ASSOCIATION

The British Videogram Association, which has been formed to represent the interests of videogram producers in this country, has now been officially set up. There are over 30 members, including Thorn-EMI, CBS Records, BBC Home Video, Warner Bros. and Intervision. Amongst the Association's first priorities will be the formalisation of terms and conditions for the employment of creative talent, the protection of copyrights and mechanical rights, an approach to the government for a levy on the sale of blank cassettes, liaison between the videogram industry and relevant bodies from other related industries, and consideration of the commercial piracy problem. The word videogram is new to us, but seems a logical way of covering both video cassettes and discs (playable, we'll assume, on machines you don't have to wind up).

ILLEGAL VIDEO CASSETTES

JVC (UK) Ltd. report that illegal, imitation JVC E180 blank video cassettes have appeared in the UK. Though branded JVC, the tapes differ in the following respects: (1) The JVC cassette has a cellophane wrapping with a stripe to open the pack: the imitation is shrink wrapped. (2) The JVC tape's cellophane wrapping has a yellow cut tape: the imitation doesn't. (3) The JVC cassettes are contained in a ten pack carton with JVC printed on it: the imitations come in twelve pack cartons. (4) The JVC cartons are packed five to a JVC printed master carton holding fifty cassettes: the imitation cartons are packed four to a plain master carton that contains 48 tapes. (5) There's a difference in the design of the bottom shell of the cassette body. Being branded imitations, the counterfeit tapes are illegal.

NEW PORTABLES

A 14in. monochrome portable, Model 1045, has been added to the Pye range. It uses the now well established TX chassis. Two more portables have been added to the Ferguson range, Model 3857 (black case) and 3858 (white). Called the "Courier", these sets are fitted with the 1691 chassis.

Two interesting models have been added to the Hitachi range. The K2300 is described as a bedside TV, which combines a 4½in. TV set and digital clock. It has a four-way power supply option. The set works at either v.h.f. or u.h.f., and also incorporates a v.h.f./m.w./l.w. radio. The suggested price is £115. The K2400 is described as a portable entertainment centre, combining a 4½in. TV set and cassette radio. The suggested price is £175.

From Philips comes the TC2100, which combines a three waveband a.m./f.m. radio, cassette recorder/player, digital clock and 9in. monochrome TV set – the clock can be programmed to switch on the TV, radio or cassette player at any preset time. All this is housed in a remarkably compact square case. The TC2000 is a version without the cassette player.

INTERNATIONAL VIDEO WEEK

An international video week is to be held on 10-17th May, with events in London and Birmingham. Participating in the week will be *The Economist* newspaper, the British Film Institute, the British Industrial and Scientific Film Association and exhibition organisers Brintex. *The Economist* Video Conference will be held on May 11-12th at the National Film Theatre, the International Video Festival on May 13-15th at the same venue, and the Audio, Video and TV Fair on May 10-17th at the National Exhibition Centre, Birmingham. An International Video Forum will be held during the week at the National Film Theatre, London.

Teletext Decoder Corrections

THE following corrections to the *Television* teletext decoder up-date series (June-September 1979) should be noted.

(1) New mother board power supply feeds (see Fig. 3, page 540, August 1979 issue). The 70V and one of the two 12V power supply feeds to the board were shown transposed. This must be corrected as follows. Disconnect the 12V feed from pins 25/26 of the i.f. panel edge connector on the mother board, also the 70V feed from pins 23/24. Reconnect the 70V feed to pins 25/26 and the 12V feed to pins 23/24. Remove the wire link between pins 25/26 and the track to the modulator, connecting this to pins 23/24 instead.

(2) Write signal to the memory board. Refer to the mother board layout (Fig. 3, page 540, August 1979). The link between pin 7 of the input board and pins 8/9 of the memory board was not shown. For normal operation these two points should be linked together. A modification is possible however (see Fig. 1). A page hold switch can be incorporated by including a switch in series between these points. Connect a 10kΩ resistor from pins 8/9 of the memory board to the 5V rail to ensure proper operation of the memory when the switch is opened. Opening the switch freezes the page currently being displayed on the screen.

(3) Colour options board (refer to Fig. 7, page 586 and Fig. 5, page 585, September 1979 issue). Pin 2 of IC7 must be connected to the nearby track leading to pin 28 of the edge connector.

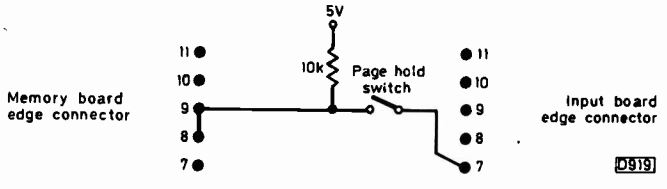


Fig. 1: Correction to the connections between the memory and input board edge connectors on the mother board – viewed from the print side. A page hold switch can be added at this point as shown above.

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DY86/7	66	EZ80/1	56	PCL86	81
ECC81	60	GY501	1.45	PD500	2.93
ECC82	68	G234	1.56	PFL200	1.35
ECC83	60	KT66	6.98	PL36	1.15
ECC84	80	PC86	81	PL81	94
ECC85	98	PC88	81	PL82	46
ECC88	1.35	PC92	80	PL83	1.43
ECF80	80	PC97	1.14	PL84	84
ECF82	88	PC900	80	PL95	1.00
ECH81	1.04	PCC84	70	PL504	1.32
ECH84	1.13	PCC85	85	PL508	1.43
ECL80	84	PCC88	82	PL509	2.39
ECL82	77	PCC89	79	PL519	2.78
ECL86	84	PCC189	1.02	PL802	2.15
ECF86	78	PCC805	1.40	PY33	61
EF80	68	PCF80	75	PY88	81
EF85	68	PCF86	1.13	PY500A	1.40
EF86	1.19	PCF200	1.23	PY800/1	69
EF89	1.43	PCF800	1.38	UCF80	67
EF183	68	PCF801	1.13	UCH81	1.43
EF184	68	PCF802	86	UCL82	84
EH90	1.02	PCF805	1.63	UCL83	94
EL34	1.63	PCF806	1.30	UL84	1.02
EL81	86	PCF808	1.63	U26	1.30
EL84	68	PCH200	1.45	U191	95
EL90	82	PCL82	78	6F23	85
EL509	2.22	PCL83	2.00	UY85	80

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RECTIFIER TRAYS

Thorn 950	£4.25	GEC 2110 before Jan 77	£6.95
Thorn 1500/1580	£3.85	GEC 2110 after Jan 77	£6.65
Thorn 1500 5 stick	£4.25	GEC 1028 2028, 1040	£5.64
Thorn 1600	£3.45	ITT/KB CVC5/7/8/9	£5.35
Thorn 3000/3500	£6.89	ITT/KB CVC20/25/30	£5.35
Thorn 1400	£3.85	Korting (similar to Siemens TVK1)	£6.65
Thorn 8000	£3.51	Philips 3113 550/1/3	£5.85
Thorn 8500/8800	£5.40	Philips G8	£5.85
Thorn 9000	£7.43	Philips G9	£6.33
Decca CTV 19/25	£5.35	Pye 691/3	£5.13
Decca CS1730/3 CS1830/5	£3.68	Pye 731/25	£5.40
Decca 1910 Bradford 2213	£5.92	Rank BM A823/2179	£5.78
Decca 30	£5.92	Rank BM A823 A/V	£6.89
Decca 80	£6.28	Reddiffusion MK1	£6.04
Decca 100	£6.04	B R C 2000	£6.60
		'Universal Tripler'	£5.40

MAINS DROPPERS

Type	Price (p)
Decca 20 Decca 20 Series	£1.10
G E C 2018	70
Philips 210/5050	66
Philips G8 5081	35
Philips G8 5083	56
Pye 725	53
RBM 161	55
RBM A823	77
Thorn 1500	96
Thorn 3500	68
Thorn 8000	86
Thorn 8500	83

PREFERRED VALUES RESISTORS

WIREWOUND	Price Each (p)
4 watt 1 ohm-1 5kohm	13
2 2k, 3 3k	15
4 7k, 6 8k	17
10k	22
7 watt 1 ohm-4 7 kohm	14
5 6k 12k	15
15k-22k	18
11 watt 1 ohm 6 8kohm	17
10k 15k	18
22k	21
17 watt 1 ohm 10 kohm	24
15k, 22k	25

TRANSFORMERS

LINE OUTPUT TRANSFORMERS

Type	Price (p)
Bush A774	£11.75
Replacement Tripler for A774	£10.75
Decca 80	£8.58
Decca 100	£8.58
Decca 1730	£8.58
Decca 2230	£8.58
G E C 2040	£9.20
G E C 2047	£5.00
G E C 2110	£8.59
Philips G8	£10.00
Pye 691/693	£14.00
Pye 697	£14.00
Pye 731	£10.15
Thorn 3500	
Scan AC EHT Transformer	£5.00
Thorn 8000	£9.00
Thorn 8500	£10.00

Type MAINS TRANSFORMER	Price (p)
Thorn 3000/3500	£9.50

AERIAL EQUIPMENT

10 Ele UHF A-B-C/D	£1.62
2 Ele F M	£4.28
3 Ele F M	£5.78
6 Ft Mast	£1.16
Lashing Kit 6" Bracket	£1.58
Low Loss Coax Cable per 100m	£13.50
Coax Plugs	20p

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Type	Price (p)	Type	Price (p)	Type	Price (p)
AC126	22	BC212	9	BF160	27
AC127	22	BC212L	9	BF167	24
AC128	20	BC213	9	BF173	22
AC128K	32	BC213B	10	BF178	26
AC141K	34	BC213L	9	BF179	28
AC142K	30	BC214	9	BF180	36
AC176	25	BC214L	10	BF181	36
AC176K	32	BC237	9	BF182	30
AC187	26	BC238	8	BF183	30
AC187K	28	BC251A	12	BF184	30
AC188	25	BC251B	15	BF185	30
AC188K	37	BC252A	12	BF194	11
AD140	75	BC252B	12	BF195	10
AD143	82	BC261A	18	BF196	10
AD149	79	BC261B	15	BF197	11
AD161	42	BC262A	15	BF198	18
AD161/2	£1.15	BC262B	15	BF199	15
AD162	42	BC300	30	BF200	30
AF124	34	BC301	28	BF224	16
AF127	32	BC303	28	BF241	15
AF139	42	BC307	10	BF257	28
AF239	45	BC307A	10	BF258	25
AL102	£2.00	BC327	11	BF259	26
AL103	£2.00	BC328	8	BF271	24
AU110	£2.00	BC337	11	BF273	12
AU113	£1.49	BC338	9	BF274	13
BC107	11	BC461	30	BF336	36
BC107A	12	BC546	7	BF337	30
BC107B	13	BC547	10	BF338	34
BC108	11	BC548	10	BF355	37
BC108A	12	BC549	7	BF362	37
BC108B	12	BC550	7	BF363	33
BC108C	14	BC557	7	BF371	30
BC109	11	BC558	7	BF457	23
BC109A	14	BCY72	13	BF458	24
BC109B	13	BD115	30	BF459	35
BC109C	11	BD116	65	BFT42	28
BC114	12	BD124P	60	BFT43	27
BC118A	12	BD124=2N3054		BFW10	60
BC140	32	BD131	33	BFX29	30
BC141	26	BD132	35	BFX84	27
BC142	21	BD133	40	BFX85	28
BC143	24	BD135	26	BFX86	28
BC147	9	BD136	27	BFX88	25
BC148	9	BD137	23	BFY50	20
BC149	9	BD138	23	BFY51	20
BC157	11	BD139	28	BFY52	20
BC158	9	BD140	30	BFY90	75
BC159	10	BD144	£1.20	BR100	17
BC160	25	BD182	70	BR101	30
BC161	28	BD183	65	BRC4443	80
BC170B	10	BD201	85	BRX46 (TIC46)	40
BC171	9	BD202	80	BRY39	30
BC171A	10	BD203	80	BT106	£1.00
BC171B	10	BD204	84	BT108	£1.24
BC172	9	BD222	46	BT116	£1.21
BC172A	10	BD225	47	BU104	£2.00
BC172B	10	BD232	45	BU105	£1.25
BC172C	10	BD233	35	BU105/02	£1.65
BC173B	12	BD234	31	BU106	£1.50
BC174B	10	BD235	31	BU108	£1.80
BC182	9	BD236	31	BU124	£1.30
BC182LB	10	BD237	31	BU126	£1.49
BC183A	12	BD238	33	BU204	£1.50
BC183LA	10	BDX32	£1.50	BU205	£1.34
BC184	9	BDY 20	20	BU206	£1.80
BC184LA	10	BF115	35	BU208	£1.80
BC204	9	BF127	26	BU208A	£1.65
BC208	13	BF154	12	BU208/02	£2.00
BC209	10	BF158	18	BU308	£1.75

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BU407	£1.25
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MJE340	40
MJE520	44
OC71	27
OC79	15
R2008B	£1.80
R2010B	£1.80
R2265	£1.40
R2322	58
R2323	67
R2461	£1.50
R2540	£2.80
RCA16334	90
RCA16335	80
TIP29C	43
TIP30C	43
TIP31C	41
TIP32C	42
TIP41C	46
TIP42C	47
TIP47	70
TIP2955	90
TIP3055 (SEP3055)	63
TIS91	21
TV106/02	£1.20
2N696	19
2N2905	22
2N3054	60
2N3055	60
2N3702	11
2N3703	10
2N3704	10
2N3705	10
2N3706	10
2N5294	38
2N5296	48
2N5298	38
2N5496	53
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INTEGRATED CIRCUITS

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ETTR6016/ ML231B	£2.20
MC1307	£1.00
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MC1349	£1.20
MC1351	£1.00
MC1352	£1.00
SAS560S	£1.80
SAS570S	£1.80
SL901B	£4.45
SL917B	£6.25
SL1310	£1.80
SL13270	£1.20
SN76003N	£1.75
SN76013N	£1.15
SN76013ND	£1.15
SN76023N	£1.45
SN76023ND	95
SN76033N	£1.53
SN76110N	89
SN76131N	£1.30
SN76226N	£1.55
SN76227N	£1.10
SN76532N	£1.50
SN76533N	£1.30
SN76544N	£1.35
SN76650N	89
SN76660N	60
SN76666N	70
TAA550	28
TAA570	£1.80
TAA661B	£1.20

Type	Price (p)
TAA700	£1.70
TBA120B	£1.30
TBA120S	69
TBA120AS	70
TBA120SQ	79
TBA120U	£1.00
TBA396	80
TBA4800	£1.25
TBA510	£3.00
TBA520Q	£1.20
TBA530	£1.20
TBA530Q	£1.28
TBA540Q	£1.49
TBA5500	£1.58
TBA560CQ	£1.59
TBA570	£1.00
TBA750Q	£1.39
TBA8000	89
TBA810AS	£1.35
TBA920	£1.80
TBA920Q	£1.99
TBA9900	£1.49
TCA270D	£1.20
TCA270SQ	£1.25
TCA800	£1.99
TCA940	£1.60
TDA1170	£1.99
TDA2030	£2.80
TDA2522	£2.40
TDA2640	£2.50
TDA2690	£1.00
TBA641/B11	£1.50
TBA720AQ	£2.50
TBA950	£2.40
TBA2532	£2.95
TDA280D	£2.95
TDA2540	£3.15
TDA2560	£2.95
TDA2591	£2.75

SOCKETS

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14 pin	18
16 pin	20
14 Dil/Oul	24

THERMISTORS

VA1104	52
VA8850	45

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Description	Price (p)
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Excel Polish	55
Fire Extinguisher 640 grms	£1.87
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Type	Price (p)	Type	Price (p)
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BA102	17	OA47	9
BA115	13	OA90	5
BA145	17	OA91	6
BA148	17	OA95	6
BA154	6	OA202	11
BA155	14	IN914	3
BA156	15	IN4001	4
BAX13	4	IN4002	4
BAX16	5	IN4003	4
BB105B	30	IN4004	5
BB105G	30	IN4005	5
BY126	10	IN4006	5
BY127	11	IN4007	6
BY164	45	IN4148	2
BY176	85	IN4448	10
BY199	10	IN5401	12
BY206	14	IN5402	14
BY210/800	22	IN5403	12
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BY299/800	22	IN5405	13
BYX10	20	IN5406	13
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BY223	90	ITT20D2	11

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

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Price per 10

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100ma	48
250, 500, 750ma 1A	49
1 5 2, 2 5 3 5A	40
1¼" AS	
250, 500, 600, 630, 750 850ma	
1 1 25 1 5, 2A	£1.41
2 5, 3, 5A	£2.16
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2, 3 5, 10 13A	84
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80ma	£3.11
100ma	£2.08
160, 200ma	£1.89
315, 500, 630 800ma	
1, 1 25, 1 6 2A	£1.07
2 5 3 15A	£1.43
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100ma	45
250 500 630 800ma	
1, 1 25, 1 6 2, 2 5, 3 15, 5A	37

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10	47	7	63	10	9
10	100	8	63	22	12
10	220	11	63	47	16
10	470	18	63	100	19
10	1000	20	63	220	30
10	2200	30	63	470	38
10	4700	48	63	1000	53
25	4 7	8	83	2200	85
25	10	7	100	10	12
25	22	7	100	22	14
25	47	9	100	47	19
25	100	10	100	100	29
25	220	17	100	140	32
25	470	22	100	220	35
25	1000	36	450	1	23
25	2200	46	450	4 7	28
25	4700	80	450	10	28
40	2200	52	450	22	56
63	1	7	450	33	62
63	2 2	7			

MIXED DIELECTRIC

Volts (DC)	MFD	Price (p)	Volts (DC)	MFD	Price (p)
400	022	9	1000	47	75
600	1	38	1250	033	32
1000	01	20	1250	1	45
1000	047	29	1500	022	24
1000	1	32	1500	033	39
1000	22	48			

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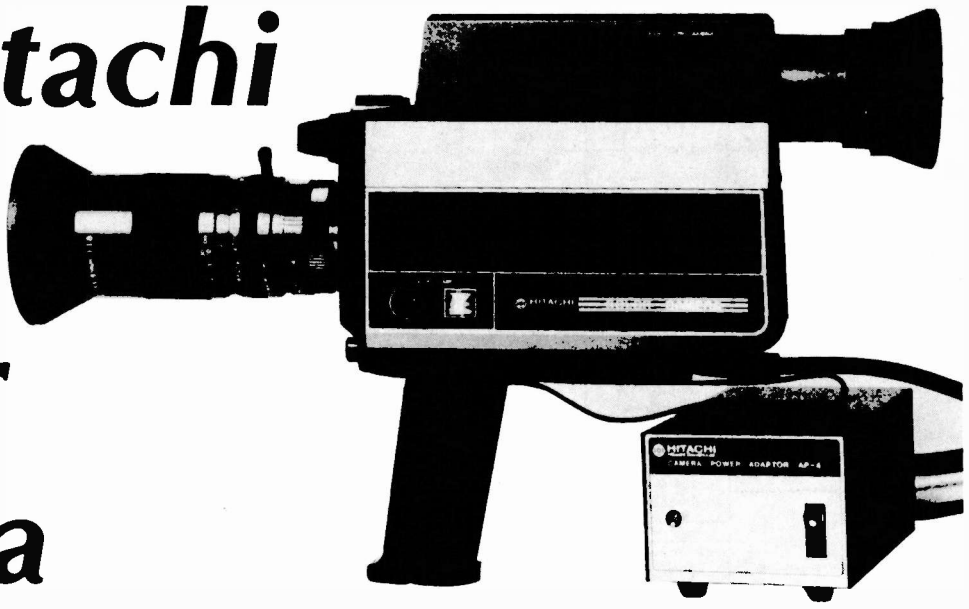
The Hitachi GP4 Colour Camera



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

THE Hitachi Model GP4 is one of the latest colour cameras to be launched on the domestic video market. It's available in two versions, the GP4B and the GP4D, the former having an f2 2·8× zoom lens and an optical viewfinder whilst the latter, de luxe version has an f1·8 6× zoom lens and an electronic viewfinder which can also be used to provide instant videotape playback with a suitable VTR. The two models are otherwise identical, so we'll look at the GP4D here.

Hitachi introduced the earlier GP5 (or VKC500 as the domestic version was known) colour camera in late 1978 – regular readers will recall our review of it this time last year. It was one of the first colour cameras to be aimed at the home video market. Several lessons have clearly been learnt from that earlier model and incorporated in this latest one. The main selling feature of the GP4 however is a non-technical one – its price. The suggested retail price of the basic version is £330 and of the de luxe version £450, excluding VAT. The SRP for the de luxe GP5 is £729. These prices make the GP4 one of the cheapest colour cameras available – and that's before the discount houses get their hands on it.

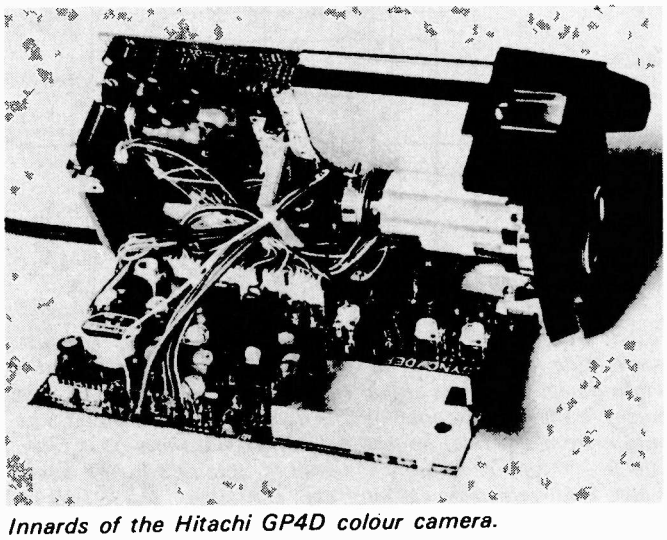
Features

We'll look first at the features offered by the GP4, then at some of the technology inside it. In all honesty, there's little to choose in terms of facilities offered between several similar cameras available from a number of manufacturers. The GP4D has most of the features normally found, plus one or two special ones.

The basic camera weighs around 2·2kg and has a nice balance to it – it's rather like a large super 8mm cine camera. The 6× zoom lens covers 13·5 to 81mm and has a maximum aperture of f1·8. The iris ring on the lens can be turned to a capped position to stop light falling on the tube – this feature can also be used to fade scenes in and out. A feature not found previously on domestic cameras is the lens macro position, which allows objects between 10-30mm away to be clearly focused – useful for shots of flowers, small captions etc.

A single multicore lead connects the camera to either a portable VCR, such as the Hitachi VT7000, or a mains power supply unit which is available as an optional extra (at a SRP of £27 plus VAT). The lead terminates in the new standard VHS 10-pin locking plug – at last the major video manufacturers have agreed to a joint standard for pin configurations and locking mechanisms. Even Sony, who employ a 14 wire lead, are producing a special 10 to 14 pin adaptor lead to enable this type of camera to be used with their Betamax VCRs such as the C7 and the SL3000 portable. A remarkable display of cooperation for once.

The electronic viewfinder can be added as an extra to the basic camera. It has a large and rather uncomfortable rubber eye-cup which encloses a plastic lens facing on to a 1in. c.r.t. This acts not only as a focusing aid but also as a playback monitor, a slide switch on the side of the viewfinder switching between playback and camera viewfinder use. There's also provision for audio monitoring via an adjacent earphone socket. Unlike some other cameras, the viewfinder lens and eye-cup cannot be focused for users who wear spectacles, nor can it be flipped back to allow several people to view videotape playbacks. There are three warning LEDs in the viewfinder. These indicate low battery power, low light and VTR running. Screwdriver adjustable presets allow the contrast and brightness of the viewfinder picture to be altered without affecting the signal from the camera to the VTR.



Innards of the Hitachi GP4D colour camera.

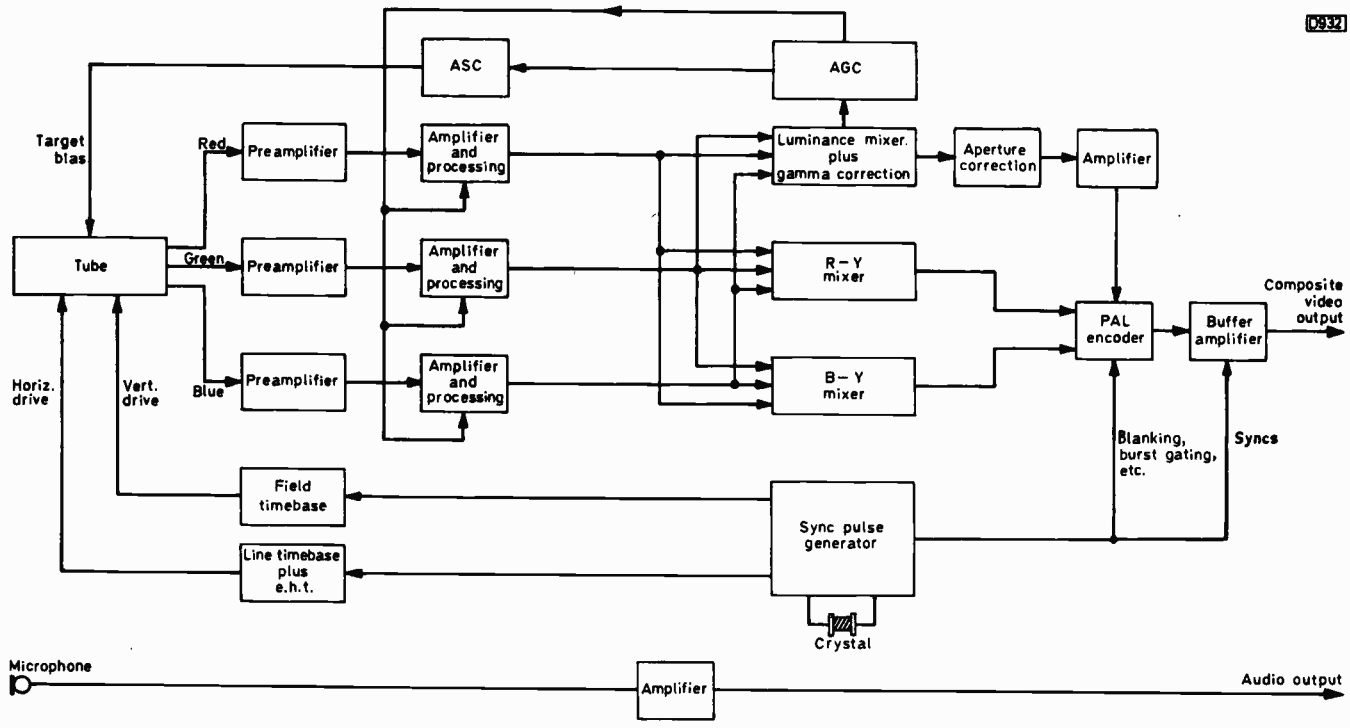


Fig. 1: Block diagram of the Hitachi GP4 colour camera.

A small, omnidirectional capacitance microphone is mounted above the lens. It can be switched off by plugging an external microphone into a socket on the right-hand side of the camera's body – any high-impedance microphone with a sensitivity of around –65dB is suitable. An accessory shoe on the top of the camera enables suitable models to be secured.

Another switch at the rear of the camera introduces an increase in video gain of some 3dB for recording under low-light conditions. Use of this extra gain increases the noise however, so it should be employed only when essential.

The final user controls are concerned with balancing the electronics within the camera to get correct operation under different lighting conditions. With the GP5 and cameras from several other manufacturers this adjustment is carried out by watching the camera's output on a colour monitor, altering the colour temperature control until a satisfactory picture is obtained. This is not always possible under field conditions of course, and can be a problem under varying lighting conditions. The GP4 has a neat arrangement with a centre-zero meter and a single potentiometer. The camera is pointed at a white card and the control adjusted to zero the meter. This ensures that regardless of the type of lighting present, from normal daylight through overcast daylight to various types of artificial lighting, the fidelity of the output obtained from the camera remains constant.

The camera I tested was quite good without being exceptional. It did everything claimed for it, and provided generally good colour rendering. The automatic sensitivity

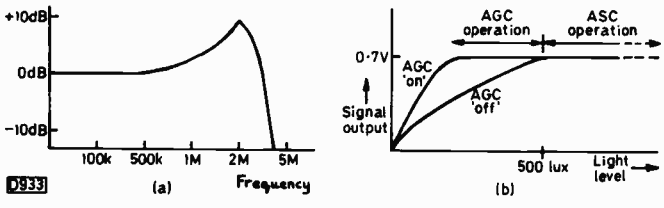


Fig. 2: (a) The frequency characteristic of the aperture correction circuit in the luminance channel – a non-linear amplifier copes with h.f. loss in the tube system, effectively improving the camera's resolution. (b) Gain/light level characteristics of the a.g.c. and a.s.c. circuits.

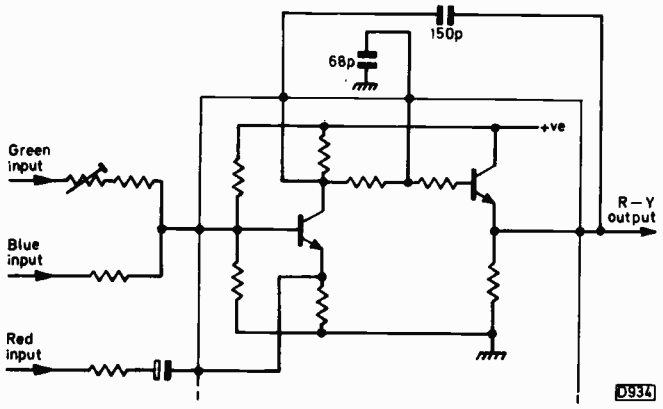
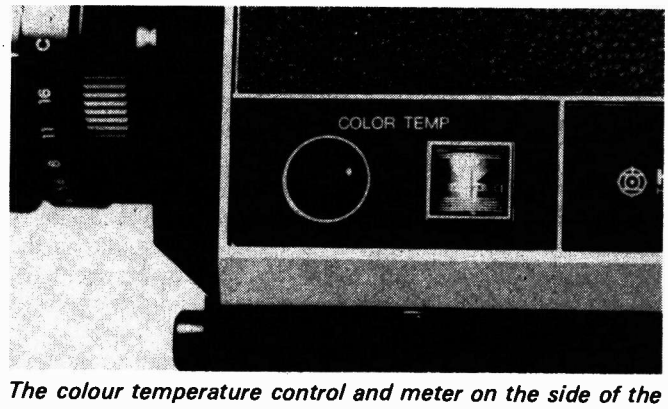


Fig. 3: Obtaining the R – Y colour-difference signal. The first stage adds the G, B and R signals in such a manner that a white object produces signal cancellation, i.e. no output. The preset in the G input enables this balance to be obtained. The output from the first stage then passes via a low-pass filter. The B – Y colour-difference signal is obtained in the same way. The relevant circuitry is contained in IC105 – type ZC0226.



The colour temperature control and meter on the side of the camera.

circuits worked well under a range of lighting conditions, giving acceptable pictures at down to around 300 lux. Below this the results were rather muddy, but with the sensitivity control set to the high position a colour picture could be obtained at around 100 lux. For optimum results, around 2,000 lux was required at f4 – i.e. mid-morning overcast English weather. According to Hitachi the camera is designed to give optimum results at around 2,000 lux, 60 per cent reflectivity with a colour temperature of 3,000°K (i.e. tungsten lighting).

My main complaint about the picture is the apparent over enhancement of the high frequencies, presumably done to give an apparently better resolution. This tends to give rather a cardboard cutout effect. In all fairness however the camera does give very reasonable pictures, and at the price one can't complain.

The Electronics

The electronics within the camera are arranged on five printed panels. The two main ones house the sync, deflection and video circuits. The three other ones are for filters and switches. All these boards are built to the high standards one comes to expect from Japanese equipment. A block diagram of the camera is shown in Fig. 1 – the arrangement is similar to that used in the GP5, but the use of custom designed i.c.s has considerably simplified matters. The tube is a $\frac{2}{3}$in. tri-electrode type, providing RGB output signals. This type of tube provides very good colour fidelity.

A single i.c. for each channel (red, green and blue) provides most of the amplification and the initial signal processing, including automatic level control, clipping, clamping and gamma correction. The clipping and clamping circuits fix the signal peak white and black levels respectively and don't have any special design features, while gamma correction is conventionally required to compensate for the tube's non-linear response. The automatic video signal level control is rather clever however, being built around two interrelated circuits (see Fig. 2), a.g.c. (automatic gain control) and a.s.c. (automatic sensitivity control). The a.s.c. circuit senses the level of the luminance (Y) signal, and increases the vidicon's target voltage as the video signal level falls. This in turn increases the signal current, restoring the video output level. The a.s.c. circuit operates when the light level is reasonably high. When there is less light, the a.g.c. circuit is brought into play. This circuit can cope with a difference in light level of about two lens stops, and works by altering the gain of the amplifiers in all three channels simultaneously. The high/normal sensitivity switch at the back of the camera effectively switches the a.g.c. to "on" (high) or "off" (normal).

IC105 produces the R–Y and B–Y colour-difference signals from the RGB signals. These two colour-difference signals, along with the Y signal, then go to the colour encoder where they are turned into a composite PAL (or NTSC) colour signal. Fig. 3 shows the way in which the colour-difference signals are obtained.

The sync pulse generator consists of a single CMOS chip (see Fig. 4) which is driven by a four times subcarrier frequency crystal. Division gives the 4·43361875MHz subcarrier and also the correctly phased B–Y and R–Y subcarriers. The i.c. also gives composite sync, line drive, field drive, burst flag and various blanking waveforms.

It's interesting to note that for NTSC use only six component values have to be changed and a wire link on the panel altered. But then the Japanese do design their equipment for world markets!

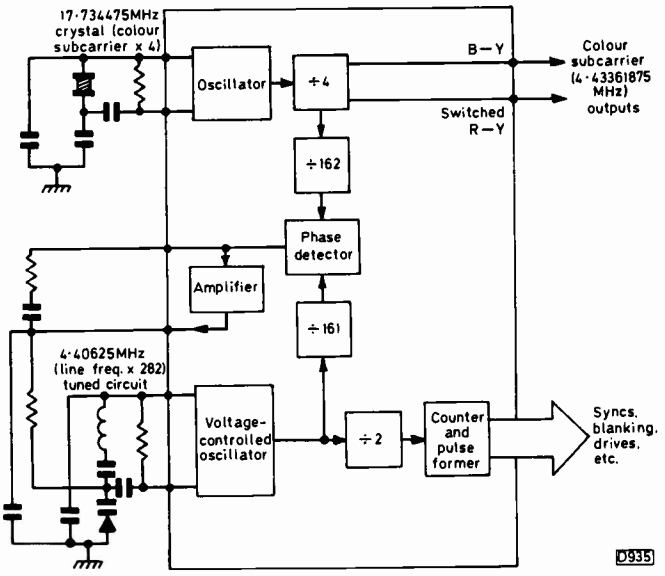


Fig. 4: Block diagram of the HD440071 sync pulse generator i.c., which is driven by a four times colour subcarrier frequency crystal.

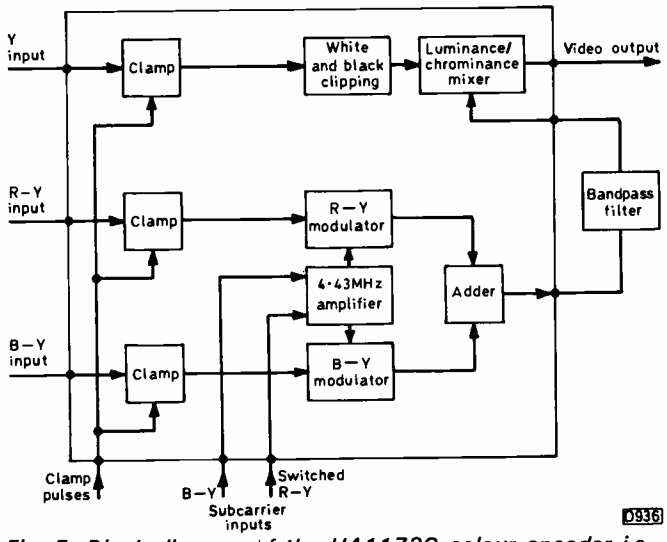


Fig. 5: Block diagram of the HA11720 colour encoder i.c.

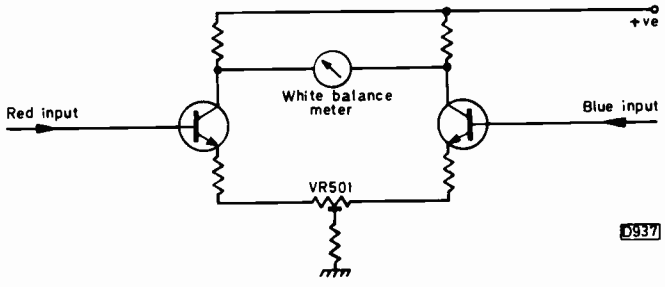


Fig. 6: Colour temperature meter circuit. VR501 is used to set the black balance with the lens capped up. When a true white signal is present the R and B signals will be equal and the meter will give a centre zero reading. The user colour temperature control at the side of the camera alters the gains of the R and B channels to achieve the correct balance.

The PAL coder is another area that's benefitted from the use of i.c.s. A single CMOS i.c. is used here, type HA11720 (see Fig. 5).

The colour temperature meter circuit (Fig. 6) measures the difference between the red and blue signals. When the two are present in equal amounts, as they should be with the

meter focused on to a white card, the meter is centred. The colour temperature control provides differential adjustment of the gain in the red and blue channels, the green gain being kept constant.

The deflection and e.h.t. circuits are quite standard and operate on similar principles to those used in domestic TV sets.

Summary

In conclusion, it's a well designed camera that incorporates most of the features required for domestic use. It lacks the sophistication of say the Sony HVS200P, but you get very similar picture quality at a price of around £200 less. I'd say it's a good colour camera to start off with, for domestic use or for use in schools etc.

A Novice's Viewpoint

As an additional check, I decided to get a novice's viewpoint. Here it is – thanks Kate!

The camera is apparently designed with us non-technical, inexperienced users in mind, so I was interested to have a go. Its weight was the first factor that struck me – it's too heavy to hold comfortably for long. Immediately the camera was switched on very good pictures were obtained – and acceptable pictures were present at very low light levels. The warning lights in the viewfinder seem a good idea – especially the low light level one. The rubber eyepiece is convenient, particularly as I wear glasses.

Manipulation of the zoom lens seemed straightforward at first, but proved difficult in practice because it couldn't be operated smoothly while wilting under the camera's weight. Focusing on maximum zoom was not too satisfactory, as the viewfinder picture is too grainy for my unpractised eye. I could have spent ages fiddling with this while any subject other than a snail passed by.

Further problems relating to the camera's weight – and I'd better mention that I am myself no little 'un – were experienced when operating the colour balance control. Keeping the camera fixed on the white card while looking at the meter at the same time presented difficulties. A needle in the viewfinder, as with a 35mm camera, would be a big improvement.

The macro lens seems to be a good idea for close ups of small objects – though I'm not too sure of what exactly. But it was not possible to hold the camera sufficiently still at close range to get a reasonably steady shot. A tripod or rest is definitely called for here.

It's a simple camera to operate, but one can't expect spectacular results in the hands of an inexperienced user. Practice and the use of a tripod are required. ■

VCR Clinic

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

Shifting Chroma

As I've said before, the same symptoms can often be caused by various different faults. We've had three cases recently where the colour part of the picture, observed when replaying a test card, moved sideways with respect to the luminance display then back again. This fault is usually very sluggish, sometimes rhythmic and sometimes very intermittent, and I should point out straight away that the cause can sometimes be determined only by measurement using the VHS jig kit of special alignment parts (all these faults were on HR3330 and similar machines).

A very rapid shift could be seen with the first case – a pointer to the drum servo rather than the capstan servo. So the drum servo ramp and sample pulse waveform was examined. This showed that the drum was shifting. On replay this servo is locked to the signals on the control track, and is thus influenced by the tape speed and hence the capstan servo. So the check had to be carried out in the record mode.

Now the drum servo waveform is normally very stable in the record mode, the sample pulses on the ramp coming from the transmitted syncs. So if the ramp is shifting, with a wobble, the cause of the trouble is variations in the rotation of the drum. I've found that the best approach to this problem is to disconnect one of the leads to the motor and then feed it with 6V via a meter – initially on the 1A range as the motor works up to speed, then on the 100mA range. The reading thus obtained should be between 40mA and 80mA, though it's subject to a wide tolerance range. Anyway, in the case in question the motor current was varying between 60mA and 100mA instead of being stable, thus proving that the motor was at fault.

In the second case the customer sent us a tape along with the machine. On the tape there was a test card which revealed regular colour shifts – quite large errors in fact. No variation in the drum servo waveform could be detected on record, and the drum motor current was a steady 50mA. Attention was turned to the capstan servo therefore. It's no use looking at the waveform, because nothing will show up. So I checked the capstan motor current, which was found to be 65mA, varying by ± 1-2mA. Was this the cause of the trouble, or was it a red herring? Another capstan motor was tried, and this time the current was 110mA. The variation was less, but was still there.

It's at this point that the test kit starts to be useful. I put in the back tension gauge, and the measurement went off the scale. This was the problem then, too much back tension – the supply reel skidding on the tight brake band, so that there were variations in the tape tension. I'd better mention that I was using my own test tape for the checks, as the customer's one had the errors recorded on it.

On these machines there's a test point (TP8 on the audio/servo board) at the output of the drum servo sample

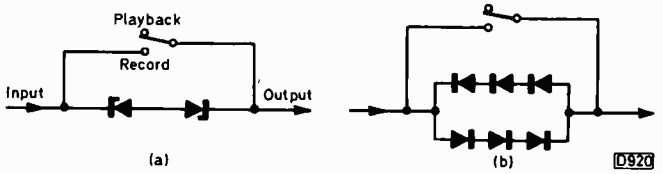


Fig. 1: The non-linear circuit (transistors X5/6/7) in the drum servo circuit used in the HR3330 is like two back-to-back zener diodes (a) or a diode string (b).

and hold circuit. This point sits at 4-4·6V d.c., and varies up and down. The variation should not be more than ±0·25V, or within 1cm on a scope set to 0·5V/cm on an a.c. range. If the variation on playback is greater, the limit set by a non-linear circuit (see Fig. 1) is exceeded and an error signal is sent to the motor drive circuits, the servo then shifting. What happens is this. If the tape speed or tension in the record mode varies, the control track pulses are recorded with a variation and the playback varies. If the playback drum servo variation is greater than normal, the excursions go outside the limits, the motor kicks and the colour shifts away from the luminance and back again. The symptoms can be erratic and intermittent, depending on whether the error level is sufficient.

The tape tension on the recorder in question was adjusted, and stability achieved. The original capstan motor was then replaced, the capstan sample pulse position was set and a test recording made. The tape transport was stable, with no noticeable colour shifts. The back tension had been well over 60gm/cm, when it should have been between 28-45gm/cm.

On the third machine the cause of the trouble was found to be the edges of the tape creasing on the tape guide next to the audio head. If the edges of the tape crinkle, the control track head-to-tape contact is erratic. This results in control track pulse timing variations, and the effects previously discussed. The only way to overcome this problem is first to check the height with equipment in the jig kit. Don't adjust the guide. It's most likely that the pinch wheel is not parallel with the capstan drive spindle: a special tool is required to adjust it.

No Colour

Two VHS machines came in recently with the no colour fault. The first one I looked at replayed a known good recording in monochrome, but with a herring bone type of patterning. This patterning cleared when the switch at the rear of the machine was moved from the colour to the monochrome position, indicating that the colour was being replayed but that there were phase errors in the colour signal processing circuitry such that the colour killer was not operating.

The way in which I tackle this sort of thing is to look at the balanced modulators and work back to the phase-locked loop and the basic voltage-controlled 2·5MHz oscillator – the circuitry was described in some detail in the May 1980 issue. As in the previous case, we found that there were no sync pulses from the servo panel (these are used in the phase-locked loop). So a check was made on the servo panel, where it was found that there was no video signal. Back to the luminance/colour panel therefore, where we had plug and socket problems on connector 83.

The trouble with the second machine was rather different. The monochrome replay was clean and was not affected by the colour/monochrome switch at the rear. Checks were made on the balanced modulators and the phase-locked loop, but everything was in order. So we traced the colour signal from the output of the second balanced modulator to the two-line delay line, where there was a distinct lack of input signal. Further tests showed that the emitter-follower transistor X204 had an open-circuit emitter.

Mostly Panasonics

We've had several Panasonic machines in recently. An NV8030 time-lapse machine required new video heads, which are not too easy to fit since they require dihedral adjustment, i.e. adjusting the video head assembly so that it's not off centre, using a gauge on the circumference as with Betamax machines. An NV3160 reel-to-reel ½in. tape machine had been serviced by others and had not been right since. It required a series of adjustments to the book, then a final tweek based on experience to ensure that the replay colour picture was free from noise. I was quite pleased with this one, and so was the customer.

An NV7000, Panasonic's latest, came in with the complaint that the tape speed was varying, suspect capstan servo. I spent some time checking through the capstan servo. All very complicated – the simplified block diagram more complex than the circuit, with direct drive as well as 120° phase-shifted drives. Yours truly getting nowhere, so time for coffee. Sup, sup, slurp. Hello, what's that funny clunking noise in the top of the recorder? I'm sure the pinch roller shouldn't be moving backwards and forwards like that! Puts coffee down. Inside the top, the tape drive capstan shaft was bent. By about 30°. No wonder the capstan servo was all over the place. My next thought was of the complex task of removing the capstan direct drive motor. But no, just two plugs, three screws and out it came. Aren't these Panasonics nice to service?

More than can be said for the Sony SLC7. I've had two for evaluation. The first one refused to play my new Blondie "Eat to the Beat" cassette – there was a phase fault in the colour replay circuit. So back it went. The second one was much better till the tape rewound to the beginning. What was that bleeping sound? Why did the recorder keep trying to rewind – it was already there? If in doubt, panic! This machine had brain failure. The end of the tape alarm, which should bleep only at the end of the tape, not the beginning, was going off. After each ten second bleep, rewind would operate. But the tape was already rewound. Then the alarm sounded, and so on. At five-ten minute intervals. I decided to have a look at the microprocessor board – if I could find it. When I did I took the only corrective action possible – put the machine in the box and sent it back. Sony seem to have gone back to the dark ages with the SLC7. It's an attractive machine and performs very well when working correctly, but from the servicing point of view it's a nightmare to get at. The out of guarantee servicing costs are going to be high. Very high.

Next another Panasonic NV7000, which wouldn't record sound. A good look at the picture showed that it wasn't erasing either. A minor fault. The switching is solid-state in this machine, with a transistor used to switch the power to the erase oscillator in the record mode. The transistor has a 3V zener diode between its base and emitter to prevent reverse bias breakdown – the zener diode was short-circuit, with the result that the transistor could not switch on.

The JVC HR7700

Some information has arrived on the new JVC HR7700. Wow! Twin-loop servos, a direct drive motor for the video heads, and four more motors – for capstan, reel drives, threading and cassette lift. The most remarkable feature however is the back-space editing. When the machine is put into the record pause mode, it rewinds twenty frames. After being released back into record it plays for twelve frames to lock the servos and phase the incoming video with the control track pulses, then edits over the recording for the last eight frames. The edits take place within a frame and are beautiful.

What's the Name of that Shop?

Finally, my Newark Video Centre is now open. It's also my intention to run more frequent video courses from there for those TV service engineers who want to learn more about video. Oh yes, and to launch more receiver/monitors on to the market for video and hi-fi enthusiasts.

Long-distance Television

Roger Bunney

LAST month I expressed the hope that F2 propagation conditions would improve this winter. Fortunately the improvement has already started, producing quite dramatic signals in most parts of the UK. Signal strengths have been such that even the most modest of DX-TV installations have been rewarded with signals from afar – from as far distant as Australia! Apart from F2, Sporadic E and tropospheric openings have also provided signals, and in fact during the two decades I've been DXing I've never experienced a more eventful month than the one under review.

I'll deal with tropospheric reception first. The prevailing high pressure systems during late September/early October produced widespread reception, particularly along the south and east coasts, from France, the Low Countries and West Germany. Conditions improved during October 1st-3rd, giving reception from Switzerland, Austria and the southerly parts of West Germany. The 3rd produced quite dramatic signals via tropospheric ducting from Switzerland, throughout Bands I and III and at u.h.f. It's the first time that the Swiss channels E2, 3 and 4 have been received at high strengths in the UK via tropospheric propagation. The signals included Grunten ch. E2. Hugh Cocks in East Sussex had these signals at overloading strengths! Here at Romsey (South Hampshire) I was pleased to receive four Swiss stations not previously received, including La Chaux de Fonds ch. E9 (4kW) and Niederhorn ch. E12 (5kW). Cyril Willis (Cambridge) received RTL (Luxembourg) transmitting 625-line System G signals on ch. E27 to Belgium – a rare catch.

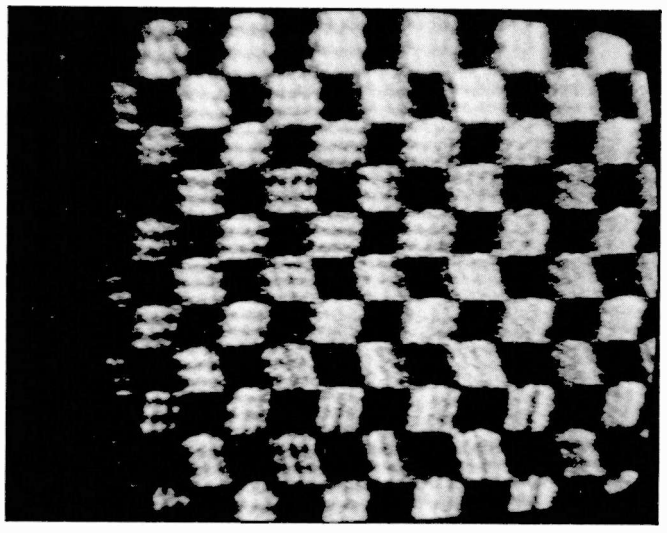
The ducting area was relatively limited, with ORF (Austria) just visible here above the noise (ch. E5). Optimum reception seemed to be from around 0900 BST and throughout the morning of the 3rd. At Hugh Cocks' location reception continued into the 4th, but an approaching cold front effectively killed off further tropospheric reception during the night here at Romsey. Hugh logged numerous West German u.h.f. stations and East German transmitters at v.h.f./u.h.f. Perhaps his most dramatic reception was of the 525-line System M signals transmitted by AFRTS (American Forces network) from Vogelweh on ch. E30 (3kW). At 1100 however the cold front arrived in East Sussex and activity ceased.

Excellent F2 Conditions

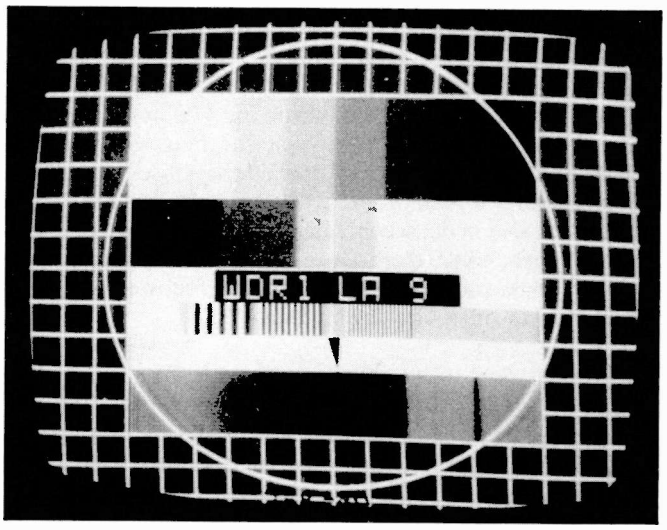
F2 conditions improved sufficiently from October 10th to give the first really distant TV signals, with TSS (USSR) present for several minutes during the morning. The intensity and variety of the signals increased during the next few days, with sightings of African transmissions and longer duration signals from the Eastern USSR. Hugh Cocks noted a suspected Kenyan signal (ch. E2) at 1600 BST on the 12th, then Russian ch. R1 and African ch. E2 signals on the 13th, trailing the first substantial opening on the 14th. From 0745 BST on this day I logged very strong Russian ch. R1 signals, both test pattern and programme, all suffering from the characteristic smearing and multiple images. Whilst talking to Hugh on the phone it became apparent that signals which were very strong in Hampshire were present though barely visible at noise level in East Sussex. This factor was noted in subsequent F2 openings, and seems to be due to increasing ionisation of the F2 layer. When the F2 opening starts, the critical frequency is such that only a very shallow v.h.f. signal can be reflected. Then as time progresses and the ionisation increases, there's a sharper angle of reflection for the same signal, the range decreasing. During this opening the signals lasted until mid-morning.

On the 18th, fortunately a Saturday, strong signals put in an appearance from 0815 BST on ch. E2 – the familiar PM5544 test pattern. This changed to a test chart with Arabic writing at 0830, then a clock (stating 1200) at 0900 followed by an Arab newscaster. Reception of this signal has been widely reported – it appears to have come from Dubai on the Gulf. During the afternoon, strong ch. E2 African signals were logged. African signals were again present on the following day – two on ch. E2, one of a football match (now known to have been from Ghana) and the other an RMA monochrome test card (suspected to have come from Nigeria).

The North Atlantic path has not so far provided any ch. A2 signals, though there have been highway patrol signals at up to 50MHz. African signals were present on most days following the reception mentioned above, and on the 23rd



The Chinese checkerboard test pattern, received by Anthony Mann in Australia on ch. R1.



The new WDR Fubk test pattern with identification LA9, indicating Langenberg ch. E9. Photo from Ryn Muntjewerff.

strong Dubai type programmes were present from 1330 preceded by colour bars and the PM5544 pattern. The 24th and 25th both gave incredible signals from Russia, Dubai and Africa, but perhaps the most exciting event was Hugh Cocks' reception of the Australian ch. A0 from 0935-1015. The signals were generally of poor quality and suffered from severe interference from Russian signals.

On Sunday the 26th, the USSR ch. R1 signals were relatively late in putting in an appearance – at 1031 GMT (clocks changed to winter time) – but there then followed nationwide F2 conditions. A very strong ch. E3 signal was noted during the morning, reappearing at 1350 and 1500. Several enthusiasts report that it came from Nigeria, Andrew Tett apparently seeing the NTV caption. At 1545 there was a very strong test pattern on ch. E3, while on ch. E2 sound there was a commentary on a football match between Accra and Tamale of the Ghana premier division. The accompanying vision was for most of the time at or below the noise level. Strange indeed. Finally on the 27th Russian signals with the usual ghosting/smearing appeared at 0815, then ch. A0 vision rose above the noise. Hugh Cocks observed subtitled programmes (suggesting one of the new ethnic channels) and Mark Baldwin (Rugby) received relatively strong signals.

Summary

There were SpE openings on the 12th, 16th and 17th. Strong, but less noteworthy than the international TV via F2!

Many thanks to Hugh Cocks, Mark Baldwin, Brian Fitch, Ray Davies and others who reported on their reception during the period.

From down under Anthony Mann (Perth) also reports a very good month, with Chinese and East Russian reception, also ch. B1 audio on several occasions and a new one – North Korea ch. R2 (October 14th). Malaysia ch. E2 has also provided strong signals (I'd hoped to receive this in the UK!).

Let's hope that conditions continue to improve during November.

New EBU Listings

West Germany: Power reductions – Minden chs. 26 and 57 reduced from 500kW to 300kW, Muenchen chs. 35 and 56 from 500kW to 200kW.

Finland: Two new stations transmitting YLE-2 – Pyhatunturi ch. 25 650kW, Tampere ch. 53 1,000kW, both with horizontal polarisation.

News Items

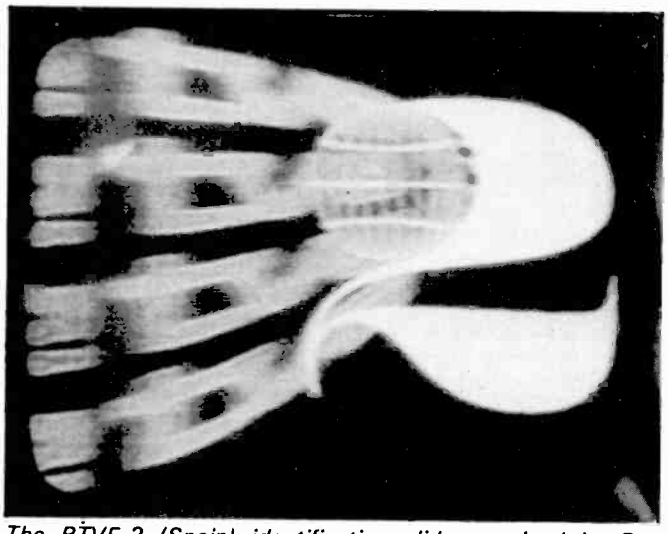
Australia: Brisbane TV BTQ7 has commenced a full teletext service – called "Seventel"!

Canada: CBC is proposing to start a second programme which will be distributed via the Anik A3 satellite, at 4GHz, and relayed to viewers via cable operators. The tentative on-air start is September 1981.

South Africa: The SABC is to start a second network by January 1982, catering for those languages not covered by TV-1. A TV-3 network is also proposed.

Japan: The Yuri satellite, which was intended to provide direct TV broadcasting to viewers, has been taken out of service due to problems with the travelling-wave tubes. Tests are being carried out with a new satellite.

Italy: RAI have obtained court approval in Florence to resume full power transmissions. Apparently pressure from commercial broadcasters had earlier led the court to order a



The RTVE-2 (Spain) identification slide, received by Ryn Muntjewerff (Holland) on ch. E2.

power reduction. When RAI's audience dropped to 44 per cent, RAI threatened to cease transmissions and the court reversed its earlier decision.

In brief: South Korea is to use the NTSC colour system ... Chinese authorities in the Canton area have banned the viewing of Hong Kong TV – outdoor v.h.f./u.h.f. aerials are no longer allowed ... The BFBS Rheindahlen, W. German TV studio has now been opened.

New Propagation Records

Roger Thorn (G3CHN) of Kingsbridge, South Devon had a two-way 144MHz contact via tropospheric ducting with an amateur in the Canary Islands. The distance is 2,600km. On August 12th, amateur contact was made between Hartland, North Devon and Saint John, Newfoundland, again at 144MHz. The signals were weak but positive identification was established.

From our Correspondents . . .

Robert Copeman and Wenlock Burton report that the Australian ethnic TV service has now started – it's known as multicultural TV, with the call sign MTV. Test transmissions commenced on October 10th, with the start of programmes on October 24th. The PM5544 test pattern is used, with the identification "ch.0-28" at the top and "A World of TV" in the lower segment in Sydney and "ch.0-28"/"Melbourne" in the Melbourne area. Also in Melbourne, a student run educational service has been started on ch. 34.

During the tropospheric opening on october 3rd, Dave Kenny received Austrian and Yugoslavian radio transmissions in Band II.

Alexander Wiese has started a DX-TV club for European members. Publications will be in German. For details, write to PO Box 801965, 8000 Munich 80, W. Germany.

Following my mention of 430MHz amateur TV transmissions in the November column, John Wood has written pointing out that several Japanese portables can tune down to 70cm without modification and that the ELC2060 varicap tuner can also be tuned down to 430MHz without modification. Mark Baldwin, who lives near John at Rugby, receives John's transmissions using a Wolsey Colour King aerial, an ELC2060 tuner and a domestic TV set. Further information on modifying popular tuners was included and will be featured in a future column.

Getting Organised for Field Servicing

Harold B. Berkley, T.Eng. (C.E.I.)

TELEVISION servicing in the field calls for a different approach from bench servicing in the workshop. The time available per call is limited, and very often the conditions under which the repair has to be carried out are far from ideal. Field engineers tend to be "loners", with everyone adopting an individual approach – if you look in the estate cars of different engineers from the same company you'll find no two alike. Looking further, into the toolcases carried, you'll probably find even greater divergencies. Some of us are naturally neat, others not. Nevertheless there are some guidelines that can be of benefit to all and can be adapted to suit the individual's particular needs. The ideas presented in this article represent my own approach, based on ten years' experience of field servicing.

One major mistake is to carry too many tools, often duplicates, and to overstock with components. Apart from being costly and wasteful, this makes it difficult to find particular items when they are needed. The point is that time is the most precious thing for the field engineer: it should be spent diagnosing faults and carrying out repairs, not fumbling about in the back of the case for components or running to and from the car.

Several things can more conveniently be carried in one's pockets than in the toolcase. I carry a neon screwdriver, a small screwdriver suitable for adjusting potentiometers and a small double-ended metal trimmer in my shirt front pocket, and a reversible screwdriver, one end Pozidriv 2PT and the other flat, in a trouser or jacket pocket. The latter combines two screwdrivers in one and is ideal for removing set backs, some of which are held by a combination of both types of screw. The vast majority of European TV sets use Pozidriv screws, usually 2PT but also some 1PT. The Phillips crosspoint screwdriver is not a good fit, a point overlooked by those responsible for selecting the contents of some expensive toolcases. It can be difficult finding a reversible screwdriver with a Pozidriv rather than a Phillips section: I use one manufactured by Footprint of Sheffield, and find it just right for the job.

The number of small tools you need to carry in the toolcase is less than might be thought. I started field servicing in an area which included many high-rise blocks of flats – and it's no joke going from the twentieth floor several times for bits and pieces. This in fact is what got me interested in being well organised. The toolcase should enable you to deal with most situations, yet be easy to carry about. I carry one each of the following items in my case:

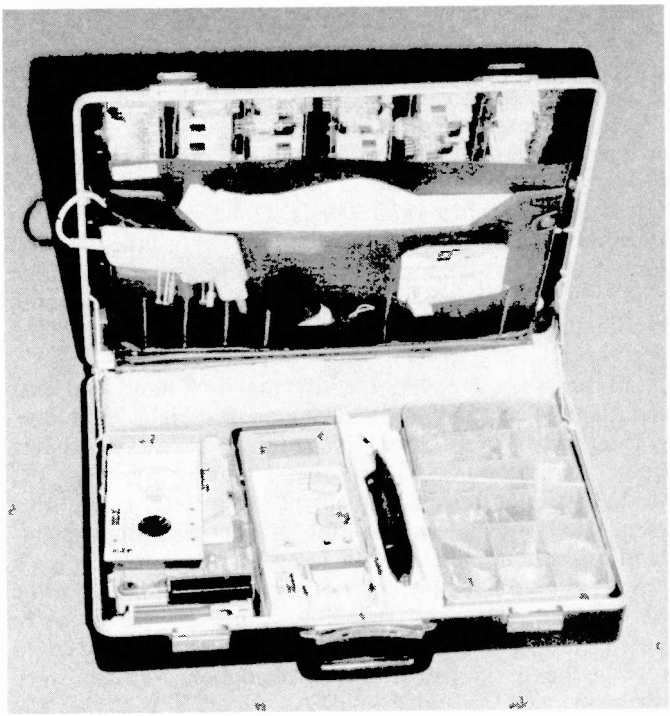
Stanley Pozidriv screwdrivers, 1PT and 2PT.
Pair of medium sidecutters.
Pair of snip-nose pliers.
Box spanners, 4BA and 6BA.
Hexagonal nylon trimmer.
Pair of tweezers.
Dentist's mirror (very useful).
I.C. extraction tool.
Rechargeable soldering iron.
Solder sucker.
Small mains-operated soldering gun.
Small rechargeable torch.
And of course a multimeter.

The medium sized sidecutters can be used for fine work and should be strong enough for heavier cutting, e.g. chopping the lugs off smoothing capacitors. I find expensive small pliers and cutters unnecessary for field servicing, but others may have different opinions on this.

I've been using rechargeable soldering irons since they first came on the market. They are ideal for field servicing – no looking for mains sockets and extension leads, or waiting for the iron to heat up and cool down. I carry two in fact, one in the toolcase and the other charging from an adaptor in the car. There are several makes on the market. The Wahl iron I use has rather fragile bits, but the ones sold by Tandy for their irons can be used instead and are very robust. One iron of particular interest is the "Scope" one made in Australia and imported by Toolrange Ltd. It uses a patented "carbon arc" principle, but I've yet to try one. Rechargeable irons can be used only for light soldering of course, so as a standby a soldering gun is useful. The Ersa Sprint is small enough to fit in the tool case yet still gives 150W.

If you're starting from scratch, why not take the plunge and invest in a digital meter with LCD display? Tandy have one that retails for £49·95: it's an excellent meter with an Ohms range that goes up to 20MΩ. What no one tells you about digital multimeters however is that they are pretty useless for making cold checks on semiconductor devices – the old forward and reverse resistance checks on diodes and transistor junctions. You just get confused. So you will also need a small, cheap and nasty meter with an Ohms range for testing semiconductor devices.

Another gadget worth carrying is a simple battery tester (try Tandy). This is a recent addition to my kit, being handy



Everything you need to take with you – conveniently arranged in a Custom executive briefcase.

for use with sets featuring remote control – it's worth testing the batteries in the transmitter unit before getting involved in fault-finding in the remote-control circuitry.

So much for tools. What about components? Contrary to the belief in some quarters, the valve is very much alive so far as the field service engineer is concerned – a fact that Philips seem to have overlooked in their latest toolcase. I bought one of their cases some years ago. It had special plastic clips to hold valves and was an excellent case, though after several years of heavy use the outer case fell apart. So I bought an executive briefcase made by Custom – they do a deep one, 19 x 14 x 16in., which is ideal – and glued the valve clips in the lid (see photo). The folder provided is useful for circuits, and the little pockets intended for pens can be used for trimmers, tweezers, etc. It's obviously not feasible to carry a full set of manuals, but the circuits for the popular chassis you're likely to meet should fit in the folder.

At the rear of the case I've made a small compartment about 2½in. wide and the full width of the case. This takes all the small tools. In front of this I have four Raaco plastic boxes (10½ x 6 x 1¾in.) for components. These can be stacked two high. It's prudent to have a stout rubber band round each. There's still room for the multimeters I carry, the soldering iron and gun and one or two other items. A piece of plastic foam about ¼in. thick covers the lower compartment and doubles as a kneeling mat. As mentioned before, don't overstock with components. Throw the used ones in a box, and replenish daily.

In addition to making life a lot easier, the toolcase impresses the customer, giving him confidence in your technical ability.■

The Exorcism of Fred

Les Lawry-Johns

WHEN I heard all the shouting and cursing coming from the bathroom I had an uneasy feeling that something was wrong. Only that morning the gas fitter had been to repair the multipoint so that honey bunch could have her bath and splash around happily. Now it seemed that she wasn't splashing around, and it appeared that a bath was out of the question as the gas was again not flowing. It was all my fault of course.

I did my best. I took an electric kettle up and plugged it in for her so that she could splash around in the sink, but she still wasn't happy. So the next day I phoned the gas board and told them that as far as gas goes, it had gone again.

Another and much nicer chap came and said that the faulty unit couldn't be repaired and that he would bring a new one as soon as possible. The next day brought two messages from the gas board: one was a bill for the repair of the old unit, the other was a note to say that a new unit would be fitted in two days' time.

Smack on time the new unit arrived, and was fitted by the fitter who had brought his stereo cassette deck with him to be repaired. Apparently, all the time it was playing there was an intermittent crack from one speaker, accompanied by a distinct jump on the right-hand VU meter. The left did not appear to be affected.

It was a Marantz 1820 Mk II. Quite a nice job if you understand these things, but normally I'm a little shy and confess to a total ignorance of them. If he was good enough to get my honey bunny into hot water however, I was going to sort this thing out however much I suffered. And suffer I did.

Off screws, off cover. Identify the right-hand and left-hand amplifiers and concentrate on the right-hand one. Without a cassette in, but with the thing playing away like mad, there shouldn't have been much noise in the headphones nor any movement of the meters. Every now and again however there was this distinct click in the right-hand headphone and a small jump on the meter.

So I shorted the base and emitter of what appeared to be the final amplifier and the noise vanished. Good, we're making progress. Ignore the fact that a slight click could now be heard in the left-hand headphone, about every fifteen seconds.

Proceed down the right-hand channel to the input, shorting the base to emitter of each transistor in turn, and at no point did the click reappear on that side. It reappeared only when the amplifier was left working normally – and then far louder on the right-hand side. So we listened for the background hiss, and this too was louder on the right-hand side. When the two sides were equalised, the clicks sounded the same and both meters responded to them. I sat there encased in my headphones and pondered.

The regularity of the clicks suggested that the cause was nothing irregular. Therefore it was something building up a static charge due to regular movement.

"You're the only moving thing" I said to the cassette motor, prodding it with my meter and leaving it there. What a masterstroke! What genius resides here! Removing the prod and allowing fifteen seconds on my dad's old watch brought back the clicks. The cassette motor is cushioned on rubber grommets, and has no bond to earth. It has now. The gas man was awfully pleased. Then I gave him the bill.

Enter Mr. Slaughter

Mr. Slaughter's a jolly fellow. Must be something to do with his living. I don't mean the *fact* that he's living, I mean what he does for a living. He's a butcher of course. What a way to get rid of your inhibitions! Chop up a leg here or there. Nice piece of breast madam? – certainly. Slice, slice. Anyway, I helped Mr. Slaughter in with his Bush CTV1122 (Rank A823A chassis). "Picture's sort of faded. As though the entrails have been taken out, ha, ha." "O.K. Mr. Slaughter, call back this afternoon. I may have managed to stuff them back by then."

When Mr. Slaughter had departed I was alone again. As all geniuses who can earth the casing of a Marantz cassette motor must be. I would again try my diagnostic ability.

The picture certainly lacked entrails – we don't say guts in this magazine, we leave that sort of thing to *Wireless World*. Plenty of foreground but no background. Our diagnosis was immediate. Faulty SL901 demodulator/matrixing chip. Just to be sure, I clipped in the test panel. Lovely picture. "When the chips are down, you know who the men are" I muttered. With two deft sweeps of the desoldering braid the SL901 was free. Pop in the new one and Bob's your auntie.

In went the new chip and back went the panel, not forgetting to put the black plug back in the power unit.

When I switched on I noticed a flash from the surge-limiting thermistor, and resolved to change it before completing the job.

The picture was still the same and all my cheer departed. The sound was o.k. and the colour was there, so I made another guess. The luminance emitter-follower transistor – where was it? I grabbed the circuit and took off my glasses so that I could see it. There it was, 3VT3 (BC148). Coupled to the luminance delay line via that electrolytic ... that electrolytic (3C43). Then I remembered. I always do when I've wasted quite a bit of time.

The capacitor is of the type (you know the ones) that when frightened by the meter reads about 500kΩ and steady. The circuit said 6·5μF, the faulty one was 10μF, so I put in an 8μF type because one was looking at me out of the box. In it went (round the right way for a change) and harmony was restored – until I switched on and the surge-limiting thermistor flashed and fell to bits. Why didn't I change it the first time I noticed?

The Card Game

We labour for six days without complaint. Almost without complaint. On Sunday morning we tidy up a bit, sort out the books etc., and at twelve o'clock get ready for the big event of the week. At one o'clock the card game starts at "The Call Girl" which, if you remember, is a pub in Harper St. where Ernie presides over the taking of our hard earned cash.

All week long honey bunch and I are on the best of terms. Most of the time. But at one o'clock on Sundays we are bitter enemies, no quarter asked or given. She's Sean's partner, and I have either Mick or Dick depending upon who's helping Ernie behind the bar.

The game is whist, and therefore partners are not always on the best of terms, or let's say don't always see eye to eye, though I must say that honey bunch and Sean rarely fall out and are most polite to each other. This is in distinct contrast to my partner and I, who scream and shout abuse at each other at the slightest suggestion of one trumping the other's trick. Despite this we are usually handomely in the lead after a hard fought battle, and honey bunch has many theories as to why this should be, none of which holds water as far as I'm concerned.

If there's one topic I hate during all this it's TV sets, and if anyone broaches the subject to me at Sunday lunch time they usually get short shrift. When Sean was dealing this week however (he deals hearts as trumps) he started telling me about his TV set that had gone wrong the previous day. I didn't hear a word of it because I've got a lot of wax in the ear nearest to him. The fact that I didn't hear what he said upset honey bunch who immediately accued me of not taking any notice of what Sean was saying.

"I can't hear through this ear" I explained. I'd just about got the gist of it however. ITV keeps dropping out, but the other two channels are fine. "The grease in the tuner unit wants cleaning out" I said. This seemed to me a perfectly valid explanation, since the set was a Thorn 1500. Sean muttered something like the grease in his tuner being about as troublesome as the wax in my ear.

But we got back to playing cards, and Dick and I won the hand by two tricks. It was then Dick's turn to deal and he deals clubs. "My set's playing about as well. Keeps going green it does." His set was a Thorn 9000, which we'd sold him some four years earlier. I was busy collecting all my trumps and putting them in order when Sean stirred it up.

"He doesn't hear out of that there, but I can tell you what's wrong. You've got wax in your tuner unit."

I shot Sean a baleful look. "He hasn't got grease in his tuner, but you have and when I clean it out tomorrow the ITV will be as good as the other two, however daft that seems, and what's more I doubt whether you'll get one trick in this hand."

That concentrated everyone's attention on their cards wonderfully. Honey bunch whispered "I bet he's got a handfull of trumps."

"Too true I have" I sneered, and then realised that I'd heard her whisper very well. "I haven't any wax in this ear, so there."

A Ghost Story

I suppose that at this time of the year a ghost story's in order. This one I've known about for some time, so it's not a tale that someone has just made up. Maybe there's an explanation, but I can't see it.

Our local newsagent and his wife and family live in a house at the top of the road, adjacent to an old church that was pulled down some years ago, the site being grassed over and preserved. Some years ago they realised that some peculiar things were happening, like rings vanishing from the dressing table in the bedroom and appearing on top of the TV set. Silly things, but irritating when you put a thing down in one place and then find it somewhere else. Hardly a ghost however. Then one day on arriving home in the evening they found a quaint looking old man in a funny hat sitting in a chair in the lounge. When they came in he got up and walked through the wall (the people next door also see him passing through apparently). He didn't seem to harm anyone, so they accepted him as an occasional visitor and called him Fred.

They saw a lot of him after that, coming and going at odd times, and he seemed to have a liking for that particular chair. Their teenage daughter was not so keen however, since she swears that he laid on her bed one night and wouldn't get off for some considerable time, during which she was unable to move. They also have two sons who were well acquainted with Fred, and a black and white spaniel by the name of Toby who was scared stiff of him. On one occasion when Fred appeared and walked toward Toby, the poor dog became almost hysterical and backed up the stairs with every hair on his body standing on end. In short therefore everyone in the house had seen him.

When I heard about all this I was convinced that one of the younger members of the family was responsible for the manifestation, as young people often are without being aware of this peculiar ability. As they get older they seem to lose the ability, and many a good ghost has gone west merely because the children have grown up. In this case however the children were not particularly young, and the one most affected by Fred appeared to be the dog.

As I say all this was well established and caused little concern. Some time later however the family acquired another dog, this time a golden spaniel by the name of Copper. Now Copper is one of the most extraverted and joyous dogs I've ever known. Always chasing around and barking for the sheer fun of it.

Copper hadn't met Fred who popped in only from time to time. One evening however Fred appeared in the lounge just as Copper came hurtling through the front door and into the lounge. Copper saw Fred and made straight for him. Fred took one look at the barking dog and promptly vanished. He hasn't been seen since. Or so I'm told.

So now you know what to do if you want to exorcise a ghost. Any ideas about the different effects on the two dogs?

VHS Tracking Monitor

L. Sadarangani

IN VHS videocassette recorders the video signal is recorded on the tape using frequency modulation between the limits 3·8-4·8MHz. During playback the paths traced by the video heads across the tape must match the pattern recorded on the tape for the maximum f.m. signal output to be obtained, i.e. the maximum signal-to-noise ratio. There are two aspects to obtaining this condition. First, the user adjusts the tracking control on the front panel to obtain a clear picture on the TV set. This adjustment operates through the head drum servo system. Secondly the servo system compares the head drum speed and the control signals recorded on the tape and corrects the drum speed via feedback action.

The tracking control can be adjusted manually or can be set to the "auto" position. The latter is not always the best setting however, particularly when a prerecorded cassette from a different machine is being played back. The auto position also fails to give optimum results if the machine hasn't been set up correctly. It's generally best therefore to adjust the control manually whilst watching the screen.

An alternative approach to setting up the tracking is described in this article – the use of an external metering unit which indicates the amplitude of the off-tape f.m. signal on a scale marked 0 to 10. This method has a number of useful advantages that are not immediately apparent – as follows.

First, adjusting the tracking control for a maximum reading on the meter provides a definite way of achieving the best possible picture not only when viewing but also when making a recording. This is because when making a recording it's essential to adjust for maximum f.m. signal, i.e. signal-to-noise ratio, which corresponds to a picture with minimum noise (fuzziness).

Secondly, if the meter reading obtained with a particular prerecorded tape is noted it's possible to keep an eye on the machine and the cassettes. If the meter reading falls at a later date, this indicates that maintenance is required – the video heads may be dirty or the control head out of alignment. This also gives an idea of the condition/quality of the tape.

Thirdly, the meter provides a check on the auto position of the tracking control. Note the meter reading in the auto position, then see what is the best reading that can be obtained using the tracking control manually. If the difference between these readings is greater than 1dB, the position of the audio/control head requires adjustment.

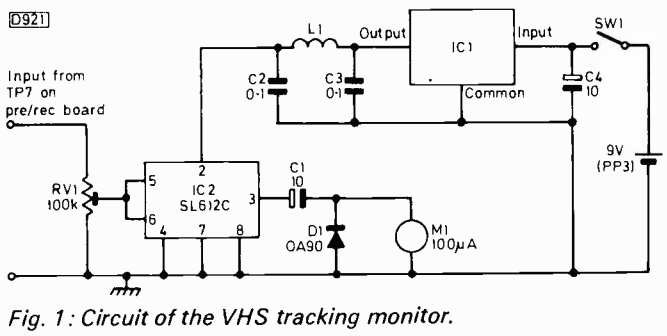


Fig. 1: Circuit of the VHS tracking monitor.

Circuit Details

The most convenient point for monitoring the playback f.m. level in the JVC machines is at TP7 (playback f.m. output) on the preamplifier/record amplifier board, which is mounted on the left-hand side of the machine. The maximum f.m. level at this point is usually around 300mV. The signal then goes off to the chroma and luminance circuits for processing.

The meter circuit must interface as simply as possible therefore at this point, and be capable of amplifying and rectifying the signal thus obtained in order to drive the level meter. The circuit used must also be sensitive to the small variations in the playback f.m. signal level obtained as the tracking control is adjusted.

Several circuits were tried, but the one shown in Fig. 1 was found to offer the best solution in terms of performance and the minimum number of components. It's based on the Plessey SL612C integrated circuit, a low-noise amplifier which is usually found in i.f. applications. The i.c. provides a voltage gain of 34dB, with a maximum signal handling capability of 210mV r.m.s. It operates with supply voltages in the range 5V to 12V, drawing 5mA at 5V. Supply line decoupling is included within the i.c.

The signal from TP7 in the VCR is connected to the i.c.'s input via the input attenuator control RV1. This control is used to set up the meter's f.s.d. TP7 is connected to a d.c. blocking capacitor within the machine, so no input blocking capacitor is required. C1 is required at the output from the i.c. however. D1 removes the negative-going f.m. signal transitions, with the result that the meter indicates the average signal level on its scale. This simple circuit was found to work satisfactorily – improvements were made during the design but were found to be unnecessary.

The regulator IC1 maintains the supply voltage at 5V. Since the complete circuit draws 10mA, a PP3 battery is used as the power source.

The meter used is scaled from 0 to 10, and with the circuit shown the change in f.m. signal level from one scale mark to the next represents a ratio of approximately 1:1, i.e. 1dB.

Construction and Calibration

The instrument is calibrated by recording a signal on the

★ components list

IC1	78L05 100mA, 5V regulator
IC2	SL612C Plessey i.f. amplifier
C1	10μF, 16V electrolytic
C2	0·1μF ceramic
C3	0·1μF ceramic
C4	10μF, 16V electrolytic
L1	1A v.h.f. choke-RS Components type 238-255
M1	100μA f.s.d. RS Components meter type 259-561, Scaled 0-10
D1	OA90 diode
RV1	100kΩ preset

IC2 is available from:
Semiconductor Specialists (UK) Ltd.,
Falling Lane,
Yiewsley,
West Drayton.

VCR and then playing it back with the tracking control in the auto position. Adjust RV1 until the meter reads 10. Next check with the tracking control used manually. If the machine is correctly set up internally, a reading of between 9 and 10 will be obtained. If the reading is greater than 10, adjust RV1 to reduce it to 10. Full-scale deflection corresponds to an input of 20mV at pins 5/6 of IC2 and an output of 1V at pin 3.

The circuit is so simple that a layout doesn't seem necessary. The prototype was built on a piece of Veroboard 2×1in., and was then incorporated in a plastic box along with an on/off switch, the meter and a PP3 battery. The input connection from the VCR to RV1 can be routed via the recorder's ventilation area or the lead can be pushed through a small hole drilled in the machine's back panel. Screened wire is strongly recommended.

Performance

The instrument has been found to perform satisfactorily, observation showing that the maximum meter reading corresponds with the best picture. It was interesting to see the different signal levels obtained with different cassettes – a difference as great as 6dB was noted. ■

Letters

ANOTHER SONY SAGA

The article in your June issue on the Sony set that blew gate-controlled switches brought to mind a recent, similar problem I encountered. The set was a Sony KV192SA, which is similar to the KV1810, and came in with its chopper and line output GCSs short-circuit. We replaced these and checked that the start-up circuit was operational with the set powered via a variac. Everything seemed to be o.k., so the set was connected to the mains. Bang went the chopper and mains fuse. In the hope of avoiding an expensive recurrence of the trouble we fitted a new start-up GCS and replaced the line output stage tuning capacitor (C542), then renewed the chopper. Start up on the variac was o.k., and the set was put back into service. Ten days later the set failed whilst in use, blowing the chopper GCS and the fuse again.

Since the set was in operation when it failed, the start-up circuit was obviously in order. A new chopper was fitted and the set came back to life – for three hours. This time the chopper again failed (for the fourth time), taking with it the 10Ω, 7W series resistor R607. The fuses were intact however. We went through the official Sony troubleshooting procedure, but nothing much came to light. A check with the scope revealed the presence of line drive right up to the gate of the line output GCS. Fortunately this time we'd another, working set of the same type available, so we were able to compare waveforms.

What we discovered was that the waveform at the collector of the line driver transistor (Q509) in the faulty set had a distinctly damped appearance, the leading positive-going edge not rising as rapidly as it should. Obviously the line driver transformer T502 had shorted turns, which was confirmed by replacement.

So what had been happening? The incorrect drive waveform had sporadically failed to turn on the line output GCS, thereby removing the chopper drive (no 19V rail). If this left the chopper on, it would go short-circuit.

Martin Pomeroy,
Johannesburg, S. Africa.

IC FAILURE

The problem I had with a colour set fitted with the Thorn 8500 chassis was occasional failure of the SN76227N decoder i.c. Assuming that this was due to some sort of flashover trouble, I made a careful check of the components on the c.r.t. base panel. The result was that W601 in the beam limiter circuit was found to be short-circuit, its failure in this way reducing the effectiveness of the beam limiting action. Replacing it seems to have cured the trouble, and as this problem could be expensive it seems worth mentioning it for the benefit of other readers.

S. W. Wakelam,
Birmingham.

SERVICE COMMENTS

I was interested to read the article on ASA hybrid colour receivers in the September issue – particularly the description of the unusual beam limiter/spot suppression circuit which operates on the tube's cathodes. You see we had one of these sets in not so long since, due to poor sound and a faulty on/off switch. The sound problem was simply a worn PCL86 valve, but the on/off switch puzzled us at the time because of the single-pole, two-way switch ganged to it. This was found to be wedged in an intermediate position, so that the pole was making both ways. The wedge was removed, and both switches were found to be making and breaking correctly. Sound and e.h.t. were present, but there was now no raster. Check tube base voltages and find the first anode supplies missing due to the feed resistor R336 having gone open-circuit. It seems that wedging the switch in the intermediate position had resulted in the tube being kept in the switch-off spot suppression mode, with the cathodes sufficiently negative to give a picture (the RGB drives are applied to the grids). An unusual set of circumstances to say the least!

Concerning the Decca 30 series set with very bad flutter (*Service Bureau,* October), this could well be due to the beam limiting voltage smoothing electrolytic C69 as you suggest. When this component deteriorates it causes such faults as brightness changes from one side of the picture to the other, weak contrast, weak colour and complete loss of field sync (since it provides the video emitter-follower transistor's base bias). This last fault can lead one to a frustrating search in the sync separator/field timebase departments. C69 seems to suffer (not immediately) after failure of the PL509's cathode resistor R467. I find that when R467 has failed, C434, R36 and R37 are usually replaced but not C69. This results in the faults previously listed eventually putting in an apperance.

A. M. Sheppard,
Swansea.

A CORRECTION

In my letter on resistors in the September issue the subject of noise with carbon composition resistors was mentioned. Unfortunately someone changed "excess noise" to "excessive noise". Excess, or voltage-dependent, noise is the accepted technical expression, and I'd appreciate it if you would print this correction.

E. F. Good,
Darlington, Co. Durham.

Aerial Phaser Unit

Roger Bunney

ONE of the main problems one experiences with DX-TV reception in Band I is that of interference. Adjacent channel problems will arise from the use of a wideband i.f. strip, while electrical and industrial electronic equipment, motor car ignition systems and local BBC 405-line signals all add their quota. The unit described here was initially constructed in an attempt to reduce the effects of interference caused by a VDU installation. It was subsequently realised however that the device can be used to remove or reduce interference from a variety of sources. It can actually remove an unwanted signal, leaving the spectrum clear for receiving another weaker signal at the same frequency!

Early efforts to reduce the effects of the interference from the VDU installation revolved around the use of stacked aerial arrays. An improvement was obtained by using separate feeders from the stacked arrays, combining the signals indoors with additional lengths of feeder used to give a 180° phase shift so as to get cancellation of the interference picked up by the two arrays. I feel that there's scope for experimentation here, using delay lines instead of lengths of coaxial cable. Another approach tried was to use a simple circuit to get cancellation of the unwanted signal by adding a reference signal in anti-phase. The results obtained were doubtful however, and I fell back on the use of notch filters.

Subsequently I noticed in the RSGB publication *Radio Communication* an advertisement for the G3JFK "AVP4 Antenna Vector Processor". This claimed that it could dramatically reduce interference when used in the h.f. communications band. I got in touch with the manufacturers, Radmic Systems Ltd., at Crawley, and received a very enthusiastic reply from the designer of the unit, Ken Franklin. The AVP4 was designed for use up to 30MHz, but enough information was given in the handbook to get me to go back to the earlier experiments using a reference signal to get cancellation of unwanted interference. There are two inputs to the AVP4, one from an h.f. dipole and the second from a modified reflector element. The idea is that when the phase and amplitude of the input from the reflector are adjusted suitably and this signal is then added to the input from the dipole, interference (particularly from the rear) can be reduced by 40dB upwards. So I set out to produce a Band I version.

Circuit

The circuit that eventually emerged is shown in Fig. 1. It's simply a means of comparing a wanted signal input, with interference, and a reference signal that contains a high level of interference only. The idea is to adjust the phase of the reference input so that it's 180° out of phase with the interference in the wanted signal input. Then, by adjusting the amplitude of the reference signal and adding it to the wanted signal input, the interference should theoretically cancel out. Note that the interference reference source must be of higher amplitude than the interference accompanying the wanted signal for this to work, i.e. the reference signal has to be phased and reduced to match the interference you are trying to cancel.

The reference signal input is passed via a TDA1061 integrated pin diode attenuator network to the 180° phase splitter D1/D2/L1. SW1 forward biases either D1 or D2 depending on the position it's switched to, so that the input passes via either D1 or D2. Coils L1 and L2 are wound on a ferrite toroid (type T37-12 from Ambit), using 26 or 28 s.w.g. enamelled wire. L2 consists of nine turns wound over two thirds of the toroid, while L1 consists of four turns, centre tapped, wound between the central turns of L2. Seal the windings on the core with clear varnish. This gives tight signal coupling. L2 is tuned by CT1 and CT2, with CT1 used to set the l.f. resonance when CT2 is at maximum capacitance. The field-effect transistors Tr2 and Tr3 provide a buffer between L2/CT2 and the low-impedance input of the SH120 (or SH124) hybrid wideband amplifier. The output from the wideband amplifier passes through a second pin diode attenuator network, which is used for amplitude adjustment, to the mixing network R32/VC. Pin diode D3 is included to enable the input from the DX aerial to be removed (with SW2 in the chassis position). This enables L2/CT2 to be tuned to approximately the correct setting without the wanted signal being present or masking the peaking action.

Use

Two aerials are required of course. One will be the normal DX array, the other being orientated to give maximum pick-up of the interference signal (reference signal input). To operate the unit, use SW2 to remove the DX input and tune L2 for maximum interference. Then switch SW2 to the other position so that the two signals mix. Set VR1 for minimum attenuation, using VR2 to attenuate the reference signal. Provided the reference input is at a higher level than the interference present with the DX input, it will be possible to reduce the setting of VR2 until the reference signal is seen to equal the interference accompanying the DX signal input. If reducing the setting of VR2 (increasing the attenuation) suddenly produces an increase in interference, SW1 is in the correct phase position and careful adjustment of CT2 and VR2 will give an interference null. If reducing the setting of VR2 (increasing the attenuation of the reference signal) reduces the interference in the display, so that only the interference present in the DX input appears, reverse the position of SW1. VR1 is included to prevent overloading.

Once CT2 has been peaked and the situation where the interference reduction is seen to be working has been reached, a further slight adjustment of CT2 will produce a phase shift and in combination with the settings of VR2 and SW1 interference cancellation should be achieved. The operation may seem to be rather complicated, but with experience the correct setting of the phaser unit is both easy and quick.

Results

The circuit certainly works with the two main problems present at my location, i.e. the presence of the BBC ch. B3 and radiation from the VDU room at night. The latter comes from a single source. Unfortunately during the day there are six VDUs in operation, in different positions and each radiating individual information. Thus one or more of the VDUs can be phased out, but not all of them.

By using the main Band I DX aerial at 53ft and another

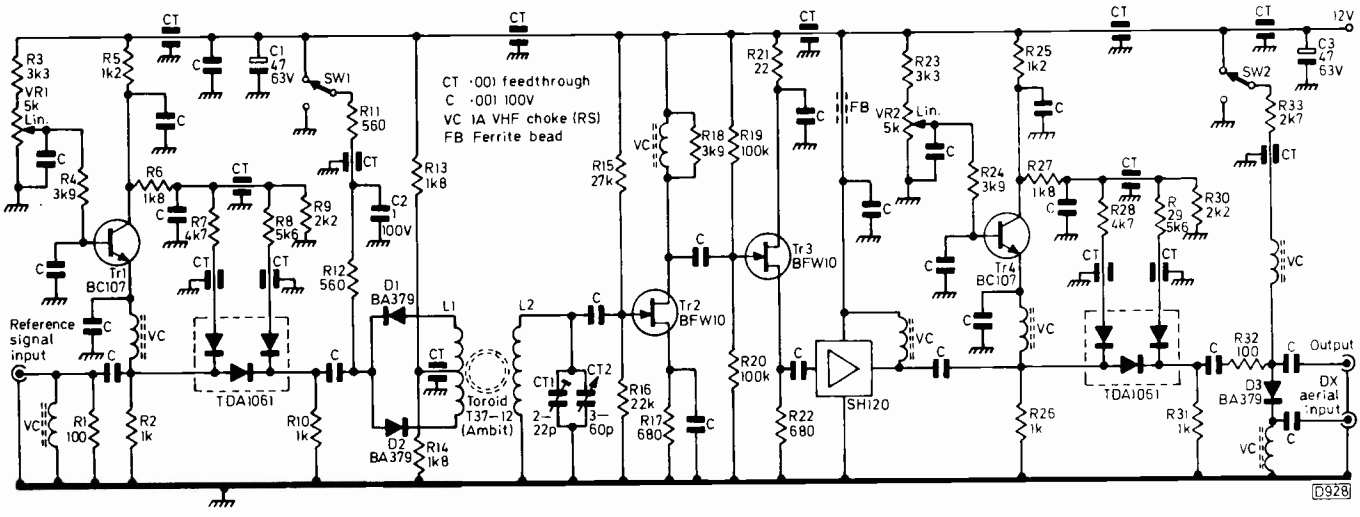


Fig. 1: Circuit diagram of the aerial phaser unit. CT1 is a miniature preset trimmer and CT2 a Jackson aerial trimmer. The pin diodes can be type BA479. The SH120 is an SGS device. SW1/2 are s.p.d.t. sub-miniature switches. House the unit in an Eddystone diecast box. Three coaxial sockets (Belling-Lee type) are required.

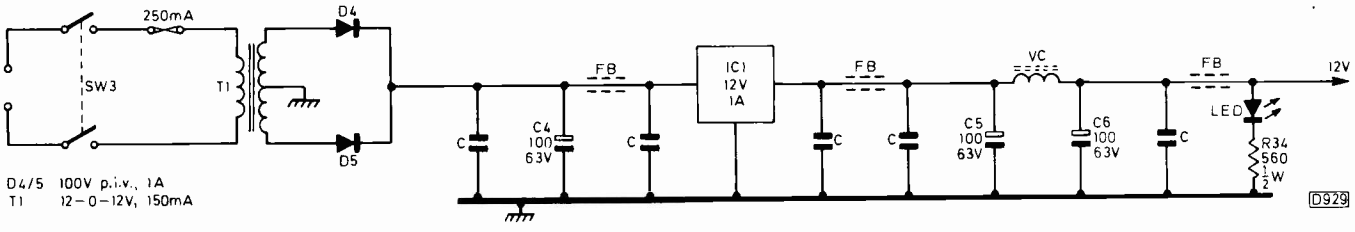


Fig. 2: Power supply circuit.

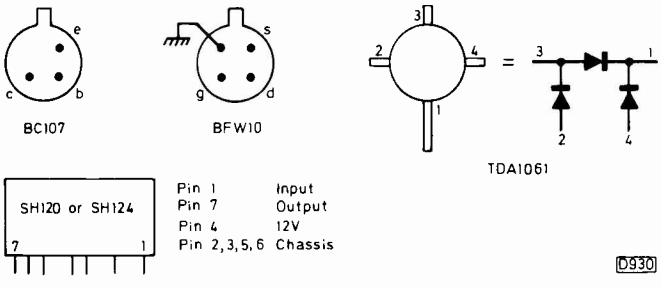


Fig. 3: Pin connections.

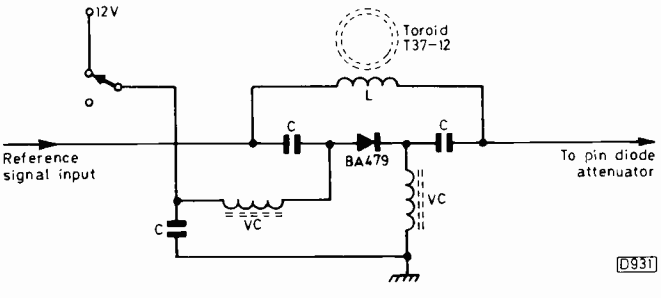


Fig. 4: Contemplated modification. L consists of approximately five turns on the toroid. Alternatively the coil could be wound on a $\frac{1}{4}$in. coil former, with a dust core to enable the time delay to be preset.

Band I array at 35ft on the same mast, it's possible to phase out completely either the local ch. B3 sound carrier or the vision carrier, leaving just noise. This represents an attenuation of 40dB upwards, the action being not unlike that of a notch filter though leaving the frequency clear for any other signal present on the DX array only.

The reference signal aerial should be the lower of the two and orientated for maximum interference reception. If it's mounted too high you may well get a degree of cancellation of the wanted DX information if this is also present on the reference input.

The value of the unit should now be apparent. The DXer living in an area with a ch. B2 (48·25MHz sound carrier) local signal will not be able to use a notch filter if he wants to receive a ch. E2 (48·25MHz vision carrier) signal clearly. The phaser unit however will enable him to remove the ch. B2 sound so that the frequency is clear for ch. E2 vision reception. Rotating the aerial will affect the conditions of course, necessitating readjustment of the unit.

A modification I'm considering is to add a circuit prior to the first pin diode network to give a delay of at least 360°. This could be done using either a few turns wound on a toroid (see Fig. 4) or simply a coil.

Note that the reason for using VR2 as the main attenuator adjustment is to minimise the amount of noise from the wideband amplifier and the rest of the circuit mixed with the DX signal.

Despite the unit being a first attempt, the performance figures achieved were most encouraging. At maximum the reference channel has a gain of 8·5dB, so the loss in this channel is relatively high. Attenuation of the DX signal fed via D3 is 1·9dB, rising to 30dB when SW2 is switched to the chassis position. Attenuation of the unwanted signal varies with setting accuracy, but will be at least 30dB and typically above 40dB. If an additional delay circuit, as mentioned above, is added to give a wide time delay range, it should be possible to get extremely good performance figures with any input source.

Acknowledgement

Finally my thanks to Ken Franklin of Radmic Systems Ltd., 10 Weald Drive, Crawley, Sussex RH10 6JU for his help and encouragement with the project. The integrated pin diode networks were obtained from Ambit International. ■

Practical TV Servicing: Making the most of your meter

S. Simon

OUR postbag suggests that a large number of readers, including those who followed the beginners' TV servicing series, still don't know how to use their meters to the maximum advantage and misunderstand some of the readings they obtain.

Testing Transistors

One of the handiest checks that can be made with an ohmmeter is to prove whether or not a transistor is capable of conducting. This is surely so well known that it hardly bears repetition. Yet the strange thing is that some of the facts one sees stated are simply not true. What are we on about this time?

It's often stated that to test an npn transistor you apply the black probe to its base and the red probe to either the collector or emitter. If you get low readings conduction has been proved. True. It's also stated that if you get a low reading when making the check between the transistor's emitter and collector the transistor is faulty due to leakage. This is not necessarily so however, and has resulted in many a good transistor being consigned to the waste bin.

A Game of Simon Says

What Simon says is that, using an AVO Model 8 or similar meter, you should first switch it to the lowest ohms range and then look at the transistor to be tested. If it's of the straightforward amplifier variety, say a BC148, it's perfectly true that if you get a reading between its emitter and collector the transistor should be consigned to the waste bin. If however the transistor is designed for use in a gain-controlled stage, for example a BF196, there must be a reading of around 50Ω between the emitter and collector, with the black probe to the emitter and the red probe to the collector, if the transistor is to function correctly. The reading you obtain may vary up to around 100Ω, but the fact is that you should obtain such a reading. A reading should not be obtained when the probes are reversed, i.e. red to the emitter and black to the collector, and this is where the confusion arises.

So when you're checking a transistor designed to work with forward a.g.c., you should expect a reading of about 30Ω between the base and collector and the base and the emitter, with the black probe to the base for an npn device: you should also get a reading almost as low when reading between the collector and the emitter, with the red probe connected to the collector. No readings when the leads are reversed. O.K.?

With the meter switched to its low ohms range most transistors can be checked in situ. With the meter switched to the × 100 range the external circuitry may cause confusing readings – depending on the resistor values used.

What we've said does not apply to straight amplifier transistors of the BF337 type for example, where readings should be obtained between the base and the other two electrodes only.

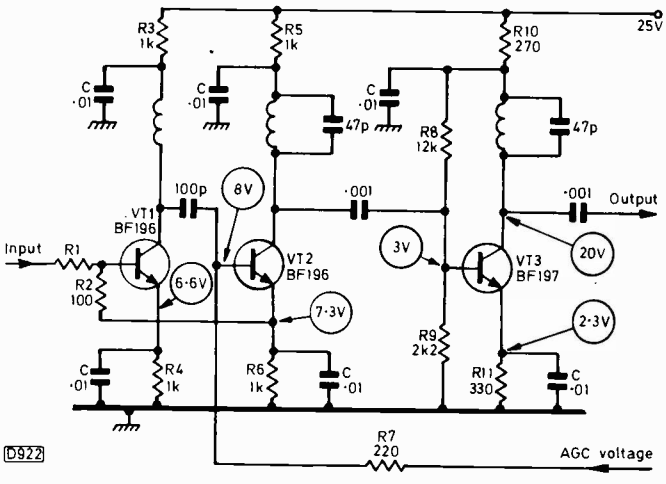


Fig. 1: A typical three-stage i.f. amplifier circuit, with the a.g.c. voltage applied to the base of the second transistor VT2 and to the base of the first transistor VT1 from the emitter of the second transistor via R2. The capacitors marked C provide decoupling in the emitter and collector circuits.

Voltage Checks

Next to voltage measurements. Switch the set on and the meter to the voltage range appropriate to the measurement to be made. The first fact that should be appreciated here is that connecting up the meter will have an effect upon the circuit being checked. This is so because the circuit has to provide the energy to deflect the meter's movement. Some cheaper meters require a considerable current flow to deflect the pointer, and this current flow will alter the circuit's operation, with the result that you get a misleading reading.

If the voltage measured is divided by the current required to deflect the meter, a figure in ohms will be obtained. A good meter should have a sensitivity of 20k Ω per volt or more, which means that using a 20kΩ /V meter will impose little current drain on the average circuit. If the circuit employs high-value resistors – some focus networks for example use resistor values of hundreds of megohms – the application of a moving-coil meter will affect the circuit considerably. In this case there's no point in trying to take a reading unless you know the sort of reading you should expect with the sort of meter you're using.

Having got that much off our chest we can get down to the job in hand, checking circuit operating conditions.

A typical IF Circuit

Let's consider a typical i.f. amplifier (see Fig. 1) consisting of two gain-controlled stages (VT1/2) and one straight amplifier (VT3). We'll assume that it uses two BF196 transistors and a BF197. Simon says that such a circuit can give rise to some confusion, so that if possible the circuit diagram should be to hand.

The reason for this confusion is that the a.g.c. is often, as shown, applied to the base of the second transistor rather than to the base of the first one. If so, making the base of the second transistor more positive with increased signal strength (an npn transistor with forward a.g.c. applied) will increase the transistor's emitter voltage (across R6). This increased emitter voltage can be used to bias the base of the first transistor (feedback via R2). Thus the gain of both transistors is being controlled. This mode of a.g.c. operation is the opposite to that employed with controlled valves, of the EF183 variety for example. In this case increased signal strength would result in an increased negative voltage being applied to the valve's control grid, thus reducing the valve's conduction. Unfortunately applying a negative-going control voltage to the base of a transistor will result in it cutting off sharply, with little or no control range. So we go about things differently, applying forward a.g.c. as it's called.

So with a circuit such as that shown in Fig. 1, the first obvious voltage check to make is at the emitter of the second transistor. Why? Because VT2's base voltage is derived from the a.g.c. line, while the voltages around VT1 are set by VT2. The voltage across R6 is the result of the current flow caused by VT2 conducting. If the transistor is operative, there will be a voltage difference of 0·7V between its base and its emitter. Say the base voltage is 8V. The emitter should be at 7·3V. This is the standard voltage drop developed across a forward biased silicon pn junction.

So if we find that VT2's base and emitter voltages are about right, with a voltage difference of roughly 0·7V between them, we can assume that VT2 is operational and turn our attention to the first transistor – to see whether it too is doing its job. Since the base of this transistor is biased from the emitter of the second one, a voltage of 7·3 – 0·7V is to be expected at the emitter of the first transistor, i.e. a voltage of around 6·6V. If this is found to be the case, it would appear that VT1 and VT2 are in order. Having made these quick – but not conclusive – checks, we would turn our attention to the third transistor.

A.G.C. is not applied to this one, and its base voltage will be much lower, say 3V. So the emitter should be at about 2·3V, and assuming that the supply line is 25V the collector voltage should be about 20V. This 5V difference indicates that the transistor is passing current, and is another quick check that indicates whether or not the stage is operating normally.

If on the other hand the base voltage is found to be somewhat higher, with precious little voltage at the emitter and the collector voltage at say 25V, we know immediately that VT3 is not passing current and that its base-emitter junction is probably open-circuit. This situation is not unusual with the transistor used in the final i.f. stage. Switch the set off and the meter to ohms to check the transistor's base-emitter junction.

Pitfalls

All this is easy enough, but there are pitfalls. The transistors may be working, but the i.f. strip may not be working. We quoted 8V as the initial a.g.c. line voltage. This is perhaps a trifle on the high side, and something around 6V is perhaps more what to expect. If the a.g.c. voltage is incorrect, it would obviously be appropriate to look at the a.g.c. circuit. A very low a.g.c. voltage would suggest that a leaky electrolytic capacitor in the a.g.c. circuit is pulling the voltage down. If the voltage is high however we would be more inclined to suspect lack of decoupling, leading to instability. In this event shunting each decoupling capacitor in the i.f./a.g.c. circuits with a known good one could be a productive exercise.

It's far more often the case that an a.g.c. amplifier transistor is at fault however. So this transistor (or these transistors) should receive a close look, bearing in mind that one or more of them could be of the pnp variety, which means that polarities are reversed – the red probe has to be connected to the base and the black one to the emitter and collector for the initial conductivity checks. These transistors should be of the straight amplifier type, so there should be no low reading in one direction when checking between the emitter and collector.

This is not meant to be a fault tracing exercise on i.f. strips however, merely a guide to checking transistors in situ.

We said that 0·7V represents the basic turn-on bias for the base-emitter junction of a silicon transistor. If this voltage difference is not present, the transistor will not conduct. It takes no great effort to identify a transistor's base and emitter leads, and even less to short them together with a screwdriver blade or test probe. We prefer to use a screwdriver because this leaves the probes free for making voltage measurements. Say at the transistor's collector. If no change in voltage is recorded here when the transistor's base and emitter are short-circuited, the transistor was clearly not conducting in the first place – either because it's incapable of doing so (check it with your ohmmeter) or because the associated circuitry is preventing it from doing so.

Before taking voltage readings you should have a good idea of what to expect. Take a sync separator stage for example. The transistor used for this purpose is usually arranged so that it spends most of the time cut off. Occasionally things may be arranged the other way round, the transistor being fully on between pulses, then fully off when the sync pulse arrives. Voltage checks are not very conclusive under these conditions therefore, and a scope check is more useful.

Audio Circuits

Let's venture into the audio side of a TV set however. The detected audio signal is pretty weak, and whilst it may be able to drive a high-impedance headphone it certainly won't drive a loudspeaker. So it's fed first to a preamplifier stage, which may well contain high-value resistors in its base circuit. This takes us back to the meter's loading effect: if there's any doubt about the validity of the voltage reading obtained at the base of the transistor, it would be better to check the emitter voltage or, if the emitter is connected direct to chassis, the transistor's collector voltage. With the meter recording the collector voltage, short the transistor's base and emitter leads. The collector reading should then rise to the supply line voltage. In practice touching a screwdriver blade on the base will produce a loud hum from the speaker if the whole audio circuit is operating, so this is obviously the first check to make, going on to make voltage and cold ohmmeter checks if there's no hum or the fault being investigated is distortion. The point is that some preamplifier stages employ high-value resistors which render base voltage checks invalid or even inadvisable (since the d.c. conditions will be changed by the meter).

Very noisy sound (loud crackling or rustling) should also direct attention to the audio preamplifier stage. The first check this time is to short-circuit the base and emitter to see whether this stops the noise. If so, one is faced with several possibilities: a faulty transistor (most likely), a leaky

coupling capacitor (usually in the base circuit), or a defective resistor. This latter possibility is one that's usually ignored, but is a distinct likelihood if the transistor and the capacitors all prove innocent. Failure to take the resistors into consideration has caused many a good man to go prematurely grey.

Dry-joints

The other cause of defective transistor circuit operation is dry-joints, which seem to abound on some printed panels. If in doubt, resolder all suspect connections, but bear in mind that the application of the heat from the soldering iron might well remake a poor connection not at the joint but within a capacitor or a transistor, particularly the latter, with the result that the cessation of noise (say) is only temporary. When you appear to have cleared the fault, switch the set off, pretend to wrap it up – then check it again from cold. It pays to carry out this recheck.

This applies to all sections of the receiver – particularly the three colour drive (video output) stages, which normally run fairly warm and are thus hotbeds of discontent you could say.

Summing up

We hope that this brief outline has cleared up some doubts about checking transistor circuits, particularly where forward a.g.c. is involved. We've concentrated on npn silicon transistors since these are the most common. To prove a pnp device however all that's necessary is to reverse the polarity of the meter's probes – remembering that where forward a.g.c. is concerned, a reading between the collector and emitter in one direction only may simply mean that the device is intended for use in a controlled stage. Other things to remember are that in older sets you may come across germanium transistors, that you will encounter transistors operated upside down (with the emitter to the supply line and the collector connected to chassis), and that you may find negative as well as positive supply lines. But then you'd note these things from the circuit you'd be looking at, wouldn't you?

Video in/out Conversion for the Philips G11 Chassis

A. R. Rumbelow, G3KKC

WHEN you first look at the circuitry used in the Philips G11 chassis, it may not seem to be a very suitable candidate for video input/output conversion. We've been getting excellent service from this chassis however, and required a cheap monitor. So we decided to take a closer look. The outcome is the conversion presented in this article. A couple of chassis have been modified in the manner shown, and have proved to work very successfully in daily use.

Conversion Procedure

The conversion procedure is as follows. First build up the video input/output buffer circuits shown in Fig. 1. They are quite simple and can be built on a small piece of stripboard. The next thing is where to break into the G11's circuitry? The demodulated video signals are present within the U600 vision detector module on the i.f. panel. The relevant circuitry is shown in Fig. 2. The emitter-follower T653 feeds the chrominance and luminance circuits, so to get a video output all that's necessary is to tap off the signal developed across its emitter load resistor R654. See Fig. 3. When it comes to feeding video into the G11 things get a little more complicated.

First, as a comparison of Figs. 2 and 3 shows, it's necessary to break the link between the emitter of T653 and C651 (which feeds the chrominance circuitry)/R661 (in the feed to the luminance circuitry). There's an added complication in that the G11's sync circuits are fed from a different point – from the output of pin 10 of the TCA270S i.c. within module U600. This output appears at pin 13 of the U600 module, so a further break has to be made on the i.f. board print after pin 13.

Switching between off-air reception and video input operation is carried out by means of a two-pole changeover relay (RS Components type 348-914). This has a 700 Ω coil which is energised to change over to video input when switch SW1 is closed. The connections to the relay are shown in Fig. 3. Mount the relay on top of can U600, using Araldite.

The modification within the U600 module consists of moving the position of R654, cutting the print adjacent to the emitter of T653 and adding a couple of leads to connect to the relay. Leave the earthy end of R654 undisturbed: move the other end from its original position, soldering it directly to the emitter of T653 via a small hole drilled near to T653's emitter. Then cut through the print immediately to the left of the emitter, and add a pair of leads, one connected to the emitter of T653 and the other to the feed end of C651. Bring the leads out through the top of the can and connect them to relay pins 5 and 6.

For the sync switching, cut the print on the i.f. panel leading from pin 13 of module U600, then take a pair of leads from across the cut to pins 8 and 9 of the relay.

When the relay's coil is not energised, the set is in the off-air condition and the video output is also available. Note

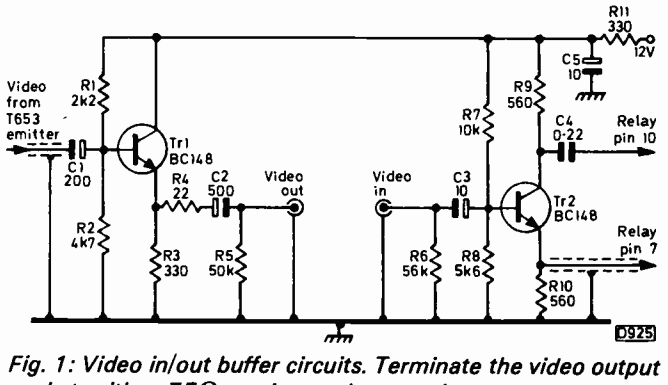


Fig. 1: Video in/out buffer circuits. Terminate the video output socket with a 75Ω resistor when not in use.

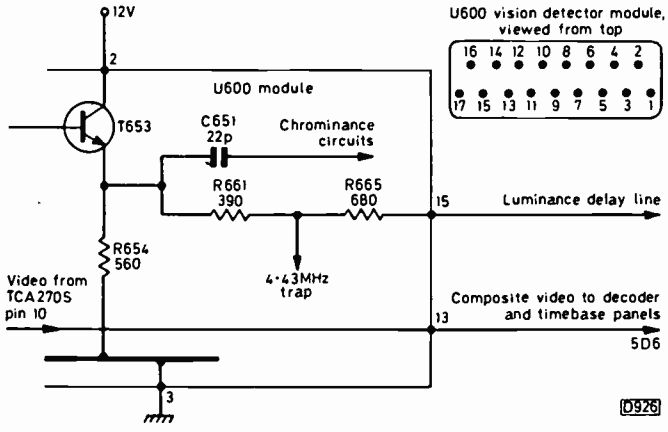


Fig. 2: Conversion is carried out in the emitter circuit of transistor T653 in the U600 vision detector module and in the printed track leading from pin 13 of the module.

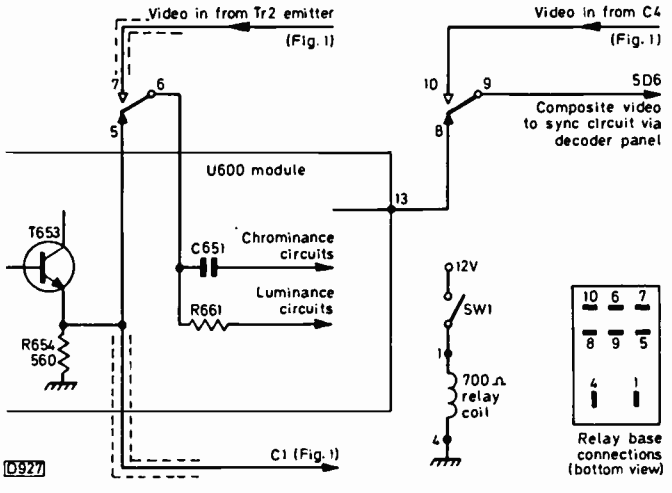


Fig. 3: Details of the conversion, using an RS relay type 348-914 for video in/out switching.

that the video output socket should be terminated with a 75 Ω resistor when not in use. The video input/output buffer circuits and the relay are powered from the G11's 12V LT2 rail, which is conveniently available at pin 2 of module U600. Pin 3 of the module can be used as the earth connection.

To mount the switch and the input/output sockets, first remove the Philips nameplate panel – this can be done by using a soldering iron to melt the plastic clips inside the cabinet. Cut a suitably sized piece of 20 s.w.g. aluminium to fit the space thus made available, and fix it with Araldite within the cabinet. Drill out and mount two BNC 75 Ω sockets and a small single-pole changeover toggle switch. The piece of aluminium serves to strengthen the mounting of the sockets and switch. The video input/output board can be conveniently mounted below the loudspeaker, using self-tapping screws. There are two vacant plastic pillars into which these can be screwed.

Mains Isolating Transformer

Finally, note that it's essential to use an external 500VA mains isolating transformer – the chassis sits at around half mains potential. We use an RS Components type 207-481, which is in an insulated case, modified so that the plug and socket are not compatible with standard 13A mains connectors.

The suggested conversion can easily be removed and the set restored to "standard" operation. ■

Video Camera

Part 4

Malcolm Burrell

IN the past three issues the camera's circuitry has been described and two of the four PCBs have been shown. We can now show the remaining two boards and provide constructional, setting up, and component details.

Construction

Constructional details of the camera are shown in Fig. 12. Drill four holes in the lower shell (assuming that a 203 Verobox is used) to support the deflection coils, which are mounted on 6BA screws. These should be approximately $\frac{1}{4}$in. long to allow for the final positioning of the coils relative to the lens mount. The holes should be countersunk since the lens mount must rest flush on the front of the case, with the boss protruding through the aperture. Three fixing holes are needed for the mount, which has countersunk fixings. The screws for the mount could be of the 6BA round-head type, about $\frac{3}{8}$in. long. Don't drill the holes for the mount until you've obtained one – the external dimensions vary slightly.

Make all seven holes and the lens aperture before assembly. Insert the countersunk yoke fixing screws first, with a dab of quick setting glue in the hole. Fit the lens mount, then fit 6BA nuts to the protruding countersunk screws, with washers to support the deflection yoke, which is mounted next. Fit washers and nuts to secure the yoke.

A C mount (16mm) lens should be used. Fortunately this enables the tube to be inserted and removed without having to remove the lens mount. Though a D mount lens could be employed, such a lens could cause shading at the picture edges.

The black lead from the deflection coils (EMI type KV12S) is the internal screen. This should be connected to the common earth tag on the power supply.

The pinning of the EMI 9831 vidicon is as follows: pin 1 cathode, pin 2 mesh, pins 3 and 4 heater, pin 5 grid, pin 6 first anode, pin 7 wall/focus anode.

We suggest constructing the video/field timebase board first. Use the components specified – this is important – and position them close to the board as shown in Fig. 11 last month. The resistors stand on end, and the leadout wires should be neatly bent using pointed-nosed pliers. The value of Tr2's emitter resistor R4 is critical and needs careful adjustment – otherwise no output will be obtained. It's best to use a 500Ω potentiometer initially, mounted on the posts, replacing this with a fixed value resistor after testing.

After building the board, inspect it carefully, connect a 12V supply and, with a scope connected to the video output pin 5, observe the output: touching pin 1 (input from the vidicon's target) will produce a great deal of noise when the potentiometer in the R4 position has been adjusted correctly.

Instability may be a problem, and it may be necessary to connect an earth lead temporarily to pin 2 as well as pin 10.

Next check that the field timebase is working by connecting the scope to pin 11. A relatively large, rounded sawtooth will be seen if all's well, and connecting the field scan coils temporarily will produce approximately the waveform shown in Fig. 17. Check that adjusting the setting of VR1 varies the frequency while adjusting VR2 adjusts the amplitude. The linearity control VR3 has only a slight effect on the scope's trace – care is needed not to induce field judder with this adjustment. Check that a field frequency waveform is present at pin 3.

Without a scope some guesswork is needed. The use of an earpiece or headphones should enable the low-pitched buzz of field pulses to be heard however.

The sync pulse generator panel is much easier to build and get operational. Note however that the correct waveforms will not be present everywhere until the board is connected to the video/field timebase board from which the field pulse input is obtained. Once this connection has been made and everything powered up, the waveforms can be checked (see Fig. 17) or, alternatively, a monitor connected to the video board (terminate the output with a 75Ω resistor if necessary) should show a raster with sync pulses. Adjust VR1 for vertical lock and VR4 for horizontal lock. Touching the video input pin 1 on the video board should produce noise etc. without undue loss of sync.

The video/field timebase and sync boards are mounted side by side on a panel of copper-clad board, which is slotted into the Verobox. Each panel must have a separate earth lead to the common earth point (see Fig. 18). Use screened leads for the target input, video output and

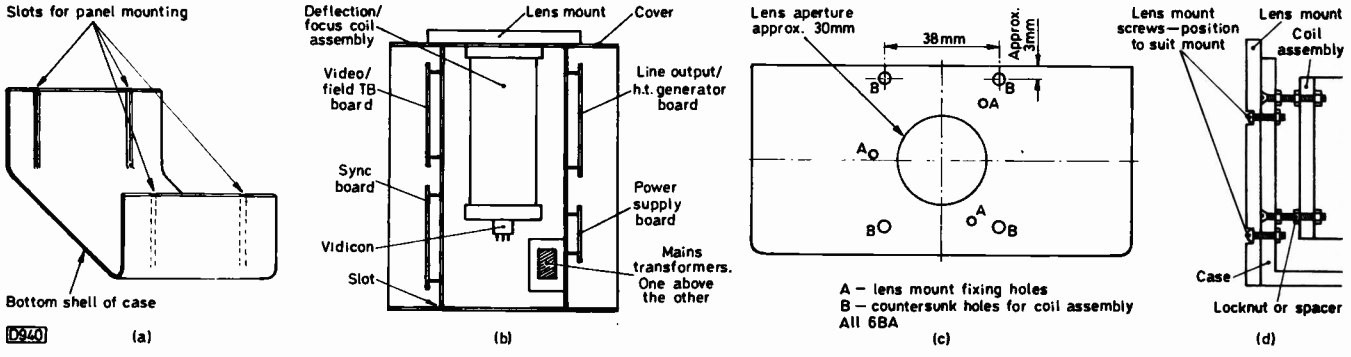
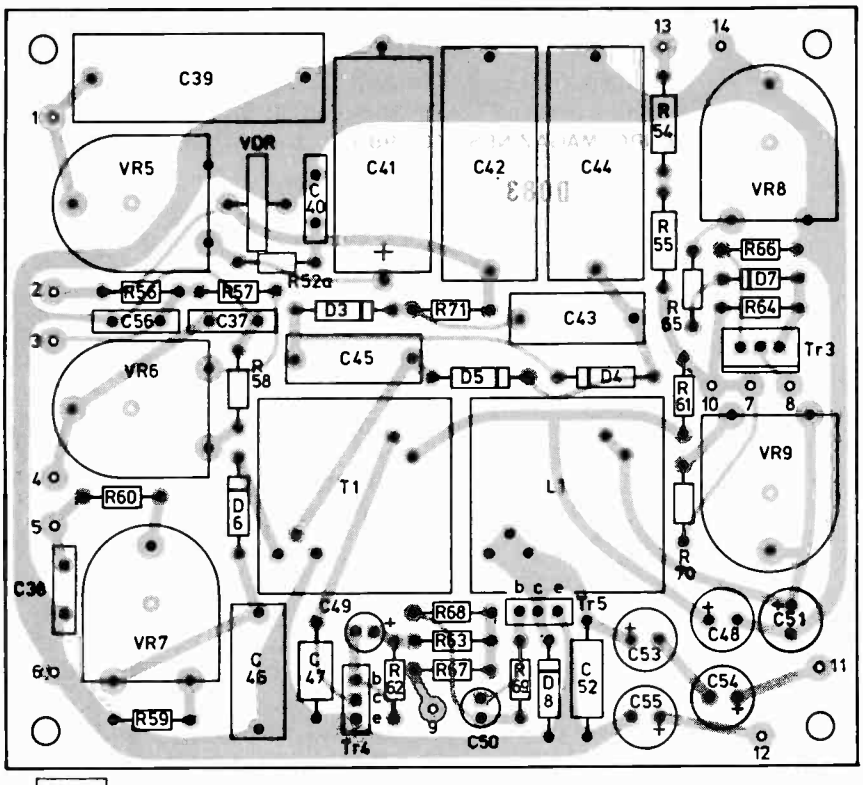


Fig. 12: Constructional details, using a Verobox type 203. We suggest mounting the boards with spacers on sheets of plain copper-clad board as shown in (b), with the copper side towards the deflection/focus coil assembly. Suggestions for fitting the EMI coil assembly and a C lens mount are shown in (c) and (d).



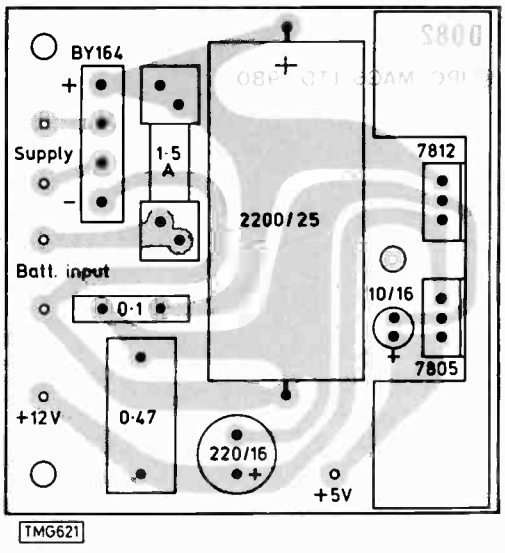
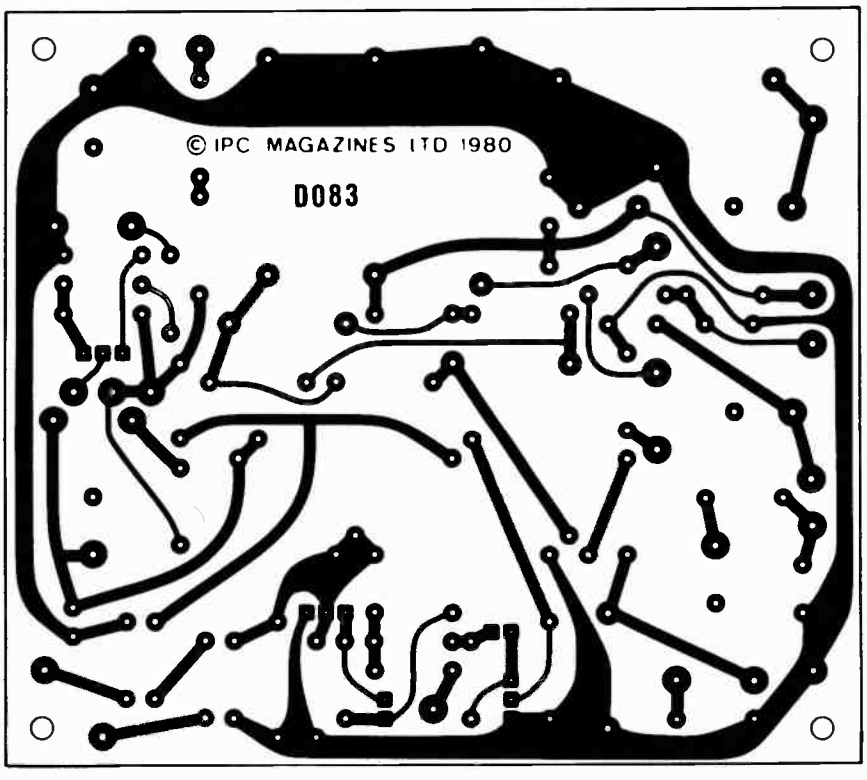


Fig. 13 (above): Power supply board component layout. Fit a tag to the bolt securing the 7812 regulator, and use this as the common earth point for the entire camera. Fig. 14 (left): Line timebase/h.t. generator board layout. R61 and R70 should be spaced off the board.



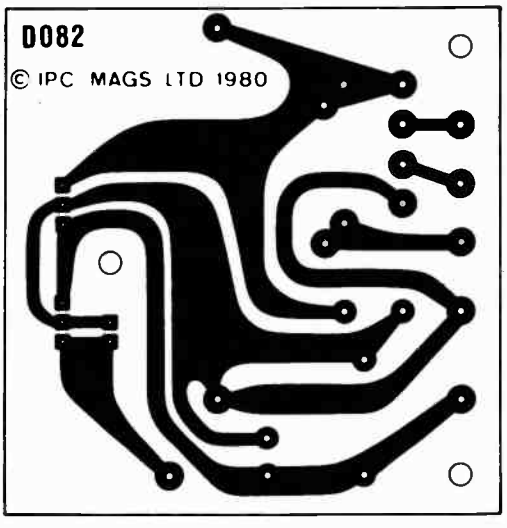


Fig. 15 (above): Power supply board print pattern.
Fig. 16 (left): Line timebase/h.t. generator board print pattern.

external sync input – microphone cable is suitable. Only the target lead braid is connected to the video earth at pin 2. At the target end, the braid is connected to the outer foil of the deflection yoke, close to the target connector. A short length of braid is also used to connect this point to a tag in contact with the lens mount. Without this, stray r.f. would cause patterning on the picture, particularly when adjusting the lens. Connect the inner of the cable and R53 to the target connector, taking the other end of R53 back to pin 1 of the line timebase/h.t. board. Keep the video cable as short as possible.

On the original prototype, the electrostatic focus (VR6) and target bias (VR5) controls were mounted on a control panel for user operation. Provision has been made to mount them on the line output/h.t. generator panel however as internal presets. They can be mounted for external use with leads to the panel as required. I'd recommend leaving the electrostatic focus control as an internal preset – the focus drifts a bit as the camera warms up, but can be left at an optimum setting – with the target bias as an externally adjustable control.

Keep the leads tidy – binding them together to form a loom improves the appearance and reduces instability. If any video instability remains, adding a separate earth return to pin 2 on the video board should improve matters. Remember that, as pointed out in Part 1, all earth returns

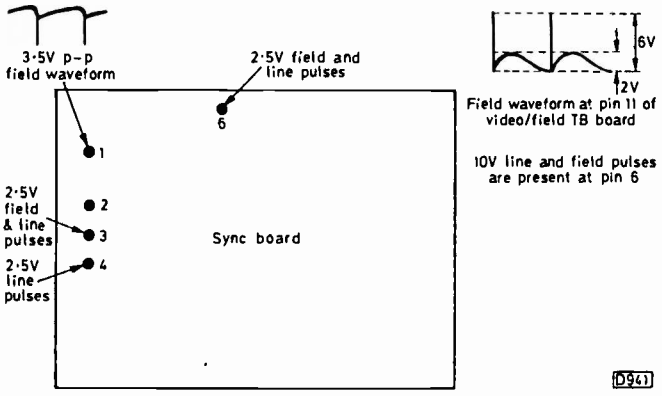


Fig. 17: Waveforms. A pulse of about 100V should be present at the collector of Tr4, with a pulse of 50-80V at the collector of Tr5.

should be taken to a tag bolted to the 7812 regulator on the power supply panel.

Setting Up

Having built the boards and made all relevant connections, set up the camera as follows. Don't insert the vidicon tube at the start – there's no protection to prevent target damage, which will be permanent if the tube is operated at high beam current with either of the scans absent – the result will be a prominent vertical or horizontal white line on the picture.

Temporarily connect a 68Ω, 1W resistor between points 13/14 on the line output/h.t. generator board, apply power and check that the vidicon's 6V heater voltage is present and correct. Using a scope, check that a 6V sawtooth is present at the input to the field scan coils (green lead on KV12S assembly), and that a flyback pulse is present at point 11 on the line output/h.t. generator board. With a meter, check that approximately −120V is present at the junction of D6/C46 and that 250V or so is present at the junction C40/R56. Remove the 68Ω resistor and switch off.

We'll assume that the video/field timebase and sync boards have already been checked as described above and the hold controls adjusted. Fit the tube, set the beam control VR7 to the maximum negative voltage end, the width (VR9) and height (VR2) controls to maximum, and all other controls to midway. Connect the video output to a monitor, terminated as necessary, switch the camera on and adjust VR7 towards the chassis end, at the same time gradually increasing the setting of the target bias control VR5. The monitor screen should brighten, with at least one of the curved edges of the target visible. Adjust the focus controls (VR8 and VR6) for the sharpest display, then try to move the target image to an approximately central position, using the centring (alignment) rings on the deflection yoke.

Fit the lens and focus on a nearby, well lit object. Adjust the lens aperture in conjunction with the target bias control VR5, reducing the beam current (VR7) as necessary, until a vaguely recognisable image is seen. Roughly set the lens focus for a better display, then reduce the scan amplitudes in order to *increase* the image size on the monitor.

Measure the distance from the object to the front of the lens, set the lens so that its markings correspond with this, then adjust the position of the deflection yoke on its mountings for the sharpest display. Secure the yoke.

Set up a test card at a reasonable distance from the camera and increase the scan amplitudes slightly to ensure that its corners just touch the edges of the target. Reduce the scan amplitudes until the test card fills the screen, and trim the focus controls for the sharpest display. The magnetic and electrostatic focusing (VR8 and VR6) are interdependent, so you may at first find it confusing trying to get the optimum focusing in conjunction with adjustment of the lens.

Use

Generally, the brighter the scene, the smaller the lens "stop" and the smaller the target bias – too much beam current produces picture blurring and defocusing. Set the target bias just short of this point. Operation in poor light conditions requires a larger lens aperture and increased target bias. The depth of field will be impaired, so will the focus, and there'll be a tendency for images to "stick" as objects move. With experience, optimum results will be obtained.

Faults and Problems

The semiconductor devices used are surprisingly robust – the ones in the prototypes were subjected to a certain amount of misuse . . . Most constructional problems will be caused by incorrectly positioned components (especially on the video/field timebase board, where the compact circuitry can cause confusion), dry-joints or open-circuit 10Ω decoupling resistors. The latter have a very short life when subjected to inadvertent short-circuits whilst testing. The CA3046 i.c. needs to be treated with care – in the event of a suspected fault it's possible, after disconnecting the relevant pins, to wire in a BC107 transistor as a check. The section used for vidicon blanking is rather vulnerable – tell-tale sloping black lines (flyback lines), fairly widely spaced, are usually due to the i.c. being at fault.

Noise from the video amplifier is rare. If a random herringbone pattern is present, try screening the points where the target lead is connected to either the video board or the deflection yoke. If the noise resembles that of cross-modulation with an aerial system, i.e. random lines missing from the picture, monitor the field scan waveform at pin 11 and note whether there's noise on the scope trace. If so, temporarily bridge C23 with an 0·01μF capacitor and if the fault clears change R39 to 56kΩ and C23 to 0·0033μF.

If, even with neat wiring and the screening can fitted, there's instability – usually vertical lines which spread across the screen as the target bias is increased – disconnect C5 and note the effect. If the fault clears, leaving a very poor image, add a 270Ω resistor in series with C5 (see Fig. 19), and add a 10kΩ resistor between the collector and base of TR2 (soldered on the print side of the panel). It may be necessary to increase the value of R4 when this is done.

After final testing, you may find that the definition is improved by increasing the value of C4 to about 0·0047μF.

On some monitors you may notice a line flyback pulse near the centre of the screen, i.e. a vertical white line whose position changes as the horizontal frequency control is adjusted. This pulse can be removed by taking a separate earth wire to the common earth point from the negative plate of C55. R52a can be reduced to 4.7MΩ if necessary should a greater target bias range be required. If the picture is dim, with excessive width, reduce the value of R70 and increase the value of VR9 to get a greater control range. This may increase the dissipation in the potentiometer, so that a more robust type spaced off the board may be required. Since line collapse with voltages still present on the

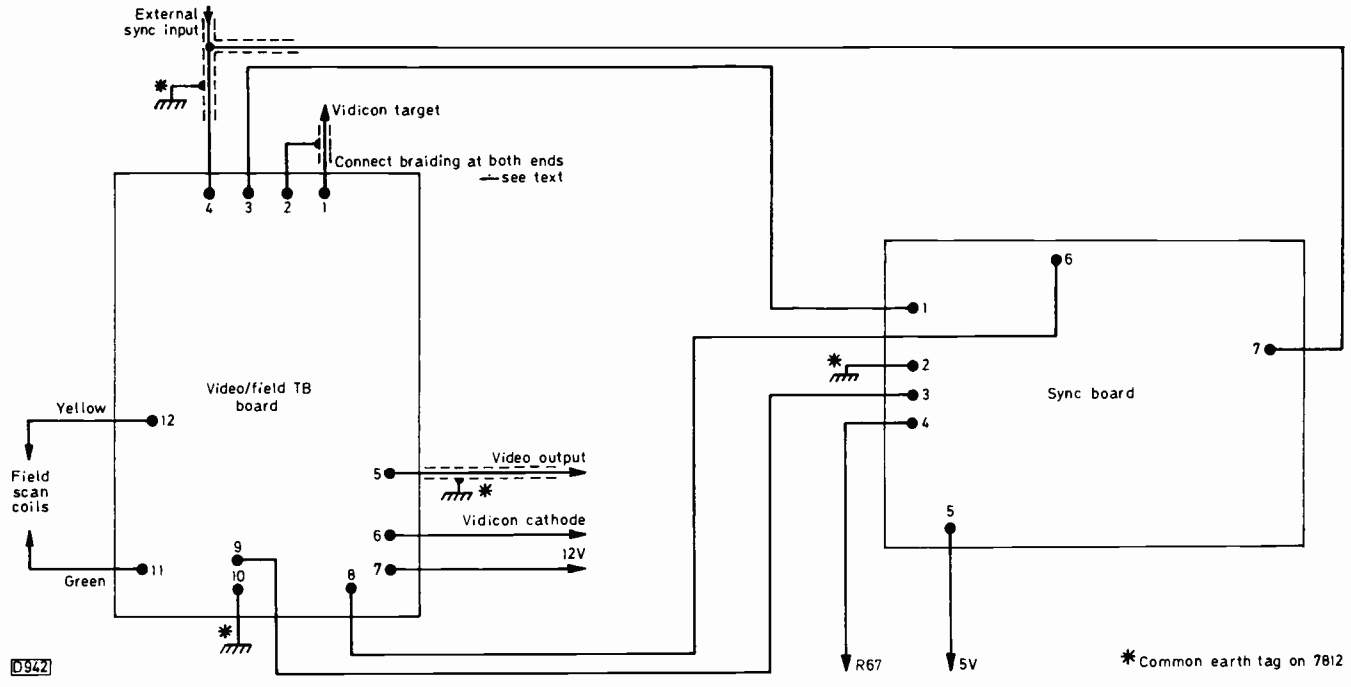


Fig. 18: Connections to the video/field timebase and sync pulse generator boards.

tube could cause permanent damage, it would be a wise precaution to add a 560Ω ½W resistor in parallel with R70 and VR9 to preserve some horizontal deflection in the event of failure of either of these components.

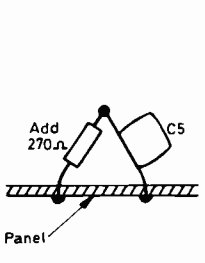
Precautions in Use

Don't point the camera at extremely bright lights or the sun. Avoid keeping the camera pointed at a scene for too long with a high target bias setting, otherwise you'll get a semi-permanent image. Avoid very contrasty scenes except for effect. Keep the lens capped, or at the very least at minimum aperture, when not in use. Keep the lens and target clean and free from condensation.

Inadvertent exposure to a bright light which causes an image burn-in can often be cleared by operating the camera pointed at a light card for a while. Unless the damage is severe, the marks will disappear after prolonged use.

Lens

Use a reasonably good quality lens. Those from 35mm etc. still cameras will generally give disappointing results and a severely reduced field of view. Unless you fit a zoom lens, a wide-angle lens will be adequate for indoor use. A telephoto lens may work well, but you'll have to keep well back. This will give quite good close-ups at several yards range. The lens shown on our October cover is not suitable – it just happened to be the only one around when the cover photograph was taken.



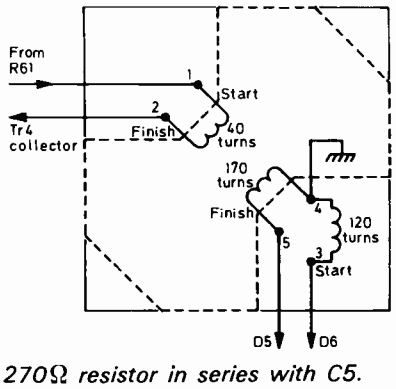


Fig. 19 (left): Adding a 270Ω resistor in series with C5.
Fig. 20 (right): Method of winding T1.

Notes on Vidicons

Note that a vidicon works badly if under scanned – in fact its output can be undetectable. Apart from this, the target may retain an image of the raster, so that when the full scan is obtained this image will mar the picture. The secret of setting up is start with maximum scan amplitudes, which with some cameras will enable the whole target to be seen as a bright ball on the monitor. Then reduce the scans to normal. As the scans are reduced, the image intensity decreases and the picture size *increases*.

Vidicon tubes are cheaper than most other pickup devices. They nevertheless give good pictures under reasonable lighting conditions. The aims of the present camera design have been cheapness and simplicity. It has its limitations therefore. It can resolve 3-4MHz under good conditions however, the definition limitations lying mainly with the quality of the lens used and the operating conditions rather than the design of the video amplifier.

Vidicon Supply

The original prototypes were fitted with EMI vidicons. If difficulty is experienced in obtaining these, note that a vidicon of Japanese manufacture, type 8844, is available from Complete Video Systems, 49 Malden Way, New Malden, Surrey KT3 6EA.

Miscellaneous Points

The Verobox mentioned was used because it's one of the few cheap off-the-shelf cases that's suitable. One way of avoiding many of the screening problems associated with the video amplifier, and at the same time avoiding the need to use a lens mount, is to use a purpose-built metal case. A manufacturer of cases for security cameras has suggested that he would be prepared to supply cases for the project –

contact Mr. Wright, Robawn Engineering Ltd., Unit 1, Stobart Street, Sheepfold Industrial Estate, Monkwearmouth, Sunderland, Tyne and Wear.

In Part 1 it was stated that only the 7812 regulator needs to be mounted on a heatsink. It was found to be advisable to reduce the current in the 7805 regulator however. In the event, it was finally decided that the simplest solution was to mount both regulators on a common heatsink.■

★ Video camera components list

Resistors:

R1	1M	R57	5M6
R2	2k2	R58	2M2
R3	2k7	R59	1M
R4	270*	R60	220k
R5	2k2	R61	82 2·5W w.w.†
R6	10	R62	47
R7	1k5	R63	10
R8	100	R64	820
R9	1k5	R65	560
R10	10k	R66	47
R11	10k	R67	47
R12	1k	R68	10
R13	2k2	R69	47
R14	3k3	R70	270 2·5W w.w.
R15	560	R71	100k†
R16	820	0·25W, 5% carbon film	
R17	1k2	unless otherwise stated.	
R18	560	*See text.	
R19	100		
R20	4k7		
R21	15k	**Presets:**	
R22	270	VR1	100k miniature
R23	470	VR2	1M miniature
R24	1k5	VR3	100k miniature
R25	47k	VR4	4k7 miniature
R26	4k7	VR5	2M2 see text
R27	330	VR6	2M2 standard
R28	100k	VR7	2M2 standard
R29	47	VR8	470 standard
R30	22k	VR9	100 standard
R31	560	All vertical mounting.	
R32	1k		
R33	150k		
R34	560k	**Capacitors:**	
R35	470k	C1	470p ceramic plate
R36	22k	C2	10μF 16V radial electrolytic
R37	10	C3	4n7 ceramic plate
R38	47k	C4	680p ceramic plate
R39	220k	C5	4n7 ceramic plate
R40	100k	C6	22μF 16V radial electrolytic
R40a	3R3	C7	33n Siemens polyester
R41	4R7	C9	10μF 16V radial electrolytic
R42	22k	C10	4μ7 35V radial electrolytic
R43	100k	C11	4μ7 35V radial electrolytic
R44	1M	C12	100μF 16V radial electrolytic
R45	5k6	C13	22n Siemens polyester
R46	10k	C14	47n Siemens polyester
R47	1k	C15	100n Siemens polyester
R48	6k8	C16	100n Siemens polyester
R49	560	C17	150n Siemens polyester
R50	6k8	C18	100n Siemens polyester
R51	3k3	C19	100n Siemens polyester
R52	12k	C20	10μF 16V radial electrolytic
R52a	5M6	C21	100μF 16V radial electrolytic
R53	1M	C22	22μF 16V radial electrolytic
R54	33½W	C23	33p ceramic plate
R55	33½W	C25	100n Siemens polyester
R56	33k†	C26	100μF 16V radial electrolytic

†Value or rating change since circuit published.

C27	1n ceramic plate		
C28	680n Siemens polyester		
C29	680n Siemens polyester		
C30	470p ceramic plate		
C31	10n 1% polystyrene		
C32	2n2 ceramic plate		
C33	1n ceramic plate		
C34	1n ceramic plate		
C35	100n ceramic disc		
C36	470μF 16V radial electrolytic		
C37	1n 750V ceramic disc		
C38	1n 750V ceramic disc		
C39	470n 630V polyester		
C40	1n 750V ceramic disc		
C41	1μF 450V axial electrolytic		
C42	1μF 400V polyester		
C43	100n 630V polyester		
C44	470n 630V polyester		
C45	100n 630V polyester		
C46	100n 250V polyester		
C47	2n2 500V polyester		
C48	47μF 16V radial electrolytic		
C49	4μ7 50V radial electrolytic		
C50	4μ7 50V radial electrolytic		
C51	47μF 16V radial electrolytic		
C52	4n7 500V polyester		
C53	47μF 16V radial electrolytic †		
C54	47μF 16V radial electrolytic †		
C55	47μF 16V radial electrolytic †		
C56	1n 750V ceramic disc		

Semiconductors:

D1	1N4148
D2	1N4148
D3	BY207
D4	BY207
D5	BY207
D6	BY207
D7	1N4148
D8	BY207
Tr1	BFW10
Tr2	BC214L
Tr3	TIP31
Tr4	BD131
Tr5	BD131
IC1	TBA500P
IC2	CA3046
IC3	TDA1170
IC4	555
IC5	74121
IC6	74123
IC7	74123
IC8	7400
IC9	7400

Power Supply:

2200μF 25V electrolytic
100n ceramic disc
220μF 16V radial electrolytic
470n Siemens polyester
10μF 16V radial electrolytic
BY164 bridge rectifier
7812 regulator
7805 regulator
1·5A fast fuse with p.c.b. fuse clips
15mm length of RS heatsink type 401-497
PCB

Miscellaneous:

Lens and C lens mount. See text
Verobox type 203 or alternative. See text
Mains on/off toggle switch
500mA anti-surge fuse and fuseholder
⅔in. vidicon EMI type 9831/AM or alternative. See text
Vidicon scan coil/focus coil assembly. EMI type KV12S or alternative to suit tube
VDR, Mullard type E299DD/P354
L1 and T1, wound on Mullard LA4543 core assembly with single-section bobbin and two retaining clips (Maplin Type 3 – order as HX09K, HX10L, HX11M). For winding details see Fig. 20.
Two 0-15V/0-15V 200mA 6VA mains transformers, Maplin order no. WB15R (two off)
Sockets for vidicon base, video output, external sync input and battery input.

Small-screen Monitor

Part 2

Luke Theodossiou

THE only circuit section not covered in last month's article is the power supply. A 5V regulator i.c. (IC4) is used, with its output voltage made variable from around +9·5V to +12V. This is achieved by placing a 4·7V zener (D9) and a 1kΩ preset in series with the common lead to the regulator. This has the effect of increasing the d.c. closed-loop gain, with a subsequent increase in output voltage. In order to maintain a high ripple rejection ratio, C32 decouples the common lead, thus reducing the a.c. gain to its original value. The output from the i.c. is used to drive the series pass transistor Tr5.

Construction

The single board design makes construction extremely easy, and constructors should not encounter any difficulties with this. We suggest starting off by inserting all the smaller components (e.g. resistors and diodes) and progressing on to the larger items. We strongly recommend that the components used are as in the components list, since the board is specifically designed for these.

A screened lead is required for the video input, with its screen going to connector A1. All other leads need not be screened. The input impedance exhibited by the TDA2150 is fairly high, and if required a 75 ohm resistor may be wired directly across the video input circuit for line termination. It may of course be made switchable. The contrast and brightness controls are both 10kΩ linear rotary or slider controls, with their tracks connected between +10·5V and earth and the wipers connected to the appropriate points.

The mains transformer should be a 15V 3A type with its secondary connected to connectors D2 and D3. If a d.c. supply is used, such as a car battery, this should be connected to D4 and D1, ensuring correct polarity.

The tube base board is the same as that used in the monochrome portable (reference no. D076), the exception being that the c.r.t. grid is now connected to +10·5V, which is available at the c.r.t. heater connector. It's a simple matter therefore to arrange for connector A to be bridged to connector B.

The circuit and component layout details for the c.r.t.

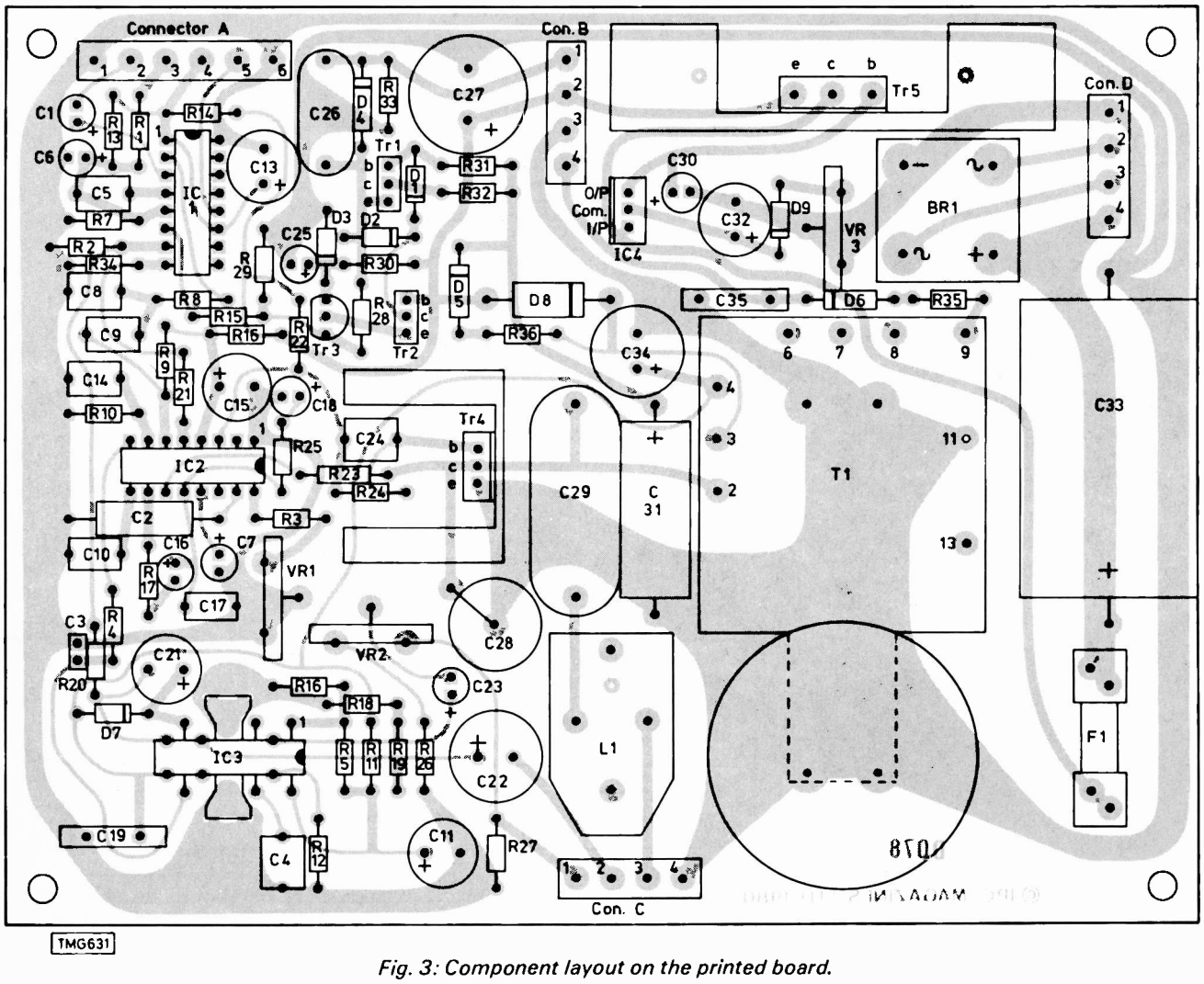
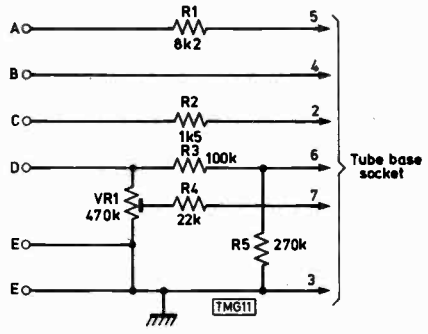


Fig. 3: Component layout on the printed board.

★ Monitor Components List

Capacitors:

C1	10μF 16V radial electrolytic
C2	10n 2·5% polystyrene
C3	10n ceramic plate
C4	150n Siemens polyester
C5	150n Siemens polyester
C6	10μF 16V radial electrolytic
C7	1μF 63V radial electrolytic
C8	150p ceramic plate
C9	330n Siemens polyester
C10	100n Siemens polyester
C11	100μF 16V radial electrolytic
C13	100μF 16V radial electrolytic
C14	330n Siemens polyester
C15	100μF 16V radial electrolytic
C16	22μF 16V radial electrolytic
C17	100n Siemens polyester
C18	4μ7 50V radial electrolytic
C19	100n Siemens polyester
C21	100μF 25V radial electrolytic
C22	470μF 16V radial electrolytic
C23	10μF 16V radial electrolytic
C24	330n Siemens polyester
C25	10μF 16V radial electrolytic
C26	220n 250V polyester
C27	1000μF 16V radial electrolytic
C28	33n 1000V mixed dielectric
C29	2μ2 250V polyester
C30	10μF 16V radial electrolytic
C31	10μF 250V axial electrolytic
C32	220μF 16V radial electrolytic
C33	4700μF 25V axial electrolytic
C34	220μF 50V radial electrolytic
C35	10n 750V ceramic disc



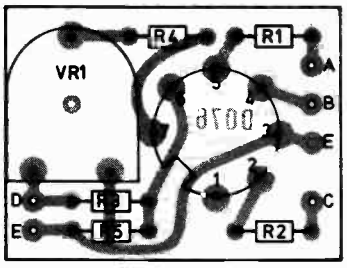


Fig. 4: Circuit and component layout, c.r.t. base board.

Resistors:

R1	39k	R10	1k2
R2	100	R11	1k8
R3	4k7	R12	180k
R4	3k3	R13	68k
R5	47k	R14	10
R6	33k	R15	1k
R7	27k	R16	10
R8	2k2	R17	470
R9	1M	R18	12k
		R19	18k
		R20	100
		R21	1k

TELEVISION
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Issue	Project	Ref. no.	Price
November 1976	Ultrasonic Remote Control	D007/D008	£3.85 per set
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May 1977	Teletext Decoder Input Logic	D011	£12.50
June 1977	Wideband Signal Injector	D031	£1.00
June 1977	Teletext Decoder Memory	D012	£10.50
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September 1977	Teletext Decoder Switch Board	D021	£1.75
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October 1978	Colour Receiver PSU Board	D052	£4.00
January 1979	Colour Receiver Signals Board	D053	£10.75
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March 1979	Colour Receiver Timebase Board	D049	£17.13
July 1979	Colour Pattern Generator	D062	£14.50
		D063	£9.15
September 1979	Teletext Decoder Options Board	D064	£8.50
August 1979	Teletext Decoder New Mother Board	D065	£6.00
August 1979	Simple Sync Pulse Generator	D067	£4.00
September 1979	New Teletext Signal Panel	11331	£8.00
October 1979	Teletext Keyboard	D057	£3.50
October 1979	Teletext Interface Board	D058	£5.00
November 1979	Colour Receiver Remote Control	D066	£5.00
January 1980	Remote Control Preamplifier	D061	£3.75
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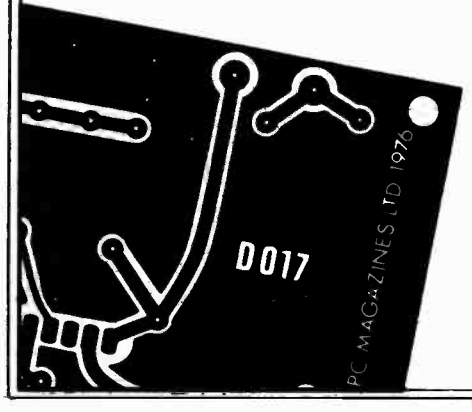
February 1980	LED Channel Display	D071	£4.00
March 1980	Improved Sound Channel	D072	£3.25
May 1980	Monochrome Portable Signals Board	D074	£6.25
June 1980	Monochrome Portable Timebase Board	D075	£7.75
July 1980	Monochrome Portable CRT Base Board	D076	£1.00
Sept/Oct 1980	New CTV Signals Panel	D077	£9.50
January 1981	Small-screen Monitor Board	D078	£8.50
December 1980	Video Camera Pulse Generator Board	D079	£4.50
December 1980	Video Camera Video/Field Timebase Board	D080	£5.50
January 1981	Video Camera Power Supply Board	D082	£2.00
January 1981	Video Camera Line Timebase/H.T. Board	D083	£4.00

All boards are epoxy glassfibre and are supplied ready drilled and roller-tinned.
Any correspondence concerning this service must be addressed to READERS' PCB SERVICES LTD, and not to the Editorial offices.



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Please supply p.c.b.(s) as indicated below:

Issue Project Ref. Price

Prices include VAT and post and packing. Remittance with order please.

NAME

ADDRESS

Post Code

R22	330	**Semiconductors**	
R23	100k, ½W	D1	1N4148
R24	680	D2	1N4148
R25	1k2	D3	BZY88 C3V6
R26	100	D4	BY206
R27	2R2	D5	BY206
R28	47k 2% thick film	D6	BY207
R29	2k2	D7	1N4001
R30	2k2	D8	BY298
R31	22k 2% thick film	Tr1	BF458
R32	1k	Tr2	BF458
R33	330k	Tr3	BC182L
R34	1k	Tr4	BU807
R35	330	Tr5	TIP33
R36	10	BR1	RS Components 262-078
0·25W, ± 5% carbon film unless otherwise shown		IC1	TDA2150
		IC2	TDA9513
		IC3	TDA1044
		IC4	7805

Miscellaneous:
P.c.b. ref. no D078
Heatsink for Tr4: RS Components 401-964
Heatsink for Tr5: RS Components 401-497 (50mm)
L1, T1, scan coils: Set of wound components available from Manor Supplies
Mains transformer: Secondary 15V, 3A
Mains on-off switch
Mains fuse (500mA A/S) with holder
F1 2A A/S
Contrast control 10k lin.
Brightness control 10k lin.
C.r.t. base board ref. D076
Base board components (see Fig. 4)
Video input socket (e.g. 75Ω BNC)

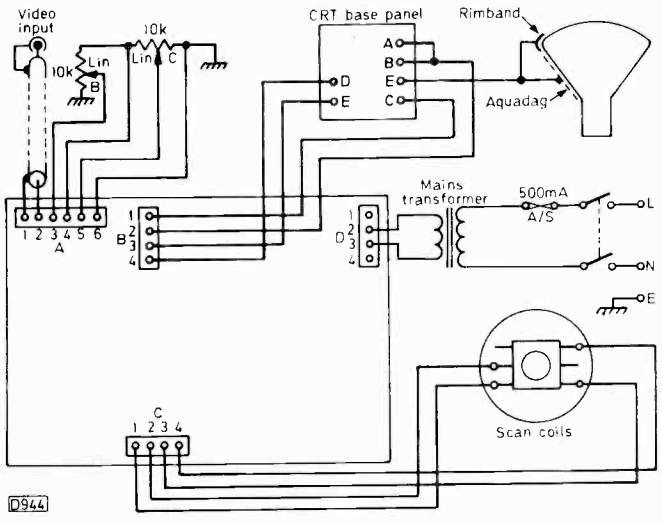

Fig. 5: Interconnection diagram.

base board are shown in Fig. 4. We recommend the use of 0·5W carbon composition resistors on this panel. Figs. 3 and 6 show the main panel details.

Connecting Up

An interconnection diagram is shown in Fig. 5 and is self-explanatory. We understand that Manor Supplies will provide a connection diagram for the specific scan coils which will be supplied – those shown on the diagram are a guide only.■

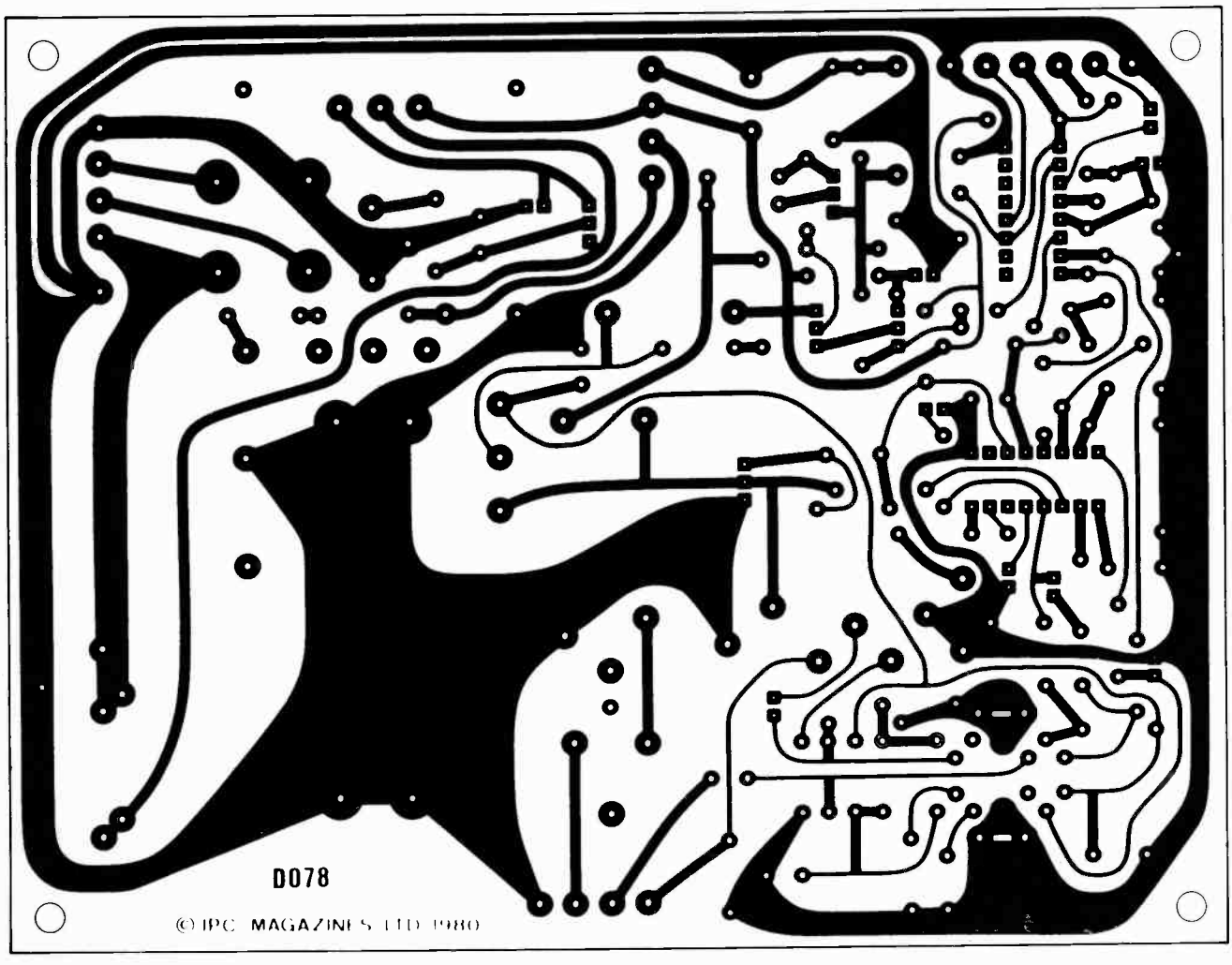

Fig. 6: Printed board print pattern.

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 156 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.

GEC 2040

The trouble is sibilance after the set's been on for about three-four hours. Since the fault seems to be temperature dependent I tried running the set with the back removed. This made no difference. The quadrature detector coil has been adjusted, but again this didn't help. The trouble is worse when the volume is set to a low level. A new audio output valve has been fitted, and the voltages around it are all about right.

Sometimes the loudspeaker cone warps when the set has warmed up, giving this effect. Fit a new speaker, then trim the quadrature coil for best results – Angela Rippon's speech is ideal for this purpose!

BEOVISION 3400 CHASSIS

There's ample e.h.t. but no raster, with the c.r.t.'s cathodes at around 220V. Disconnecting the luminance output valve's anode load resistor and operating the service switch produces a horizontal line across the screen, but this is the only result I can obtain.

We take it that the c.r.t. heaters are alight – if not, the 6A feed fuse will have failed. Otherwise it seems that the tube is incorrectly biased. The voltage at the cathodes is about right, so check for 100V at the grids (if low, check the voltages around the tracking circuit transistor 3TR3), for 350-650V at the first anodes (if missing check 8D9/8C32), and for 4-5kV at the focus pin 9.

PYE 697 CHASSIS

This set was bought as a non-worker, but after replacing the e.h.t. tripler and the field output transistors I found that it was in good shape. The main problem is poor interlace, which tends to spoil the fine picture detail.

Interlace can be tricky on this chassis. The sync separator transistor VT7 is on the i.f. panel, and we suggest checking around the integrating circuit R36/C41 and the interlace diode D4. Our guess is that C41 (0·0047 μF) has changed value.

THORN 1500 CHASSIS

The initial fault was no e.h.t. This was traced to defective scan coils which damped the line output stage. On connecting an aerial, a broken up, negative picture was obtained. The contrast control had no effect, but adjusting the r.f. gain control produced a normal, synchronised but very noisy picture. I then discovered the preset contrast control, and by juggling with this and the r.f. gain control obtained a noise free picture, though lacking in punch as far as the contrast is concerned and with the whites apparently clipped. The setting of the preset contrast control is very critical – all or nothing or complete lack of sync.

Since the main contrast control has no effect, we'd start by checking the electrolytic coupling capacitor C37 which is connected in series with it. The preset contrast control sets the level of signal tapped off to the a.g.c. circuit, so it's possible that there's a fault here. If the a.g.c. department is in order, the voltage across C11 should be about 6·7V. Suspects in the a.g.c. circuit are the electrolytics C3 and C6 and the transistor VT3. If these checks fail to reveal the cause of the trouble, it's likely that one of the 0·01μF ceramic decouplers in the i.f. strip is leaky. Check C8, C13 and C25. A low emitter voltage reading will reveal the defective stage.

GEC C2110 SERIES

The trouble with this set is that the field hold is very poor – very delicate adjustment of the field hold is necessary, and on some days the rolling cannot be stopped. When the defect is worst, the picture loses half an inch at the top and bottom. An improvement has been obtained by reducing the setting of the height control.

The cause of the trouble could be in the field timebase or the power supply. The usual cause of field hold problems on the field timebase panel is the electrolytic C452 (4·7μF) which decouples the emitter of the field sync pulse amplifier transistor TR451. If the trouble is due to a power supply fault, the suspects are the BT106 regulator thyristor and its BR100 trigger diac.

RANK A823 CHASSIS

There's a perfectly good monochrome picture, and sound, but no sign of colour. The 18V supply to the decoder board is present, and disabling the colour-killer makes no difference. The voltages around the SL901 i.c. are correct, but the voltages around the transistors in the burst/reference oscillator section are haywire. The transistors themselves have been checked and found to be in order.

The first thing to establish is whether the chroma signal is reaching the decoder – most of the chroma amplification is carried out on the i.f. panel in this chassis. The chroma comes into the decoder panel at plug 3Z1-9 – check at test point 3TP3. If the chroma signal is arriving at the decoder panel, it's possible that the pulses from the line output stage aren't. They should be present at 3TP1. If they are, they may still not be getting anywhere much if diode 3D3 in the feed to the burst gate pulse generator tuned circuit is open-circuit. It would be worth checking 3C43 (100μF) in the crystal oscillator circuit.

HITACHI CNP190

The user brightness control now has to be at maximum to get a reasonable picture. Is there a preset brightness control, and if so how should it be set?

The internal brightness control R310 is labelled sub-brightness and is in the corner of the signal panel opposite the cut-out corner. The drill is to set the user brightness control to midway, then adjust R310 for the correct brightness level, i.e. keep the black but allow full brightness. One wonders why the brightness level has changed however? Check the tube's first anode voltages (pins 4, 5 and 13), which should be at about 400V. If this voltage cannot be achieved, check back to the supply resistor R722 (120kΩ) on the deflection panel – there should be about 560V at connector L1. If all's well here, it would be an idea to check the 10μF electrolytic (C312) in the brightness control circuit.

BEOVISION 2600/3200 CHASSIS

A faint vertical stripe is present on the left-hand side of the screen, about 2½in. from the edge. The stripe is about half an inch wide and is red on the left, green on the right. It's present on colour and monochrome programmes, and with no signal, though it only shows up against a dark background – if the screen is brightly illuminated on the left-hand side, the stripe is not visible. The video valves (12HG7 and ECL84) and the clamp diodes (EAA91s) have all been replaced. Another problem with the set is that the field hold is at times very touchy – i.e. it needs careful adjustment, works correctly for a while, then loses lock again. A new ECC81 field oscillator valve has been fitted.

To deal first with the field sync problem, fit a new PL508, then adjust the adjacent d.c. balance potentiometer 501 for zero voltage at the valve's control grid (TPg3). If the fault persists, check the BC110 field sync amplifier transistor. The colour striation is often caused by leaky diodes in the pulse feeds to the signal circuits. Check D513 (OA81) in the feed to the cathode of the 12HG7, and the BA148 diodes D578/580 in the feeds to the EAA91 clamp diodes. Also check the anode load resistor (R202, 4·7kΩ) in the ECL84 blanker circuit.

EKCO T554

The trouble with this Japanese made monochrome portable is a faulty regulator transistor. I'm having difficulty getting a replacement however. Any suggestions?

The l.t. regulator transistor used in this model is type 2SA473Y. It's a silicon pnp device rated at 3A. A BD204 would be a suitable replacement, or a 2N6126.

TV GAME

My Pye colour set (697 hybrid chassis) provides perfectly normal off-air reception, but I can't get locked colour with a TV game that was bought. The game has been tried on a Sony colour set and gives correct colour. No fault can be found on the Pye set, which will handle games in monochrome, with correct sound and sync. Adjusting the fine tuner on a colour game produces broken colour without sound, but the colour fades away very quickly when the tuning is corrected.

It could be that the colour game's burst timing is non-standard and that the Sony set doesn't object to this. In the Pye hybrid colour chassis the burst gate pulse is derived from the sync pulse in the incoming signal, with the delay set by the tuned circuit L28/C126. It would be an idea to see whether slight adjustment of L28 helps matters.

COMBI COLOUR

The trouble with this set is that the e.h.t. overwinding on the line output transformer keeps burning out. The GY501 e.h.t. rectifier has been replaced, but the problem persists. One replacement transformer lasted for only three weeks, while another lasted just three days. And they're not cheap!

The line output stage in these sets often runs hot, with the result that everything gets overheated. Some of them were not adapted for 240V operation, being originally designed for 200V operation on the Continent. To get the heater voltage down, fit an additional 50Ω resistor in the heater chain (assuming that the set uses a conventional diode plus resistor dropper circuit – some of them used a paper capacitor). Doing this will considerably reduce the heat in the line output stage. Check that the e.h.t. is not too high, resetting if necessary with the horizontal amplitude control R517 – adjust for normal picture width. Also check C501 (180pF) in the line drive waveform shaping circuit. The set will still work if this goes open-circuit or low in value, but the drive to the PL509 will be excessive and R517 may have been offset to compensate. The early transformers used on these sets were notorious, but the Mk. 2 version is more reliable. Converting to tripler operation would help keep down the cost of the repair.

RANK A774 CHASSIS

The trouble with this set is that the picture pulls to the right (viewed from the front). BBC-2 is perfect, the problem being on BBC-1 and ITV. On a BBC-1 test card the circle tends to have ripped edges and there's picture pulling, approximately two inches, across the top, the rest of the picture being perfect.

First ensure that the contrast control is not advanced farther than is necessary to produce a reasonable picture, as this fault is usually due to the video output stage being overloaded. Check the settings of the preset controls on the left-hand side of the chassis, particularly the video bias control 2RV1. If the fault persists on certain channels only, check the aerial.

DECCA 80 CHASSIS

The TBA920 sync/line oscillator i.c. was replaced to cure intermittent field rolling and slow upwards jumping of the field, and the TDA1170 field timebase i.c. has been replaced to cure distortion at the top of the raster. The only problem now is that once or twice during an evening's viewing the picture will jump vertically – only one field. Could this be due to the camera at the transmission end, or is there another fault in the set?

This effect sometimes occurs on ITV as the local station comes on or off the network. If it occurs on BBC as well, R301 (2·2MΩ) which biases the sync input pin of the TBA920 is suspect.

SABA H CHASSIS

After a while any vertical lines in the bottom half of the picture appear wavy. This is accompanied by trapezium distortion. Also the brightness control is at maximum and although the picture is normally quite good the screen appears to be blank on dark scenes.

The preset controls P701 (EW phase) and P702 (EW amplitude) often overheat after the set has been running for a time. They then go open-circuit, producing the bent verticals and distortion described. Try slight readjustment of each control in turn when the fault condition occurs – this often re-establishes continuity, the bent verticals jumping back to a straight position. Readjusting the preset brightness control P357 at the centre bottom of the signals board usually provides an acceptable picture brightness level.

THORN 1500 CHASSIS

There's a sharp, clear raster but no picture. The sound is perfect, and when the set is switched off the picture appears momentarily and then fades out. I've checked around the video circuit without finding anything amiss.

This sounds like a classic case of a.g.c. trouble – confirm by checking the voltages around the a.g.c. amplifier transistor VT3. If the voltages here are wrong, check VT3, the a.g.c. detector diode W1 and the a.g.c. reservoir/smoothing electrolytics C3/6. D.C. voltage checks are the clue to this trouble. We've also had trouble with C8 and C13 leaking. These 0·01μF capacitors decouple the emitters of the two gain-controlled i.f. transistors, thus affecting the voltages in the first two i.f. stages.

SANYO MODEL CTP5101

The initial symptom with this set was that the height collapsed to about four inches. The set was left for a couple of days, and on switching on gave a normal picture for the first evening. On the second evening the picture started to come up from the bottom, and now seems to be quite stable with the picture about an inch short at the bottom. Voltage checks reveal that the voltage at the collector of the discharge transistor Q423 (type 2SC536 or 2SC945) is substantially down at 1·8V instead of 8·5V. Any ideas for a suitable replacement for this transistor?

The field timebase circuitry used in these sets is usually extremely reliable, so we've little experience of faults in this area. The low voltage you mention could be due to leakage in the discharge transistor Q423 or in the field charging capacitors C429/C430, to a changed value resistor in the charging circuit or incorrect drive to Q423 from the preceding oscillator stage. The transistor and the capacitors are the most likely suspects – a BC107 can be used in the Q423 position.

BEOVISION 3200

The trouble is no line sync with weak field sync. On detuning a poor picture with reasonable sync is obtained, but with correct tuning the line won't lock and the picture appears to be over-contrasted, though the control does provide some variation. The fault is not in the tuner or the i.f. panel, as with good replacements fitted the fault is still present. The only other thing I can tell you is that there was a burn up in the line output stage, as a result of which a new line output transformer had to be fitted and some capacitors replaced.

If the output transformer that had to be replaced was the scan one (8014108) rather than the e.h.t. one, make sure that you correctly phased the pulse winding feeding the a.g.c. gate via pins 8/9 of plug 3. This is the small sleeved winding on the spare transformer limb and is easily connected back-to-front. Check also the 12V zener diode 112 and the screened leads that carry the sync signals around the main chassis – these have a habit of going short-circuit. Finally, ensure that the N +30V line is in order.

TEST CASE

217

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.

With all types of sets tuning drift is these days a major headache for the serviceman. Far from solving the problems of tuning drift and poor resetting, the introduction of varicap tuners and, in some cases, the fiendishly complex circuits used for tuning and remote control channel selection have meant an increase in the workshop load. Gone are the mechanical dark ages when a squirt of jungle juice sufficed to clear such problems!

A recent case in point was a Tandberg colour set which arrived in the workshop for attention due to a tuning drift problem – it was one of the sets fitted with the CTV2-2 chassis. As a first step, the voltage on the varicap tuning line was monitored. This remained stable, so the diagnosis reached was that the tuner unit itself was responsible. It's the familiar ELC1043/05 type, so the decision was made to fit a replacement. The unit used was a pin-compatible one made by Elpro.

On switching on and tuning in, the long-suffering technician was confronted with a very snowy, barely-locked picture. This prompted him to check the connections to the panel and the aerial connections to the tuner. These were all in order, so as the latest fault seemed to have been introduced by the new tuner another one, of the same make, was fitted. The results were exactly the same.

With the prospects of any profit from the job rapidly receding, the original tuner unit was replaced in the set. The result was a noise-free picture, but with the original drift problem still present. The cause of the problem was eventually traced – it turned out to be a rather obscure one – and the set was then sent off in good working order. Now for a hint: for those not familiar with these sets, there are two tuners, an ELC1042 for v.h.f. reception and the ELC1043/05 for u.h.f. reception. This is relevant to the unusual fault!

SOLUTION TO TEST CASE 216
– page 98 last month –

The paradoxical symptoms with last month's Rank A823 receiver were an overheating h.t. filter resistor (8R15) though there was no excessive d.c. flowing through it – in fact the d.c. was quite low. The next test made, the one that provided the vital clue, was to measure the a.c. flowing through the resistor. This revealed the presence of a very heavy ripple current. Everything then clicked into place! The h.t. reservoir capacitor 8C9 had gone virtually open-circuit, with the result that the h.t. smoothing capacitor 8C10 was being asked to perform both roles. In consequence, the average d.c. voltage across 8C10 was low – hence the low h.t. output – while the ripple current flowing through 8R15 and 8C10 was sufficient to heavily overload the resistor.

The circuit used in this power supply is relatively simple, and it's easy to be blasé about fault diagnosis. As this example shows, there are still traps for the unwary!

QUERY COUPON

Available until 21st January, 1981. One coupon, plus a 75p (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 154.

TELEVISION JAN. 1981

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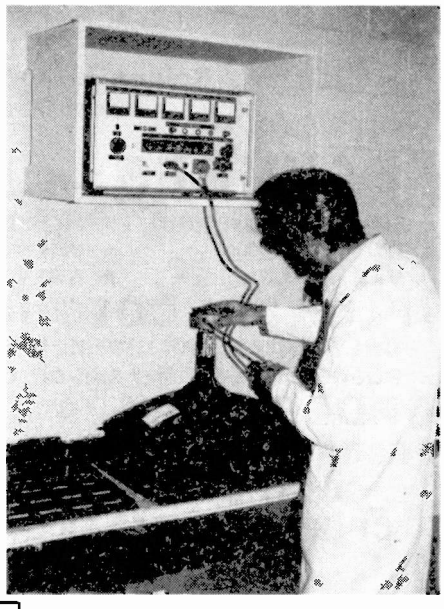

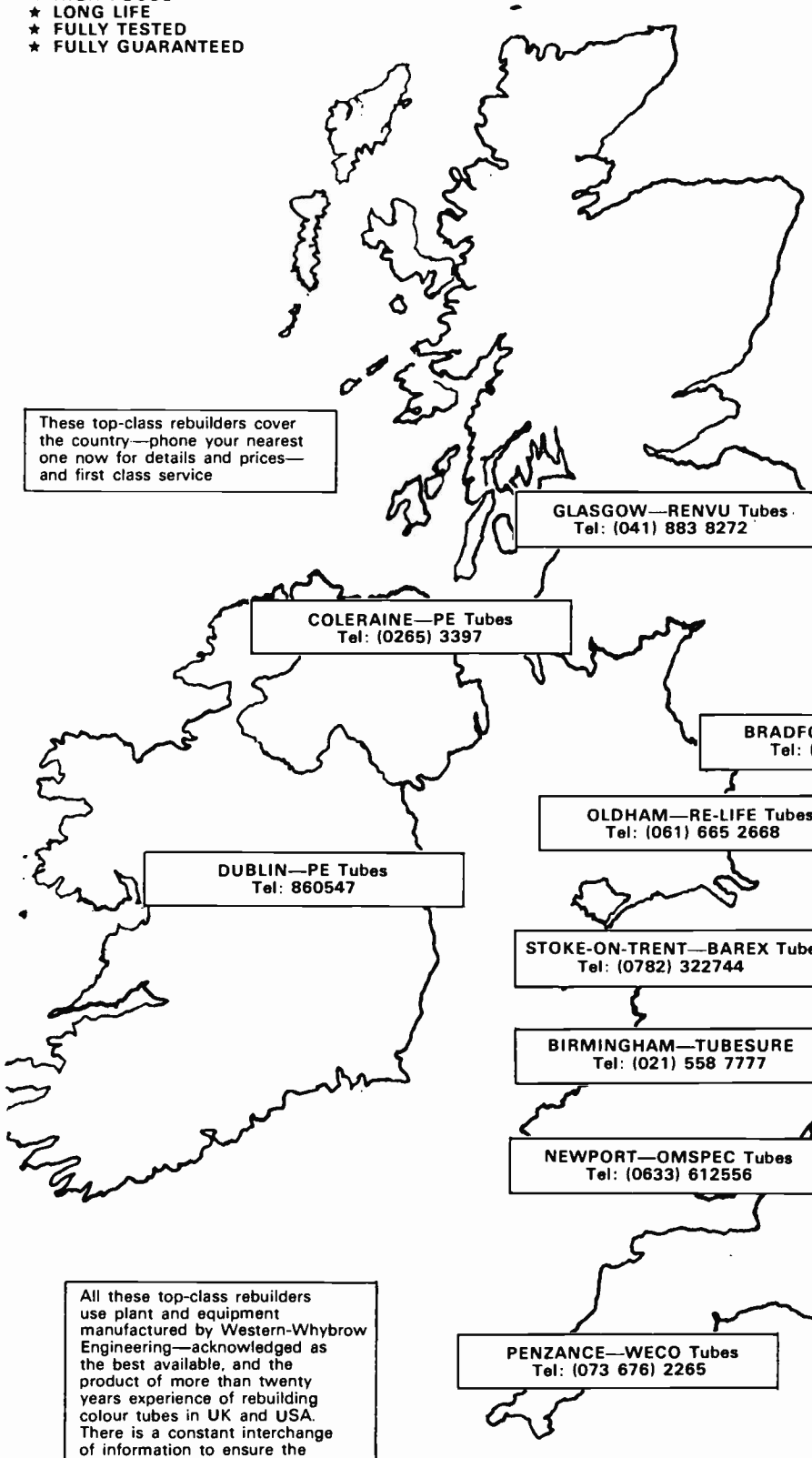

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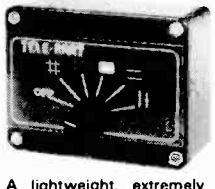

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INTRODUCTION

The Office of Fair Trading have agreed that the notice of the Mail Order Protection Scheme to appear in periodicals carrying mail order advertising should appear as follows:—

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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.

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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:

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(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.

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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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	our price	+VAT 15%	total price
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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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PL509=£2·82	PL519=£2·92	PY88=70p
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OR

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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.

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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
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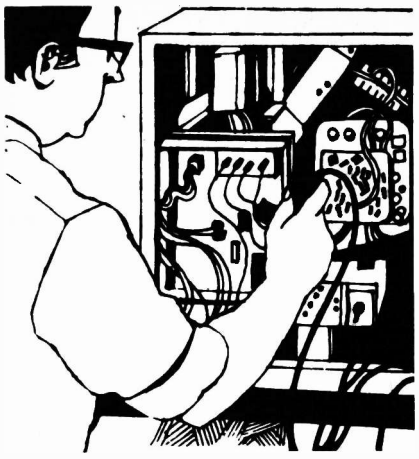

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Established 1957

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

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GOOD CLEAN CABINETS

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20 AX & P.I.L. TUBE

Colour Tubes	from **£25**
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VHF/MW/LW size 13×3½".
4 push button unit, 7 transistors, V/condenser, 10 coils rod aerial I/C decoder CA 758E (no power supply and output stage). Circuit supplied. **£6.00**
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