R. CHARLESTON X

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TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

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INTERNATIONAL TV STANDARDS

TELEVISION

October 1982

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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, 25 Lavington Street, London SE1 0PF.

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

this month

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 20

TRANSISTORS, ETC.

Type	Price (£)
AC107	0.48
AC117	0.38
AC126	0.36
AC127	0.54
AC128	0.48
AC128K	0.55
AC141	0.65
AC141K	0.70
AC142	0.60
AC142K	0.65
AC151	0.31
AC152	0.36
AC153	0.42
AC153K	0.52
AC154	0.41
AC176	0.45
AC178	0.51
AC179	0.55
AC187	0.56
AC187K	0.65
AC188	0.52
AC188K	0.61
AC193K	0.70
AC194K	0.74
ACY17	1.20
ACY19	0.95
ACY28	0.98
ACY39	2.02
AD140	1.79
AD142	1.90
AD143	1.78
AD149	1.42
AD161	0.66
AD161/162	1.22
AD162	0.71
AF114	1.32
AF115	1.26
AF116	1.28
AF117	1.32
AF118	0.98
AF121	0.68
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.86
AF139	0.58
AF147	0.52
AF149	0.45
AF178	1.35
AF179	1.36
AF180	1.35
AF181	1.33
AF186	1.46
AF202	0.27
AF239	0.73
AF240	1.40
AF279S	0.91
AL100	1.30
AL103	1.58

Type	Price (£)
AU103	2.40
AU107	2.75
AU110	2.40
AU113	2.60
BC107*	0.16
BC108*	0.15
BC109*	0.16
BC113	0.22
BC114	0.22
BC115	0.24
BC116*	0.25
BC117	0.30
BC118	0.24
BC119	0.34
BC125*	0.30
BC126	0.30
BC132	0.20
BC134	0.22
BC135	0.21
BC136	0.22
BC137	0.30
BC138	0.32
BC140	0.36
BC141	0.44
BC142	0.35
BC143	0.38
BC147*	0.12
BC148*	0.12
BC149*	0.13
BC152	0.42
BC153	0.38
BC154	0.41
BC157*	0.13
BC158*	0.12
BC159*	0.14
BC160	0.52
BC161	0.58
BC167B	0.15
BC168B	0.14
BC169C	0.15
BC170*	0.15
BC171*	0.15
BC172*	0.14
BC173*	0.22
BC174A & B	0.26
BC176	0.22
BC177*	0.20
BC178*	0.22
BC179*	0.28
BC182*	0.15
BC182L*	0.15
BC183*	0.14
BC183L*	0.14
BC184*	0.15
BC184L*	0.15
BC185	0.36
BC186	0.25
BC187	0.27

Type	Price (£)
BC192	0.56
BC204*	0.39
BC205*	0.39
BC206*	0.37
BC207*	0.39
BC208*	0.37
BC209*	0.39
BC211*	0.36
BC212*	0.17
BC212L*	0.17
BC213*	0.16
BC213L*	0.16
BC214*	0.18
BC214L*	0.18
BC225	0.42
BC237*	0.16
BC238*	0.15
BC239*	0.22
BC251*	0.25
BC252*	0.26
BC253*	0.38
BC261A*	0.28
BC262A*	0.28
BC263*	0.26
BC267*	0.20
BC268*	0.28
BC286	0.40
BC287	0.49
BC291	0.27
BC294	0.37
BC297	0.36
BC300	0.62
BC301	0.38
BC302	0.86
BC303	0.84
BC304	0.44
BC307*	0.17
BC308*	0.14
BC309*	0.18
BC317*	0.15
BC318*	0.15
BC319*	0.19
BC320	0.17
BC321A&B	0.18
BC322	0.28
BC323	1.15
BC327	0.16
BC328	0.18
BC337	0.17
BC338	0.17
BC340	0.19
BC347*	0.17
BC348A & B	0.17
BC349B	0.17
BC350*	0.24
BC351*	0.22
BC352A*	0.24
BC360	0.59

Type	Price (£)
BC377	0.29
BC394	0.39
BC440	0.52
BC441	0.59
BC461	0.78
BC477	0.30
BC478	0.25
BC479	0.33
BC547*	0.13
BC548*	0.13
BC549*	0.15
BC550	0.24
BC556	0.23
BC557*	0.16
BC558*	0.16
BC559*	0.17
BCY10	0.30
BCY30A	1.06
BCY32A	1.19
BCY34A	1.02
BCY72	0.27
BD115	1.35
BD123	1.50
BD124	1.85
BD130Y	1.56
BD131	0.58
BD132	0.68
BD133	0.70
BD135	0.37
BD136	0.38
BD137	0.40
BD138	0.42
BD139	0.46
BD140	0.50
BD144	2.24
BD145	0.75
BD150A*	0.51
BD155	0.90
BD157	0.51
BD158	0.75
BD159	0.68
BD160	2.69
BD163	0.67
BD165	0.66
BD166	0.88
BD175	0.90
BD177	0.58
BD178	0.92
BD181	1.94
BD182	2.10
BD183	1.34
BD184	2.30
BD187	1.20
BD188	1.25
BD189	0.71
BD222	0.91
BD225	0.91
BD232	0.91
BD233	0.62

Type	Price (£)
BD234	0.68
BD235	0.63
BD236	0.63
BD237	0.66
BD238	0.68
BD253	1.58
BD410	1.65
BD433	0.65
BD435	0.70
BD436	0.71
BD437	0.74
BD438	0.75
BD519	0.88
BD520	0.88
BD599	0.87
BD600	1.23
BD663BR	0.86
BDX18	1.55
BDX32	2.95
BDY16A	0.63
BDY18	1.55
BDY20	2.29
BDY38	1.38
BF115	0.48
BF117	0.45
BF120	0.55
BF121	0.85
BF123	0.48
BF125	0.55
BF127	0.51
BF137F	0.78
BF152	0.19
BF158	0.25
BF159	0.27
BF160	0.20
BF161	0.84
BF163	0.65
BF164	0.95
BF166	0.50
BF167	0.38
BF173	0.35
BF177	0.36
BF178	0.46
BF179	0.58
BF180	0.53
BF181	0.53
BF182	0.44
BF183	0.52
BF184	0.44
BF185	0.42
BF186	0.42
BF194*	0.14
BF195*	0.13
BF196	0.14
BF197	0.15
BF198	0.29
BF199	0.29
BF200	0.25
BF218	0.42

Type	Price (£)
BF222	0.51
BF224 & J	0.22
BF240	0.60
BF241	0.31
BF244*	0.51
BF245*	0.43
BF254	0.46
BF255	0.58
BF256L*	0.49
BF257	0.47
BF258	0.52
BF259	0.54
BF262	0.73
BF263	0.88
BF270	0.47
BF271	0.42
BF272A	0.80
BF273	0.33
BF274	0.34
BF336	0.63
BF337	0.65
BF338	0.68
BF355	0.72
BF362	0.49
BF363	0.49
BF367	0.29
BF451	0.43
BF457	0.46
BF458	0.49
BF459	0.52
BF594	0.16
BF596	0.17
BF597	0.27
BFR39	0.30
BFR40	0.29
BFR41	0.30
BFR50	0.29
BFR52	0.33
BFR61	0.29
BFR62	0.28
BFR79	0.30
BFR80	0.29
BFR81	0.30
BFR88	0.42
BFT41	0.46
BFT43	0.55
BFW11	1.02
BFW30	2.58
BFW59	0.19
BFW60	0.20
BFW90	1.65
BFX29	0.38
BFX84	0.42
BFY50	0.38
BFY51	0.37
BFY52	0.36
BFY53	0.36
BFY90	1.98
BPX25	1.62

Type	Price (£)
BPX29	1.62
BR101	0.53
BR103	0.64
BR303	1.06
BRC4443	1.76
BRY39	0.60
BRY56	0.44
BSS27	0.92
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	2.85
BU105	1.80
BU105/02	1.95
BU108	2.98
BU126	2.91
BU204	2.50
BU205	2.58
BU206	2.59
BU208	2.75
BU407	1.38
BUY77	2.50
C106D	0.80
C106F	0.46
C111E	0.43
D40N1	0.84
E300	0.42
E1222	0.47
E5024	0.19
GETB72	0.46
ME0402	0.18
MF0404/02	0.18
ME6001	0.18
ME6002	0.18
MJ2955	1.30
MJ3000	1.58
MJE340	0.68
MJE341	0.72
MJE370	0.74
MJE371	0.79
MJE520	0.85
MJE521	0.95
MJE2955	1.20
MJE3000	1.95
MJE3055	1.22
MPF102	0.40
MPS3702	0.33
MPS3705	0.30
MPS6521	0.36
MPS6523	0.36
MPS6566	0.44
MPSA05	0.30
MPSA06	0.32
MPSA55	0.43
MPSA56	0.46
MPSA93	0.56
MPSL01	0.33
MPSU01	0.61

Type	Price (£)
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
MPSU60	0.82
MPU131	0.59
OC26	1.90
OC28	1.49
OC29	1.60
OC35	1.25
OC36	1.25
OC42	0.90
OC44	0.68
OC45	0.63
OC70	0.65
OC71	0.73
OC72	0.73
OC81	0.83
OC81D	0.95
OC139	1.30
OC140	1.35
OC170	0.80
OC171	0.82
OC200	3.90
OC201	3.95
OC202	2.40
OC205	3.95
OCP71	1.98
ON236A	0.94
R20088	2.72
R2010B	2.79
R2322	0.75
R2323	0.85
ST2110	0.49
ST6120	0.48
TIC44	0.25
TIC46	0.35
TIC47	0.45
TIP29A	0.47
TIP30A	0.50
TIP31A	0.51
TIP31C	0.67
TIP32A	0.56
TIP32C	0.72
TIP33A	0.77
TIP34A	0.84
TIP41A	0.72
TIP42A	0.80
TIP2955	0.77
TIP3055	0.58
TIS43	0.44
TIS73	1.36
TIS90	0.23
TIS91	0.28
ZTX108	0.14
ZTX109	0.16
ZTX213	0.2
ZTX300	0.16
ZTX304	0.26

Type	Price (£)
ZTX500	0.18
ZTX502	0.22
ZTX504	0.28
2N404	1.30
2N696	0.46
2N697	0.46
2N706A	0.33
2N708	0.29
2N914	0.32
2N916	0.46
2N918	0.54
2N930	0.29
2N1164	10.29
2N1304	1.40
2N1305	1.29
2N1306	1.49
2N1307	1.32
2N1308	1.53
2N1711	0.47
2N1893	0.52
2N2102	0.71
2N2217	0.55
2N2218	0.38
2N2219	0.42
2N2221A	0.26
2N2222A	0.41
2N2369A	0.40
2N2401	0.80
2N2484	0.35
2N2570	0.74
2N2646	0.82
2N2784	1.15
2N2869	2.08
2N2894	0.46
2N2904*	0.40
2N2905*	0.39
2N2906*	0.36
2N2926G	0.15
2N2926O	0.14
2N2926Y	0.14
2N2955	1.12
2N3053	0.48
2N3054	0.66
2N3055	0.72
2N3250	0.52
2N3254	0.58
2N3391A	0.38
2N3633	0.60
2N3703	0.17
2N3704	0.19
2N3705	0.17
2N3706	0.16
2N3707	0.18
2N3708	0.17
2N3715	1.70
2N3771	2.09
2N3772	2.08
2N3773	2.90
2N3794	0.40

Type	Price (£)
2N3819	0.47
2N3820	0.72
2N3866	1.08
2N3904	0.20
2N3905	0.20
2N3906	0.20
2N4036	0.94
2N4123	0.17
2N4124	0.17
2N4126	0.17
2N4236	2.20
2N4289	0.32
2N4292	0.32
2N4416	0.85
2N4444	1.90
2N4921	0.80
2N5042	1.65
2N5060	0.28
2N5061	0.30
2N5064	0.63
2N5086	0.49
2N5087	0.50
2N5208	0.59
2N5294	0.66
2N5296	0.68
2N5298	0.71
2N5322	1.16
2N5449	0.18
2N5457	0.46
2N5458	0.40
2N5459	0.58
2N5494	0.85
2N5496	1.05
2N6027	0.55
2N6107	0.71
2N6122	0.60
2N6178	1.07
2N6180	1.39
2N6211	2.74
2SB337BP	4.28
2SC458C	0.78
2SC643A	2.25
2SC930D	1.50
2SC1061	1.45
2SC1172Y	3.55
2SD234	1.48
3N128	1.60
40250	0.98
40251	1.14
40327	0.67
40361	0.48
40362	0.50
40410	0.94
40429	0.88
40530	0.79
40595	1.39
40603	1.13
40636	1.25
40654	0.89

Alternative gain versions available on items marked*.

For matched pairs add 20p per pair.

LINEAR IC's

Type	Price (£)
CA810QM	2.44
CA3005	1.85
CA3012	1.45
CA3014	2.23
CA3018	0.71
CA3020	1.89
CA3028A	0.60
CA3028B	1.09
CA3045	3.75
CA3046	0.70
CA3065	1.74
CA3068	1.90
CA3130S	1.57
FCH161	2.40
FCJ101	3.32
LM309K	1.98
LM380N-14	1.65
LM1303N	1.03
MC1307P	1.82
MC1310P*	1.84
MC1312P	2.34
MC1327P*	1.86
MC1330P	0.83
MC1350P	1.22
MC1351P	1.42
MC1352P	1.42
MC1357P	2.92
MC1358P*	2.30
MC1458G	1.43
MC1496L	1.15
MC3051P	0.58
MFC4008	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	1.10
ML231	3.57
ML232	3.57
NE555	0.72
NE556	1.34
NE566	1.95
SAA1024	5.70
SAA1025	10.35
SAS560A	2.01
SAS570	2.01
SC9503P	1.40
SC9504P	1.38
SL432A	2.52
SL450	5.10
SL901B	4.70
SL917B	5.60
SL918A	5.95
SN72440N	2.21
SN76001N	1.67
SN76003N	2.20

Type	Price (£)
SN76003N	3.32
SN76013N	2.52
SN76023N	3.02
SN76023ND	2.52
SN76033N	3.32
SN76023ND	1.40
SN76033N	2.20
SN76110N	1.20
SN76115N	1.62
SN76116N	1.78
SN76131N	2.10
SN76226N	2.60
SN70227N	1.61
SN76228N	1.80
SN76502N	1.92
SN76530P	0.97
SN76533N	1.38
SN76544N	1.85
SN76546N	1.85
SN76570N	1.81
SN76620AN	0.99
SN76650N	1.46
SN76660N	0.64
SN76666N	0.96
TA7073P	3.51
TAA263	2.20
TAA300	3.85
TAA320	1.10
TAA350A	2.46
TAA370A	3.18
TAA435	1.70
TAA450	3.39
TAA521	1.10
TAA522	2.09
TAA550	0.35
TAA560	1.93
TAA570	2.20
TAA611A	1.67
TAA611B	2.85
TAA621AX1	4.75
TAA630Q	3.91
TAA630S	4.18
TAA661A	2.39
TAA661B	1.75
TAA700*	2.80
TAA840	3.38
TAA861A	0.95
TAA930A	1.43
TAA930B	1.43
TAA960	3.20
TAA970	2.81
TAD100	2.66
TBA120A	0.90
TBA120S*	0.99
TBA120SA	1.02
TBA231	1.32

Type	Price (£)
TBA240A	3.98
TBA281	2.07
TBA395*	2.58
TBA396	2.40
TBA400	2.20
TBA480Q	1.84
TBA500*	2.21
TBA510*	2.21
TBA520*	2.98
TBA530P	2.24
TBA540*	2.88
TBA550*	3.13
TBA560C*	3.18
TBA570*	1.29
TBA611B	2.68
TBA641	4.55
TBA641A12	4.55
TBA641BX1	4.60
TBA651	2.42
TBA673	2.31
TBA700*	2.50
TBA720AQ	2.38
TBA720Q	2.38
TBA750*	2.18
TBA800	2.05
TBA810AS	2.00
TBA920*	2.80
TBA940	3.52
TBA950	2.08
TBA990*	2.90
TCA270A*	3.55
TCA280A	1.43
TCA290A	3.46
TCA420A	2.10
TCA440	1.67
TCA640	4.26
TCA650	4.26
TCA660	4.26
TCA730	4.10
TCA740	4.04
TCA750	2.53
TCA760	1.52
TCA820	3.29
TDA440	4.16
TDA1003	1.68
TDA1004	3.85
TDA1005	3.04
TDA1022	6.89
TDA1024	0.97
TDA1034	2.98
TDA2610	2.86
TDA2640	2.86
ZN414	1.45

* Indicates Q version is also available.

DIODES

Type	Price (£)
AA113	0.17
AA119	0.21
AA129	0.28
AA143	0.18
AAY30	0.28
AAZ13	0.42
AAZ15	0.35
AAZ17	0.28
AY102	3.85
BA100	0.24
BA102	0.36
BA104	0.19
BA110	0.60
BA111	0.70
BA115	0.17
BA116	0.56
BA121	0.85
BA129	0.45
BA145	0.19
BA148	0.19
BA154	0.06
BA155	0.17
BA156	0.12
BA157	0.25
BA158	0.28
BA159	0.40
BA164	0.14
BA182	0.27
BA201	0.13
BA202	0.14
BA203	0.14
BA216	0.08
BA219	0.11
BA243	0.45
BA317	0.06
BA318	0.07
BAV10	0.10
BAV21	0.18
BAW62	0.06
BAX13	0.07
BAX16	0.10
BAX17	0.19
BAY72	0.16
BB104B	0.52
BB105B	0.33
BB105G	0.30
BR100	0.40
BY100	0.35
BY103	0.35

Type	Price (£)
BY114	0.60
BY118	1.10
BY126	0.20
BY127	0.21
BY133	0.35
BY140	1.40
BY164	0.75
BY176	2.80
BY179	0.83
BY182	1.14
BY184	0.44
BY189	5.30
BY190	4.90
BY206	0.26
BY238	0.25
BYX10	0.30
BYX38/600	0.70
BYX70/500	0.53
ITT44	0.08
ITT210	0.63
ITT827	0.80
MCR101	0.48
MR854	1.10
OA5	0.88
OA10	0.58
OA47	0.20
OA81	0.19
OA90	0.13
OA91	0.15
OA95	0.20
OA200	0.13
OA202	0.13
OA210	0.89
TIL209	0.14
TIL211	0.18
TV20	2.25
IN914	0.06
IN916	0.06
IN4001	0.06
IN4002	0.07
IN4003	0.08
IN4004	0.08
IN4005	0.09
IN4006	0.10
IN4007	0.12
IN5400	0.15
IN5401	0.17
IN5402	0.20
IS920	0.09
IS921	0.11

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
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	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59
2322 662 98003	0.88

VALVES

Type	Price (£)
DY86/87	0.75
DY802	0.75
ECC81	0.78
ECC82	0.95
ECC83	0.78
ECH81	0.83
ECL80	0.82
EF80	0.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.08
EY51	1.20
EY86/87	0.67
PCC84	0.61
PCC85	0.79
PCC89	0.74
PCC189	0.94
PCF80	1.20
PCF86	0.87
PCF200	2.32
PCF801	0.74
PCF802	1.20
PCF805	3.37
PCF808	3.80
PCL82	0.93
PCL83	5.25
PCL84	0.65
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	4.75
PL519	4.75
PL802	5.60
PY81/P810	0.60

BRIDGES

Rating	Price (£)	Rating	Price (£)
1½A 50V	0.27	2A 100V	0.36
100V	0.28	200V	0.40
200V	0.32	400V	0.47
400V	0.40	600V	0.53
600V	0.50	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	0.60
800V	0.80	800V	0.86
1000V	1.20	1000V	0.95

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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

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200, 250, 315, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 5A	all 56p

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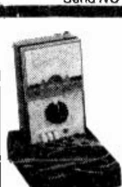

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4n7F	1500V DC	60p	100nF	1000V DC	46p
10nF	1000V DC	22p	470nF	1000V DC	60p

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Historic Times

There have been three occasions when the subject of television has been of major public interest – it's taken for granted most of the time. First when Baird and his associates were calling attention to the possibilities of the new medium in the late twenties/early thirties. Secondly during the epic debate on "independent TV" in the early fifties. And today. The BBC is celebrating its sixtieth anniversary, Channel 4 is about to start, and a decision on the development of cable TV is likely to be made shortly – the Hunt Committee, which was set up last March to consider technical standards and methods of control, is due to report back to the government by September 30th.

Our congratulations to the BBC, which started operations as the British Broadcasting Company (the Corporation bit came in 1927) on November 14th, 1922 – with a staff of four. There were 35,774 radio licence holders at the time, which was pretty good going. Broadcasting quickly caught on: by the end of 1923 there were almost 600,000 licence holders and the rise continued rapidly thereafter. The BBC's achievement – to have set unmatched standards of programme quality, interest and integrity – is rightly acclaimed throughout the world. One has only to reflect on the way in which broadcasting in most countries is subject to political control to appreciate the heritage created for us by those who led the BBC in its formative years.

The fourth TV network commences operations on November 1st in Wales and on November 2nd elsewhere in the UK. We shall have to fall in line and call it Channel 4 in future in these columns, but before doing so we utter a final, faint protest at the misuse of the term channel. The public is to be offered a "distinctive" sixty hours or so of programmes a week, and it will be interesting to see how this major breakthrough in broadcasting in the UK turns out.

Which brings us to cable. Would this be another breakthrough or a shambles? It would be a useful way of increasing the services available to the public, but one's concern is with its economic viability. Kenneth Baker, the Information Technology Minister, put the question "can it be that this is the time for further enquiries . . . ?" when speaking at the Edinburgh Festival TV conference recently. We'd say "yes indeed" if there are good grounds for doubt, but Mr. Baker seems intent on casting all caution aside. There's such a thing as misplaced enthusiasm, Kenneth.

When we last commented on the subject, we expressed reservations on the financial aspects and on the general vagueness of the original report by the Cabinet Office's Information Technology Advisory Panel in dealing with the ultimate use of an advanced cable network – it seems that a curious cross between multi-channel TV and a souped up telephone system linked to computers is envisaged. Since then, the National Economic Development Office's Electronics Consumer Goods Sector Working Party (another mouthful) has published its report, called for by Mr. Baker, on the technical issues. This doesn't seem to get us much further ("market forces should decide between competing cable technologies") and certainly gives no credibility to the idea that a short time scale is vital. Already the cost figure – suggested as being "of the order of £2.5 billion" in the original ITAP report – is beginning to creep up. Mr. Baker sees this as "a major new area of economic activity that can generate wealth". It could. It could also generate losses, especially if the public, which would have to pay for the services, fails to show interest. As the SWP report says: "There is a need for more information on what people want and what they will pay for it . . . There is a potential demand for interactive services, but the only one now available (Prestel) is not yet attractive to consumers." And "the demand for interactive services is expected to grow slowly from a very low base."

Despite these reservations, the SWP supports the view that it's necessary to make an urgent start to multi-channel cable TV – on the curiously pessimistic grounds that the UK's TV setmaking industry can survive only if it moves on to the production of more sophisticated receivers. But if the Japanese consumer electronics industry can produce cheap VCRs, colour cameras, video disc players and what have you, there's no earthly reason why they shouldn't be able to produce TV sets with frequency-synthesis tuning etc. Or has someone a way of stopping them?

There's something odd about the clamour for an urgent decision on the extension of cable services. If everyone's agreed, as seems to be the case, that the likely demand for such services is uncertain, what's the hurry? The attraction for cable operators is extra, paid for entertainment channels of course – none of this "armchair shopping" lark. There are indeed times when extra programme options would be welcome. Provided they are not more of the same!

A final interesting aside. I quote from Jack Bennett, writing in *Electrical and Radio Trading* after a recent visit to the USA: "One very definite impression I came away with is that cable TV has stunted the demand for video recorders and players. I think it's certain to exert a similar influence when eventually cable TV surfaces here."

ELECTRONIC HOBBIES FAIR

It's planned to hold an electronics hobbies exhibition at Alexandra Palace, N. London, on November 18th-21st. The exhibition is sponsored by "Everyday Electronics", "Practical Electronics" and "Practical Wireless".

COVER PHOTO

Our cover photo this month shows automatic component insertion equipment in use at Rediffusion's Durham CTV plant. Our thanks to Rediffusion for their assistance.

PCB SERVICE

Once again shortage of space has prevented inclusion of the list of panels available through the readers' PCB service. The list given in the August issue (page 543) remains valid.

Routine TV Receiver Tests: The Philips G8 Chassis

S. Simon

WE thought originally to leave the popular Philips G8 chassis out of this series, since it's been written about on a number of occasions in past issues. It's been suggested however that a quick guide to checks for common faults would be a handy thing to have all in one go, and we do of course have new readers to consider. So here goes.

Set Completely Dead

When the complaint is a dead set, remove the rear cover and note whether the tube heaters are alight. If not, check the left side (covered) fuse which has a rating of 3·15A anti-surge. To gain access, remove the grey plug which connects the a.c. mains supply to the power panel. If the fuse has failed, note the manner of its demise. Did it die of old age or did it meet its end violently as shown by a blackened appearance? If it looks clean, it's fair to try another without further ado, though the more cautious will check for shorts across the h.t. rectifier thyristor's anode to cathode connections. The usual type of thyristor fitted is a BT106, though some models have the tab type with a large washer providing some sort of heatsink. The body of the BT106 is the anode and the longer of the two legs is the cathode. It's extremely common to find the thyristor short-circuit, which will normally result in the 3·15A mains fuse showing signs of distress.

The mains filter capacitor C1366 is rarely the cause of fuse blowing on this chassis – for the record it's on the reverse side of the bulkhead to the fuse and plug.

No Results, Tube Heaters Glowing

If the set appears to be dead except for the stir of the degaussing coils as the set is switched on, plus the fact that the c.r.t. heaters are glowing, it's necessary to carry out the following checks so that the right conclusion can be reached in the minimum time.

Switch the meter to the 250V or 300V d.c. range and clip the negative prod to chassis. Apply the positive prod to the fuses (FS1391/2, see Fig. 1) on the rear edge of the power supply panel. Something like 200V should be recorded. The next step depends on whether this voltage is present or not.

If it's absent, view the front end dropper (the long black one with four tags) with suspicion and proceed with caution. There should be 240V a.c. at the bottom two tags (R1367) to suggest that the thyristor is being supplied at its anode. We say suggest because there could be an open-circuit track on the panel to prevent this. If there's a.c. at only one tag, the bottom 2·2Ω section of the dropper is open-circuit and the search has ended almost before it began. If there is a.c. at both tags, confirm that it's reaching the body of the thyristor – the connections to the choke (L1378) often become loose on the print, giving rise to sparking etc.

The top section (R1381) of the dropper is the d.c. smoothing resistor and if this is open-circuit the h.t. reservoir electrolytic C1385 (600μF) will charge fully and will remain charged after the set has been switched off. So if a meter check reveals that there is no voltage at the top tag of the dropper and that there's a high reading at the second tag down, beware: switch the set off and connect a resistor of say 100Ω between the two tags to discharge the electrolytic fully.

The reservoir electrolytic often becomes faulty, normally sparking at its terminals to call attention to itself and thus leaving little doubt as to the source of the disturbance. Fortunately, such behaviour does not lead to the nasty effects that an intermittently poor contact has on the later G11, where frequent failure of the BU208A line output transistor and/or the TDA2600 field timebase i.c. can be traced to a faulty h.t. reservoir electrolytic on the lower power supply board – the suspect capacitor is the large 470μF one coloured red (if it's not coloured red it's not suspect). Back to the G8 however.

Voltages OK at Power Supply Panel

If the expected 200V (approximately) is present at the rear edge fuses (this was our original check, remember), move over to the right side line output panel and locate fuse FS5557 (800mA). This is the horizontal fuse half way up the rear edge.

If the 200V is present at only one end of the fuseholder, the fuse is open-circuit and you could well have stumbled upon the curse of the G8: the line output transformer is always suspect in this chassis. Remove the metal screen and observe its windings, looking for a black pinhead which will denote sparking. If none can be seen, remove the tripler clip from the transformer and connect the meter, switched to the 500mA or 1A range, across the fuseholder, keeping one eye on the meter and the other on the transformer. Switch on and note whether the meter reading exceeds 500mA, or if there's a spark or sound of protest from the transformer.

A normal reading is in the region of 400mA. If the reading is well in excess of this and the set is left on the left side power unit h.t. fuse (FS1391) may well fail, so it's a matter of making a quick judgement. If the reading is normal with no sign of stress, reconnect the tripler cap to see whether this is the cause of the problem – a bulge in the side of the tripler may well have called attention to this item during the initial inspection.

The transformer and tripler may prove to be completely innocent and the trouble may turn out to be due to a faulty line output transistor (there are two) or perhaps a defective flyback tuning capacitor (C5545/6 – upper left of the line drive panel, the ones at the top).

This is less likely, but there's another point to watch. If the line output transformer is suspect, so too is the scan correction transductor on the bottom right timebase panel. The red socket from the line output panel goes down to this item and can be removed in a matter of seconds to prove whether it's giving trouble. Removal of the socket (H) leaves the set fully working apart from the lack of scan correction (bowing) which often goes unobserved to the untrained eye. So as well as disconnecting the tripler we should also disconnect plug H (red) on the timebase panel before making our current reading.

If the 200V h.t. supply is present at both sides of FS5557, proceed to the front end of the same panel and observe the large 47Ω wirewound resistor (R5535) mounted on its own. This could well be open-circuit – check the voltage at both ends. It's in the feed to the line output transformer and just dies.

Not So Simple

These then are the usual run of the mill defects to expect.

Once in a while the voltages in the power supply all appear to be correct and reaching the line output stage but nothing else seems to be happening. This can be an awkward and time consuming business. Tackle it logically, after an initial illogical move. This is to disturb the wiring at the top of the panel to the left of the line output transformer (not to it). These leads are the base and emitter connections to the line output transistors from the panel (where dry-joints occasionally lurk). It's often the case that the slightest movement of almost any lead will restore normal working. You then have the job of finding the poor connection – this is best left to the patience or perhaps intuition of the repairer. It really is frustrating to find that the slightest touch almost anywhere in the region is sufficient to start the thing up but the cause is so difficult to locate. We have found the upper part of the line scan panel and the lower part of the line drive panel (the top one) a happy hunting ground for dry-joints that are not always obvious to the eye.

Sometimes a dry-joint on the upper sections is not responsible and the problem is that there is no drive to the output pair of transistors. In this case one has to prove that the line driver stage is working, with drive in turn from the preceding trigger amplifier transistor, and that the line oscillator is functioning.

The line driver transistor is a hefty device (ON188/BD144) and we've yet to find one faulty (we probably now will). First check that h.t. is reaching the collector of this transistor (TR5519). There is no feed resistor, just the primary winding of the driver transformer, between the h.t. line and the transistor's collector, so the voltages at the two points should be well nigh the same. If the preceding stages are working, there should be some 0·5-1·6V (depending on version) at the emitter and a negative voltage of a volt or so at the base.

A fairly common complaint is that there is no supply to the collector of the preceding trigger amplifier transistor due to its 8·2kΩ collector load resistor (R5515) being open-circuit. If a reading of some 3V is recorded at the collector of this BC147 transistor (TR5514), or maybe the voltage is much higher, attention should be directed to the line oscillator stage on the right side horizontal timebase panel. A 10kΩ wirewound resistor (R4516, see Fig. 1) will be seen just to the rear of the transductor on the right side edge, approximately midway. This is the line oscillator's start-up resistor and is connected to the h.t. line – since during normal running the supply to the oscillator comes from the line output stage, something is required to get things started. That something is R4516, which should have 200V at one side and 18V at the other if it's intact.

The line oscillator stage uses a couple of BC147 transistors and is generally trouble free. The small electrolytics are a possible source of trouble, but only once in a while.

The Field Timebase

The field timebase is on the same panel. The main items are a silicon controlled switch which acts as the oscillator (BRY39 in early versions, BRY56 in later production), a BC148 discharge transistor, an AC128 driver transistor and the two output transistors (BD124s in early production, BD131s in later production). The output transistors generate a fair amount of heat, and are therefore suspect in the event of severe non-linearity or total field collapse. Where the earlier BD124s are used the soldering to the collectors is suspect, and it's sometimes advisable to add an extra lead to the body (collector) to ensure good contact if this has not already been done.

Of the capacitors in the field timebase, C4451 (47μF) and C4452 (22μF) in the charging circuit can be responsible for height problems and should be taken out and tested when this fault is present.

Inspection of the timebase panel will sometimes show that R4484, which is in series with the transductor's windings on the line side, is charred though red socket H is still fitted. This means that the transductor is faulty, and may look it. Since this leads to slight distortion of the raster at the top and bottom the customer's complaint may be one of a vague "lack of height". The replacement resistor should be one of the same type as fitted (not one of a higher wattage).

Signals Panels

Whilst early models used separate i.f. and decoder panels, later versions have a single combined unit. If the RGB leads from the tube base go to the rear left side it is the early version, whereas if they go roughly amidships

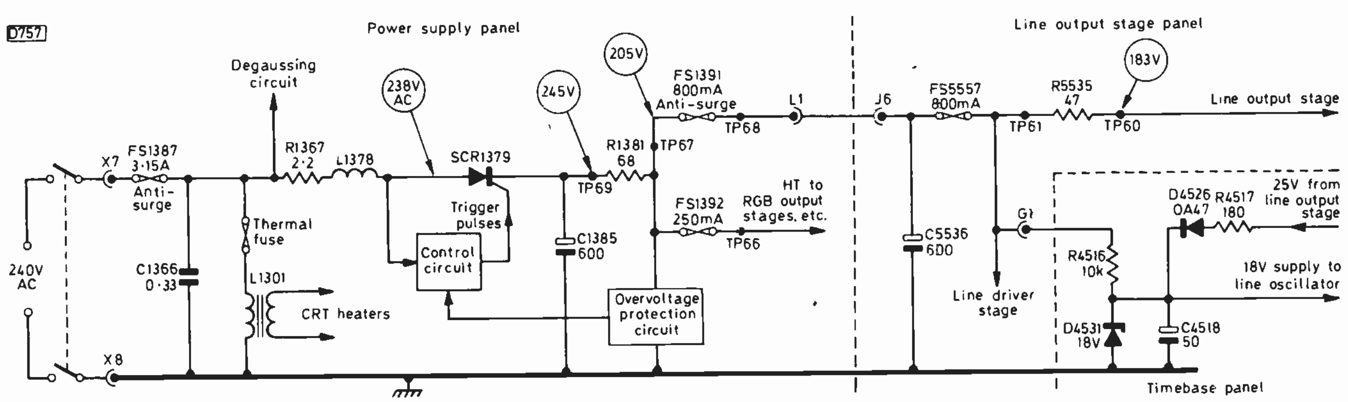


Fig. 1: H.T. supply arrangements used in the Philips G8 chassis.

under the tube you are dealing with the later version.

Frequent faults include the lack of or predominance of one colour, and this should lead one to investigate the operating conditions of the three BF337 RGB output transistors. While one of the transistors is often at fault, a dry-joint at the base, emitter or collector is a frequent cause of the trouble and these dry-joints are not always as easy to see as we would like them to be. To be sure, remake any that are suspect. Also suspect are the three 39kΩ resistors which provide external loads for pins 1, 11 and 14 of the TBA530 RGB matrixing i.c. These pins should be at about 8·5V.

No colour at all often presents a problem, particularly on the older separate panel version where a polystyrene capacitor (C7204, 0·027μF) in the ident tuned circuit often gives intermittent results. For example, one may be faced with a no colour problem and then carry out the colour-killer disabling procedure by clipping a shorting lead from TP80 (l.t. line) to TP26 and then immediately get good colour which remains when the link is removed. For a short time that is, perhaps as long as it takes to arrive back at the customer's house. If this sort of intermittent trouble is experienced, look for the polystyrene capacitor near the left side delay line and give it a touch or two – it often suffers from an internal poor contact.

Also ensure that the core of the centre coil L7008 in the reference oscillator circuit is correctly set: with the passage of time it often needs to be screwed in slightly to give reliable colour.

After this the transistors (early versions) are suspect – check voltages.

In the event of intermittent sound, first check the speaker leads back to the panel plugs and ensure that these are making good contact. Also check the plugs and sockets to the volume control. These two possibilities are by far and away the most common causes of intermittent sound. If necessary check the BD131 output transistors for dry-joints. The TBA750 intercarrier sound i.c. used on the single panel is sometimes responsible for sound failure.

Whilst on the subject of these later versions, don't forget that there's a 12V regulator (a BD131 transistor) in the rear right corner of the panel, roughly in line with the three BF337s. If the entire signal section fails to function, check this regulator which takes in 23·5V and gives out (or should do) a steady 12V.

Miscellaneous Matters

Most other faults concern the power unit, programme selectors and tuner, and come under the category "run of the mill". For example, a rapidly fluctuating picture is nearly always due to a defective h.t. rectifier thyristor, with the BR100 trigger diac a secondary suspect. Difficulty in obtaining the correct supply voltages should direct attention to the fairly high-value resistors associated with the set h.t. and over-voltage presets, also the 7·5V and 12V zener diodes in the power supply unit.

Other zener diodes can cause problems. The beam limiter circuit in earlier and later versions of the chassis differs. The 12V zener diode D5582 in the later version can be responsible for intermittent low brightness. Line drift can be due to D4531 (18V) on the timebase panel or D2166 (12V) in the i.f. strip.

Finally it's worth mentioning that a wide and rather poor picture can be due to one of the line output transistors going short-circuit and the other one soldiering on.

Frequency-synthesis Tuning

Stephen Clay

PREVIOUS articles (July/August) have dealt with the basic Rediffusion Mk. 4 chassis. Probably the most interesting feature however is the remote control/frequency-synthesis tuning system used on some versions. The infra-red remote control system is based on use of the ITT SAA1251 chip – the arrangement was described in detail in the December 1979 issue. Hence we'll concentrate in this article on the operation of the frequency-synthesis (FS) part of the circuitry.

Operation of the Set

The operation and tuning of the set will first be described so that the practical difference between frequency-synthesis tuning and a manually tuned receiver can be seen.

A photograph of the front control panel is shown in Fig. 1. In normal operation the only visible control is the mains switch at the top: it's assumed that all other functions (the analogue controls – volume, brightness etc. – and programme change) will be controlled by the user via the remote control handset. A relay coil fitted to the mains switch provides remote switch off, but the switch has to be pressed to switch on.

There are two sets of controls behind the flap at the bottom. First a duplicate set of analogue controls and a programme "step" button to allow the customer to continue to use the receiver should the remote control handset be lost or be unavailable for some other reason. The handset has 16 buttons to give direct selection of the 16 programmes to which the set can be tuned, the step button giving provision to move from programme 2 to 3 etc. Secondly there are the tuning set-up buttons.

On the equivalent manually tuned set there would be 16 programme selector buttons, each of which would be

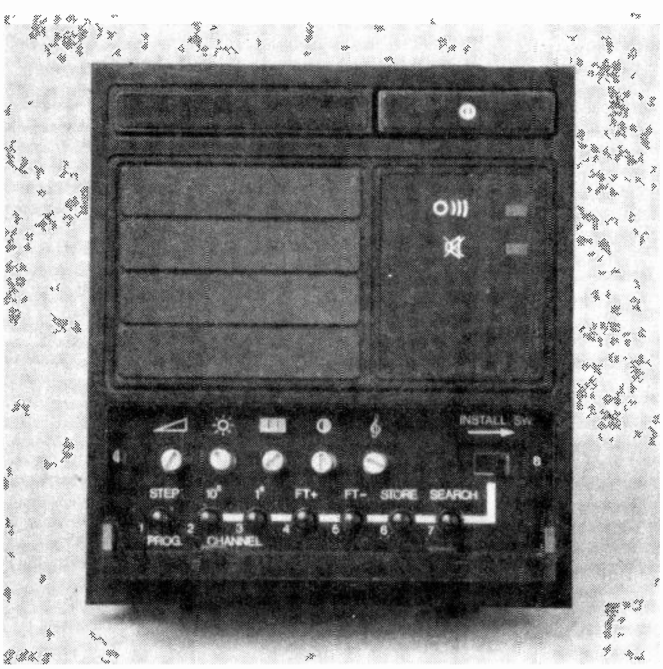


Fig. 1: Front control panel with the bottom flap lowered.

set to a particular u.h.f. channel by means of a tuning potentiometer. The disadvantages of this are that it's difficult to know exactly which channel you're on when tuning, the tuning can drift and is difficult to set accurately so that a.f.c. is required, and the tuning potentiometers can fail or at least become dirty.

On the remote control version of the Mk. 4 chassis the channels to which each of the programme buttons are tuned are semi-permanently stored in a non-volatile memory (NVM), i.e. one that doesn't require a battery to prevent loss of information when the set is switched off. When a particular programme is selected, the channel number (which is digitally stored) sets the dividers in the frequency-synthesis tuning loop so that the tuner's local oscillator will be at the exact (or almost) frequency – we'll be looking at the reason for the use of dividers shortly.

The layout of the controls beneath the flap on the front panel is shown in Fig. 2. The on-screen display is also shown. If the spring-loaded installation switch is held on and programme 8 is selected, the display shown will be obtained if the memory is storing channel 33 and the recall button on the handset is pressed. If we want to change this to say channel 45, we press the tens button once, the units button twice and then press the store button so that channel 45 is stored in the NVM in place of channel 33. If you forgot to press store you'd get channel 33 instead of channel 45 next time programme 8 was selected.

It may sometimes be necessary to tune the set to a non-standard frequency – for use with a cable system or VCR modulator for example. The fine tune buttons enable the set to be tuned in small, 62·5kHz steps for this purpose.

Although the system gives very stable and accurate tuning, it may also be necessary to use the set with a signal that drifts, such as one from a VCR or video game, so a.f.c. cannot be dispensed with entirely. For this purpose a.f.c. is applied when programme 7, 8, 15 or 16 is selected – the arrangement can be changed internally if required.

The search button gives a slow sweep across the band, stopping where there are signals on programmes 7, 8, 15 and 16.

When the installation switch is not held on the tuning controls have no effect: this reduces the possibility of accidental mistuning.

Fig. 3 shows the basic components that comprise the remote control/frequency-synthesis system. These are:

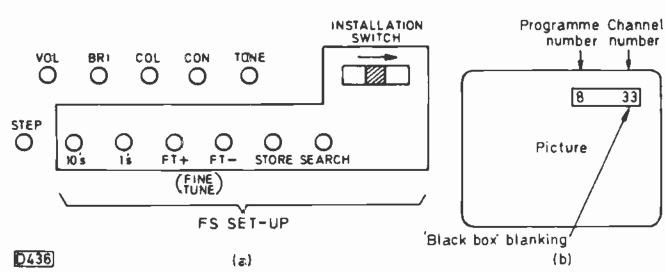


Fig. 2: Layout of the tuning and other controls behind the bottom flap (a); on-screen display (b).

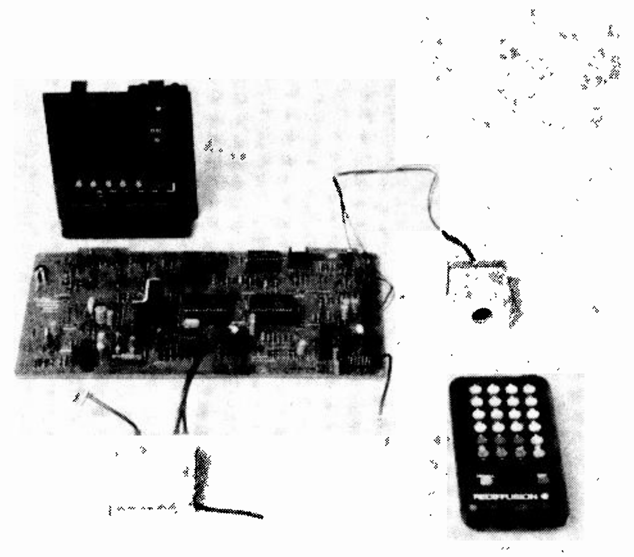


Fig. 3: The various items that comprise the remote control/ frequency-synthesis tuning system.

(1) The handset, which contains an ITT SAA1250 i.c. and infra-red LEDs.

(2) The infra-red preamplifier – an ITT TEA1009 i.c. fitted at the front of the receiver inside a screening can to reduce pick-up. A hole in the end of the can enables the infra-red signal to be picked up by the diode inside.

(3) The pre-scaler. This is a small can which is mounted adjacent to the u.h.f. tuner on the signals panel. The AEG U465B i.c. inside this can divides the local oscillator signal from the tuner to a lower frequency (the u.h.f. tuner is type U321-LO, which has a socket fitted to the top to enable the oscillator signal to be tapped off and fed to the pre-scaler). Use of a screening can reduces local oscillator signal radiation.

(4) The remote control/frequency-synthesis panel. This large PCB contains the following five i.c.s. An ITT SAA1251 remote control receiver/decoder i.c. An ITT SAA1174 frequency-synthesis control i.c.: this contains a programmable divider whose setting depends on the channel selected, in turn producing the appropriate tuning voltage. An ITT SAA1075 non-volatile memory which stores the channel numbers and any off-set for each of the 16 programmes. An ITT SAA1276 on-screen display device to generate the numbers displayed on the picture when activated and fed with the appropriate programme and channel information. And finally an LM358 dual operational-amplifier i.c. which is used for a.f.c. correction. The front panel controls and set-up buttons plug into this panel.

The Frequency-synthesis Control Loop

Having looked at the way in which the set is tuned and the main components involved, we can now go on to see how the frequency-synthesis frequency-locked-loop is used for tuning. We'll ignore the NVM for a start and assume that the channel information comes directly from the FS set-up panel. The system is shown in Fig. 4.

The channel information from the FS set-up panel is fed to a temporary store in the SAA1174 i.c.: the division ratios for both the pre-scaler and the programmable divider in the i.c. are calculated from this information. The frequency/phase comparator has two inputs, the divided down local oscillator frequency and a fixed stable frequency of about 976Hz ($4MHz/2^{12}$) which is derived from a crystal oscillator. If the tuner's local oscillator is at the correct frequency, there will be no output from either pin 15 or 16 of the i.c. and the tuning voltage, which is stored by C6, will remain constant. If the local oscillator frequency is too high, due to drift or when a channel change is required, there will be an output of pulses from pin 16. These pulses switch transistor TR6 on, thus discharging C6 until the correct tuning voltage is obtained. Similarly if the local oscillator frequency is too low there will be a pulse output from pin 15. As a result, C6 will charge via TR5 under the control of TR4. The duration of the pulses from pin 15 or pin 16 depends on how far the local oscillator is off tune. R53 and C5 improve the stability of the loop.

As an example of the division process, let's take channel 21 (471·25MHz). The local oscillator frequency is 510·75MHz, and the temporary store will hold two numbers, 515 and 68. The programmable divider is set to 515. For the first 68 counts of this 515 there will be 0V at pin 4 of the SAA1174 i.c. and the divide-by-fifteen circuit in the pre-scaler i.c. will be switched in. For the rest of the counts to 515 (447) there will be 5V at pin 4 and the divide-by-sixteen circuit will be switched in. Hence

$$510{\cdot}75\text{MHz} \times \frac{1}{64} \times \frac{1}{(68 \times 15) + (447 \times 16)} = 976\text{Hz}.$$

This is the counted down oscillator frequency and is the same as the fixed frequency. It follows that changing the digital numbers fed to the temporary store changes the division ratios and hence the tuning voltage.

The divide by 15/16 circuit is used because it's a relatively simple way of shifting part of the programmable divider into the pre-scaler i.c., which is capable of operating at higher speeds than the FS control i.c.

The tuning resolution of this system is determined by the amount of fixed division (which is 64), and is 64 × 976Hz (derived from the crystal oscillator) = 62·5kHz. This means that we can fine tune in steps of 62·5kHz, which is perfectly adequate for TV set use.

It should be noted that although all such loops use the same principle of dividing the local oscillator frequency down and comparing it with a fixed stable frequency to produce the required d.c. tuning voltage, other designs may use different fixed divider ratios, programmable dividers, crystal frequencies etc., depending on the tuning resolution required, the tuning cycle time, technology available and so on.

Fig. 5 shows the non-volatile memory i.c. connected to the FS control i.c. The SAA1075 NVM uses MNOS technology to store the channels, giving a selection of 16 programmes, and can hold this information for at least ten years after the power has been disconnected.

For normal customer operation, when a button on the remote control handset is pressed a signal goes through the infra-red system and outputs appear on the Pa-Pd lines from the SAA1251 remote control i.c. These lines are connected to the NVM (IC2), and consist of a parallel four-bit data bus: 0000 means programme 1, 0001 means programme 2, 0010 means programme 3 and so on up to 1111 which means programme 16. The step button on the front control panel is connected to the SAA1251 i.c. and simply adds 1 to the four-bit code each time it's pressed.

The four-bit code changes each time another programme is selected, the channel information for the new programme then being fed from the NVM into the tem-

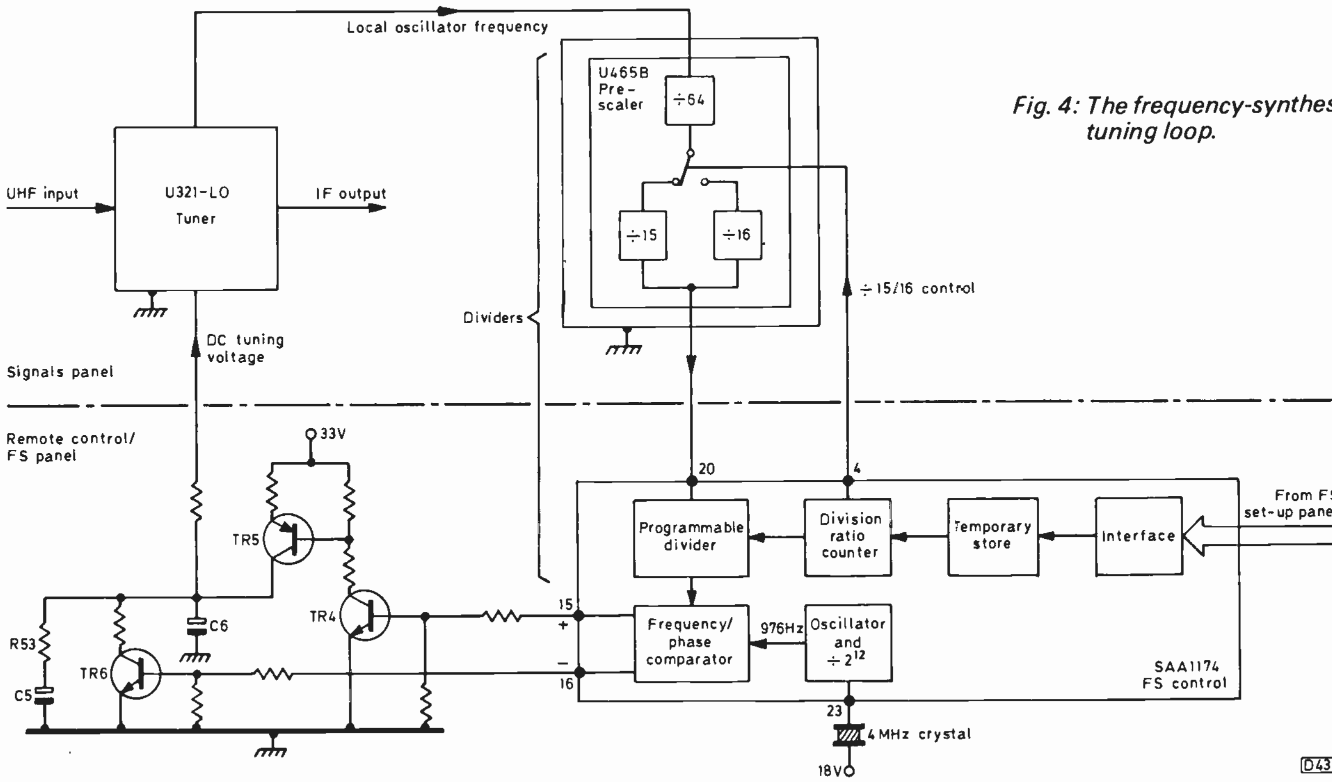


Fig. 4: The frequency-synthesis tuning loop.

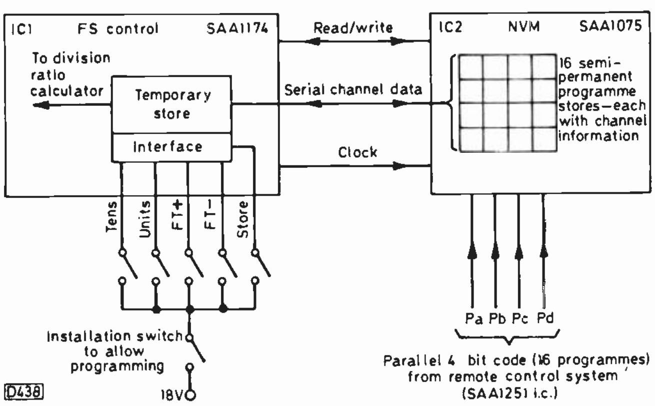


Fig. 5: Links between the FS control and non-volatile memory i.c.s.

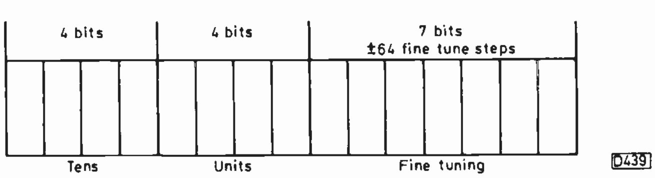


Fig. 6: The coding system used for holding channel information in the stores. Note that a four-bit system has sixteen possible states: only the first ten are used.

porary store in the FS control i.c. As a result, the tuning frequency changes.

The channel information is held in the two stores using the binary code arrangement shown in Fig. 6. It's sent from the NVM to the temporary store as a serial data stream, i.e. the ones and zeros are fed via a single wire in sequence. With serial data it's necessary to have a clock frequency so that the receiving i.c. reads the zeros and ones at the correct times.

Returning to Fig. 5 you can see that with the installation switch in the on position a positive voltage is fed to the appropriate IC1 input pins when the tens, units, FT+ or FT− button is pressed. The channel information in the temporary store is thus changed. If a new programme is selected at this point the temporary store will be overwritten with new information from the NVM: if the store button is pressed however the information in the temporary store is sent in the reverse direction into the NVM.

Normally it's not possible to erase the information in the NVM. When store is pressed however a high voltage of about 30V is applied to the i.c., erasing the previously stored channel (for whichever programme was selected). The 30V supply is obtained by adding the 18V supply that feeds the remote control/frequency-synthesis circuit and a −12V supply which is obtained from the negative d.c. output from the Mk. 4 chassis' switch-mode power supply.

The SAA1276 on-screen display i.c. is basically a read-only memory (ROM) which stores the characters 0 to 9 and enables these to be read out and displayed on the screen in a similar manner to teletext: the character output is fed into the green channel of the colour decoder i.c., together with a blanking signal to put a black box around the characters. The i.c. requires field and line sync inputs, and is fed with programme information from the Pa-Pd bus, channel information from the serial data line, and a display clock signal from the FS control i.c. A capacitor and resistor connected to one of the i.c.'s pins determine the length of time during which the characters are displayed.

If the signals on the Pa-Pd bus change, the programme number will be displayed on the screen: if the recall button on the handset is pressed, the timing of the display clock and serial data line signals is such that the channel information is also displayed.

Other Versions

The teletext version of the Mk. 4 chassis with remote control/frequency-synthesis tuning has the following additions:

(1) A Mullard teletext decoder module.

(2) 12V and 5V stabiliser i.c.s mounted on a heatsink for the teletext decoder's power supply inputs.

(3) A small text buffer panel (plugged into the teletext decoder). This incorporates emitter-followers to enable the SAA5050 TROM i.c. in the teletext decoder to drive the TDA3300 colour decoder i.c.'s data inputs.

(4) A small text interface panel to enable the SAA1251 remote control chip to operate the teletext decoder. The SAA1272 i.c. on this panel generates a suitable Mullard information bus signal (IBUS) from the data signal available at pin 17 of the SAA1251 i.c.

The text interface panel also contains a bleep generator. This operates on text commands from the remote control handset, to help the user to know that his page selections have been received by the remote control receiver system.

A different handset fitted with text command buttons is used.

In export models fitted with u.h.f. and v.h.f. tuners the SAA1174 i.c. is replaced with an SAA1274 which has outputs for switching the tuner supply between Bands I and III and u.h.f. The division ratios in this i.c. are such that the local oscillator frequencies for each channel will produce an i.f. at 38·9MHz instead of the 39·5MHz with the SAA1174.

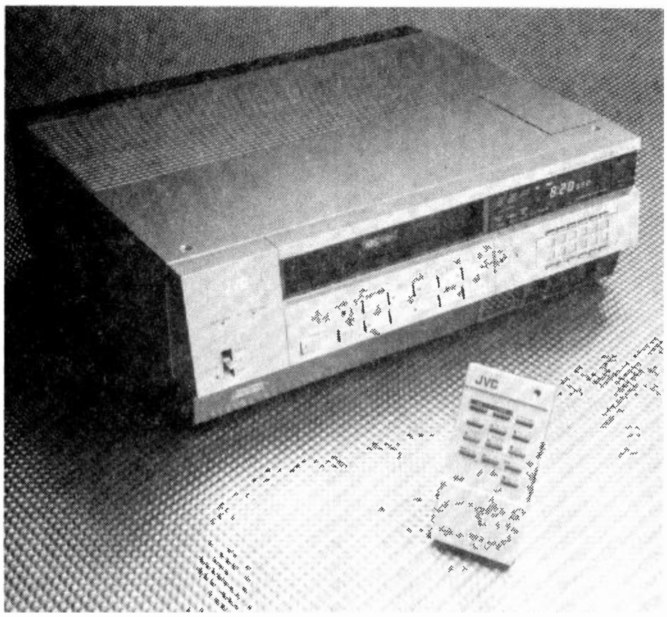
This article has described the basic features of the ITT system as used in the Rediffusion Mk. 4 chassis. It has not been possible to describe all the circuit details such as search tune, a.f.c., etc., or other ways of using the system such as seven-segment displays or programming from the handset. The system has been in production for over a year and has proved to be extremely successful.

The JVC HR7650

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

I'VE now received supplies of the new JVC VCR – the HR7650 which, amongst other things, features stereo sound capability. Last Saturday we recorded the Incredible Hulk and the replay was brilliant. The luminance recording and replay circuits have been redesigned: equalisation and peaking circuits enhance the signal without introducing edge noise or ringing, and a luminance comb filter technique hitherto found only in the more advanced Betamax machines (Sony C7 and Toshiba V8600/8700) has been added to reduce crosstalk. The recently introduced JVC HR7200/7300 machines also have the luminance comb filter, and as soon as more details are available I'll produce an article explaining the VHS approach to this technique. Meanwhile, treat recently distributed manufacturer's information explaining it by means of a timing diagram with an open mind!

The HR7650 also has a microprocessor in the capstan servo: its function is to control the noise-free still-frame selection and slow-motion tracking – as the slow-motion tracking is now automatic, there's no slow-motion tracking control. The microprocessor receives from the drop-out compensator circuit a pulse which represents any tracking error/noise. The timing of this pulse with respect to the CH1 edge of the head switching waveform indicates the tracking error. If the pulse appears before the CH1 edge, the tracking error is at the bottom of the screen, indicating that the tape transport has fallen short of its optimum position. The time between the pulse and the CH1 edge is measured and added to the next capstan motor stepping pulse, transporting the tape farther to compensate for the shortfall. Similarly if the pulse occurs after the CH1 edge the tape will have travelled too far and the next capstan stepping pulse is reduced in width.



The JVC HR7650EK stereo VCR which also features insert and assemble editing and full infra-red remote control.

When still frame is selected the microprocessor has eight frames to get it right, after which it stops anyway. In slow motion the correction is continuous. Unlike other VHS machines, where a tracking error can be seen shunting down the picture out of sight, the HR7650 is so rapid that tracking noise can barely be seen when a still frame is selected. Due to the automatic control it can accommodate, up to a point, tapes made on other machines.

Stereo/two-channel sound is a major feature, with Dolby noise reduction. As there are no stereo TV broadcasts at present in the UK, provision is made for use with simultaneous TV/f.m. radio stereo. A front panel switch enables the audio recording source to be either the tuner or an auxiliary input – hence video can be recorded with an auxiliary audio input.

Andy and I modified a Grundig A7681 stereo TV to switch to external inputs on the AV channel. We enjoyed watching Star Wars in stereo sound for a bit until Andy sold our first HR7650!

Assembly and insert edits are available on the HR7650. During an insert however not all the colour under carrier can be "over-recorded", and as a result a certain amount of colour flicker can sometimes be seen. Other than that, the edits are good. The audio edit flexibility is borrowed from U-matics. During full edits or audio dub edits only channel two (right) of the sound track is replaced. In playback there are three sound options: original audio, original and new audio, or new audio. So audio dubs can be performed and there's a choice to maintain background audio.

Good, innit?!

Teletopics

PHILIPS VIDEO DEVELOPMENTS

The LaserVision disc system has now been made available throughout the UK, through over 1,000 outlets. Philips Video divisional director Jimmy Dunkley commented that the decision to go national follows the successful introduction of LaserVision through 150 outlets in London and the south east. Though sales figures are not being released, there is talk of a "positive consumer response". The disc catalogue is being expanded beyond the current 120 titles, with additional feature films and special interest programmes, as part of a plan to widen consumer choice. The policy that the players and discs must both be available at all outlets is being maintained, and all current LaserVision stockists in the south east have been regularly visited to check on dealer reactions, shop displays, consumer responses and service back up.

National distribution is being supported with a major autumn advertising campaign which will boost the 1982 LaserVision promotional budget to nearly £3 million. Adverts will appear on television nationally, in the national press and on networked local radio and in regional newspapers, directing potential buyers to specific outlets.

On the VCR front, Philips have shown pre-production versions of a portable using the V2000 system. The machine is due for release on the UK market this autumn.

The Philips CS3850 22in. TV set with stereo sound also offers a more advanced teletext arrangement which Philips call Super Text. The idea is to simplify user operation by storing in a memory up to twenty frequently used page numbers which can be selected by pressing a single button. The succeeding and preceding pages to the one being displayed can also be selected more easily. Other features of the set include frequency-synthesis tuning and direct video and audio inputs.

TELESOFTWARE EXPERIMENT CONCLUDED

The experimental project on the use of telesoftware for educational purposes, organised by Brighton Polytechnic in conjunction with nine schools from Brighton in the south to Edinburgh in the north and with the support of the BBC, IBA and Mullard, has been successfully concluded. Just to remind you, the idea of telesoftware is to transmit computer programmes in the same way as teletext data is transmitted, so that simple computers with minimal storage capacity can be used at the receiving end. A summary report has been issued, and by the time this is read the full report will be available at £4·50 from the Faculty Officer, Faculty of Education Studies, Brighton Polytechnic, Falmer, Brighton, Sussex BN1 0PH. The conclusions can be summed up as follows. Telesoftware was found to be an efficient, cheap, reliable and practical means of making computer programmes available to schools, and proved to be an effective teaching/learning medium. By making television sets "intelligent", the system helped to gain interest in computing and introduce computers into areas where they had not previously been used. The polytechnic comment that it's now up to the broadcasters to decide on what commitment they will make to developing the idea, and to educationalists to decide on how to incorporate it into their teaching arrangements.

COMPACT VHS MACHINES

Both Sharp and JVC have announced portable VCRs using the new JVC compact VHS system (see Teletopics August). The system is now known as VHS-C. JVC's Model HR-C3 weighs 2kg without batteries. Sharp's Model VC220N weighs 2.2kg and has a recommended price of £420 for the machine alone or £550 including an a.c. adaptor/r.f. converter, battery pack and cassette. The mini cassette itself has a playing time of half an hour and fits into an adaptor for replay via a standard VHS machine.

PRESTEL'S PROJECT Y

To date Prestel has been a total flop so far as domestic users are concerned – it's seen as an expensive and unnecessary service. To counteract this view and encourage the use of electronic banking and shopping from home, British Telecom are engaged in negotiations with a bank to set up a joint venture which amongst other things will result in the offer of a free Prestel adaptor to some 100,000 households, with installations running at a rate of 2,000 a month. One aim is to get mass production of Prestel adaptors started so that the cost can be reduced to well under £100 each.

RGB OUTPUT IC

The latest generation of Mullard colour decoder i.c.s was mentioned in the March Teletopics column earlier this year. Mullard have now developed an RGB output i.c., type TDA3602, to partner the TDA3562A decoder chip, thus getting everything between the demodulated video and the c.r.t.'s cathodes into just two chips plus the necessary peripheral components. Black-current sampling is carried out within the TDA3602, with feedback to the TDA3562A to provide compensation. This reduces the number of presets required and provides automatic adjustment for black-level drift with tube ageing.

HITACHI LAUNCH MULTI-STANDARD VIDEO

The latest addition to the Hitachi VCR range is a four-standard machine capable of operating on the PAL, SECAM, NTSC-3·58 and NTSC-4·43 standards in both the record and playback modes. The new machine, Model VT8040EM, has a suggested retail price of £730 and is complemented by a similarly multi-standard 20in. CTV, Model CMT2060, with a recommended price of £477.

COMPANY COMINGS AND GOINGS

The biggest news on the company front last month was AEG-Telefunken's application for voluntary receivership and its subsequent bailing out with aid from the government and the firm's bankers. Due to the complex company structure, the Telefunken radio and television subsidiary was not affected. The move to link up with Grundig (see Teletopics last month) continues, but objections have been made by the W. German cartels office on the basis that Telefunken's participation in the joint J2T video venture (with JVC and Thorn) would, along with Grundig, give the combined group some 70 per cent of the W. German VCR market. The outcome of all this remains to be seen.

On the home front both Alba and Wharfedale have been reprieved. Alba Electronics are being bought from the receiver by Harvard International. The plan is to run the firm as an independent division trading as Alba Radio. Wharfedale has been bought by Tradewest Ltd. and renamed Wharfedale Loudspeakers. Only 50-60 of the 300 staff will be taken on initially, but it's hoped to be able to increase the workforce once production is resumed.

Tandberg, who only recently returned to the consumer TV market, have once again withdrawn. Tandberg's Norwegian CTV plant was closed down a couple of years back, its UK plant at the same time being sold to Mitsubishi. The sets being offered by Tandberg recently were manufactured by Loewe-Opta in W. Germany. In future Tandberg will be concentrating on the specialized fields of high technology hi-fi equipment and electronic learning aids, with some involvement in specialist television applications.

Nature abhors a vacuum as they say, and as one firm goes another steps in. The newcomer to the UK market is Zanussi, with a range of CTVs from 16in. upwards and a VCR manufactured by Grundig. Zanussi's current CTV production is some 250,000 sets a year, with the capacity to expand quickly to 400,000. Zanussi expect to sell some 18,000 sets during the first year in the UK. Earlier Zanussi sets came ex-rental from British Relay rather than directly through the Zanussi organisation.

EXTENDED PAL

We've mentioned before the BBC's proposed extended PAL system, which would make use of the wider bandwidth available with satellite broadcasting to provide improved reception by removing cross-colour effects – the system has been successfully demonstrated. Fig. 1 shows the signal spectrum, with the h.f. luminance signal components shifted to a higher frequency so that they no longer overlap with the chrominance signal. Fig. 2 shows the additions that would be required to the decoder.

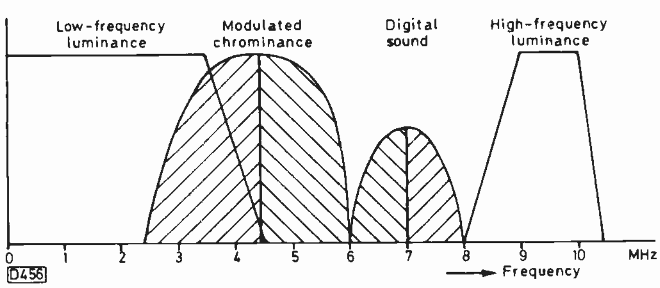


Fig. 1: Extended PAL signal spectrum.

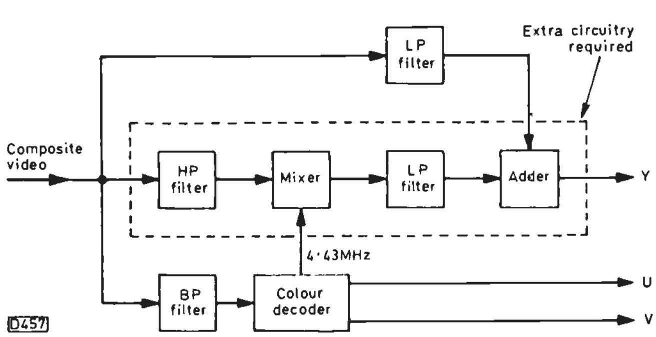


Fig. 2: Decoder arrangement for extended PAL reception.

These are quite simple – just a mixer, some filters and an adder stage. A neat feature is that by shifting the h.f. luminance signal by 4·43MHz the colour subcarrier can be used as the local oscillator signal. An important point is the compatability of the system with existing TV receivers: since the current generation of shadowmask tubes cannot resolve the h.f. luminance signal anyway, the extended PAL transmissions are displayed with no loss of definition and with the irritating cross-colour patterning removed.

KOREAN US CTV PLANT

Following in the steps of the major Japanese CTV manufacturers the Korean Gold Star company, a subsidiary of the Lucky Group, is setting up a CTV plant in Huntsville, Alabama to manufacture sets for the US market. The aim is production at the rate of 120,000 annually to start with, rising to 400,000 by 1987. S. Korea's vigorous consumer electronics industry could well be eyeing the European CTV market next.

TRANSMITTER OPENINGS

The following relay transmitters are now in operation:
Dumfries South BBC-1 ch. 40, Border Television ch. 46, BBC-2 ch. 48, TV4 ch. 50.
Hove BBC-1 ch. 39, TV4 ch. 42, BBC-2 ch. 45, Television South ch. 49.
Micklefield, High Wycombe BBC-1 ch. 54, Thames Television/London Weekend Television ch. 57, BBC-2 ch. 64, TV4 ch. 67.
Ness of Lewis Grampian Television ch. 41, BBC-2 ch. 44, TV4 (future) ch. 47, BBC-1 ch. 51.
Strathblane Central BBC-1 ch. 21, Scottish Television ch. 24, BBC-2 ch. 27, TV4 ch. 31.
Tarbert, Harris BBC-1 ch. 39, BBC-2 ch. 45, Grampian Television ch. 49, TV4 (future) ch. 52.

The above transmissions are all vertically polarised.

TV BURGLAR ALARM

Radio Rentals have under test in several areas a TV set that also acts as a burglar alarm. The alarm is incorporated in a teletext model and operates on an ultrasonic basis. After switching the set off the viewer sets the alarm which becomes effective twenty seconds later, emitting a piercing, high-pitched sound should an intruder subsequently enter the room. There's a fail-safe device should the plug be removed, and before switching on again the user has a twenty seconds time interval. Radio Rentals are offering the alarm for an extra £1·50 monthly.

SANYO'S BUDGET VCR

Another budget-price VCR, Model VTC5000, has been added to the current Sanyo range – joining the VTC5300P and VTC5400P. The new machine has soft-touch controls, monochrome picture search in the forward and reverse modes, an eight day, one programme timer and built-in r.f. signal loss compensator, with the timer display doubling as tape counter with memory function. The suggested retail price for this "bargain-hunter" model is £329·95.

It's been reported that exports of Japanese VCRs to the UK during the first half of the year comfortably exceeded those for the whole of 1981, suggesting that there could well be bargains in the offing.

Servicing the Rank Z718 Chassis

Part 3

John Coombes

IN this final instalment we'll be dealing with faults in the signals sections of the receiver.

The Decoder

The decoder is of the Mullard three-chip type – TBA560C, TBA540 and TCA800. The latter i.c. is followed by RGB driver and output stages, all direct coupled. Fig. 7 shows the driver and output circuits: the output stages operate under class A conditions, and negative feedback is applied to the bases of the emitter-follower drivers via resistors 3R60/1/2 to keep the black level constant. 3VT10 forms a common emitter load for the output transistors and provides a convenient method of setting the black level. There are one or two "extras" in the earlier part of the decoder. First a blanking pulse amplifier stage (3VT2). Secondly a timing circuit for the burst gating/black-level clamping pulses (3L12 etc.). And finally an overload circuit which reduces the contrast via pin 2 of the TBA560C i.c. in the event of an excessive output at pins 3, 5 or 7 of the TCA800 i.c. Diodes 3D8/9/10 conduct in the event of excessive RGB output signals, driving the base of one transistor in a differential amplifier circuit (3VT17/18) linked to pin 2 of the TBA560C.

For ease of reference we'll list the various faults and their usual causes.

No luminance: The usual cause is the luminance delay line 3DL1 going open-circuit. The TBA560C i.c. can also be responsible for this fault. Check by substitution – this is easy as all the i.c.s plug in.

Loss of one colour: First check whether the relevant output transistor is open-circuit. Other things to check are: the driver transistors; the drive presets 3RV6/7/8 (the tracks tend to give rise to intermittent faults); and the TCA800 i.c. by substitution.

If any further difficulty is experienced, check the first anode presets on the timebase panel. If faulty, make sure that the modified 2·2MΩ type is fitted in each position. Associated modifications that must be carried out are as follows: change 4R48 to 430kΩ and make sure that 4R44 and 4R45 are 510kΩ and 560kΩ respectively and are fitted between the collector of the constant-current transistor 4VT14 and the junction of 4D16/4R48.

Bright red/green/blue raster: Check whether the relevant output transistor is short-circuit or its load resistor 3R69/70/71 is open-circuit. This latter check is easy: switch off and touch the resistors lightly – a cool one is suspect. If necessary check the relevant driver transistor, the TCA800 i.c. and the condition of the first anode presets – careful movement of the relevant control will generally prove the point.

Floating colours: First check the TBA540 i.c. by replacement, then if necessary the 4·43MHz crystal (3XTL1). Occasional culprits are the chroma delay line and the reference oscillator frequency trimmer 3C35.

Bright raster (no picture) with flyback lines: Check whether 3R55 (120kΩ) in the line pulse feed to pin 8 of the TCA800 i.c. is open-circuit. Under this condition the voltage at 3TP2 will fall to about 0·5V.

Flyback lines at low brightness level: Ensure that the black-level preset 3RV13 is not set too high and check the condition of its track. If necessary check 3VT10 for being short-circuit.

Bright raster: Check the diodes 3D5/6/7 in the burst gate/clamp pulse timing circuit for being short-circuit.

Intermittent loss of brightness: Check the preset brightness control 3RV11. Then if necessary check 4R46/7 on the timebase panel (see Part 1).

Blank raster: Check the TBA560C i.c. by substitution. The TCA270Q i.c. in the i.f. strip and the tuner unit can also be responsible for this fault.

Black zigzag shading at the top of the picture: This is a strange fault when you first encounter it. The cause is the diode (3D1) in the field flyback pulse feed going short-circuit. It's type BA317.

No colour or intermittent loss of colour: A clue is given by measuring the voltage at 3TP2 (TBA540 pin 9, TCA800 pin 14, and, via 3R42, TBA560C pin 14). A normal reading is about 1V. If the reading is 2·5V the colour-killer is operating – it can be overridden by pulling out link 3LK2. If the voltage is 4V there's no burst signal. This condition can be obtained by shorting together 3TP3/4 – so that the set a.c.c. control 3RV2 can be adjusted (for 4V at 3TP2). If the reading is 6·5V there's a mis-ident condition – the burst swings but the bistable is out of step.

When confronted with the no colour condition you will usually find that the voltage at 3TP2 is 4V. This may vary according to the particular cause of the fault. As a first step check all three i.c.s by substitution, which is easy enough to do. Make sure that the pins aren't bent or turned over when removing/refitting the i.c.s as this may induce another fault. And don't push too hard as this can cause dry-joints on the print side or even cracks in the panel/print.

Other things to check are the chroma delay line which may be open-circuit and the set a.c.c. control 3RV2 which is sometimes responsible for intermittent loss of colour – this can sometimes be detected when setting up the control, i.e. a variation in the voltage at 3TP2 is obtained instead of 4V.

In stubborn cases check the following items: The 4·43MHz crystal (3XTL1) which may be open-circuit. Capacitors 3C12 (0·1μF), 3C24 (10μF), 3C28 (220pF), 3C36 (0·33μF) and 3C40 (0·33μF) for shorts. These defects will produce a reading of 4V at 3TP2. If 3C22 (22μF) is short-circuit the reading at 3TP2 will be 1V. If 3C27 (2·2μF) is short-circuit the reading at 3TP2 will be 3·5V.

Finally note that the cause of the fault may lie on the timebase board (see final paragraph of Part 1) or in the tuner (see later).

IF Strip

The main source of trouble in the i.f. strip is the TCA270Q vision demodulator i.c. In the event of a blank raster check this i.c. by substitution or by checking the

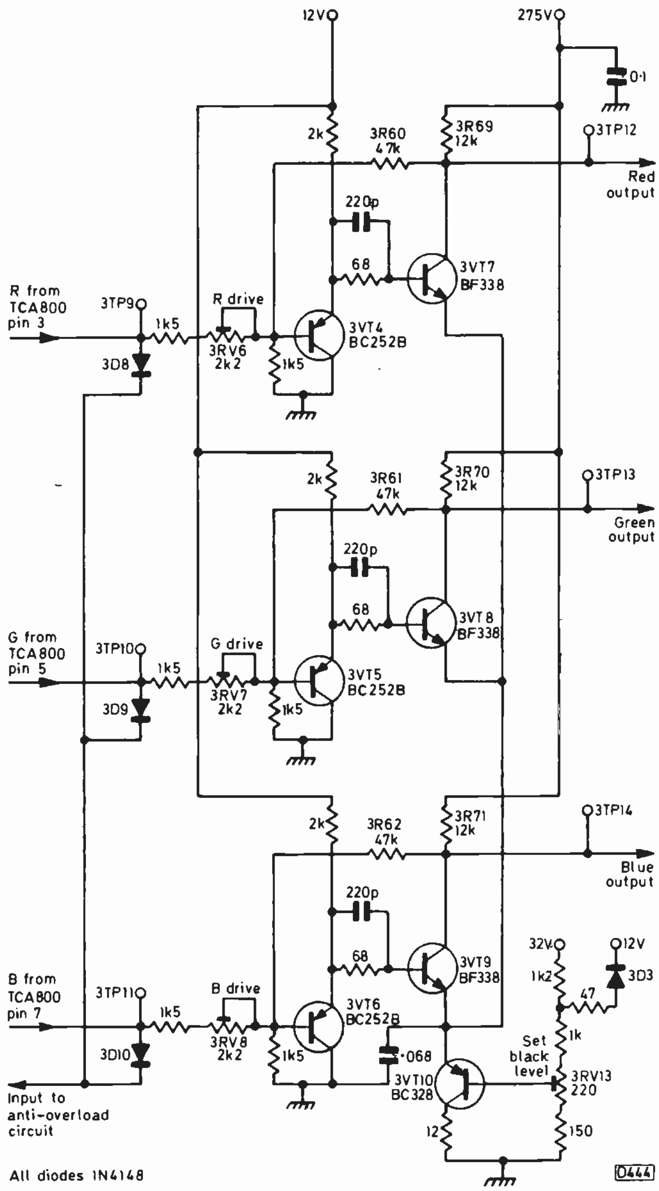


Fig. 7: The RGB driver and output stage circuits. 3VT10 forms a common emitter load for the output transistors.

voltages very carefully. This fault can also be caused by the i.f. strip l.t. feed components – check whether 2R4 (10Ω) is open-circuit or 2C13 (100μF) short-circuit. The TCA270Q i.c. can also be responsible for poor field sync or, on occasions, loss of sync.

There are three transistors in the i.f. strip. Any of them can go open-circuit, but it's usually 2VT2 (BF198) that's at fault. The result is a very snowy picture or no picture at all, just grain. These faults can also be due to the tuner or the aerial system of course. Voltage checks on the transistors will reveal which one if any is defective.

Mechanical Tuner

Since the tuning buttons are so frequently used they tend to break up around the star shape which pushes over the tuner bar, making it impossible to tune or, in extreme cases, making it impossible to push the bar in to select any channel. The compression springs stretch or get caught under the push-button bar, with the result that it's impossible to change channels.

The main cause of failure is the moulded nylon nuts or slugs which can be responsible for no colour, intermittent colour, a snowy picture, lines on the picture, picture jumping or rolling, poor sound, buzz on sound – even a poorly focused picture. The nylon nuts can get slack and slide on the bar, or crack and break up altogether.

A word of warning. After removing the metal can that covers the tuning slugs, make sure that it's replaced correctly. If you obtain a replacement, check whether it's received a knock in the post. The problem is that a misfitting cover can cause component short-circuits at the back of the tuning assembly. This may result in a blank raster with no sound or picture, which can be misleading – especially if you are out in the field.

If when changing channels you get flicks and flashes and have to retune there's excess grease around the bar on which the tuning vanes are mounted. Remove and clean, also oil the ball bearing at the end of the tuner assembly. Check that there are no particles of solder floating around as these can cause a temporary short-circuit on the vanes. Check that the vanes themselves aren't touching – when held up to the light it should be possible to see a small gap all round the traverse of the vanes.

When the tuner cover has to be removed make sure that you replace the rubber packing and copper screen when the job has been completed. Failure to do this can lead to mistuning and affect the performance on the higher channels.

A blank raster (no sound or picture) may be due to oscillator failure. Check the BF181 mixer/oscillator transistor 1VT2. It's possible to change this transistor, but make sure that you cut the leads to the same length and insulate them where necessary to avoid short-circuits. The lead length and positioning are important.

If the picture is grainy or snowy, check the BF180 r.f. amplifier transistor 1VT1 which sometimes goes open-circuit. Check that the 12V supply is reaching the tuner unit at 3Z5 pin 3, and that the bias resistor 1R3 (1·2kΩ, mounted on top) is not open-circuit.

One point I feel it's important to emphasize is that the aerial isolator is a safety component which should be replaced only with the correct type from the manufacturer.

Varicap Tuner

The usual faults caused by the varicap tuner are a snowy picture, a blank raster (no signals) or intermittent thin black pencil lines. The tuner is difficult to service and it's much simpler and more economic to unsolder it from the subpanel and fit a replacement. If the picture is slightly grainy after doing this, adjust the r.f. bias control 1R102 for a clean picture – do this with a signal you know and is clean to start with.

One of the most common faults is tuning drift. In this event check the TAA550 tuning voltage stabiliser i.c. You may find that applying freezer and warm air results in a variation on the 33V line. Take care not to apply excessive heat or you may get extra trouble. I've noticed on several occasions that a voltage reading of 28V is obtained with a defective TAA550, so this is one clue. Other causes of drift are the tuner unit itself and the tuning potentiometers – check the carbon tracks.

Miscellaneous Points

Random channel changing can occur with touch-tuned sets. Check whether the sensors are clean, also for spray polish. If still in trouble replace the ETT6016 touch-tune control i.c. Remember to handle it with care as it's a MOS device. On later models a 100kΩ resistor was added between the base and emitter of the BC157 shunt stabiliser transistor 9VT1, mounted on the print side, to prevent damage to 9VT1 and/or the ETT6016 i.c.

If the remote control unit won't change channels or mute the sound, check the PP3 9V battery and the switch (11SW1) which cracks the metal strip, resulting in failure to turn on. Also check the switch contacts which can bend and fail to operate. A high-Q coil is used to give maximum battery life – battery failure should lead to a check on the switch contacts in case they are making all the time.

The following circuit changes apply to 20/22/26in. models and should have been noted in the captions to Figs. 3 and 4. An 0·1μF decoupling capacitor is added between pins 3 and 2 of the line output transformer. A 2·2μF decoupler is added between the h.t. end of the line driver transformer's primary winding and chassis. One side of the line windings on the NS transductor is earthed (instead of being taken to pin 5 of the line output transformer). The capacitor in 5VT6's base circuit is 0·33μF.

Finally note that "standard" and quick-heat c.r.t.s have been fitted. If you change from one to the other, it's important to adjust the c.r.t. heater voltage coil 5L14 – otherwise the tube will be damaged.

Letters

THORN 9000 CHASSIS

I've also had the fault of tripping on channel change with the Thorn 9000 chassis (Service Bureau, September). After a period of time the set would trip intermittently. The problem was cured by replacing the 87.9V line reservoir capacitor C715 (22μF) – on removal it had white deposits around the base. Mick Dutton referred to this trouble in the March 1982 issue (page 247).

R.J. Musson,
Solihull.

CAPACITOR TESTER

With reference to my letter on Victor Rizzo's simple capacitor tester in the January 1982 issue and your editorial note, I tried the modified circuit arrangement suggested but found that the voltage across the test probes was only about 26V. This was increased to 100V by changing the value of the 47kΩ resistor to about 140kΩ. I've since developed the device to make it more flexible, the resultant circuit being shown in Fig. 1. The initial capacitor test remains as before. To recap, no suggestion of a flicker when a capacitor is tested indicates that it's open-circuit, a continuing glow that it's short-circuit, and continuing flickers that it's leaky: a good capacitor will light the neon (N1) momentarily as it charges, the glow depending on the capacitor's value.

A second capacitor test has been added as follows. If the first test indicates that the capacitor is good, discharge the capacitor through the neon (the power supply can be left on or switched off). A good capacitor will flash the neon as before, but there are advantages in making this second test. First the discharge flash obtained is brighter than the charging flash. If the flash is missed when making the initial test, especially with low capacitor values which produce a weak flash, this second test will prove the point one way or the other. It also proves that the capacitor can hold a charge: I've found that a new 0·1μF 600V capacitor will flash the neon 24 hours after charging.

In use, check first with probes A and B to each side of the capacitor. If the capacitor is good, remove probe A and after a few seconds apply probe C or D depending on the capacitor's value. Below 0·2μF, use probe C; for 0·2μF or above use probe D which adds the current limiting resistor R5 (10kΩ).

Note that the tester is not meant for testing electrolytics. Low-value electrolytics of up to 25μF can be connected across the probes however provided the capacitor is rated at over 100V – observe polarity! The neon should glow and extinguish in less than thirty seconds. After the electrolytic has charged, leave it for a while before discharging it via the 10kΩ resistor. If the neon glows you will know that the electrolytic has held its charge.

Probes A and B can be used to make continuity tests on neons, fuses, lamps, etc. Rectifier diodes can also be checked. With the anode to A the neon will glow – if it glows with the cathode to A the diode is short-circuit. For most other types of diode the tester is unsuitable.

A mains polarity test is also included. Plug the tester into the mains socket, make sure that all probes are clear, then switch the power on. Press push-button switch PB. If both neons are off, link probes A and B. Two electrodes should glow (one in each neon), indicating that the polarity and earth connections are o.k. If all four neon electrodes glow when switch PB is operated the input is a.c. – don't use the probes, switch the power off as the polarity is reversed.

Leave switch PB open for all other tests so that the circuit is disconnected from earth. Capacitors being tested must not be connected to earth.

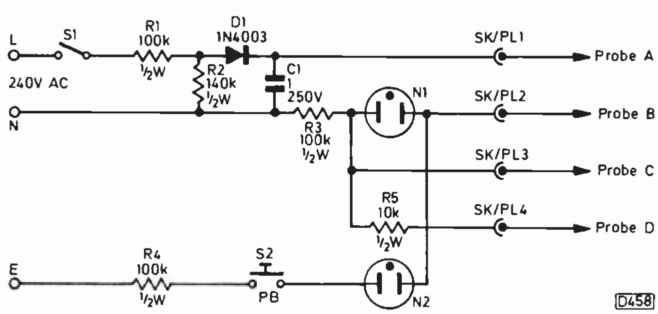


Fig. 1: Modified capacitor tester circuit.

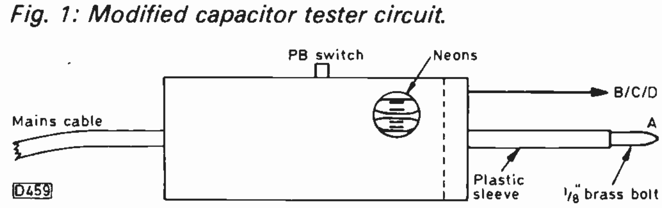
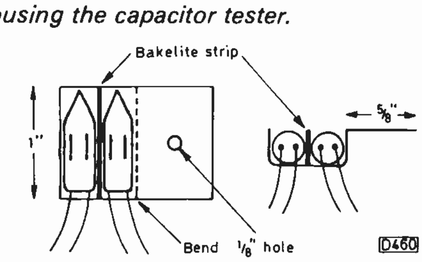


Fig. 2: Method of housing the capacitor tester.

Fig. 3 (right): Method of securing the neons.



The probes can be connected via suitable sockets as shown in the circuit. A and C are probes, but B can be an insulated crocodile clip. Probe C can be used in the D position by connecting it to SK4 instead of SK3. The voltage across A and B should be 100V with R3 140kΩ. Increasing the resistance value increases the output voltage. If the polarity test feature is not required, omit R4, PB and N2.

I housed my unit in a plastic pill bottle (see Fig. 2). You could alternatively use Victor Rizzo's original idea (see March 1981). There are other possibilities of course.

A bracket to hold the neons can be made from a one inch strip of aluminium as shown in Fig. 3. Cover the leads with plastic tubing and glue the neons in position (I used Araldite).

C1 can be checked by switching on and off and then after about ten seconds linking probes A and B. A good capacitor will discharge and flash the neon.

Walter Spencer,
Brisbane, Australia.

OLDER SONY COLOUR SETS

There are quite a few of the older Sony colour sets in our area, and as the original agents in these parts have ceased to trade the sets tend to come to us when faults arise. A recent case may be of interest to others who find themselves in this position. Because of its symptoms, we christened the fault the "barber's pole". There was weak, incorrect colour, with a barber's pole spiral of red and green bands down the left-hand side of the picture. These bands varied in width but extended roughly a third of the way across the screen. The decoder circuit is not easy to follow – we're referring to the early non-PAL type – but we've found that the voltage readings given by Sony are very accurate. We eventually traced the cause of the fault to one of the 2SC633A transistors in the flip-flop circuit that controls the colour switching, the evidence being a slight discrepancy in one of the collector voltages. The same fault, this time intermittent, has since occurred in another of these sets that came our way.

Richard Roscoe,
St. Austell, Cornwall.

SIMPLE ZENER DIODE CHECKER

This simple zener diode checker will help those who buy "bargain" components which are often unmarked or have their markings smudged or illegible. Apart from that it's always worthwhile checking zener diodes before inserting them in circuit – many zeners will zener but are not true to their markings! The checker will distinguish a zener diode from an ordinary rectifier or signal diode and will cater for zener diodes rated at up to 33V, indicating their polarity and showing whether they are short- or open-circuit. It's very basic and is not to be compared with the checkers/analysers on the market. My prototype has given satisfactory service for over five years however.

The unit can be contained in a common 13A plug (see Fig. 4). Two miniature crocodile clips with the back parts opened flat, then bolted or otherwise fixed to the top of the plug, are used to hold the diode under test. Readings are taken by connecting a 20kΩ/V meter across the clips. There's more than enough space within the plug to house the few components used, but since the thing is plugged into the mains directly it's imperative to ensure that no shorts take place. Use wide sleeving to cover the three resistors, leads and all. Note that the 22kΩ resistor is connected to the live terminal and the 56kΩ one to neutral (see Fig. 5). Wire a suitable bell push across the 56kΩ resistor to short it out as necessary. The bridge rectifier is a high voltage one which fits snugly into the space shown and is rated at 1·6kV, 0·5A – for safety. Even when the test terminals are shorted together the current flowing will be very small (about 10mA when the push switch is pressed). A second 22kΩ resistor is connected across the output from the bridge rectifier to tame the off-load d.c. voltage across the terminals. It also reduces the slight but sometimes annoying (though quite harmless) shock the user is apt to get if the test terminals are touched when a diode is not in place.

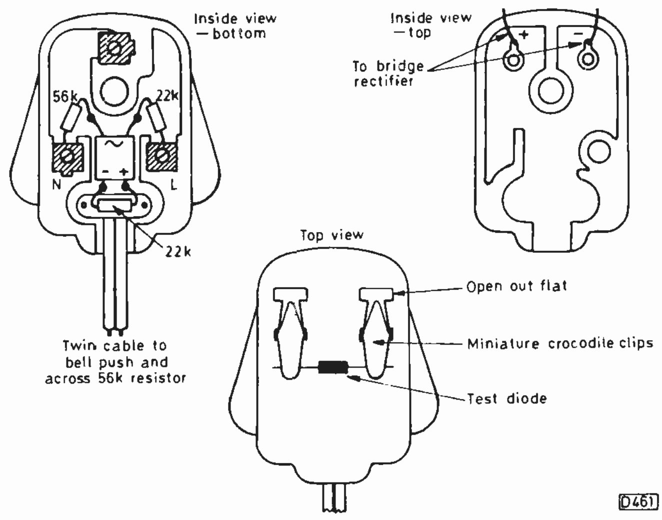


Fig. 4: Constructional details of the zener diode checker.

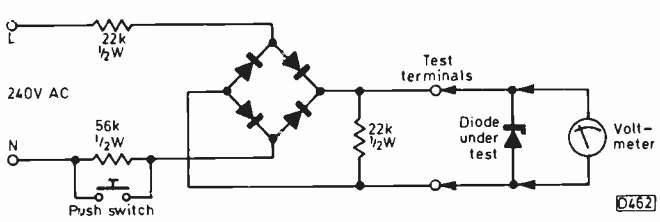


Fig. 5: Zener diode checker circuit.

After building the unit, check the voltage and current across the test terminals, using a 20kΩ/V meter. With the bell push off, the readings should be about 40V and 2·5mA. When the bell push is pressed the readings should rise to about 100V and 10mA.

If everything is all right, connect a zener diode to the crocodile clips and set the meter to a suitable scale. If the zener diode is connected the right way round, the meter should show the zener voltage. Press the switch and note whether the voltage reading changes appreciably. A certain degree of difference between the two readings is acceptable, especially with lower voltage devices. A big difference generally means that the zener diode is defective or second rate.

If the diode is connected the wrong way round the voltage reading will be about 0·6V. An ordinary silicon diode will give readings of about 40V when reverse biased and 0·6V when forward biased. A short-circuit diode of any sort will give no reading or very little reading either way round. An open-circuit diode will show the full voltage (40V) both ways round. A germanium diode will give much the same readings as a silicon diode, but a lot depends on the type.

Victor Rizzo,
Msida, Malta.

Big Boys Don't Cry

Les Lawry-Johns

"Will you pop down and have a quick look at my set? It's fairly new, so there won't be much wrong with it. As you did my sister's the other week and were there only a couple of minutes I thought I'd ask you rather than take it back to where I bought it. I was watching that John Wayne film last night and was just beginning to enjoy it when the set went off."

I scowled at the phone. What she really meant was that I hadn't charged her sister very much since she was getting on a bit, and now she wanted the same treatment. Oh well. So I agreed to call as she had no transport and later that afternoon I arrived at her flat. As she let me in she started off again.

"Just as I was enjoying that John Wayne film, off it went. Makes you sick the way these things let you down just when you're enjoying a film. It's as though they know. Ha, ha."

Battle with a Pye 184

I made my way to the set, which was a Pye Model 184 – solid-state monochrome 176 chassis with 24in. c.r.t. A set in fact with which I'd rarely tussled. It was on a stand, and had about twenty thousand ornaments and photographs on top. She collapsed into an armchair and fanned herself with a book. I wasn't going to get any help with the clearance then. I started to remove the paraphernalia, and in doing so accidentally dropped an ornament that wouldn't be damaged by the fall.

"Oh dear!" She shot out of the chair and the top of the set was clear in no time. "You really must be more careful – these things are precious to me."

"I never could be trusted to clear the top of a telly" I admitted.

"I hope you're more careful with the inside" she commented.

"I usually muck up more sets than I mend" I cheerfully assured her. I then removed the rear cover (sliding a screwdriver into each slot fastening) and peered into the interior. A vertical printed panel surrounded the tube, held vertically by two side plastic clips. The panel flopped down when the clips were released, revealing two wirewounds (lower centre) that had sprung their thermal springs. Without the circuit I assumed they were in the feed to the line output stage. My spirits sank: no quick job here.

"Have you done it?" the lady enquired.

"No I bloody haven't" I muttered. I hooked up the soldering gun and repaired the two springs, then on second thoughts unsoldered them to check for shorts. There didn't appear to be any, and as the BU205 line output transistor seemed to be o.k. I once more soldered up the springs and applied the mains. The sound came through and the lady beamed. I waved my neon over the line output transformer and it glowed – but only just.

I looked at the screen with the brightness turned up and there was just a dull glow there also. The e.h.t. rectifier is of the stick type, so I switched off, removed the end cap and tried again. The neon didn't respond any better, and I was aware of heat coming from the line output transformer's overwinding, accompanied by the smell one gets from overheated plastic. The lady must have been watching my face rather than the set, because she knew the news would be bad.

"Will you have to take it away?"

I nodded. "It wants a new transformer and I haven't one with me. There isn't one at the shop either, so I'll have to send off to Philips for one. That means it may be away for quite a few days."

"Oh. Then I'll have to watch my sister's. It was a good job you were able to do her's, wasn't it?"

Back on the Bench

So I hauled the set back to the shop, where I stupidly had another go at it instead of leaving it till the transformer came. I had Sam Magrew's Bush in mind, the occasion when we lost three transformers in a row, and didn't want a repeat performance. Also upon looking at the circuit I couldn't quite see why the second wirewound resistor should have gone open-circuit – it was in the feed to the line driver stage, the other one being in the feed to the line output stage. R615 (6·8kΩ) and R631 (82Ω) respectively. So I checked the line driver stage carefully, but couldn't find anything amiss here. Whilst in the area I again checked the line output transistor, and was amazed to find that it was now short-circuit. It certainly wasn't so in the lady's flat, so why now? Had the hot line output transformer administered one parting slap in the face before R631 sprang open again, or was there something more sinister here? How could I check without the new transformer?

So I disconnected the overwinding at both ends and made a note of the line output transistor connections – white to the collector, grey to base, red to emitter. With some difficulty I removed the faulty transistor and fitted a new one – leaving three on the shelf with a similar number of BU208As. After making sure that there were no leaks, I switched on and checked the supply voltage at R631: 70V where there should have been 200V or more. I switched off before R631 could spring, and checked the line output transistor. It was short-circuit and the overwinding was still hot, even though disconnected. It would have to come off.

Removing the transformer was easy, removing the overwinding was not. Eventually, by fair means or foul, the winding was rendered impotent (which makes two of us, though I have high hopes of these heart pills I've been swallowing of late). Again with difficulty I fitted another line output transistor, and just to be on the safe side I clipped a wirewound of some 300Ω in series with R631. Everything was in place, including the bare looking transformer, and with some optimism I switched on. Clonk. Another dead line output transistor.

Panic set in. Obviously someone up there didn't like me. So I put the set to one side and repaired a couple of sets that had been waiting patiently for attention. They were both despatched in minutes, which meant that in no time I was back to the horrible Pye. I thought I'd better think.

I thought long and hard but I couldn't make any sense of it, partly because I find it hard to think straight and partly because I haven't much sense anyway. So I wearily swung down the panel and looked at the shorted line output transistor. I looked again and then shone my little torch on it. What was that grey lead doing on the collector, and more ominously what was that white lead (h.t.) doing on the base? Surely I couldn't have been such a fool? Yes I could, and heaven only knows what might be wrong now.

I decided to adopt a different approach. The line output stage circuit is shown in Fig. 1, and as can be seen the line output transistor's emitter is connected to the 35V rail. This supply is provided by rectifier diode D631, which rectifies the voltage developed across winding 6-7 on the line output transformer to produce 35V across its reservoir capacitor C626. 12V and 22V supply lines are derived from the 35V supply, the former being stabilised by transistor TS301. If something linked to the 35V line was the cause of the trouble, we could apply an external 25V supply and monitor the current without the need for the line output transistor to be connected. This we did, and after a lot of unhooking this circuit and that we discovered that the 12V regulator transistor TS301 (BC328) was playing about.

A replacement was fitted and the circuit was deemed to be in full working order. Another line output transistor was put in and correctly wired. Some 600Ω worth of wirewounds were inserted in the h.t. feed to the line output stage and the set was switched on. The tube heater lit up (much to my surprise), indicating that the line output stage was at last functioning correctly, even at this reduced power. So we took out some of the wirewounds, leaving about 200Ω in just in case. The line output stage continued to work, so we took out the rest and soldered the spring of R631. We were still left with no e.h.t. of course, so we tried a couple of experiments with a five-stick tripler. As the results were disappointing, we resolved to await the arrival of the new line output transformer from Philips.

There is one point not so far mentioned. When we applied the 25V to the 35V line for test purposes we also loaded the h.t. supply to the line output stage (with the transistor disconnected), using a 40W light bulb to simulate the line timebase load. We did this so that we could monitor the h.t. voltage, which was high and not adjustable (R312, labelled width) until the 12V regulator transistor had been replaced – the 12V regulator, the 35V supply and the h.t. regulator circuit are linked. Once the 12V regulator transistor had been replaced we were able to adjust the h.t., thus making our little light get brighter or darker as the voltage varied between 180V and 240V. We set it for the correct 220V.

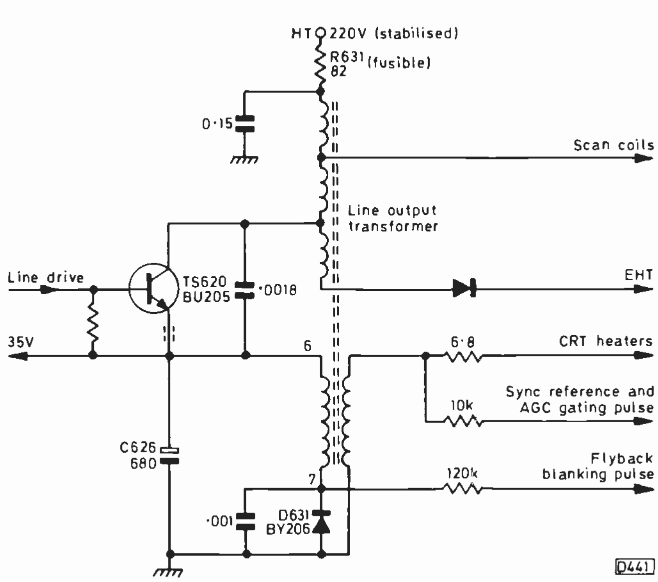


Fig. 1: Line output stage circuit used in the Pye 176 solid-state monochrome chassis (version with A61-520W c.r.t.).

When the transformer arrived we fitted it and the set performed quite nicely. We returned it to the lady who had broken quite a large number of the china ornaments that had previously adorned the top of the TV set. This was a blessing in disguise we said, since a lot of bits and pieces on the top of a TV set tend to make it go wrong more often . . .

I've condensed this little story into a few words, but in reality it caused me any amount of heartache and a fair amount of expense – I lost more line output transistors than actually mentioned. I felt like crying.

Errant Chips

Hard on the heels of the Pye came a Bush set fitted with the T22A chassis – the one with the surface-wave filter and TDA2540 i.f. chip. The complaint was that reception would be perfectly acceptable for some time, after which the picture would fade with loss of colour. The sound and vision would then be completely lost for a period which varied. On test the fault didn't show up for quite a time. The symptoms were then as described – first loss of contrast, then excessive noise followed by complete loss of signals.

I first suspected the 12V regulator, since we've had trouble with the 910Ω resistor in this circuit, but a quick check revealed that all was well here. So we checked the voltages around the TDA2540, and found a wild variation at pin 4 (tuner a.g.c. output) where the voltage rose to 8V as the signals faded out. We had one TDA2540 on the shelf, and this was fitted after removing the signals panel and inspecting it closely for any dry-joints etc.

The board was replaced, and we confidently viewed the picture. Like a rock it was, perfect. For a time that is. Then it started to fade again to suggest that we'd made another hasty and inaccurate diagnosis. The voltage at pin 4 was still varying – probably trying to make up for the lack of signals due to a fault in an earlier stage I thought. What precedes it? The tuner, a two-transistor preamplifier, then the SWAF. The two transistors checked out o.k. and I was not inclined (didn't want) to suspect the filter. So the tuner was the obvious suspect (to me). Out again came the panel, and in went another tuner. Again we had high hopes: again they were dashed after two hours.

I then grabbed the hairdryer and freezer and played for ten minutes. The conclusion was beyond doubt. Everytime the TDA2540 was sprayed, the signals returned as good as gold. I searched the shelf but there was no sign of a TDA2540. So I phoned my friend Geoff of Moon Lane and he said "rest in peace my son, for I have two." Off I went on my little roller skate (Renault 5) to see him. When I got there he was in trouble with an ITT CVC30. He was still in trouble when I left, because he said my remarks added to the confusion. I had my chip however, and lost no time in fitting it. This time we were rewarded and the gain stayed steady despite lots of heat and cold.

INTERNATIONAL

A country by

Country	Colour	Standard	Mains supply
Abu Dhabi	PAL	B	240V 50Hz
Afghanistan	PAL	B	220V 50Hz
Algeria	PAL	B	220V 50Hz
Antigua	NTSC	M	230V 60Hz
Argentina	PAL	N	220V 50Hz
Australia	PAL	B	240V 50Hz
Austria	PAL	B,G	220V 50Hz
Bahrain	PAL	B	230V 50Hz
Bangladesh	PAL	B	230V 50Hz
Barbados	NTSC	M	110V 50Hz
Belgium	PAL	B,G	220V 50Hz
Bermuda	NTSC	M	120V 60Hz
Brazil	PAL	M	110V 50Hz
Brunei	PAL	B	230V 50Hz
Bulgaria	SECAM (V)	D	220V 50Hz
Canada	NTSC	M	120V 60Hz
Canary Islands	PAL	B	220V 50Hz
China	PAL	D	220V 50Hz
Colombia	NTSC	M	110V 60Hz
Congo	SECAM (V)	D	220V 50Hz
Costa Rica	NTSC	M	120V 60Hz
Cuba	NTSC	M	120V 60Hz
Cyprus	PAL/SECAM	B,G	230V 50Hz
Czechoslovakia	SECAM (V)	D,K	220V 50Hz
Denmark	PAL	B,G	220V 50Hz
Dominican Republic	NTSC	M	110V 60Hz
Dubai	PAL	B,G	220V 50Hz
Ecuador	NTSC	M	110V 60Hz
Egypt	SECAM (V)	B	220V 50Hz
Eire	PAL	A,I	220V 50Hz
El Salvador	NTSC	M	115V 60Hz
Ethiopia	—	B	220V 50Hz
Finland	PAL	B,G	220V 50Hz
France	SECAM (V)	E,L	220V 50Hz
Germany (West)	PAL	B,G	220V 50Hz
Germany (East)	SECAM (V)	B,G	220V 50Hz
Ghana	PAL	B	230V 50Hz
Gibraltar	PAL	B	240V 50Hz
Greece	SECAM (H)	B	220V 50Hz
Guatemala	NTSC	M	120V 60Hz
Haiti	SECAM (V)	M	115V 60Hz
Honduras	—	M	110V 60Hz
Hong Kong	PAL	I	200V 50Hz
Hungary	SECAM (V)	D,K	220V 50Hz
Iceland	PAL	B	220V 50Hz
India	PAL	B	230V 50Hz
Indonesia	PAL	B	220V 50Hz
Iran	SECAM (H)	B	220V 50Hz
Iraq	SECAM (H)	B	220V 50Hz
Israel	PAL	B,G	230V 50Hz
Italy	PAL	B,G	220V 50Hz
Ivory Coast	SECAM (V)	K	220V 50Hz
Jamaica	—	M	220V 50Hz
Japan	NTSC	M	100V 60Hz
Jordan	PAL	B	220V 50Hz

Table 1: Internatio

CCIR system	*Number of lines*	*Channel bandwidth (MHz)*	*Vision bandwidth (MHz)*	*Sou sep (MH*
A	405	5	3	– 3
B	625	7	5	+ 5
C	625	7	5	+ 5
D	625	8	6	+ 6
E	819	14	10	+11
F	819	7	5	+ 5
G	625	8	5	+ 5
H	625	8	5	+ 5
I	625	8	5.5	+ 6
K	625	8	6	+ 6
K′	625	8	6	+ 6
L	625	8	6	+ 6
M	525	6	4.2	+ 4
N	625	6	4.2	+ 4

The field frequency is 50Hz except for system M which uses 60 system M which uses ±25kHz. Systems C, E, F and H are bec 220V 50Hz

Resistors: Beware!

Bryon Pascoe

SURELY I can't be the only one who occasionally spends fruitless hours trying to repair a TV set by changing various major components only to find in the fullness of time that the cause of the trouble was a simple resistor costing a few pence? We may then be left with the exercise of using trade lingo to dress up the customer's bill, since "changing resistor five pence, labour thirty quid" never seems to be acceptable!

As an example, I was confronted with a dead Pye CT200 – the 18in. colour set, using the 713 chassis. We found that operating the on/off switch produced a buzz, then nothing more. We got out the books, including the fault-finder one that never seems to list the fault you've got. Then the fault-finding merry-go-round started in earnest, including amongst other things changing the line output transformer. All needless! Several hours later the set was still dead. It stayed that way until R519 (220kΩ) on the main chassis was changed. It read o.k. in circuit, but was open-circuit when tested out of circuit. A lesson there somewhere. In case you're not familiar with this chassis, R519 is the charging resistor in the BR101's triggering circuit (when the BR101 fires, the BT106 controlled h.t. rectifier switches on).

Whilst on this chassis, a couple of other recent resistor faults: tube heaters out due to failure of the two 1Ω resistors R767/8 on the main chassis; and no signals, only noise on sound and vision, due to R209 (22kΩ) on the signals panel being open-circuit (thus no tuning voltage supply).

Hands up those of you who've changed a tube on a Pye 731/725 series chassis only to be confronted with the same lousy picture. More than likely our arch enemy the resistor was responsible, this time R642 (270kΩ) and R643 (390kΩ) in the first anode supply network on the line timebase panel.

A regular dead set problem occurs on the Rank

TV STANDARDS

country guide

Kenya	PAL	B	240V 50Hz
Korea	NTSC	M	100V 60Hz
Kuwait	PAL	B	240V 50Hz
Lebanon	SECAM (V)	B	220V 50Hz
Liberia	PAL	B	120V 60Hz
Libya	PAL	B	230V 50Hz
Luxembourg	PAL/SECAM (V)	C,G,L	220V 50Hz
Malaysia	PAL	B	230V 50Hz
Malta	PAL	B,G	240V 50Hz
Mauritius	SECAM (V)	B	230V 50Hz
Mexico	NTSC	M	127V 60Hz
Monaco	SECAM (V)/PAL	C,G,L	220V 50Hz

ıal TV Standards

nd-vision ıration 'z)	*Vestigial sideband (MHz)*	*Vision modulation sense*	*Sound modulation*
.5	0.75	+	a.m.
.5	0.75	–	f.m.
.5	0.75	+	a.m.
.5	0.75	–	f.m.
.15	2	+	a.m.
.5	0.75	+	a.m.
.5	0.75	–	f.m.
.5	1.25	–	f.m.
	1.25	–	f.m.
.5	0.75	–	f.m.
.5	1.25	–	f.m.
.5	1.25	+	a.m.
.5	0.75	–	f.m.
.5	0.75	–	f.m.

ɪz. The f.m. sound maximum deviation is ±50kHz except for
ɪming obsolete and are being replaced by B, G or L.

Morocco	SECAM (V)	B	220V 50Hz
Netherlands	PAL	B,G	220V 50Hz
New Zealand	PAL	B	230V 50Hz
Nicaragua	NTSC	M	120V 60Hz
Nigeria	PAL	B,G	220V 50Hz
Norway	PAL	B	230V 50Hz
Oman	PAL	B	240V 50Hz
Pakistan	PAL	B	230V 50Hz
Panama	NTSC	M	120V 60Hz
Peru	NTSC	M	220V 60Hz
Philippines	NTSC	M	110V 60Hz
Poland	SECAM (V)	D,K	220V 50Hz
Portugal	PAL	B,G	220V 50Hz
Puerto Rico	NTSC	M	120V 60Hz
Qatar	PAL	B,G	240V 50Hz
Saba and Sarawak	PAL	B	240V 50Hz
Saudi Arabia	SECAM (H)	B,G	220V 50Hz
Sierra Leone	PAL	B	230V 50Hz
Singapore	PAL	B,G	230V 50Hz
South Africa	PAL	I	220V 50Hz
Spain	PAL	B,G	220V 50Hz
Sri Lanka	PAL	B	230V 50Hz
Sudan	PAL	B	240V 50Hz
Surinam	NTSC	M	115V 60Hz
Sweden	PAL	B,G	220V 50Hz
Switzerland	PAL	B,G	220V 50Hz
Syria	SECAM (H)	B	220V 50Hz
Taiwan	NTSC	M	110V 60Hz
Tanzania	PAL	B	230V 50Hz
Thailand	PAL	B	220V 50Hz
Trinidad	NTSC	M	115V 60Hz
Tunisia	SECAM (V)	B	220V 50Hz
Turkey	PAL	B,G	220V 50Hz
UAE	PAL	B,G	220V 50Hz
UK	PAL	A,I	240V 50Hz
USA	NTSC	M	120V 60Hz
USSR	SECAM (V)	D,K	220V 50Hz
Uganda	PAL	B	240V 50Hz
Uruguay	PAL	N	220V 50Hz
Venezuela	NTSC	M	120V 60Hz
Yemen	PAL	B	220V 50Hz
Yugoslavia	PAL	B,H	220V 50Hz
Zaire	SECAM (V)	K'	220V 50Hz
Zambia	PAL	B,G	220V 50Hz
Zanzibar	PAL	B	220V 50Hz
Zimbabwe	PAL	B	225V 50Hz

T20/T22 chassis. We changed the line output transformer on the first one we came across only to find, as we have on most of them, that 4R16 (910Ω) on the timebase panel was open-circuit. This is in the 12V regulator circuit, and with no 12V supply the line oscillator shuts down.

A real stinker we had was on the later version of the Philips G8 chassis (550 series). The left-hand side of the raster was black whilst the right-hand side was excessively bright: there was also no colour. We began by consulting the oracle on this set, namely Philips Service. They tried to be helpful, but all the suggested remedies failed. Being a firm believer that two heads are better than one at a time like this, I got together with a senior engineer who smokes a fault-finding pipe. With this in action, after considerable puffing the fault was found. Another resistor open-circuit, this time R212 (750kΩ) on the combined decoder/i.f. panel (see Fig. 1). When this happens the gating/clamping pulses don't reach pin 10 of the TBA560C chroma/luminance signal processing i.c. We told Mr. Philips, who said he'd never had that one before and would make a note of it. Even thanked us for telling him! (Someone else who's had it is our friend Les – Editor.)

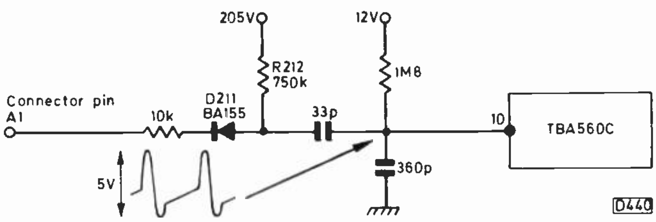


Fig. 1: Burst gating/black-level clamping pulse delay circuit used in later versions of the Philips G8 chassis.

So be warned: the resistor is waiting there to get you running around!

Finally, did you hear the one about the regional TV weather forecaster who used individual adhesive letters on his map to make up words such as cloud and rain? Despite repeated attempts he couldn't get the letter F to stay on and was left with -og. Forecast completed the lady announcer appeared on the screen and said in her most cultured voice "we would like to apologise for the F-in-fog".

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling and Mike Sarre

Toshiba V8600

We delivered a new Toshiba V8600 to a technical college in Nottingham. The following day we had a panic call to say that there was no picture, on replay or during recording, after the AV technician had moved the machine. Andy suggested that he switch the input selector back to the TV position, which dealt with one aspect of the problem. Elaine was then despatched to the City of Nottingham with a head cleaning tape, two cotton buds and a can of AF spray. There seemed to be some surprise at the college when she announced she'd come to check the video recorder. Head cleaning did no good, so an exchange machine was left and the faulty one came back to me.

I also tried to clean the heads whilst checking the playback f.m. output on the scope. The output from one head, via the preamplifier, was completely missing and no amount of cleaning restored the picture. Attention was then turned to the head preamplifiers, and to my surprise one of the f.e.t.s came off in my hand. 'nuff said.

Another V8600 had two faults. It wouldn't rewind, and intermittently wouldn't operate at all. There were also mutterings about not recording colour. The rewind problem was due to the upper drum assembly being worn – the wear is caused by the back tension being set too high during manufacture. So the assembly was replaced.

A cassette was then inserted and the machine went dead. Threading took place, but nothing else would operate – including unthreading. In an instance like this, the first check to make is on the after-loading switch, for if this fails to tell the microcomputer that threading has taken place nothing more will happen. The after-loading switch was all right, so the next step was to check the microcomputer's inputs and outputs – four scan outputs and seven scan inputs.

One of the inputs had data that was of a low level on it. This was linked to a logic chip that decodes the remote control data. It appeared to have an output that shouldn't have been present (confidential data information revealed this), and anyway it was of low amplitude. Replacing the chip, TVH202, restored normal service. The no colour fault has yet to put in an appearance. **S.B.**

Akai 9300/JVC HR3300

A couple of Akai 9300s (equivalent to the early JVC HR3300s) have been in the workshop recently. The problem with one of them was intermittent audio recording and erasure – the original audio was left on the tape after re-recording. The reason for this is that the bias oscillator is not having the desired effect, a clue being given by patches of colour flickering in the background due to the previous colour under carrier not being erased. If this is found to be the case, both record/replay switches on the audio/servo panel should be changed.

The other machine had a systems control fault: once it had threaded, the keys ejected. We mentioned once before that to prevent the keys resetting the base of transistor X7 in the stop solenoid control circuit can be connected to chassis. We then discovered that the flip-flop (head switching) signal was of low amplitude. It comes from the AN318 i.c. on the audio/servo panel, and after replacing this i.c. the problem was cured. This second machine also suffered from intermittent audio recording and required replacement switches. **S.B.**

Sony C7 – Transformer Trouble

This interesting little problem would have made a fine *Television* test case item. It concerns a Sony C7 from the local mental hospital (yeah, we know the jokes). It was dead: power supply problems.

The fuses looked intact but one 100mA fuse was open-circuit – not blown, just high impedance. It was in series with the primary winding of the 20V mains transformer. A replacement lasted just a couple of milliseconds, so the power unit was removed. On the bench, with the unit supplied via a variable transformer, everything seemed to be all right. The only discrepancy was in the input voltage to the permanent 12V regulator circuit. This is given as 17·5V but measured 30V. As it's peak rectified from a 20V a.c. supply and the unit was off load things were considered to be normal.

To cut a long story short, the machine worked perfectly with the power supply back in circuit and a 315mA anti-surge fuse fitted in place of the correct 100mA. But as you know we can't return a VCR with a bigger fuse fitted in case a fire is started. So I phoned Sony – not normal for me, but I can grovel with the best of them. A very nice man there asked whether the 400mA fuse in series with the secondary winding was all right. I said it was, and we then discussed the pros and cons of the situation. The Sony man said the current in this fuse should be 380mA a.c. Mine measured 340mA, whilst the fuse in series with the primary winding carried 80-90mA. Then it clicked: 240V down to 20V is a factor of 12, so the primary current should have been 340 (say 360) divided by 12, i.e. 30mA. Well, if you add a generous 10mA for eddy current leakage you don't get near 80mA do you? So I ordered an advance replacement mains transformer plus two fuses (there's a 100mA fuse in series with each of the two 120V primary windings). Four weeks later they arrived on a chargeable order.

The replacement transformer cured the fault. The correct primary winding current should be around 45mA, so the original one suffered from high eddy current leakage. **S.B.**

Panasonic NV8600 – Motor Trouble

A previously repaired National Panasonic NV8600 was returned with a note to say that it had a fault different from the previous one. A quick look through the records revealed that last time it had a recording fault. This time however the tape speed was varying – an understatement if ever there was one! A prerecorded tape belted through the replay system as though it was in fast forward.

Out came the service manual, and the capstan servo was checked through from beginning to end then back again. The second time around I found that a motor power drive transistor, one 2SA699, was short-circuit. A TIP42 was fitted and play selected – you can't put it into record as the PCB that is hanging out carries the record/

playback switching. The TIP41 got very hot very quickly, though the servo locked – just! I then measured the motor current, a mere 300mA or more, a bit high I thought.

Order new capstan motor which arrives within days. Check free-running current of new motor with 9V supply: 30mA. So as the old motor was still around I checked that too: 200mA. Even a living brain donor could work out that the motor current was wrong.

Seriously though, most VCR d.c. motors consume around 15-30mA off load with the correct voltage applied across them: on load you can expect 80-120mA. Anything higher than 120mA means that the motor is suspect. Also check the a.c. ripple across the motor. This is normally fairly low, some 200mV peak-to-peak. High values of around 1V peak-to-peak indicate excess motor current and a faulty motor or motor drive amplifier (MDA to you!). **S.B.**

Toshiba Head Drums

Another contributor to VCR Clinic (August, page 519) mentioned Toshiba VCRs requiring upper drum cylinder replacement due to advanced wear. This can be due to a cause other than abrasive cleaning tapes. If the tape tension arm is incorrectly adjusted (see above) there's high tape tension towards the end of a cassette. Personally, I don't recommend for use in Toshiba VCRs a particular brand of tape which is not English, Welsh or Japanese . . . **S.B.**

Sanyo VTC5300

I have to report a small problem you may encounter with the Sanyo VTC5300. We, or rather Andy, run a video library and are getting complaints from owners of these machines about some of our older tapes. It seems that the preamplifiers or limiters may be slightly below par. When we're called upon to replace an older tape whose magnetic flux is a bit on the low side due to wear, we find that the replay is not viewable: it's covered with white spots, unlike more expensive machines such as the Toshiba which provide a viewable though grainy picture. Any comments please? **S.B.**

Ferguson 3V29

The complaint with a Ferguson 3V29 we'd installed quite recently was that it tangled tapes – ever since the customer had first had it in fact. A quick check showed that no braking was being applied to the supply spool at stop. It didn't take long to find out that the brake shoe was missing – nor was it to be found anywhere in the machine. How these things get past quality control I don't know. The fault on another of these machines was failure to record. A scope check revealed that there was an f.m. output at pin 28 of IC202, but the signal was not re-entering the i.c. at pin 1. A meter check then showed that the voltage at pin 1 was wrong. There's a shorting switch transistor here (Q209), and the problem was traced to the zener diode (D208) in this transistor's base circuit. It was leaky, with the result that Q209 was being turned on, thus shorting out the signal. We've also had three of these machines with faulty cassette lamps – fortunately they plug in on this model and are much easier to change than in the previous 3V22. In one case however simply changing the bulb, though it was faulty, failed to cure the problem. The bulb is driven by a transistor (Q1) on the small panel the bulb plugs into. The arrangement is similar to that shown in Fig. 3 (page 520) of the August issue, though in this case Q1 is the transistor on the left-hand side. Checks showed that the voltage at the base of this transistor was varying – replacing it restored normal conditions. **D.S.**

Ferguson 3V22

A couple of 3V22s about a year to eighteen months old have required new lower drum assemblies recently, the problem being excessive noise (mechanical) due presumably to worn bearings. In view of the cost and difficulty in carrying out the replacement I hope this doesn't become a common fault with these machines. **D.S.**

Panasonic Aerial Amplifiers

In the July VCR Clinic Mike Sarre mentioned the problem of faulty aerial amplifiers in the Panasonic NV2000. During the past six months we've had three NV2000s and three NV7000s with defective amplifiers, so they are clearly a weakness on Panasonic machines. The amplifiers used in the two models are similar but have different part numbers: does anyone know whether they are interchangeable? **D.S.**

Hitachi VT8000 Series

A problem we occasionally get with VT8000 series Hitachi machines is intermittent tape tangling on rewind. This is due to the supply reel brake operating more quickly than the take-up reel brake, resulting in a loop of slack tape which either gets caught in the machine when you try to remove the cassette or gets trapped in the cassette flap. The cause of the problem is that the take-up brake slips: the cure is to clean and if necessary roughen up the rubber tyre on the turntable. Also check that the brake arms are free to move, and if necessary strip down, clean and lubricate with graphite grease. **D.S.**

Philips V2000 Machines

Maybe we're unlucky with our Philips V2000 type machines – we've had another one with a faulty head. This gives a failure rate of 5 per cent on the heads and the machines are barely nine months old – this compares with a failure rate of 1 per cent on our Hitachi machines over a twelve-month period. **D.S.**

Sony C5

Fault: Line slip, poor tracking and tape speed fluctuations.

After checking all functions I found that field lock on the TV set could not be obtained with the test signal. The test signal generator i.c. (IC13) is synchronised by the output from IC12, which is in turn counted down from the 4·43MHz chroma oscillator. This counted down signal is also used as the servo reference. On checking these frequencies I found that the 4·43MHz oscillator was correct but the output from IC12 was at 69Hz instead of 50Hz (hence the rolling test signal). Changing IC12 (M58478P) cleared all the fault symptoms. So what initially appeared to be two separate faults turned out to be only one, thus enhancing the advice to check all functions first before leaping in. **M.S.**

Garbledegook

Eugene Trundle

As the price of teletext equipped TV receivers comes down and public awareness of the service increases, so text receiver installations are becoming more widespread. In 1981 8·7 per cent of TV receivers sold/rented in the UK were text equipped. In most cases reception of the text signals is quite acceptable, and in our experience the decoders used have proved to be very reliable. We've found that the level of customer usage of the text facility drops off considerably once the novelty has worn off, and that when display errors occur people tend to be less concerned about them than they are about faults that affect normal viewing. My own view is that teletext will come into its own only when a comprehensive regional service is available, so that viewers can call up local information at the touch of a button.

Coming back to the problem of garbled displays however, we find that the incidence of problems is increasing in proportion to the number of installations. Where a garbled display of text pages is encountered, the traditional approach has been to blame the aerial (rather too much emphasis was placed on aerial performance in the early days of teletext) and to call out the poor old rigger, sometimes umpteen times, to replace, reorientate, realign and curse the aerial system. This situation arose because the teletext system is not widely understood – the decoder itself is a "black box" – and the cause of a decoding error was difficult to establish.

So what's changed? It's becoming obvious that the decoder will remain a closed book to the TV service engineer. There would be little point in setmakers issuing circuit information – you can't wade in with an ordinary scope and Avo with much hope of diagnosing the cause of a problem, even if you fully understand the decoder. It's much simpler to operate an exchange module service.

Acceptable Reception

How then can we decide whether the aerial, the receiver or the decoder is faulty – or the customer is perhaps being over fussy? Let's take the last question first. It's generally accepted that an error probability of one bit per thousand or better will provide subjectively satisfactory text displays. This corresponds to less than eight character errors in a full page of data (e.g. the clock-cracker page) on first acceptance of the signal. At the first update, i.e. within 25 seconds, all errors will normally be corrected. On an average page, the one in a thousand error probability will give rise to less than eight character errors at the first go.

The clock-cracker page is a particularly useful subjective test of text reception, containing as it does alternative character codes of 11111110, 01111111 throughout the page. It's a stringent test of clock synchronisation, and the regular pattern makes blanks or errors easy to spot. It won't test the control codes for colour and other facilities, but if the cracker page is acceptable there's no doubt that the control data is being correctly received. So much for "acceptable" reception then: what do you do when you've got a badly corrupted page or fifty per cent garbledegook?

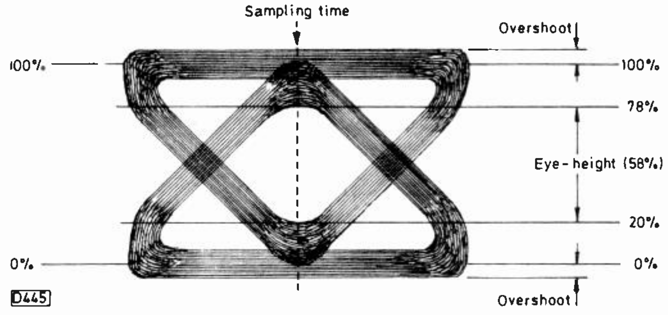


Fig. 1: A typical eyeheight display. The individual ellipses represent separate 0 and 1 pulses and are overlaid to give average and worst-case conditions.

Binary Decisions

We don't propose to go into the technicalities of the teletext system here. Suffice it to say that it's a digital system, based on the transmission of pulses – pulse present signifies one, pulse absent zero. Under the control of the synchronised clock, the decoder takes a brief look at the text signal at the instant when any pulse present is at a maximum. At this instant the circuit has to make a decision between one and zero. It sounds easy enough, the answer depending on whether the instantaneous pulse amplitude is above or below the "slice" level set by the decoder manufacturer. All subsequent decoder operations depend on the accuracy of this decision. An inbuilt correction system is able to cope with a reasonable error rate, but a serious deficiency in the incoming data stream will result in a badly corrupted display.

Eyeheight Measurement

So we come to one of the few tests we can make on a text system – eyeheight measurement. The idea is to overlay the text pulses transmitted over a period so that their varying amplitudes are integrated to form a blur or fuzz at the top and bottom of an eye-shaped display (see Fig. 1). The upper ellipse represents all the one signals and the lower ellipse all the noughts. Because the amplitude of an individual pulse depends very much on the status and position of preceding pulses, some are greater in amplitude than others. The average amplitude of the lot depends on the propagation conditions between the studio and the output from the set's vision detector. Thus by superimposing the pulses we are able to see worst-case conditions, i.e. the lowest one and the highest zero. The typical display shown in Fig. 1 represents an eyeheight of about 58 per cent – fairly typical in a domestic installation under average conditions, and quite adequate for a commercial teletext decoder to work with.

Unfortunately the equipment required to produce an eye display of the sort shown in Fig. 1 is fairly complex. The X-axis of the Lissajous pattern is produced by a sinewave at half the teletext bit rate (3·469MHz), derived from a bit-synchronous clock generator similar to that used in a teletext decoder. The Y-axis signals are derived from the video signal, while the Z-axis (intensity modulation) must be unblanked during the teletext lines only. Such an apparatus cannot be produced cheaply enough to justify its occasional use in the service depart-

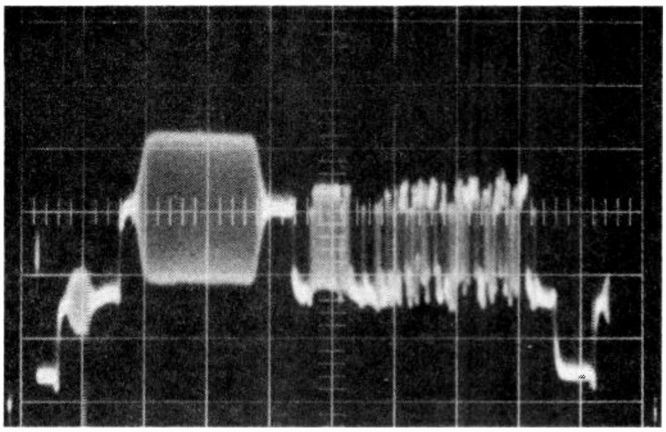


Fig. 2: BBC line 20, the second half of which provides a teletext eyeheight display.

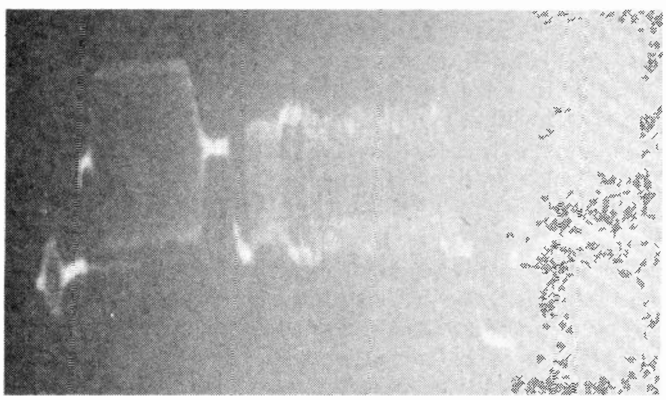


Fig. 3: Lines 20 and 333 superimposed, showing the complementary form of the teletext test pulses on these lines.

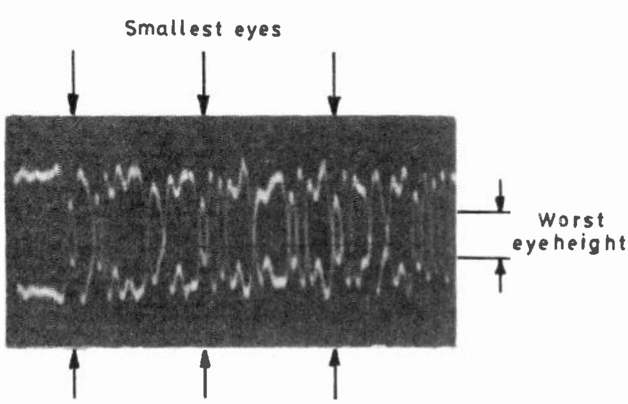


Fig. 4: An expanded portion of the trace shown in Fig. 3, with examples of worst eyeheight arrowed.

ment – the broadcasting authorities have gone a stage further, with portable eyeheight indicator/recorders giving a digital readout.

Practical Displays

What can we do with an ordinary oscilloscope? Given a degree of patience, it's possible to arrive at an idea of eyeheight without special equipment. The method was described by Harold Peters in the January 1978 issue (page 128), but in case that issue is not to hand we'll repeat the relevant details.

Find a full-bandwidth output from the vision detector in the receiver under test, and connect this to a scope with a bandwidth of at least 10MHz. Trigger from the field sync, either internally from the video signal or preferably via an external trigger input from the field timebase. With a sweep speed of about 150μsec per division, you should be looking at the whole of the field blanking period. The four active teletext lines, numbers 15, 16, 17 and 18, will be seen to be busily twinkling. Checks can be made on these, but it's easier to see what's happening by studying line 20 (BBC transmissions) where a stationary teletext test signal is inserted. Zoom is on this line by manipulation of the scope's X-shift and X-gain controls. If your scope has a delay sweep, count 20 lines or 1·28msec.

Close examination of the second half of line 20 will show that it has a variety of pulse spacings (see Fig. 2). These are designed to show up the effects of ISI (intersymbol interference) and form a good test of eyeheight. Now we need to superimpose line 333 – line 20's twin on the other field. This carries a similar signal but all the digits are reversed, complementary to those on line 20, providing a series of "eyes" when the two lots are superimposed. If you are using a single-beam scope lines 20 and 333 will be there already, like it or not. The same applies to a double-trace instrument when switched to single-trace operation.

A dual-trace scope can be used to see the complementary nature of lines 20 and 333. Select dual-beam operation, hook both probes to the video signal and the alternate trace switching in the scope will do the rest. If required, the traces can then be overlaid with the Y-shift controls. Fig. 3 shows the effect. The fuzziness at the tops and bottoms of the eyes can be seen, with a clear area between them containing only vertical lines. It's in this area that the decoder has to operate, and the clear part (hopefully symmetrical about the zero line) is the effective eyeheight.

Fig. 4 shows an expanded portion of the trace in Fig. 3. The areas of worst eyeheight are arrowed. How much of this you will be able to see depends very much on your scope: almost certainly you'll have the room lights out by now!

Eyeheights Compared

Once we've arrived at a figure for worst eyeheight, we can go on to relate this to expectancy of text page errors.

What sort of eyeheight can we expect? The one digits are transmitted with an amplitude of 66 per cent of the peak white level, though the effect of overshoot means that the peak pulse level is usually greater than this. Thus the text pulse amplitude displayed should be two-thirds of the peak amplitudes of the bar and pulse signals on line 19 next door, or just over twice the amplitude of the sync pulses.

Let's assume that we've set up the scope's vertical gain (or the a.g.c. in the TV set) for a total signal excursion – sync tip to peak white – of four divisions on the scope's screen, and that each screen division is 1cm. This is the condition in Fig. 2. Since the picture-sync ratio is 7:3, the sync pulses should occupy six of the small (2mm) divisions, the burst six, and black level to peak white (bar and pulse) fourteen. If any of these are far out, the set is off tune, the scope probe needs setting up, or there's something wrong somewhere! If the relative proportions are correct, the eyeheight figure we get will be valid.

One hundred per cent eyeheight would be represented by a clear eye of 9·3 small divisions – this is something that's impossible in theory and in practice. A 50 per cent eyeheight would show a clear area of just over 4·5 small divisions, while a 32 per cent eyeheight would be equal to half the sync pulse amplitude. According to the broadcasting authorities, setmakers aim at a minimum eyeheight of 25 per cent at the input to the decoder – modern receivers usually do much better than this, given an average aerial signal input.

At the other extreme, the main transmitters radiate a signal with an eyeheight of about 70-80 per cent. Relays loose very little of this, especially the transposer relays which work by heterodyning the incoming signal to achieve rebroadcast at new frequencies. Relays which demodulate the sound and vision signals then remodulate them on to a new carrier are more likely to degrade the final eyeheight, but under worst-case and cascaded transmitter conditions the eyeheight will rarely be under 60 per cent.

Under ideal conditions then we'll rarely see an eyeheight at the receiver's detector better than 70 per cent. We average about 50 per cent with our local measurements here, and good teletext can be expected with this figure.

Decoder and Peripherals

The Mullard decoder doesn't start to make mistakes until the eyeheight falls to about 20 per cent. Other makes are on their limit at around 25 per cent. If text reception is bad with an eyeheight greater than say 30 per cent, there's a good chance that the decoder is defective. Before condemning it however there are several points worth checking.

First and foremost, check the supply voltage to the decoder module. It's usually derived from some sort of stabilizer, either a fixed-voltage i.c. type or a discrete component, adjustable regulator. We've known decoders become incoherent if their supply voltage exceeds 5·25V, and the same applies at 4·6V. Ideally, the supply voltage should lie between 4·9V and 5·1V.

Decoupling is also important – there are decouplers for l.f. and h.f. Make sure, with the scope and by substitution, that they haven't dried up or gone open-circuit. Beware of earth loops and high-impedance chassis connections. The current consumption of a decoder (5V line) is between 500mA and 1A, and good low-resistance connections at the interfacing are important.

If the signal input to the decoder is separately earthed, check this connection too. Finally check the eyeheight right at the decoder module's input if possible, in case the video interface amplifier/impedance matcher has problems.

Receiver Faults

If the measured eyeheight is between 20 and 30 per cent, the result will be marginal operation of the decoder. We'll assume that you're dealing with a commercially produced teletext receiver with a synchronous vision demodulator and SAW filter. If you're experimenting, or adding teletext to an existing receiver, go back to the January 1978 article!

A common cause of poor eyeheight is incorrect tuning. If the tuner has a drift problem, data reception will be unreliable. Reduced eyeheight can occur if the a.f.c. performance and alignment are not absolutely correct, and a degree of mistuning unnoticeable on the picture and sound can badly impair the text performance.

If necessary, set up the a.f.c. for best eyeheight performance. Although i.f. and detector alignment are best left to the setmaker, slight and careful adjustment of the tuner's i.f. output coil and the synchronous vision detector's tank coil can do wonders for eyeheight, especially where the module concerned has been replaced or repaired since factory alignment of the original set. Sometimes the SAW filter or i.f. chip may be responsible for poor eyeheight, but this is unlikely. Where problems are encountered we've generally found setmaker's service departments to be most helpful, sometimes to the point of making available complete tuner/i.f. strip assemblies, aligned for text reception, on an exchange basis.

Aerial and Propagation Problems

When the decoder and the set have been eliminated, preferably by trying another teletext set at the site, it's time to look beyond the aerial socket. Field trials by both broadcasting authorities have shown that generally speaking teletext is a robust system, and that in terms of signal-to-noise ratio the service area of a given transmitter is greater than for ordinary TV reception by as much as 11dB. Thus text reception is maintained until the picture performance has deteriorated to EBU grade 5 ("definitely objectionable") and the picture signal-to-noise ratio is down to 23dB or so. A noisy signal alone is unlikely to cause problems.

In surveys using a good quality but otherwise perfectly normal aerial, the greatest cause of text failure was found to be a combination of noise and reflections. It's in these circumstances that attention to the domestic aerial system – type, gain and alignment – is beneficial. Don't forget the feeder cable – mismatching, bad joints or kinking will cause reflections. It is significant that the broadcasters' survey results from test vehicles showed very few cases where text reception failed *due to reflections alone* in the presence of adequate field strength. When it came to domestic aerial installations however no less than 32 per cent of teletext failure cases were predominantly due to reflections. This suggests that the average TV aerial installation leaves something to be desired – we understand that one viewer was watching u.h.f. programmes using a Band III array, and that several others had aerials of the wrong channel group in use.

With the correct aerial, polarisation and alignment, it's unlikely that trouble will be encountered. We've heard of a few cases where text reception was perfect on two of the three available channels but very corrupt on the third. This is usually due to reflections from objects within a metre of the aerial causing very short-term echoes and thus nulling out the text pulses on the affected channel. It's similar to the "colour suck-out" problem that sometimes occurs: a remedy for either is usually slight repositioning of the aerial.

How does teletext fare in the presence of other reception problems? Ignition interference is seldom troublesome, due to the negative-modulation characteristic of the TV signal and the fact that to have any real effect the pulse repetition frequency would have to coincide with the data rate. Co-channel interference is usually a weather-dependent and short-lived phenomenon, and modern decoders tolerate co-channel interference down to 20-26dB below the strength of the local channel.

Cable and relay systems can cause problems if a mismatch exists in the network, and there's no doubt that relay systems using h.f. carriers are difficult to maintain in this respect. Where upconversion to u.h.f. is carried out at the receiving site it may be difficult to achieve a good eyeheight.

Microcomputer Control of VCRs

Brian Dempster

EARLY VCRs were relatively uncomplicated. The electrical safety circuit generally consisted of a pick-up coil which sensed the passing of a small magnet attached to the flywheel of the capstan and/or head drum motor. The signal thus picked up was amplified, and if it disappeared the safety circuit switched the machine off. The beginning and end of mechanical operations such as threading and unthreading were signalled by limit microswitches, perhaps operating relays. Since the front controls were mechanically operated, protection against misuse generally took the form of mechanical interlocks to prevent undesirable combinations of control operation. The protection and monitoring requirements were modest, and could be dealt with by means of a few mechanical linkages and a couple of logic chips.

As the domestic VCR came of age however more and more features came on offer. Microswitches replaced mechanically linked front controls; clock-timers became multi-choice over longer periods of time; still frame, picture search and slow-motion became the in things; extremely fast wind/rewind speeds became possible; and infra-red remote control appeared on the scene. All these introduced new control or monitoring requirements. The problem could have been tackled by using the "traditional" methods along with some specially designed logic i.c.s, but the result would have been unwieldy and inflexible to say the least. The sheer number of different combinations of control requirements would have made a lot of the logic circuitry redundant for most of the time, while much redesign would have been necessary if a new feature was required on a subsequent model.

Let's illustrate the problem by considering a single control requirement (play) in a hypothetical machine – see Fig. 1. Before the logic array produces a play output and maintains this, at least ten conditions should correct: (1) cassette in place; (2) tape fully threaded; (3) fast forward not selected; (4) fast rewind not selected; (5) head drum rotating; (6) tape capstan rotating; (7) take-up spool rotating; (8) brakes released; (9) pressure roller engaged (delayed); (10) tape not at end. A fairly simple bit of logic circuitry would suffice, but a different combination of requirements is needed for each mode of VCR operation

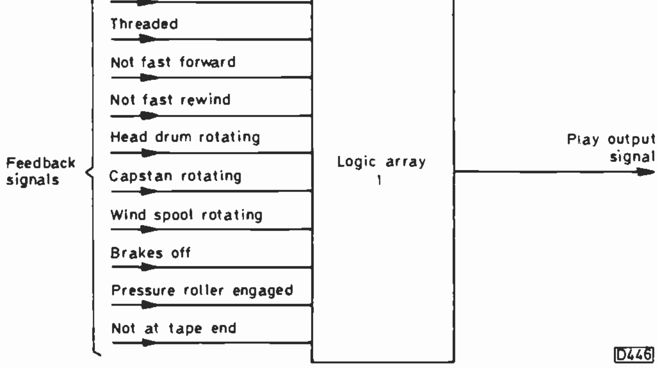


Fig. 1: Example of play control requirements.

– and for the transition from each mode to any other.

The feedback signals required are usually obtained from microswitches (to indicate the correct operation of solenoids etc.), optotransistor/LED combinations or tachogenerators of one form or another, but the signal must generally be processed to make it suitable for application to the logic circuitry.

Apart from monitoring the conditions needed for each mode, the machine must constantly check the control buttons to see whether a new operation has been selected, must update the time, store timed recording requests, check these against the actual time and carry out the recordings, respond to remote control commands and have a high degree of immunity from user abuse.

All this suggested the need for a new approach. In its simplest sense, a programmable logic array could handle the control and monitoring operations, each combination being selected by the control keyswitches. But that would simply provide go/no-go control. Take Fig. 1 again. Say we've switched the machine on and require play, but are initially in fast forward. We press the play key but logic array 1 will not allow play to commence since there's a fast forward signal present. We would have to press stop and then play. Clearly for foolproof operation we need some kind of "intelligent" control.

Suppose that we've designed a VCR and made a list of the requirements for each mode of operation and the responses required when each control button is operated. We connect each button to a lamp, with the lamps labelled and mounted on a panel. On another panel we mount a switch to operate each machine function – brakes, pressure roller, head drum etc., again clearly labelled. Each function supplies a feedback signal to indicate that it has taken place, lighting up lamps beneath the appropriate switches – so that if say the brake release switch is pressed, the lamp beneath the switch lights only when the brakes have actually been released. As well as the lists of requirements for each mode of operation, we must prepare lists of functions to be continually checked whilst in each mode, together with instructions to be followed should any function fail. So far then we have:

(1) A panel of lamps indicating which function is requested by the user.
(2) Detailed lists of responses to each request and the conditions to be monitored in each mode.
(3) A panel of switches to operate each appropriate machine function.
(4) Lamps to indicate that the functions have been carried out.

All that's left to do is to sit an intelligent, trustworthy person at the two panels to carry out the necessary tasks – the machine's user simply presses his buttons and, provided you've prepared your lists of instructions correctly, the end result is foolproof, reliable and safe operation of the machine. If the control panels and the machine's "driver" were present in a small room, the effective block diagram would look like Fig. 2.

Suppose next that you decide to improve the machine's

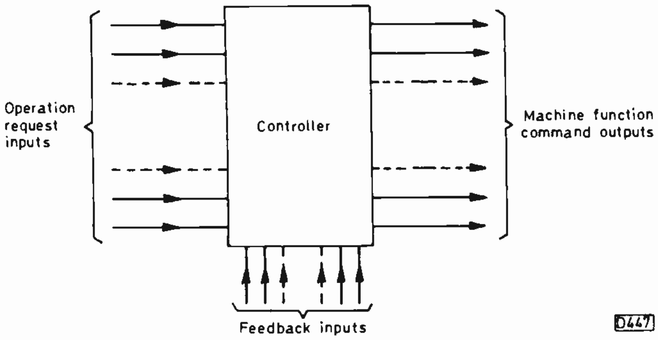


Fig. 2: Control block diagram.

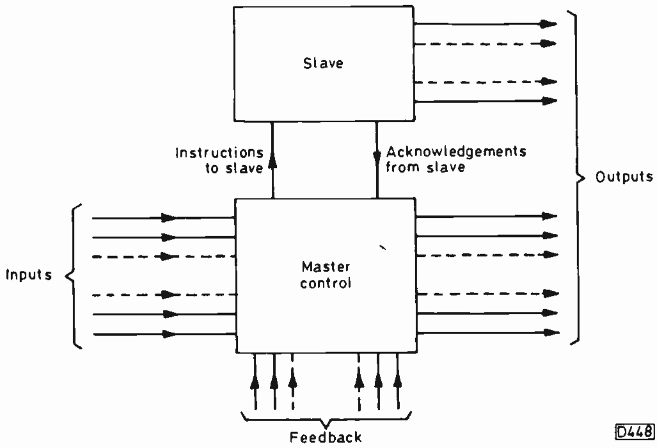


Fig. 3: Master/slave control arrangement.

specification, with say more timed recording choices and a clock which updates every second. The driver you've trained to perform the original tasks may not be up to, or may not have time to carry out, these additional requirements. What you can do is to write new instructions to cover the extra tasks, and employ a less skilled person to do the work under the driver's control. We now have the arrangement shown in block diagram form in Fig. 3.

Human drivers are out of course. What's wanted is a device that will obey the instructions quickly and faultlessly. A microcomputer will clearly serve the purpose. The same facilities as before are required:

(1) An indication as to which key has been pressed, now signalled by a logic level.
(2) A list of instructions on how to react to all possible circumstances – the computer's programme.
(3) Outputs to operate the appropriate machine functions, now logic level signals.
(4) Feedback from the relevant functions, again signalled as logic levels.

The block diagram remains as in Fig. 2, but the "black box" is now a microcomputer, complete with programme. If extra "help" is needed, a "master/slave" arrangement can be used as in Fig. 3 – here the slave computer has its own programme, but follows only that part of it instructed by the master computer at any given time.

There are some practical limitations to this simple approach. For example, on the Philips VR2020 VCR there are some twenty nine control buttons. If we assume that about the same number of outputs to the rest of the machine are required (including updating the displays), and that there are say twelve feedback signals, our microcomputer chip would need at least seventy pins. Obviously then some form of multiplexing must be used, i.e. employing the same group of input or output lines for several purposes (we refer to a group of lines as a bus). In practice, time multiplexing is used – one set of signals is put on the bus to activate various device(s), the signals are then removed and another set applied and so on. If this is done very rapidly, a large amount of data can be handled apparently simultaneously.

The signals can be put into an input/output expander – a sort of electronic multipole, multiposition switch (see Fig. 4). The chip has the ability to "switch" the data from the bus port to any of ports A-D and vice versa. Instructions as to which port to select, and in which direction, are also fed in at the bus port. A two-cycle sequence is needed therefore. First, instructions as to port and direction are placed on the bus and the chip is enabled by an appropriate logic level at the enable input. The programme/data pin is simultaneously pulled low to tell the chip that instructions are present at the bus port. The data is next placed on the bus and the programme/data pin is driven high, so that the data is transferred to or accepted from the port requested. The ports are usually latched, i.e. they "remember" the data until new data comes along and overwrites the previous data. They can thus serve as drivers for external interfacing devices such as transistors.

The use of one or more expander chips greatly increases the capability of a microcomputer i.c. Each expander can be connected to the same bus, accepting data intended only for itself under the control of chip enable signals from the microcomputer.

Another limitation is the programme memory (ROM) capability of a one chip microcomputer. In some cases an additional ROM (read-only memory) may be needed to carry part of the programme. This extra ROM can be conveniently housed in the same chip as an input/output expander. The instruction to this type of chip must also include the required memory address for requests for information from the memory.

The method of monitoring the keyboard for instruc-

Fig.4 (right): Input/output expander.

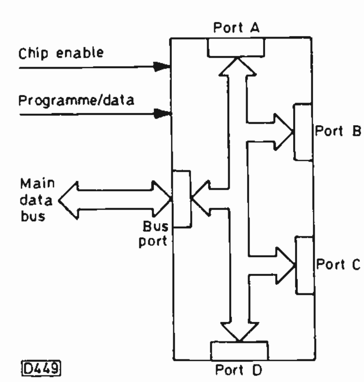
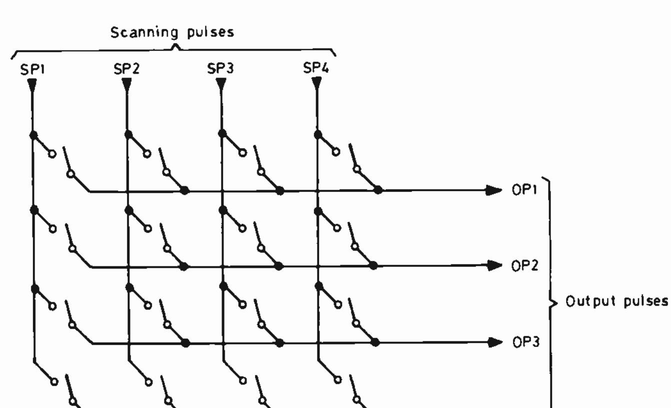


Fig. 5 (below): Keyboard scanning arrangement.



tions from the user (keyboard scanning) usually takes the form shown in Fig. 5. The microcomputer continually generates scanning pulses each of which lasts from about half to say ten or so milliseconds. The pulses are sequential, so that SP1 occurs for say one millisecond whilst SP2/3/4 are at zero, then SP2 is present for a millisecond whilst SP1/3/4 are at zero and so on. If any of the switches is operated, a scanning pulse will appear on the appropriate output line. By checking which output line is active during which scanning pulse, the microcomputer identifies the user instruction.

An alternative method of multiplexing is often found, generally for feedback inputs. The principle remains the same – see Fig. 6. B1-8 are "bus buffers", devices which are normally open-circuit but switch on when a scanning pulse is applied. They can be selected for either logic zero or logic one gate pulse requirements. In Fig. 6, buffers 1/2 and 5/6 are enabled (switched on) by sample pulse one, 3/4 and 7/8 being enabled by sample pulse 2. Thus an output on say line OP3 during SP2 can be only from input IP7 and so on.

Another economy in output lines is found in the keyboard scanning unit used in the Philips VR2020. Only two scanning pulses are generated – see Fig. 7. Input pulse one has a timing of 36 milliseconds while input pulse two has a timing of 18 milliseconds. Thus during the first half cycle of IP1, IP2 has two states. During an "a" period, both IP1 and IP2 are high. Examination of Fig. 7 reveals that the NAND gate N1 is the only one with both inputs at logic one under these conditions, thus SP1 is the only low output. This continues for nine milliseconds after which IP2 goes low and the output from N1 goes high. During a "b" period N2's two inputs are high – IP1 and IP2 via inverter 2. Thus SP2 goes low for nine milliseconds. In this way the two binary inputs IP1 and IP2 are converted to four sequential nine millisecond pulses to scan the keyboard.

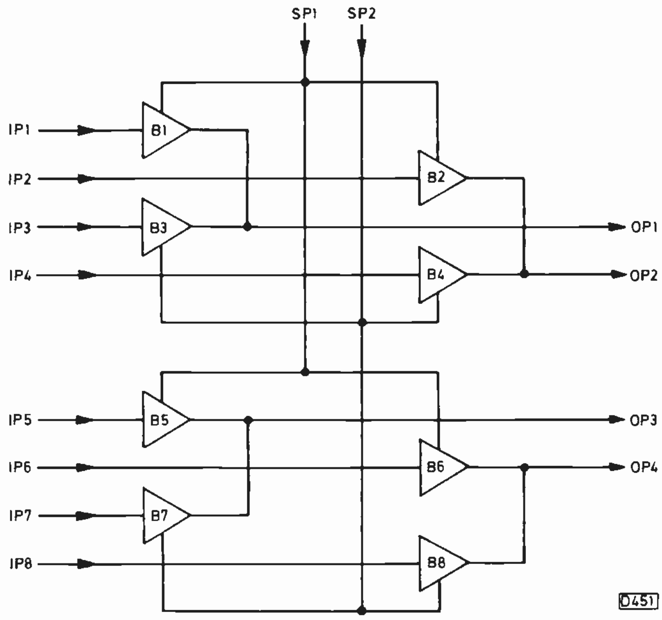


Fig. 6: Multiplexing system using bus buffers.

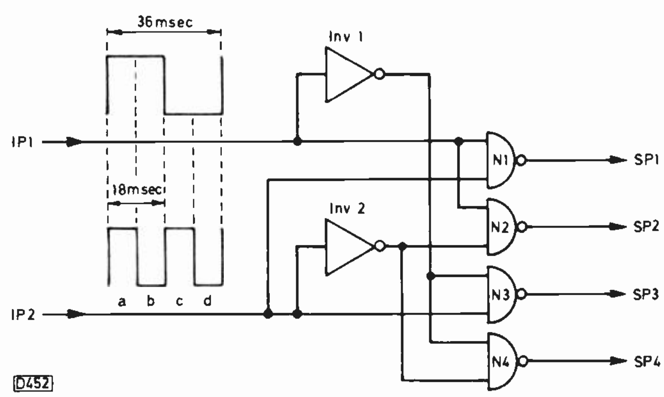


Fig. 7: Keyboard scanning economy arrangement used in the Philips VR2020 VCR.

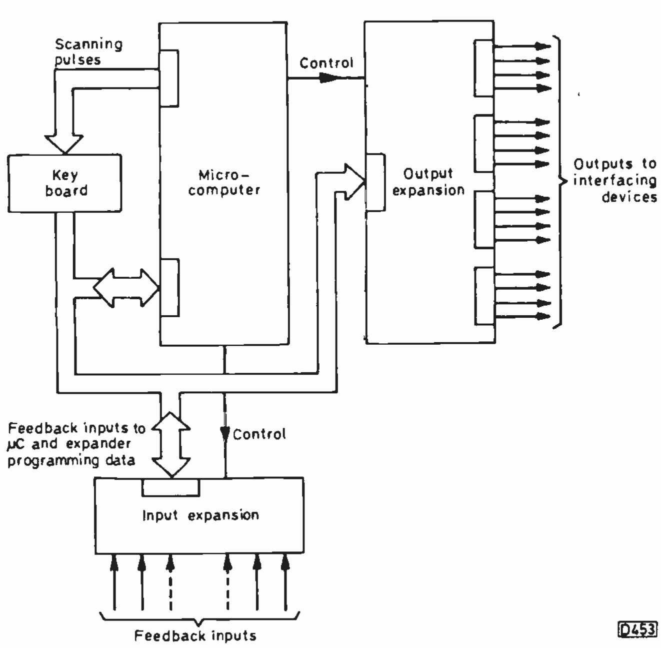


Fig. 8: Block diagram of a microcomputer VCR control system.

Summary

Microcomputers are now widely used in domestic VCRs – some use more than one. The microcomputer carries a programme containing instructions to deal with all likely situations. Inputs from the keyboard to the microcomputer give access to the appropriate part of the programme for each key, the computer then carrying out the programme's instructions. These tell the microcomputer to check various machine operating conditions before selecting a new mode of operation. The information about machine operating conditions is fed back to the microcomputer as logic levels from transducers of various kinds.

The programme carries instructions to bring about various conditions such as brakes on, pressure roller off, etc., also to check that these conditions have occurred, before giving an output in the form of a change in logic level which is sent to the appropriate part of the machine to bring about the mode requested.

Obviously the microcomputer or its peripheral devices cannot directly switch relays, operate solenoids and drive motors: interfacing devices such as transistors are required as drivers for these purposes.

Expansion or multiplexing chips are frequently employed to enable each microcomputer i.c. input/output pin to do different jobs at different times.

This has been only a very general review of the way in which microcomputers are used to control VCRs. Most machines now employ the principles outlined, and the block diagram shown in Fig. 8 will serve as a starting point before you delve into individual circuit diagrams.

Long-distance Television

Roger Bunney

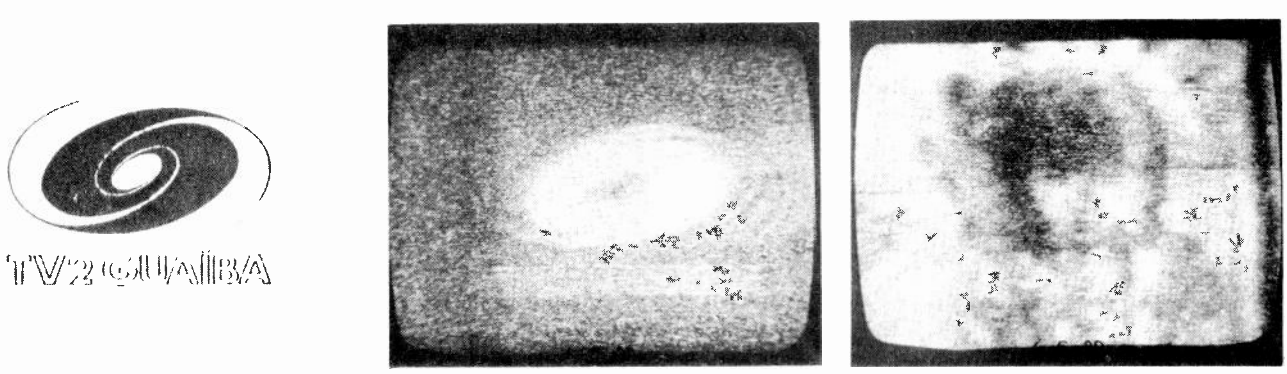
JULY produced signals from a wider area than in earlier months. Instead of the predominance of signals from southerly/south eastern directions, there has been reception from most of Europe. TVR (Rumania) has been sighted on several occasions via single-hop sporadic E, while an Aurora livened things up a bit in mid-July. There have also been two sightings of NTA (Nigeria) ch. E3 via double-hop SpE, so the results for July have perhaps exceeded those for June. The following log of UK SpE reception is based on my own and reports from regular contacts:

5/7/82 RTVE (Spain) E4; RTP (Portugal) E2, 3.
6/7/82 RTVE E2, 3, 4; RTP E2; YLE (Finland) E3; TVP (Poland) R1; SR (Sweden) E2.
7/7/82 TSS (USSR) R1, 2, 3; TVR R2; MTV (Hungary) R1, 2; JRT (Yugoslavia) E3; RTVE E2, 3, 4; RTP E3; RAI (Italy) IA, B; NCT (Italian free station) E3; ARD (W. Germany) E2; plus many unidentified signals.
8/7/82 TSS R1-4; TVP R1, 2; CST (Czechoslovakia) R1; MTV R1, 2; TVR R2; JRT E4; SR E2; RAI IA, B; RTVE E2-4; RTP E2, 3; Switzerland E2, 3; ORF (Austria) E2a, 4 – the E4 outlet is now listed as only 60W; ARD E2.
9/7/82 SR E2, 3; NRK (Norway) E2-4; RTVE E2-4; RTP E3; MTV R1; RAI IA.
10/7/82 RTVE E2-4; RAI IA, B; MTV R1, 2; CST R2; JRT E3; DFF (E. Germany) E4; ARD E2.
11/7/82 TSS R1, 2; TVR R2; RTVE E2-4; RAI IA, B; RTP E3; Switzerland E3; ARD E2, 4; TF1 (France) F2 (819 lines).
12/7/82 CST R1, 2; MTV R2; JRT E4; ARD E4; RAI IA; Switzerland E3; RTVE E2-4; RTP E3.
13/7/82 RAI IA; TSS R1, 2; MTV R1; RTVE E2-4.
15/7/82 RTVE E2-4; TVP R1, 2; ARD E2; JRT E3, 4; DFF E4; RAI IA, B; SR E3, 4; NRK E2; RUV (Iceland) E4.
16/7/82 RTVE E2-4; RAI IA; ORF E2a; JRT E3; RTP E3; TSS R1; RUV E4.
17/7/82 SR E2, 3; NRK E2-4; TSS R2; CST R2; ORF E2a, 4; RTVE E2-4; RAI IA; RUV E3, 4.
18/7/82 RTVE E2-4; RTP E2, 3; RAI IA, B; CST R1; JRT E3; MTV R1, 2; TSS R2; TVP R1; TF1 F4.
19/7/82 RAI IA, B; RTVE E2-4; TF1 F2, 4; RTE (Eire) ch. B.
20/7/82 JRT E3, 4; RAI IA, B; RTP E3; MTV R1; TSS R1, 2; CST R1; TVP R2; TF1 F4.
21/7/82 RTVE E2-4; RAI IA, B; JRT E3; CST R2; MTV R1; TSS R1; TF1 F4.
22/7/82 RTVE E2-4; RAI IA, B; MTV R1; RTP E2, 3; TVR R2, ORF E2a, 3; TF1 F4.
23/7/82 TVR R2, 3; MTV R1, 2; TSS R1, 2.
24/7/82 RTVE E2-4; RAI IA, B; CST R2; RTP E3.
25/7/82 TSS R1, 2; ORF E2a.
26/7/82 TSS R1, 2; SR E2; RTVE E3.
27/7/82 TSS R1-4; YLE E3; SR E2, 4; NRK E2; RUV E3, 4; TVP R1.
28/7/82 RAI IA.
29/7/82 RAI IA, B; TSS R2, MTV R1, 2; SR E2; ORF E2a, 4; CST R1, 2.
30/7/82 TVR R2, 3; MTV R1, 2; JRT E3; ORF E2a, 3, 4; ARD E2; CST R1; TSS R1-4; TVP R1; RTVE E2-4; RTP E3; NCT E3; SR E2; DFF E3; RUV E3.
1/8/82 RTVE E3, 4; TSS R1, 2.

A mystery signal – an IBA type test pattern (colour-bar version) – was noted by Cyril Willis (Cambridge) on ch. E4 on July 20th. A similar pattern was seen on ch. E 3 on the 30th – weak, from the south east. Reg Roper (Plymouth) logged NTA Sokoto (Nigeria) for almost three hours (1500-1800) on the 18th, via multiple-hop SpE at "fair" strength. The Sokoto identification could be clearly seen. Hugh Cocks had Sokoto from 1845-1900 on the 20th. Earlier, on the 17th, he logged Dubai ch. E2 via double-hop SpE from 1030-1045, on programme with sound.

The Auroral event occurred on the 13/14th. Reg Roper noted unusual sound effects in the 27MHz CB band, and checking on Band I received NRK ch. E3 – in addition to the usual rumbling. On the following day he again noted ch. E3 signals during the first phase 1700-2100. It will be interesting to see if the 27 day repeat pattern occurs.

There was enhanced tropospheric reception during July, with the period 7-9th being particularly active. Reports from Suffolk to the west country and up into Lancashire indicate reception along a largely east/west path. Fair strength u.h.f. signals from W. Germany were noted here at Romsey, while Trevor Rose (Lowestoft) logged Grunten ch. 28 (S.W. Germany), a good haul. Cyril Willis had Swiss u.h.f. signals on the 7th, DDF in Band III and at u.h.f. on the 8th, also ATV stations in



Left, the station logo for Guaiba TV2, Porto Alegre, Brazil. Centre, the logo received by Ryn Muntjewerff on June 4th (ch. A2). Right, a station announcer received during the same period.

Holland (PA3CHH) and Belgium. There was a further slight lift on the 12th, with W. German u.h.f. signals in the eastern UK, and on the 20-22nd. Further enhanced conditions gave Band III and u.h.f. reception in the south/east UK over the 29-30th, including DR (Denmark) in Band III.

I was on holiday in the Isle of Wight from the 23rd-30th, armed with a 5in. Plustron set and WB1 wideband Band I dipole array atop the Shanklin cliffs. Despite this minimal equipment, it was obvious that the S.E. of the island is a prime location for DX-TV. The Dutch ch. E4 was present all the time, also ch. E29 at times, and even the slightest lift would produce French signals throughout the u.h.f. bands (including the 819-line ch. E65). So if anyone has a job available thereabouts . . .

In summary then, a very active month. My thanks to the following who contributed to the co-ordinated log: Hugh Cocks (E. Sussex); Cyril Willis (Cambridge); Garry Smith (Derby); Arthur Milliken (Wigan); Trevor Rose (Lowestoft); Brian Renforth (Chippenham); Reg Roper (Plymouth); David Moller (Eastbourne); Neil Carnegie (Glasgow); and Ian Mitchell, G4NSD (Biggin Hill, Kent).

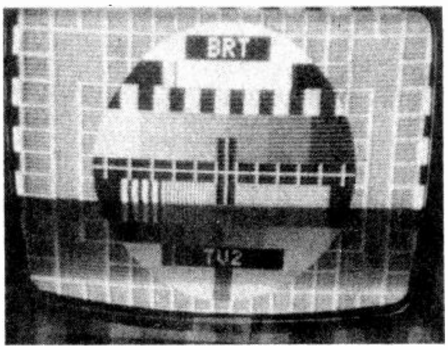
Ryn Muntjewerff (Beemster, Holland) reports an unusual and exciting logging – a system M (525 lines) ch. A2 signal on June 4th. Several photos were taken, but the signal remains unidentified. The detail in one shot taken during the reception suggests however that the signal comes from station TV Guaiba, Porto Alegre, Brazil – with some 42kW e.r.p. The time was 1517-1548 GMT, the reduced height confirming the system M standard. This looks like an SpE record, the multiple imaging suggesting triple hop.

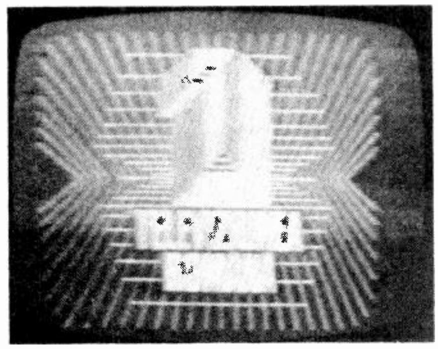
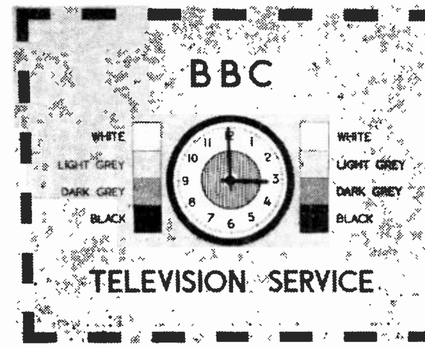
CB Filter

Some months ago I received for testing a small filter, the label saying that it was a CB filter. The unusually packaged device consisted of a small, flying coaxial lead with aluminium coaxial plug and a chassis-mounting coaxial socket, the main body being a shallow polythene box measuring some $1\frac{1}{4} \times 2\frac{1}{4} \times \frac{1}{2}$in., filled with potting compound. Tests proved that the unit, about which I was initially doubtful, provided an impressive performance. It's essentially a 27MHz notch filter with a very low insertion loss at over 40MHz – ideal for Band I DX use. There's no braid break. The measured figures were: 16·2MHz −22dB; 23·2MHz −29dB; 25·2MHz −28dB; 27·2MHz −49·5dB; 29·2MHz −19dB; 45·2MHz less than −1dB. I can recommend the unit, which costs £4·99 plus 50p post and packing, from PAM Ltd., 47 Holly Court, St. Modwen Road, Marsh Hills, Plymouth (tel. Plymouth 666107).

News Items

France: The French communications minister has announced that an experimental fourth channel using system L will replace the present 819-line v.h.f. service.
Sri Lanka: The first network now has nationwide coverage and the government owned ITN network is to be expanded to give similar coverage. Viewers in S. India will also be in range. The Indian transmissions are at present in monochrome with no adverts, as a result of which many viewers tune to Sri Lankan TV and many of the commercials are aimed at them.
Australia: The Australian broadcasting satellite project AUSSAT has been given the go ahead, with two orbiting and a backup craft. Each will have eleven 12W transpon-



Left, the Belgian PM5544 test pattern taken with a 1/60th frame speed. Reducing the speed to 1/15th will remove the shading. Centre, the new TVR (Rumania) first chain identification caption, received by Garry Smith (Derby) on ch. R3. Right, the BBC's 1949 tuning signal — Band I, ch. B1.

ders and four 30W transponders, the higher-power outputs providing services to specific regions via spot beams – the ABC TV service will be brought to the outback and other remote parts. The 30W capability will also enable a start to be made to services to Papua/New Guinea.

In brief: The EBU have confirmed that Morocco has a station operating on ch. E4 . . . The Dutch government has expressed concern over a proposed AFRTS TV transmitter at Soesterberg – it's intended to use a channel above E68 . . . The DFF ch. E3 Helpterberg transmitter continues to be received at good strength despite reports of its closure . . . Greek radio/TV intend to introduce regional TV over the coming year, starting at Thessaloniki, with a third service to start in Athens next year. Yened is to be demilitarised . . . Zimbabwe is to commence a colour service this month, following a long experimental period . . . Plans to adopt the PAL colour system in Kenya are at an advanced stage . . . The French are giving aid to Benin to expand the relatively small Band III service around Cotonou.

From our Correspondents . . .

T. S. Nanda Kumar (Madras, India) continues to receive good sound/vision at 714MHz from the Russian Stat T craft, using a home-constructed multi-element Yagi, a 27dB gain preamplifier and ELC2060 tuner feeding the i.f. strip in a standard Indian hybrid TV set. The sound is resolved using a second aerial/u.h.f. tuner combination feeding a locally produced i.c. (CA3065) i.f. section tuned to 6·5MHz. The Russian consulate staff at Madras have viewed the results and were very impressed.

During recent SpE openings Neil Carnegie (Glasgow) has been very active with f.m. radio reception. He apparently heard – with an American accent – "the South European Broadcasting Corporation/Network". I've no idea what this could be unless AFRTS have an outlet in S. Italy or N. Africa. Any ideas? Two French TV pirates are listed in a free radio movement publication: further information is awaited with interest.

Robin Crossley (St. Albans) has been re-equipping with a new v.h.f. amplifier, two-element Band I aerial and XG8W aerial. His receivers are modified Bush TV161 series models capable of wide/narrowband i.f. operation and adjustment for 5·5, 6 or 6·5MHz intercarrier sound. He finds the ET021 tuner (with MOSFETS) superior to the valved tuners he used previously. Attempts at off-screen photography have produced shots with hum bars – Robin used a Praktica manual SLR camera, 400 ASA film and a 1/60th frame speed. Fortunately the camera has a 1/15th frame speed, and use of this slower shutter speed should solve the problem.

Ian Johnson (Bromsgrove) started TV-DXing earlier this year, using an "ageing" GEC dual-standard monochrome receiver, a wideband Band I aerial and v.h.f. preamplifier. He's sent us an impressive list of receptions, including the RTVE teletexto on July 21st. Earlier, on the 12th, another teletexto transmission covered the theory of digital coding for such operations, including decoder and matrix layouts. In contrast, Worzel Gummidge was seen via RAI-1 on June 25th! Ian has unfortunately had to spend a considerable amount of time in hospital: we wish him well.

Graeme Wilson (Middlesbrough) has been using a Tandy Patrolman 50 as a tunable i.f. strip. The output from the TV tuner is fed to the aerial input via a f.e.t. amplifier/impedance matcher to save loading down the tuner's output. He's found that the system works well, with the sound on chs. E3 and 4 easily resolvable, though the ch. E2 sound is more difficult, probably due to the local ch. B3 signal (the radio's a.f.c. is probably making the receiver lock to this signal). Use of this relatively cheap radio with its 30-50MHz coverage enables the TV sound signals to be tuned independently. During the improved tropospheric conditions on July 21st, Graeme logged NRK E5, 6; DR E7; and DFF E9, 11.

The Way We Were

By great good fortune I was recently sent some very early copies of *Practical Television.* The issue for March 1949, labelled Vol. 1, No. 1, was actually a supplement to *Practical Wireless* Vol. 25, No. 512. So there were at least three Vol. 1, No. 1 issues, the first in the present series (now *Television* of course) appearing in April 1950 while a pre-war series started back in 1934 – when it was all Nipkow discs and spinning mirror drums.

The September 1949 issue illustrates the new BBC tuning signal, with the clock face representing a definition of 2·5MHz. Considerable space was devoted to how to adjust the contrast and brightness controls. The October 1949 issue mentioned that local councils were prohibiting the erection of TV aerials on council houses, also that W. Jones of Wellington, Salop, a radio dealer, had been the first to receive satisfactory reception from the new Sutton Coldfield transmitter. There's also a report of an unnamed experimenter in S. Africa receiving the BBC's ch. B1 Alexandra Palace transmissions using a single-element aerial (in preference to a three-element design) and a Pye Model B16T TV set. The first DX-TV report of fast-scan reception? Apparently mounting the aerial horizontally or vertically made little difference.

If anyone is having a clear out and comes across any very early issues, please don't burn them but let us know!

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon from page 659 and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

THORN 8500 CHASSIS

There are two problems on this set. First, slight jittering of the picture at the top of the screen. This usually occurs after switching on or changing channel after a long period of time, but also occurs less frequently at other times. The second problem starts shortly after switching on – a popping and crackling from the speaker, similar to the sound of frying bacon.

The MJE340 sound output transistor VT701 is notorious for this sound crackle and hiss. The intercarrier sound i.c. (IC2, MC1358PQ or equivalent) is a less likely possibility. For the jitter, first check carefully for bad connections or dry-joints in the field timebase, then suspect the following, given in order of likelihood: the field R/G balance control R460, the bootstrap capacitor C438 (10μF), the 2N6178 field output transistor VT410, the field scan coupling capacitor C439 (160μF) and diode W413 (OA91) in VT410's base circuit.

DECCA 30 SERIES CHASSIS

There's an intermittent fault on this set. Usually the valves light up when it's switched on, but occasionally they don't.

Wait for the fault to occur, then check with a meter that h.t. is present at the h.t. fuse F1. If not, check the mains fuse F3, its connections and the holder. If the h.t. is present there's an intermittently open-circuit connection on the mains transformer or at some point in the heater chain. In the latter case the PY500A boost diode and the print around the PL508 field output valve's holder are suspect.

TYNE 5265

The sound is being almost blotted out by a steady whistle whose frequency seems to be around 2·5kHz. The frequency of the whistle changes when the volume control is at about 75% of its maximum setting, but at all other settings the volume and frequency of the whistle remain the same.

As the vision signal is not affected, the cause of the fault appears to be around the TDA1190 intercarrier sound/audio output i.c. Check the various decoupling/smoothing capacitors associated with this – C831 (0·1μF) which decouples the differential input, C835 (0·01μF) which decouples the volume control's slider, C844 (33μF) which decouples the 24V rail and C838 (220μF) and C837 (100μF) in the power amplifier gain setting network. These capacitors can be checked by bridging. C839 (220pF) and C841 (0·001μF) which prevent parasitic oscillation in the chip should be checked by substitution if necessary, also the damping network R839 (1Ω) and C842 (0·22μF). If the fault persists, the TDA1190 chip itself is suspect. Before replacing it, make sure that it's earth tabs are well jointed and that the print land to which they are connected is well earthed to chassis.

ITT VC300 CHASSIS

The problem with this 12in. portable is reduced line scan – the picture is only about half the normal width.

Start by checking that the l.t. supply is correct at 11V. The simplest place to do this is at pin 3 of the c.r.t. If the voltage is lower, suspect the power supply. Check the 8·2V zener diode D6, the series regulator transistor T2 and the setting of R20. If the 11V supply is correct, move over to the line output stage. Suspects here include the 1·8μF line scan coupling capacitor C92, the boost capacitor C93 (220μF), the boost diode D15 and the line output transistor T14. If the overwinding on the line output transformer is very warm, the e.h.t. stick D17 (TV11) could be leaky.

RANK A774 CHASSIS

Once the set has warmed up the picture shrinks till it's only five inches high, with blank areas at the top and bottom. A new PCL805 field timebase valve has been tried without success.

If the reduced field scan is linear, the trouble is probably in the height circuit. Check the boost supply filter network 3R64/3C38, the height supply feed resistor 3R31, the control itself for a dud spot on the track and if necessary the height stabilising VDR (3VDR3). If the reduced field scan is non-linear, check the output valve's cathode bias components 3C18/3R37 and the linearity coupling capacitor 3C17.

AQUADAG COATING

I have a salvaged colour tube which checks out at about 60% on my tube tester, so it should be worth using. The graphite coating at the rear of the tube has flaked off in places however. I've considered painting it with powdered graphite, but am not sure whether the coating is in any way critical.

The external Aquadag coating is mainly present to provide the e.h.t. smoothing capacitance (in conjunction with the glass and the internal coating). If 70% or more of it is still there the tube will work all right. If more than 30% of the external coating is missing a conductive paint with sufficient adhesion will need to be applied.

GRUNDIG 1500

There's no raster and as the usual negative voltage at the control grid of the PL509 line output valve is absent I assume that the line oscillator has stopped. A new PCF802 line oscillator valve and checks on most of the components in this stage have failed to cure the fault however. The voltages in the line oscillator stage seem to be correct.

We suggest that you start by disconnecting the line output valve's screen grid feed resistor R563 to prevent overheating in this stage whilst investigating the cause of the fault. The usual cause is failure of the PCF802 valve or one of the four associated capacitors C611/2/3/4, but if the voltages in the stage are indeed correct, especially the −36V at the control grid of the pentode section of the valve (pin 2), the oscillator is running correctly and suspicion must fall on the transistor line driver stage (Tr621, type BF259G). If this transistor has failed, the normal −90V at the control grid of the PL509 will not be present.

VCR Servicing

Part 12 **Mike Phelan**

To round off our discussion of the basic VHS machine (JVC HR3330/Ferguson 3V00 etc.) we'll cover the few odds and ends not yet mentioned. The audio circuitry is fairly simple and reliable, but there are one or two stock faults.

Continuous slight variations in audio level, whether on the machine's own recordings or on prerecorded tapes, are usually caused by one or both of the switches on the audio-servo panel being dirty. They are both slide switches, one for record/playback and the other smaller one for the audio dub facility. When in audio dub the sound track only is erased by the audio erase head mounted next to the audio-control head, the full erase head on the left-hand side not being in operation. A word of warning here: when replacing the board, the actuating rods do not go into the holes in the switches (see Fig. 53).

Another common audio fault is that the machine will play prerecorded tapes perfectly but its own recordings have a varying sound level. This is usually caused by short-circuit turns in the audio record/playback head. Why doesn't it affect playback? Those of you familiar with audio recorder servicing will probably have guessed why. The signal developed at the head on playback is infinitesimally small, not nearly enough to break across the defective insulation between the windings. On record however there's an a.c. bias voltage of 70-80V peak-to-peak plus the audio signal – this "bridges the gap" quite effectively.

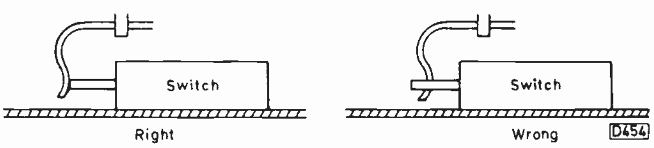


Fig. 53: Audio switch actuator arrangement.

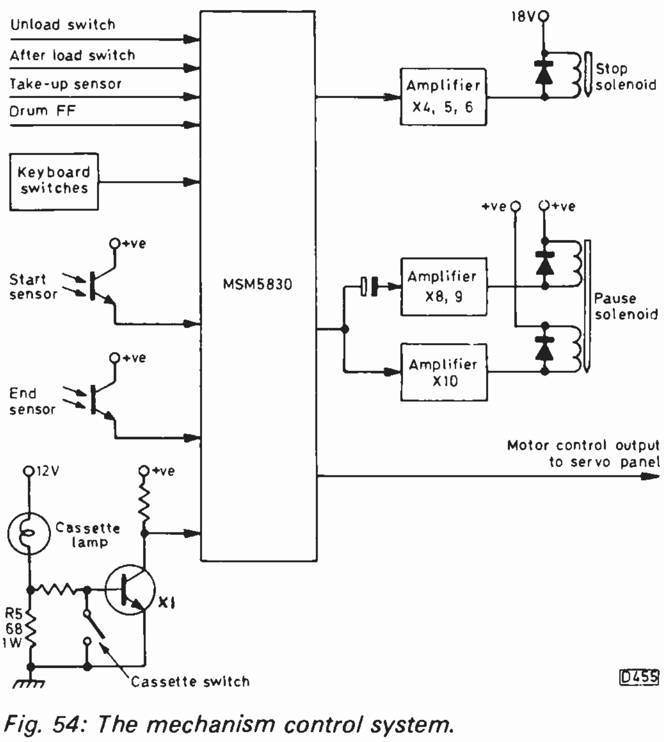


Fig. 54: The mechanism control system.

It's worth noting that it's not much use looking for the audio record signal past the point where the bias is added – the relative signal amplitudes are such that the bias makes the audio difficult to see on a scope.

The only other problem in this part of the machine concerns the erase/bias oscillator. This sometimes fails intermittently due to the oscillator's l.t. supply feed resistor R135 (5·6Ω) increasing in value. Where the oscillator is running but the output amplitude is very low, try disconnecting the full erase (FE) head. If the amplitude suddenly increases, the head has short-circuit turns and must be replaced.

It's as well to remember that if the erase function is not working the f.m. luminance erases the previous recording quite well, leaving the audio and traces of the chrominance information. The result is that the new recording appears with a vestige of the old audio and erratic flashing chroma or no chroma at all. This latter possibility depends to a great extent on whether both recordings are from the same channel, as to reproduce chroma it must be in phase with the sync. So always listen as well as watching.

The only other part of the circuit to discuss is the mechacon board below the operating keys. This controls the pause and stop solenoids, using a special-purpose i.c. (MSM5830) which receives several inputs – from the microswitches operated by the keys and several safety inputs (see Fig. 54). The after load, unload and keyboard switches cause the pause solenoid and motor control to operate in the correct sequence. The stop solenoid will operate under the following conditions: when the cassette lamp shines on the end sensor in fast forward, record or playback; when the light shines on the start sensor in rewind; and when the light shines on both sensors (i.e. no cassette inserted or tape broken) in any mode.

If the cassette lamp fails, the auto-stop facility no longer works. To prevent damage to tapes in this event the circuit is arranged as follows. The current through the bulb turns on transistor X1 due to the voltage developed across R5: if the bulb fails, X1 switches off and operates the stop solenoid via the MSM5830 i.c. In addition, if the cassette housing has not been depressed the cassette switch remains closed, shorting the base of X1 to chassis to switch it off.

Should the take-up spool stop rotating in any mode, or the drum stop rotating in record or playback, the machine will go to "stop" after a delay of several seconds. In the case of the head drum this is done by monitoring the drum FF signal, i.e. the head switching signal. If the flywheel has moved on the spindle so that the magnets are not close enough to the pick-up head, if the latter is open-circuit (sometimes intermittently), or the AN318 servo i.c. is defective, the machine will run for only ten seconds or so in record or playback but the rewind and fast forward modes will not be affected. Take-up spool rotation is sensed by a Hall effect i.c. mounted near a rotating magnet on the counter pulley which is driven by the take-up spool. The Hall effect i.c. produces an output when the magnetic field around it varies. This control function is obviously overridden in the pause mode, but only for five minutes or so – after this time the stop solenoid operates to prevent wear of the tape as a result of the video head scanning the same portion all the time.

Finally, if the "memory" switch is depressed the stop solenoid operates when the tape reaches 9999 – on rewind only.

Earlier machines used discrete CMOS logic i.c.s and transistors in place of the MSM5830 i.c.

This part of the machine is fairly reliable. Both the phototransistors occasionally go leaky, giving rise to random tripping, but this can also be caused by holes in the tape oxide. Beware also of stray light when operating the machine with the top removed, particularly in the case of the start (right-hand) sensor which has only a short rubber cover on it. If you put black tape on the sensors to avoid this, don't forget to remove it!

TEST CASE

238

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.

The circuit used in the GEC C2110 series follows the conventional practice of the time. It's a well known chassis, still in widespread use. The various stock faults don't cause much trouble with diagnosis and repair, and apart from the mixed blessing of the double-sided print on the panels the design is a likeable one so far as we are concerned. A recent workshop job gave us rather more trouble than usual however.

The symptom was lack of field sync when hot. We switched the set on to run for a while, and checked that the field hold control had a normal locking range when cold. After an hour or so field hold was lost, so the set was wheeled to the operating table. Being very subtle, we started by shunting a 47μF capacitor across the a.g.c. reservoir capacitor C117 (47μF), but this had no effect at all. The line sync was satisfactory, so we connected the oscilloscope to the field sync input connection (PL47) on the field timebase panel. What we found was a 5V positive-going spike sticking up from the line frequency pulses, i.e. the correct conditions as shown in oscillogram 26 in the manual.

This pulse is applied to the base of the field sync pulse amplifier transistor TR451, so we went on to make a check at its collector and found a 30V negative-going spike here, just like the book says. At this point we emerged from the back of the set and looked at the screen, only to find the picture solidly locked. Damn intermittent faults! As we didn't want to hang about we replaced the following items: TR451, its emitter decoupling capacitor C452 (4·7μF), the sync pulse integrating capacitor C451 (0·01μF), and the sync separator bias resistor R404 (2·2MΩ) on the sync/line generator panel. We then left the set on soak test.

Twenty minutes later the picture was rolling like a fruit machine again. Hardly daring to breathe on it we gently checked once again at PL47. Sync input o.k. Clipping the scope's earth lead firmly to the metal chassis frame, we once more moved on to the collector of TR451. The −30V sync pulse was present, but was riding on a sawtooth waveform of several volts amplitude. What was this? The field scan sawtooth is developed later in the circuit, at the collector of TR452. What was it doing back at TR451? It couldn't be getting back via TR452 and the BR101 field oscillator, not with the timebase working – as it was. The mysterious sawtooth was also present at the emitter of TR451. Just before the fault disappeared and normal sync was resumed, we noticed that the rolling picture was lacking a bit in height.

With the above symptoms in mind we settled down to study the circuit diagram whilst having a cup of tea. Soon it all fell into place, and the soldering iron was wielded to good effect. What was happening then? See next month!

ANSWER TO TEST CASE 237 – page 605 last month –

A Toshiba V8600B VCR was the patient on the bench last month, the rather daunting symptom being failure to record when under the control of the timer. We'd found that head rotation was correct, and that the tape slack sensor was shutting the machine down soon after it started to record. It remained for us to find the cause of the momentary tape slackness when starting.

In this machine the take-up spool is belt driven from the direct-drive head drum motor. The drive in fact comes via three belts, the third and smallest coupling the fast-forward pulley to the take-up spool pulley. The trouble lay here: the small belt was slipping at the moment the machine started up, with the result that the take-up spool was not accelerating fast enough to maintain correct tape tension. A degreasing operation was carried out on the belt and pulleys and this did the trick.

The slack sensor switch is linked to the system control department via a time-constant delay consisting of R697/C628. The race between the take-up spool and the slack sensor can be a rather close-run thing, especially when the machine starts from cold. To overcome this problem, Toshiba recommend lengthening the time-constant by adding a 10μF, 16V tantalum capacitor across C628 – on the print side of the servo/logic board. C628 lives at the edge of this board, near IC603.

QUERY COUPON

Available until 20th October 1982. One coupon, plus a £1.00 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the usual conditions (see page 657).

TELEVISION OCTOBER 1982

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BA131	8p	BZY79C 20V	8p	IS1658	8p
BA154	8p			ITT638 CV9	6p
BA157	8p	DA002	8p		
BB103	8p	IM102255	8p	ZX150	8p
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9000 LOPT	10.15
Mono portable LOPT. Thorn, GEC, etc.	3.75
Mullard diode splitting LOPT. GEC, etc.	14.75

DROPPERS

Pye 78+161	40p
Pye 147+260	40p
Thorn 6+1−100 3K	50p
Thorn 56+1K+47+12	1.00
Thorn 350+20−148+1K5+317	1.00
Thorn 50+40+1K5	50p
RBM 250+14+58TV161	50p
3R5 + 15R − 45R 28W Working @	90p
140+140 28W	40p

3000, 8500 Thorn focus pot	1.25
9000 Thorn focus pot	1.00
IC inserters. 16 pin	50p
Large IC extractor	50p
Crystals 4.433619MHz	50p
EHT lead for split diode LOPT	1.00
Litesold 20 watt 240V soldering iron element	65p each or 4 for 2.00
EHT final anode cap	47p
6MHz ceramic filter	30p
ITT bridge rec. FXS 244/2A	15p
Castors, sets of 4	2.50
Direct panel mounting. 20mm fuse clips	pair for 25p

WIRE WOUNDS

1.5R 5W Thorn 3K	30p	270R 5W	15p
2R 5W Thorn 3K	30p	270R 7W	16p
2.2R 4W	15p	280R 17W	23p
3.3R 9W	30p	330R 5W	15p
4R 11W fusible	25p	330R 7W	16p
7R 9W fusible	25p	330R 11W fusible Thorn	25p
8.2 7W	15p	370R 17W	23p
10R 7W	15p	820R 4W	15p
12R 9W	20p	1K2 9W Thorn 3K/4K	18p
15R 5W fusible	25p	1K2 11W fusible	25p
15R 7W	16p	2K2 5W fusible	25p
15R 11W Thorn 3K	30p	2K2 7W	16p
15R 17W	23p	2K2 7W fusible	25p
22R 4W	15p	2K2 9W fusible	25p
22R 9W fusible	25p	2K3 5W	15p
27R 7W	16p	2K7 9W fusible	25p
27R 7W fusible	25p	3K9 5W fusible	25p
36R 17W	23p	3K3 4W	15p
82R 4W	15p	4K7 7W fusible	25p
82R 9W fusible	25p	5K1 7W	16p
100R 5W fusible	25p	8K2 7W	15p
220R 7W Korting fusible	30p	8K2 9W 8K Thorn	23p
220R 17W	23p	10K 7W	15p
235R 9W fusible	25p	10K 9W	16p
240R 9W Thorn 4K	30p	39K 4W	15p

8500 IF/decoder panel. Ex-equipment, untested	4.75
Mains on/off switch, rotary	20p
Mains on/off switch, push	20p
A1 switch. Thorn 3000/3500	50p
A1 switch. Thorn 4000 + fits ITT/Pye	50p
A1 pot 5M 3000/3500	70p
100K 40 turn pots for v/cap tuners	25p
Double fuse holder on small pax. board (20mm type)	10p
Single fuse holder on small pax. board (20mm type)	5p
In line fuse holder (1¼" type)	50p

Ex-equipment untested 3000/3500 panels any specified panel	3.75
UHF aerial socket & lead. Pye, ITT, Thorn	25p
UHF aerial socket & lead. GEC	25p
UHF aerial socket & long lead. GEC	35p
UHF aerial socket & mounting bracket for Thorn 4000	40p
UHF TV aerial for portable	50p
625 aerials + fittings available. Price list on request	
Coax plugs	12p
Switched flush fitting aerial outlet (white)	1.20

CARBON RESISTORS

12R ½W, 22R ¼W, 27R ½W, 39R ½W, 56R ¼W, 56R ½W, 62R 1W, 68R ⅛W, 68R ¼W, 68R ½W, 75R ½W, 82R ½W, 100R ½W, 120R ¼W, 120R ½W, 130R 2W, 150½W, 180R 1W, 220R ½W, 220R 2W, 240R ½W, 240 R1W, 270R ½W, 270R 1W, 300R ½W, 330R ½W, 470R ½W, 560R ½W, 680R ½W, 820 R½W, 820 R1W, 1K ½W, 1K 1W, 1K 2W, 1K 5½W, 1K 5 1W, 1K 8½W, 2K 2.1W, 2K 7.1W, 4K 7⅛W, 11K ½W, 12K ½W, 18K 2W, 22K 1W, 33K ½W, 36K ½W, 47K ½W, 68K ½W, 100K ½W, 110K ¼W, 270K ½W, 330K ½W, 330K 1W, 390K ½W, 500K ½W, 1MEG ½W, 1MEG 2W, 2M 2½W, 2M 7½W, 4M 7.1W, 10M ½W **any 10 for 25p**

Thorn 9K thick film units FR1 or FR3	1.25
10 Meg thick film focus resistor	65p

EX-EQUIPMENT SPARES

Convergence yoke 3000/3500	1.75
Scan coils 3000/3500 please state which	2.75
3000/3500 LTB (tested) L501/L502/L503/L504/T502/T501	50p each
3000/3500 PSU (tested) T602/L601	50p each
3000/3500 chroma delay line DL301 (tested)	65p
3000/3500 lum. delay line L203 (tested)	65p
3500 convergence (tested) T751, L751, L752, L753, L754	50p each
3000/3500 frame output transformer (tested)	1.00

CAPACITORS

3.3PF	350V	3000PF	2KV
6.8PF	63V	3300PF	250V
8.2PF	350V	4700PF	400V
10PF	350V	.0047MF	500V
12PF	1000V	.0075MF	2KV
22PF	63V	.01MF	250V
30PF	63V	.01MF	600V
47PF	350V	.015MF	400V
182PF	63V	.02MF	200V
250PF	2000V	.02MF	250V
330PF	63V	.022MF	250V
330PF	160V	.047MF	400V
330PF	8KV	.1MF	250V
470PF	250V	.1MF	2KV
560PF	63V	.22MF	400V
1000PF	250V	.33MF	250V
1500PF	250V	.39MF	250V
1800PF	160V	.47MF	250V
2700PF	63V		

Any 10 @ £1.00

ELECTROLYTICS

1MF 63V	20/£1	100MF 100V	10/£1
1.5MF 63V	20/£1	100MF 160V	10/£1
2.2MF 25V	20/£1	125MF 16V	10/£1
4MF 64V	20/£1	150MF 25V	20/£1
4MF 350V	10/£1	160MF 25V	20/£1
6.8MF 40V	20/£1	160MF 40V	10/£1
10MF 40V	20/£1	220MF 40V	10/£1
10MF 160V	10/£1	250MF 25V	10/£1
15MF 16V	20/£1	330MF 10V	20/£1
15MF 63V	20/£1	330MF 35V	10/£1
22MF 10V	20/£1	330MF 63V	10/£1
22MF 40V	20/£1	470MF 6.3V	20/£1
22MF 63V	20/£1	470MF 10V	10/£1
22MF 160V	10/£1	470MF 25V	10/£1
32MF 275V	10/£1	470MF 40V	10/£1
33MF 40V	20/£1	640MF 10V	20/£1
33MF 50V	20/£1	680MF 16V	20/£1
33MF 250V	10/£1	680MF 40V	10/£1
47MF 350V	10/£1	1000MF 10V	10/£1
50MF 25V	20/£1	1500MF 16V	10/£1
68MF 250V	10/£1	2200MF 25V	6/£1
100MF 18V	10/£1	3300MF 25V	10/£1

MULTI SECTION CAPACITORS

175+100+100 350V Thorn 3K	2.00	200+200+100 350V	70p
100+150+50 350V	50p	200+100+50 300V	60p
200+32+300+100 350V	50p	150+150+100 300V Thorn 1K5	1.90
2500+2500 63V Thorn 8K	1.20	32+32+16 350V	40p
		32+32 350V	30p
200+100+100+50 350V	50p	200+100 325V	70p
		200+47 250V	65p

CAN TYPES

2MF 20V	50p	800MF 250V	70p
22MF 375V	50p	1250MF 40V	50p
50MF 350V	50p	1250MF 50V	50p
100MF 150V	65p	1500MF 70V Thorn 3K	1.00
220MF 400V Thorn 9K6	1.30	2000MF 30V	50p
200MF 450V Thorn 4K	1.30	2200MF 40V Thorn 4K	1.00
400MF 350V Thorn 8K	90p	2500MF 35V	65p
		2500MF 40V	65p
800MF 250V print type	80p	300MF 25V	50p
		3300MF 25V	60p

39 HIGH ROAD, NORTH STIFFORD, GRAYS, ESSEX, RM16 1UF.

(Mail Order Address Only) Delivery within 28 days.

PLEASE ADD 60p P&P, PRICE INCLUSIVE OF VAT, ADD POSTAGE FOR OVERSEAS ORDERS

THOUSANDS OF ADDITIONAL ITEMS AVAILABLE, ENQUIRIES INVITED

I wish to pay by Access.

Access No. ....

Amount ....

NAME ....

ADDRESS ....

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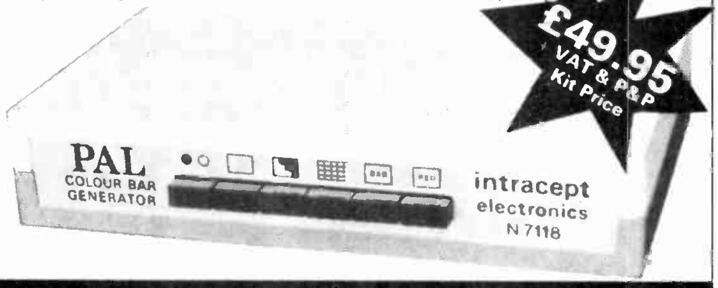
Signature ....

N7118 PAL COLOUR BAR GENERATOR

An extremely light, compact and durable instrument, designed for mobile Colour T.V. Maintenance in the customers home. The basic model includes a built-in rechargeable battery plus a Power Unit/Charger. (A fully charged battery gives 10 hours continuous use). All patterns and sync. pulses are derived from a single crystal controlled oscillator, producing extremely accurate, stable displays. The patterns available are: Standard Colour Bars, Red Raster, Linearised Grey Scale Step Wedge, Crosshatch and Peak White Raster. A Coaxial Socket on the rear panel provides a modulated UHF or VHF (please specify) signal of approx. 1mV for direct connection to Receiver Aerial Socket. An (optional) integral Sound board is available, producing a Sound Carrier (6MHz or 5.5MHz), frequency modulated by a 1KHz Sinewave. The N7118 will also house a third board that provides a 1 Volt p to p, 75 ohm Video Signal to a rear panel B.N.C. Socket.

£49.95 VAT & P&P Kit Price

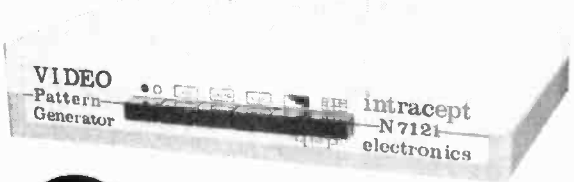
Complete kit, including a professional finished case, screen printed P.C.B., Ready Built P.S.U., and all components – **£59.50** inclusive. Sound and Video Boards, add **£10.29** per board.
Ready Built – **£88.25** inclusive, Sound and Video Boards add **£11.45** per board.
S.A.E. for details and specification.



N7121 VIDEO PATTERN GENERATOR

This Generator, based on the N7118 is designed for the mobile servicing of Colour Monitors and V.D.U.'s. It produces three separate Colour output signals at 1 Volt peak to peak into 75 ohms. Also provided is a separate sync. output which may be adjusted for positive or negative-going sync. tips. The Generator may be operated at 625/50Hz or (by operating a push switch on the rear panel) 525/60Hz.

The patterns available are colour bars, crosshatch, 8 step grey scale wedge, peak white plus many other combinations i.e., red raster, blue raster, yellow crosshatch etc., as defined by the three (red, green – blue) beam switches on the front panel. The generator is powered by an internal Ni-Cad battery and is supplied complete with the Charger/Power Unit.



Price (Built & Tested) **£75.00** + VAT & p. & p.
Total **£88.25**.

All goods despatched within 14 days.

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GUARANTEED COMPLETE · GOOD CABINETS
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AD149	0.480	BU126	0.700	TBA950	0.800
AD161	0.220	BU205	0.750	TBA990	0.800
AF139	0.220	BU208	0.800	TDA1170	0.900
AD162	0.220	BU208A	0.850	TIP29	0.150
AF239	0.220	BU526	0.800	TIP41A	0.220
BD131	0.250	BY127	0.080	TIP42A	0.220
BD132	0.250	BY133	0.080	TIP2955	0.340
BD136	0.200	BY164	0.220	TIP3055	0.340
BD137	0.200	C106D	0.220	2N.3055	0.320
BD139	0.200	OA47	0.060	2N.3771	0.900
BD140	0.200	OC28	1.000	2N.3772	0.950
BF194	0.050	OC29	0.800	2N.3773	1.000
BF195	0.050	OC35	1.000	LM309K	1.000
BF196	0.060	R2008B	0.800	7805	0.350
BF199	0.060	R2010B	0.800	7812	0.380
BFX86	0.150	TBA520	0.750	7815	0.380
BFX87	0.150	TBA530	0.750	7818	0.380
BFX88	0.150	TBA540	0.750	7824	0.380
BFY50	0.140	TBA550	0.750	7905	0.350
BFY51	0.140	TBA560	0.700	SMALL LED	0.050
BFY53	0.110	TBA800	0.350	RED.	

Please add 40p. P&P and VAT at 15%. Govt. Colleges, etc orders accepted.
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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:

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

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

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

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

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

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The prepaid rate for classified advertisements is 33p per word (minimum 12 words), box number 60p extra. Semi-display setting £5.64 per single column centimetre (minimum 2·5 cms) All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television, Room 2612, IPC Magazines Limited, King's Reach Tower, Stamford St., London, SE1 9LS. (Telephone 01-261 5846).

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

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ORDER FORM PLEASE WRITE IN BLOCK CAPITALS

Please insert the advertisement below in the next available issue of Television for . . . . insertions. I enclose Cheque/P.O. for £. . . . . .

(Cheques and Postal Orders should be crossed Lloyds Bank Ltd and made payable to Television)

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ADDRESS ....

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Classified Advertisement Dept., Room 2612, King's Reach Tower, Stamford Street, London SE1 9LS. Telephone 01-261 5846.
Rate
33p per word, minimum 12 words. Box No. **60p** extra.

OCT 82

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G8 WORKING PANELS

Power £6, Chroma £9, Line £12, Tuner Assy £5, I.F. £6, Field £6, Conv. £6 (state type), Selectors £4 (flat) £8 (slope)

All tested before despatch. Post paid. No exchange required.
C.W.O. to:
TELE-Q, Lutwidge Ave., Deepdale, Preston.

Rank, Bush, Murphy TV Panels
Repair/Exchange Service
Same Day Return
With 3 Months Guarantee
Also On The Spot Repair To BUSH TV's Brought In
T.K. Panels Service,
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PROFESSIONAL STICK
DE-GAUSSING-COILS
£18 EACH INCLUSIVE & DELIVERED
1 Year Guarantee.
U.View (Tubes)
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Thousands of different full size service sheets Thousands of different manuals of all kinds in stock.
(Many of above are unique to us and obtainable nowhere else.) Any published single service sheet still only £1 + s.a.e.
British CTV circuit/layouts from dual to latest from Decca, G.E.C., ITT, Philips, Pye, Rank, Thorn, etc.
Continually updated – 3 giant binders only **£39.50** – latest update includes Thorn 9200 to 9800.
Revised foreign C.T.V. Repair System in 2 huge binders plus 3 Repair Manuals for £39.50.
Contains chassis from Grundig, Hitachi, Korting, Kuba, Luxor, Mitsubishi, National P., Nordmende, Sharp, Skantic, Toshiba, Zanussi.
Any Repair Manual only £6.50 for the first – £6 each thereafter.
Save £6.50 on complete set of 11 unique TV repair manuals – only £60. Mono +colour from dual standards to recent sets, McCourt & Tunbridge.
Thousands of different full size service sheets Thousands of different manuals of all kinds in stock. £2 for catalogues with £4 vouchers.
L.S.A.E. brings free 50p, magazine, any quotations, details of unique T.V. publications and bargain offers.
Phone: 0698 883334, anytime. Callers 4–6 pm. weekdays, Saturdays 11 am.–1pm only.
G.T. TECHNICAL INFORMATION SERVICE
76 CHURCH ST., LARKHALL, LANARKSHIRE ML9 1HE.

30,000 SERVICE SHEETS IN STOCK. COLOUR MANUALS ALSO AVAILABLE

TV Monos, Radios, **£2.00.** Tuners **£2.00.** Tape Recorders, Record Players **£2.00.** Transistors, Stereograms & Music Centres **£2.00** + SAE. Also Colour Available. Car Radios **£3.00** + SAE. All Radiograms **£2.00.** State if Circuit will do if sheets are not in stock. All TV Sheets are full-length 24×12, not in Bits & Pieces. All other Data full-lengths.
All Sheets **£2.00** except Colour. Old Valve Radios
MAIL ORDER S.A.E
C. CARANNA, 71 BEAUFORT PARK, LONDON NW11 6BX. 01-458 4882

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Television Service Sheet Specialists
Workshop Manuals, large selection of Japanese and European TV Sheets. Callers 5.30-7.00 pm, Upper Floor. Send S.A.E. for Catalogue and Enquiries:
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REQUIRED. Part time or Freelance Engineer. 021-773 8181.

NEWLY ESTABLISHED video showroom requires part-time or free-lance colour video service engineer, with own workshop or equipment. Phone Mr Shaw, Windsor 67774.

WANTED

EMI CABLE TV, valve ALC bias unit for use on RE703, any condition, also any 700 series info. 87 Bath Street, Abingdon, Oxon. 0235 20005.

COLOUR T.V's PORTABLE (or small screen) any quantity, new/secondhand (worker/non-worker). Tel: (0203) 714213.

WANTED Privately 26" Teletext T.V., preferably Thorn or Phillips, but other makes considered. Cash waiting, might collect. Telephone (0608) 3050 day, (0993) 841999 evenings.

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Comprehensive repair data with all circuits, layouts, modifications for any early model from AKAI (7100/9300), Baird ( ), Ferguson 3292, JVC ( ), Thorn (3V00/3V01/3V16/3V22/3V23) and others using same format **(for only £8.50 each).**

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Set of 4 Repair Manuals to match above collection £8.50
Most VCR Service Manuals by return.
Repair data with circuits almost any named TV £8.50.
L.S.A.E. for free 50p magazine/quotes etc.

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LANARKSHIRE ML9 1HG. PHONE 0698 883334.

FOR SALE

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TELEVISION, January 1970-October 1981. 10 missing, 2 incomplete. Offers, 0272-557076.

COLOUR T.V.'s. Good working, £25 each, any quantity. Most makes, sizes available. Tel: Coventry (0203) 714213.

REGUNNED A1 TUBES 22" £25.00. Mono £11 – Sub £11.00 PIL in stock. Ring first 021-773 8181, 772-1573 seven days till 8 pm.

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For a good selection of used TV sets in good cabinets . . .
* Large stock of working sets. * U.K. Delivery Service.
* Stands, Aerials, Tubes and Panels.

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(A) That you have clearly stated your requirements.
(B) That you have enclosed the right remittance.
(C) That your name and address is written in block capitals, and
(D) That your letter is correctly addressed to the advertiser.
This will assist advertisers in processing and despatching orders with the minimum of delay.

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THORN Front Panels, 6 slider pots & knobs & touch button. Ultrasonic transductor & I.C. & components & Mains Switch **£3.75**

GEC C2110 Line OP Transformer **£7.00**

ZTX 109K	3p	BC548	4p
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TDA1003	15p
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TDA2560	50p
TBA540Q	40p
SN76660	30p
TBA800	30p
SN76707	50p
TBA810	30p

CVC 45 Line O.P. Trans	£4
CVC 45 Triplers	£3.50
3500 Triplers	£3.50
KT3 AE Sockets	25p
G11 Tuner Units	£6.00
G11 6 Button Key Switch	£2.00
G11 E/W Coil	50p
G11 E/W Transformer	50p
G11 Line OSE Tran.	50p
G11 .47/250	10p
G11 8200pF/2000V	15p
G11 11000/1500V	15p
G11 Transient Suppressors 245V	25p
G11 Scan Coils	£5.00
KT3 AE Sockets	25p
G11 Mains On/Off Switch	40p
ELC1043/05 NEW on Panel	£4.00
20 BY298 3 Amp fast recovery diodes	£1.50
4000 Thorn Frame Panel	£5.00
4000 Thorn Power Supply	£3.00
4000 Thorn Line OP Panel	£20.00
Post **£4.** 15" T.V. Tube Hitachi; New	£6.00
NPN PNP 80V 6 Amp TO66 O.P. Trans Piar	25p
GEC IC CBF16848, SN16861, SN1682	50p each
Mixed Packs, Mounting Kits and Washers for Power Transistor	50p
DECCA I.F. 80-100	£3.50
BRIDGE REC Wire leads KBP04	15p
G11 Time Base Panel	£12.00
A.E.C. V/cap Resistor Unit U.H.F. with I.C. SAS 660 SAS 670	£3.00
KT3 200×25×25 385v	£1
BF458	10 for £1
Thorn 3500 Frame Panel	£1.50
Thorn 900 Sound O.P. Panel. NEW	£1.00
U321 T/Unit on Panel Cum 40 ITT	£6.00

Thorn 3500 I.F. Panel. NEW	£3.00
Thorn Tuner Panel, 6-100K Pots & Components, NEW, NO Tuner ELC1043/05	£2.00
GEC Line O/P Trans & Rec Stick for Portable	£3.00
RANK TOSHIBA Tube Base	25p
LP1162 O/P STAGE	75p
Y933	5p
IN914	5p
BA248	5p
G11 Power Supplies	£12
REC & TRANS 40K Transducer	**EACH** 50p
TIC 126 12A 800V	30p
BPW41	15p
BD437	25p
PHILIPS NE511N	£1.20
GEC 2040 Line OP Transformer	£5.00
LD57 CA Infrared L.E.D.	15p
SAA5010	£2
BD131	10 off £1.50
BD136	10 off £1.25
BD226	20p
BD239	10 off £1.50
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20 GEC Black Spark Gaps	£1.00
Mono Rank Line Trans T704 A	£3.50
4000 Thorn Mains Dropper	35p
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G11 Line Driver Transformer	35p each
2 SD350A BU208A	£1
G11 IF Detector	£3.00
G11 Teletext Transmitter	£19.00
G11 Chrome/Lumin Can	£3.00
KT3 LOPT	£3
BG200/43 Tripler	£3
BU208A	£1
RCA CA270	40p
KT3 2SD 200 Line Transistor	£2
V.H.F. 3 Transistor Rotary Tuner Units D.X. T/V	£1 NEW
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DL 20A	£1.00
8 Core Screen Cable R.S.	35p per metre
Line O/P Transformer	
ITT CVC9	£7.00
AT2076/38 ITT CVC40 Split Diode	£10.00
Philips G8 Line O/P	£7.00
Philips G11 Split Diode	£12.00
ITT CVC32 Chassis	£30.00

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CMA10	£2.00
CMU40	£7.00
CMN40	£1.00
CMC67	£3.75
CMH31	£1.50
CMS30	£1.50

DIODE
MR856 20 for **£1.50**

IF PANEL CVC40-45	£5.00
CMF40	£2.00
CMU30	£7.00
CMU45	£1.50
CMA40	£1.50
CMA11	£2.0

BF470	30p	MC78M18	20p
BF757	30p	SL432 A/T	75p
ZTX213	4p	CA3094AE	50p

Infra Red Hand Set KT3	£18.00
BD437 and BD438 on Heat Sink	50p
International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
6A/600V Stud Diodes 20p; 6A/1000V Stud Diodes 20p; EHT Rectifier wire-ends 16Kv	10p
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10	BU126	£6.00	BF363	15p
10	BU208A	£8.00	BF362	15p
20	BU204	£8.00	BF480	50p
10	BU205	£8.00	BU326	£1.00
10	BU105	£8.00	BU526	75p

DECCA 100 Tripler	£4.00
BSX 19-20	15p
20 Large Red LED £1.00; 20 Small Red LED £1.00; 4000 Tube Base Print Board & Pots	£4.00
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
Mains-dropper PYE 3R5+15R+45R	50p
Thyristor 600V/4 amp C106M/2	24p
9500 THORN Tripler	£4.50
G11 Preh Red LED Push Button for C.H. Change	20p
THORN 3500 175+100+100 350V	£2.00
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RANK TOSHIBA Transductors TPC-2011	50p
Ultrasonic G11 Hand Set	£12.00

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VAT 15%, 50p Post.
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SENDZ COMPONENTS

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VAT 15%, 50p Post.
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TUNERS

MITSUMI small v/cap tuner units UHF	£4.00
MITSUMI small v/cap tuner units VHF	£3.70
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New. ELC 1043/05 Mullard on Panel	£4.00
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NSF 1043 on Panel	£5.00
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DECCA Bradford Tuner 5 button	£4.00
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LP1179 Seconds	50p
LP1162 New PYE OUTPUT STAGE	£1.50

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GEC 2040 Tripler	£2.50
DECCA 80 Tripler	£2.50
PYE TBQ	£1.50
DECCA 80	£4.00
TBZ fits GEC 1028, 2028, 1040, 1060, CS108	£4.00
G9	£4.00
CVC 20/25/30	£3.50
THORN 9000	£4.50
THORN 9500	£3.50
GEC 2110	£3.50
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GEC 2100	£3.00
LP1174/NC	£3.50
GRUNDIG TVK52	£3.50

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BG 100/61	£3.00
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TAU	£1.25

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THORN 3500	£1.00
DECCA Large	£1.00
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PYE 731 3+56+27R	50p
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Coax Plugs	12p
De-solder Pumps	£4.00
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RANK TOSHIBA Tube Bases	30p

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5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
5×3	15 ohm	80p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
8×5	16 ohm	£1.50

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470/470/250V	50p
385V/330M	60p
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4700/25V	25p

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750/50V	10p
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220/40V	5p
4/350V	5p

8/350V	5p
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680/40V and 25V	5p
47/250V	10p
33/450V	15p
2200/25V	10p
·1/600V	15p
·1/800	10p
·1/1000V	10p
·1/2000V	15p
·47/1000	30p
·01/1000V	10p
22/375V	15p
·047/1000V	8p
·0047/1500V	10p
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2N2-1500V	10p
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ITT CV5 7 Push Button Unit	£7.00
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TV 12 EHT REC	30p
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TV 14 EHT REC	40p
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MR 508 3 amp 800V	12p
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TCA650	£1.00
TCA660	£1.00
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AF139	25p
AF239	25p
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BA159	7p
BA182	7p
BA248	7p
BB103	7p
BB105	7p
BC107	7p
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BC109	7p
BC139	7p
BC147	7p
BC148	7p
BC149	7p
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BC157	7p
BC158	7p
BC171	7p
BC173	7p
BC174	7p
BC182L	7p
BC183	7p
BC207	7p
BC212	7p
BC213	7p
BC237	7p
BC238	7p
BC245	7p
BC250	7p
BC251	7p
BC252	7p
BC257	30p
BC300	30p
BC303	30p
BC307	7p
BC308	7p
BC327	7p
BC337	7p
BC338	7p
BC350	20p
BC365	10p
BC413	7p
BC454	7p
BC460	25p
BC462	7p
BC463	7p
BC546	7p
BC547	7p
BC548	7p
BC559	7p
BD130Y	25p
BD131	30p
BD132	30p
BD135	30p
BD136	30p
BD207	30p
BC221	20p
BD228	25p
BD238	20p
BD239	12p
BD331	20p
BD332	20p
BD253B	35p
BD416	25p
BD595	35p
BD596	35p
BD681	25p
BD807	20p
BD534	20p
BF127	20p
BF137	20p
BF157	20p
BF180	20p
BF181	20p
BF182	20p
BF185	20p
BF195	7p
BF198	7p
BF199	7p
BF200	20p
BF240	7p
BF245	7p
BF263P	15p
BF264	15p
BF273	7p
BF274	7p
BF337	24p
BF338	24p
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BU137	50p
BU204	50p
BU205	£1.00
BU208	60p
BU208A	£1.00
BU407	50p
BU426V	50p
BU526	£1.00
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BY210/400	5p
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BY226	15p
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BY296	10p
BY298	10p
BY299	10p
BYF3123	40p
BYF3126	40p
BYX55/350	10p
BYX38/600	50p
BYX38/300	25p
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TIP32	20p
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TIP34	50p
TIP35	50p
TIP36	50p
TIP41	30p
TIP42	30p
TIP100	30p
TIP130	30p
TIP2955S	40p
IN60	3p
Y716	20p
Y827	30p
BYW56 2A/1000v	8p
BYV95	8p
BYV96D	10p

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100 Mixed Sticks	£1.00
10 Thermisters	50p
20 Slider Pots	£1.00
30 Presets	50p
40 Pots	£1.50
300 Condensors	£1.50
300 Resistors	£1.50
150 Electrolytics	£2.00
15 Bulbs	40p
100 Diodes	£1.00
100 Fuses	£2.00
100 W/W Res	£1.50
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20 Slider Knobs	70p
8 Mixed Gun Switches	50p
20 I/C Holders	£1.20
Red Green L.E.D.	£1.00

DIODES

1 Amp 1600v	7p
3 Amp 100v	7p
3 Amp 1200v	10p
MR856 3 amp diodes	10p
W004 Bridge	15p
W005 Bridge	20p

9000 Thorn O/P Transistors with Heatsink T903 8v	£1.00
SW150 Surface Wave Colour TV Filter	£1.00
TiC 126N Thyristor 800v/12A	50p
Mullard Surface Wave Filter RW154 Colour T/V Filter	60p
7 Seg Display, Led, Red	50p
LM340T12 Reg	25p
1800/4KV	5p
4.7NF/5KV	10p
180/8KV	10p
210PF/8KV	10p
270PF/8KV	10p
330PF/8KV	10p
1000PF/10KV	10p
1200PF/12KV	10p

ITT SPARE PANELS

CVC9 Power Supply Board	£1.50

DECODER PANEL

ITT CVC20-25 30-32-40	£7.50
Audio Amp Driver Mod	£1.50
ITT Control Panel 5 Sliders and Mains Lead	£1.50
ITT 3 Sliders Control Panel	£3.50
2SC1030	£1.00
BF858	50p
TDA1010	£1.00
TA7607	£1.00
TA7609	£1.00
TA7315	£1.00
TDA2653	£1.00
TDA2560	£1.00
TDA7315	£1.00
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TAU80	£1.00
DL50	£1.00
DL70	£1.00
DL600	£1.00
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3.15 AS Fuses	5p
G11 Teletex Panel No. 3113-267-1597	£30.00
THORN R1039	50p
THORN R1038	50p
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