AUGUST 1977 45p

TELEVISION

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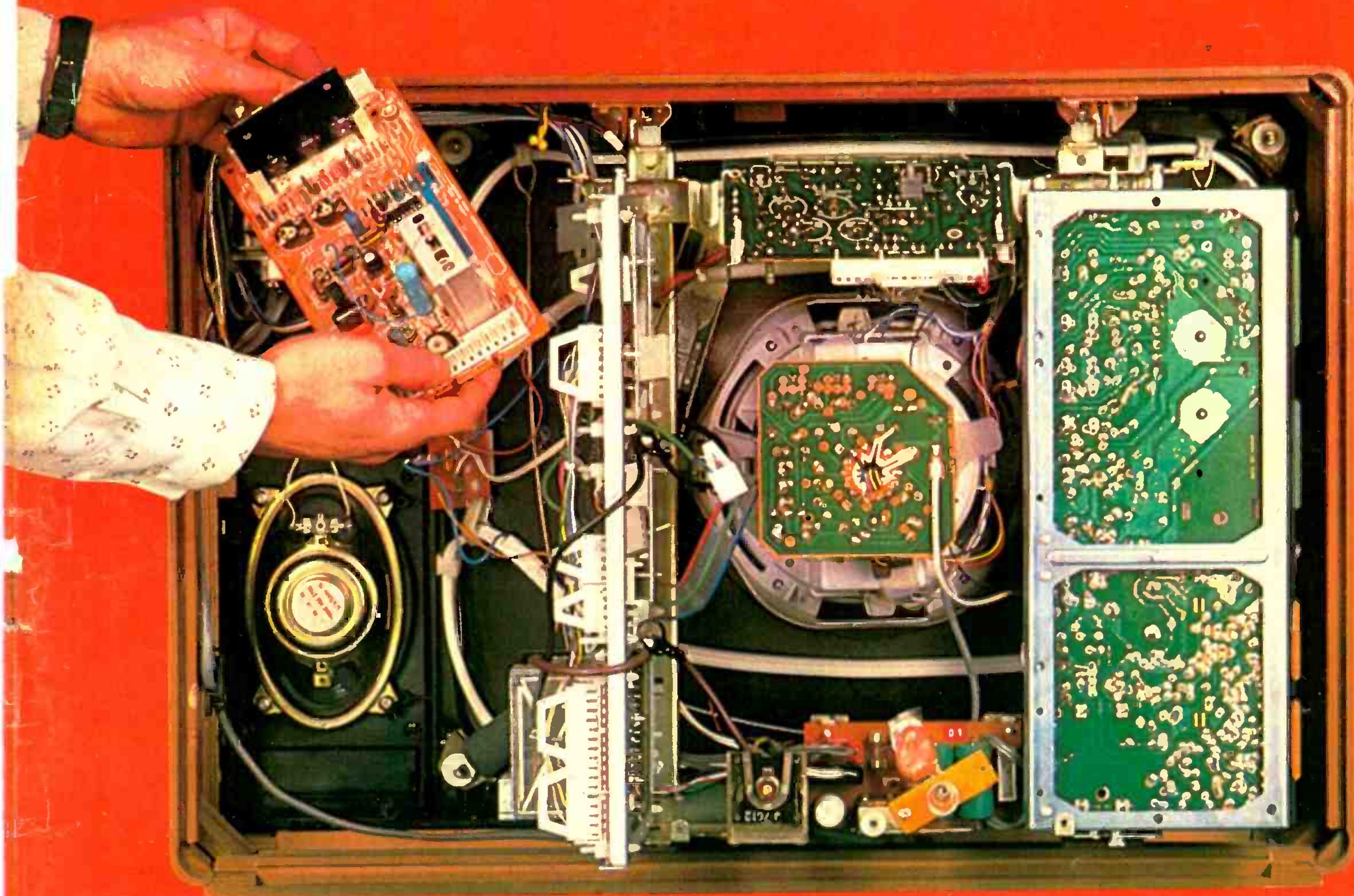

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TELEVISION

August 1977

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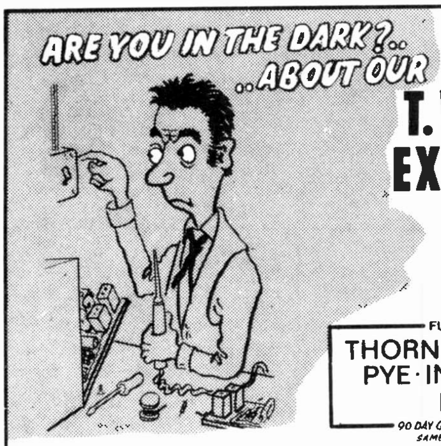

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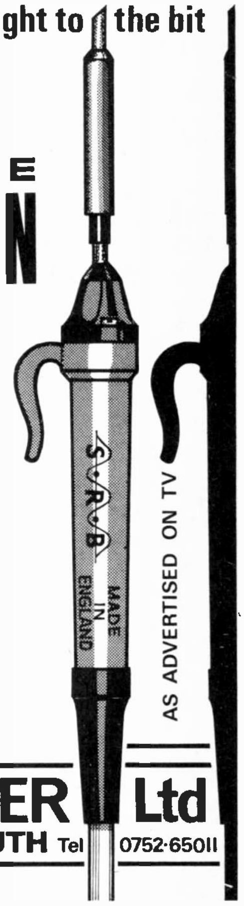

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AC141K	0.40
AC142	0.34
AC142K	0.39
AC151	0.31
AC152	0.34
AC153	0.42
AC153K	0.43
AC154	0.31
AC176	0.42
AC178	0.42
AC179	0.48
AC187	0.42
AC187K	0.45
AC188	0.42
AC188K	0.42
AC193K	0.48
AC194K	0.52
ACY17	0.50
ACY19	0.40
ACY28	0.35
ACY39	0.78
AD140	0.68
AD142	0.69
AD143	0.71
AD149	0.86
AD161	0.65
AD162	0.70
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AF115	0.35
AF116	0.41
AF117	0.32
AF118	0.98
AF121	0.50
AF124	0.38
AF125	0.38
AF126	0.36
AF127	0.45
AF139	0.48
AF147	0.52

Type	Price (£)
AF149	0.45
AF178	0.75
AF179	0.78
AF180	0.75
AF181	0.72
AF186	0.99
AF202	0.27
AF239	0.60
AF240	1.40
AF279S	0.91
AL100	1.10
AL103	1.13
AU103	2.10
AU107	1.90
AU110	1.90
AU113	2.40
BC107*	0.16
BC108*	0.15
BC109*	0.17
BC113	†0.16
BC114	†0.20
BC115	†0.21
BC116*	†0.21
BC117	†0.20
BC118	†0.17
BC119	0.32
BC125*	†0.22
BC126	†0.24
BC132	†0.17
BC134	†0.20
BC135	†0.19
BC136	†0.20
BC137	†0.20
BC138	†0.30
BC140	0.90
BC141	0.95
BC142	0.29
BC143	0.33
BC147*	†0.12
BC148*	†0.11
BC149*	†0.13
BC152	†0.25
BC153	†0.20
BC154	†0.20
BC157*	†0.13
BC158*	†0.12

Type	Price (£)
BC159*	†0.14
BC160	0.78
BC161	0.80
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*	†0.14
BC182L*	†0.14
BC183*	†0.14
BC183L*	†0.14
BC184*	†0.14
BC184L*	†0.14
BC186	0.25
BC187	0.27
BC192	0.56
BC207*	†0.14
BC208	†0.12
BC212*	†0.17
BC212L*	†0.17
BC213*	†0.16
BC213L*	†0.16
BC214*	†0.17
BC214L*	†0.17
BC237*	†0.16
BC238*	†0.15
BC239C	†0.23
BC251A & B	†0.27
BC252A*	†0.25
BC253B	†0.38
BC261A	0.28
BC262A*	0.26
BC263B	0.27
BC267	0.16
BC268C	0.14
BC294	†0.37
BC300	0.60

Type	Price (£)
BC301	0.35
BC303	0.60
BC307A & B	†0.17
BC308 & A	†0.17
BC309*	†0.17
BC317*	†0.22
BC318C	†0.23
BC319C	†0.26
BC320	†0.28
BC322	†0.24
BC323	0.68
BC327	†0.23
BC328	†0.23
BC337	†0.24
BC338	†0.19
BC347A*	†0.17
BC348A & B	†0.17
BC349A & B	†0.17
BC350A*	†0.20
BC351A*	†0.18
BC352A*	†0.18
BC360	0.24
BC377	0.22
BC441	0.59
BC461	0.78
BC477	0.20
BC478	0.19
BC479	0.19
BC547*	†0.13
BC548*	†0.12
BC549*	†0.15
BC550	†0.15
BC556	†0.18
BC557*	†0.14
BC558*	†0.13
BC559*	†0.15
BD115	0.93
BD123	0.98
BD124	0.88
BD130Y	1.56
BD131	0.49
BD132	0.54
BD133	0.51
BD135	0.42

Type	Price (£)
BD136	0.46
BD137	0.48
BD138	0.52
BD139	0.56
BD140	0.59
BD144	2.24
BD145	0.76
BD157	0.51
BD160	1.65
BD163	0.67
BD177	0.58
BD178	0.59
BD181	1.04
BD182	0.90
BD183	1.18
BD184	1.43
BD187	0.61
BD188	0.65
BD189	0.71
BD201	1.15
BD202	1.50
BD222	0.78
BD225	0.91
BD232	2.20
BD233	0.52
BD234	0.75
BD235	0.69
BD236	0.62
BD237	0.69
BD238	0.70
BD253	2.58
BD410	1.65
BD437	0.98
BD438	1.17
BD517	0.41
BD518	0.43
BD519	0.88
BD520	0.88
BD599	0.87
BD600	0.92
BDX14	1.02
BDX18	1.55
BDX32	2.75
BDX64A	1.89
BDX65A	1.69
BDY16A	0.43
BDY18	1.55

Type	Price (£)
BDY20	1.07
BF115	0.30
BF117	0.45
BF120	0.55
BF121	0.85
BF123	0.58
BF125	0.55
BF127	0.68
BF137F	0.78
BF152	†0.19
BF157	0.32
BF158	†0.25
BF159	†0.27
BF160	†0.22
BF161	0.45
BF162	†0.65
BF163	†0.65
BF164	†0.95
BF166	0.38
BF167	0.52
BF173	0.30
BF177	0.36
BF178	0.38
BF179	0.42
BF180	0.36
BF181	0.35
BF182	0.44
BF183	0.52
BF184	0.31
BF185	0.28
BF194*	†0.12
BF195*	†0.11
BF196	†0.14
BF197	†0.15
BF198	†0.29
BF199	†0.29
BF200	0.65
BF218	0.42
BF224J	†0.20
BF240	†0.32
BF241	†0.31
BF244	†0.37
BF245B	†0.68
BF255	†0.58
BF256L*	†0.49
BF257	0.49
BF258	0.53

Type	Price (£)
BF259	0.61
BF262	0.64
BF263	0.62
BF270	0.47
BF271	0.52
BF273	†0.33
BF274	†0.34
BF333	0.67
BF336	0.43
BF337	0.46
BF338	0.58
BF355	0.52
BF362	†0.62
BF363	†0.62
BF457	0.68
BF458	0.84
BF459	0.91
BF594	†0.16
BF596	†0.17
BF597	†0.17
BFR39	0.33
BFR40	0.29
BFR41	0.26
BFR60	0.35
BFR61	0.29
BFR62	0.28
BFR79	0.36
BFR80	0.32
BFR81	0.28
BFT41	0.48
BFT43	0.55
BFW11	0.66
BFW30	2.17
BFW59	†0.19
BFW60	†0.20
BFW90	0.28
BFX29	0.33
BFX84	0.30
BFY18	0.53
BFY50	0.33
BFY51	0.31
BFY52	0.30
BFY90	1.37
BLY15A	1.09
BR101	0.47
BRC4443	0.76
BRY39	0.48

Type	Price (£)
BRY55	†0.48
BRY56	†0.44
BT106	1.50
BT109	1.99
BT116	1.45
BT119	5.18
BU102	2.85
BU105	1.95
BU105/02	1.95
BU108	3.15
BU126	2.18
BU133	1.77
BU204	2.02
BU205	2.24
BU206	2.97
BU208	3.15
BUY77	2.50
BUY78	2.66
BUY79	2.85
D40N1	0.64
E1222	0.47
E5024	†0.19
GET872	0.46
MC140	†0.36
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	0.78
MPF102	†0.40
MPS6566	†0.31
MPSA05	†0.47
MPSA06	†0.48
MPSA55	†0.50
MPSA56	†0.53
MPSU05	0.66
MPSU06	0.76
MPSU55	1.26
MPSU56	1.32
OC26	0.90
OC28	1.19
OC35	0.93
OC36	0.88

Type	Price (£)
OC42	0.55
OC44	0.34
OC45	0.32
OC71	0.73
OC72	0.73
OC81	0.53
OC81D	0.57
OC139	0.76
OC140	0.80
OC170	0.34
OC171	0.34
ON236A	0.72
R2008B	2.25
R2010B	2.65
TIC44	†0.29
TIC46	†0.44
TIP29A	0.49
TIP30A	0.58
TIP31A	0.62
TIP32A	0.67
TIP33A	0.99
TIP34A	1.73
TIP41A	0.80
TIP42A	0.91
TIP2955	1.78
TIP3055	0.67
TIS43	†0.38
TIS73	†1.36
TIS90	†0.23
TIS91	†0.25
ZTX108	†0.13
ZTX109	†0.14
ZTX213	†0.21
ZTX300	†0.16
ZTX304	†0.24
ZTX500	†0.17
ZTX502	†0.19
ZTX504	†0.30
2N696	0.30
2N697	0.36
2N706	0.16
2N708	0.35
2N914	0.21
2N916	0.24
2N1164	3.60
2N1304	0.55
2N1711	0.45

Type	Price (£)
2N1893	0.40
2N2102	0.51
2N2221A	0.50
2N2222A	0.52
2N2369A*	0.44
2N2484	0.55
2N2646	0.75
2N2696	1.30
2N2904*	0.42
2N2905*	0.33
2N2926G	†0.15
2N2926O	†0.14
2N2926Y	†0.14
2N2955	1.12
2N3053	0.25
2N3054	0.62
2N3055	0.70
2N3702	†0.19
2N3703	†0.18
2N3704	†0.18
2N3771	1.85
2N3772	1.92
2N3773	2.90
2N3819	†0.35
2N3866	1.72
2N3904	†0.24
2N3905	†0.26
2N4032	0.57
2N4036	0.60
2N4058	†0.18
2N4291	†0.27
2N4392	2.84
2N4902	2.40
2N4921	0.81
2N5060	†0.32
2N5294	0.46
2N5296	0.62
2N5496	1.05
2N6178	0.71
2N6180	0.92
2SC643A	1.36
2SC1172Y	2.80
2SD234	0.89
40361	0.48
40362	0.50
40595	0.89

LINEAR IC's

Type	Price (£)
BRC1330	†0.93
CA3005	1.80
CA3012	1.32
CA3014	1.80
CA3018	1.06
CA3020	1.86
CA3028A	1.06
CA3028B	1.26
CA3045	1.35
CA3046	1.02
LM309K	1.98
MC1307P	†1.32
MC1310P	†2.94
MC1312P	2.20
MC1314P	3.85
MC1315P	4.15
MC1327P	†1.86
MC1327PQ	†1.86
MC1330P	†0.93
MC1350P	†0.85
MC1351P	†0.90
MC1352P	†0.90
MC1353P	0.92
MC1355P	1.15
MC1357P	1.42
MC1358P	†1.80
MC1358PQ	†1.85
MC1458G	0.98
MC1496L	0.88
MC3051P	0.58
MFC4000B	0.85
MFC4060A	0.98
MFC6040	1.11
MIC1P	†2.58
ML231	†4.60
ML232	†4.60
NE555	0.72
SAS560A	†2.01
SAS570	†2.01

Type	Price (£)
SC9503P	0.95
SC9504P	0.97
SL414A	1.91
SL432A	2.52
SL450	5.10
SL901B	†4.10
SL917B	†5.50
SN72440N	†0.96
SN76001N	†1.45
SN76003N	2.24
SN76013N	1.50
SN76013ND	1.25
SN76023N	1.50
SN76023ND	1.25
SN76033N	2.24
SN76110N	†2.30
SN76226N	†3.15
SN76227N	†1.85
SN76502N	†0.92
SN76530P	†1.85
SN76533N	†1.20
SN76544N	†1.85
SN76660N	†0.60
SN76666N	†0.90
TA7073P	†3.51
TAA300	†3.85
TAA320	0.94
TAA350A	†1.96
TAA435	1.70
TAA450	†3.39
TAA550	†0.60
TAA570	†2.30
TAA611A	1.70
TAA611B	1.85
TAA621AX1	2.43
TAA630Q	3.91
TAA630S	4.18
TAA661B	1.75
TAA700	†3.90
TAA840	†3.38
TAA861A	0.95

Type	Price (£)
TAA960	†1.35
TAD100	†2.66
TBA120A	†0.90
TBA120S	†0.99
TBA240A	†3.98
TBA281	†2.07
TBA395	†2.58
TBA396	†2.40
TBA480Q	†1.84
TBA500	†1.99
TBA500Q	†2.00
TBA510	†1.99
TBA520Q	†2.98
TBA530	†1.98
TBA530Q	†2.50
TBA540	†3.21
TBA540Q	†3.20
TBA550Q	†4.10
TBA560C	†3.13
TBA560CQ	†3.22
TBA570	†1.29
TBA641AX12	2.55
TBA673	†2.19
TBA700	†2.50
TBA720AQ	†2.38
TBA720Q	†2.39
TBA750A	†2.07
TBA750Q	†2.07
TBA800	2.40
TBA810AS	1.95
TBA920Q	†3.68
TBA940	†1.95
TBA950	†3.88
TBA990	†2.90
TBA990Q	†3.35
TCA270A	†3.55
TCA270CQ	†3.55
TCA270Q	†3.55
TCA800	5.55
TDA440	†3.70
ZN414	†1.45

DIODES

Type	Price (£)
AA113	0.17
AA119	0.13
AAZ13	0.30
AY102	1.85
BA100	0.24
BA102	0.25
BA104	0.19
BA110	0.80
BA111	0.70
BA112	0.85
BA115	0.15
BA121	0.85
BA129	0.39
BA145	0.19
BA148	0.19
BA154	0.19
BA155	0.19
BA156	0.15
BA157	0.25
BA158	0.28
BA201	0.13
BAX13	0.08
BAX16	0.10
BAY72	0.18
BB104B	0.52
BB105B	0.52
BB105G	0.45
BB110B	0.45
BR100	0.40
BY100	0.35
BY103	0.35
BY118	1.10
BY126	0.16
BY127	0.18
BY133	0.35
BY140	1.40
BY164	0.55
BY176	1.68
BY179	0.60
BY182	1.14
BY199	0.29

Type	Price (£)
BY206	0.31
BY238	0.25
BYX10	0.31
FSY11A	0.58
FSY41A	0.51
ITT44	0.08
ITT210	0.63
ITT827	0.80
ITT921	0.12
ITT922	0.12
ITT923	0.18
ITT1075	0.15
ITT2001	0.12
ITT2002	0.13
ITT2003	0.25
OA10	0.37
OA47	0.15
OA81	0.17
OA90	0.10
OA91	0.12
OA200	0.10
OA202	0.13
S2M1	0.38
S6M1	0.49
TV20	2.25
IN914	0.07
IN916	0.09
IN1184	1.10
IN1185	1.30
IN4001	0.05
IN4002	0.06
IN4003	0.07
IN4004	0.08
IN4005	0.09
IN4007	0.14
IN4148	0.06
IN4448	0.10
IN5400	0.15
IN5401	0.17
IS44	0.07
IS920	0.09
IS921	0.12

ZENER DIODES

400mW plastic 3.0-33V	12p each
1/1.3W plastic 3.3-180V	20p each
1.5W flange 4.7-75V	85p each
2.5W plastic 7.5-75V	48p each
20W stud 7.5-75V	74p each
75W stud 7.5-75V	£5.60 each

VDR'S ETC.

Type	Price (£)
E295ZZ	
/01	†0.21
/02	†0.21
E298CD	
/A258	†0.20
E298ED	
/A258	†0.18
/A260	†0.18
/A262	†0.18
/A265	†0.18
/P268	†0.18
E298ZZ	
/05	†0.20
/06	†0.18
E299DD/P116 – P354 all	†0.17
E299DH	
/P230	†0.72
2322 554 02221	†0.59
VA1015	†0.78
VA1026	†0.64
VA1033/34/38/39/40/53 all	†0.17
VA1055s/56s/66s/67s/ all	†0.21
VA1074	†0.17
VA1077	†0.27
VA1086	†0.17
VA1096/97/98 all	†0.19
VA1104	†0.44
VA8650	†1.20

VALVES

Type	Price (£)
DY86/87	†0.54
DY802	†0.54
ECC82	†0.54
EF80	†0.54
EF183	†0.70
EF184	†0.70
EH90	†0.94
EL34	†1.08
PCC84	†0.65
PCC85	†0.79
PCC89	†0.74
PCC189	†0.94
PCF80	†0.65
PCF86	†0.74
PCF200	†1.16
PCF801	†0.74
PCF802	†0.79
PCL82	†0.65
PCL83	†0.74
PCL84	†0.65
PCL86	†0.74
PCL805/85	†0.74
PD500	†2.16
PFL200	†0.94
PL36	†1.08
PL81	†0.94
PL84	†0.79
PL504	†1.05
PL508	†1.33
PL509	†1.80
PL802	†3.25
PY81/800	†0.58
PY500A	†1.16

RESISTORS

Carbon Film (5%)† ea

½W	5.6 Ω-330K Ω (E12)	3p
¼W	10 Ω-10M Ω (E24)	3p
1W	10 Ω-10M Ω (E12)	5p
2W	10 Ω-10M Ω (E6)	9p

Wirewound (5%)

2½W	0.22 Ω-270 Ω	18p
4W	1.0 Ω-10k Ω	22p
7W	1.0 Ω-22k Ω	24p
11W	1.0 Ω-22k Ω	28p
17W	1.0 Ω-22k Ω	33p

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PAL subcarrier crystals (wire-ended) ONLY 55p each.

Rotary mains switch DPST 4A silver contacts JUST 18p each.

"FM" tuning meter, 100μA movement, centre "null" – standard size.

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Labgear CM6052/CB: VHF/UHF gives standard 8 band colour bars + variable tuning + front panel on/off switch + sync trigger output + blank raster + red raster + crosshatch + grey scale step wedge + colour bar + centre cross + dot pattern + centre dot. £148.05

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THORN 3000. Tripler £9.90. PSU dropper £1.25. 1000 mfd £1.15. 200 mfd 68p. 175/100/100 £3.40. Focus £3.50. Cut-out £1.38. Video TF pk £2.15. R2010 £2.70. E1222 90p. IR5 7w 28p. **8500** tripler £8.50. **1500** dropper £1.25. EHT tray £3.95. **BAIRD** 700/710 some ex-equip parts.

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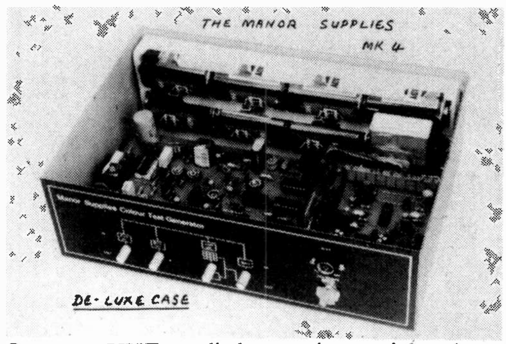

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RELIABILITY REVOLUTION

For many years now the Japanese have been the world's largest manufacturers of TV sets. The UK however was the first country to establish a TV industry. At present, the talk wherever one goes in the UK TV set industry is of "chasing the Japs", which means catching up with the standards of reliability for which Japanese sets have become renowned. It might seem odd that having started off first we have any catching up to do, but then that has often been the way with UK industry.

The reasons for the Japanese successes are not hard to find. Their industry has always been export orientated. It has had to be, since Japan has few natural resources of its own. When TV services were started in Japan after the war the same standards as used in the USA were adopted. Thus the USA became an obvious market for Japan's TV exports. Their success has been remarkable: at present, almost 80% of colour sets sold in the USA are imported from Japan. And considering that in addition Sony, Hitachi and Matsushita all have plants within the US the overwhelming dominance of the US market by the Japanese TV industry becomes very clear.

But you can't succeed in this sort of thing unless you have a reliable product. And that means sets that can be taken out of their cartons and be sure to work properly first time and without any need for adjustments. In the Japanese case the sets must be able to do this after travelling maybe half way round the world. If you can achieve that, it's not surprising that the sets will go on working satisfactorily with a very low service call rate throughout their normal working life.

The UK's setmaking industry has never been export orientated. For years it existed reasonably comfortably all by itself, in a sense fenced off from the rest of the world by its unique 405-line system. That's not to say that UK TV setmakers had an entirely easy time. Consumer durables have been the favourite target for chancellors of the day during the successive stop/go cycles that have been inflicted upon the economy. It's difficult to embark on a long-term investment programme when the chancellor may squeeze the market hard within six months. There is no doubt that lack of long-term investment has been one of the reasons for the comparative lack of reliability of UK sets.

The daddy of all "goes" was of course the 1973/4 boom. UK setmakers – and component suppliers – simply couldn't produce enough to meet the demand the boom unleashed. It was a question – admitted within the industry – of maximum output as first priority. But all this happened while the rapid changeover to 625 lines and PAL colour was taking place. And that made the UK market wide open to overseas setmakers. In particular large quantities of Japanese sets started to come in, and dealers found that all you had to do was unpack them, switch on and you had another satisfied customer.

It was clearly essential for the UK's setmaking industry to do something substantial, and fast, if it was to survive. And this is where the chasing and catching up comes in. Despite the economic constraints of the last couple of years, the industry has been investing substantially. The results are now coming through in the new generation of colour TV sets with their PIL or 20AX tubes.

These new products are impressive, and it seems to us that the catching up has pretty well been completed. Only time will tell whether long-term reliability has been achieved, but it seems very much like it from some of the work we have seen. During a recent visit to Thorn's Enfield plant for example we were shown environmental testing of sets which were being cycled between extremes of heat and cold at high humidity. Some of the sets had been operating under these conditions for a year or more. Thorough investigations have been made of each breakdown. If sets can keep going under these conditions they should be reliable indeed. The important point however is what this sort of thing teaches about component failure and the behaviour of a TV set's mechanics. Once these lessons have been converted into careful component specification and mechanical design you are half way to what's required – the out of the carton, switch on and up comes the picture degree of product reliability. The other half of the story is component testing before use, reliable assembly techniques and thorough soak testing. All these were apparent during our visit to Enfield.

From this and other evidence, it does seem that the industry has made very rapid engineering progress during the last couple of years. It's a heartening thing to be able to say.

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teletopics

Trade Shows

The annual trade shows have been and gone and we can now see the lines along which the setmakers' programmes are developing. All UK setmakers now have a colour chassis built around an in-line gun, self-converging tube, but for some time ahead production of existing chassis with 90°, delta-gun tubes is to continue. Some major new chassis were on show, the Philips G11 for example which is clearly destined to form the basis of the Philips range of models for some years ahead. Articles on this and the new Thorn chassis appear elsewhere in this issue. Thorn were showing various models fitted with their new chassis – the Ferguson 3736, 3737 and 3743 with the 9600 chassis, the 3745 and 3749 with the 9800 chassis, and the 3840, 3845, 3847 and 3848 mains/battery portables in the 1690/1691 series. We were surprised to find that Rank have announced a new range of Bush receivers using the Mullard/Philips 20AX tube. Until now Rank have relied on Toshiba's RIS in-line gun tube. Another surprise in the Bush range was a 12in. mains/battery portable made in the UK, the "Bush Ranger 2". GEC have also adopted the 20AX tube, but for the time being it will be used in the sets at the luxury end of their range of models – the C2218H and C2628H 22 and 26in. models respectively.

Most UK colour setmakers now have chassis fitted with the 20AX tube, the exceptions being Thorn and Rediffusion/Doric who have adopted the RCA PIL tube. Rediffusion's Mk. III chassis has a number of interesting technical features, including the use of a thyristor line timebase. ITT is the odd man out in using both the 20AX and the PIL tube. Another feature which all setmakers have now introduced on some of their models is remote control. There is in fact a bewildering variety of remote control systems of varying degrees of complexity. It seems that options such as remote control and automatic tuning are considered essential for export chassis, while both retailers and renters in the home market are increasingly demanding such features, the view being that you can persuade people to change sets only if you can offer them something extra. A large number of mains/battery monochrome portables were being shown by various importers.

The problem of fault diagnosis in sets with switch-mode power supplies which can be tripped in the event of a fault is clearly receiving setmakers' attention. Thorn have introduced a couple of convenient sockets to allow key voltages to be monitored easily in their new 9600 chassis. ITT have gone a stage further in the latest versions of their CVC20 and CVC30 chassis. These incorporate six built-in l.e.d.s which give the service engineer an instant indication of what is happening in the set.

An absent brand name this year was Marconiphone. This was one of the oldest brand names in the industry, dating back to the 1920s, and has in recent years been used by Thorn for models distributed via wholesalers. Ultra now becomes the Thorn wholesale brand.

All-Digital TV Studio: IBA's World First

The IBA has recently been demonstrating to other European broadcasting authorities the major component parts of an all-digital television studio of the future. It's the first time that it has been shown to be practical for all major studio vision operations apart from picture origination to be carried out with the vision signal in digital form – including digital vision coding and decoding, vision mixing and switching, videotape recording and the generation of a colour-bar test signal.

The main problem of an all-digital TV studio is recording digital signals on tape without requiring an extremely high-speed tape transport system. Further development work is required to produce a full-width digital vision recorder suitable for operational use – the machine at the demonstration produced faultless colour pictures of half width.

Further work demonstrated included an experimental 34 Mbit/s system which for the first time makes possible good quality signals when coding the composite PAL signal. The IBA's digital development programme is aimed at achieving an international standard for digital television. The basic concept of an all-digital TV studio centre was first described by John L. E. Baldwin of the IBA at the 1972 London International Broadcasting Convention. He then outlined how a digital vision recorder might be realised, despite the apparently insurmountable problem of the enormously high bit rate.

Video Developments

There have been rapid developments in the videocassette recorder field – primarily in the USA, where various Japanese firms have been trying to get their systems established as the accepted standard. Sony achieved considerable success with their Betamax system, but it seems that this has now been superseded. The prime aim of recent developments has been to increase playing time, for two reasons. First, to reduce the cost to the consumer – at

£20 for a one-hour cassette video recording is not exactly a cheap hobby. Secondly, because a two-hour cassette enables feature films to be recorded without a break. There are legal aspects to this latter point, but this is a grey area that seems likely to remain so. Sony's Betamax Mk. II system gives two hours from the same cassette – by considerably reducing the tape speed. This means that track width has to be decreased proportionately, making head design and the avoidance of interference between tracks that much more difficult. The latter problem can be overcome by using slanted heads, so that signals on adjacent tracks are in antiphase and thus cancel. This seems to be the technique generally adopted. Sony's main contender at present is JVC, whose VHS (video home system) has been adopted by such giants as RCA and Matsushita. A two-hour VHS system has been introduced, and a four-hour version is understood to have gone into production. The latter is thought to use field skipping in addition to slanted heads to increase the signal storage density on the tape – by recording only alternate fields and repeating each recorded field twice on playback. This reduces the vertical definition but nevertheless gives acceptable results – old hands will recall that Sony used it on their original reel-to-reel helical-scan system. So far none of the Japanese manufacturers has got around to producing a PAL version of their VCRs.

In Europe, a two-hour VCR, the N1700 "VCR Long Play", has been announced by Philips and is expected to be introduced in the UK this autumn. This is a slanted head machine with a tape speed of 6·5cm/sec (the tape speed of the current N1502 is 14cm/sec). The heads are produced by a special laser beam technique. An incidental advantage of a lower tape speed of course is that head wear is decreased and head life is thus considerably longer. The price of the N1700 is expected to be only about £50 more than the N1502. It doesn't seem that Philips will be able to make their one- and two-hour machines compatible. There is some confusion at present over Sony's intentions in this respect.

On the disc side, the first public demonstration of the Philips/MCA optical (laser) videodisc system in the UK is to be made at the Video Disc '77 conference in London. This is to be held on November 8/9th at the British Academy of Film and Television Arts' Princess Anne Theatre, Piccadilly. Previously, the system has only been seen, on a restricted basis, in Japan, the USA and in Europe in Berlin and at Cannes. A detailed description of the basic operation of this system was given in our June 1975 issue.

The Staticon Camera Tube

For a long time the Plumbicon has been the standard tube for studio colour cameras. As is well known, this is a development of the vidicon principle, but using a lead-oxide target. A growing challenge to the Plumbicon is being made by the Staticon tube, which was originally developed by Hitachi in conjunction with the Japanese broadcasting authority NHK. The Staticon has a selenium-arsenic-tellurium target. RCA, who are marketing the Staticon in the USA and plan to manufacture it, claim that it has longer target life without performance change with time, and higher resolution.

Tube Reflections

It seems that many sets are troubled by reflections due to the presence of the Teletext lines above the top of the screen. The effect is clearly described in a recent service bulletin from ITT and we cannot do better than quote: "The presence of Teletext information sometimes gives rise to bright areas on the upper half of the screen, varying in intensity as the information changes, the effect being noticeable on dark scenes when viewing under low ambient lighting conditions". This in fact is almost identical to our friend Les Lawry-John's description of the same trouble he's been having recently on Philips G8 chassis. The Grundig 2210/2222/2252 range of models is prone to this trouble, described by Grundig as "light patches at the top left and right of the screen". In fact many setmakers have now introduced official modifications to counteract these troubles, which seem to occur with some types of tube more than with others. The modifications are all aimed at altering the duration of the field flyback blanking pulse. The G8 modification consists of simply adding a resistor – suggested value being 220-470Ω, depending on the timebase panel used and deflection coil tolerances – in series with the base of the flyback blanking transistor. A couple of diodes and an extra capacitor are required in the Grundig "Super Colour" series. ITT and Decca have both introduced modification kits to overcome the problem in their hybrid colour chassis. It's understood that the kits consist of a panel with a monostable multivibrator to obtain a stretched field flyback blanking pulse. A quick glance at the circuit of the new Philips G11 chassis revealed a monostable circuit present apparently for this purpose.

Transmitter Notes

The following transmitters are now in operation:

Bressay (Shetland Islands) BBC-1 channel 22, ITV (Grampian Television) channel 25, BBC-2 channel 28. Receiving aerial group A. Vertical polarisation.

Chalford (Gloucestershire) BBC-1 channel 21, ITV (HTV West) channel 24, BBC-2 channel 27. Receiving aerial group A.

Cornholme (Lancashire) BBC-1 channel 58, ITV (Granada) channel 61, BBC-2 channel 64. Receiving aerial group C/D.

Dalton-in-Furness (Cumbria) BBC-1 channel 40, ITV (Granada) channel 43, BBC-2 channel 46. Receiving aerial group B.

Llanfyllin (Powys) BBC-Wales channel 22, ITV (HTV Wales) channel 25, BBC-2 channel 28. Receiving aerial group A.

Porth (Glamorgan). The transmitting aerials have been modified to extend the coverage eastwards.

Sutton Row (Wiltshire) BBC-1 channel 22, ITV (Southern Television) channel 25, BBC-2 channel 28. Receiving aerial group A.

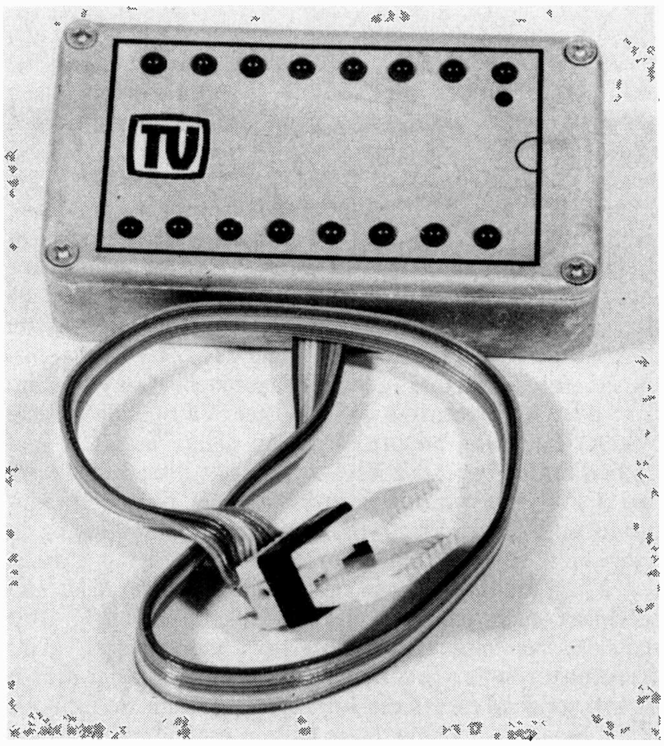
Thetford (Norfolk) ITV (Anglia) channel 23, BBC-2 channel 26, BBC-1 channel 33. Receiving aerial group A.

Ton Pentre (Glamorgan) BBC-Wales channel 58, ITV (HTV Wales) channel 61, BBC-2 channel 64. Receiving aerial group C/D.

Except for Bressay, all the above transmissions are vertically polarised.

A two-channel relay station is being built by the BBC and the IBA to improve the service in the Wrexham-Rhos area of Clywd, North Wales. BBC-Wales will be on channel 39 and ITV (HTV Wales) on channel 67. The extreme shortage of channels available in the area has meant that only these two programmes can be transmitted and that wideband receiving aerials will be necessary. Shortage of channels is also presenting difficulties in the development of the services in the North Somerset/North Devon area, where a station at Hutton is planned.

IC Logic State Checker



D. Symons B.Sc.

THE logic checker to be described consists of an i.c. test clip connected by about 18in. of cable to a remote unit which contains the circuitry and the display l.e.d.s. It can be used to check circuitry using TTL or DTL i.c.s. The unit locates the supply and earth pins of the device under test, and displays by means of its 16 l.e.d.s the logic state of each of the other pins. An illuminated l.e.d. represents logic 1, the supply line (Vcc), or an open-circuit; an unilluminated l.e.d. represents logic 0 or earth. This assumes the use of positive logic. In the case of an i.c. with less than 16 pins, the logic checker's unused inputs will display the logic 1 condition. The test clip pins can also be used for connecting an oscilloscope or other test equipment as required.

Circuit Description

The circuit consists of four 7400 quad dual-input NAND i.c.s (see Fig. 1), with each of the 16 outputs connected to the positive supply via a current-limiting resistor and one of the indicator l.e.d.s (see Fig. 2). The germanium diodes connected to the input pins, together with the internal diodes, locate the supply and earth pins of the i.c. under test and supply about 4V to pins 7 and 14 of the 7400s. If for example pin 1 in Fig. 2 is connected to +5V and pin 4 to 0V, diode D1 will be conducting since it's forward biased while diodes D2-D4 will be reverse biased and thus cut off. Similarly the internal diode connected to pin 4 will be forward biased while the other diodes will be reverse biased.

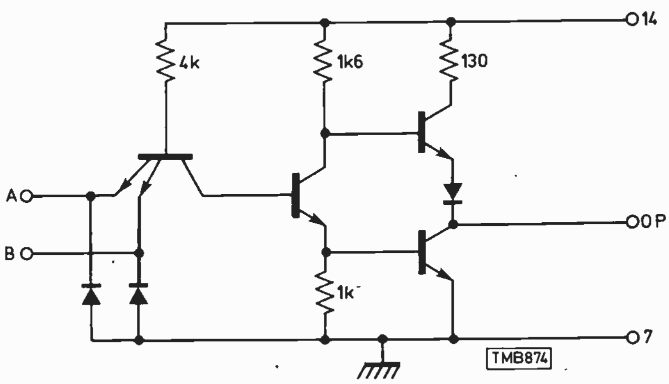


Fig. 1. Internal circuit of each of the four dual-input NAND gates of the 7400 i.c.s.

If any gate input is at logic 1 or open-circuit, its output will be at logic 0 and it will draw current through the associated l.e.d. With the current-limiting resistors having a value of 1·5kΩ, the current will be about 1·2mA. The other input of each gate is left open-circuit, so that the loading on the i.c. under test is one TTL load per pin. Each 7400 can draw an absolute maximum current of 22mA and the 15 l.e.d.s can draw 20mA, giving a total current consumption of about 110mA. In practice, the current drawn by the author's original prototype with a supply of 5V and 15 of the l.e.d.s illuminated is only 45mA, due to the voltage drop across the diodes. With a supply of 6V the current rises to 60mA.

Construction

The original prototype was built on a piece of 0·1in. matrix Veroboard, with 40 × 22 holes, and was mounted in an aluminium diecast box with the l.e.d.s arranged so that they are visible through holes drilled in the lid (see Fig. 6). The lid was marked with appropriate legends and drilled in accordance with the accompanying diagram. The unit was connected to the i.c. test clip by about 18in. of ribbon cable. The maximum length of connecting wire recommended by the manufacturers of 7400 series digital i.c.s is 10in., but no trouble has been experienced in practice with using an 18in. cable. To simplify construction, a printed circuit board has been designed. Track details are given in Fig. 3, whilst Fig. 4 shows the component location. The p.c.b. reference number is DO38.

Alternative Arrangement

The 7400 i.c.s can be replaced with National Semiconductors MM74C00N i.c.s (see Fig. 5). These are TTL pin compatible CMOS integrated circuits. (For more

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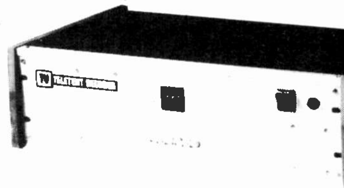

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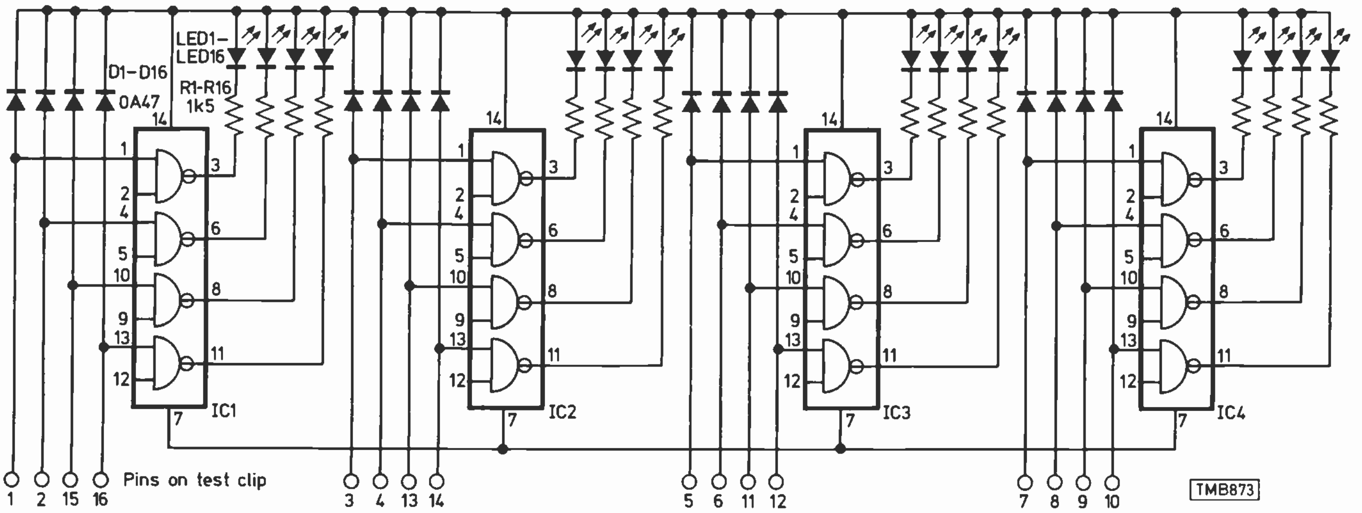
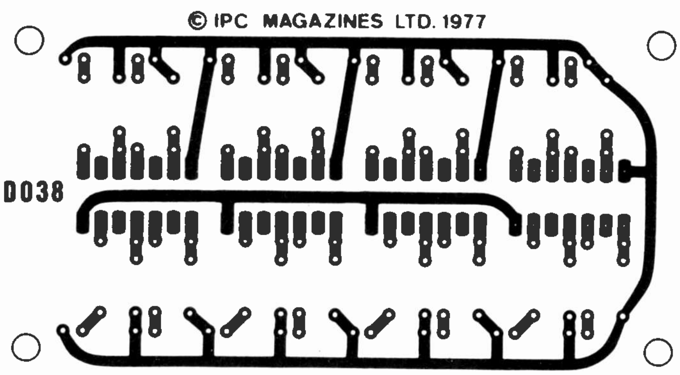


Fig. 2. Complete circuit diagram of the unit.

information see the National Semiconductors application note AN77, "CMOS, the ideal logic family".) The supply voltage required is between +3V and +15V, and the logic checker can now be used for checking CMOS i.c.s with supply rails of up to +15V, though the l.e.d.s are rather dim at voltages below 10V. D1-D16 are not needed, and R1-R16 should be 10kΩ, giving a measured current of 500μA at 15V through each l.e.d.

The two gate inputs on each i.c. should be connected together, so that the loading on the i.c. under test is now two CMOS loads. Unused inputs must *not* be left open-circuit, since the very high input impedance (approximately $10^{12}\Omega$) may result in the input floating up and down between logic 1 and logic 0. ■



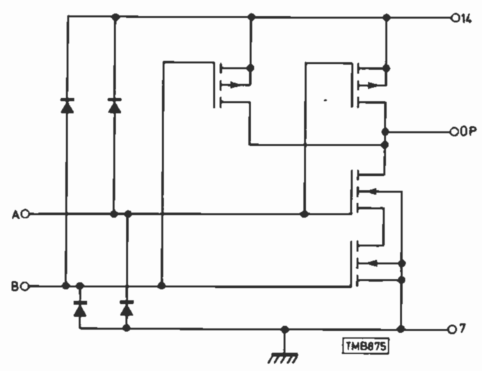
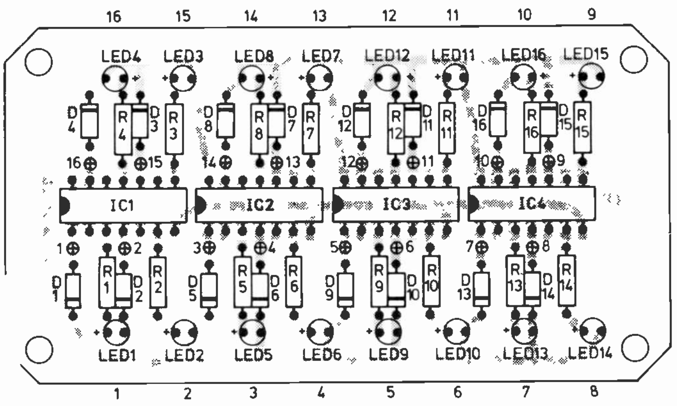
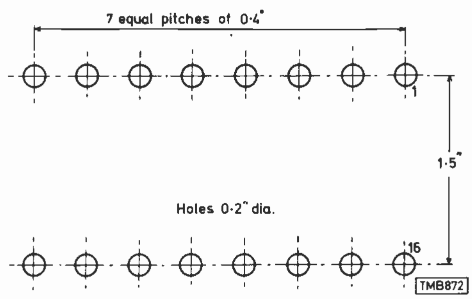


Fig. 3 (top) shows the track details of the p.c.b. Fig.4 (below) is the component location diagram.

Fig. 5 (top) shows the equivalent circuit in Fig. 1 of CMOS devices which can be used as alternatives – see text. Fig. 6 (below) shows drilling details for the lid of the diecast box which accommodates the l.e.d.s.





Introducing the Philips G11 Chassis

Part 1

A. G. Priestley, B.Sc.

Most engineers in the TV receiver industry will be familiar with the Philips G8 colour chassis which has been produced in very large numbers since its introduction in 1970. The G8 has of course been up-dated in a variety of ways since then, but the basic concept, and the policy of making the up-dated plug-in units interchangeable with their predecessors, have been carefully preserved. The time had come however for a completely new chassis, and Philips have duly come up with the G11. The G8, and its 110° derivative the G9, will continue in production for some time but the G11, with its 20AX 110° in-line gun tube, is clearly intended eventually to take its place and to have a long life.

An important new chassis such as the G11 is not an everyday event, and it's of some interest therefore to see in detail how Philips tackled the difficult task of evolving a new chassis which is intended to be the basis of their colour television range well into the 1980s.

In this first part we will discuss the commercial and engineering philosophy behind the design, and some of the techniques it uses. Next month we'll look at the basic electronic arrangements, seeing the types of circuits used and the reasons for their adoption. A more detailed account of particular circuits will be given in later articles.

The Commercial Brief

The operation started with a commercial brief which consisted of a detailed specification of the performance expected of the new receiver and other technical details, together with a long list of preferences and ideas. Some of the more important features set out were: the chassis to be used in a range of receivers with different tube sizes; must be adaptable for use with a variety of styling presentations; must provide good picture and sound quality; flexibility required to allow for different forms of customer controls; a very high degree of reliability; lower production cost; even greater ease of servicing than in the G8; a long life; a high standard of production quality; and full compliance with the safety requirements of BS415, the European specification IEC65, and the radiation limits of EEC directives.

In addition it was considered important to keep to the policy of using interchangeable plug-in assemblies in order to allow future design evolution rather than revolution. This enables continuity of servicing and production techniques to be assured for a considerable time ahead.

This list of commercial requirements is clearly a formidable one but has now been translated into a product which is being mass-produced on a highly streamlined assembly line. Only time and the customer however will tell whether Philips have got it right.

The Engineering Concept

Such a complex product as the G11 was not dreamt up overnight by an inspired engineer whilst having his bath. Numerous discussions between the commercial, design, styling and production departments were required, the accumulated facts and ideas obtained from many design studies spread over quite a long period being used as the basis for the final decisions. Experimental receivers were built and discarded, but the experience gained in these exercises was stored for future use. Finally an overall concept emerged from what began as a jumble of competing, and sometimes conflicting, ideas.

To start with it was decided to use the 110° 20AX range of display tubes. These give good picture quality combined with self-convergence while the yoke system requires only minor adjustments to take into account manufacturing tolerances. Furthermore the overall depth of these tubes is small: if this could be exploited by the engineers it would reduce the limitation imposed on the styling department. A slimmer and more attractive cabinet in a wider variety of presentations became possible.

The requirement for a slim cabinet posed a considerable challenge to the engineers however. How could the electronic components be housed in this awkwardly shaped space in a manner which still met the need for the greatest possible ease of access for servicing?

At this point another factor had to be considered. It was important not only that virtually every component in the G11 should be part of an assembly which could be easily removed by unplugging, but also that it should be mounted on a printed board. This would ensure that nearly all soldered joints could be made using automatic dip or flow soldering techniques, with a consequent improvement in reliability and cost. Saving in screw fixings and other forms of mountings would also save cost, and contribute towards a more integrated and tidy structural form.

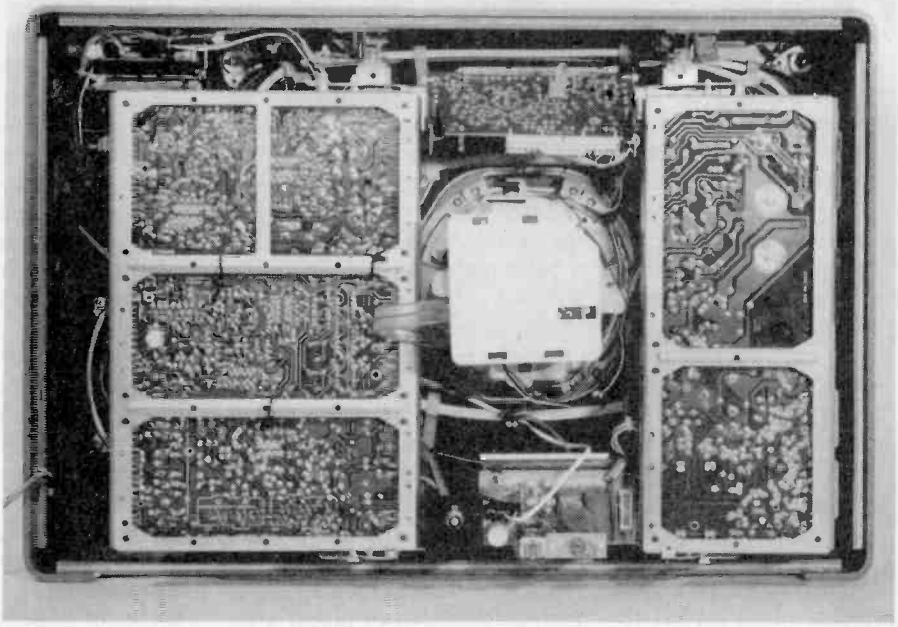
The next decision to be made concerned the possibility of using complete modular construction. At a quick glance the idea of using small plug-in modules is highly attractive – think of computers and certain types of professional equipment. Then think of a plug-in module containing a line output transformer and the high voltage and high current circuits. How do you split it up into genuine small modules?

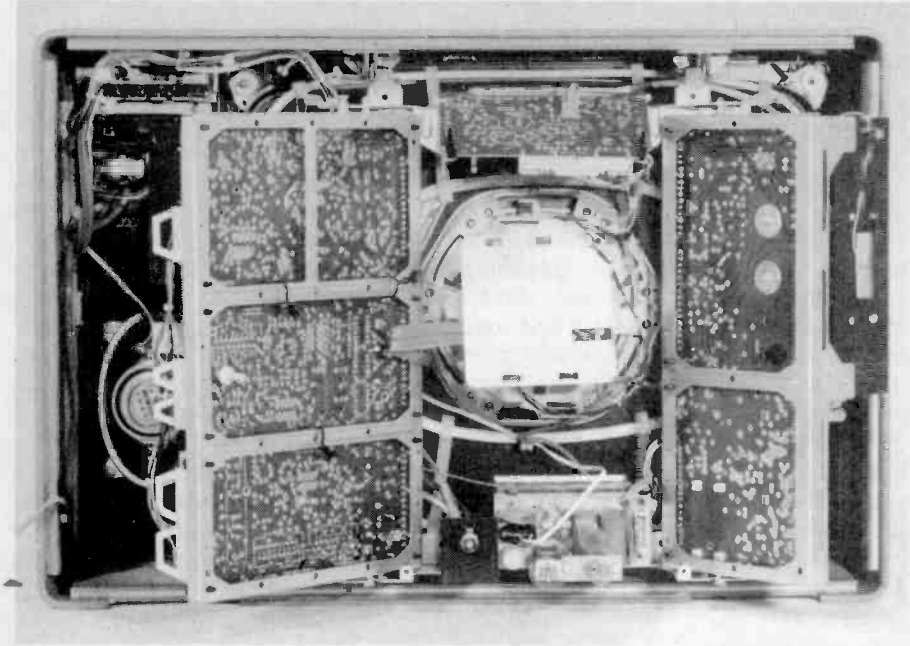
To test the concept, an experimental working modular receiver was built and design studies were carried out on variations of this approach. It soon became clear that a fully modular system involved an enormous number of interconnections and a complex and bulky structure. The implications in terms of poor reliability and high cost were unacceptable. Furthermore it was difficult to fit the numerous modules into the space available.

The next possibility to consider was a part modular approach. This involves a mixture of modules and individual components mounted on a mother board. It has been done before by several European setmakers. The drawback is that although the modules are easy to service, the mother board is not. It is not a convenient unit for unplugging and exchange or repair on the bench. So this idea, too, was not acceptable.

After a long programme of development it became clear that the best approach consisted of using modules considerably larger than conventional ones but smaller than the assemblies used in the G8. Each module would be functionally complete, and independent as far as possible for ease of assembly, testing, and servicing.

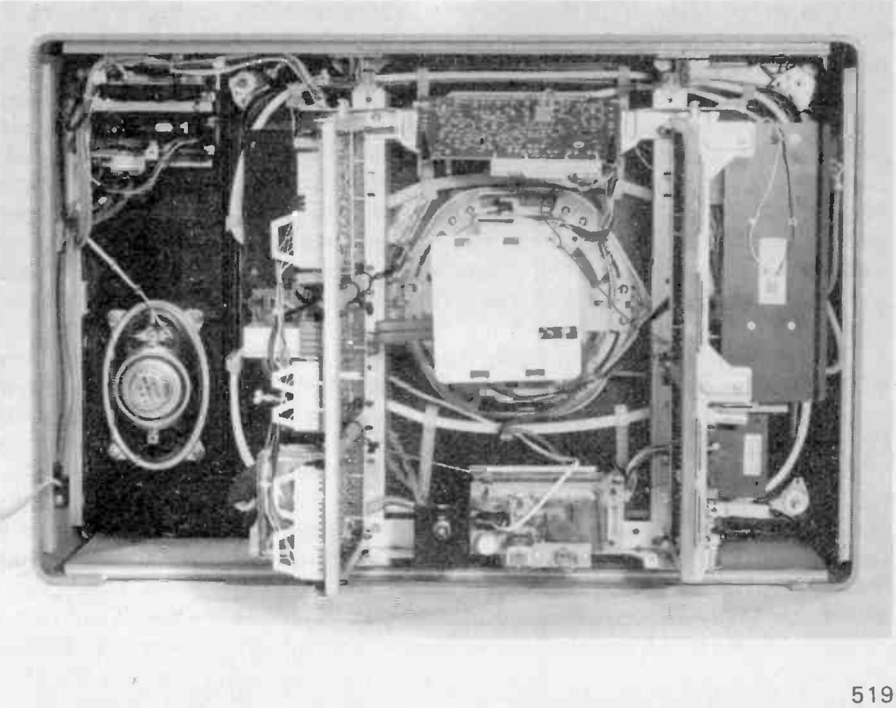
Right: The G11 chassis, intended as the basis of the Philips colour TV range until well into the 1980s, is built around the 20AX in-line gun c.r.t. Almost the entire circuitry is contained on five printed circuit boards which are mounted vertically on two "doors", one at each side of the c.r.t. There are two smaller boards at the top and bottom, carrying the convergence tolerance circuitry and the mains input components respectively.





Left: The two "doors" are hinged at their inner sides and can be swung outwards after removing a securing screw and releasing a catch. The left-hand "door" contains three panels: the i.f. strip, with varicap tuner, at the bottom; the decoder in the centre, with the RGB output stages close to the c.r.t. base panel; and the timebase board at the top. The latter board houses the line oscillator, the EW raster correction circuit and the complete field timebase. The latter consists of a TDA2600 i.c. with a class D (i.e. switch-mode) output stage. The right-hand "door" contains the power supply board at the bottom and the line output board at the top. The stabilised power supply circuit features two thyristors operating in tandem.

Right: The chassis with the two "doors" in the fully open position. Note the specially designed edge connectors, which can be clearly seen at the left-hand side. These also serve to strengthen the boards, being mounted on the outer edges. The power and line scan edge connectors are mounted on the inner board edges. The BU208A line output transistor is on the massive heatsink at the right-hand side. Overvoltage protection is by means of a neon tube which operates a thermal cut-out. These components are mounted on the power supply board.



By this time a circuit diagram had been drawn up for the whole receiver, incorporating all the electronic decisions generated as a result of earlier development work. From this it was possible to establish the total printed board area needed, also the best ways in which the circuitry could be divided up, and hence the possible permutations of different numbers of boards and their sizes. In point of fact it very quickly became obvious that the circuitry divided itself naturally into certain groups of functions. These needed only inputs and outputs of a basic nature, and also resulted in boards of a convenient size – small enough for ease of assembly, servicing, soldering, handling, testing and alignment, but large enough to make economic sense and to avoid a proliferation of interconnections.

Further study showed that although the necessary printed board area could be housed in the cabinet in a variety of ways, in most cases the accessibility was not good. There was the added difficulty that some arrangements demanded board sizes that did not suit the natural circuit split established earlier. It finally became clear that the best configuration consisted of boards placed in a vertical plane behind the tube. Calculations of board area showed that this was indeed practicable, but that the layout of the components and the design of the printed copper conductor patterns would have to be carried out by skilled engineers in order to make best use of the space available. The choice of layout seemed good, but it was not an easy one to put into practice.

The Final Structure

Clearly the plane surface behind the tube could be divided into a wide variety of board sizes, and these could be mounted in a number of different ways. After several brainstorming sessions by a group of engineers, agreement was finally reached on a basic principle: the boards would be housed in two doors mounted one each side of the tube neck. This enabled each of the two large board areas to be divided up in a manner to suit the circuit function split.

It was at first decided to hinge the doors by their outer edges to the sides of the cabinet. It was then realised that although ease of servicing was good, the proposal had a serious defect. This concerned the RGB leads between the decoder and the tube cathodes. Full drive on a contrasty picture involves a peak-to-peak signal swing approaching 100V at up to 5MHz. If the doors were to be hinged at their outer edges the RGB leads would have to be well over a foot long to enable the door containing the PAL decoder to be fully opened. When closed, it would be very difficult to prevent this lead from passing close to the signal circuits and inducing signal voltages in several sensitive areas. Furthermore radiation of high order harmonics in the u.h.f. band would be picked up by the tuner, causing direct picture interference. In addition to this the interconnecting leads passing between the pivot points of the doors would also be long, and would have to trail across the floor of the cabinet.

One answer to this problem would have been to place the RGB output stages on the tube base mounting board, in order to keep the high voltage cathode connections short. Unfortunately this would have made the board too large, while its weight would have exceeded the tube maker's recommendations.

All these difficulties were overcome by hingeing the two doors adjacent to the tube neck. The length of the leads was thus kept to a minimum, and subsequent experience has shown this decision to have been a particularly good one.

The locations of the principal circuit functions were fairly easy to decide. The i.f. strip and the field timebase had to be kept well away from the line timebase to avoid problems caused by the pick-up of line flyback pulses. In addition the tuner had to be kept cool to reduce oscillator drift, and the PAL decoder needed to be close to its signal source on the i.f. strip. These considerations, coupled with the natural routing of various leads, gave rise to the layout shown. This remained unchanged throughout development and was fully justified by experience.

The basic form of the G11 had now been established and this enabled detailed mechanical design work to go ahead in preparation for the layout of the printed boards. The final design of chassis structure is shown in the accompanying illustrations. Note that full use has been made of the available space by mounting a mains input board with fuses underneath the tube neck, and the preset convergence tolerance correction board above it. This arrangement is intended to allow easy access in the factory for final convergence adjustment. It also allows easy checking of the mains fuse during servicing, whilst keeping the live mains components recessed and out of harm's way. It has a metal cover for added safety.

The Interconnect System

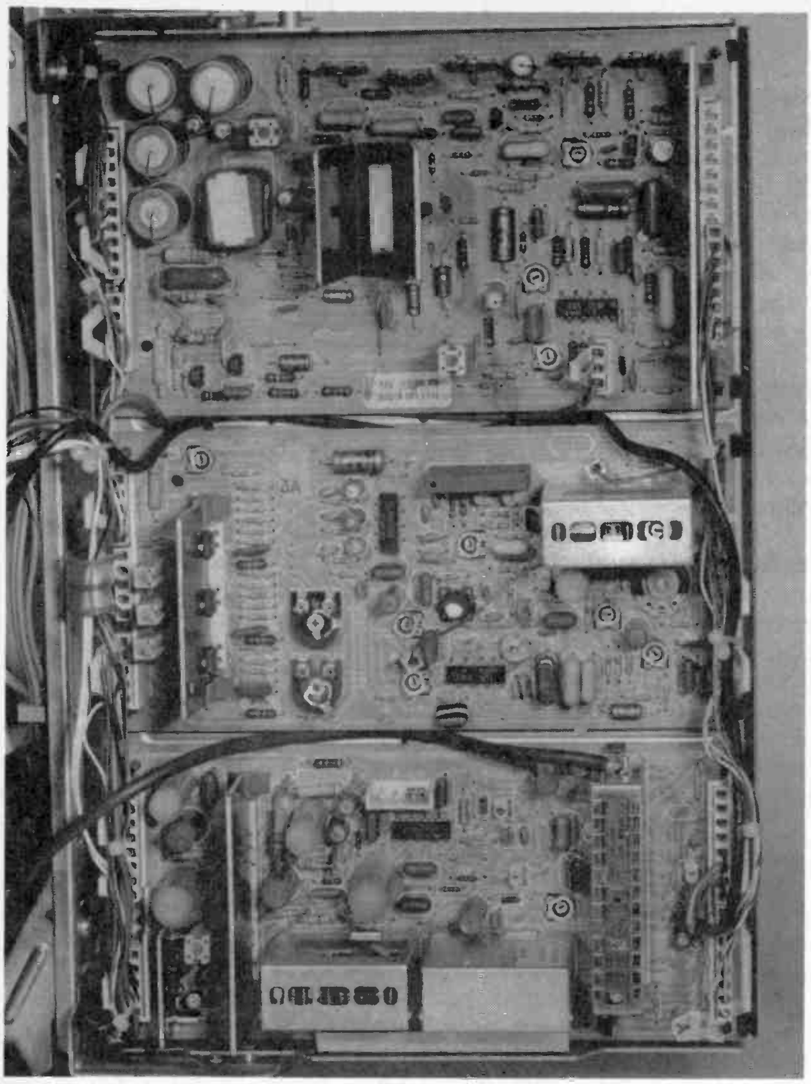
The interconnection system presented engineering problems of a more detailed nature. An important feature of the commercial brief was that it should be easy to remove each module by unplugging. Now this sounds quite a simple matter, but to do it properly so that the hundred odd connections do not adversely affect the overall reliability is in fact surprisingly difficult. Remember that each plugged lead has three interfaces: lead to contact, contact to contact, and contact to lead.

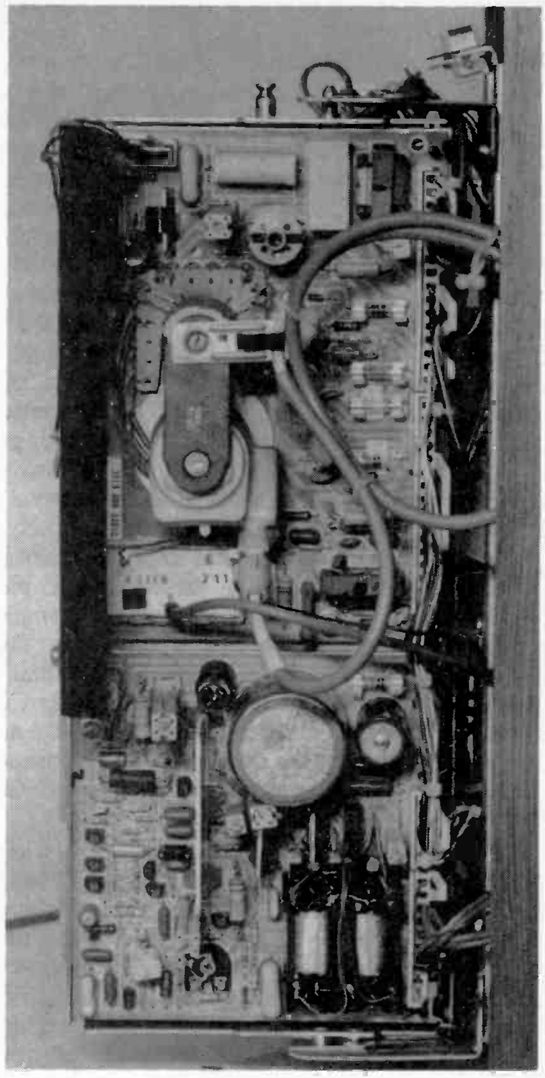
Following normal procedure, a detailed specification was drawn up describing the current carrying capability required, the resistance to voltage stress, push-on and pull-off forces, and many other parameters. This was followed by a survey of the interconnection systems available on the market, both in this country and abroad. A number of these were tried but none combined all the features needed.

As a simple example, one popular system made by three different manufacturers in three different countries had a serious fundamental design defect. It consisted of a pin and a socket with two leaves. These leaves were so short that they provided inadequate spring action. Any reduction in the quality of the material, or any sideways stress on the contact, would allow deformation of the leaves and hence an unreliable electrical contact.

After considerable investigation and many experiments it was considered necessary to commission a new interconnection system, based on well proven technology, from a firm which specialises in this type of product. The key feature of this system lies in the form of the socket. The pin is a conventional one of generous size, and it slides between a fixed abutment and a long folded leaf spring which is formed from the same piece of metal. A long wiping action with a large area of contact is achieved, giving high current carrying capacity with low contact resistance. The long folded spring has a high degree of resilience, and this avoids stressing the metal beyond the yield point – with consequent permanent deformation. The same contact has been used throughout the receiver, and a useful degree of standardisation has been achieved by keeping the variation of plastic housings to a minimum.

A byproduct of this philosophy is that the sixteen-way plugs (carrying the pins) are mounted on the boards and serve to reinforce the edges as shown in the illustrations.





The component sides of the printed boards. Considerable ingenuity was required in order to pack the components into the available board area. Note the field timebase i.c. with its heatsink towards the centre of the timebase panel (top left). The line scan board (top right) is dominated by the diode-split line output transformer.

Note that each socket (on the ends of the leads!) has a plastic indexing pin for unambiguous assembly. It also has a handle which makes unplugging easy and avoids stressing the leads.

The same engineering process of component specification and design was needed for two other items, the focus and tube first anode potentiometer units. As a result both have an exceptionally stable electrical performance in order to prevent any changes of spot quality or grey scale over long periods of time.

General Receiver Development

Once the form of the G11 had been decided, the next step was to prepare outline drawings of the complete structure. From these it was possible to establish the exact size of each printed board and the restrictions imposed by fixing clips, interconnecting plugs and clearances above the board surface. In some cases contour maps had to be drawn showing how the overhead clearance varied at different parts of a board. This information provided a mechanical frame of reference which the circuit engineers used when designing the component layout and the copper track patterns.

The process of designing a printed board involves a multitude of electrical and mechanical problems, every one of which must be solved if the board is to be completed. The final result nearly always has a very definite character of its own, and it needs little more than a quick glance to establish its place in the spectrum between a work of art and a dog's breakfast.

As an example of the "occupational hazards", it will usually be found that the tallest component can be placed in only one particular spot for mechanical reasons, but must be located at the other end of the board for electrical ones. This, in its most elegant form, is known as the law of cosmic cussedness. It applies equally to input and output connections which obstinately refuse to group themselves at the required edge.

Other problems involve hot components, predetermined earth path requirements, clearances round high voltage conductors, avoiding the use of jumper wires, making the board easy to assemble for mass production, and in general persuading the circuitry to fit an unnatural rectangular board shape without wasting space. All these, and countless others, are routine problems which had to be solved in the G11 before complete prototype receivers could be made for testing.

It is a common misconception that once the individual circuits have been designed all that remains to be done is to put them all together and the job is finished. Surely this is especially true in the case of integrated circuits, where much of the design work has already been carried out? In practice this has never been the case, and the advent of i.c.s has not had much effect on the total engineering effort needed by the setmaker.

Two or more circuits which perform properly on their own usually interact when harnessed together – particularly if they are mounted in a compact assembly such as the G11. Furthermore, i.c.s owe their good performance to the use of sophisticated internal circuits which are easily upset by the presence of spurious inputs. Common examples are hum, field or line pulses on l.t. or earth lines or picked up from electrostatic or magnetic fields generated by neighbouring conductors or components, or simply the all pervading fields from the scanning yoke and the line output transformer. For instance, a phase-locked loop in a line oscillator i.c. has high gain, and if any hum or field voltages appear in the loop the result will be curved verticals on the picture. Another example might be a high-gain clamp circuit in an RGBY matrix stage in an i.c. Any pick up of line pulses coinciding with the clamping interval will cause the signals to be clamped to the wrong potential.

A bit of thinking along these lines will make it easier to understand why it is that an important part of the development effort required to design a complete colour receiver consists of solving odd problems. This trouble shooting process can begin only when the first prototype receiver using printed circuit boards has been completed. Countless problems can be avoided by careful anticipation in the early stages of the design, but some unexpected ones always slip through the net. The only answer is plenty of hard work.

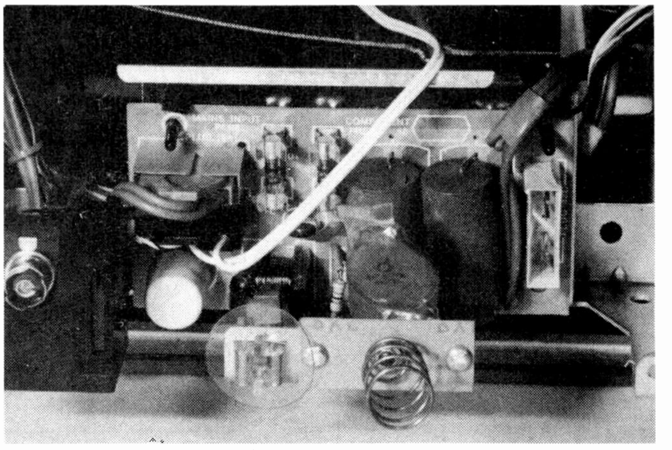
Prototype G11 receivers were subjected to a long series of field and home tests until every problem had been identified and cured. In most cases this involved modifying a printed board, and this took time. The following unavoidable sequence (for which there is no satisfactory short cut) had to be repeated: redesign of the board; preparation of artwork; cutting up boards; etching; drilling, and punching or filing specially shaped holes; procurement of components; assembly of new boards. Then the new version had to be retested under all the appropriate conditions to make sure that the cure really was effective.

At various stages in the development programme the design was temporarily frozen and new batches of prototype receivers were built, based on the most up-to-date specification. These of course had to be retested to make sure that all previous assessments were still valid, and that minor changes had not introduced new problems. For instance, rerouting a lead or conductor to prevent pick-up at one point might introduce it elsewhere. This kind of effect has to be guarded against as a matter of routine.

A stage was finally reached when repeated testing failed to show up any performance defects and the commercial department was satisfied. At this point the design could be said to comply with the electrical specification. It was not however the end of the development programme. A lot of work had been going on in parallel with the electrical design and more remained to be done.

Designing for Production

Design work for a chassis' production has two aspects: electrical and mechanical. Continuing the theme that we have just been discussing, about electrical development, it can never be assumed that because a small batch of receivers works well the job is complete. Far from it. If mass production started on this basis the result would be certain and expensive catastrophe. The reason? Tolerances – and also inadequate knowledge about what has actually been designed, quite apart from matters of safety and reliability.



The small mains panel is conveniently situated to enable the fuses to be quickly checked.

In the engineering division at Philips there is a separate laboratory completely independent of the design group. This checks and rechecks every aspect of the product. The laboratory makes comprehensive measurements of every part of the circuitry on complete batches of receivers. Any defects or doubts are referred back to the design team and appropriate action is then taken until the product is proved to be correct.

Similar action is taken with regard to the mechanical aspects of the design. This activity is concerned with two main objectives. First, it ensures that even when adverse component tolerances occur the receiver will still perform correctly – this confirms the calculations and testing on which the design was based. Consequently a high degree of confidence is gradually built up so that when the receiver is mass produced in hundreds of thousands, every one leaving the production line will perform to specification.

The second aspect concerns production test gear, which has become highly sophisticated and in many cases automatic. Most of this equipment is specially designed for testing a particular assembly, say an i.f. board. It must not only be capable of measuring the performance characteristics of the i.f. response, it must also know what to accept and what to reject. It must be programmed to know the difference between a normal, acceptable variation in selectivity and an abnormal, unacceptable one. It can only do this if the correct assessment has been made of the fundamental design characteristics.

Test limits which are too tight result in rejection of perfectly good i.f. boards, whilst loose limits will result in boards which have a production defect resulting in poor picture quality being passed.

Efficient production demands good test gear programmed with the right information based on extensive laboratory measurements. Furthermore it is not just a question of setting limits. It is essential to decide upon the right combination of tests in order to achieve full control of what actually leaves the production line. All this work has to be completed well before production starts, and in the case of the G11 chassis all the necessary data was provided by the long programme of tests referred to earlier.

The other aspect of designing for production concerns the mechanical features of the product. The whole concept of the structural form of the G11 took careful account of the need to achieve a streamlined work flow in the factory. Every electrical assembly is pretested, and so is the cable harness. This means that at the casing stage where cabinet, chassis and boards come together, all units can be clipped or plugged into place with the minimum amount of time, handling and disturbance. Awkward operations such as hand soldering or putting in screws are avoided almost completely. In addition to being efficient in the production sense, it is also conducive to achieving the best possible quality. This is because any unnecessary handling of a fully tested assembly involves the risk of introducing a defect as a result of minor mechanical damage.

Subsequent operations consist of prolonged soak testing, routine adjustments of the preset controls and, of course, the purity and convergence, and final testing of every aspect of the receiver performance. When this testing is completed and the backplate is on, the receiver passes to yet another test station where a full customer check is carried out before it is packed.

It is not possible here to go into all the ways in which design techniques have been applied in order to make production more streamlined and consequently the output quality better. Numerous rules were followed in the design of the printed boards in order to make assembly and soldering easier and to avoid the risk of short-circuits or dry-joints; mechanical tolerances were thoroughly checked; many items involving assembly operations were designed so that special jigs and tools could be used to speed production, improve accuracy and reduce mechanical stress, and a number of operations were designed to be completely automatic. In short, the human element has been designed out as much as is practicable – because it's fallible! It was considered better to demand skill in the engineering development programme rather than in the repetitive routine assembly process.

Reliability

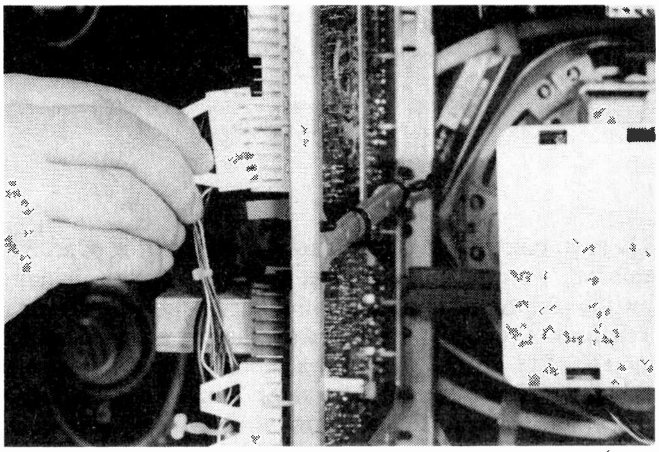
Aiming to produce a reliable product is not so much a matter of technical skill as an attitude of mind. If the need for reliability is considered at every stage of the design and production process the final product will be good. It is not sufficient merely to mount a reliability campaign after a new product has started production and the engineering pressures have eased off.

In the case of the G11 a high standard of reliability was required right from the start: this involved a long programme of testing and assessment running in parallel with the other development activities. Many design features contributed to what promises to be a good result. A few of them are listed below.

Careful and detailed checking has ensured that all components are operated well within their published ratings – in particular, large heatsinks have been used so that all semiconductor junction temperatures have a large margin of safety (look at the line output transistor heatsink). Circuits with low heat dissipation have been chosen in order to reduce the general operating temperatures, and these have been measured all over the chassis assembly and reduced still further whenever this has been practicable.

Many thousands of test flashes have shown that the precautions against damage due to tube flashover are fully effective; special quality tube first anode potentiometers and focus units give freedom from drift of the grey-scale or the focused spot quality; the new interconnect system adopted was described earlier; many components have been subjected to endurance and type approval tests and some have been rejected as inadequate; and life tests of complete receivers have clocked up many tens of thousands of hours. And this is only part of the story.

The first life test was carried out on a large batch of early prototype receivers. Inevitably a few failed in the first thousand hours of cycled on/off operation at a high ambient temperature. The vitally important and encouraging factor however was that the failures were not random in nature but were due to only two simple causes. They were very carefully



The specially designed edge connectors: the plugs are provided with handles for easy withdrawal.

investigated, the underlying reasons understood and cured, and subsequent life tests showed no recurrence of the trouble. During recent tests the failure rate, even on hand built prototypes without the advantage of proper production test gear and tooling, was similar to the best obtained from an experienced production line and a well established product.

The auguries for the future look good therefore, and are backed by a large quality control department which monitors production quality on a continuous basis. Various techniques are used, but perhaps the most important is the permanent series of life tests that are carried on day and night all through the year on large batches of receivers.

Safety

The engineers carrying out the detailed testing procedures referred to earlier also had the responsibility of ensuring compliance with the requirements of the national safety specification BS415. This is a highly specialised type of work which needs considerable experience in order to understand fully the practical implications of some of the more subtle requirements of the specification. The sheer volume of work needed is formidable, but it is all part of the process of designing a new colour TV receiver.

Philips have built up their own standards of good practice over the years, and in a number of cases these are in addition to the official ones. The most important one insists that all material inside the cabinet must be flame retardent or nonflammable, whether it be an electronic component or a simple plastic clip. It costs money, but the improvement in overall safety is considerable. It will also be noticed that leads carrying high voltages have special heavy duty insulation, while those combining high voltages and currents in the line scanning circuits are duplicated in case one lead has a poor contact or gets broken. This avoids the possibility of a high energy arc occurring in a fault condition. In addition, special care is taken with the printed copper conductors carrying these high currents.

This brief description of some of the design philosophy and the procedures that gave birth to the G11 has done little more than scratch the surface of a very large amount of engineering activity. Next time you have a chance to inspect a G11 chassis, check its performance, look at its styling presentation, and try to assess the engineering inside. Have Philips got it right?

Next month we will be considering some of the interesting technical features of the chassis: these include the use of a novel two-thyristor controlled rectifier bridge power supply, a diode-split line output transformer to provide the e.h.t., and a class D i.c. field timebase.

Servicing Telpro Colour Receivers

Barry F. Pamplin

TELPRO colour TV sets, marketed under the Carnival emblem, were manufactured at Kearsley, Lancs., initially by the Telpro company, a subsidiary of the rental firm Telefusion Ltd., and later, when the factory changed hands, by ITT Ltd. There were three models, the 20in. Model C501, the 22in. Model C561 and the 26in. Model C671.

Designed along similar lines to the Decca 30 series chassis, and using the same "mix" of Mullard and Baird circuits, the Telpro chassis is electrically similar to the 30 series but the physical layout is different, giving better accessibility for service – clearly a number one priority for any rental company embarking upon TV production.

Because of the basic similarity to the Decca chassis, many of the comments made by R. W. Thomson in the June/August 1976 issues of *Television* apply equally to the Telpro sets. The purpose of this article is to note the faults which have shown themselves to be common on the Telpro chassis in addition to those already dealt with in the earlier articles. Guidance is also included on the remedial action to take in those cases where experience has shown that a modification to the original circuit produces more reliable operation.

Front End Troubles

The Telpro chassis uses a varicap tuner which is prone, under certain circumstances, to produce patterning problems. These problems occur because of the tuner's poor image rejection performance.

Without going into too much detail, the problem arises when the channel spacing between programmes gives rise to an image frequency which beats with the i.f. to produce a visible pattern on the screen. To take, as an example, the Winter Hill transmitter in Lancashire. Here the channel spacing is 32MHz, and if the image rejection of the tuner is poor this channel difference frequency will beat with the 38·15MHz sound i.f. to produce a 150kHz herringbone pattern on the screen. Known in the esoteric language of tuner designers as N + 4 interference, the only answer is to replace the tuner with one having a better image rejection such as the ELC1043/05 unit (67dB rejection as compared with only 38dB for the Elpro unit fitted). Another area of the country where a similar problem occurs, only this time it is N + 10, is Portsmouth.

Another cause of patterning in the tuner circuit is the capacitor C96 (6·4μF) which is mounted on the tuner control unit. Moving the capacitor from this position to a position on the tuner printed board immediately beneath the tuner unit will often clear up minor patterning problems.

Fuse Troubles

The tendency exhibited by the Decca chassis for intermittent fuse blowing occurs with equal regularity in the Telpro sets. The 500mA h.t. line fuse F1, which is mounted on the power supply/sound panel, is frequently ruptured by flashovers in the PL519, the PY500 and the c.r.t. The understandable tendency simply to fit a "fatter" fuse should be resisted. Nine times out of ten one gets away with it, but in the tenth case the line output transformer really does get alight with expensive damage to the adjacent cable forms.

The most satisfactory solution to the problem is to remove the fuse altogether and to replace it with a fusible 10Ω resistor rated at about 5W. This will open up in the event of a "solid" fault occurring, but the thermal inertia will avoid spurious failure due to flashovers and the like.

Rupturing of the 2A mains fuse F3 is nearly always caused by the h.t. rectifier diode D600 (BY127) being damaged by transients created by the on/off switch. Very often its series 3·9Ω resistor R603 goes open-circuit as well. On unmodified sets this failure happens very frequently: the way to prevent recalls is to fit a VA1005 thermistor in series with the resistor.

Valve Troubles

One of the consequences of the physical arrangement of the chassis is that the PCF802 line oscillator valve is tucked away in the "depths" of the set, where it gets very hot and irritable! This shows up when the viewer complains that the line takes a long time to settle down when the set is switched on or when the channel is changed. In most chassis this would indicate flywheel sync diode trouble – in the Telpro chassis it's invariably caused by the PCF802 ageing – often within a few months of replacement.

The two other valves that seem to give regular trouble are the PL508 field output pentode which produces field fold up, and the PCL82 sound output valve which, even allowing for its known tricks, seems to suffer from open-circuit heater troubles in this chassis.

Field Timebase Faults

Apart from valve trouble, the two components which cause most trouble in this area are the main linearity control VR421 (100kΩ) and – guess what – the *tripler!!*

The linearity control on the Decca chassis is a big beefy component, whilst that on the Telpro sets is a miniature preset mounted in a position where it can cook gently. If the linearity control has a white control ring it should be changed on sight since it will otherwise give trouble sooner or later – usually causing a jittering picture.

Just how the tripler can cause field troubles is only obvious to those who have dealt with the Telpro chassis through the hot summer days as well as the long winter nights!

The subject usually arises innocently enough with a phone call to say that the picture has collapsed to a horizontal white line. Invariably however by the time the engineer calls the line has reverted to a picture, and no amount of prodding around the field timebase panel will produce a collapse. This sequence of events will repeat itself at intervals of anything from a few days to a few weeks, during which time the PCF80 and the PL508 will have been changed once – if not twice – the height control replaced and, depending upon the sagacity of the engineer, a completely different field timebase board fitted.

Eventually, with the viewer frustrated and the engineer cussing, the set will be dragged into the workshop for a soak test. Once there, and assuming that the fault occurs, it will be found that the field collapse is due to an open-circuit(s) in the four leads feeding the field output transformer. These leads, which are very thin, run very close to the tripler and corona discharge from the case of the tripler causes them to become corroded and fracture. Simple once you've found it!

Whilst on the subject of triplers, it's worth mentioning that

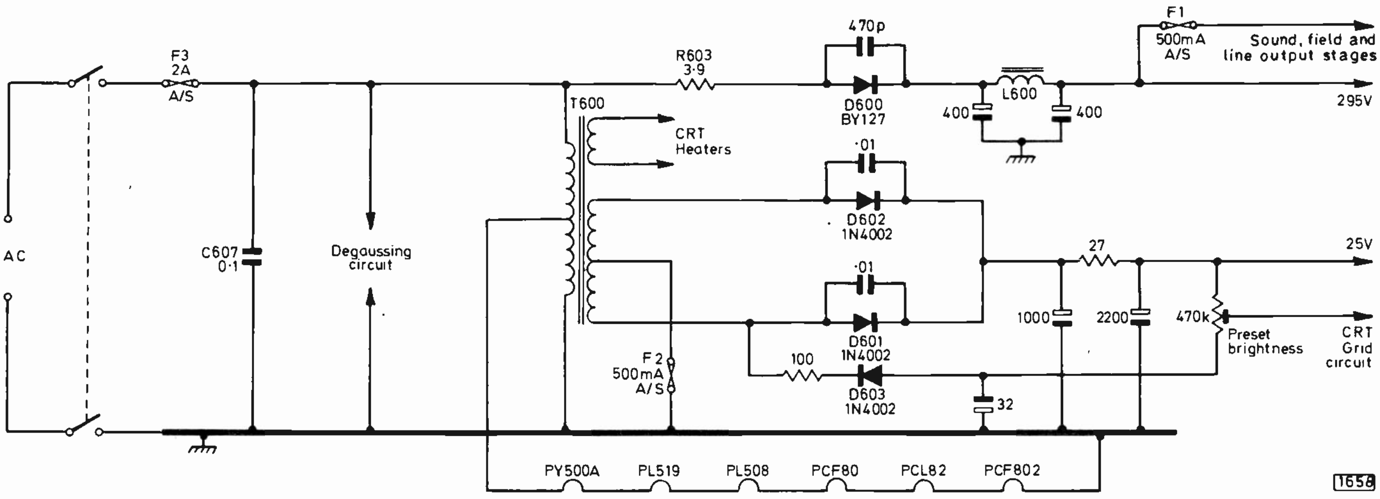


Fig. 1: Circuit diagram of the power supplies.

in cases where the line output stage appears to be operating normally but the e.h.t. is excessive (28-30kV) the culprit is usually the tripler. Just what happens to cause this effect I do not know – only that it occurs.

In both the Decca 10 and 30 series and these sets there is a tendency for R402 (820kΩ) to increase in value. Since it's in series with the height control the result is loss of height.

Decoder Troubles

The decoder and colour drive circuits are, with a few exceptions, trouble free. In the decoder proper the two most common culprits are the d.c. amplifier (TR212) in the reference oscillator control loop and the i.c. MC1327P.

Loss or excess of one colour is usually due to one of the two small preset controls associated with each output transistor becoming defective. The effect is usually intermittent, and when tracking it down it's important to get the viewer to observe what happens to the monochrome picture when the fault occurs. If the viewer tells you that the picture keeps flicking to purple, for example, then the remedy is to change the two presets associated with the green channel.

Early production panels had output transistors with flat heatsinks. These are not reliable and should be replaced with BF337s with circular corrugated heatsinks.

Intermittent loss of luminance and sync is usually due to a dry-joint on the luminance delay line where it joins the printed board. Complete loss of luminance and sync is usually caused by a faulty delay line – either an open-circuit winding or a short between the winding and the earthed inner foil.

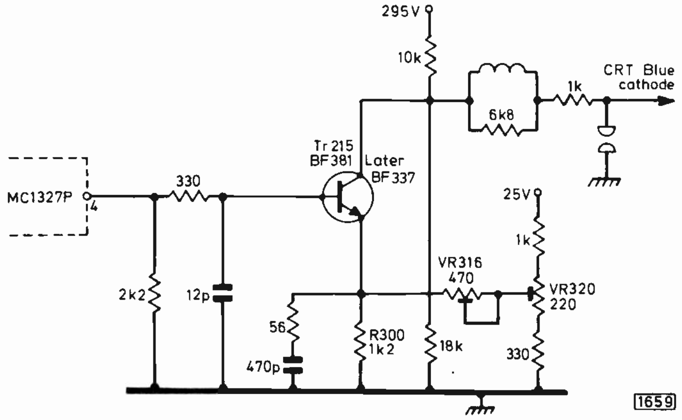


Fig. 2: One of the RGB output stages.

Vague complaints about the picture flickering can be due to a poor contact at either end of the lead carrying the sync pulses from the decoder panel to the timebase panel. If in doubt, waggle each end of the lead in turn whilst watching the screen.

Sundry Troubles

Apart from the faults listed above, there are one or two other points which deserve a mention. The two hinge down assemblies at each side of the chassis, especially the one carrying the decoder panel, can trap wires when replaced into the closed position.

In some sets the original convergence assembly has been replaced by a Mullard unit, and the clearance between the red convergence components on the yoke and the timebase assembly is very tight – extra care is then needed when hingeing the unit down.

In cases where there is an obvious dead short between h.t. and chassis it's worth checking the PL519's screen grid decoupler C432 (0·1μF) before embarking on a long sortie through all the plugs and sockets to track down the culprit.

Getting Spares

Because ITT ended the production of the Telpro chassis soon after they acquired the factory the total number of sets produced was fairly small and the supply of spares can sometimes be difficult.

As far as the writer is aware there are no panel repair facilities, and getting hold of some of the smaller items such as the front panel controls is difficult. The similarity to the Decca 30 series means that the line output transformer, field output transformer and mains transformer used on that chassis can be fitted to the Telpro without much modification.

As far as service data is concerned, the Decca 30 series circuit diagram can be used, most of the component reference numbers being identical. There are only minor circuit variations.

Acknowledgement

The author wishes to thank the directors and engineers of Telefusion Ltd. for their assistance in the preparation of this article.

Tristar

These sets were also sold through Trident Discount outlets under the Tristar name. ■

TV Games In Colour (Part 2)

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

Construction

It has been arranged so that all the components for the main control unit are assembled on a single printed circuit board which fits into a Vero case type 1411. Fig. 2 shows the track layout for the PCB whilst Fig. 3 shows the layout of the components on the board.

The three main integrated circuits fit into sockets which may be either low profile DIL sockets or made up from Soldercon socket pins.

In the u.h.f. modulator section it is important to wire the components in the positions shown, otherwise the output frequency or oscillator operation may be affected. When soldering the BFY90 transistor, it is advisable to use a small pair of pliers on the transistor lead to act as a heat shunt – these transistors are easily damaged by applying excessive heat to the leads. Using a heat shunt will allow a good joint to be made on the PCB whilst keeping the heat away from the transistor itself.

The leads for the player controls are most conveniently made from miniature three core mains cable – this is robust and neater than a twisted cable. The connections for the player controls are soldered directly to the main PCB. The lead should be anchored to the case before being brought out, so that an accidental tug on the cable will not pull the connections off the printed circuit board. A similar anchoring of the cable in the player control unit is desirable.

Each player control uses a 500kΩ potentiometer for bat position and a push-button reset switch for bat size selection and to start a new game. With the 500kΩ control potentiometer, a rotation of just under 180° moves the bat from the top to the bottom of the screen. This has been found to give quite reasonable play control. If a more sensitive control is desired, the potentiometer can be increased to 1MΩ in which case a movement of about 90° moves the bat from top to bottom.

Setting up and Testing

Having thoroughly checked the wiring of the PCB for missed joints or illegal solder bridges, test the circuit with the three main integrated circuits removed from their sockets. Apply power and check that the –15V and –9V supplies are set at the correct levels. Couple the u.h.f. output to a television receiver and tune the receiver until the

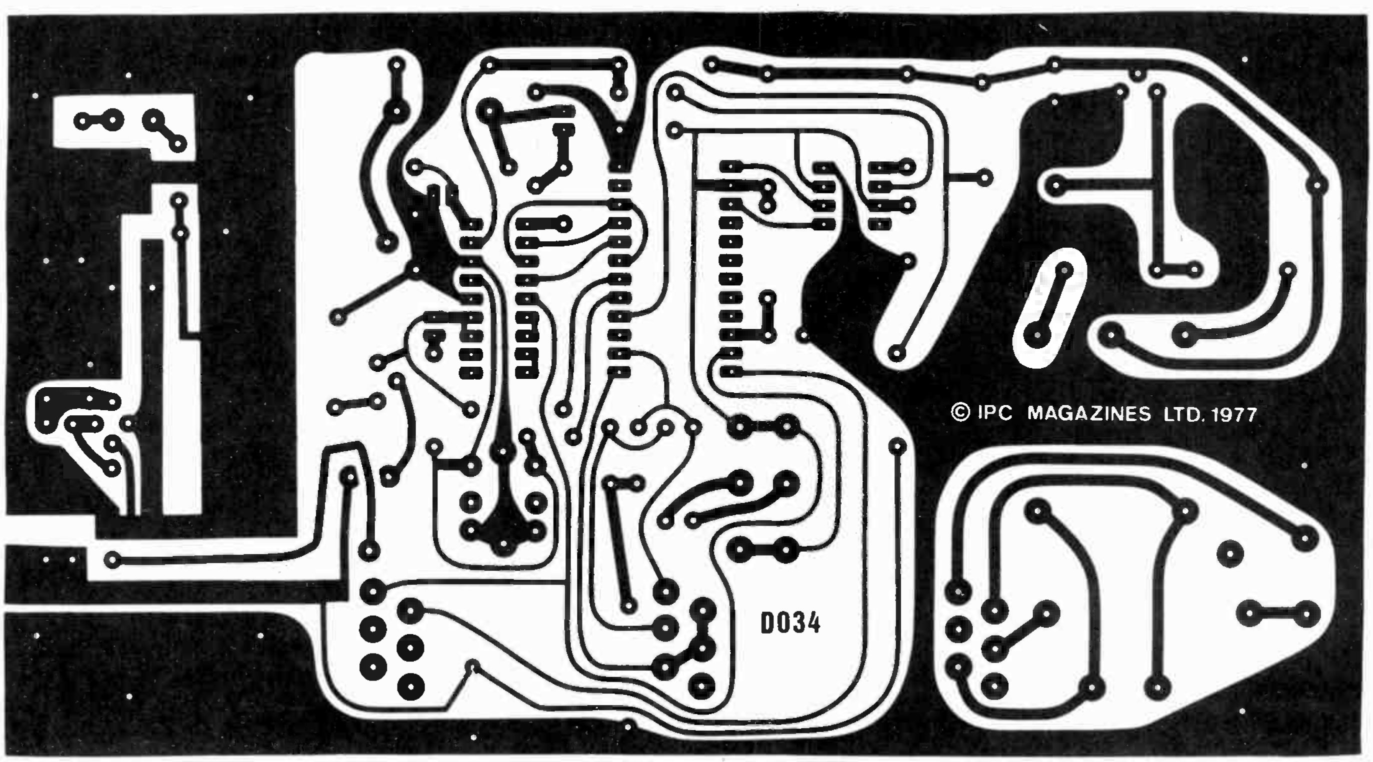


Fig. 1: Track detail of p.c.b. The board is available from Readers' PCB Services Ltd.

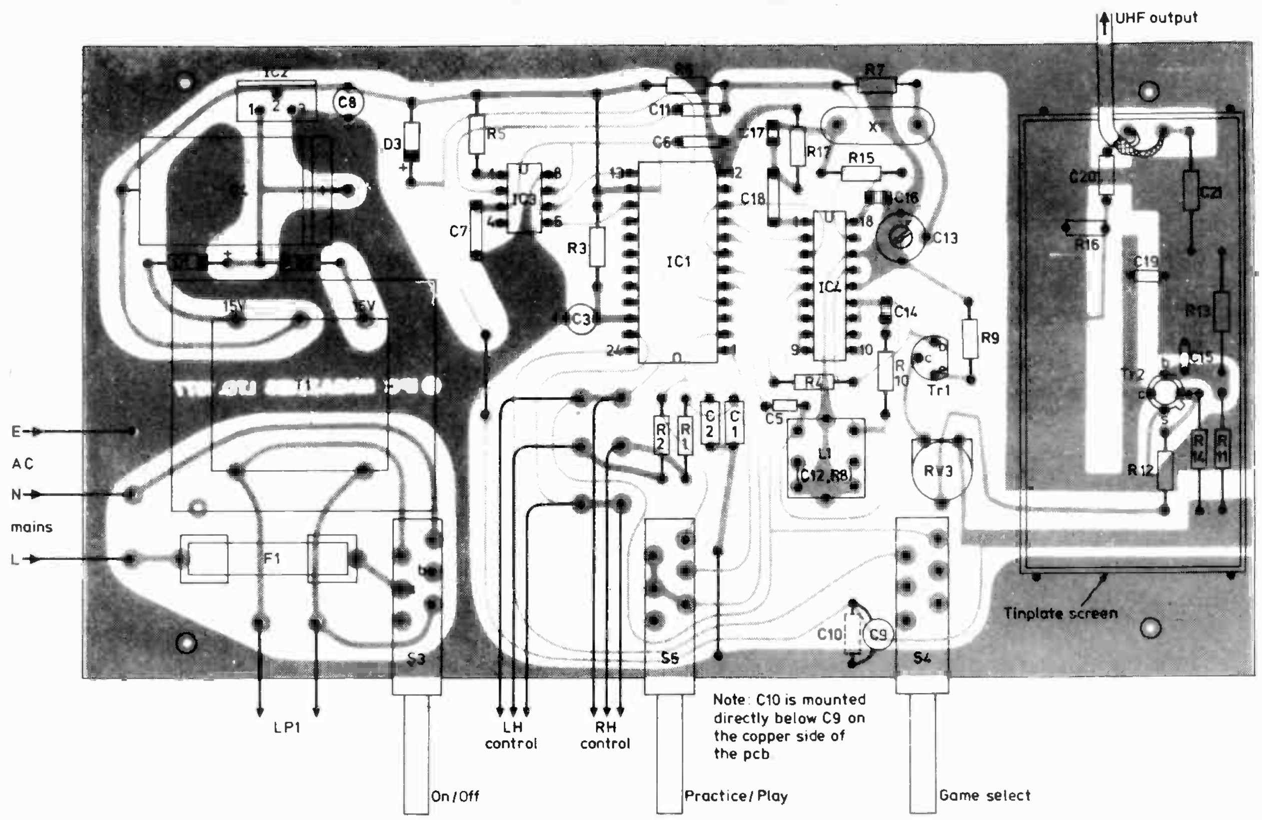


Fig. 2: Component location diagram. The metal screen enclosing the modulator is made up of strips of tin plate, about 25mm high and secured by soldering to the four pins inserted at the corners of the modulator section.

games unit's u.h.f. carrier signal is detected. This will be indicated by a reduction in the normal off channel noise to give a blank screen.

Switch off the power and insert the three integrated circuits, taking care to ensure that they are correctly orientated. When the power is turned on again it is likely that there will be some video modulation on the screen. If not, the colour reference oscillator is probably not set up correctly: adjust the value of C13 and try again. It may be necessary to switch the power off and on to ensure that the games chip resets correctly. Once video signals appear on the screen, retune the receiver for a locked display. If the display will not lock correctly it's likely that the sync pulses are being clipped. Adjustment of RV3 should clear this fault.

When the picture is locked in it should show the field for the hockey game since this is always selected at switch on. Press the game select button and check that the display changes to tennis. Pressing the game select button again should give the squash display. A further press of the game select button should bring back the hockey game.

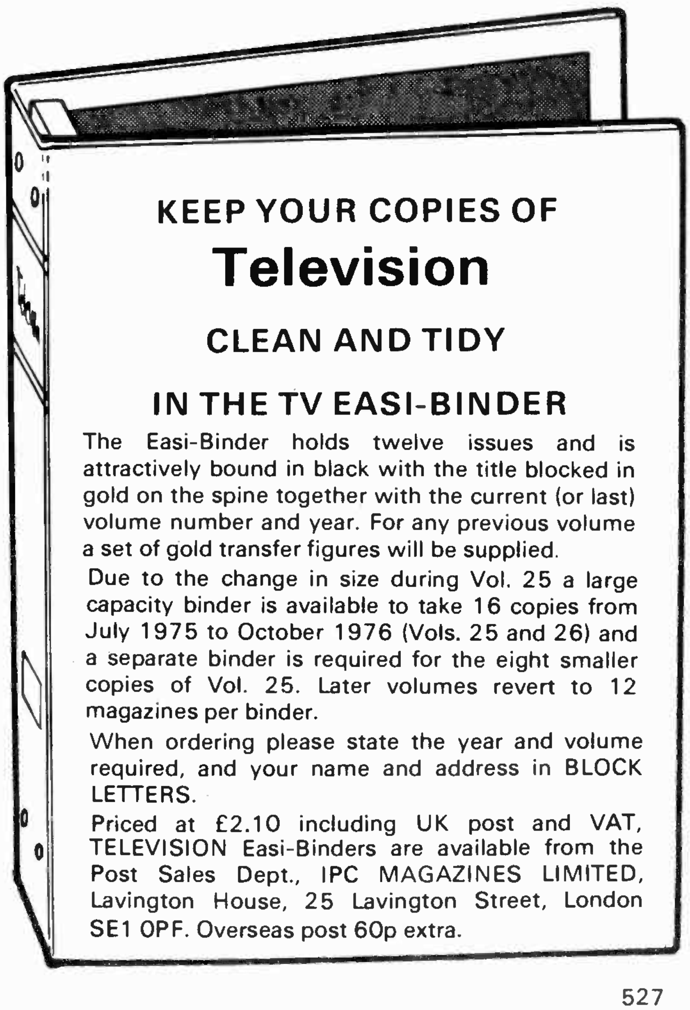
With hockey selected, press one of the player reset buttons. After about two seconds the ball should appear and will travel around the screen. At this point there may be video buzz on the sound channel. Tune the sound sub-carrier coil L1 until the buzz fades out and the sound effects ping is heard each time the ball bounces off a wall or player.

On some receivers where the a.f.c. is permanently active it may be found that at switch on the receiver will lock to the sound or chrominance subcarrier and it will be necessary to retune the receiver for optimum picture display.

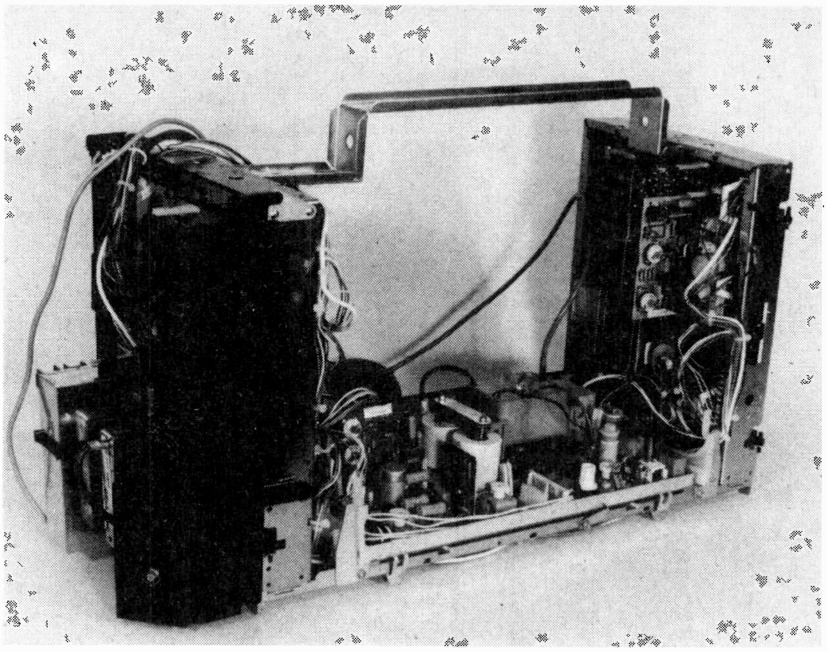
Check that the player controls move the bats up and down the screen. Bat size control can be checked by moving the bats to the top of the field and pressing the player reset button: the bats should change size each time the button is pressed.

There is also a time out facility after each point has been scored. If one player moves his bat off screen at this time play will be stopped until he moves his bat back into the playing field: service will then commence and the game resume.

Having checked all the functions you are all set to start your first television games tournament. . . . ■



Thorn's new TV Chassis



THREE new TV chassis have been introduced by Thorn and were demonstrated to the technical press at a recent briefing at Thorn's Enfield plant. There are two colour chassis, the 9600 and 9800, and a monochrome portable chassis, the 1690/1691, which is intended to replace the well known 1590/1591 series.

THE 9600 CHASSIS

The 9600 chassis (9500 is the export version) is designed to drive the 110° version of the RCA PIL tube, in the 22 and 26in. sizes. This tube, with its permanently attached toroidal scanning yoke and sealed purity and static convergence magnets, provides excellent geometry, self-convergence and overall focusing, points which are particularly important for Teletext displays where viewers pay as much attention to the corners as to the centre of the picture.

Chassis Layout

As the accompanying photographs show, the chassis is soundly constructed and accessibility is excellent. The i.f./decoder board design used in the 8000/8500/8800/9000 chassis has been retained, but most of the rest of the chassis is new or substantially revised. The various printed boards are carried on a metal chassis and can be easily removed. The power board is mounted vertically at the right-hand side (viewed from the rear) and has two daughter boards, the Syclops and the line/field oscillator boards. These can be removed and plugged on to the projecting pins on the rear of the power board for easy service access. There are two boards mounted vertically at the left-hand side, the tuner/remote control board and the i.f./decoder board. A metal "door" provides screening between these and also carries service information – there is a similar door on the right-hand side of the chassis. The field and line output board is mounted horizontally at the bottom of the chassis. This position was selected because it's the coolest part of the chassis. The power output transistors are mounted on a quite massive heatsink which can be clearly seen in the photograph of this board (board PC888). The board is held in slides which allow it to be withdrawn to the rear: it can then be raised and hooked into the service position.

The chassis has been designed to allow a wide range of tuning and control arrangements to be used. Hence the mounting of the tuner/remote control board at the left, adjacent to the cabinet's front panel control layout.

Circuit Innovations

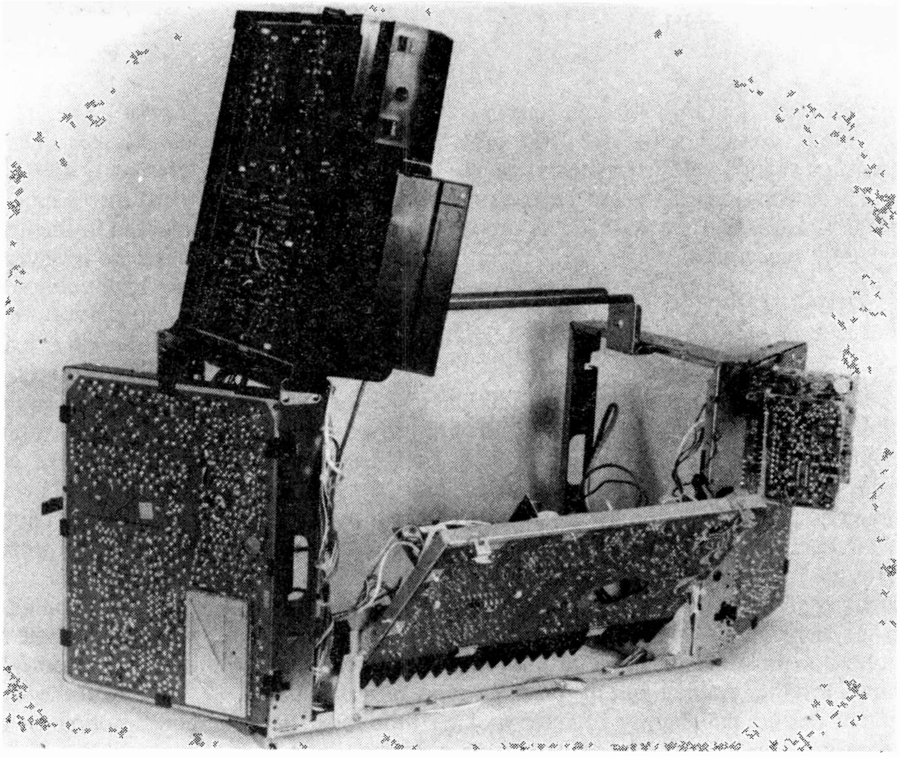
The main circuit innovation is the use of the Syclops Mk. II power supply/line output circuit. It will be recalled that in Syclops Mk. I, used in the 9000 chassis, a single transistor acts as chopper and line output transistor, driving the chopper and line output transformers. This arrangement is not suitable for use with the large-screen, 110° version of the PIL tube, mainly because of problems associated with the start-up system required. In Syclops Mk. II there is a separate line output transistor, whose base is driven by a secondary winding on the chopper transformer. This arrangement is similar to that used in several Sony sets and the ITT FT110 chassis. It offers the incidental advantage that an isolated chassis could be achieved quite simply by using the chopper transformer as a mains isolating transformer. The chopper and its drive circuitry would then be at mains potential, in a screened compartment, with the rest of the circuitry isolated. There is a likelihood of a move to the use of isolated chassis in the future, due to the increasing tendency to connect other equipment (TV games, VCRs, Teletext and Viewdata arrangements) to TV sets.

Thorn comment that the Syclops circuit used in the 9000 chassis has proved to be very reliable, and we've certainly not had any feedback of problems ourselves. The circuit has low power consumption and provides stabilisation against wide variations in the mains supply (between 180V and 265V r.m.s.). A further improvement to the comprehensive protection circuitry has been introduced in the 9600 chassis – there are now three modes of operation. The protection circuitry monitors the chopper transistor's current and various important voltages within the receiver. Should any of these exceed various predetermined levels, the protection circuitry either shuts the receiver down for a moment or limits the power demand to safe values, depending on the severity of the excess. If the overload is transitory (e.g. a mains surge or c.r.t. flashover) normal operation is immediately restored, but if the fault condition persists for a second or more the set is shut down completely.

Now this is all very nice, but makes fault finding rather

Left: *General view of the new Thorn 9600 chassis, which is designed to drive the 110° version of the RCA PIL tube in the 22 and 26in. sizes. The arrangement of the chassis is remarkably clean and compact. Ample space is available on the left-hand side to allow a variety of tuning and control arrangements to be used.*

Right: The chassis is arranged for easy servicing accessibility and, with the power devices mounted on the lower horizontal board, for cool operation. The left and right-hand panels hinge outwards or upwards. The power board's two daughter boards are shown in the service position, on the print side of the right-hand vertical panel. The horizontal line and field output board is shown in the service position – withdrawn to the rear, then hinged and retained at an angle of 45° to give access to both sides.



tricky since there is so little time in which to make a diagnosis. Thorn have thought of this too, and have provided two sockets to allow easy measurements of critical voltages so that a rapid diagnosis can be made. The socket on the line and field output board can be seen in our photograph, at the bottom slightly to the right of centre. The other socket is on the power board.

The annoying effect of picture breathing – changes in raster size due to e.h.t. voltage variations – has been overcome by introducing compensation circuitry. This monitors the e.h.t. and feeds correction waveforms to the NS and EW raster correction circuits. The EW diode modulator is of the high-level type, and a patented high-performance NS correction circuit is used.

Reliability

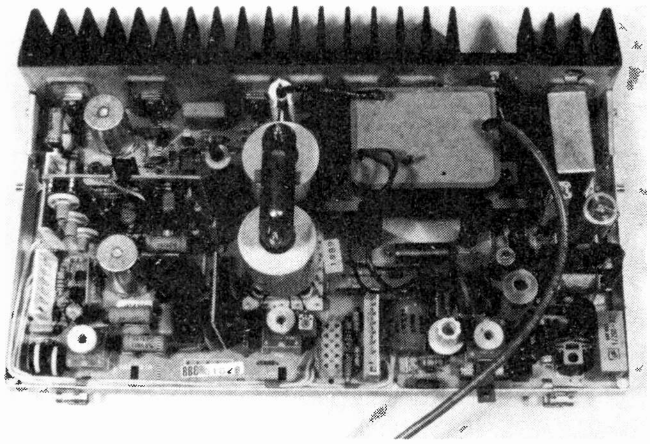
Our leader this month comments on the subject of the increased reliability of recent chassis, and the 9600 is a prime example. Thorn comment that an important aspect of the design brief, from which work on the chassis started, was that the receiver should "show a dramatic step forward in television reliability". To this end Thorn carried out an exhaustive investigation to determine the failure mechanisms associated with components used in the television environment and thereby enable their behaviour to be predicted. This investigation greatly influenced both the electrical and mechanical design of the 9600 chassis.

It was found, for example, that the reliability of most electronic components can be doubled by reducing their operating temperature by as little as 10°C. The operating temperature of the 9600 chassis has been reduced by paying careful attention to layout and ventilation, using low-power circuitry and providing substantial heatsinks. In addition, handsome operating margins have been adopted on the operating conditions specified for components. A particularly striking example is the position of the e.h.t. tripler, which is mounted in the coolest part of the receiver where there is an unrestricted flow of cool incoming air. The design of the chassis takes into account the worst external ambient temperature and humidity ever likely to be encountered (in Alice Springs, Australia, some people watch television in a room temperature of 45°C). All components have been specified so as to operate reliably under these worst conditions.

A problem that arises is that having reduced the set's operating temperature there is a corresponding increase in the time during which initial failures can occur (the burn-in period). These component failures are those which do not follow the normal reliability curves. Thorn have overcome the problem by fitting a special back to the chassis during its 24-hour soak-test period in order to increase the internal temperature of the set. The back is also fitted with a fan to ensure that the cabinet heat is not concentrated at the top. Receivers are put through detailed set-up and testing both before and after the soak-test period, so that parameters which drift during the soak period can be effectively screened. Thorn say that this method is unique.

Well known causes of unreliability are intermittent connections and dry-joints. On the 9600, any connectors which might cause damage should they become intermittent are "doubled up" to minimise the chance of failure. Stringent vibration tests are carried out to reveal possible dry-joint problems.

Because of the high degree of voltage stabilisation, things such as the tube's heater voltage can be carefully tailored for maximum tube life without the normal compromises



The PC888 line and field output board. Note the massive heatsink and the test socket at the front, towards the centre.

necessary to take into account heater voltage variation due to mains voltage variation. The tube heater in fact is operated slightly below its rated voltage.

Thorn have certainly got their priorities right with the 9600 chassis, and we wish them success with this and its eventual successors.

THE 9800 CHASSIS

The 9800 chassis replaces the 8800 in Thorn's range of chassis. It drives a 90° delta-gun tube of improved type – a pigmented phosphor, black matrix tube. Let's consider the tube first. To obtain a high contrast ratio despite high ambient lighting conditions, glass with a light transmission of around 50% is normally used. This reduces the reflected light by 75%, but also reduces the light output by 50%. In a black matrix tube the space between the phosphor dots is blackened. This enables the glass to be changed to give a light transmission value of around 80%. The result is a much brighter display, but the contrast ratio suffers to some extent due to the slightly brighter looking tube face. With pigmented phosphors the red and blue phosphor dots are dyed red and blue to reduce the reflected light from the tube face by about 25%. This darkening gives a much better contrast ratio with a light output loss of only about 5%.

Basically, the 9800 is an updated version of the 8800, retaining certain boards, but with the aim of adopting current state-of-the-art techniques, improving the performance and producing a clean, easy to make and to service chassis. The 8800 panels retained are the i.f./decoder and field timebase/line driver panels; also, with some modifications, the power and audio output panels.

Apart from the c.r.t., the main change with the 9800 chassis is the use of a diode-split line output transformer. This provides an e.h.t. supply of 26kV with a source impedance of around 2MΩ. The combination of this line output transformer and the new c.r.t. provides bright pictures with minimum breathing. In addition, all the auxilliary supplies for the receiver are derived from the line output transformer, simplifying the mains power supply circuit. The transformer is mounted on a module board in order to reduce the number of hand-wired components and hand-soldered joints.

The mains power supply unit now has to provide only a stabilised 170V rail for the line output stage. The thyristor circuit is retained with an overvoltage trip, but the mains transformer is no longer required.

Thorn comment that the 9800 has also benefited, in terms of fully specified components, from their research into component failure mechanisms, and that the chassis has been subject to all the "torture testing" they can devise.

MONOCHROME PORTABLES

Thorn's new monochrome portable chassis looks conventional indeed at a first glance at the circuit, there being just one i.c., a CA3065 for the intercarrier sound channel. It seems however that in terms of the performance you can get for a given cost, discrete component circuitry has the advantage in applications such as this. And we've heard that from other sources, so it's certainly not a Thorn "line".

There are however several innovations. First, the set uses one of the new generation of monochrome c.r.t.s which operate at a much reduced first anode/focus voltage – 95V in fact. So the same supply line can be used for these potentials as for the video output transistor's collector supply. The result is a much simplified line output transformer. This component is novel in another respect however – the silicon e.h.t. rectifier diode is encapsulated in with the e.h.t. overwinding. This technique has been adopted in the interests of improved reliability, in particular when the receiver is used in high humidity conditions, since the high-voltage a.c. waveform is contained within the encapsulation, only the d.c. being in free air. Also novel is that the e.h.t. lead can be easily changed if damaged – it simply unscrews.

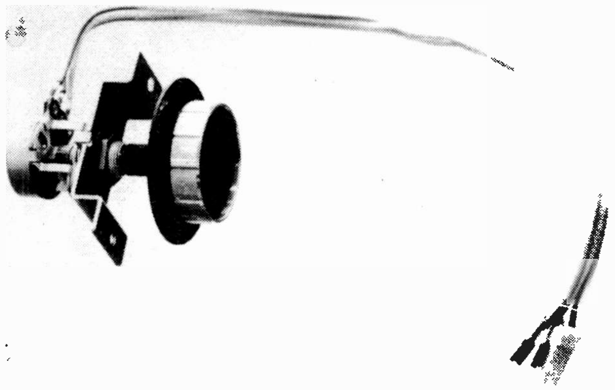
The other main innovation is the use of a varicap tuner with rotary tuning. In a truly portable receiver, rotary tuning has the advantage that the band can be searched with ease. The rotary drive system has been designed specially for Thorn and employs an epicyclic system driving a special-law potentiometer. The component is both simple and compact.

Also compact is the single printed circuit board, on which the whole receiver apart from the mains transformer and the customer controls is mounted.

One of the design targets was to achieve low power consumption on both mains and battery operation. Battery consumption has been reduced by typically 24% in comparison with the 1590 series chassis – it's just over 1.3A at 12V, only slightly above the average for a modern 90° tube set whereas this chassis drives a 110° tube. An extensive test programme was undertaken before the chassis was put into full production.

REMOTE CONTROL

A simple, two-function ultrasonic remote control system has been devised for use with the 9800 chassis. A standard intercarrier sound i.c. (the TBA120) is used for the receiver, with the centre frequency tuned to the mid-point of the two frequencies used by the remote control transmitter. This technique has the advantage of immunity from triggering by wideband noise signals. For their export range of colour receivers Thorn have designed a sophisticated remote control system which has thirty control functions. This is sufficient to provide remote facilities for use with a receiver equipped for Teletext reception – Thorn consider that to be successful with viewers, remote control should be used for Teletext operation. Another feature introduced on Thorn's export range of colour receivers is provision for the time (in hours, minutes and seconds) and the channel number to be shown in a box on part of the screen. The techniques used to do this are basically similar to those involved in Teletext control, so the two have been combined in the new remote control system. Thorn's Teletext receiver was on show, giving excellent results.



The rotary tuning drive system designed for the 1690/1691 series of monochrome portables.

Servicing the Waltham Model W125

Les Lawry-Johns

THESE 24in. monochrome receivers have been imported recently and are likely to be encountered in increasing numbers. They are of East European (Hungarian) origin, and we do not so far have a great deal of service information on them. They appear to be pretty conventional in design however and should not present too many problems.

The tube is a type A61-120W and six valves are used in the hybrid circuit. The front of the receiver is simple and uncluttered. The main controls are concealed beneath a pull down flap on the right side and consist of three user controls, volume, brightness and contrast, with the volume ganged to the rotary on/off switch, plus four press-buttons for station selection and tuning. Each button has its own scale, which rises toward 68 on clockwise rotation and down to 21 anticlockwise. There are three recessed controls at the rear: line and field hold plus height.

Removing the rear cover reveals a vaguely familiar swing down chassis having something in common with the ITT VC200 and the Indesit T24 layout. The method of securing and releasing however has more in common with the Russian Temp! A lever at either side operates heavily spring-loaded claws, and there is nothing flimsy about this arrangement.

It comes as some surprise to find that the line oscillator is on the extreme left of the panel, driving the line output stage which is on the extreme right. Apart from this the layout is what one would expect, but one point will attract the eye and that is the e.h.t. connector to the side of the tube. This is a clip with no surrounding cover (a wire clip that is) and this could come as a great shock to some. It could be an even greater shock to the thin scan coil connecting leads which are held at the top of the line output cage by a thin elastic band: when the chassis is in the operating position, these leads are in close proximity to the e.h.t. connector. The elastic band is unlikely to survive long under (over!) the heat of the line output section, so we strongly suggest that the leads are moved from this position and secured elsewhere.

In contrast to the exposed e.h.t. connector, the top caps of the PL504 and PY88 valves have elaborate (screwed) fixings!

Power Supply Circuits

The mains supply fuse B1 is in the neutral line to chassis after the on/off switch, which means of course that when this fuse fails the chassis and all other parts are left live. The mains filter capacitor C405 could be one of the reasons for the fuse being found severely blackened, as could a shorted h.t. rectifier (D403). A BY127 can be used as a replacement for this diode and a BY126 as a replacement for the heater circuit dropper diode D404. There is a 22Ω 20W surge limiting resistor (R408) in series with the h.t. rectifier diode and a 180Ω 20W dropper resistor in series with the heater circuit.

The first heater in the chain is that of the PL504, followed by the PY88. We don't like this arrangement too much, and would prefer to see the PY88 first as this valve is usually the first casualty (not because it is a PY88 but because it is the efficiency diode) and if it is first in the chain it is usually the only casualty. Being second, it will tend to take the PL504 with it and this is not nice. The last heater in the chain is not that of the c.r.t. but the PCL86 audio output valve.

There is a 400mA fuse in series with h.t. lines C, D and E. In all there are five h.t. lines, so the smoothing is pretty comprehensive. The main transistor supply line H (24V) is obtained from pin 1 on the line output transformer via rectifier D401. The varicap tuner programme selector voltage supply is obtained via R401 from h.t. point D on the other hand, as is the supply to the a.g.c. amplifier T104.

Signal Circuits

The tuner unit is fairly conventional and is operated from a 12V supply which is stabilised by D402. The mixer (T5, BF679M) is followed by the i.f. preamplifier transistor T2 (AF139). The tuning is by R523 etc., preset by R402.

The a.g.c. to the tuner r.f. amplifier (T4, BF272A) is obtained from the emitter of T104 (BC107B), that for the i.f. strip from its collector. Tuner a.g.c. delay is preset by R139.

The first i.f. transistor T101 has a.g.c. applied to its base, its emitter controlling the following transistor T102. These two are followed by the final i.f. transistor T103 which is fixed biased by R114-R115.

The sound i.f. is picked off at the detector stage and passed to a TAA691 i.c. for amplification and detection. The 6MHz quadrature coil is L207.

The detected vision signal is applied without further amplification to the video amplifier (pentode of the PCL84). The amplified signal is developed across R124 and filtered through to the c.r.t. cathode, the brightness control operating on its grid.

The triode section of the PCL84 is the a.g.c. gate, the contrast control R503 operating on its control grid, preset by R130.

Timebases

The attenuated video signal appearing at the junction of R125-R126 is applied to the base of the sync separator T301 via the filter network R302/C302, the resulting pulses appearing at the collector being applied to the sync amplifier (one half of the ECC82). The amplified pulses developed across R305 are passed to the flywheel line sync discriminator (D301-D302) and, after integration by R306-C313, to the control grid of the field oscillator (PCL85 triode).

The d.c. output from the line sync discriminator is used to control the line oscillator, which is the second half of the ECC82 (the oscillator coupling is between its grid and cathode). The sawtooth waveform appearing across R315 is coupled to the line output valve's control grid via C312, producing some 50V drive which is stabilised in the usual

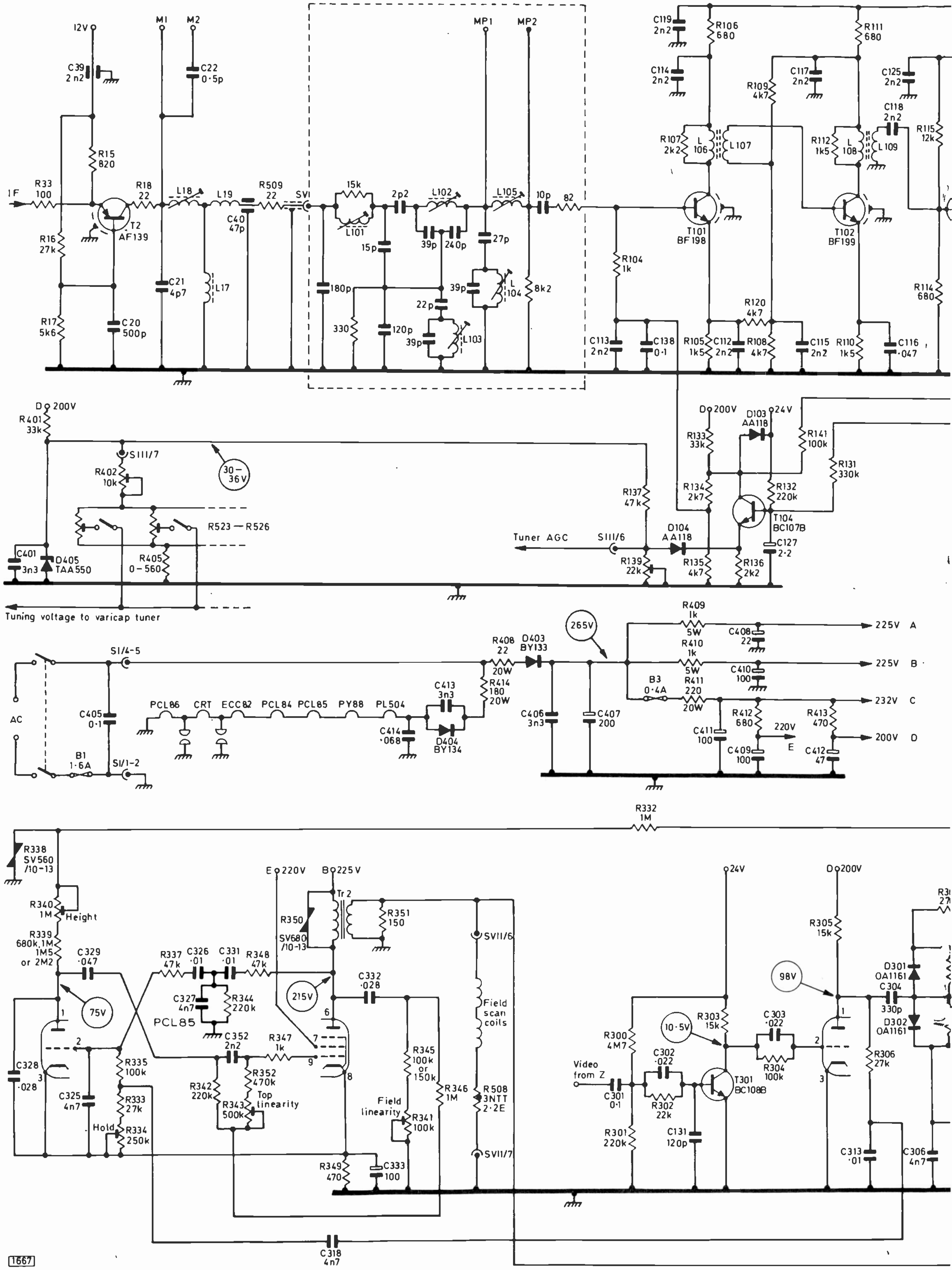
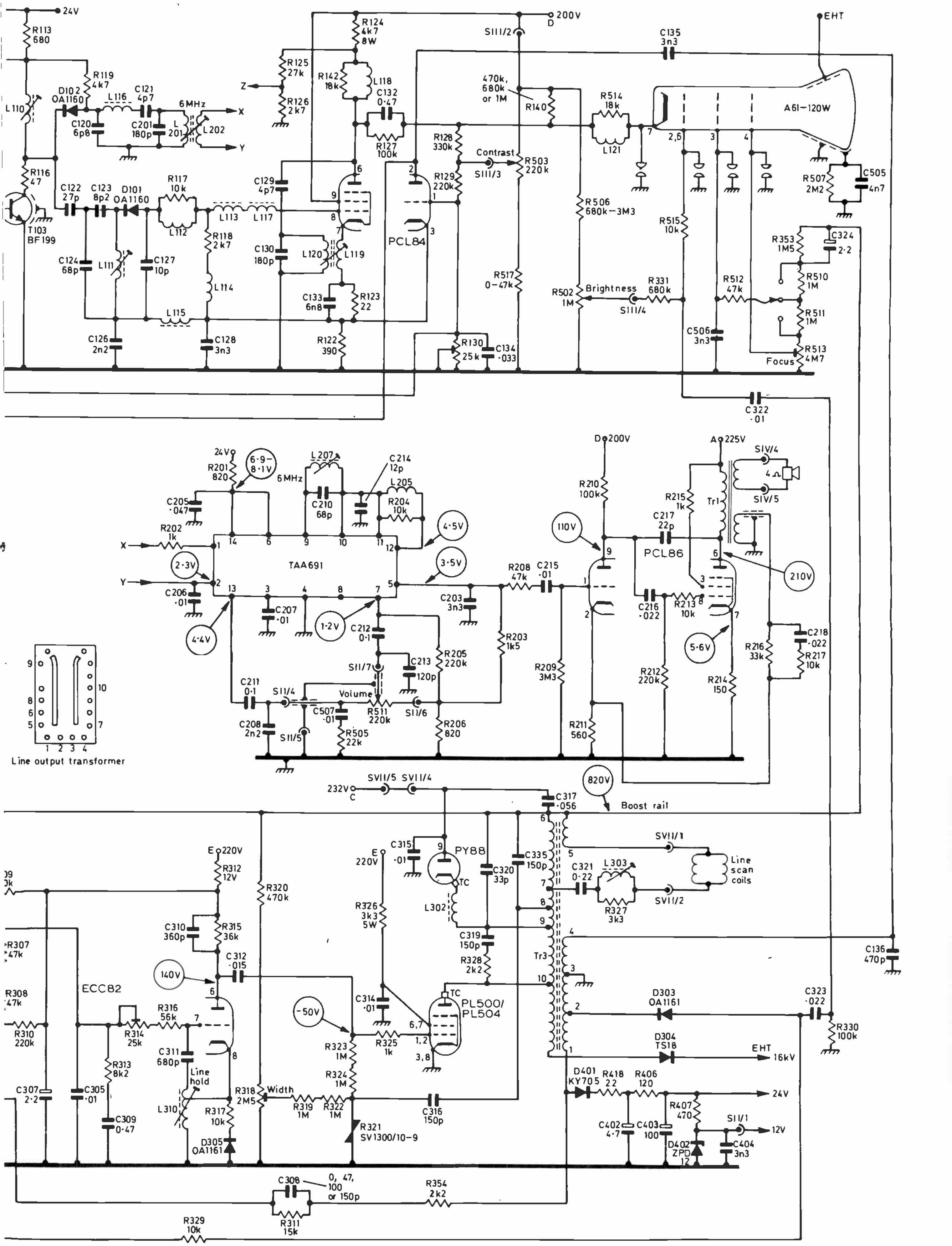


Fig. 1: Circuit diagram of the Waltham Model W125, excludi



ng the r.f. amplifier and mixer stages in the varicap tuner.

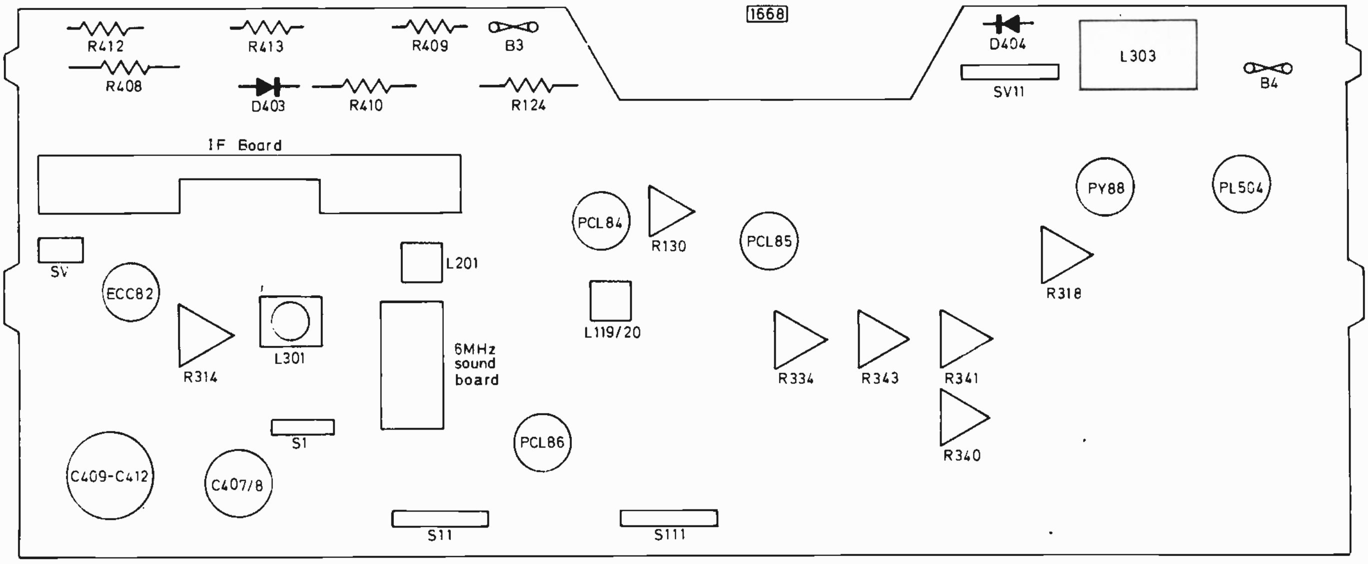


Fig. 2: Layout of the main components on the main printed circuit board.

manner (R321 etc.). R318 acts as the width control. The boost capacitor is C317 and the boost voltage some 820V.

Additional windings on the line output transformer supply gating pulses for the PCL84 triode section, blanking pulses for the c.r.t. grid, reference pulses for the flywheel sync circuit and a feed to the transistor supply rectifier D401. The 16kV e.h.t. is derived from an overwinding and rectified by D304.

The field timebase circuit calls for very little comment as it's quite conventional except for the fact that the triode's cathode and control grid are returned to the output pentode's cathode, which is something to bear in mind when taking voltage readings.

Something else worth bearing in mind is the fact that the control grid of the output pentode is returned to chassis via the linearity controls. Thus an open-circuit at an end contact on one of these can cause total field collapse, due to the control grid being driven heavily negative, causing the valve to cut off (no voltage across R349, no 22V at the cathode).

Sound Output Stage

Similarly the audio output stage is quite straightforward, except for the output transformer's feedback winding which applies negative feedback to the cathode of the triode stage. Additional feedback is provided by C217.

Common Faults

There is one fault which will certainly be encountered sooner or later. The symptoms are that the picture and sound signals fail, leaving a goodly amount of snow and noise. This denotes that the tuning voltages are in error. The two suspects are R401 (33kΩ) and D405 (TAA550 stabilising i.c.). If the voltage at the i.c. is low, check the value of R401. If this is in order disconnect the i.c. If the voltage immediately rises the i.c. is leaky. If the voltage is normal however, check the preset R402 which could be open-circuit, leaving nothing at the tuning presets.

There are variations on this theme of course. The i.c. can play about, the plug and socket connections can be less than positive, or the presets can have poor contact. The symptoms will nearly always give a clue as to the cause.

The next common fault is a rather unexpected one. The valve holders do not always exactly match the valve pins, and it's not unusual to find one of the valves looking decidedly pale due to the ingress of air. Fit the replacement with care.

No EHT or Lack of Width

It's often the case that the 400mA fuse (B3) will be found open. This is usually due to the PL504 line output valve drawing excess current. Nine times out of ten this is due to the ECC82 line oscillator failing to operate, either because it doesn't feel like it or because it is not being supplied with h.t. If checking these points fails to restore the raster it could well be that the PL504 itself is at fault, but there are times when the valves are not at fault and the supply to the ECC82 is intact but still the output valve is cherry red (no drive).

Note that the supply to the oscillator is from E via the decoupling resistor R312 and then through its load resistor R315. Another feed is taken from R312 to the line sync discriminator diodes via R309 and R310. If one of these resistors goes high, first the line sync is lost and then the ECC82 gets a bit upset. Make a general check on these resistors and the diodes therefore, and include in this check the cathode circuit diode of the ECC82 (D305).

Lack of line drive isn't the only reason for the PL504 getting hot and bothered. Lots of things can upset it, although not quite as severely as lack of drive. The trouble need be nothing more than a shorted boost capacitor (C317). Lifting the top cap off the PY88 will prove this by restoring a goodly measure of e.h.t. if C317 is short-circuit.

A shorted e.h.t. rectifier and shorted turns in the scan coils can be proved by disconnecting these items, as can disconnecting the l.t. supplies prove whether a fault here is damping the stage. The PY88 should also be checked – by replacement.

With all these possibilities out of the way, the prospect of shorting turns in the line output transformer remains to daunt the faint at heart.

Many of the items mentioned above could also cause lack of width, and to this list must be added R320 and the width control itself, R318.

Weak Sync

If the field sync is steady but trouble is experienced with the line hold, check the ECC82, R309, R310 and the discriminator diodes D301-D302. If the field sync is also affected (general loss of sync) check the 4·7MΩ resistor

R300 to the base of the BC108 (T301). Then check R303 and R305, the BC108 and the ECC82. Check R125 if necessary.

If the line sync is good but the field takes some time to come to rest (i.e. rolling when first switched on) the PCL85 is almost certainly responsible. Cries of "Oh, the man's a genius". Think nothing of it: there are more blinding glimpses of the obvious to come.

Field Faults

Severe bottom compression is usually due to the PCL85's cathode electrolytic (C333) drying up, and if the valve has given trouble its cathode bias resistor R349 must also be checked (I told you there were more gems to come). It is as well to bear in mind that if this resistor rises in value the top of the picture can be compressed.

Even loss of height at the top and bottom should call attention to R332 and R339 (well I never).

Sound Troubles

Still in the kindergarden or sprogsschool, if the sound plays about, making a loud noise when it goes off or comes back on, sharply tapping the PCL86 will further your education no end. If it's the cause of distorted sound however, please check its bias resistor R214 after replacing it.

If the distortion varies with the tuning however, check the setting of L207. The tuning of this core is quite critical.

Habits of the PCL84

As a PCL84 valve is used as the video amplifier it is as well to be aware of one of its shortcomings. This is its distressing habit of developing a screen to control grid short. It would appear that the set's designer didn't know about this, because if he (or she) had they wouldn't have fed pin 9 direct from the D h.t. line and they wouldn't have d.c. coupled the control grid (pin 8) to the vision detector diode. Instead, they would have included a small resistor of say 5kΩ (decoupled) in the feed to pin 9, hung a d.c.restorer on pin 8 and inserted a capacitor between L113 and L117. As it is, one will have to face up to a clean up job in this area when the fault occurs. This will involve replacing the detector diode D101 and R122 (cathode bias) when the fault burns out these items. Nonsense, they scream. Pure speculation, they holler. Sorry, we say, very sorry.

Conclusion

We will be watching these sets closely over the next couple of years, and if any unusual faults develop we will report accordingly. It looks as if home produced monochrome sets will be in short supply in the near future, so we may have to get used to imported table models as well as portables.

Speaking for myself, if the sets I encounter in the future use the somewhat dated design of this one I shall not quarrel with my fate, though they tell me that some types of valves are going to be in very short supply very soon. Oh well.

Spares

For spares, enquiries should be sent to Waltham Electronics (UK) Ltd., 155-159 Queen's Road, Watford, Herts. WD1 2QH.

next month in Television

● ONE-CHIP TOUCH TUNING

Mechanical station selection using a combined potentiometer/switch assembly is the most common method employed in sets equipped with varicap tuners. Our constructional project next month describes an exceptionally easy method of going "all electronic", based on a Plessey touch-tuning i.c. Connection to the receiver is via the existing leads used for the mechanical selector. The unit is powered from the 33V tuning supply and uses l.e.d.s for channel indication.

● A DAY IN THE LIFE OF . . .

It's that man again. Who else but Les LJ, commenting on an average (?) day's business, faulty sets, dropped Avos, troublesome customers and all.

● IC BURST GATE GENERATOR

A precisely timed burst gate pulse is essential for correct colour reception. This can present problems for the constructor, especially if his test equipment is limited. An effective answer is the use of a simple monostable i.c. to provide the pulse.

● PYE HYBRID COLOUR SETS

The Pye 691/693/697 chassis were produced in large quantities: Andy Denham provides a run down on the stock faults.

● VCR RECEIVER CONVERSION

Older TV sets were not designed to operate with VCRs and can't usually follow the more variable line sync pulses in a VCR's signal. A complete solution is to fit a modern line oscillator i.c. designed for switching between off-air and VCR operation.

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ROGER BUNNEY

"WHERE has all the Sporadic E gone?" was the question heading a recent letter from a correspondent. On the day I write this (May 25th) the hoped for SpE conditions have yet to materialise. True, there have been some fairly good openings, but nothing very sustained and certainly nothing up to the expectations for late May. SpE conditions seem to have been excellent in Australia, where the season has just come to an end. It could be just that our season is starting late, and that by the next time I write there will be plenty to report. But there have been years when SpE just hasn't been good – 1966/7 for example.

During the few openings so far there has been only one surprise. Several enthusiasts have reported that RTP (Portugal) has been seen using the Fubk pattern with the identification "RTP 1" and PAL colour. Clive Athowe for one locked strong colour signals. Confusion was caused for several days when RTP apparently transmitted the Fubk pattern without identification. The Canary Islands were twice received in Leeds, on ch. E3 with the identification "Izana".

Stations Logged

My own log shows a healthier trend this month compared to earlier in the year. With the assistance of Baby Bunney, early morning activity has been enhanced, with switch on most days at 0600-0630. It's almost a daily event to log the USSR on either programme material or the electronic pattern, and from about 0650 pings from CST (Czechoslovakia) occur with the EZO pattern. The following report contains my own results plus observations from others, in the interests of assisting with station identification etc.

4/5/77 There was an early morning SpE opening from 0745 to 0815 BST. Signals included MTV-1 (Hungary) ch. R1, West Germany E2 and JRT (Yugoslavia) E4.

5/5/77 Another 0650 SpE opening, lasting ten minutes, with two Russian transmitters on ch. R1, one on programme material and the other with the electronic test pattern.

13/5/77 Two SpE signals from Russia on ch. R1 between 0735 and 0815.

15/5/77 Russian ch. R1 signals at 0725 and 1350.

16/5/77 A good SpE opening provided strong ch. E2 signals from Finland, using the Fubk pattern with the identification "YLE HLKI". Also SR (Sweden) ch. E2 and TSS (USSR) chs. R1, 2 between 0820-0915.

17/5/77 Slight SpE activity, with SR ch. E2 and an unidentified signal on ch. R1 between 0855-0905.

22/5/77 An excellent SpE opening: RTVE (Spain) chs. E2, 3, 4; RTP E2, 3; MTV-1 R1, 2, 4; ORF (Austria) E2a; plus unidentified signals on E2, E3 and R3. The opening lasted from 1300-1500, with a later opening from 1800 onwards giving RTVE.

25/5/77 Just before writing this there was a minor SpE opening with TVP (Poland) ch. R1; SR E2; and several unidentified signals on chs. R1 and E3

A number of SpE openings were logged by Clive Athowe (Norwich). On May 4th he received TSS (USSR) on chs. R1 and R2 at 1300, and on the 9th he again received TSS R1 and R2, also RUV (Iceland) ch. E2 at 1800 on colour bars. The 15th produced RUV again from 2325-0001 on chs. E3 and E4, and the 17th JRT (Yugoslavia) ch. E3 during the early morning and TSS R1. Later on during the 17th RTVE chs. E2/3/4 appeared, and there was another mystery signal, possibly of African origin, from 1919-1928. The signal was very distorted, with smearing and ghosting – the type of signal you get from Africa on the rare occasions when they appear. The propagation mode seems to be some form of trans-equatorial skip combined with SpE. Did anyone else see this signal – on ch. E2?

The prolonged high pressure system over the UK, with accompanying easterly air flow, failed to produce many tropospheric signals here in south Hampshire. Elsewhere however I gather that such signals appeared with above average frequency. Band III and u.h.f. trop signals were received from West and East Germany, and Danish Band III signals also put in an appearance.

To summarise then, a quiet period for the time of the year, with few surprises.

Band I Aerials to your own Design

We have often given details of various wideband Band I aerials for home construction, since apart from the Antiference combined Band I/III MH308 aerial such arrays are not available commercially. Recently however we've been in contact with a couple of manufacturers who will make wideband Band I arrays to your own design – provided they are straightforward and not, say, complicated log-periodic aerials. Anyone interested should send exact details of their requirements to either of the following two companies: Maxview Aerials Ltd., Maxview Works, Setch, King's Lynn, Norfolk PE33 0AT; or Premier Industries (Cheltenham) Ltd., 343-5 High Street, Cheltenham, Glos. GL50 3HS. A quote will be forwarded and the aerial made on receipt of payment. Since the aerials will be one-off jobs the prices will inevitably be somewhat higher than for a standard Band I array.

IC Wideband Amplifier

In the May column I mentioned an i.c. wideband amplifier available from J. Birkett (Lincoln). Frank Luman (Glasgow) has since written with advice on improved performance. He was experimenting at 96MHz and found that much of the noise and other problems experienced completely disappeared when a 10-30pF trimmer was added across the input choke – thus decreasing the bandwidth by tuning the input circuit. Frank found that the tuning was critical but that when correctly aligned the amplifier gave really excellent results. Another constructor found that reducing the supply from 6V to 4·5V gave better results with one i.c., and it may be worthwhile experimenting with rail voltages in the range 4-8V.

Foreign Desk

Switzerland: Brian Fitch reports that the authorities have dropped plans for a second TV network in each of the three languages French, German and Italian. Instead, a further expansion of the relay network is planned to give full coverage of the country in all three languages.

Malaysia: Radio Television Malaysia (Kuala Lumpur) is to experiment with PAL colour transmissions. Regular programmes are expected to start in Autumn next year.

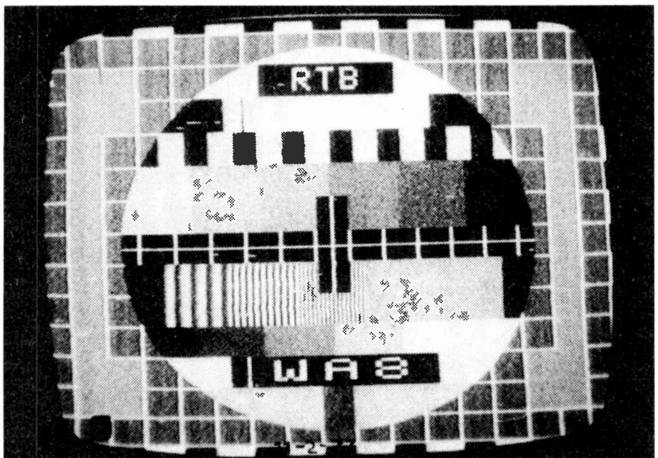
Libya: Libyan TV is experimenting with SECAM colour. A programme exchange with France via satellite is proposed this Autumn.

Italy: RAI (the Italian TV service) started PAL colour transmissions on February 1st, with up to 42 hours weekly on both networks.

Israel: For those within tropospheric range, take care! Kol Yisrael is transmitting 90 minutes of Arabic programmes nightly: this might cause confusion if the sound is Arabic and subtitles Hebrew!

News in Brief

The Indian government is to encourage further expansion of TV, and the setting up of autonomous networks within the AIR system ... It seems that Cuba has abandoned SECAM colour in favour of NTSC for economic and technical reasons.



The PM5544 test pattern used by RTB-1 (Belgium), ch. E8. Photograph courtesy Ryn Muntjewerff.

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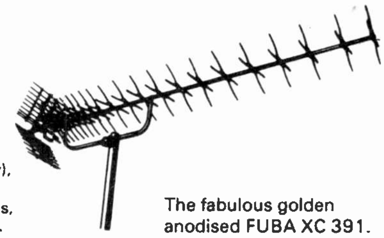

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FM AND TV AERIALS AND ROTATORS ON DISPLAY.

New Masthead Amplifier

Labgear Ltd. (Abbey Walk, Cambridge) have produced a new high-gain low-noise masthead amplifier, type CM7025. This is a grouped device, not wideband, having a gain in groups A, B and C/D of 29, 28 and 27dB respectively. The noise figure is less than 4dB.

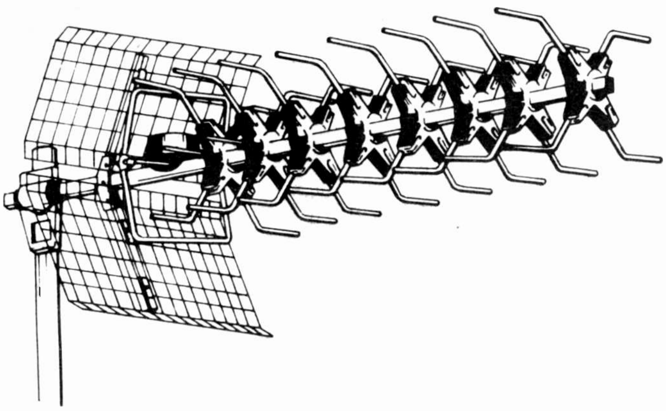
Help Wanted

Mike Allmark (6 Miles Hill Avenue, Meanwood, Leeds LS7 2EL) has purchased a government receiver type RL85. Unfortunately he has no information on the circuit. Can anyone help? It looks an interesting unit, despite rather elderly valve types, and is tunable between 28-84MHz, ideal for DX monitoring. If there is a source for these receivers we would appreciate hearing of it.

From Our Correspondents . . .

Anthony Harris (Fareham) has returned from the Canaries with information on RTVE Tenerife. The test card is transmitted between 1315-1330, with programmes thereafter (at 1435-1500 Telecanarias, a local news programme). There is a further test transmission for the evening programmes at 1745-1800. These times are similar to BST. Tony comments that the UK TV services are sophisticated in comparison with RTVE's offerings there. Colour TV receivers in the SABA range (26 in.) cost £800-£1000!

Good news from Hugh Cocks (Devon). He's noted Norway (NRK) using the PM5544 test pattern with in-



The new range of Multibeam u.h.f. aerials, the MSG range, features an extra large screen-grid reflector to give improved directivity. There are three models, the MSG8, MSG15 and MSG21, with eight, fifteen and twenty one multi-element director assemblies respectively. The aerial shown above is the MSG8.

dividual transmitter identifications. Recently he observed both ch. E2 Melhus and ch. E3 Gemel with identifications.

Anthony Mann (Western Australia) reports increased F2 activity on April 11th. This brought in Chinese video on ch. R1 from two stations, but weak unfortunately. At 1920 local time the KBS (the Korean Broadcasting System) f.m. transmitter link at 44·3MHz was received. This prompted a look on ch. R1 which had a relatively strong signal but with low video modulation, possibly a still shot. This became patchy and weak, but a 5kHz beat pattern (indicating the presence of at least another station) was noted. There had been other F2 activity that day, up to 36MHz with another KBS link at 32·6MHz. April 16th again produced F2, in the high forties (MHz), but nothing was seen on ch. R1/E2. These signals are propagated over some thousands of miles. Earlier, in February (12th), Anthony logged triple hop (3,400 miles) from New Zealand on ch. 1, and double hop (2,000 miles) from NSW on ch. 0 and 1.

Whilst on multiple hop reception, Alan Latham in the warm Gulf area of Abu Dhabi has been experiencing quite remarkable Band I reception. First of all he comments that Jordan ch. E3 uses vertical frequency bars, and at 1455 GMT the PM5544 pattern appears with the identifications "JTV" and "AMMAN", followed by the clock at 1500 (which of course is two hours ahead of GMT). His reception includes Rostov ch. R1 (1,800 miles); Calcutta ch. E4 (2,200 miles); Pakistan ch. E4; Bucharest, Rumania ch. R2 (2,100 miles); and Budapest, Hungary (3,000 miles) ch. R1. Most of this reception (apart from unidentified PM5544 patterns on channels R1 and R2) occurred on May 20th. Did anyone see anything on this day in the UK? With the excellent signals that Hungary can provide on ch. R1, combined with a double hop from the Middle East to Hungary, I feel that given the right conditions we could just have seen Iran ch. E4, other Band I Middle East stations or even Bombay ch. E4!

Unusual Propagation Effects

Alan has seen two unusual propagation effects. One consisted of a 1,000 mile SpE signal which travelled over a land path but showed fading similar to a trop signal. He wonders whether this is a combination of SpE and trop ducting! The other effect consists of a very distorted but strong SpE (?) signal with an 0·5MHz bandwidth, often lasting less than a minute. The stations so far identified are of Indian origin (i.e. 900-2,200 miles), but the 0·5 MHz bandwidth makes identification very difficult. I must confess to never having seen anything like this, though I have experienced the weak SpE/trop fading type of signal on very long hop reception from Russia. The one time I *think* I received Cyprus (Ian Beckett received it twice) on its old ch. E2 it appeared as a weak and slow fading trop signal. The characteristic test card was the clue to reception of Cyprus. This transmitter closed some years ago unfortunately. Perhaps a reader can enlighten us on these unusual signal phenomena?

HOW TO DX – PART 4

In previous parts we have dealt with aerials, practical aerial installations and preamplifiers. We don't intend to say much about filtering out unwanted signals and inteference, since this subject will be covered by Hugh Cocks in a separate article which will appear in these pages shortly.

Sporadic E signals often arrive at considerable strength, usually in Band I but sometimes extending up to Band II and occasionally Band III. Since the signals are reflected from the ionosphere, aerial height is not too important: one can often trade signal strength for reduction in interference from local signals. The Band I DX array can be the lowest of the aerials therefore. With tropospheric signals in Band III and at u.h.f. however, the method of propagation means that the aerials must be mounted as high as possible for maximum signal. For optimum DX-TV reception we need to be able to receive all the various TV channels used in East and West Europe, in Bands I/III and at u.h.f.

VHF Coverage

Very few recent UK receivers have v.h.f. coverage. The majority are limited to pushbutton or continuous u.h.f. tuning. Some of the more expensive continental colour sets have v.h.f./u.h.f. tuning systems, but unfortunately these again usually feature pushbuttons. The easiest way to start DXing with the minimum of technical knowledge is to obtain a current model with full v.h.f./u.h.f. tuning on separate tuners (preferrably without pushbuttons), or to obtain an imported set with continuous u.h.f. tuning. At a price, various importers will provide sets featuring separate v.h.f./u.h.f. tuning and with sound channels that tune to System I (6MHz, UK system) and System B (5·5MHz, continental system). Portatel Conversions Ltd., Unit 19, Sunbury Cross Centre, Staines Road West, Sunbury-on-Thames is one source.

The Polish TVP-2 network identification card.

Alternatively, full v.h.f. coverage can be obtained using a u.h.f. only receiver by adding an up-converter which converts signals in the 40-250MHz spectrum to a suitable section of the u.h.f. spectrum. The output from the up-converter is simply plugged into the u.h.f. set's aerial socket, and the u.h.f. tuner then gives v.h.f. coverage (often between channels 30-60). It's essential however to use an up-converter which has an r.f. amplifier stage. Such units are available from Teleng and Labgear. I understand that secondhand units are sometimes available from rental companies.

Both the imported v.h.f./u.h.f., 5·5/6MHz receiver and the u.h.f. only receiver will normally operate at 625 lines with negative-going vision and f.m. sound, and since the intercarrier sound system is used the i.f. bandwidth will be wide. An up-converter will not change standards of course, so that if a channel with 5·5MHz sound is being received on a set designed for System I the results on sound will be very poor.

Multiple-standard receivers are available in some Western European countries where programmes on different standards can be received – in such areas as the French, German, Dutch, Belgian, Swiss and Luxembourg borders. Such sets can be obtained, but the price is relatively high by UK standards.

IF Bandwidth

As the accompanying frequency chart (Fig. 1) shows, a great many frequencies are used for TV channels. Signals at all these frequencies will obviously not normally be received at the same time at a given location. Under certain circumstances however, for example an SpE opening, several signals may be received simultaneously. Let's consider the Bournemouth area for a moment. If short skip SpE signals come in from the south you could find France ch. F2, Italy ch. IA, Spain ch. E3, Portugal ch. E3 and Switzerland ch. E3 all present. In addition the local BBC transmitter at Rowridge provides strong signals in this area on ch. B3. So if you tune to say ch. IA under these conditions there will be severe problems due to the wide i.f. bandwith – if all the signals are strong, the presence of the F2, E3 and B3 signals will make it extremely difficult to tune in the Italian signal. In other words, the selectivity is poor, with low adjacent channel rejection – to be expected since the receiver is simply working as its designer intended! The answer is to modify the receiver, reducing its i.f. bandwidth so that it becomes a vision only set but with excellent selectivity. In this way, closely adjacent channels can be tuned in with minimum overlapping. An added advantage is that for a given signal level the visible noise will be less.

Most DXers – myself included – use elderly 405/625-line dual-standard receivers. The timebase switching is disabled so that the set works on 625 lines only. The i.f. strip switching is retained to give provision for positive- or negative-going vision signals and wideband (625 line) or narrowband (425 line) i.f. bandwidth. For 99% of the time I operate my sets in the narrowband mode. Such modifications depend on the enthusiast's skill – if you don't know what you're doing it's unwise even to remove the set's rear cover.

Using a VHF Tuner

Apart from using an up-converter there are two methods of obtaining v.h.f. coverage. A turret tuner fully loaded with coils preset to the required frequencies can be used – it may be necessary to employ two such tuners, one for Band I and the other for Band III – or a v.h.f. varicap tuner can be obtained. For about £10-£15 the latter can be made into a self-contained unit with its own channel metering and power supply (for details see the October 1973 issue of *Television*). I've modified the v.h.f. tuners in my sets so that they tune to the sets' i.f.: by feeding the output from the v.h.f. varicap tuner to the set's v.h.f. tuner you in this way obtain an extra two-stage i.f. preamplifier. It's essential to disable the local oscillator when doing this of course, to prevent noise and patterning. Information on set modification was given in the December 1973 issue of *Television.*

There's no reason why an external v.h.f. tuner unit should not be used with a "u.h.f. only" receiver. Care must be taken over mains and d.c. isolation between the units however.

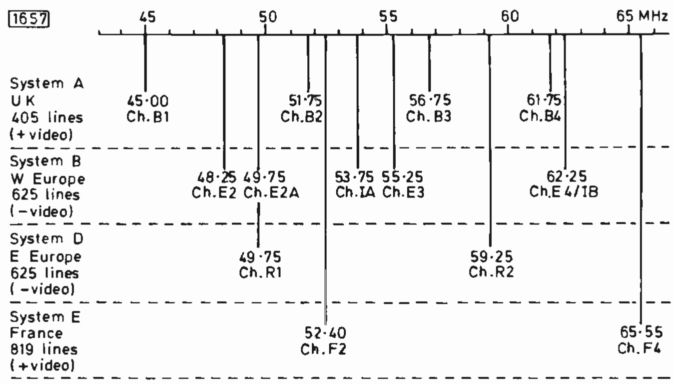


Fig. 1: Band I vision carrier frequencies used in Europe, excluding Eire and the UK B5 channel.

Adding Tuned Circuits

The i.f. bandwidth of a u.h.f. receiver can be reduced by adding tuned circuits prior to the i.f. strip's input. The most economical way of doing this is to use the selectivity unit from the Philips G8 chassis. This unit contains a transistor and four tuned coils. If you connect this in circuit and tune the coils for maximum output with a weak signal present excellent bandwidth reduction is achieved. A miniature d.p.d.t. switch can be used to bypass the unit when wide-band operation is required (for further details see the March 1976 column).

Other Receiver Requirements

Other basic receiver requirements are high gain with stability, and excellent sync locking under weak signal conditions, with freedom from line frequency drift. Flywheel line sync is essential.

Conclusion

This brings me to the end of this potted "How to DX" series. I'll be pleased to answer individual queries either individually or, if there are sufficient questions, in a "Q and A" section in a subsequent column. I've often been asked how many DXers there are. Quite honestly, we've no idea. I have a list of several hundred who regularly write with news etc., but from time to time we hear from new correspondents who've evidently been DXing for many years without contacting us! There's no club in the UK for TV DXers, though several short-wave clubs have a v.h.f. section in which there is some TV interest.

Some Japanese Colour Set Faults

Peter Murchison

JAPANESE colour television receivers have over the years earned a reputation for being extremely reliable, often giving several years of service without any sign of failure. In the end however the inevitable happens and the luckless service engineer finds himself with an alien Eastern receiver sitting upon the bench in front of him, exhibiting an obscure fault which will probably mean hours of frustrating work, often without the aid of a service manual.

The interior of a colour set of this type is unfortunately a rather fearful sight. There are usually many circuit boards of every conceivable shape and size, poised at precarious angles within the cabinet. These boards are connected by a labyrinth of multicoloured wires which theoretically run from board to board but which seem to go round and round in circles when any attempt to trace their exact destination is made! Because of this, the repair racks often end up bulging with Japanese sets when all the Decca, ITT, and Philips receivers have long since been despatched to their respective owners.

Over the last few years a number of different types of Japanese colour receivers have found their way through our workshop, and we have even noticed occasional trends towards a common fault pattern emerging. So in view of this we are going to have a look at a variety of makes of Japanese colour sets and see what sort of faults are likely to turn up. A few weeks ago we had to make a concentrated effort to clear the backlog of these sets from the sagging "in for repair" racks, where they had been sitting patiently awaiting attention. Our experiences during this repair session are relayed to our fellow engineers in the following notes, in the hope that someone somewhere will be saved perhaps just a little time and brain power.

National TC42G

A National Model TC42G colour receiver was the first to be taken down from our repair racks, and a quick glance at the job ticket revealed that it was suffering from a complete loss of colour. As we had never experienced any sort of trouble with the colour decoder before, it meant starting from basic facts by making a quick study of the service manual. We soon discovered the colour killer control R616, which is mounted on the chroma board at the bottom left-hand side of the set. To override the colour killer the control is rotated fully anticlock wise, but on doing this we found that there was still no trace of colour information to be seen on the c.r.t. From this we could only conclude that either the reference oscillator had stopped running (IC602, type AN236) or the chroma amplifier had given up working.

We thought it wise to check the power supply to the decoder panel first however, and all was found to be well at test point B4 (see Fig. 1) where the 24V supply enters the decoder unit. We then noticed that this line fed a rather large 3W resistor, R628 150Ω on the middle left-hand side of the panel. This was cooking away merrily. Investigation showed that this resistor fed a further 12V supply line stabilised by a zener diode, D604 type ZB1-12, and since there was no voltage at the 12V end of R628 we thought it possible that the zener diode has failed. A check with an Avo meter switched to the ohms range soon proved that there was a dead short to chassis across the 12V line.

Having suspected the zener diode we were now left with the job of finding it! After much searching it turned out to be an oval shaped green component hidden away under a tinplate screening cover along with the entire reference oscillator circuitry. Once located, the zener diode was soon proved to be faulty and was quickly unsoldered. Having no genuine National Panasonic replacement, we had to make to do with the next best, a Radiospares BZX61 C12V, a fairly heavily rated component, which was soon fitted. On switching on, the 12V line was found to have been restored to normal and colour once again returned to brighten the image on the screen.

We noticed however that there was a tendency for bands of miscoloured lines to flash at random across the picture, especially when the line hold control was set toward one end. It looked rather as though the PAL bistable switch was occasionally missing a trigger pulse, since the lines were "mirror image colours". We checked the line pulse input to the bistable – at test point B5 on the decoder – but the pulses were present and of reasonable amplitude.

Our thoughts then turned to the ident circuit, which also controls the bistable switch, and a quick check with a scope at the collector of the ident amplifier transistor Tr602 proved that the 7·8kHz ident sinewave was a little low in amplitude at 25V. A quick twiddle of the tuning coil L610 soon restored the ident to a full 30V however and the fault condition cleared.

We now found that the colour locked solid irrespective of the setting of the line hold control, and a good colour picture was obtained. On subsequent occasions when servicing these receivers we have noticed that the ident coil has been slightly maladjusted, and we can only conclude that some drift in component tolerances has occurred after a few years' operation. Perhaps one of the tuning capacitors C655 or C656 could have slightly changed value, throwing the tuned circuit slightly off resonance.

Having successfully tackled the no colour fault on the formidable National set without difficulty we felt confident

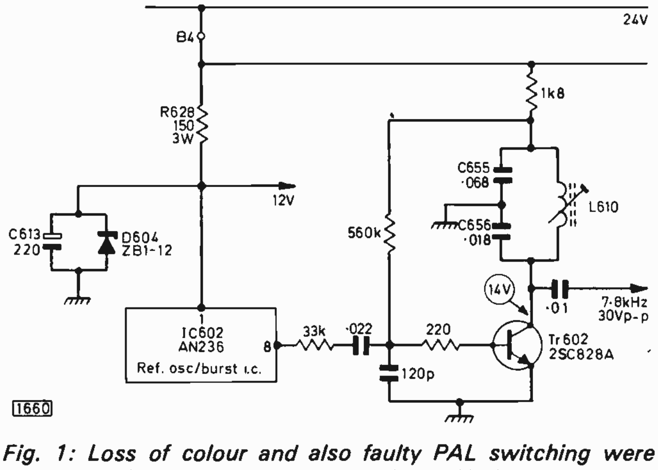


Fig. 1: Loss of colour and also faulty PAL switching were traced to this section of the decoder in the National Panasonic Model TC42G. The ident tuning coil L610 occasionally needs peaking for maximum ident output and hence optimum colour stability.

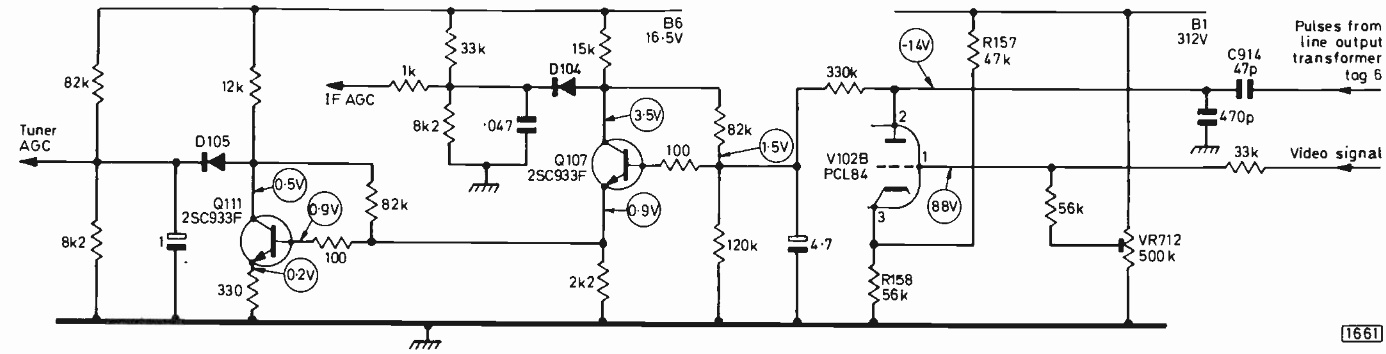


Fig. 2: The a.g.c. circuit used in the Sanyo Model CTP370 hybrid receiver. The gated PCL84 (triode section) will be familiar to those who recall the Plessey/Defiant monochrome sets – see also the Waltham circuit elsewhere in this issue. In this Sanyo circuit however the video signal is applied to the grid instead of the cathode of the triode – which conducts during the back porch period of the signal when a line-frequency gating pulse arrives at its anode. The negative voltage developed across C914 is thus proportional to black level, and is used to control the conduction of the following two transistor d.c. amplifier stages.

enough to take the next Japanese colour set down from the "awaiting repair" racks, hoping for another quick and easy repair. This proved to be an ancient hybrid Sanyo 16in. receiver which everyone in the workshop had been steering clear of!

Sanyo CTP370

The only circuit diagram we had proved to be a single sheet of paper Selotaped to the rear of the set. It showed only the bare essentials, there being no layout diagram or any oscillograms. The valve line up looked promising however, there being the usual PL509 and PY500 in the line output stage, a PCL86 for sound, a PCL805 field oscillator and output plus three ECC82s and two PCL84s. Two ECC82s turned out to be the colour-difference output valves, with the spare triode section for flyback blanking, whilst the third ECC82 proved to be the line oscillator stage. The pentode sections of the PCL84s were video amplifiers, whilst the triodes were the sync separator and part of the gated a.g.c. circuit respectively.

We switched on and were immediately greeted with a really nasty situation. The set had an old fashioned rotary u.h.f. tuner, and an "automatic fine tuning switch" which was first set to manual before commencing tuning. The display consisted of a faintly "snowy" raster until a station was reached, when it came in with a sudden rush, severe video overloading, bent verticals and loss of sync, plus a very loud buzzing on the sound. Simulating a weaker signal by holding the aerial plug about an eighth of an inch away from the socket produced a more stable picture, so we deduced that the a.g.c. circuit was acting up.

On the rear back cover there was a multitude of holes for poking screwdrivers into, and one of these was marked "r.f. a.g.c." We decided to try giving this control a "twiddle", but found that we could only get two extremes of picture, overloaded with sound buzz, or nothing at all. Off came the back and the hunt was on for the a.g.c. circuits. These were soon found to be centred around a PCL84 on a vertical board at the left-hand end of the receiver. The circuit of the a.g.c. section of the set is shown in Fig. 2 – Sanyo had thoughtfully marked the various voltages to expect at the PCL84 and transistors Q111 and Q107.

In the gated a.g.c. circuit the PCL84 triode section V102B acts as the vital element which links the video signal to the two a.g.c. amplifier transistors during the back porch period of a few microseconds. The normally biased off PCL84 is driven into conduction by the gating pulse from the line output transformer. This comes via capacitor C914 during the flyback period, driving the anode of V102B momentarily positive. The degree of conduction of the PCL84 triode is governed by the setting of the a.g.c. control VR712, which presets the grid voltage of the valve.

When we took voltage measurements around the a.g.c. circuit we found that Q107's collector was at 5V and that its base was also more positive than it should have been. The grid of V102B was at around the correct potential, which could be set up by means of VR712. There was a lack of cathode voltage however, whilst the anode was at a reduced negative potential of around −1V. The cathode of the valve is fed from a 312V line via a 47kΩ resistor (R157) which forms a potential divider with R158, a 56kΩ resistor, so we would have expected a potential of about 150V here, making the cathode well and truly positive and thus cutting the valve off during the normal video periods. Further checking revealed that R157 had gone open-circuit, so that the valve's cathode was not at the correct potential and it was consequently being driven hard on, causing an a.g.c. overload. On replacing R157 all reverted to normal, a good colour picture being obtained.

We have experienced this same fault several times since on this model, so it would appear to be something of a stock fault. Indeed much time has since been saved by field engineers now that they have been made aware of it. (*Editorial note:* we have on file a report of the associated potential divider resistor R158 being defective, giving intermittent overloading with the contrast control VR902 having no effect.)

Whilst on the subject of Sanyo receivers it would be as well to mention further stock faults which have occurred on the more modern 16in. solid-state colour receiver.

Sanyo CTP5101

We have recently had several of these 16in. portables in the workshop with the same complaint. On switching on, we were greeted with a brilliant white raster with field flyback lines across it. No apparent control of brilliance, but with perhaps vague chrominance information breaking through in the background.

Here again we had only a single service sheet to work with, but we managed to find that the set employed RGB drive to the c.r.t. cathodes, all three cathodes being at a potential of 195V whilst the three grids were strapped together and at a potential of 120V. When these voltages were measured all seemed normal, so it was decided to check the first anode potentials. These all proved to be extremely high at around 920V. The service switch was

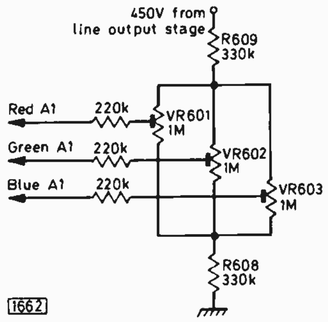


Fig. 3: C.R.T. first anode supply circuit, Sanyo Model CTP5101. The resistors at each side of the potentiometers are troublesome.

operated in order to collapse the field and we attempted to reduce these anode potentials by means of the "screen controls". Obtaining no effect we decided to check the associated circuitry (see Fig. 3), which is mounted on the c.r.t. base panel, and found that R608, a 330kΩ resistor forming the bottom end of the potential-divider circuit with the controls VR601-3 and R609, was open-circuit. Replacing this resistor restored operation to normal and the grey scale was then set up in the usual way.

Three weeks later the set came back to us, this time suffering from lack of picture. The e.h.t. was normal, so we once again applied our test meter prods to the tube base, this time finding a complete lack of first anode voltages. The culprit this time proved to be R609, again 330kΩ. Replacing this open-circuit resistor restored things to normal.

We later found that this resistor is a very troublesome one, and that in later production receivers it is replaced by two 220kΩ resistors in series in order to improve reliability. We now carry out this modification as standard procedure should we get any earlier CTP5101 receivers in the workshop for service.

Sony KV1330UB

Feeling very confident after having completed so many successful Japanese colour receiver repairs we heaved an innocent looking Sony colour set on to the bench, little knowing that it would prove to be our downfall.

We removed the back cover and gazed in wonderment at the interior of the set, which was really a jungle of wires and boards. Feeling adventurous we plugged the set into the mains and switched on. There was an ominous hum from the speaker and the red button popped out from the back with a loud click, cutting off all power. A power supply fault perhaps? We found a circuit diagram and a cursory glance told us that a switch-mode power supply was used, very similar in nature to that used in the Thorn 3000 chassis. A quick check with an Avo meter told us that the chopper transistor Q903 (2SC867) had punched through from collector to emitter, and that there were no shorts on the supply rail which it provides – a 110V line.

A clear case of replacing the transistor we thought, so we put in a BU206, the nearest Mullard equivalent, and switched on. Hum, click and the cut-out tripped exactly as before. At the same time however we'd left the Avo connected to the 110V line and were able to observe that its potential rose to nearly 300V before the cut-out flipped. Something strange here we thought, and decided to investigate the circuit further. In the meantime the chopper transistor had blown its top again.

Unlike the Thorn 3000 circuit, it turns out that this one is not fail-safe. A fault can result in the h.t. rail rising to 240V before the crowbar thyristor conducts, and the excessive voltage can kill the line output transistor, the converter

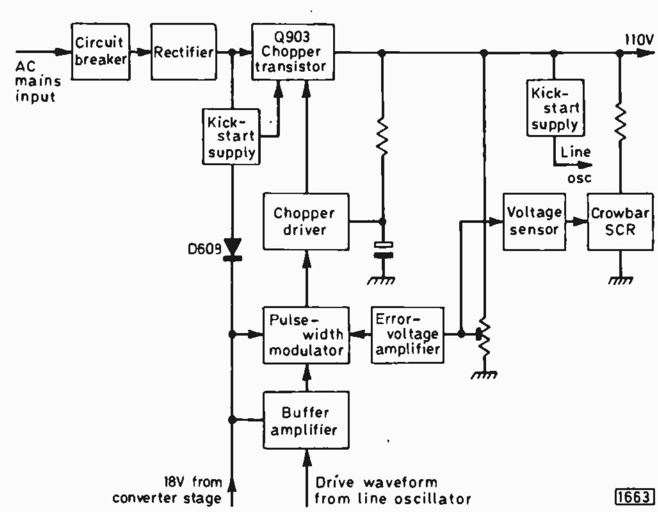


Fig. 4: Block diagram of the chopper supply circuit used in the Sony 13in. Models KV1300UB, KV1310UB and KV1330UB.

transistor, the sound output transistor or the field output transistors.

The arrangement of the power supply circuitry is quite complex and is shown in block schematic form in Fig. 4. A pulse-width modulator stage is used instead of a variable mark-space ratio multivibrator. The operation depends therefore on the presence of an input drive waveform. This comes from the line oscillator – a multivibrator, hence no need for another one in the power supply itself. Complications arise due to the need to get the circuit to start up. Kick-start circuits are used to turn on the chopper and to provide an initial 18V l.t. supply for the power supply board, since during normal operation this is derived from the converter stage (see Fig. 5) in the line timebase, and also to start up the line oscillator. The chopper has to be turned on because the chopper driver is powered from the 110V rail it provides.

Trouble sets in because if a fault occurs in the line timebase – the oscillator fails or the 18V supply doesn't develop – the chopper transistor can remain on until the h.t. line rises sufficiently for the crowbar thyristor to fire and activate the cut-out. Sadly, and for some reason best known to Sony, the crowbar thyristor is connected across the chopper transistor's output rather than its input, so the chopper transistor just has to go!

After some thought we decided to tackle the problem by using an external 18V supply so that we could carry out a few scope tests with the set switched off. This revealed that

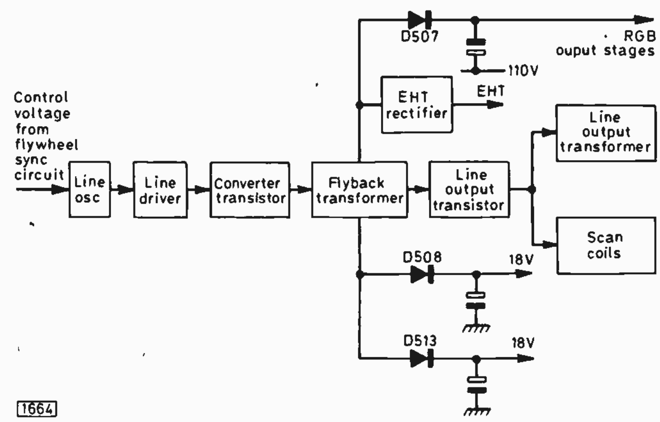


Fig. 5: Block diagram of the line timebase, showing how various supplies are obtained from the converter stage between the line driver and output stages.

the line oscillator was working and that the chopper drive circuitry seemed to be in order. So we decided to switch on with the external 18V supply still connected. The chopper was found to be operating normally, producing a 110V line, but there was no e.h.t. Clearly there was something amiss in the sections of the line timebase following the oscillator. On checking the line driver stage, we found that there was a drive waveform at its base but no output waveform. We'd run the fault to ground at last! The voltage measurements were normal, and the transistor seemed to be in order when tested with the Avo. We decided to try a replacement however, and put in a BD115 as a temporary substitute. On switching on again the e.h.t. came up with the normal crackle and we decided that now was the time to disconnect the external 18V supply. This we did and to our relief the set continued to function normally. With no drive to the converter stage, the normal 18V supply hadn't been able to develop. We switched the set off and on again to check that the kick-start arrangements were operating normally, and as the set burst into life once again we knew that all was well.

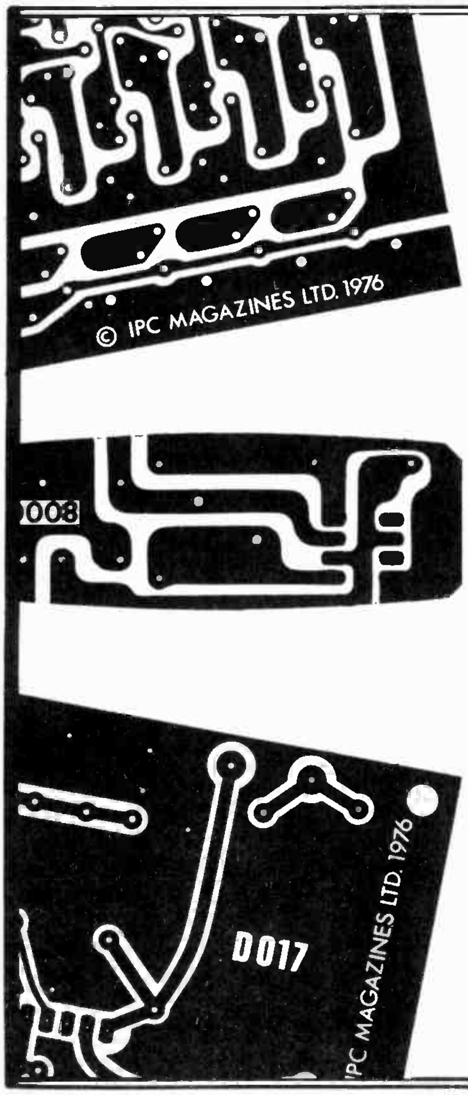
Connecting an external supply proved to be a good dodge, one which got us out of trouble and has been used many times since when checking the chopper circuit. The beauty of running with the external 18V connected is that line oscillator and chopper drive circuits can be tested without any danger of the full h.t. voltage finding its way to the converter, line output, field output or sound output transistors, all of which can be destroyed very easily!

Incidentially, Models KV1300UB, KV1310UB and KV1330UB all use this chopper circuit. Model KV1320UB uses a series regulator transistor while the latest 13in. set, Model KV1340UB, uses something totally different – see the article on *Developments in Switch-Mode Power Supplies* last month.

Having boxed up the Sony set we went back to the repair racks to find that we had cleared up quite a heap of small Japanese colour sets, so we were able to plug in the well furred workshop kettle and brew up a cup of good workshop tea with a clear conscience! ■

Ceefax Time Accuracy Increased

The top row of every Ceefax page shows the day, the date and the time in hours, minutes and seconds. No particular time accuracy has been claimed in the past, but Ceefax now checks its time every minute with signals transmitted by MSF, the standard frequency transmitter at Rugby. The MSF time signals are derived from what can be loosely described as an atomic pendulum, but is more correctly known as a rubidium vapour oscillator. Since it takes about a quarter of a second to transmit a Ceefax page, the Ceefax time does not generally change at the exact second: the change occurs during the last quarter of a second before a new second begins, so that the change of second is never late and never more than a quarter of a second early.



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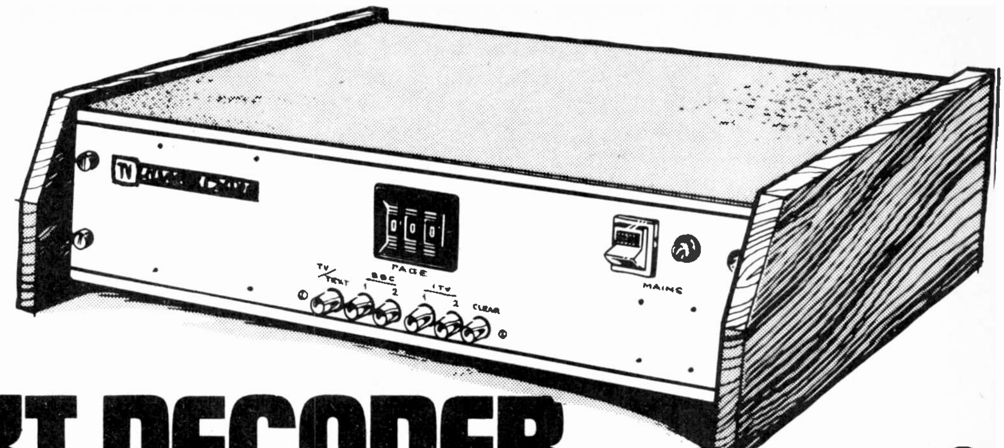


THE TV TELETEXT DECODER Part 6

Steve A. MONEY T. Eng. (CEI)

ALTHOUGH most of the information transmitted via the Teletext system is presented on the screen in the form of text, there is also provision for producing relatively simple graphics displays. These graphics patterns can be used to produce large text symbols for the titles of pages, or to present simple diagrams such as weather maps and other simple charts.

GRAPHICS FORMAT

Let's see how the graphics patterns are built up on the screen. In the graphics mode of operation, each of the spaces normally occupied by a text symbol can be used to contain a graphics pattern made up of six segments as shown in Fig. 1. Each segment in the graphics cell is controlled by one of the bits in the data code for that symbol space. Each segment will be displayed as either light or dark according to whether its control bit is a 1 or a 0. The actual data bits assigned to each of the cell segments are shown in Fig. 1. It will be noted that bit 7 is used in place of bit 6 for the bottom right hand segment, and we shall see the reason for this arrangement later in this article.

If the whole page was used in the graphics mode it would be possible to produce a fairly low-definition picture with 80 elements across the screen and 72 lines down the screen.

With six elements in each graphics cell, there will be 64 possible patterns that can be created in the cell space. These call for 64 different data codes to define them. The 7-bit data code used for teletext allows for only 128 combinations, and of these 96 are already being used for the text characters and signs. As a result it is not possible to code the graphics patterns directly, because there are not enough spare codes available. To overcome this problem the display system is switched between the graphics and text modes by using special control commands. When graphics operation has been selected the codes for the text symbols are interpreted as graphics patterns instead of text. In Table 1 the series of graphics patterns and their corresponding data codes are shown. This table also shows the set of special control codes used in Teletext to select display modes and various other display options.

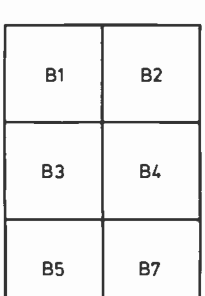


Fig. 1: Representation of a graphic cell made up of six segments with the assigned data bits shown for each segment.

It will be seen that there are in fact seven codes which will switch the display to graphics, and a further seven codes to return the display to the normal character display. Each of these codes also defines the colour in which the following symbols or graphics patterns will be presented. It's possible therefore to present the page in six colours apart from white. To avoid the need for a control code at the start of every row it is assumed that all rows start off with white text selected, and the display circuits must be arranged to set up this condition at the start of every scan line.

	B7 B6 B5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
B4 B3 B2 B1	Col. / Row	0	1	2	3	4	5	6	7
0 0 0 0	0	NUL	DLE			@	P		
0 0 0 1	1	Alpha red	Graphics red			A	Q		
0 0 1 0	2	Alpha green	Graphics green			B	R		
0 0 1 1	3	Alpha yellow	Graphics yellow			C	S		
0 1 0 0	4	Alpha blue	Graphics blue			D	T		
0 1 0 1	5	Alpha magenta	Graphics magenta			E	U		
0 1 1 0	6	Alpha cyan	Graphics cyan			F	V		
0 1 1 1	7	Alpha white	Graphics white			G	W		
1 0 0 0	8	Flash	Conceal display			H	X		
1 0 0 1	9	Steady	Contiguous graphics			I	Y		
1 0 1 0	10	End box	Separated graphics			J	Z		
1 0 1 1	11	Start box	ESC			K	←		
1 1 0 0	12	Normal height	Black background			L	½		
1 1 0 1	13	Double height	New background			M	→		
1 1 1 0	14	SO	Hold graphics			N	↑		
1 1 1 1	15	SI	Release graphics			O	#		

Table 1: Graphics patterns and their corresponding data codes.

When the mode is to be changed from text to graphics and vice-versa, or the display colour is to be changed, a control code is inserted into the data for the row. This control code takes up the slot normally occupied by a symbol code and the corresponding symbol space must be left blank on the screen. When there is a mixture of text and graphics across a row, several symbol spaces may be lost because of the need for the inserted control codes. To improve this situation it has been arranged that when bit 6 of the data code is set at 1 and the display is set for the graphics mode, the capital letters and some of the text signs will be displayed without the need for an inserted control code. This allows some text to be embedded within a graphics area on the screen and is referred to as "blast through alpha-numerics".

GRAPHICS CIRCUITS

Referring to the circuit diagram of the display card in last month's issue, the 74153 (IC3) controls the selection of the graphics patterns according to the data code received from the memory system. This device contains two four-input multiplexers, and can be looked upon as a two-pole, four-way switch where one of the four inputs of each section will be connected through to the output line for that section. The particular pair of input lines selected in this way can be controlled by a pair of select inputs on pins 2 and 14. Both switch sections are controlled by the same pair of inputs, so that the device works as a two-gang switch. Only three of the four inputs on each switch are actually used, and these six input lines are fed with the six data bits which control the state of the segments in the graphics display cell. The basic arrangement therefore is as shown in Fig. 2.

Suppose the input 0 lines on each of the switches have been selected. Data bits B1 and B2 corresponding to the two upper segments of the graphics symbol will now be passed via pins 7 and 9 on the 74153 to the data inputs of flip-flops 4a and 4b. To ensure correct timing, these flip-flops are clocked at the start of the display cell where the symbol is to be displayed. The data code for this symbol will have been set up at the memory output some time during the scan of the preceding symbol in the row. As soon as the new data has been clocked into flip-flops 4a and 4b, the memory will be told to set up the data ready for the next symbol to be displayed in the row.

The signals from flip-flops 4a and 4b pass on through gates 5b and 5c where they are gated with the character clock signal and a graphics select control signal. It is arranged that when graphics are selected, gate 5b will be opened for the first half of the symbol scan period and 5c will be opened during the second half of the scan time. In this way the appropriate video signals to produce segments 1 and 2 of the graphics cell will be produced at the gate outputs. Gate 5a is already producing the dot pattern for text symbols when text is selected, and these signals are wired directly in parallel with the outputs of gates 5b and 5c to produce the complete video luminance component.

So far we have selected whether the first or second part of a symbol space is lit or not. Next the three segments in the vertical direction need to be selected. To do this we need a two-line binary coded signal to apply to the select inputs of the 74153 switch. Since there are ten scan lines to a row of text and three segments to be set up in the graphics cell, it's not possible to have equal size segments. It is arranged that the top and bottom pairs of segments are three lines high, whilst the middle pair are four lines high. This in fact produces quite an acceptable display.

IC15 is already counting off scan lines in groups of ten and providing a binary count signal to drive the line selection of the character generator ROM. Combinations of the outputs of this counter are fed to gates 13a, 13b and 13c

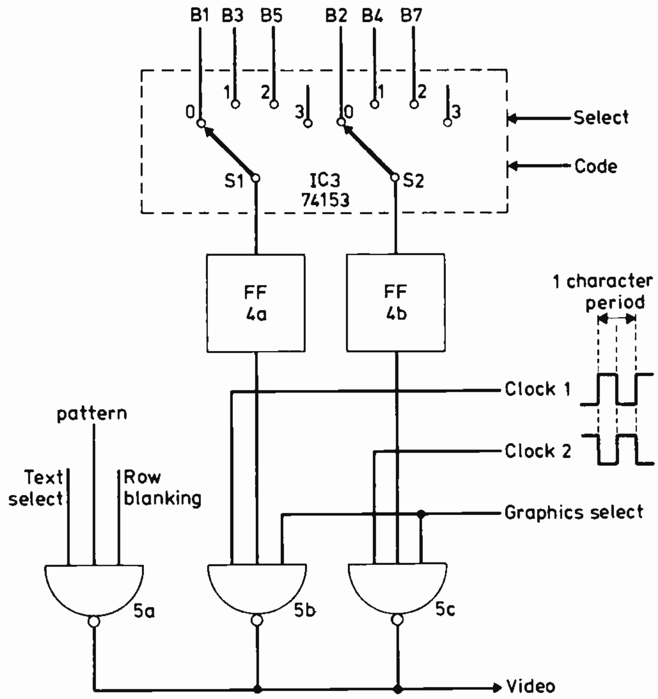


Fig. 2: Graphics pattern logic.

which select lines 7, 3 and 0 respectively of the ten lines for the row of text. Flip-flops 14a and 14b are then used to produce the binary coded select signals for the 74153. During the first scan line of a row of text (line 0), the output of gate 13c resets flip-flops 14a and 14b to produce the select code 00 which in turn selects bits B1 and B2 in the 74153 switch circuit. At the start of the fourth scan line (line 3), the output of gate 13b clocks flip-flop 14a to 1 producing the select code 01 and switching in bits B3 and B4 for the display of the middle segments of any graphics symbols in the row. Finally, at the start of the eighth line scan flip-flop 14b is clocked to 1 and 14a resets to 0 to give the code 10 which sets up bits B5 and B7 to complete the production of the graphics symbols.

DISPLAY MODE SWITCHING

The control codes NUL and DLE are not used for Teletext and appear on the screen as blank spaces. To simplify the logic these codes are treated as Alpha Black and Graphics Black respectively in this decoder. In all of the Graphics and Alpha control codes the three least significant bits B1, B2 and B3 are used solely to select the colour in which the following symbols are to be displayed, so we need consider only bits B4, B5, B6 and B7 for display control. In the Alpha mode all four bits are 0, whilst for graphics bit B5 is a 1 whilst the others are at 0.

Bits B6 and B7 are inverted in gates 6a and 6b, then gated together in gate 8a which detects when both bits are at 0. This signal is gated with bit B4 in gate 6d which produces a clock pulse for flip-flop 9a when the three data bits are at 0. The D input of this flip-flop is fed with bit B5 so that the flip-flop will be set by a Graphics mode control command and reset by the Alpha mode command. Actual mode switching is controlled by flip-flop 9b, which is clocked to the same state as 9a at the start of each symbol period. Outputs from this flip-flop are used to select gates 5b and 5c during graphics mode, or 5a during alpha mode.

Blast through alphanumerics are catered for by gate 10b, where the graphics/alpha control signal from flip-flop 9a is compared with the state of bit B6. When B6 is at 0 gate 10b

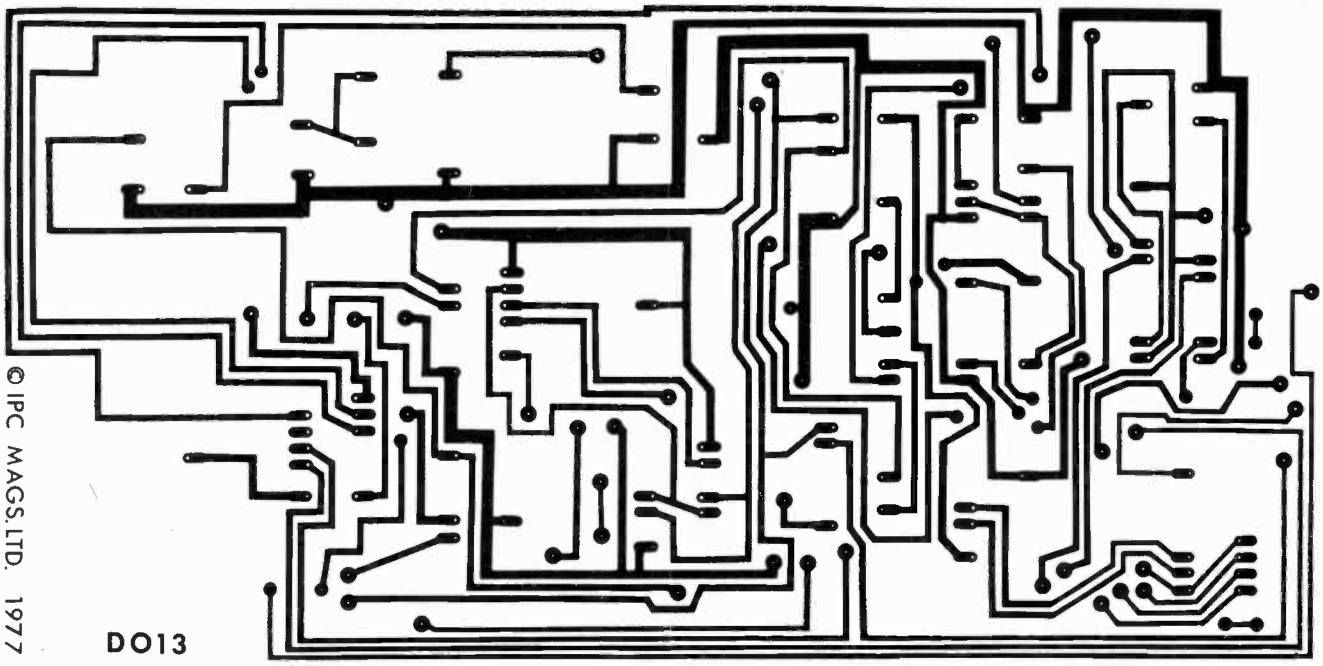


Fig. 3: Copper print on the top side of the p.c.b. The full size of the board is 4in. x 8·375in.

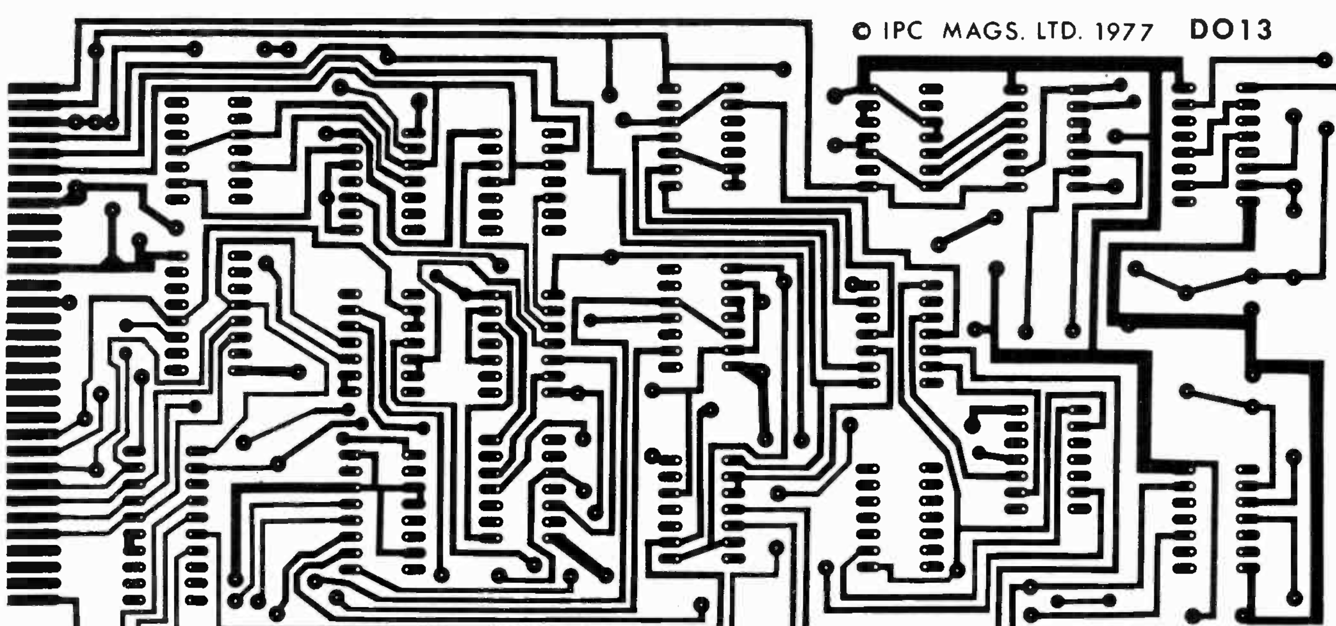


Fig. 4: Copper print on the under-side of the p.c.b.

will close and flip-flop 9b will switch on the text video in place of graphics. As soon as bit B6 goes back to 1, the display mode will return to the state set up on flip-flop 9a.

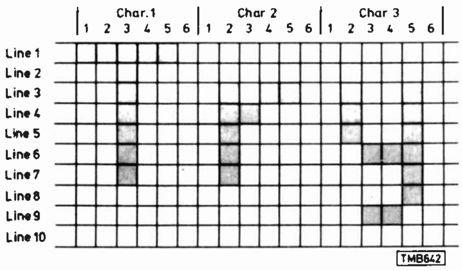
BLANKING

To ensure that control codes are displayed on the screen as blanks we need to switch off the video output whenever bits B6 and B7 are both at 0. This is done by using the output of gate 8a to control flip-flop 7b, which in turn controls gates 10c and 10d to turn off the video gates 5a, 5b and 5c.

When bits B6 and B7 both go to 0 the output of gate 8a goes to 0 and this signal passes through gate 10a to the D input of flip-flop 7b. On the next symbol, clock pulse 7b will be reset and gates 10c and 10d will close, in turn switching off gates 5a, 5b and 5c to give a blank space on the screen.

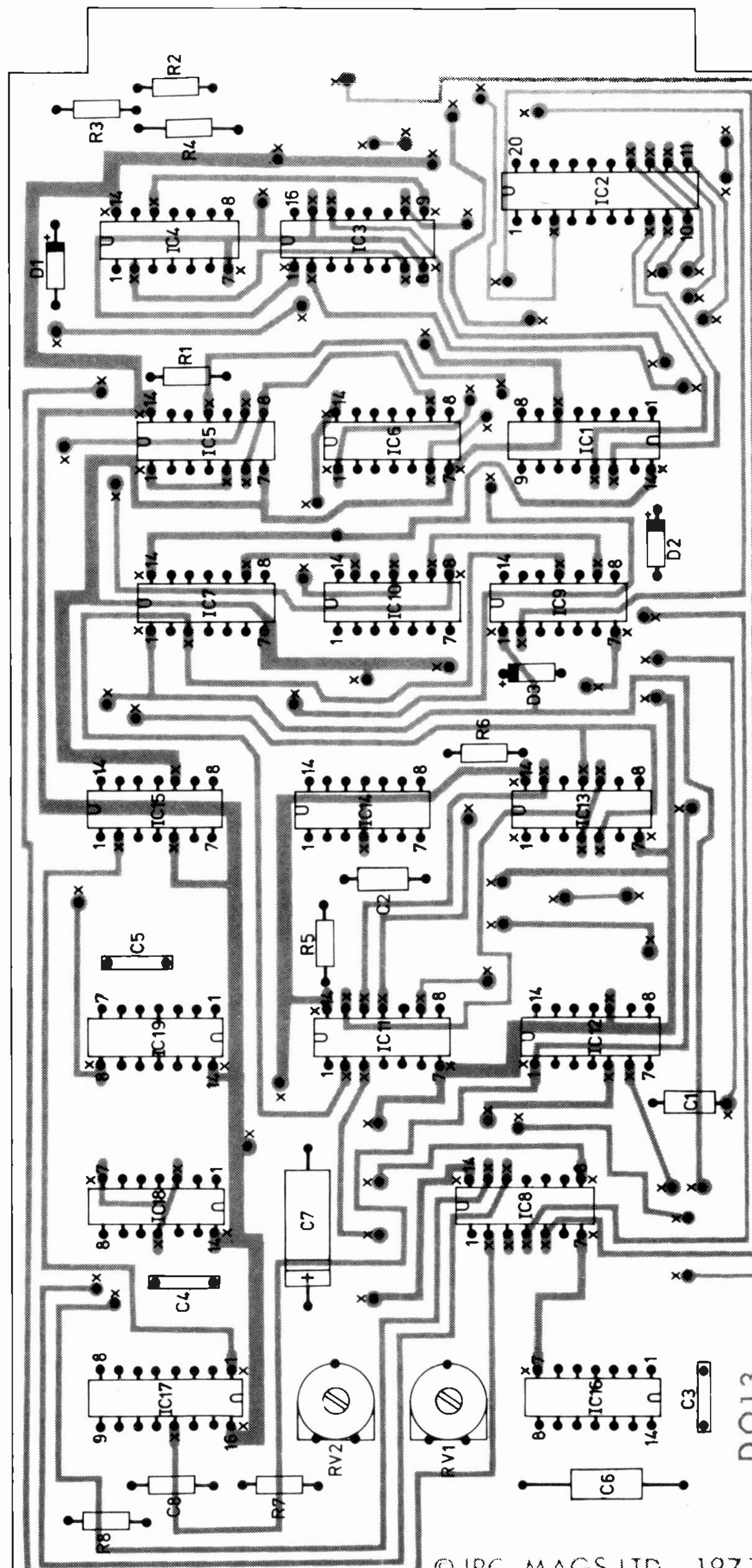
Blanking is also required after the last symbol in a row has been displayed. An End of Line signal from the memory board feeds the D input of 7a. This is being clocked at the start of each symbol space. After the last symbol in a row the EOL lines goes to 0. Flip-flop 7a then resets, in turn holding 7b reset for the rest of the line. This gives a blank margin at the right-hand side of the screen. At the start of each new line scan, flip-flop 7a is reset by the line sync pulse to ensure that the screen will be blank during the left-hand margin period.

The video signals from gate 5 are inverted to produce positive-going video, and are mixed with the sync pulses to give a composite video signal to feed the u.h.f. modulator. A composite video signal of some 1·5 to 2V peak is produced at this point and is fed out via pin 3 of the edge connector.



The above diagram shows a typical character format as seen on the screen. The process of character generation was explained on page 490 last month.

We apologise for the way in which Fig. 1 was presented last month – this was due to a misunderstanding with the printers. The important points to note are as follows: (a) Pin 13 of IC17 is connected to pin 1 of IC12 and to pin 2 of IC1; (b) Pin 8 of IC12 is connected to pin 1 of IC11, to one side of C1 and to pin 2 of IC5; (c) the output on pin 6 of the p.c.b. edge connector should read DCK.



x ..... denotes connections that must be soldered-through both sides of the printed circuit board.

Fig. 5: Component layout diagram for the display board.

CONSTRUCTION

The display board uses a double-sided PCB measuring 8 × 4in., with a 32-way edge connector at one end. Figs 3 and 4 show the layout of the tracks on the two sides of the board whilst Fig. 5 shows the component layout.

Although the 74S262 (X887) character generator ROM is a TTL device, and thus not prone to damage by static electricity, it is nevertheless convenient to mount it in a socket. Twenty pin 0·3in. sockets are not normally available however, so it will be necessary to use Soldercon socket strips to make this up. The device could of course be soldered directly into the board if desired.

The construction procedure is the same as for the other logic boards in this project, and no problems should be encountered provided care is taken in making the soldered joints and in checking that there are no solder bridges, and that all the through card links have been inserted.

Next month we shall deal with the fourth circuit board, which contains the receiver and data recovery sections of the decoder. ■

LETTERS

I read with interest G. R. Wilding's comments in *Service Notebook* on the momentary loss of power experienced with a set fitted with the Thorn 3000 colour chassis. However, where only momentary interruption of the power has occurred I think it highly unlikely that the crowbar thyristor W621 could in any way have been responsible. This is normally open-circuit, but when triggered on by a fault condition places a short-circuit across the h.t. input to the chopper circuit so that either the fuse blows or the overload cut-out operates. When a thyristor is triggered by a d.c. supply it conducts and remains in that condition until all the voltages are removed from it.

Without going into more detail, I suspect that the fault was one of the more common ones in this series – either the 30V zener diode W605, the 30V supply reservoir capacitor C607, or the secondary of the chopper driver transformer T602 becoming momentarily open-circuit. Otherwise a fault in the monostable circuit would be suspect. – **K. Rogers,** *Service Manager, Rumbelows Ltd., Catford, London SE6.*

NO BBC-2 COLOUR

I thought you might be interested in a rather unusual case I was asked to investigate recently. The complaint, on a Rank single-standard colour chassis, was no colour on BBC-2. Rather odd I thought, but it turned out to be so – near perfect colour on BBC-1 and ITV, but only traces of patterning where the colour should have been on the monochrome BBC-2 picture. The set was being operated with a loft aerial directed at the Divis transmitter, some sixty miles or so across the water, the usual set up here prior to the opening of a local relay station (the arrangement led to some annoying reception problems, such as severe tidal fading, occasionally leaving a town full of blank screens, much to the chagrin of the local rental outlet (Granada), and "I know that next door's got a dinky little set-top aerial, but *you* need an MBM70!").

It seemed unlikely that the set was at fault, but changing the aerial alignment, moving the cable and altering the aerial's position gave no improvement, while the set was found to work perfectly at another site. Next door's set perhaps? The problem was there with it off, and it was at the other end of the house anyway. The local wired relay system maybe? The outlet was at the other end of the room, and disconnected (and v.h.f.!). In desperation I decided to try moving the set around in the room while it was switched on. An extra length of coaxial lead was fitted – and at about six feet from the set's normal position the BBC-2 colour appeared!

Investigation of the built-in cupboard on which the set normally stood revealed a Superverter (v.h.f./u.h.f. converter) connected to a mains socket inside, its flying lead lying on the floor! It transpired that the set had been purchased several months previously from a friend living in the north of the country, where it had been operating on a v.h.f./625-line relay system. The new owner had thought that the box was part of the set and had plugged it in as a matter of course. The moral: always look inside cupboards! – **W. Linworth,** *Girvan, Ayrshire.*

BECOMING A SERVICE SPECIALIST

I have been following with great interest the correspondence on "becoming a service specialist". Two years ago I made the break, after working for a firm for thirteen years. During the first year I tried doing work which came via the trade, but found that the only faults that came my way were of the type that results in grey hairs. So I gave that up and tried local advertising – newspapers and boards. Fine! But now I find that everyone is on to this approach, ranging from shops – yes, half the advertisers are shops which don't want to lose servicing revenue – to my biggest problem, moonlighting engineers from rental or multiple outlets. I can compete on service and prices with shops, but not with the moonlighters who unlike me do not pay for their car, or income tax on their private work, and can easily exchange parts used on their private jobs with items from their firms' stores. Most engineers employed by shops or rental organisations do the odd private job, which is fair enough, but there are a number whose evening work brings in more money than their daytime employment!

I'm not sour graping – I'd do a certain amount of sideline servicing myself – but going it alone does present problems. It means hardly any work during the day, and the phone going after seven in the evenings – so you cannot make money during the day. And it means that by not working on the new, under guarantee models you are always a year or so behind the times – I've yet to see a set fitted with the Thorn 9000 chassis, the Decca 80 chassis or the ITT CVC20 chassis. While even your Sunday is spoilt as orders have to be written out and the books kept – you never know when to expect a visit from VATman and the boywonders.

Also, local advertising tends to bring mainly "down market" customers. It's not uncommon on huge, newish housing complexes to return to the underground car park to find your wheels missing or your car vandalised – all possibly for an ex-rental Thorn 900 chassis which you've spent an hour on for fifty bob! – any greater charge and you'd be accused of ripping them off. If anyone can advise on reaching the "up market" I'd be grateful – you can't advertise a service with "sorry no plebs served"! – **D. Paye,** *Chingford.*

UNUSUAL FAULT

I feel that other readers might like to be warned about an unusual fault experienced recently with a GEC Junior Fineline portable Model 2114. We switched on and the set instantly displayed the classic symptoms of rectifier failure. After replacing the bridge the picture could be locked and after a casual glance the back was replaced. We then noticed that things were not right: the picture appeared to be defocused at the sides, along with increased brightness at these points. Reducing the contrast control setting removed the picture content completely, leaving the sides with bright stripes and the centre completely black. On checking with the owner he commented that the fault had been present previously.

Voltage measurements didn't give much of a clue, except that the video output transistor's collector voltage was somewhat low at 70V. This was to be expected however in view of the varying picture content. The obvious course seemed to be to start checking electrolytics, and eventually C234 (10μF) was found to be open-circuit. This is the reservoir capacitor for the video output transistor's collector supply voltage, which is obtained by rectifying the output at one of the line output transformer taps. What amazes me is that some sort of results had been obtained despite the presence of the fault, and that the owner had been prepared to watch the terrible picture. Oh, I forgot to add that the brightness bars could be moved to the left or the right by adjusting the line hold control. – **F. G. Roberts,** *Mold, Clwyd.*

Service Notebook

G.R. WILDING

Severe Hanover Bars

"Incorrect colours with bars across the picture" was the 'phoned complaint about a Decca Model CTV25, and as expected the cause was found to be a severe case of Hanover bars. These can range from a minor condition due to phase and/or amplitude differences between the direct and the delayed chroma signals applied to the chrominance matrix circuit, to severe cases such as this where the PAL switch is obviously not working. This was confirmed by the fact that the "bars" were more evident in predominantly red picture areas and that on closer inspection alternate *pairs* of lines (due to the field interlacing) were correctly and incorrectly coloured in these areas. On reducing the height to show the strip of colour bars at the top of the test card blue was seen to be unchanged, red had shifted to a dull orange, green had shifted towards yellow while magenta was more of a purple hue.

The usual cause of an inoperative PAL switch is that one of the transistors in the bistable circuit is defective – generally due to an internal disconnection or a short-circuit base-emitter junction. When a bistable circuit is working, the collector voltages of the two transistors are roughly the same at approximately half the supply rail voltage – since they are being switched on and off for equal periods. With a stalled bistable one of the transistors will have a high voltage at its collector while the other will have a low voltage. The meter showed that the collector voltage of one was at almost the rail voltage, 12V, while the collector voltage of the other was only a small fraction of a volt above chassis potential. The transistor with the high collector voltage was found to have an open-circuit base-emitter junction, replacement restoring a normal picture.

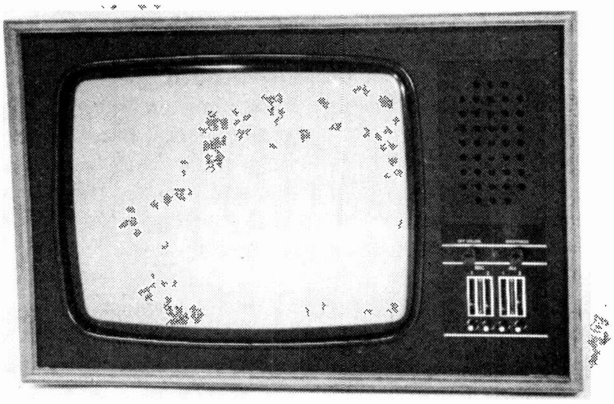
Dynatron Hybrid Colour Sets

Dynatron sets fitted with the popular Pye/Ekco hybrid colour chassis differ mainly in having a cable-connected remote control unit. After replacing the $0{\cdot}47\mu F$ boost capacitor in one of these receivers – this necessitates removal of the big line timebase panel – we found that although the picture had been restored there were wide bands of blue and green tinting across the screen on both colour and monochrome. As the fault was present with the colour control at minimum, and thus no signal feed from the colour-difference output stages to the c.r.t. grids, it appeared that the grid clamp stages were not operating correctly. There could have been a variety of reasons for this, but as the owner said that the picture had been perfect prior to it going off completely it seemed probable that something had inadvertently come adrift or been damaged during the service work. What could have taken considerable time to find fortunately came to light very quickly, for on removing the earth link from the line timebase panel to the main receiver chassis we found that the clip had come away from the lead inside the thick Systoflex sleeving. This had clearly affected the clamp pulse feed from the line output stage to the c.r.t.'s grid clamp triodes, with the result that their anode voltages and the c.r.t.'s grid voltages were no longer being maintained at a fixed d.c. level. Fitting a new earthing link completely removed the wide bands of tinting.

In another of these receivers the complaint was intermittent loss of colour. The set was used with the remote control unit only, but despite an extensive test on this and the receiver's main controls no fault could be found until, when we were replacing the unit in its housing at the back of the set, the colour suddenly went off. We then found that the colour remained off when the set's controls were used, but that on reverting to the use of the control unit the colour could be restored by fully depressing and holding any of the channel selector buttons to the fullest extent.

On removing the unit the colour returned, but it was the cable and not the remote control unit that was at fault. Usually breaks in leads occur close to where they are clamped, since maximum bending occurs there. In this case however the break was at a point almost two metres from the unit – found by careful manipulation of the lead. Stripping off the outer plastic covering for about three inches on each side of the suspect point exposed about fifteen insulated leads. On pulling each end of each wire the red and black leads came apart. We added short new sections, well covered with insulating tape, then placed a stiffening length of Systoflex across the entire stripped area and finally applied more tape. Quite a simple job, but we thought at first we had an intermittent circuit fault on our hands. Worth bearing in mind when dealing with these receivers!

What's this then . . . ?



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Miller's Miscellany

Chas. E. Miller

THE Queen's Silver Jubilee took one back to the early days of post-war TV. I did not watch the re-run of the BBC's Coronation broadcast, put out on BBC-2 last New Year's Day, but merely reading about it brought back memories. At the time of the Coronation, the threat of competition from commercial TV was in the air, and the BBC made great play of their Coronation coverage as an indication of how wonderfully well they could handle such occasions, and how their monopoly must be preserved at all costs. Those of us who remained totally unconvinced pointed out rather sourly that Coronations were few and far between!

In 1952 TV receivers were rather thinner on the ground, and the fortunate owners opened their doors for the day to neighbours. There can be no doubt that as a sales-aid this was extremely successful: those who had never previously seen TV crowded into darkened living rooms to watch the hours of pomp and ceremony, and became instantly attracted to the idea of having their own sets.

In the 25 years that have passed since then the number of technical advances that have been made in the design and manufacture of receivers is overwhelming (the question of whether serviceability has improved is a different story altogether!), but the outstanding and undeniable fact is that real prices are still lower than in 1952. Viewers then queued up to pay £100 or more for a 12in. screen single-channel set, and by comparison with say house and car prices, today's 24in. multichannel TVs ought to cost at least £500, just for monochrome! That they don't is a remarkable tribute to the efficiency of the industry: the only other item I can think of off-hand that's matched this price stability is the ballpoint pen!

A Switch in Time saves Lime

Some years ago the national papers ran a story about a viewer whose TV set in the late evenings lost field sync, which could be restored only by turning on the hot water tap. This seemed to mystify the newpapers, but we know, don't we, that the fellow's wiring must have been in a shocking state (no pun intended!), and that the heavy load of the immersion heater dropped the mains voltage enough to do the trick. As a hold control the tap was effective, but rather expensive!

An updated version of this happened whilst I was on holiday in a chalet on the East Coast. The set was an elderly 22in. Murphy colour one, and it soon became apparent that there was a distinct lack of green in the picture. Now the chalet had one of those high-powered water heaters fitted above the kitchen sink – when it was turned on there was a very noticeable dimming of the lights. At the same time the colour picture returned to normal. I happened to have an Avo with me, and found that the mains voltage dropped by 20V when the heater was in use. Further investigation revealed that the set's transistor l.t. line fell by about 4V and the main h.t. rail by 20V.

The only components I had with me were a few wirewound resistors and dropper sections which had gravitated to the bottom of my tool box, so any repair would have to be a real makeshift one. First of all I tried dropping the l.t. line by loading it up with a resistor, but this had no effect. It appeared that it was the 20V drop in h.t. that was causing the green to return, so I did a swift mental calculation. Estimating the h.t. current at around 300mA indicated that 60Ω in the main feed ought to be o.k. Luckily I had a coulple of 120Ω sections to wire in parallel and, lo and behold, I had an acceptable picture. Am I right in thinking that there was an official modification on these lines in the Rank service manuals? If so, and it was intended to do the same job, no doubt some one will let me know.

The Optimist

Recent phone call: rather nervous voice asks have I any good, cheap secondhand TVs for sale. I reply yes, would something between £10 and £20 be of interest? Pause. Then "is that black-and-white or colour?" Oh, well . . .

Consumer Protection?

When one browses through certain magazines one gets the impression that shopkeepers in general are unscrupulous ne'er-do-wells ready and willing to cheat their whiter-than-white customers. I speak with some feeling, having just been badgered over several days (including a Sunday) by a certain individual to supply a specific colour TV set. Yet as soon as I delivered it, after spending considerable time and effort in collecting it from a depot some 50 miles distant, I was told that it was no longer wanted. Extremely annoying, but what can one do about it? Just write it off to experience I suppose. But had the boot been on the other foot no doubt the accusation of broken contract would have been in the air. Why can't there be protection for suppliers as well as consumers?

Vintage Spot: English Electric

The English Electric Co. Ltd. (now part of the GEC Group) is probably remembered best for washing machines and cookers rather than television receivers, but in the early 1950s the Company ventured into unfamiliar pastures with a series of TV sets. The first one to hit the market was sometimes unkindly referred to as looking like a refrigerator, due to its half-metal cabinet.

This large console housed a 24-valve chassis known as the 1550 or 1550M, the difference being that the former had a conventional 15in. c.r.t. whilst the latter had a 16in. metal-coned tube made by English Electric themselves. If you imagine that having a large metal object carrying about 10kV might create insulation problems, you'd be quite correct! The physical size of these tubes by the way was enormous. The 15in. glass tube in particular was long, out of all proportion to its face diameter (the deflection angle was about 55 degrees; the "wide-angle" 70 degree types were still in the future), and terrifying to handle. It was so big and heavy, and yet appeared so vulnerable, that changing one was an ordeal. Engineers were recommended to wear goggles while working with tubes, but having seen the results of an implosion, in the form of thick glass flying many yards, I'd consider nothing less than a suit of armour adequate protection!

The designers of the 1550 gave it various unusual features, but one alone made it different from all other sets then available: it incorporated a fully tuneable v.h.f./f.m. receiver. Although this was interesting it was hardly useful, since at the time no regular f.m. broadcasts were being made! Perhaps in acknowledgment of this, or perhaps because of the quality of the programmes on TV, provision was made for the owner to switch off the timebases (and hence the e.h.t.) to render the tube inoperative, so that the television sound alone might be received! One is tempted to wonder why anyone should bother to buy a television set in the first place!

A first glance into the works might well puzzle an engineer. He would see no fewer than four valves of the line output type, and possibly two vacant holders. In their wisdom the designers had opted for the Cossor 185BT valve for sound output, video output, line output, and e.h.t. generator! They'd also gone for an optional flywheel sync ("synchrophase") system: without it the set had a simple shorting link which had to be replaced with a plug-in transformer and two ECC33 valves should the "synchrophase" be required.

A look at the valve line up in the service data reveals that one section of an EB91 double diode valve is described as the line oscillator! Just how it operated is not clear, though it was connected as part of a feedback path. The line output valve itself acted as an oscillator, with feedback between its anode and control grid. The line output transformer was extremely simple, just two windings, with the secondary driving the e.h.t. generator as well as the scan coils. Focus control was obtained by varying the e.h.t. generator's screen grid voltage and hence the e.h.t.

The designers seem to have been rather fond of diodes. Separate sections of EB91 double diodes were used as the line and field sync separators, the latter fed from the vision detector. The video signal was a.c. coupled to the c.r.t.'s grid, but with another EB91 section used to provide d.c. restoration here.

Having regard to the danger of shock from a half-metal cabinet, one might well imagine that a three-core mains lead would have been used. Not so: it had four cores! Separate earth wires went to the metal work and a "polarity indicator" which produced a loud hum in the loadspeaker should the live mains be connected to chassis. As one of the earths was coloured brown, it's interesting to speculate on what might happen if one of these sets was discovered and connected up to the modern standard!

The subsequent models 1650 and 1651 had some detail modifications and, significantly, a three preset station a.m. tuner unit. But as has been remarked before when considering certain vintage TVs, it seems doubtful whether the makers could have found the exercise profitable.

The next generation of English Electric chassis was far simpler in design, but still managed some unusual features, such as two EF80 r.f. amplifiers and a voltage-doubling e.h.t. supply system using two EY51 valves to produce 14kV. With the metal c.r.t. still in use, insulation became even more critical!

Later still a 13-channel Band I/III model was brought out, sporting a 17in. c.r.t. and pretty well conventional on all counts. Whether it was successful financially is open to doubt, because it turned out to be English Electric's swansong as far as TV was concerned. The brand name disappeared completely, mercifully perhaps, without recourse to the "badge engineering" which was the fate of many another once independent marque. The present situation of a few major groups dominating production is truly an example of the survival of the fittest!

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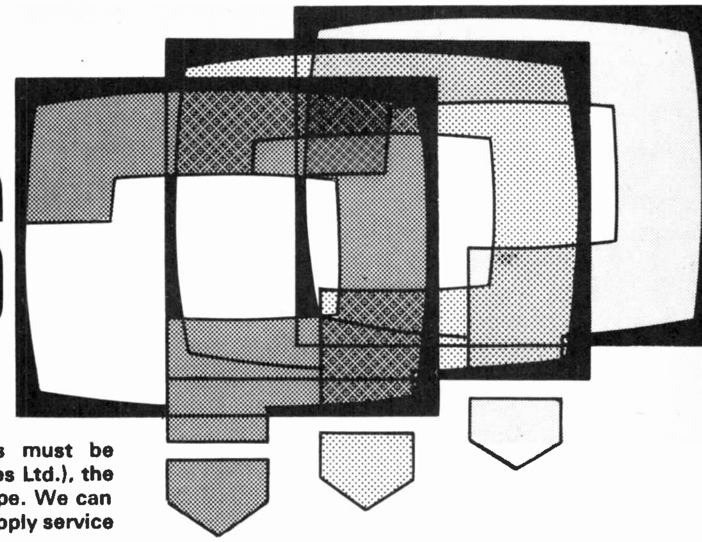

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GEC C2110 series

When the set has been on for a couple of hours the sound becomes distorted. Increasing the volume control setting overcomes this, but the distortion returns after a short while. The sound module has been changed but the problem remains.

These symptoms are commonly caused by the 24V zener diode D603 which stabilises the supply to the audio i.c. It's mounted on the line output panel (PC475).

Beovision 3400

The set was bought as a non-worker, and after replacing the line output transformer the e.h.t. was restored. The problem is that the horizontal convergence will not pull in at the sides, although the focus and general convergence are otherwise very good. In the upper half of the picture the red lines are above the green ones at the sides while in the lower half red is below green. The corner convergence and NS raster correction potentiometers have hardly any effect. The convergence procedure has been gone through thoroughly. Also, is there any way of ensuring that the e.h.t. is correctly set?

The e.h.t. can be measured only with a proper e.h.t. meter or probe. If the boost voltage at TPa4 is correct – 860V – however and the picture size is correct the e.h.t. is likely to be right. Regarding the convergence problem, there is a cunningly concealed switch (switch 45, below the audio output valve – PL84) which cancels the corner convergence. Make sure it's on – clockwise. If this does not cure the trouble, check the following components which have all been found to contribute to these problems. Corner convergence, transistors OTR6 and OTR7; NS correction, 5C24, 5C25, transistors OTR4 and OTR5 and the 5mH coil 5L1.

Thorn 3500 chassis

The problem with this set seems to us to be due to an internal short-circuit in the c.r.t. The raster disappeared, leaving sound only, and after a few seconds smoke appeared. This was traced to the c.r.t. final anode connector, where the plastic covering at the end had melted leaving a bare resistor whose soldered connection had also melted. This was resoldered, on the assumption that it had broken, causing arcing, but the result was a repeat performance.

An internal short-circuit from the c.r.t. final anode is almost unheard of, but could be proved with a Megger or ohmmeter. What is much more likely is that the effect is due to a defective tripler passing a.c.

Rank A774 chassis

There are two faults with this set. First there are two glowing areas at the top corners when the scene is supposed to be all black or with a centre caption. These glowing areas appear to be due to signals in the field blanking interval, just out of sight at the top of the screen. Secondly, the picture flickers for a while on change of camera or scene, returning to normal with the next change.

You might get some improvement by expanding the height or top linearity so as to push the information in the field flyback interval well above the top of the screen. The effect occurs on many sets and is due to secondary emission. A complete cure should be obtained by increasing the field flyback blanking time. The components which are concerned with the blanking pulse are 3R41, 3C25, 3C26, 3R42 and 3C27 – try increasing the value of 3C25. For the flickering on change of scene we suggest you check the beam limiter components 3D4 and 3C8 between the video output transistor and the cathode of the c.r.t.

Hitachi colour sets

In your May 1975 issue you reported the fault intermittent loss of sound and picture due to R597 (2·2Ω) on the power board going open-circuit intermittently, removing the 12V supply to the tuner and other parts of the circuit (Models CSP680/CNP860/CFP470). I recently had a similar fault on a Model CAP160 (the CEP180 uses the same circuit), where the 2·2Ω resistor is R581, fusible. As the set was being converted from the German to the UK standard, the power/signal block was unplugged and the tuner removed for inspection. This revealed that the shaft carrying the tuning capacitor's rotor vanes was out of alignment, as a result of which the vanes were shorting. The fault was cleared after carefully resetting the bearings. A simple ohmmeter check across the 12V line and earth can be made to ensure that the vanes do not short at any position when the tuning capacitor is rotated from one extreme to the other.

Many thanks for your help in sending us this report!

Thorn 2000 chassis

The trouble with this set is no results. Before the complete failure the picture didn't fill the screen. C16 (250μF) in the 66V stabiliser circuit on the power supply board has blown.

We suspect that the trouble is on the top centre power supply regulator board. If the set 55V control R1 here has a dud spot it shuts off the audio circuit and the field timebase and leaves a high voltage across C16 which thus blows.

CONNECTING TWO AERIALS

I am able to receive transmissions from Belmont and Holme Moss and would like to connect two aerials to my set for this purpose. How should this be done and what matching network is required?

A passive splitter can be used. Link all the braids together, then fit a 39Ω resistor from each aerial downlead to the inner of the coaxial lead connected to the set's aerial input socket. There will inevitably be some signal loss with an arrangement of this sort.

THORN 3500 CHASSIS

The trouble is that the line oscillator is running at the wrong speed – it will not lock. The resistors and capacitors in the flywheel sync and reactance circuits, also the discriminator diodes and the reactance transistor, have been replaced without success. To check that the sync separator is in order another line timebase board has been fitted and this cured the trouble. What's wrong on the original board?

You would seem to have covered just about every component in the circuitry concerned. We suggest you check around the line oscillator coil L501 however, looking for dry-joints. This sometimes causes trouble in these sets. You didn't mention the thermistor X501 in the line hold control circuit. This can also be defective.

ITT FT110

There is a good picture when the set is switched on but when another channel is selected a number of horizontal rainbows appear across the picture. If the set is switched off for five minutes, the picture is correct when the set is switched on again.

You are losing colour lock on channel change. Find the reference oscillator frequency control R870 – top left-hand side of the chassis panel – and adjust it for a quick lock-in when changing channels.

PHILIPS 210 CHASSIS

This set is fitted with a six press-button tuner which is faulty. When the buttons are tuned they will not stay in, coming out after rotation of the button. This happens only when the buttons are tuned – each button can be pressed in and locked until rotated.

It is most unusual for this type of tuner to be sufficiently worn for any replacement parts to be required. Remove the tuner and inspect the action. A spring holds in the retaining plate for the push-button stems. See that the spring is active and the plate positive. Clean and lightly oil all moving parts. Check that the tuner cores can be turned through the tuning range.

PYE 697 CHASSIS

The trouble with one of these sets is lack of field hold – the picture just rolls.

The most common cause of no field sync on these sets is poor connections on the field sync pulse lead – a screened one – from PL4A on the i.f. panel to PL9C on the field timebase panel. This can be rapidly checked by bridging a wire across the two points. Check also for a dry-joint on the connecting pins. If necessary check C255 (160μF) which decouples the supply to the field blocking oscillator, and its timing capacitor C251 (5·6μF).

PHILIPS G6 D/S CHASSIS

The set was switched on and the sound came on as usual. It then went off again, though the valves remained alight. The situation was no sound or picture, and it was then found that smoke came from R5054 in the cathode circuit of the PD500 e.h.t. stabiliser triode. R5052, R5053 and C5020 in the grid circuit of this valve seem to be in order.

Check the PD500 and the GY501 e.h.t. rectifier by substitution, and check C5026 (0·0047μF) which is also in the grid circuit of the PD500. If this capacitor is leaky or short-circuit the bias on the PD500 will be removed. If the sound is restored when the deflection coil plug or the line output stage cover is withdrawn, the line output stage is loading down the h.t. line. Remake R1073 (10Ω spring-off resistor in the power supply circuit) if necessary.

RRI A823 CHASSIS

A band of brightness moves from the bottom to the top of the picture, but is sometimes stationary. Also, the quality of the picture is reduced, and when the movement of the band is fast viewing is very unpleasant.

The trouble is most likely to be due to inefficient smoothing of the supply to the luminance amplifier transistor on the i.f. board. Check 8C4 (2,500μF) on the power supply board and 2C39 (640μF) on the i.f. board. Poor earthing could be the cause – the earthing of the capacitors and the plug and sockets should be checked.

THORN 1400 CHASSIS

The fault is sound but no raster. The PY801 boost diode gets hot, and the line output valve's screen grid resistor R138 also overheats – its soldered connection melted. The line output valve and R138 were replaced, but the PY801 and R138 still get hot.

There is a harmonic tuning capacitor from the PY801's cathode circuit to chassis. This is C114, 220pF, a pulse type. It could be leaky, placing the PY801 across the h.t. line and diverting the PL504's cathode current via its screen grid. If not, check for continuity between the top caps of the two valves to make sure that L36 is not open-circuit. The line output transformer is generally reliable but could be faulty. It would be as well to check C115 (0·1μF) which decouples R138.

RRI A823AV CHASSIS

There is a quarter inch gap at the right-hand side of the screen and the horizontal shift control is at one end of its travel – nothing seems to be overheating however. The h.t. has been adjusted to 200V as set out in the manual. The only other problem is occasional field jitter. The set functions well in all other respects.

Make sure that the purity is correct – this has a great bearing on the position of the picture. Also check the setting of the line hold control, using the procedure given in the manual, and make sure that the line shift potentiometer operates smoothly. For the jitter, make sure that 8R13 is 1kΩ and try a 4EX581 in position 8D3, with 8R12 increased to 47Ω. If the trouble is specifically in the field timebase however, rather than general picture jitter, check that the height, linearity and midpoint voltage controls 5RV2/3/4 work smoothly, then suspect the driver transistor 5VT7 (AC128) and the field charging capacitors 5C24 and 5C25 (50μF and 22μF respectively).

Thorn 1590 chassis

After the set has been on for about three quarters of an hour the picture slowly loses height, more noticeably at the bottom, where the gap becomes a quarter of an inch. There is also an annoying buzz from the back of the set, though this does not affect the sound or vision signals.

The buzz usually comes from the mains transformer. In theory it should be replaced, but devious means of wedging it can often be devised. For the field problem we suggest you check the field linearity transistor VT16, C80 (should be 10μF, 63V) in the linearity network, and the driver and output transistors as necessary.

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.

An early KB Model CK500 colour receiver (CVC5 chassis) came in with the complaint of intermittent coloured "stars" across the picture. The outside technician first investigated the trouble on site, where he observed the symptom which had been regarded as a form of external interference. This was found not to be the case however, for the symptom remained even with the aerial disconnected.

On the test bench in the workshop the receiver gave a fair picture and normal sound. The emission of the picture tube was down a bit, and the purity, convergence and grey-scale needed slight readjustment. After these adjustments had been made the picture was quite respectable for the age of the set. The receiver was then left on soak, hoping for the appearance of the fault. After several hours of random observation, it was noticed that the picture was marred by two distinct horizontal bands of multicoloured dots. There was also a slight buzzing from the loudspeaker (in the background of the sound, with the volume control well advanced) and a tendency for field locking instability.

Indeed, the symptom was very much like that of 50Hz mains interference or electric motor sparking. There was also a degree of intermittency – the effects completely vanishing for a while before starting again. As discovered by the outside technician, the symptoms remained when the aerial was unplugged.

It was the general opinion in the workshop that mild arcing was taking place somewhere in the mains power supply circuits. The set uses a mains transformer and various components for the suppression of mains transients, but testing, replacement and removal of some of these failed to throw any light on the trouble. All the mains carrying components, including the fuses and holders, the on/off switch, etc. appeared to be in good condition and no arcing effects were observed.

A d.c.-isolated oscilloscope with its timebase adjusted to record 50 or 100Hz pulses was then brought into operation, with the Y gain set high, but tests on the major d.c. lines failed to reveal any arcing pulses which could be the cause of the trouble. The scope was then transferred to the c.r.t. R, G and B cathode inputs, and here 50Hz pulses were clearly detected riding on the signals.

From this information what would you consider to be the most likely cause of the trouble? See next month's Television *for the solution and for a further item in the* Test Case series.

SOLUTION TO TEST CASE 175
(Page 497 last month)

From the circuit information given last month on the HMV Model 2701 it should have been apparent that the red tinge could very well have been caused by drift of the static biasing at the base of the clamp transistor VT9. A change in bias here would change the primary-colour amplifier's collector voltage and hence alter the red beam current.

Tests proved this to be the case, and it was found that the standing voltage at the base of VT9 had fallen dramatically from the correct value. Tests were made of the components in the potential divider network, including the diodes, but these and the resistors were in order. The fault was in the 2μF smoothing capacitor C20. When this was extracted from circuit and measured with an ohmmeter it did not appear to be particularly leaky, but when checked on a capacitor bridge its power factor was found to be very high.

Replacement completely cured the trouble and allowed the video gain, the video bias and the tint control to be restored to the normal settings.

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TELEVISION AUG 1977

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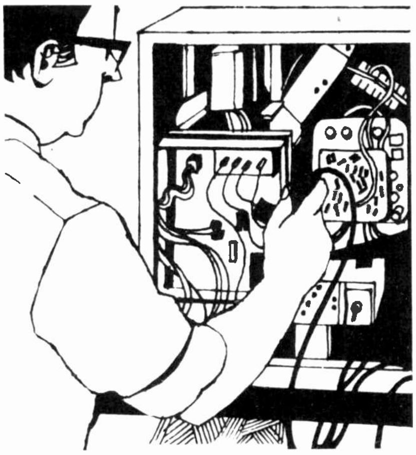

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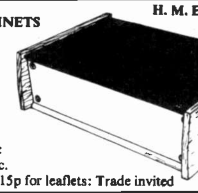

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LM301AN	0.55
LM309K	2.00
LM324	2.05
LM380/SL60745	1.29*
LM381N	2.00*
LM723	0.59
LM3900N	0.69
MC1310	2.55
MC1327	1.35*
MC1330P	0.75*
MC1350P	0.75*
NE555	0.49
NE566	1.90*
NE567	2.70*
SN76003N	2.80*
SN76013ND	1.60*
SN76013N	1.75*
SN76023N	1.75*
SN76023ND	1.60*
SN76033N	2.75*
SN76660	0.90*
TAA550	0.60*
TBA120ASQ	1.30*
TBA480Q	1.25*
TBA520Q	1.70*
TBA530Q	1.90*
TBA540Q	1.90*
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ZN414	1.40*
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TTL DIGITAL	
7400	0.15
7401	0.20
7402	0.18
7403	0.18
7404	0.23
7409	0.23
7410	0.18
7411	0.24
7412	0.25
7413	0.38
7414	0.72
7416	0.36
7417	0.36
7420	0.18
7421	0.36
7422	0.22
7423	0.34
7425	0.34
7426	0.36
7427	0.32
7428	0.50
7430	0.18
7432	0.28
7433	0.33
7437	0.42
7438	0.30
7440	0.18
7441	0.66
7442	0.68
7443	1.00
7444	1.00
7445	0.90
7446	1.00
7447	0.98
7448	0.98
7450	0.18
7451	0.18
7453	0.18
7454	0.18
7460	0.18
7470	0.32
7472	0.30
7473	0.30
7474	0.35
7475	0.49
7476	0.32
7480	0.48
7481	1.00
7482	0.90
7483	1.00
7484	1.20
7485	1.30
7486	0.43
7487	1.65
7489	3.30
7490(A)	0.55
7491	0.75
7492	0.55
7493	0.56
7494	0.85
7495	0.74
7496	0.90
74107	0.30
74121	0.38
74123	0.49
7414	0.80
74145	1.15
74151	0.94
74174	1.20
74180	1.20
74190	1.60
74191	2.10
74192	1.60

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4001	0.19
4002	0.19
4006	1.45
4007	0.19
4011	0.19
4012	0.19
4013	0.58
4014	1.42
4015	1.16
4016	0.52
4017	1.12
4023	0.19
4024	0.75
4029	1.95
4050	0.54
4511	1.94

DIODES	
50V 3A	0.13
100V 3A	0.15
200V 3A	0.18
400V 3A	0.21

BRIDGES	
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200V 1A	0.30
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7406	45p
7407	45p
7408	25p
7409	27p
7410	18p
74H10	30p
7411	28p
7412	28p
7413	36p
7414	96p
7416	35p
7417	40p
7420	18p
7421	43p
7422	27p
7423	36p
7425	33p
7427	40p
7430	18p
7432	34p
7437	37p
7438	37p
7440	18p
7441	85p
7442	75p
7443	130p
7444	130p
7445	108p
7446	108p
7447	90p
7448	90p
7450	18p
7451	18p
7453	18p
7454	18p
7460	20p
7470	32p
7472	32p
7473	36p
7474	37p
7475	48p
7476	37p
7480	54p
7481	108p
7482	85p
7483	95p
7484	103p
7485	130p
7486	36p
7489	340p
7490	43p
7491	90p
7492	55p
7493	43p
7494	96p
7495	75p
7496	90p
7497	340p
74100	116p
74104	60p
74105	60p
74107	36p
74109	70p
74110	55p
74111	80p
74116	220p
74118	90p
74120	95p
74121	32p
74122	53p
74123	73p
74125	70p
74126	76p
74128	90p
74132	76p
74136	81p
74141	85p
74142	300p
74145	90p
74147	275p
74148	173p
74150	135p
74151	77p
74153	92p
74154	164p
74155	97p
74156	97p
74157	96p
74158	160p
74159	220p
74160	120p
74161	120p
74162	120p
74163	120p
74164	130p
74165	150p
74166	136p
74167	340p
74170	250p
74173	160p
74174	130p
74175	92p
74176	130p
74177	130p
74180	118p
74181	324p
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74186	995p
74190	155p
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74192	130p
74193	130p
74194	130p
74195	104p
74196	130p
74197	130p
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74278	314p
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74290	162p
74293	162p
74298	216p
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4012	21p
4013	55p
4014	110p
4015	120p
4016	54p
4017	110p
4018	120p
4019	54p
4020	95p
4022	100p
4023	21p
4024	75p
4025	21p
4026	220p
4027	81p
4028	152p
4029	120p
4030	59p
4040	130p
4042	90p
4043	100p
4046	150p
4047	110p
4049	68p
4050	54p
4055	120p
4055	140p
4056	145p
4060	120p
4069	40p
4071	29p
4072	29p
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TAA661B	150p
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TBA480Q	200p
TBA570	145p
TBA641B	300p
TBA651	275p
TBA800	100p
TBA810	125p
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AC128	20p
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AC176	20p
AC187/8	20p
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BC184	14p
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2N1131/2	25p
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2N3706/7	14p
2N3708/9	14p
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2N3866	95p
2N3904/5	22p
2N3906	22p
2N4060	12p
2N4123/4	22p
2N4125/6	22p
2N4401/3	34p
2N4427	97p
2N4444	216p
2N4871	64p
2N5296	65p
2N5457/8	40p
2N5459	40p
2N6027	60p
2N6107	70p
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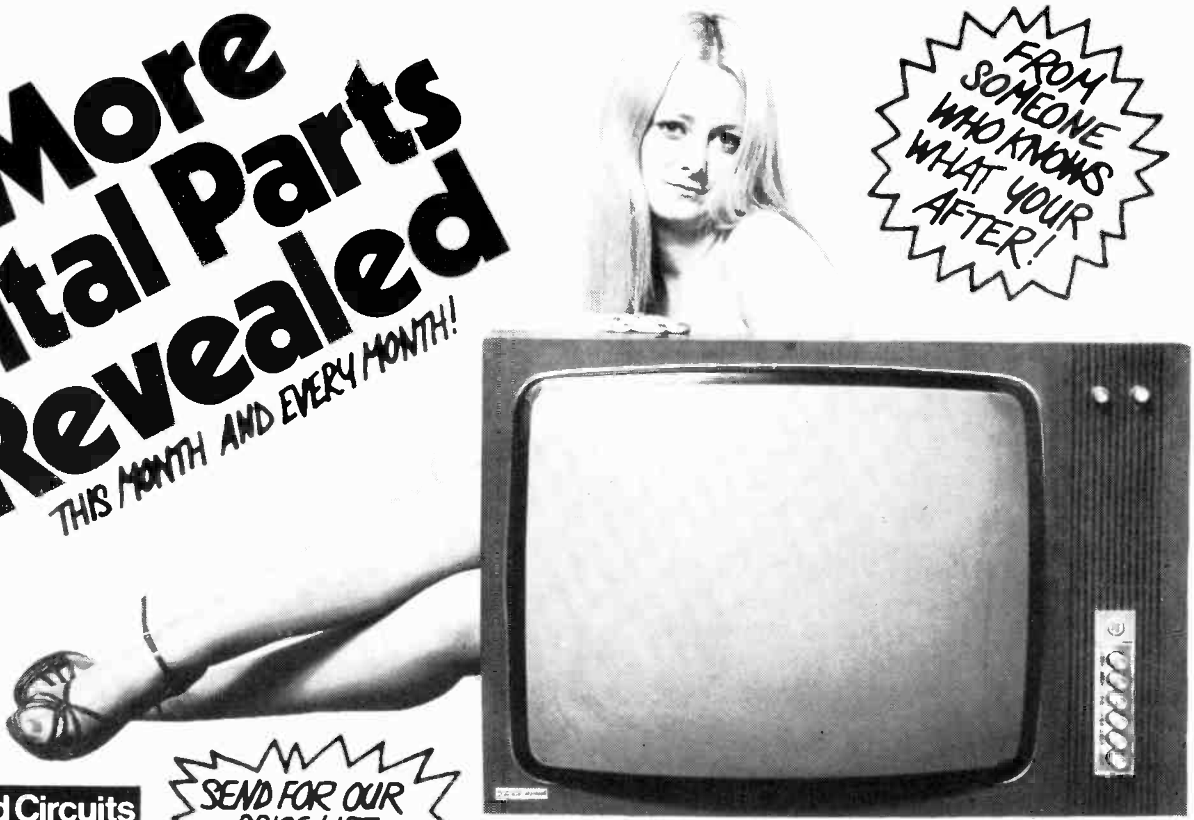

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SN 76013ND	124
SN 76023N	140
SN 76023ND	124
SN 76033N	180
SN 76110N	142
SN 76226N	180
SN 76227N	140
SN 76532N	160
SN 76533N	140
SN 76544N	150
SN 76650N	120
SN 76660N	70
SN 76666N	100
TA 7050P	125
TA 7051P	165
TA 7072P	170
TA 7047P	150
TA 7141AP	120
TA 717P/SAS 560S	186
TA 7172P/SAS 570S	186
TA 7173P	160
TA 7176P	120
TAA 550	45
TAA 570	185
TAA 661B	100
TAA 700	165
TBA 120AS	80
TBA 120SQ	100
TBA 440	300
TBA 480Q	140
TBA 520Q	170
TBA 530Q	130
TBA 540Q	180
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AC	142K	40
AC	151	31
AC	154	20
AC	155	20
AC	156	31
AC	176	24
AC	176K	38
AC	187	22
AC	187K	40
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600M 300v £1.00
400M 400v £1.00
800+800M 250v 60p
200+100+100+50M
300v 45p
200+100+100M 350v 70p
200+200+150+50 £1.00

100M 450v 25p
47M 450v 25p
680M 100v 25p
6800M 40v 35p
100M 350v 20p
22M 350v 20p
33000 10v 30p
15000 40v 50p

220M 10v
2.2M 100v
22M 100v
4.7M 100v
5p EACH

Plessey Green Condensers
6800M 16v
2200M 16v
1000M 10v
4700M 25v
680M 63v
1000M 63v
3000M 16v
330M 100v
4700M 10v
1000M 63v
3300M 25V
1000M 40v
1000M 50v
1500M 25v
1000M 10v
1500M 40v
1000M 25v
6800M 63v
1500M 50v
4700M 16v
1000M 16v
100M 63v
12½p EACH

VHF Varicap Units
New £2.50

VHF Varicap Units
New. 49·00-219·00 MHZ
£1.50

Reject VHF Varicap
Units 50p

AE Isolating Socket &
Lead 45p

6 Position 12·5k
V/Resistors Units for
Varicap 50p

EHT Rectifiers Sticks
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x80/150
CSD118xMH
12p EACH

CSD118xPA 15p

3 Off G770/HU37
Silicone 15p

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W005M 20p

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BA182
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BY210/400 5p
BY206 15p
BT106 95p
BT116 95p

12 Kv Diodes 2M/A 30p
18 Kv BYF3123 Silicone 30p

180PF 8Kv
1000PF 10Kv
1200PF 10Kv
1000PF 12Kv
160M 25v
220M 25v
1000M 16v
220M 35v
220M 40v
220M 50v
470M 25v
22M 315v
10M 350v
100M 50v
330M 10v
330M 25v
330M 35v
330M 50v
330M 63v
470M 25v
470M 35v
470M 40v
10p EACH

BA159 10p
BY184 25p

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TV20 50p
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BU205 £1.90

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Thorn

BD138 20p

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RCA16572
RCA16573
40p PAIR

BU105 Ex. Panel
BU206 Ex. Panel
50p EACH

5A-300
TIC106 Thyristors
25p EACH

RCA40506 Thyristors 50p

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BC194 7p

BC188 10p

BC149C 7p

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Supplies 15 volts £1.50

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**2 WOOD GRANGE CLOSE,
THORPE BAY, ESSEX.**

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