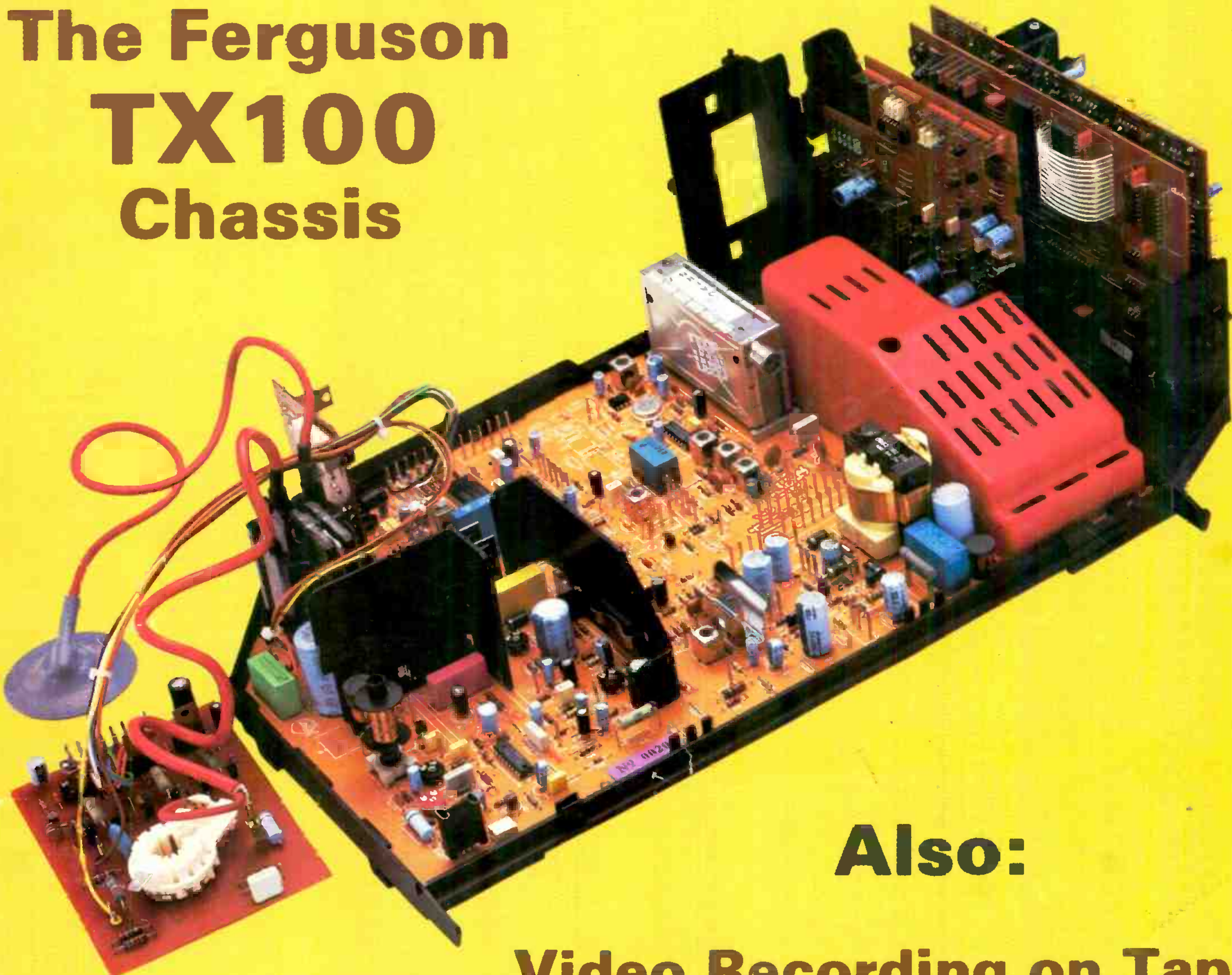
JULY 1984

Australia $1.80, New Zealand $2.20, Malaysia $5.50 £1·00

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

The Ferguson TX100 Chassis



Also:

Video Recording on Tape

Spectrum-Monitor Interface

Servicing: Grundig 2 × 4 Super

Electronic Circuit Breaker

VCR Clinic ● TV Fault Finding

N J ELECTRONICS

82 - 84 STORFORTH LANE TRADING ESTATE
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S41 0SN TEL. (0246) 209079

INTEGRATED CIRCUITS

BTT 822	1.90
CA 3089	1.20
ETT 6016	1.95
ETTR 6016	1.95
MC 1307P	1.70
MC 1310P	1.20
MC 1327P	1.10
MC 1330P	1.50
MC 1349P	1.10
MC 1351P	1.20
MC 1352P	1.50
MC 1358P	1.20
ML 236E	3.00
ML 237B	1.80
SAA 1021	3.80
SAA 1024	2.40
SAA 1025	4.40
SAA 1124	2.40
SAA 1130	4.30
SAA 5040	7.50
SAS 560	1.80
SAS 570	1.80
SAS 660	2.30
SAS 670	2.30
SL 901B	5.00
SL 917B	6.20
SN 29848	2.25
SN 57108AN	1.95
SN 76001AN	1.60
SN 76003	2.20
SN 76013N	2.50
SN 76023N	2.20
SN 76131N	1.35
SN 76226DN	1.60
SN 76227N	1.20
SN 76532	2.00
SN 76550	0.29
SN 76546	1.80
SN 76660	0.90
SN 76666N	1.10
SN 76707	1.70
TA 7061AP	3.60
TA 7063AP	3.50
TA 7066P	3.90
TA 7072P	2.90
TA 7074P	3.30
TA 7108P	2.44
TA 7117P	3.20
TA 7120P	1.61
TA 7129AP	3.20
TA 7130P	1.38
TA 7137P	2.00
TA 7139P	2.75
TA 7146P	2.00
TA 7157P	3.20
TA 7171P	3.20
TA 7172P	3.30
TA 7176AP	3.00
TA 7193P	5.20
TA 7202P	3.30
TA 7203P	3.30
TA 7204P	2.16
TA 7205P	1.40
TA 7208P	2.70
TA 7210P	5.60
TA 7222P	1.70
TA 7223P	3.50
TA 7227P	5.10
TA 7310P	1.70
TA 7313P	2.80
TA 7609P	4.00
TA 7611AP	2.90
TA 75902P	2.03
TAA 320A	1.30
TAA 470	2.30
TAA 550	0.39
TAA 691	1.95
TAA 700	1.65
TBA 120A	0.75
TBA 120AS	0.75
TBA 120B	0.78
TBA 120C	0.75
TBA 120SA	0.75
TBA 120U	0.75
TBA 231	1.65
TBA 396	1.70
TBA 395	1.70
TBA 480	0.99
TBA 510	1.20
TBA 520	1.50
TBA 530	1.45
TBA 540	1.70
TBA 550	1.80
TBA 560C	1.90
TBA 570	1.10
TBA 750	1.50
TBA 800	1.10
TBA 810S	0.90
TBA 820	1.20
TBA 890	3.50
TBA 920	2.00
TBA 950	2.65
TBA 990	1.60
TBA 1440	2.70
TBA 1441	2.70
TCA 270S	1.90
TCA 270SQ	1.90
TCA 640	2.60
TCA 650	2.40
TCA 660	2.80
TCA 740	2.90
TCA 800	2.00
TCA 830S	1.60
TCA 940	1.80
TCA 4500A	2.00
TDA 1003	2.00
TDA 1004A	2.40
TDA 1044	2.50
TDA 1170	2.80
TDA 1180	2.80
TDA 1190	2.00
TDA 1327	1.70
TDA 1412	1.00
TDA 2010	1.80
TDA 2522	2.40
TDA 2523	2.20
TDA 2530	2.20
TDA 2532	2.70
TDA 2540	2.20
TDA 1365	5.75
TDA 2541	2.30
TDA 2560	2.05
TDA 2571	2.10
TDA 2581	2.80
TDA 2582	2.60
TDA 2593	2.70
TDA 2600	5.95
TDA 2611A	1.15
TDA 2640	1.80
TDA 2653	2.10
TDA 2680	2.10
TDA 2690	2.20
TDA 3560	5.10
TDA 3561	6.50
TDA 3950	2.40
TDA 4600	2.65
UPC 41C	3.50
UPC 393C	2.90
UPC 554C	1.34
UPC 555H	0.80
UPC 556H3	1.70
UPC 557H	0.92
UPC 566H3	3.50
UPC 574J	0.55
UPC 575C2	3.00
UPC 577H	3.50
UPC 585C	1.49
UPC 741G	0.95
UPC 1009H	2.41
UPC 1017G	2.50
UPC 1018C	1.19
UPC 1023H	0.63
UPC 1024H	0.63
UPC 1025H	3.70
UPC 1026C	1.60
UPC 1028H	2.40
UPC 1031H2	2.40
UPC 1032H	1.50
UPC 1035C	2.50
UPC 1037H	1.62
UPC 1042C	2.60
UPC 1043C	2.60
UPC 1156H	2.40
UPC 1158H	0.78
UPC 1161C3	1.58
UPC 1163H	0.98
UPC 1167C2	1.58
UPC 1168C	2.75
UPC 1170C	1.75
UPC 1171C	1.62
UPC 1176C	2.43
UPC 1177H	2.60
UPC 1178C	2.14
UPC 1180C	3.00
UPC 1181H3	1.62
UPC 1182H	2.70
UPC 1183H	2.30
UPC 1185H2	3.50
UPC 1186H	0.98
UPC 1187V	1.70
UPC 1188H	3.60
UPC 1190C	2.00
UPC 1191V	1.70
UPC 1197C	1.70
UPC 1198H	1.41
UPC 1200V	1.97
UPC 1204C	1.63
UPC 1208C	2.00
UPC 1211C	4.00
UPC 1212C	1.34
UPC 1213C	1.53
UPC 1215V	2.70
UPC 1216V	1.99
UPC 1217G	3.59
UPC 1218H	3.00
UPC 1222	2.00
UPC 1223	3.70
UPC 1225	3.00
UPC 1226	2.49
UPC 1227	2.00
UPC 1228H	0.90
UPC 1230H	3.60
UPC 1238V	1.90
UPC 1245	2.20
UPC 1250	2.40
UPC 1350C	4.50
UPC 1353C	2.80
UPC 1356C2	3.00
UPC 1358H	3.00
UPC 1360C	3.50
UPC 1363C	3.50
UPC 1366C	3.00
UPC 1367C	3.00
UPC 1368H	4.00
UPC 1370C2	4.00
UPC 1373H	1.11
UPC 1377C	4.50
UPC 1378H	4.00
UPC 1382C	1.97
UPC 1384C	5.70
UPC 1447W	0.98
UPC 1470H	0.90
UPC 2002V	2.80

ZENERS

400MW	
2V4 to 75V	0.10
1.3W	
2V7 to 91V	0.18
100V to 200V	0.19
15 WATT	
BZV15C12R	1.18
BZV15C24R	1.18
BZV15C30R	1.18

DIODES

BA148	0.18
BA159	0.10
BB103	0.20
BB105B	0.20
BY127	0.11
BY133	0.11
BY176	1.35
BY184	0.40
BY187	0.69
BY190	0.60
BY210-800	0.29
BY223	0.95
BY226	0.27
BY227	0.31
BY295	0.25
BY296	0.25
BY298	0.25
BY299	0.25
BYX10	0.21
BYX36-600	0.50
BYX71-350	0.50
BYX71-600	0.99
BYX55-600	0.33
BR100	0.35
OA47	0.10
OA90	0.08
OA91	0.08
SKE5F	1.40
IN60	0.08
IN4001	0.05
IN4002	0.05
IN4003	0.05
IN4004	0.06
IN4005	0.07
IN4006	0.07
IN4007	0.07
IN4148	0.03
IN5402	0.13
IN5404	0.15
IN5406	0.17
IN5408	0.18
Y969	0.87

BRIDGE RECT.

B40	0.80
BY164	0.50
BY179	0.70
W005	0.25

TRANSISTORS

AC127	0.30
AC128	0.30
AC153K	0.36
AC176	0.30
AC186	0.30
AC187	0.30
AC188	0.30
AD149	0.88
AD161	0.45
AD162	0.45
AF139	0.48
AF239	0.60
AU113	3.40
BC107	0.15
BC108	0.15
BC109	0.15
BC116	0.13
BC140	0.30
BC141	0.30
BC142	0.22
BC143	0.27
BC147	0.12
BC148	0.12
BC149	0.12
BC154	0.11
BC157	0.11
BC158	0.11
BC159	0.11
BC170	0.13
BC171	0.12
BC172	0.13
BC173	0.12
BC174	0.12
BC182L	0.12
BC183L	0.12
BC184L	0.12
BC207	0.12
BC212L	0.09
BC213L	0.11
BC237	0.10
BC238	0.12
BC250	0.11
BC251	0.11
BC252	0.12
BC253	0.11
BC301	0.31
BC302	0.31
BC303	0.33
BC307	0.13
BC308	0.13
BC327	0.11
BC328	0.13
BC337	0.11
BC338	0.13
BC350	0.12
BC365	0.30
BC413	0.11
BC460	0.48
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BC463	0.53
BC527	0.13
BC528	0.13
BC546	0.12
BC547	0.12
BC548	0.12
BC557	0.12
BC558	0.12
BD131	0.30
BD132	0.36
BD135	0.30
BD136	0.30
BD139	0.33
BD140	0.60
BD150A	0.70
BD207	0.90
BD221	0.40
BD228	0.35
BD233	0.53
BD234	0.38
BD238	0.38
BD239	0.42
BD253B	0.65
BD416	0.42
BD534	0.33
BD595	0.55
BD596	0.55
BD681	0.58
BD807	0.50
BDX32	1.70
BF127	0.30
BF137	0.30
BF180	0.29
BF181	0.27
BF182	0.28
BF185	0.32
BF194	0.12
BF195	0.11
BF196	0.13
BF197	0.13
BF198	0.16
BF199	0.18
BF200	0.34
BF240	0.16
BF245	0.30
BF256L	0.40
BF258	0.27
BF259	0.32
BF264	0.40
BF273	0.13
BF274	0.11
BF337	0.32
BF338	0.32
BF355	0.56
BF458	0.48
BF459	0.51
BFR79	0.26
BFY50	0.24
BFY51	0.23
BFY52	0.23
BU105	1.40
BU108	1.60
BU124	0.98
BU126	1.60
BU137	1.40
BU204	1.40
BU205	1.40
BU208	1.55
BU208A	1.90
BU208D	2.30
BU326	1.80
BU407	1.40
BU426V	1.70
BU526	1.62
E1222	0.35
FT3055	0.65
MJE340	0.50
MJE520	0.45
R2008B	1.70
R2009	1.90
R2010B	1.90
R2540	2.10
SP8385	2.10
TIP29	0.38
TIP30A	0.34
TIP31A	0.34
TIP31C	0.48
TIP32A	0.34
TIP32C	0.48
TIP33B	0.75
TIP41A	0.46
TIP41C	0.58
TIP42A	0.45
TIP42C	0.68
TIP2955	0.74
TIP3055	0.55
2N3055	0.73

ZENERS

400MW	0.10
1.3W	0.18

THYRISTORS

15/80	2.50
15/85	2.50
BR101	0.40
BR103	0.62
BRY39	0.56
BRY49	0.65
BRY55	0.60
BT100	1.10
BT106	1.55
OT112	1.85
OT121	1.55
2N4444	1.55

REGULATORS

78 Series	0.60
79 Series	0.80
78L Series	0.42
79L Series	0.70

FUSES

20mm Anti Surge (10 pack)	1.20
1¼" Anti Surge (10 pack)	2.30
20mm Q Blow	0.50
1¼" Q Blow	0.70

Most Values Stocked

CAPACITORS

.1 1000V	0.40
.1 1250V	0.48
.22 1000V	0.50
.22 1250V	0.60
.47 1000V	0.70

Also stocked: Tants, Discs, Polys, Plates, Electrolytics. Please ring for details.

SWITCHES

G8 Plastic	0.85
G8 Metal	1.30
G11	0.85
G12	0.85
3500	0.85
1500 Rotary	0.80

Many others, Please Ring.

We also stock Resistors, Crystals, Filters, Thermistors, Wound Components, Service Aids, Solder, Heatsinks, Focus Units, Video Heads and Many Other Items. Please Ring.

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Decca 200/200/400 350V	2.70
Decca 400/400 350V	2.90
Decca 400/800 350V250V	2.90
Philips 600 300V	2.50
Philips 2200 63V	1.55
Philips 470 250V	2.00
Philips (G9) 600 300V	2.80
PYE 200/200/100/32	2.85
PYE 600 300V	2.80
RRI 2500/2500 30V	1.20
RRI 220 400V	2.90
Thorn 150/160/100 300V	1.90
Thorn 4700 25V	0.85
Thorn 1000 70V	0.70
Thorn 200/100/100 350V	2.85
Thorn 175/100/100 400V	2.40
Thorn 400 400V	2.50

PUSH BUTTON UNITS

Decca 30 4 way	6.80
Decca 30 6 way	7.80
GEC 2110	11.00
GEC 2112	12.95
GEC 2136/7	8.90
GEC 2112 Conversion	13.00
Hitachi 190 4 way	8.95
ITT CVC5 7 way	10.00
ITT CVC8/9	12.85
ITT CVC20/30 6 way	8.00
ITT CVC 25 6 way	8.50
Philips 520	11.00
Philips 550	13.55
Philips G11	22.50
PYE 713 4 way	8.70
PYE 715 6 way	13.50
PYE 725 (UHF-VHF)	13.50
RRI 823 4 way	8.75
RRI 823 6 way	9.50
RRI T20 6 way	10.50
RRI Z718 6 way	9.50
Thorn 3500 6 way	2.75
Thorn 8500 6 way	2.75
Thorn 9000 6 way	2.75
Thorn 1615 4 way	8.70
Telpro 4 way	8.50

PRESETS

Horizontal and Vertical Standard and sub mid sizes 100R to 4M7	0.12

MAINS DROPPERS

Decca 20 mono	1.35
Decca 30 3R9	0.60
Philips G8 2R2 + 68R	0.84
Philips G8 47R	0.50
Philips 210 (no link)	1.10
Philips 210 (with link)	0.95
PYE 725 3R3	1.35
PYE 725 3R+link+56R	1.40
PYE 725 + 56R + 3R	1.55
RR1 823 56R + 68R	0.85
Thorn 1500	1.55
Thorn 1600	1.45
Thorn 3500	0.97
Thorn 8000	1.20
Thorn 8500	0.97
Thorn 8800	0.97
Thorn 9800	0.90
GEC 2110	0.85

CONVERGENCE CONTROLS

5R 7R 10R 12R 15R 20R 50R 100R 200R 500R	0.38
G8 Metric 10R 15R 20R	0.50
Thorn 50R 200R	0.50

EHT TRAYS

Decca 1830	5.90
Decca 2230	6.95
Decca 80	6.95
Decca 100	7.00
GEC 1028	6.25
GEC 2040	6.25
GEC 2110	6.25
GEC 2200	6.25
Grundig 5011	7.00
ITT CVC 5/8	7.00
ITT CVC 20	6.95
ITT CVC 45	7.20
Korting 90°	6.95
Philips 520	7.05
Philips 550	7.05
Philips G9	6.25
Philips 570	6.50
Philips KT3	8.95
PYE 691/697	6.30
PYE 713 5 lead	6.50
PYE 713 4 lead	7.60
PYE 725/731	7.00
RRI 823	7.75
RRI T20	6.50
Tandberg TV2-2	6.50
Thorn 1500 3 stick	4.95
Thorn 1500 5 stick	5.50
Thorn 3000/3500	7.70
Thorn 8000	4.95
Thorn 8500	6.80
Thorn 9000	7.80
Telpro 561	7.00
Universal	5.50
TV11	0.65
TV13	0.65
TV18	0.70

LINE OUTPUT TRANSFORMERS

Autovox 90°	9.75
Autovox 110°	9.75
Decca 1700 Mono	9.80
Decca 1830	9.80
Decca 2230	8.30
GEC 2110	9.50
GEC 20AX	12.00
Grundig 1500 mono	13.70
Grundig 5010	11.50
ITT CVC5/8	10.25
ITT CVC20	10.75
ITT CVC30	8.75
ITT CVC45	9.75
Indesit mono	10.75
Korting 90°	10.75
Korting 110°	12.50
Philips 210	9.90
Philips G8	8.90
Philips G9	9.00
Philips G11	12.95
Philips K30	14.95
Philips KT3	8.50
Philips 570	9.50
PYE 691 P.C.	13.00
PYE 725	8.95
PYE 731	8.95
PYE 169	10.75
RRI 640/793	11.75
RRI 774	12.90
RRI 823	11.90
RRI T20	12.90
SABA	12.50
Skantic	12.50
Thorn 1500 20"	7.00
Thorn 1500 24"	7.00
Thorn 1591	10.50
Thorn 1615	10.00
Thorn 1690/1	8.75
Thorn 9000	10.90
Thorn 9600	10.00

PLEASE ADD 65 PENCE POST/ PACKING TO YOUR ORDER TOTAL AND THEN 15% VAT. GOODS ARE DESPATCHED BY RETURN AND SHOULD BE RECEIVED WITHIN 4 WORKING DAYS.

TELEVISION

July 1984

Vol. 34, No. 9
Issue 405

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

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

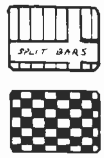
this month

OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 18

MANOR SUPPLIES

NEW MKV PAL COLOUR TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE



- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit, standard parts. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.
- ★ Also available with VHF Modulator.

Price of Kit	**£80.50**
De Luxe Case (10″×6″×2¼″)	**£8.50**
Optional Sound Module (6MHz or 5.5MHz)	**£4.50**
Built & Tested in De Luxe Case including Sound Module	**£120.75**

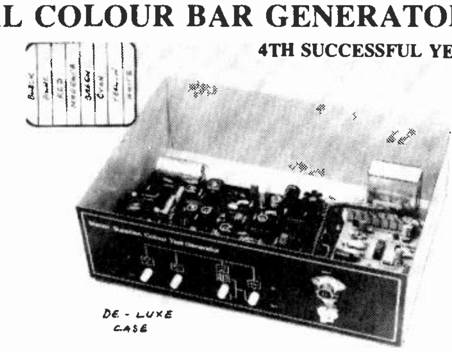
SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.50

All above prices include VAT 15%

PAL COLOUR BAR GENERATOR (Mk4)

4TH SUCCESSFUL YEAR



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s on colour bar P.C.B.

PRICE OF MK 4 COLOUR BAR GENERATOR KIT £34.50. DELUXE CASE £8.50. BATT HOLDERS £3.20. MAINS SUPPLY KIT £4.80 (Combined P&P £2.20).

MK 4 DE LUXE (BATTERY) BUILT & TESTED £66.70 + £2.20 P & P.
MK 4 DE LUXE (MAINS) BUILT & TESTED £78.20 + £2.20 P & P.
VHF MODULATOR (CHI to 4) FOR OVERSEAS £6.60.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.
(ALL PRICES INCLUDE 15% VAT)

MANOR SUPPLIES TELETEXT ADAPTOR KITS

MK 1 (Texas XMII) remote control **£158.70** p.p. £3.00.
MK2 (Mullard) infra red remote control **£198.40** p.p. £3.00
Further details on request. Tel 01-794 8751/7346

Goods available if in stock immediately over shop counter (Mail order between 3 days and 1 week from receipt of order).

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

TELEVISION MAGAZINE PROJECT PARTS

COLOUR PORTABLE TV
MONO PORTABLE TV, SMALL SCREEN MONITOR ETC.

THORN TX10 TYPE REMOTE & TUNING CONTROL PANEL **£10.80** p.p. £1.50.
PHILIPS UHF MODULATOR (AUDIO & VIDEO INPUT) **£17.25** p.p. £1.00.
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AC142K	38
AC176	35
AC176K	35
AC186	41
AC187	38
AC187K	38
AC188	35
AC188K	39
AD143	82
AD161	54
AD162	54
AD161/62 MP	1.15
AF106	49
AF114	89
AF118	1.20
AF121	75
AF124	46
AF125	46
AF126	46
AF127	38
AF139	58
AF178	1.54
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AL102	2.00
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AU107	2.00
AU113	2.00
BC107	20
BC108	20
BC109	20
BC114	12
BC115	17
BC116A	16
BC117	30
BC118	24
BC119	36
BC139	28
BC140	32
BC141	26
BC142	30
BC143	31
BC147	13
BC148	9
BC149	12
BC157	16
BC158	16
BC159	15
BC160	25
BC161	28
BC170B	15
BC171	15
BC172	15
BC173	12
BC174	10
BC177	27
BC178	26
BC182L	9
BC183L	12
BC184L	14
BC186	18
BC187	18
BC204	10
BC208	13
BC209	10
BC212	9
BC212L	13
BC213	13
BC214	10
BC237	14
BC238	14
BC251A	18
BC252	12
BC261	18
BC262	18
BC300	50
BC301	53
BC303	33
BC307	20
BC308	25
BC323	99
BC327	18
BC328	18
BC337	18
BC338	18
BC461	30
BC547	13
BC548	13
BCX32	30
BC549	8
BC550	7

BC557	8
BC558	9
BCY72	13
BD115	45
BD116A	65
BD124P	79
BD131	50
BD132	49
BD133	60
BD135	38
BD136	38
BD137	38
BD138	35
BD139	35
BD140	44
BD144	1.70
BD150	60
BD159	65
BD166	52
BD179	70
BD182	1.20
BD183	75
BD201	85
BD202	91
BD203	80
BD204	99
BD222	46
BD223	56
BD225	47
BD232	68
BD233	60
BD234	63
BD235	60
BD236	65
BD237	57
BD238	65
BD243	85
BD244	85
BD410	79
BD434	74
BD437	86
BD438	94
BD507	52
BD508	55
BD509	56
BD510	60
BD278A	81
BD517	60
BD520	75
BD526	82
BD535	82
BD536	91
BD696A	1.49
BD697	1.24
BD695	1.39
BD698	1.50
BD707	95
BDX32	2.10
BF115	38
BF117	36
BF125	26
BF127	47
BF154	23
BF158	18
BF160	27
BF167	24
BF173	22
BF177	52
BF178	46
BF179	28
BF180	39
BF181	39
BF182	36
BF183	29
BF184	36
BF185	36
BF194/394	16
BF195	16
BF198	16
BF197	16
BF198	18
BF199	21
BF200	35
BF224	25
BF225	20
BF241	25
BF256	55
BF257	28
BF258	25
BF259	35
BF262	84
BF263	75
BF271	24
BF273	24
BF274	24
BF336	36

BF337	41
BF338	41
BF355	56
BF362	68
BF363	72
BF371	30
BF392	36
BF422	34
BF423	46
BF435	35
BF457	35
BF458	43
BF459	43
BF460	86
BF462	86
BF469	46
BF470	66
BF597	10
BF757	54
BF758	54
BFR39	27
BFR40	30
BFR79	85
BFR90	1.74
BFT42	39
BFT43	39
BFW10	60
BFX29	40
BFX84	42
BFX85	30
BFX86	30
BFX88	46
BFY50	30
BFY51	30
BFY52	24
BFY90	96
BR100	34
BR101	45
BR103	83
BRC4443	94
BRC4444	98
BRX46	40
BRY39	56
BRY55	45
BRY56	57
BSW67	68
BT100	1.65
BT101	1.20
BT102/500	1.20
BT106	1.60
BT107	1.69
BT108	1.69
BT109	99
BT116	1.21
BT119	3.66
BT120	3.66
BT151/800	1.20
BU104	2.00
BU105	1.58
BU108	1.80
BU124	1.90
BU126	1.75
BU204	1.50
BU205	1.42
BU206	1.80
BU208	1.60
BU208A	1.65
BU208/02	2.10
BU326A	1.75
BU407	1.70
BU426	3.07
BU500	2.30
BU526	2.46
BU508	3.20
BU806	1.40
BU807	2.94
BUW84	1.45
BUW91A	3.84
BUX84	1.50
E1222	40
MCR101	45
MCR220	1.50
ME0411	20
MJE340	68
MJE520	50
MJ3000	1.98
MPSA92	35
MR814	45
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R2008B	1.90

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RCA16091	2.95
RCA16092	99
RCA16040	96
RCA16041	84
RCA16334	90
RCA16335	90
RCA16799	99
RCA16957	2.88
TIC45	90
TIC46	60
TIL32	65
TIL78	46
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP34B	1.06
TIP41C	47
TIP42C	50
TIP47	70
TIP120	65
TIP2955	90
TIP3055	63
TIS91	21
TU106/02	1.80
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3054	60
2N3055	60
2N3702	11
2N3703	10
2N3705	10
2N3706	10
2N3708	17
2N5294	48
2N5296	48
2N5298	69
2SB337	1.86
2N5496	53
2N6107	75
2N6109	81
2SA715	1.98
2SC495	1.10
2SC496	1.31
2SC643A	1.50
2SC1096	1.72
2SC1172Y	2.20
2SC1173Y	1.69
2SC1306	2.73
2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC2028	1.82
2SC2029	2.60
2SC2078	2.90
2SC2091	1.34
2SC2166	2.73
DEC1	2.20
DEC2	2.20
THY15/80	2.20
THY15/85	2.20
BU208B	2.20
BUW81A	3.84

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AN301	5.15
AN7150	3.97
AN6340	7.85
AN6341	4.45
AN6341N	5.10
AN6344	7.85
BA521	2.80
BA536	3.00
CA555	46
CA566	84
CA741	25
CA748	45
CA3065	1.80
HA1124	1.65
HA1151	3.89
HA1322	2.65
HA1342	2.49
HA1306N	2.60
HA1366WR	2.80
HA1392	3.95
HA11219	2.49
LA4031P	3.21
LA4032P	2.90
LA4102	3.37
LA4250	3.57
LA4400	3.05
LA4422	3.28
LC7130	5.93
LC7120	5.87
LC7137	5.50
LM1011	3.25
LM1340T	75
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MB3712	1.95
MC1307	1.99
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MC1327	1.70
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MC1349	1.99
MC1350	1.50
MC1352	1.75
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MC1495L	3.00
MC13002	3.90
MC14011BCP	86
MC14049UB	43
MC7742	1.35
MC7812	1.35
ML231	
ETTR6016	2.20
ML232	2.20
ML236	5.35
ML237	2.50
ML238	6.00
ML239	2.50
ML920	4.12
ML922	3.29
ML926	2.18
ML928	2.18
MM5387ANN	4.15
MM5402N	6.65
MRF475	2.50
MRF477	10.00
MSN5807	7.87
MS1513L	2.80
MS1515L	3.28
SAA1025	4.40
SAA1124	2.50
SAA1250	3.94
SAA1251	4.90
SAA5000	4.39
SAA5010	6.30
SAA5012	6.50
SAA5020	5.90
SAA5030	8.25
SAA5050	8.50
SAA3210	2.93
SAS560S	1.89
SAS570S	1.89
SAS660	3.25
SAS670	3.25
SAS580	2.90
SAS590	2.90
SL901B	5.50
SL917B	6.50
SL1310	1.80
SL1327Q	1.20
SL1430	1.25
SL1432	3.36
SL76544	2.05

SN76003N	2.49
=SN76013N	
SN76023N	2.00
SN76110N	1.15
SN76115N	2.27
SN76131N	2.00
SN76226DN	2.00
SN76227N	1.18
SN76532N	1.50
SN76533N	1.70
SN76033N	2.49
SN76544N	2.36
SN76650N	1.06
SN76660N	80
SN76666N	80
SN76530A	1.47
STK015	6.25
STK032	13.25
STK043	11.05
STK433	5.65
STK435	9.06
STK436	5.50
STK437	7.85
STK459	8.20
STK441	8.10
STK461=465	9.60
STK463	14.30
SW153	2.74
TA7050P	95
TA7051P	95
TA7063P	2.20
TA7074P	1.00
TA7108P	3.43
TA7120P	2.43
TA7129AP	3.76
TA7130P	1.93
TA7141P	95
TA7146P	4.67
TA7193P	5.67
TA7171P	1.85
TA7172P	1.85
TA7173P	1.85
TA7176P	2.50
TA7202P	4.27
TA7204P	3.77
TA7205AP	3.72
TA7208P	3.40
TA7210P	4.60
TA7222	2.42
TA7223P	3.74
TA7227P	5.98
TA7228P	5.98
TA7310P	2.78
TA7609P	4.39
TA7611AP	2.92
TAA300	58
TAA310	2.83
TAA320	2.00
TAA350A	60
TAA550	55
TAA630	3.90
TAA8400S1	1.96
TAA661B	1.20
TBA120A	80
(A),(S),(AS),(SA).	
TBA120B	1.30
TBA120SB	1.37
TBA120T	95
TBA120U	1.10
TBA395	1.20
TBA396	80
TBA440N	2.75
(TBA1441)	
TBA440P	2.50
TBA480Q	1.50
TBA510	3.00
TBA520(Q)	1.68
TBA530(Q)	1.38
TBA540	1.68
TBA550(Q)	1.58
TBA560Q	1.59
TBA570	1.79
TBA690	1.50
TBA641BX1	3.50
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TBA800	1.62
TBA810AS	1.10
TBA820	1.70
TBA820M	1.25
TBA890	3.94
TBA920(Q)	3.00
TBA950(2X)	3.05
TBA970	4.09

TBA990	1.90
TBA14406	2.44
TCA160	1.20
TCA760	2.30
TCA270SQ	2.50
TCA800	3.10
TCA830	2.44
TCA830S	1.75
TCA900	2.20
TCA910	2.20
TCA940	1.95
TDA440	2.20
TDA1002	1.95
TDA1003A	5.50
TDA1004A	3.35
TDA1006A	2.50
TDA1005	3.60
TDA1010	1.54
TDA1035	4.70
TDA1037	2.95
TDA1044	4.37
TDA1060A	4.44
TDA1062	1.56
TDA1083	1.68
TDA1170S	3.00
TDA1190	3.50
TDA1180	2.91
TDA1200	2.95
TDA1220A	2.12
TDA1270	3.95
TDA1327	1.70
TDA1352B	1.60
TDA1412	1.20
TDA1415	1.40
TDA1470	4.67
TDA1770	4.80
TDA2002	2.80
TDA2003	1.20
TDA2004	2.52
TDA2006	1.78
TDA2010	2.00
TDA2140	5.95
TDA2150	2.22
TDA2190	4.70
TDA2020	4.66
TDA2030	2.80
TDA2521	4.17
TDA2522	2.40
TDA2523	3.40
TDA2524	2.25
TDA2525	3.64
TDA2530	2.70
TDA2532	2.56
TDA2540	3.84
TDA2541	3.84
TDA2560	3.50
TDA2571	2.56
TDA2576	3.75
TDA2576A	3.75
TDA2577	3.25
TDA2581	3.30
TDA2582	2.60
TDA2590	3.25
TDA2591	2.95
TDA2593	2.95
TDA2600	5.30
TDA2610	3.20
TDA2611A	1.95
TDA2640	2.92
TDA2652	3.96
TDA2680	3.40
TDA2690	1.35
TDA3190	2.00
TDA3500	6.90
TDA3560	6.00
TDA3561	6.50
TDA3571	3.75
TDA3950	3.15
TDA4420	4.22
TDA4600	2.95
TDA9503	2.50
TEA1002	3.50
TEA1009	1.37
UPC554	1.34
UPC566H	2.95
UPC575C2	3.40
UPC576H	1.90
UPC587C2	1.60
UPC1025H	2.95
UPC1028H	2.52
UPC1032H	64
UPC1042C	1.56
UPC1156H	4.28
UPC1158H	78
UPC1163H	98
UPC1167C2	94

UPC1168C	1.28
UPC1176C	1.46
UPC1177H	1.56
UPC1178C	1.28
UPC1180C	1.84
UPC1181H	1.62
UPC1182H	2.95
UPC1183H	1.38
UPC1185H	3.66
UPC1188H	2.20
UPC1190G	1.20
UPC1197C	1.06
UPC1198C	84
UPC1200V	1.18
UPC1211V	2.70
UPC1212V	1.34
UPC1215V	1.66
UPC1216V	1.20
UPC1217G	1.13
UPC1218H	1.80
UPC1223C	2.28
UPC1225H	2.00
UPC1226C	1.50
UPC1227V	1.20
UPC1228H	54
UPC1230H	3.95
UPC1238V	1.16
UPC1245V	1.35
UPC1350C	4.15
UPC1353C	1.92
UPC1365C	6.38
UPC1356C2	2.08
UPC1367	2.08
UPC1378H	2.70
UPC1358H	1.88
UPC1360C	2.20
UPC1363C	2.16
UPC1366C	1.84
UPC1368H2	2.15
UPC1370C2	2.58
UPC1382C	1.08
UPC1384	3.78
UPC1447H	58
UPC41C	2.80
UPC5743	38
UPC577H	2.46
UPC585C	1.28
TDA 1011	4.00
11A 4112	75

IC/Transistor equivalent leaflet £2.25 for the pair

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA317	28
BAX13	4
BAX16	8
BB105B	30
BB105G	30
BY126	12
BY127	11
BY133	15
BY164	45
BY176	85
BY179	63
BY182	87
BY184	55
BY199	28
BY206	14
BY210/600	28
BY210/800	33
BY223	90
BY227	28
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX36/600	35
BYX55/600	30
BYX71/600	90
OA47	9
OA90	10
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	5
IN4007	6
IN4146	2
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	20
ITT44	4
ITT2002	11
Y969 – Disc. REP BZX85 30V	
BZY15-24R	1.18
BZY15-12R	1.18

SPECIAL DIODES

SKE 49	£1.09
SKE 5F	£1.19
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COVER PHOTO

Our thanks to THORN EMI FERGUSON Ltd. who provided the photograph of their new TX100 chassis on this month's front cover.

READERS' PCB SERVICE

We have received notification from Readers PCB Services Ltd. (TV) of their intention to close the service down. Stocks of some of the boards that have been available are still held and those interested should enquire (for details see page 389, May 1984).

CORRECTIONS

The suggestion that tuner control units in the Philips G8 chassis (page 433 last month) can be replaced without removing the back is incorrect. Our apologies.

TV Test Pattern Generator Part 1, May. The right-hand half LS393 row counter in Fig. 2 should have been shown as IC3, not IC9. The clear pin of IC15 (pin 1) should have been included – it's connected to the 5V line. In Part 2 (June) BR1 should be shown as type KBL02 and IC2 as type 7805 in the components list.

Digital TV

In this digital age it's perhaps inevitable that TV sets should increasingly use digital techniques. The process started some while back with teletext, sophisticated tuning systems and remote control arrangements. It's taken a major step forward with the introduction of ITT's Digivision receiver in the UK. This carries out all signal processing between demodulators and the video, audio, field and line output stages in digital form.

This calls for considerable extra circuitry of course, though the component count is reduced since most of the circuitry required is contained in six v.l.s.i. chips. The whole operation is controlled by a sophisticated device (type MAA2000) which is referred to as the central control unit. It contains an eight-bit microcomputer (8049), an eight-bit/128 word EAROM (electrically alterable read-only memory), a decoder for remote control commands, a keyboard scanner for front panel controls (maximum 32 keys), a LED channel number display drive, a phase-locked loop to provide tuning at v.h.f. and u.h.f., a crystal-controlled oscillator and an interface section to drive the bus line that links it to the rest of the digital circuitry. The memory's capacity is sufficient to contain the tuning data for up to 30 channels and the factory programmed data for tube drive and timebase control (there's only one preset potentiometer in the set, for h.t. adjustment).

The video signal from the i.f. strip is AD converted by a device called a video coder unit (MAA2100). This also carries out RGB matrixing, beam current limiting, black-level clamping, c.r.t. cut-off control, brightness setting, white balancing and DA conversion to drive the RGB output stages. It works in conjunction with the MAA2200 video processor unit which is basically a digital colour decoder capable of NTSC or PAL operation. Two v.l.s.i. chips are used in the sound channel, an MAA2300 AD/DA converter and an MAA2400 audio signal processor. The luminance signal is handled in 7-bit form, the colour-difference signals in 6-bit form and the audio signals in 14-bit form. The MAA2500 deflection control unit receives 7-bit video and 3-bit bus control information and provides line drive pulses plus field output and EW modulator drives.

This group of six v.l.s.i. chips is complemented by an MEA2600 master clock pulse generator which operates at 17·73MHz (four times the colour subcarrier frequency) and an MEA2900 tuner interface i.c. to complete the Digivision line up.

A sophisticated system such as this tends to be expensive, at least initially with low volume production of the i.c.s. ITT have invested some £20 million in developing the system. It will therefore be used in up-market models to start with.

The introduction of the Digivision Model D1000 raises a number of interesting questions. Is there real advantage in going digital and how long will it be before others follow the same path for example. These need to be considered in the light of the fact that the Digivision system is undergoing considerable development. It's at present at quite an early stage in fact. Future developments already scheduled include the use of line and field stores, also digital horizontal convergence correction and digital geometry correction via feedback from the tube's faceplate. Digital horizontal convergence correction works by stretching the RGB scanning lines. The things that will really make a difference however are the line and field stores.

A field store will make it possible to display still pictures and provide selective enlargement (zoom), also picture-within-a-picture. It will probably be some time however before such a store can be produced at the sort of price that will make it feasible for use in TV sets – other than luxury models. Whilst it's nice to think that such features can be provided, one can't help wondering how much use they would get in practice. The whole point of television surely is to watch programmes as they develop. The line store is a more interesting prospect since it will make it possible to increase the number of lines displayed fairly economically, giving a much improved picture. The plan is to use a 2·2k byte RAM with a one and a half line storage capacity and interpolation to double the number of lines. This calls for 10MHz bandwidth RGB output stages, high resolution tubes and a line output stage able to operate at 32kHz.

The Model D1000, whilst having the advantage of digital signal processing, is unfortunately not adaptable for subsequent addition of these future developments. It seems to have been launched to test the market and gain experience of digital TV set operation in the field. For the present one could say that digital signal processing is a nicety. An analogue receiver correctly adjusted will give as good a display and be a lot cheaper. If and when digital TV chips become cheap, they will come into widespread use. Other semiconductor manufacturers are developing such chips, though ITT's decision in 1977 to go digital has put them ahead for the present. In practice it takes quite a time for technology to reach the point where it's suitable for use in mass-produced domestic products. We've seen in the past the gradual way in which analogue i.c.s have taken over from discrete circuitry in TV receivers. Even now the process is not complete – there are still sets with discrete audio and field output stages for example. It might also have been assumed that the SAWF and ceramic filters would by now be universal, but you still find many a discrete coil in current chassis. Digital TV may become the standard eventually, but not for a good few years.

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TX9 Gain Control 100R	15p
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Thorn 4000 Focus Pot	2.75
Thorn 18Ω 9W (3K5) R752	30p

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Ambersil Ambertron	16oz	1.95
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315MA A/S	10 for 50p	750MA	10 for 65p
500MA	10 for 50p	7A	10 for 50p
1A	10 for 50p	10A	10 for 50p
2.5A	10 for 1.00	20A	10 for 50p
3.15A	10 for 1.00	50A	10 for 50p

Thorn Mains TX 3000/3500	7.50
Thorn Mains TX 8000/8500	10.00
Thorn S.O.P.T 8000/8500	3.50
Thorn Scan TX 3000/3500	6.00
Thorn EHT TX 3000/3500	6.00
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Thorn LOPT 1615	7.25
Thorn LOPT 1590/91	7.25
Thorn LOPT 1690/91	7.25
Thorn LOPT 8000	9.80
Thorn LOPT 8500	9.80
Thorn LOPT TX9	9.85
Pye LOPT 713	10.00
Pye LOPT 725	9.85
Pye LOPT 731	10.18
Philips LOPT G9	8.80
Philips LOPT G11	13.75
GEC LOPT 3113	7.40
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Sanyo LOPT AM-WM-21	6.75
Sanyo LOPT AM-WM-4	7.30
Philips LOPT G8	7.80
Sanyo LOPT (CW21) 4-2751-44700	5.00
ITT LOPT CVC5-9	9.60
ITT LOPT CVC30	8.75
ITT LOPT CVC45	9.75
Baird 8750	10.25
Baird 8752	10.25
Korting AZ9100	10.25
Korting B92-170	10.25
Korting AZ2101	10.25
Korting AZ2103	10.25
Korting ZTR1001	10.25
Siemens V1155	11.75
Siemens V1823	11.75
Zanussi BS2222	10.25
Zanussi BS2223	10.25
Salora FR0057	10.25
Salora FR0029	10.25

300 Mixed Resistors	1.50	10 Spark Gaps	1.00
300 Mixed Capacitors	1.50	10-16 pin Quil IC Socket	90p
150 Mixed Electrolytics	2.00	20 Assorted TV Knobs	1.00
100 W/W Resistors	1.00	10-16 pin Quil to Dil IC Socket	90p
20 Mixed Conv Pots	1.00	100 Mixed Diodes	1.00
40 Mixed Pots	1.50	50 Mixed Mica Washers	65p
20 Mixed Sliders	1.00	300 Mixed Resistors & Capacitors	1.50
40 Mixed Presets	60p	10-16 pin Dil to Dil IC Socket	1.00
20 Mixed VDR & Thermistors	1.00	50 Electrolytics & 50 Capacitors	1.00
20 Mixed Ferrite Cores	50p	50 Mixed Poly Capecitors	1.00
100 Mixed Ceramic Discs	1.00	30 Mixed Neons & Bulbs	1.00
20 Mixed Valve Bases	1.00		

AC128	39	BC172	9	BC559	8
AC131	40	BC174B	23	BC595	8
AC138	40	BC177	24	BCX33	22
AC141K	39	BC182LB	12	BCX34	11
AC142K	38	BC183L	12	BD115	49
AC153	39	BC184L	13	BD131	30
AC176	33	BC187	24	BD132	46
AC176K/ AC128K	93	BC204	15	BD133	59
		BC208	9	BD139	36
AC188	38	BC212L	9	BD140	38
AD142	1.18	BC213L	12	BD144	1.70
AD143	1.08	BC237	12	BD150	50
AD149	98	BC238B	8	BD163	98
AD161	32	BC238L	8	BD201	74
AD162	32	BC250A	15	BD203	78
AD263	1.05	BC251	8	BD204	99
AF127	45	BC252A	20	BD222	48
AF139	38	BC294	37	BD225	52
AF239	41	BC301	32	BD232	50
BC107	15	BC303	31	BD233	60
BC108	15	BC307	10	BD234	60
BC109	15	BC308	8	BD237	55
BC115	16	BC309	14	BD238	65
BC117	21	BC327	18	BD241	59
BC125	26	BC328	18	BD244	85
BC126	23	BC337	17	BD278A	81
BC139	27	BC338	17	BD386	68
BC141	34	BC347	8	BD433	71
BC142	30	BC394	8	BD437	83
BC143	31	BC454	8	BD592	1.20
BC147	12	BC455	8	BD589	1.20
BC148	12	BC456	10	BD677G	1.35
BC149	12	BC460	40	BD707	95
BC153	16	BC463	22	BD708	95
BC1540R	16	BC546	8	BDX10	93
BC154YL	16	BC547	12	BDY20	1.09
BC157	12	BC548	12	BDY82	99
BC158	12	BC549	8	BF137	20
BC159	15	BC557	10	BF153	20
BC171	9	BC558	10	BF154	25

BF167	24	BFR62	28	NKT276	20
BF173	29	BFR81	29	NKT453	1.65
BF179	32	BFR87	25	OT112	1.92
BF180	33	BFR90	1.74	OT121	2.08
BF181	30	BFR91	2.08	R1038	80
BF184	30	BFT42	30	R1039	80
BF185	30	BFT43	30	R2008B	1.40
BF194	16	BFX38	40	R2010B	1.10
BF195	16	BFY50	30	R2030	70
BF196	16	BFY51	34	R2265	1.30
BF197	15	BFY52	34	R2305	80
BF198	19	BRC116	1.50	R2322	50
BF199	15	BRC1693	1.43	R2443	25
BF223	18	BU105	1.00	RCA16446	30
BF224	19	BU126	1.10	RCA16599	1.25
BF238	20	BU207	1.05	RCA16600	1.40
BF240	9	BU208	1.15	RCA16799	1.13
BF241	21	BU208A	1.15	RCA16800	1.42
BF255	10	BU326A	1.30	RCA16802	1.38
BF256S	20	BU407	1.70	S1299	2.25
BF257	28	BU408	2.76	S28000	1.25
BF259	28	BU500	2.30	S6080A/B	3.50
BF271	25	BU526	2.46	T6050V	1.30
BF274	11	BU807	2.94	T6052V	1.30
BF337	29	C1129	9	T9003V	1.25
BF338	34	C1172B	9	T9010V	1.45
BF355	40	E5386	54	T9053V	1.30
BF362	50	E9003	28	T9054V	1.00
BF391	21	E9005	25	T9039V	1.10
BF394	16	ME0404	10	TIC45X	50
BF422	47	ME0412	10	TIC46	48
BF423	53	ME6002	10	TIC106C	40
BF450	43	MJ2501	2.36	TIP29	42
BF453	53	MJ3001	2.21	TIP30	42
BF458	37	MJE182	47	TIP31	35
BF459	40	MJE340	50	TIP32	43
BF461	59	MJE520	50	TIP33	61
BF556B	35	MJE2955	1.40	TIP41	42
BF596	15	MJE3055	1.50	TIP42	45
BF694	16	NKT241W	8	TIP110	61
BF757	62	NKT241G	8	TIS91	25
BFR52	31	NKT241Y	8	ZTX550	30

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BRC3064	1.00	SN76023N	1.80	TBA540	1.00	TDA2030	2.10
BRC/M/200	1.00	SN76033N	2.00	TBA550Q	1.82	TDA2522	2.10
BRC/M/300	1.00	SN76115	2.00	TBA560C	1.50	TDA2530	2.61
CA3060	1.58	SN76131N	1.58	TBA641	2.05	TDA2540	3.50
LM1303P	1.48	SN76226N	1.25	TBA651	2.50	TDA2560	3.50
ML231B	2.20	SN76227N	1.00	TBA720A	2.49	TDA2581	3.00
ML237B	2.00	SN76530P	1.30	TBA750	2.20	TDA2591	1.96
ML239B	2.86	SN76622N	1.00	TBA800	1.62	TDA2611A	1.95
MC1327AP	1.25	SN76660N	80p	TBA810S	1.00	TDA2640	2.90
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MC1455P	18p	SN76744	1.92	TBA920	2.08	TDA3560	6.00
MC14516BCP	60p	TA7117P	1.00	TBA950	1.95	TDA9503	2.90
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SL432A	1.80	TBA120C	1.20	TCA270CQ	1.05	MC14429P	4.50
SL1430	2.50	TBA120CQ	70p	TDA1004A	4.00	MC14514	5.00
SN15846N	60p	TBA120S	70p	TDA1035T	3.50	UA758PC	2.50
SN74123N	65p	TBA120U	1.00	TDA1037	2.72	UA1008A	2.66
SN74154N	1.40	TBA395	1.00	TDA11705	1.50	ULN2165	1.30
SN76001N	1.40	TBA480Q	1.40	TDA1200	2.42	ULN2216A	1.25
SN76110N	1.14	TBA510	1.90	TDA1270	2.76	UPC1365C	5.75
				TDA1327	2.53	SC9488P	1.40
						SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
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Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn 3/3K5 ex equip panels untested

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IF	1.75
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Conv. 3K5	3.75
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Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1.75
Thorn 3K5 PSU bottom board PC206 new	2.75
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Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 350+20+148+1K5+317	1.40
Thorn 6+1+100	92p
Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

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220+47	350V	65p
200+150+50	350V	80p
200+200+100	325V	54p
32+32+16	275V	52p
200+200+100+32	350V	70p
100+50+150	350V	58p
400+400	200V	72p
32+32+16	350V	52p
200+32+300+100	350V	70p
225+25	350V	50p
200+200+100	350V	70p
200+100	325V	65p
200+100+100+50	350V	60p
200+200+100	350V	55p
200+200+75+25	350V	80p
50+50+8	300V	55p
100+50+100	350V	55p
100+150+50	350V	55p
2500+2500 (Thorn 8K)	63V	1.20
150+150+100	300V	1.80
200+47	250V	65p
500+500 175V Thorn TX9		1.00
175+100+100 350V Thorn 3K5		2.25
400 400V Thorn 9K		2.50
470 250V Philips G11		1.50

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 70V Thorn 3K	1.00
50MF 275V	50p	1500MF 100V	1.05
100MF 150V	65p	2000MF 30V	50p
100MF 250V	70p	2200MF 40V Thorn 4K	95p
100MF 450V	75p	2200MF 63V Philips G9	1.25
220MF 400V Thorn 9K	1.30	2500MF 35V	65p
220MF 450V Thorn 4K	1.30	2500MF 40V	65p
400MF 350V Thorn 8K	1.00	3000MF 30V	65p
800MF 250V Print type	80p	3300MF 16V	50p
800MF 250V	70p	3300MF 25V	60p
		4700MF 16V	72p
		4700MF 40V	75p

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC8 On/Off Switch	65p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2·5A Push to make on/off switch	15p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BR303	46p	IN5254B	8p
BT106	1.50	IN5349	14p
BT116	1.00	IN5400	12p
BT119	2.56	IN5401	12p
BT120	2.82	IN5402	14p
BT151 650	1.00	IN5404	12p
BY127	12p	IN5406	16p
BY188	16p	IN5408	16p
BY204	26p	IS025	8p
BY206	16p	IS131	8p
BY207	16p	IS1658	8p
BY208/800	38p	MR854	35p
BY223	95p	SKE1/02	20p
BY225	1.20	MCR106/1	1.00
BY227	28p	MCR406	35p
BY298	22p	2N4444	1.50
BYX22/400	30p	Y827	80p
BYX55/600	30p	Y969	75p
BYX71/350	80p	ZX150	12p
BZV15 C12R	1.16	OA91	5p
BZV15 C24R	1.16	MCR106/7	1.00
IN60	8p	MCR106/8	1.50
IN2070	8p	TD3F800H	2.80
IN4001	4p	TD3F800R	3.00
IN4002	4p	BY255	30p

Electronic Circuit Breaker

Ged Whitney, G8RSI

Some time ago I had the misfortune to encounter that bane of all service engineers' lives, the phantom fuse blower. The set in question was a Tandberg CTV3 and the fault was incredibly intermittent – the mains and/or h.t. rail fuses would blow at odd times irrespective of temperature or the time the set had been on test. At last, after a small fortune in fuses and near mental breakdown after replacing all the more likely parts, the fault revealed itself. I went to answer the phone – downstairs from the workshop – when "bang"! The set had failed in a big way . . . Curiously, the owner was on the phone at the time.

For Tandberg fans everywhere, the cause was the 0·91μF line scan correction capacitor C532 (of course). I also had to replace the line output transistor Q526, the mains bridge rectifier diodes CR701-4, the surge limiter resistor R702, the chopper transistor Q735, one of the chopper driver transistors Q734, the power supply efficiency diode CR735, the mains fuse F701 and the 230V h.t. line fuse F727.

During a similar tussle with a TX9 I decided to be smart (?) and use my G8 method. This consists of a 22Ω or 30Ω 10W wirewound resistor connected across the fuseholder in question. It works very well – with G8s. Splat! went the 22Ω resistor, hump! went the set, and I retired for a good strong brew.

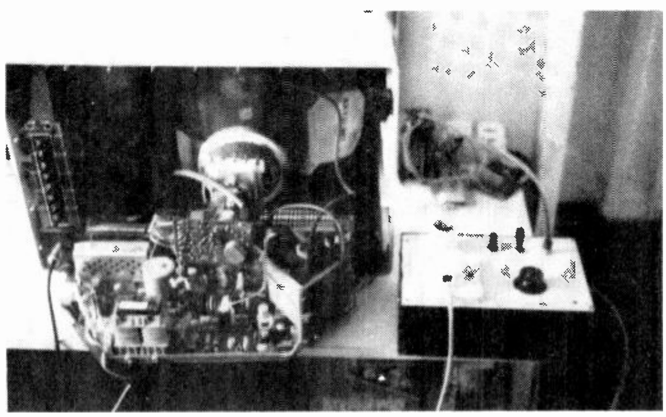
The TX9 next devoured a 2A thermal cutout. I was going through the replace the obvious, ditch the rest then hang yourself routine when I got around to replacing the line driver transistor. Bingo! One more cured, and professor Quatermass spared a phone call.

Circuit Description

To assist with such problems, the circuit shown in Fig. 1 was devised. T1 is a current sensing transformer whose output is fed to a voltage-doubling rectifier (D5-6) whose output is in turn applied to a voltage comparator stage (of sorts) based on Tr1. When the voltage at the slider of VR1 exceeds the forward voltage across D7/8 and the base-emitter forward voltage for Tr1, i.e. approximately 2V, Tr1 conducts. As a result Tr3 and, by regenerative action, Tr2 switch on. They hold each other in the conductive state until the reset switch S1 is closed to remove Tr2's base-emitter bias. With the switch circuit Tr2/3 in operation, Tr4 conducts to operate the relay. The latter removes the supply to the set, lighting the indicator instead. The use of the regenerative switch ensures that the circuit is held on when the excess current through T1 ceases.

Construction and Use

The relay is not critical. A suitable type is the RS 348-784 (two pole changeover with 475Ω coil). The current sensing transformer consists of a Philips G8 heater transformer which, for the prototype, was rescued from the bin . . . The 6·3V secondary winding was completely removed – it can be sawn off using a hacksaw or, as in my case, the C type cores can be removed if loose (they fell



The circuit breaker in use with a Thorn TX9 chassis.

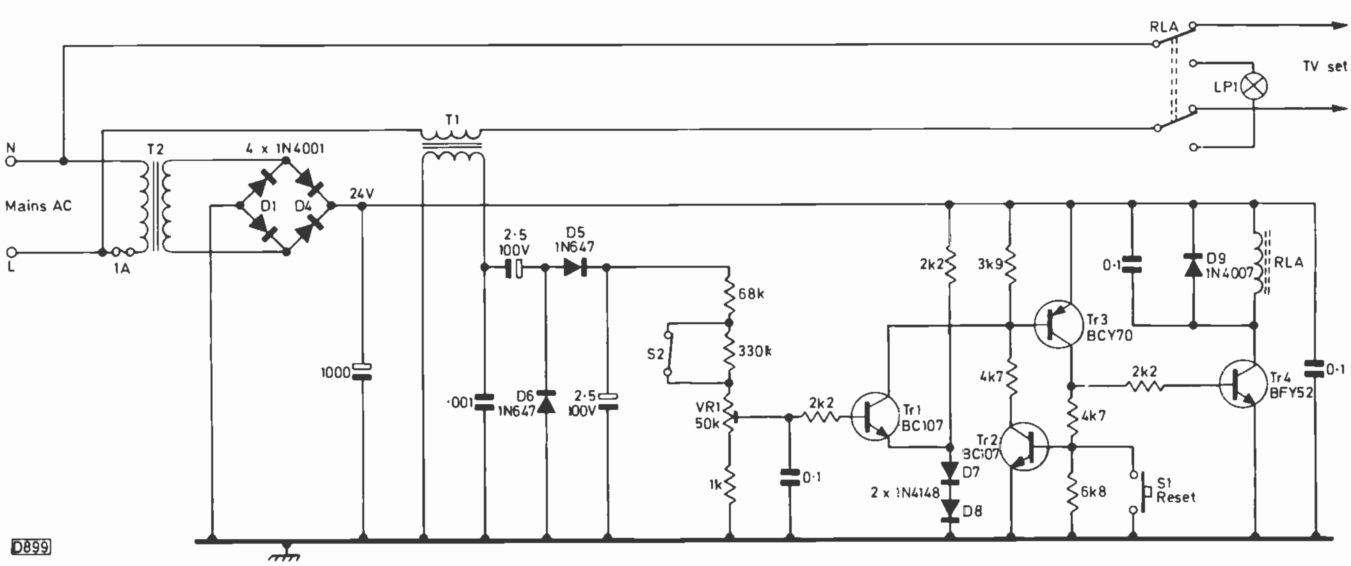


Fig. 1: Circuit diagram of the circuit breaker. Mains transformer T2 has an 18V 1A secondary winding.

out inside the set!). The original primary winding is retained to feed the voltage doubler circuit. The new sense winding consists of 14 turns of 7/36 PVC wire wound close over the outside of the retained mains winding. When complete, the whole core assembly can be secured with epoxy adhesive and held in a vice overnight. Construction of the unit is not critical though the usual safety precautions should be taken, i.e. no exposed live parts. Alternative transistor types could of course be used.

With VR1 and its series resistors of the values shown, the maximum capacity is some 300W. Calibration was carried out using various sized bulbs, calculating the trip current from these. The setting varies from chassis to chassis of course. Set VR1 so that the circuit breaker just trips, then back it off a bit. The range at the high current end can be increased by opening S2 to reduce the voltage available at VR1. A three-way switch with extra resistors could be used for greater flexibility. The limiting factor is the relay's contact rating (10A with the suggested relay).

All at Fours and Sevens

Les Lawry-Johns

Have you ever thought about the numbers four and seven? Frankly, I'd never given them a thought until the other day, when a series of sets came in and the coincidence left me wondering. It's not every day that we're kept so busy at present however, so we rolled up our sleeves and prepared to do battle.

The KT3

The first set in line was a Philips KT3. It was reported not to work at all. So we dived straight at the right side power board and accused the 4·7Ω wirewound surge limiter of being open-circuit, thus removing the supply to the chopper. It was and a new resistor put things right without further delay.

The 9800

The second set was an Ultra 6749 (Thorn 9800 chassis). Apart from a degaussing click when it was first switched on there didn't seem to be much happening. So we asked the mains rectifier thyristor whether it was being supplied at its anode. It was. So the MR510 series diode was o.k. There were no signs of life at the other two legs of the thyristor however, and this led us to suspect the start-up circuit. We looked at the upper power board where the start-up circuit, transistor VT810 etc., lives. The start-up pulses are fed to the thyristor via R814 on this panel. R814, 470Ω. It was open-circuit of course, replacement restoring normal working.

Fancy That!

The next one began to make me think. It was a Bush set (Rank A823 chassis) with a faulty tripler. It had damaged the associated chassis-connected resistor. It's value? 470Ω. Then we had an ITT set, CVC5 chassis, suffering from poor focus. This was cleared by replacing the resistor that feeds the focus stick. Value? 4·7MΩ.

An amplifier suffered from short-circuit 2N3055 output transistors. As a result the emitter resistors had been damaged. 0·47Ω. I was afraid to lift the old Thorn 1500 on to the bench because I knew without a shadow of doubt what the cause of the loss of sync was going to be. R44 of course: 47kΩ.

Voodoo Numbers

While I was glad that the jobs were all simple for a change, I was wondering when I'd encounter something without these voodoo numbers being involved.

So this chap struggled in carrying a CVC9. "Ah ha!" I thought. Tuner selectors no doubt. It wasn't. The problem was no results. We found that the h.t. fuse feeding the line output stage had blown. Naturally our first check was on the boost reservoir capacitor under the line output transformer. It was short-circuit. 0·47μF . . .

The Ferguson TX90

We haven't encountered many of these little sets so far. This one came in with the complaint of very poor sound. The nature of the fault suggested that the demodulator coil L104 was way off tune, and the presence of a 390pF polystyrene tuning capacitor in parallel with it was cause enough for us to replace this item. The sound then boomed out loud and clear, with only a trace of buzz which a touch on the core of L104 cleared.

Whilst looking at the circuit my eye was caught by the RGB output stages. Each transistor has three parallel 47kΩ resistors as its load, i.e. there are nine of them in this part of the circuit alone. There are four 47kΩ resistors in parallel in the boost regulator circuit, also four 270Ω resistors in series. The field output stage bias is provided by four 6·2kΩ resistors in series. We're told that this is all in the interests of reducing the total number of different components required in order to keep within the capabilities of the production line equipment. At least the equipment doesn't insist on components in the 47 series . . .

Mr. Neck Pain

At last the numbers game seemed to have come to an end. A rather strange gentleman next brought in a Pye CT218/1 (717 chassis). Although he was a strapping big fellow he started on about himself at great length, in this irritating sing-song voice, until I abruptly asked him what the hell was wrong with his set.

"Ah yes. I had trouble carrying it in you see because of my bad back. Haven't been to work for a long time because of it. Must see someone about it but I can't afford it. So I'm hoping the repair won't cost too much because my children will be visiting me this weekend and would like the television. My wife left me a couple of years ago, so I only see them every other weekend. Don't know why she left me. I've always worked hard. I'm supposed to be building a wall for this chap but my back won't let me. He keeps on about it . . ."

"Could I have your name please?"

"Oh yes. It's Nick Payne. That's right, Nick Payne. I told this chap that I couldn't build his wall this week. He got quite nasty about it. Said he'd been waiting for six months. But I can't help it if my back's bad.

"Do you build walls and things for a living then?" I asked, like a fool.

"Oh no. I'm a railway guard. Just do building work in my spare time. When I can that is, but I can't when my back's playing up."

"Well now, what's wrong with the set?"

"Well it sort of breathed a few times, then it went off. When I say breathed, it sort of fluttered – like it's been doing each time before it blew the fuse. I kept replacing the fuse, then put a stronger one in. Now it doesn't blow the fuse, it doesn't go at all, if you see what I mean Mr. Lorryjohns.

To cut a long story short he wanted the set there and then because of his children. So I lent him one for the weekend.

"Thank you Mr. Lorryjohns. Now could you carry it to my car? Because of my back you see."

The 18in. Pye

At last I was left to battle it out with the 18in. Pye. This and its close relative (Philips 570) are quite well known to me, so I didn't have any real misgivings. I checked the voltage-regulator thyristor with the ohmmeter. No shorts, but the 3·5Ω wirewound surge-limiter (part of the rear resistance assembly) was open-circuit. Check carefully for h.t. shorts. None. So I fitted a 3·9Ω, 17W wirewound across the defective dropper section, then checked the mains fuse. This should have been a 1·6A anti-surge type. It was 3·15A. I decided on a middle course and fitted a 2·5A fuse.

Crossing my fingers I switched the set on. It behaved quite nicely, and there was just over 150V at the end of the dropper. Then the over-voltage glow switch started to flash, indicating that the h.t. was pulsing. Time to switch off. While I was still looking in the back however there was this brilliant flash. Nearly blinded me as the mains fuse blew to pieces. Now there are only two things that commonly perform this caper. One is the mains filter capacitor, the other a shorted bridge rectifier diode. The filter was in order but two of the diodes in the bridge were short-circuit. Two new BY127s and a 1·6A fuse were fitted. Check again for shorts, avert eyes and switch on.

The set once more came on nicely enough. Then started to pulse. Next the fuse blew. This time the line output transistor was short-circuit. I replaced it with a BU208A (for convenience), and for good measure also replaced the BT106 thyristor. "That'll do it" I thought. Thought wrong. The glow switch still flickered as the h.t. pumped.

I checked the resistors in the thyristor control circuit, also one or two suspect capacitors. All perfect. But then the set did start up perfectly. So I wouldn't find a faulty part no matter how hard I looked. Something then stirred in my sluggish mind. I looked at the BR101 that triggers the thyristor. A gate controlled switch. Search for but can't find one. Why? The reason I don't keep something in stock is usually because time has proved that something else does the job. In this case a BRY56. Check connections and fit it. Bull's-eye!

The set behaved impeccably and now waits for Mr. Pain in the Neck to return my loan set, which so far he hasn't done. Perhaps he can visualise his bill.

Letters

RECEIVER NOISE

In "All About Field Strength" (April) it's suggested that a diode envelope detector produces a better signal-to-noise ratio than a synchronous demodulator. This doesn't agree with accepted theory nor with my own findings during research on teletext distortion. A synchronous demodulator effectively rejects one of the quadrature noise components, reducing the noise output power by half without affecting the signal.

With reference to the intermodulation distortion that occurs under overload conditions, I can confirm that forward acting a.g.c. systems can aggravate the situation. This causes a shift in the 6dB point on the i.f. response curve relative to 39·5MHz. As Brown and Glazier show in Telecommunications Volume 1 (pages 69-70), with a vestigial sideband signal this increases the second harmonic distortion.
G.E. Lewis, Senior Lecturer, Radio and TV Courses,
Department of Electronics and Electrical Engineering,
Canterbury College of Technology.

Harold Peters comments: Mr. Lewis is right of course – synchronous demodulators themselves are less noisy than diodes. It's the sets in which they are used that are noisier, as I was careful to say in my article. Customers complained about this. Whilst at Pye Ltd., Lowestoft in 1974 I measured the post-detector signal-to-noise ratio of close on a hundred sets of our own manufacture, together with a score from other UK and Japanese manufacturers. Fig. 1 in my article is based on the results. It ties up with subjective evaluation by our field liaison men, who used the then standard BREMA five-point impairment scale.

What came of it all? Nothing really. The diode has now vanished from the detector scene, and the once critical public seems to be quite content with the quality displayed by second generation copies seen through a well worn VCR.

REDIFFUSION Mk. 1 CHASSIS

The question of teletext lines on the picture with sets that use the Rediffusion Mk. 1 chassis was mentioned in Service Bureau last month. The official modification to overcome this problem is as follows. Change C612 from 16μF to 47μF (63V wkg) and R607 from 1·5kΩ to 3·3kΩ (0·5W 5%). These components are in the field output stage flyback damping network and are mounted on the output transformer (T601). Change R433 (15kΩ) to 12kΩ (0·5W 5%). This resistor is in the field oscillator timing network, on the timebase panel.

The thermistor mentioned (TH430) is in my experience a very common cause of ragged verticals and line flickering with these sets.
R. T. Rees, Senior Engineer, Just Rentals,
Tonypandy, S. Wales.

ALTERNATIVE GCSs

One of the problems those who handle Sony KV1810s have is that the gate-controlled switch devices used in chopper and line output stages have to be replaced from time to time. They're expensive, costing about £10 each. We've recently come across a satisfactory replacement that's a lot less expensive (about £3). This is the SG264A gate-controlled switch used as the diode modulator driver in the Sony KV2704 (circuit reference Q808, part number 8-726-420-00). Sony don't recommend this as a replacement but we've found it to be one hundred per cent satisfactory – in fact we've been using it for over eighteen months without a single call back!

Our discovery of this solution to the problem has been a great help to us as we are only a small firm but have quite a few KV1810s out on rental. This tip may help other small shops in a similar position.
A. Christou,
London N21.

THE GREAT PLUGTOP MYSTERY

I think we poor, hard pressed engineers sometimes tend to miss the obvious. Consider the mechanical arrangement of the 13A plug top. The live lead is taken to one side of the fuse mounting bracket while the neutral goes straight to its pin. This gets quite a considerable waggling each time the plug is inserted and removed. The live connection on the other hand is mechanically insulated by the fuse and holder. Solved!
G.C.C. Wride,
Cheltenham, Glos.

SPECTRUM NO COLOUR

The no colour problem mentioned in the letters column last month when using the Sinclair Spectrum microcomputer with Grundig receivers also occurs with the Sony Model KV1820. In this case changing the value of R333 from 3·3kΩ to 4 7kΩ provides a complete cure.
Brian Francis, Tech. (C.E.I.),
Plympton, Plymouth.

FOR DISPOSAL

I have for disposal a Philips Videomatic TV set Model 17TG306U which incorporates v.h.f./f.m. radio. It seems a pity to scrap this set, which is in excellent condition and working order. Anyone wanting the set will have to collect it.
L. Kinane, 38 West Lea Avenue,
Harlow Hill, Harrogate, N. Yorks.

UNSOLDERING COMPONENTS

Mr. Treeby (letters, May) and others may be interested in the method used some years ago in the service department of one of our leading setmakers for removing components from a printed board, though not all service engineers may agree with doing the job in this way. The print side of the board was sprayed with a non-stick oil-based fluid from an aerosol – a Duckhams product. I've been unable to obtain this but find Three-in-One oil satisfactory – brush it on, taking the oil across the board to the nearest edge. You then melt the solder of the component to be removed, blowing the solder off with a compressed air jet. Lift the component out, clean off the oil and loose solder with a cloth and brush, brush over with grease removing solvent spirit, blow off dry, examine for any loose solder particles, then fit the new component.

The ITT CVC9 chassis' i.f. board, with those edge connectors, could be changed in four minutes. A very good method for removing i.c.s, but it won't work with another well known setmaker's double-sided print boards. One last point: put a piece of cardboard down wind of the job – those molten solder blobs go a long way.
G.C. De Fraine,
Hartley, Nr. Dartford, Kent.

Video Recording on Tape

Eugene Trundle

Magnetic tape is far from being ideal as a recording medium for moving pictures. Compared with the relative simplicity of the first recording system, cine film, the practical difficulties involved in getting TV pictures on to and off tape are great indeed. The evolution of video recording techniques has been long and hard, the performance currently available from domestic VCRs and their professional counterparts representing a magnificent engineering achievement. One of the greatest hurdles in the path of the pioneers was the problem of accommodating the large bandwidth of a video signal within the constraints of the tape system. It's upon this aspect that we shall concentrate here.

For a reasonably detailed picture that's free from shading effects, a wide video bandwidth is required. Low frequencies define large objects, "backgrounds" and the overall brightness of the televised scene, the high frequencies representing sharp edges and fine detail. For a broadcast quality picture a bandwidth extending from virtually d.c. to over 5MHz is required, but no domestic tape system approaches the upper limit of this range – about 2·5MHz is the norm for the luminance component of the signal, this being extended by a further 1MHz or so in some machines when a monochrome signal is being handled.

This reduced bandwidth is necessary to limit the volume of tape required per hour of programme and keep the size of the cassette within reasonable limits. The less information recorded, the less storage space required, though it's possible to squeeze a greater playing time from a given size of cassette as the V2000 format and the VHS-LP mode show.

Tape Limitations

Having limited the luminance bandwidth we're left with a second, much more difficult problem that relates to the nature of the head-to-tape interface and the magnetic signal transfer system we're using. The recording head is of course inductive, which means that its impedance rises with frequency. If a 1V drive is required at 25Hz, a signal drive of many kV would be required at 2·5MHz to achieve the same flux density in the tape! This is a gross simplification, but it makes the point.

The same law works in reverse for playback. The playback head's output is proportional to the *rate of change* of the flux density in the tape. For an equal-energy recorded signal spectrum, the output from the head will be directly proportional to frequency: it will halve with each halving of the signal frequency recorded on the tape. Hence the well known 6dB/octave curve shown in Fig. 1.

Our 25Hz-2·5MHz example embraces almost 17 octaves (an octave is a doubling of frequency). Thus at 25Hz the output will be at $17 \times 6 = 102$dB down on the level at 2·5MHz. Now 100dB is a voltage ratio of 100,000:1, so even if we get an output of 1V from the head at 2·5MHz the output at 25Hz will have dropped to 10μV. One of the basic rules of a tape recording system is that 60dB or so is the best signal:noise ratio obtainable. So our 10μV, 25Hz signal will be buried under 1mV of noise – back to the drawing board!

Modulation

To make video recording practical, a carrier must be used for the signal – this is a common enough solution where the initial signal is not suited to the medium through which it's to be passed. If we use a carrier at say 4MHz, the upper sideband with our 25Hz-2·5MHz signal will be 4-6·5MHz, which is less than an octave. A full double-sideband signal represents 1·5-6·5MHz, which is just over two octaves. We've thus overcome the octave problem, and by using record/playback equalisation something approaching a flat overall response can be achieved.

What sort of modulation system should we use? The main possibilities are f.m., a.m. or p.c.m. (pulse code modulation). The latter two can be quickly dismissed. A.M. would be impossible due to its sensitivity to noise and the need for an a.c. bias waveform to overcome the nonlinearity of the tape/head transfer characteristic. P.C.M. would be ideal, but the very high bit rate required for good definition pushes the bandwidth requirements way beyond the capabilities of a domestic system, though professional digital VCRs have been demonstrated. This leaves f.m. as the obvious choice – with a lot going for it! Above a certain threshold, an f.m. system has a much greater immunity to noise than an a.m. one; and when it comes to recording a second signal (chrominance) simultaneously, the f.m. carrier provides an ideal source of a.c. bias for this.

Having settled upon the use of f.m. for our video modulation, we must optimise the noise performance by introducing a pre-emphasis system. The higher video frequencies occupy a disproportionate bandwidth in relation to the energy they contain: by boosting them prior to modulation and then restoring the balance by depressing them after demodulation, we get a useful reduction in overall system noise. Standard v.h.f./f.m. radio transmissions use this technique. It's taken a step further in most audio and video recording systems by using nonlinear pre-emphasis, i.e. the degree of h.f. boost is made proportional to signal amplitude – this is the basis of Dolby and similar noise-reduction systems.

FM Parameters

Returning to our f.m. system, we next have to decide upon the parameters to adopt – carrier frequency, deviation and modulation index. Each of these has to be a compromise – cost, performance and tape economy are the trade-off factors. We'll take carrier frequency first.

To reduce the octave range, the higher the frequency the better. For a given writing speed (video head to tape velocity) however there's a definite upper limit. At the point where a recorded signal cycle on the tape is equal to the head gap, the output falls to zero. This is known as the extinction frequency (*f*ex). In current domestic VCRs the head gap is about 0·3μ and with a writing speed of 5m/sec *f*ex occurs at about 15MHz. This may seem to be very acceptable, but at 0·5*f*ex (7·5MHz in this case) the response is 3dB down on the peak output (see Fig. 1) and is falling rapidly. Other losses occur at these higher frequencies – due to tape self-demagnetisation, head losses, gap effect, etc. – and these all combine to prevent a usuable response much beyond 0·5*f*ex. So the band we have available extends to say 8MHz. If we set our f.m. carrier at half this frequency, about 4MHz, there will be equal room for upper and lower sidebands.

At this point let's consider some basic aspects of frequency modulation. The unmodulated carrier *f*c sits centrally in the allocated channel, the modulating signal *f*m being used to vary the carrier's frequency. The required result is obtained by employing a voltage-controlled oscillator whose maximum deviation is the amount by which the carrier frequency can be shifted by the modulating signal. This maximum deviation varies with different applications. For CB radio it's 2·5kHz; for v.h.f./f.m. radio broadcasting it's 75kHz. With the VHS video recording system the maximum deviation is 1MHz. It's worth emphasizing the difference between deviation and swing. Because an audio signal contains positive and negative excursions, it will move the f.m. carrier above and below the centre frequency. Hence the total swing is twice the deviation. For a video recording however, the centre frequency corresponds to the sync tip level. So the video signal can move the carrier frequency in one direction only – in practice upwards. Deviation and total swing are in this case the same.

Maximum deviation occurs when the modulating signal is at maximum amplitude – "peak programme" for sound systems, peak white for video. Thus deviation is proportional to the amplitude of the modulating signal. If this amplitude changes rapidly – due to high frequencies in the modulating signal – the rate of deviation will also be rapid. This has considerable effects on the sideband structure, as we shall see.

Modulation Index

The relationship between the modulating frequency and carrier deviation is known as the modulation index (M). Put simply, M = carrier frequency deviation/modulating frequency. In an entertainment channel the modulating frequency is continually changing with the sound or picture, so the modulation index is also changing. It will be at a minimum at the highest modulating signal frequency. As with deviation, the modulation index varies with

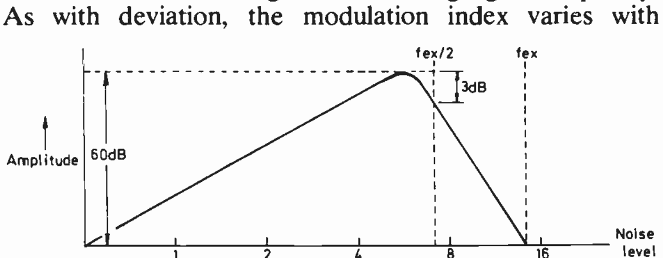


Fig. 1: The 6dB/octave curve, a plot of playback head output against frequency for an equal-energy tape recording.

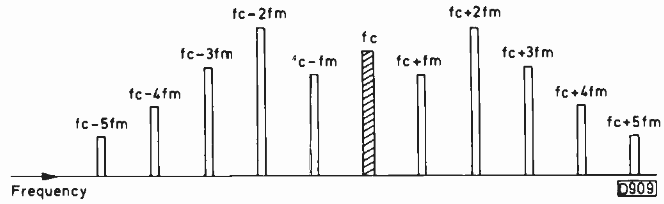


Fig. 2: F.M. system sideband distribution. The relative amplitudes of the individual sidebands depend on the nature of the modulating signal and the modulation index.

different systems. For v.h.f./f.m. radio the highest audio modulating frequency is 15kHz and the deviation limit is 75kHz. Putting these figures into our equation gives 75/15 = 5, the minimum modulation index for this system. With our video recording system the highest signal frequency is around 2·5MHz while the maximum deviation is 1MHz. So M comes out at 1/2·5 = 0·4. We shall soon see the significance of this low minimum modulation index.

Sidebands

All modulation systems generate sidebands. Their extent and nature depends on many factors. Simplest to understand is an a.m. system, in which just one pair of sidebands is produced by a modulating frequency, spaced at each side of the carrier frequency by a distance corresponding to the modulating signal's frequency. When more than one modulating frequency is present, corresponding additional sidebands are produced. A sideband group is thus formed as a symmetrical cluster at each side of the carrier frequency. The sideband limits are set by the highest modulating frequency present – for double-sideband transmission, as used for MW radio etc., the total bandwidth is 2*f*m.

With frequency modulation the situation is more complex. An f.m. system generates an infinite number of sidebands, stretching off into the distances at each side of *f*c, spaced at *f*m intervals from the carrier (see Fig. 2). In practice the number of these sidebands is limited by the bandwidth and signal/noise ratio of their path. What's of significance however is the number of these sidebands required to recreate the original signal adequately after demodulation. This depends on the energy carried in each individual sideband, and this energy distribution is governed by the modulation index. At M = 5 (the v.h.f. radio case) we need a total of 14 sidebands (*f*c ± 7) for acceptable reproduction, so the receiving bandwidth (the radio's i.f. channel) must be about 200kHz. That the energy distribution changes with M is demonstrated by considering a modulation frequency of 7·5kHz. Here M = 75/7·5 = 10, calling for 26 sidebands for adequate reception, again accommodated within a 200kHz window.

Sidebands beyond the "significant" range contain negligible energy and are discarded. For calculation of a practical system bandwidth, a general rule of thumb is B = 2 (*f*d + *f*m)Hz, where B is the bandwidth, *f*d the maximum deviation frequency (carrier displacement) and *f*m the maximum modulating frequency. This represents a compromise between channel width and noise on the one hand, and theoretically perfect reception on the other.

When M is reduced below 0·5, the maximum deviation becomes less than half the maximum modulating frequency and virtually all the sideband energy is concentrated in the first sideband on each side of the carrier frequency. This suits our VCR scheme well in view of the limited bandwidth available. From the formula given

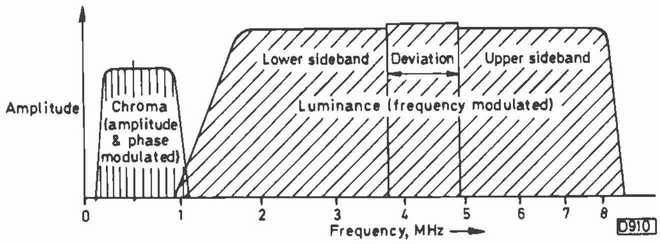


Fig. 3: Typical colour-under VCR recording frequency distribution.

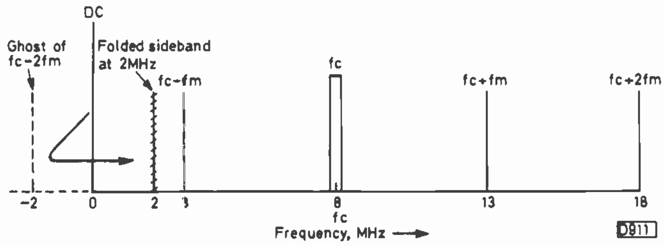


Fig. 5: Formation of a folded sideband, drawn to show the effect of a high-amplitude 5MHz signal modulating an 8MHz carrier.

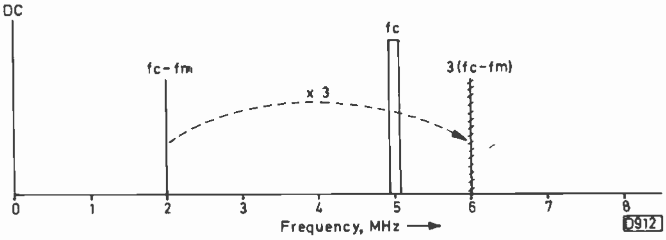


Fig. 6: Harmonic distortion of a modulated carrier: the third harmonic of the first lower sideband here gives rise to an interfering signal at 6MHz (fc 5MHz, fm 3MHz).

above we get B = 2(1 + 2·5) = 7MHz, i.e. a luminance bandspread of 3·5MHz each side of *fc*. This is a spread of sidebands from say 1MHz to 7MHz, resulting in the familiar diagram shown in Fig. 3, where the f.m. deviation range is given against amplitude.

The reality is shown in Fig. 4. This is a spectrum analysis of the off-tape f.m. signal for a standard colour bar signal. It shows the f.m. deviation range, with the lower luminance sideband sinking to zero at around 1MHz and, on the left, the "chroma cluster". Note that a colour bar signal is less "busy" than a test pattern or a detailed picture. The latter would give rise to more "meat" in the sidebands.

Folded Sidebands & Harmonic Interference

When *fc* is relatively low, it's important that no significant sideband spacing exceeds *fc* itself. If this should happen the lower sideband will go below zero frequency. The energy in it can't just disappear – it will fold back into the real spectrum, sitting at a point representing the mirror image of its "ghost" – see Fig. 5. Another possible source of spurious sideband energy is harmonic distortion of the carrier waveform. A second harmonic of the carrier will appear at 2*fc*, modulated by *fm*. The sidebands thus generated, especially 2*fc* − *fm*, will fall within the system bandwidth. Fortunately odd harmonics of *fc* give rise to sideband components beyond the spectrum of interest – which is as well in view of the basically squarewave output obtained from the i.c.-based and astable modulators used in VCRs. Third harmonic distortion of the first order lower sideband will give rise to a component at 3(*fc* − *fm*). This can beat with *fc* – see Fig. 6.

Such spurious sideband effects will, if present, cause beat patterns or moiré effects on the reproduced picture.

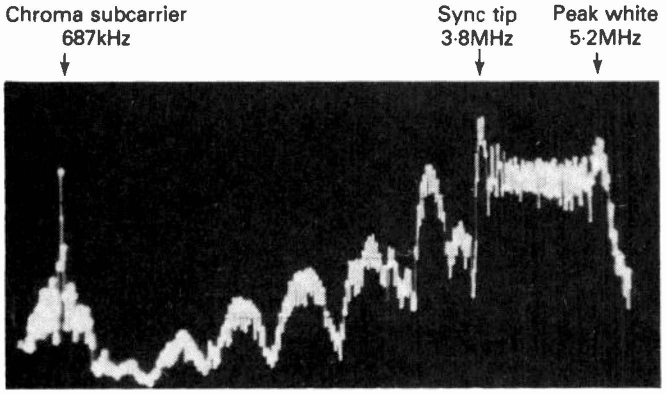


Fig. 4: Luminance and chroma signals and sidebands for colour bars on playback. This is for the Betamax system but others are similar. The modulator's deviation range can be clearly seen, along with the lower sideband energy distribution. The highly saturated colour bars give rise to considerable energy around the 687kHz down-converted colour subcarrier. Photo courtesy Sony (UK) Ltd.

Increasing the carrier frequency solves many of the problems associated with sideband beats, because the interfering signals move away from the carrier (and thus out of the practical passband) at twice the rate at which *fc* is increased. Professional VTRs use the "high-band" technique to take advantage of this. They also avoid in-band beat effects by using the heterodyne technique for f.m. modulation and demodulation. Typically the modulator takes the form of a voltage-controlled oscillator running at 50MHz. Its output is mixed with a 60MHz CW source to produce, after filtering, a very "clean" 10MHz f.m. carrier. During replay the 10MHz carrier and its sidebands are mixed with a 60MHz CW carrier to produce an f.m. signal at 70MHz. Filters before and after the 70MHz demodulator ensure the absence of beat effects. This elaborate system is capable of very linear and distortion-free operation.

No such luxuries as high-band operation and heterodyne f.m. can be afforded with a domestic machine however. These must depend on baseband frequency limitation and careful design of the filters and modulator to avoid the worst effects of sideband jangling – they do very well within the constraints imposed by cost considerations.

In most machines a switched luminance filter increases the bandwidth for monochrome operation, allowing the low-order f.m. sidebands into the 0-1MHz spectrum otherwise reserved for the colour-under signal. This greatly enhances the monochrome definition – in fact with the effect of the VCR's replay crispening circuit and the limitations imposed by the colour tube's shadowmask, it's often very difficult to tell off-air and off-tape monochrome material apart.

This "horizontal" elbow room is matched by a potential for "vertical" expansion of the recording f.m. signal – some but by no means all machines take advantage of this. As is well known, the f.m. luminance signal acts as the a.c. recording bias for the superimposed chroma signal when a colour programme is being recorded. Because of this, the f.m. carrier amplitude (luminance writing current) must be critically controlled to avoid driving the tape into magnetic saturation with heavily saturated colours (due to its f.m.

state, the luminance signal itself is immune to such limiting). When there's no chroma signal, we can gain extra benefit in noise performance by increasing the writing current, driving the tape to saturation on both half cycles of the f.m. carrier waveform. This can be done by linking the record colour-killer line to the record f.m. output or driver stage to bump up the writing current by 6dB or so.

Practicalities

This may all be very fascinating, but the serviceman may well ask whether it's a matter for the designer rather than himself. Apart from it being necessary nowadays to know the principles of how equipment works, it does become our business when a filter goes wrong and patterning or moiré effects appear on the screen.

To isolate the problem area, you need a known good prerecorded tape and another VCR with which it can be established whether the trouble is caused by a record or playback fault. For record problems a composite signal is required, containing both colour and an h.f. luminance component – the test card has these, but is not as good as a special pattern from a generator.

Most VCR signal filters consist of *LC* networks in a pi or ladder arrangement. In the case of a low-pass filter, the parallel capacitor components can come "off-earth", vastly increasing the upper cut-off frequency. More likely, an open-circuit filter will have been bridged by some well-intentioned soul.

Once you know what's going on, oscilloscope fault finding is not too difficult, with an r.f. signal generator hooked to the video input or a composite test pattern

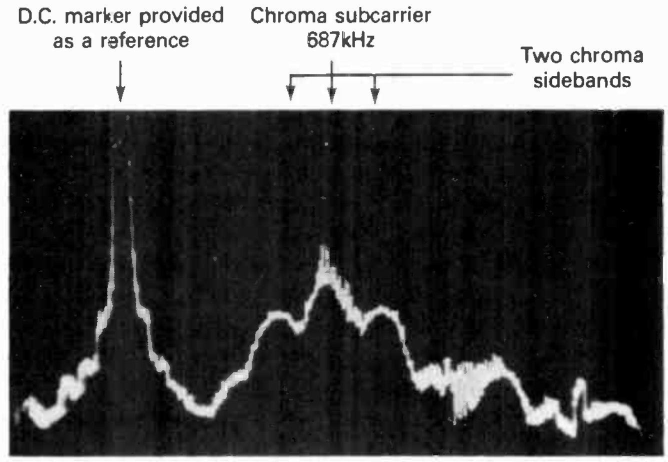


Fig. 7: Spectrum of a colour-under signal. This spectrum goes up to about 1·7MHz and shows the chroma subcarrier and its sidebands neatly contained within a total bandwidth of about 1MHz. Photo courtesy Sony (UK) Ltd.

input. In bad cases, vestiges of the chroma signal will be seen during record at the input to the luminance f.m. modulator. During playback, unwanted beat patterns should be eliminated by filters before and after the demodulator. If necessary, both should be checked.

Don't forget the chroma band restriction filter – excessive chroma bandwidth will also lead to patterning effects on luminance transitions and coloured areas of fine detail, due to beating between the outer skirts of the luminance and chroma sidebands. A photo of the chroma subcarrier and its skirts is shown in Fig. 7. It was taken during playback of a chroma-only colour bar pattern formed by removing the luminance signal during record.

VCR Clinic

Reports from Derek Snelling, John Coombes, Philip Blundell, Tech. (C.E.I.), and Michael J. Cousins, T.Eng. (C.E.I.)

Timer Troubles

The complaint that a machine "won't make a timed recording" or that "the timer doesn't work" usually involves more detective work than fault finding. The only timer faults I've had have been with a Ferguson 3V22 where the stretched capstan belts caused failure to load, similar problems with the Panasonic NV7000, and off-tune Ferguson 3V29/30s. These were not actual timer faults of course: they were the result of the cold-start conditions that occur with a timed recording. If the cause of the trouble is not one of the above conditions, set the timer a couple of minutes ahead and check its operation – this is almost always correct. The next step is to see how the user sets the timer and to spot his error. As a guide, I've come across the following mistakes.

Setting for a twelve-hour clock when a 24-hour clock is fitted. Trying to set for a 24-hour clock when a twelve-hour clock is fitted. The timer set correctly but the clock set to the wrong day. On Ferguson machines, interpreting 130 as one hour and thirty minutes instead of 130 minutes. On the Hitachi VT8000/8300, setting the timer correctly then altering the switch-on time without resetting the length of recording (this reverts to twelve hours as soon as the start time is altered). Using a tape with the record protect tab removed (this is usually detected and indicated by most machines). Not setting the minutes of the start time on a Ferguson 3V35/36 (zero minutes was wanted) – this meant that the machine wouldn't allow the stop time to be set.

To be fair, manufacturers try to make timers foolproof. Many eject the cassette when the record tab has been removed for example, while on others the timer light flashes. Similarly if all the necessary information has not been fed into the timer, or the operate switch hasn't been set to the correct position, the timer light or the word timer will flash. The meanings of these indications are explained in the instruction books of course – but who reads them? **D.S.**

Toshiba V31B

We've taken delivery of some Toshiba V31B VCRs during the last month or two. Only one fault has appeared so far, but it's occurred on four different machines – failure of the mains fuse for no apparent reason. In three cases the replacement fuse held, but in the other one two fuses went open (due, we think, to a faulty twin-plug adaptor). Has anyone else come across this fuse blowing problem and its cause – if there is one? **D.S.**

Mitsubishi HS700

Another case of fuse blowing concerned a Mitsubishi HS700. The symptoms were no clock or channel change due to the absence of the standby 14V rail – F902 had gone open-circuit. The fuse can be reached after removing a plastic part labelled "remove to gain access to fuses", but as I tend to ignore labels I first attempted to get at the fuse internally, which is not easy. After changing the fuse the machine was tried out, whereupon the fuse again blew. The front on this model has a screen that covers most of the control area: a careful check showed that it had come loose at one point, shorting R858 to chassis. Refixing the screen stopped the fuse blowing. **D.S.**

Ferguson 3V29/30

A problem that's beginning to become common on early versions of the Ferguson 3V29 and 3V30 concerns the motor drive amplifier board mounted behind the control panel at the front of the machine. On later versions of these models the panel is combined with another one, so you won't find it behind the control panel. The fault is failure of the drum and/or capstan motor to rotate, usually intermittently. This gives the symptom that the machine fails to start or switches off when going. The cause is dry-joints on the transistors on this panel. Q236 is particularly suspect, but if in doubt resolder the lot. **D.S.**

Horror Stories

A Sanyo VTC5000 came in with the complaint that there was no output from the r.f. output socket, not even the test signal. When the machine was switched on we found it to be dead. On removing the top the r.f. converter was seen to be disconnected: one of the phono plugs had touched the supply pin, shorting the always 9V rail with the result that fusible resistor R5207 had gone open-circuit. On replacing this and reconnecting the converter the original fault condition was present – it was cured by fitting a replacement converter. A phone call to the customer revealed that he'd tried checking the plugs inside in case they were loose and had forgotten to reconnect them before sending the machine in for attention . . .

That was nothing in comparison with the story of a Ferguson 3V22. A man had phoned to ask how much it would cost to have a new head fitted. He subsequently brought the machine in. Now we're always suspicious of people who bring in a machine for a specific job. After all, how to they know what's faulty? And if they do know, how come they can't repair it? Anyway the machine was put on the bench and switched on. Quick replay of a tape showed that the head could indeed be faulty, but on removing the top a series of horrors was revealed.

First, a bridge rectifier was dangling on four long wires by the mains transformer – the wires went to the place where the proper bridge rectifier should have been on the power supply panel. Then a light was noticed, also tucked away by the transformer. It was a bulb taped to two long wires that went off to where the cassette lamp should have been connected. A quick check showed that the cassette lamp and its holder were missing. Further checks showed that one of the video heads was broken, as was one of the record/playback switches, while all the guides had been screwed down fully.

Out of interest we checked the serial number against our records and found that the machine was one we'd sold in 1980. This was intriguing because the mechanics now fitted were of the later type introduced after August 1981. How all this had happened I don't know and probably never will. My guess is that the machine had been sent to another "repairer" where it had sat for several months and been robbed right and left for spares, and had finally been thrown together from anything that could be found when the customer had insisted on having his VCR back! **D.S.**

Ferguson 3V35/36

We've had several cases where the customer has complained of a jammed cassette in Ferguson 3V35/36 machines. What happens is that the cassette is inserted without the operate button being on. As the machine won't load, the customer pushes the cassette a bit harder. It then rides over the load switch which usually bends and jams in the screw holes under the cassette. **D.S.**

Ferguson 3V29

A Ferguson 3V29 switched off after a few seconds operation in playback. With the top removed the cause of the problem was obvious – the head drum wasn't rotating. I've had this before, caused by a dry-joint on the motor drive amplifier board, but tapping this failed to bring any improvement. As all the motor drive transistors are mounted on the board I decided to start here. A quick check at one of the i.c.s revealed that the 12V rail was present, so meter checks were made on the transistors. All were o.k. Further checks with the machine on then revealed that one coil to the drum motor had no voltage on it. Tracing this back brought to light something I should have seen right away – there are two supplies to the board, the 12V rail for the i.c.s and a 13V rail for the drum motor. The latter was at 4V due to a defective regulator on the power board – transistor Q5 and zener diode D14 had to be replaced (the transistor had a hole blown in it!). **D.S.**

Anyone see this?

Here's something odd. On April 20th a colleague noticed that the clocks on the two ITV teletext magazines differed by ten seconds. Did anyone else notice this? Has anyone an explanation? **D.S.**

Sharp VC9300

This machine would play for three seconds after which the reel, capstan and head motors would simultaneously stop, leaving the tape threaded around the drum. If the play button was then pressed, the machine would play the tape perfectly to the end. The clue to the fault was a faint scraping noise from the underside of the deck just before the motors stopped. It was coming from the threading motor, the trouble being that the after-load switch was not always making contact. As a result, the microcomputer cut the power when the loading motor had been on for six seconds without the after-load switch closing. **P.B.**

ITT 480 (Philips VR2020)

Here's a saga for you! The reported fault was a poor picture, but when I tried the machine it wouldn't play. The head was visibly going slow: after a few seconds the blocked rotor signal would be given and the machine would unthread. A replacement servo panel didn't help, and we then discovered that the head position pulses were missing. No current was passing through the optocoupler LED due to the reel rotation LED being open-circuit (the three optocoupler LEDs are connected in series).

The next day we found that there was no E-to-E picture due to the U322 tuner not oscillating. A replacement put that right and it was then noticed that one of the clock digits was missing – due to a faulty CD4511.

The poor picture (on its own recordings only) was cured by fitting a new drum – the picture had looked as if it was covered in small squares. Next, after running perfectly all afternoon, the picture blanked out on playback. If the mute circuit was overridden by connecting pins 10 and 11 of the diagnostic plug, the resulting picture looked as if only one head was working.

The f.m. going into the luminance playback module was o.k., a replacement module restoring the picture. This time the fault was due to the TDA2740 i.c. As I write this the machine is running on soak. Is two days enough? . . . **P.B.**

Hitachi Disc Player

We've had a couple of cases of the disc being jammed in the player. There's a hole in the bottom of the player to enable a jammed disc to be removed. In both instances the latch that holds the disc broke and the force required to remove the disc bent the metal runners connected to the caddy rail assembly. As a result, the caddy rail assembly had to be replaced as a complete unit. **J.C.**

Sharp VC8300

If the cassette is ejected after insertion, check the drum belt which could be broken, stretched or off. **J.C.**

Sharp VC2300

The trouble was "functions dead" with the tape trapped in the laced up position. All the mechanisms in these machines are driven electromagnetically, so the cassette can't be ejected even after the tape has been hand cranked back into the cassette. We found that there was 14V going to the 9V regulator transistor Q914 on the servo board but no output. A quick check showed that the transistor (type 2SA770) was open-circuit. Just to add to the confusion, there's another Q914 on the power board. **M.J.C.**

Mitsubishi HS302B – and JVC

The fault was intermittent poor playback (as if one head was going low) accompanied by white streaks. When the covers had been removed I was amazed at the debris inside – bits of torn tape boxes, and nuts and bolts that had no connection with the machine. I came to the conclusion that the family's children had used the machine as a post box. When the foreign bodies had been removed, the mechanism and heads were given a good clean. After this the playback was good, so the machine was left for some time on soak test. Eventually the playback went low and streaky.

The f.m. playback waveform was scoped and, as expected, one output was very low. The problem was to decide whether the fault was to do with the preamplifier i.c. (IC201, AN6320N) and its associated circuitry or the heads/rotary transformer. Heat and freezer suggested that the i.c. was suspect, and when a replacement was obtained and fitted the machine ran for some hours before the fault reappeared. The real culprit turned out to be C204

(4,700pF) which couples the output from one head to pin 5 of the preamplifier i.c.

Since this fault I've had the same trouble with a couple of JVC HR7350s. The offending capacitors here are C272 and C273 (both 0·022μF). **M.J.C.**

JVC HR7700

A machine that obviously escaped JVC's quality control appeared in our workshop recently. The complaint was no sound on playback. On checking with a known good tape, sure enough there was no sound. The voltages on the audio board indicated that the machine thought it was in the audio record mode. The commands for record, audio dub or playback come from the mechacon board, which was of the later type. It was found that the audio dub command was present at some 15V, putting the machine in the audio record mode even during playback. Checking through the circuitry produced no logical reason for some 15V being present at audio dub pin 23 on the mechacon board, but perseverance revealed that there was a leak between the print tracks leading to connectors 237 and 238. Connector 238 is the "not cue set" line, which is at approximately 25V regardless of the position of the cue switch. Scraping between the print restored the audio dub line to 0V, with the sound now normal. **M.J.C.**

Teletalk

Malcolm Burrell

TV servicing can be enjoyable. There's satisfaction to be had from restoring something to working order. But there's a difference between doing it for fun and doing it for a job. Many seem to have come into the profession years ago when it was the thing to "get a good trade" after leaving school. It might have been car mechanics, being a draughtsman or builder, but at one time TV was considered to be a good thing to get into. Unfortunately the wages and conditions nowadays leave a lot to be desired.

Those of us who for some misguided reason want to get good pictures and have developed a flair for this probably all too often feel those eyes watching us and hear the unspoken question "why does he spend so long on the job?" It seems that productivity and the need to maximize profit are considered to be more important than achieving reliability and just the right colour.

Whilst talking to someone recently I ventured the suggestion that much servicing was "just a con". The reply I was given was that some people want to be conned. This often seems to be so. For example, it's amazing how just before Christmas you seem to get a flood of calls of the sort that "it's not been right for months", "after two hours the sound fades" and "we wanted it right for Christmas"! If you're a field engineer the chances of putting such matters right are not very good – unless you take up residence. But if you call and make the right noises the customer is usually quite happy.

The wage problem has to be seen against the background that some firms go in for conning the public in a big way. I could go on about the case I was told about recently – of an engineer who was asked to look at a portable VCR brought in because the pictures were poor. He cleaned the heads – and got his £3 an hour. The job didn't take more than ten minutes, but the customer received a bill for £120, stating that a new set of heads had been fitted. Apparently the customer was happy – but how was he to know? In another case someone paid maintenance on a Telefunken set for ten years. The firm was happy to collect the money but reluctant to fit a new tube. It was simply boosted from time to time.

One has to acknowledge however that making honest servicing pay is difficult. Suppose that in one or two years' time someone with a Ferguson set fitted with the TX90 chassis pops in with a peculiar fault that takes four or five hours to find and put right. Could you really present an economic bill when maybe only an odd resistor had changed value? Suppose that six months later the line output transformer failed, then maybe a new tube was required some months after that. It would be cheaper to buy a new set. Have we reached the point where most faults outside the guarantee period have become uneconomical to deal with?

Field Servicing

Field servicing has one or two advantages. You may sometimes get home early, you're relatively free – and just occasionally you might get to chat up someone really nice! There are loads of disadvantages however. For a start, because the nice man from Blogg's fixed the next door's telly in ten minutes flat you're regarded as not up to much if you have "to get the map out" to discover why the set's dead.

Most people take TV for granted nowadays. This applies to servicing as well. "My husband – he's a plumber – says it can't be much. Probably the picture valve." You sometimes want to say that if he knows so much about it why doesn't he fix the set himself?

You can leave the wrong impression behind in the rush to get from one job to the next. If you know the sets with which you're dealing, it's quite easy to come to a quick decision most of the time. You change say "R23" knowing that in 99 per cent of cases this will cure the fault. You even get to the stage where you've forgotten what R23 actually does! Field servicing becomes a matter of tearing from one place to the next and going through the motions. A great many faults don't even present themselves for diagnosis. Given that "the colour goes after three hours", you have a quick tap around, then check the reference oscillator adjustment and the tuning. In 75 cases out of 100 you won't have to go back again.

This tends to get rather boring. So much so that it comes as a relief to do a stint at the bench and deal with some awkward faults that require a logical approach. Perhaps this is why I tend to get furious when I see the field approach used in the workshop to get a high throughput. You know the sort of thing: switch on, get picture, can't be much wrong, quick twiddle then back to the car magazine.

Problems with Plastics

I had a problem with a Thorn 8500 chassis not long since: the brightness tended to fluctuate, and it seemed that the slider of the brightness control was intermittent. It transpired that the problem was due to the tag at one end of the control. Since the tag at the opposite end was unused, could I connect the wire to this and turn the control upside down? Removing the control panel assembly, I was amazed to find that the plastic bracket that holds the control in place was disintegrating. I managed to effect a satisfactory repair, but wondered why the plastic should be in such a condition in a position where there's little stress.

Such problems are not uncommon on elderly sets. The on/off switch brackets on these and other sets frequently give up, and mounting by means of self-tapping screws in plastic cabinet fronts causes a lot of problems. The GEC C2110 series is notorious – either the switch falls inside or the push-button bank comes away. Repairs are often possible by removing the old mounting flanges and fitting long 6BA screws with spacers – provided there's no risk of them touching the chassis metalwork.

More drastic damage can suddenly occur. The plastic cabinet of a GEC set split almost in two one night. Not long ago a customer with a Thorn TX set found that the aerial socket had become loose – its mounting to the plastic chassis frame had broken.

Remember those little tuning ferrules used with RBM tuners? Nice and pliable when new, they became brittle and fell off after a few years' use. There are also component failures – for example the line output transformer used in the Philips 210 series chassis.

The use of plastics has caused a lot of problems in the past, maybe because ageing effects were not fully understood. One hopes that plastics technology has improved. The Thorn TX90 is a good set for example, but with so much plastic used in its construction one can't help wondering whether it might self-destruct after some eighteen years' service.

It's fair to expect ten years' use from a modern TV set. How much longer should you be able to expect if it's been properly serviced?

The Reconditioned Set Market

Secondhand colour TV sets seem to be on offer at ever lower prices. A few years ago I looked into a shop where signs above a number of clean and well-appointed colour sets, at high prices, declared that they were fitted with reconditioned tubes. I've recently heard of "reconditioned" colour sets being on sale "from £35". This would be the price of a reconditioned tube alone. How is it all possible?

I once had cause to complain about a hybrid GEC colour set that had been sold a week or so previously with a three month guarantee. When it came back I found that there was enough dirt inside to grow potatoes in. The fault, no sync, was caused by the sync separator's 56kΩ collector load resistor having burnt up. In the process it had damaged the flywheel line sync drive coil. Not an expensive repair, especially with so many scrap panels available, but with a bit of attention to known stock faults the trouble could have been avoided. I was promptly told that these ex-rental sets were being "got rid of". The same set came back as a chargeable repair shortly afterwards. "Too old, not worth it" I said, and was quickly rapped across the knuckles again! Surely if you want to keep your customers the sets you sell should come up to a reasonable standard?

Even if you don't advertise the sets as reconditioned, the customers will tend to assume that they have been. A lot can be done without too much trouble. Inspection will reveal charred print and resistors and swollen capacitors, and you should know the things to look out for on particular chassis. Does the on/off switch feel right or does it have a feeble click? Tube boosting is a dubious business and seldom lasts very long.

The law of the secondhand set jungle is to sell at ridiculous prices whilst making a handsome profit. In other words you use cheap labour to get the sets going then flog them in the hope that they won't go wrong during the guarantee period. An engineer I once knew maintained that technicians should always adopt a logical approach, and that the practice of bodging would degrade their skills. His worst fears seem to be coming to pass in this cut-price field.

Brightness Fault

My friend Len popped in one day with his Pye T173 portable (Philips TS7 chassis) . "It's the brightness control" he said. The control worked, but you couldn't get sufficient brightness – only the highlights were visible. I'd not worked on one of these sets before, and first suspected inadequate first anode voltage. A quick check revealed that this assumption was wrong, but the tube's grid was at only 25V instead of 65V at maximum brightness. Furthermore the voltage at the slider of the brightness control increased as the control was moved from minimum to the mid-position, decreasing slightly as maximum was approached. I also noticed that the voltage at the top of the control varied. Obviously something was pulling the voltage down. The prime suspect was the slider's decoupler C188, but this proved to be blameless. With some trepidation I checked with the tube's base removed. Fortunately the result was the same.

After running out of further ideas I disconnected the slider and measured the voltage there. The same thing happened, so the control was clearly leaky. As I didn't have a direct slider replacement, the track was removed from the control for inspection – it's quite easy to do this. The cause of the leakage was then apparent – a film of carbon had formed at the bottom between the track and the wiper's track. Cleaning and reassembly provided a complete cure.

That KV1810 Again

My Sony KV1810 Mk. II is beginning to show its age but had been working well enough when I lent it to someone. It was returned in a damp van and when I switched it on all I got was a puff of smoke. This had come from R608, which is in series with the start-up gate-controlled switch Q602 and had gone open-circuit. The fuse had held and, as it turned out, the demise of R608 was a bit of a red herring.

The chopper drive circuitry was checked whilst powered by an 18V battery, with no mains input – the correct procedure with this set. Scope checks showed that the monostable circuit and the chopper driver transistor were working, but there was nothing at the gate of the chopper GCS Q603. I began to suspect the driver transformer, but a meter check proved that it was o.k. By chance I put the scope's probe on the transformer connections and got a waveform, so there was obviously a break in the print. Meter checks brought me to the connections to Q603 itself: the pads for the gate and cathode connections had lifted fractionally and cracked.

Repairing the print and applying a mains supply via a variac brought the set back to life. R608 had failed because with the set connected to the mains but no output from the chopper the start-up circuit can't switch off.

Spectrum-Monitor Interface

John de Rivaz, B.Sc. (Eng.)

The interface circuit described in the following article was devised after purchasing a Sinclair Spectrum microcomputer. To obtain the best display I decided to use a monitor with RGB inputs rather than employ a TV set and link the two at u.h.f. Using an RGB link avoids the modulation/demodulation and PAL encode/decode processes and the degradation they introduce. Unfortunately, inspection of the microcomputer revealed that RGB signals are present only within the ULA chip. YUV signals are available however, and pins on the microcomputer's multipin connector at the back are listed as being connected to these signals. An oscilloscope check revealed only low-level rubbish at these points, and on further investigation it was found that the internal wire links that connect the signals to the connector had been omitted. Installing the necessary links gave us YUV outputs at the connector and we then had the problem of converting these to RGB drives for the monitor. The V signal was alternating line by line, PAL fashion, and pulses of alternating polarity were present in the position occupied by the burst signal in a standard PAL waveform.

Being familiar with the Rank A823 chassis, I decided to use the SL901B i.c. that's employed for chroma signal demodulation and matrixing in the decoder of this chassis. The first problem was to find a way of using this chip with unmodulated signals. A look at the circuit (see Fig. 1) showed that if the U and V input pins (4 and 21) are earthed one half of each balanced synchronous demodulator will be rendered inoperative, enabling the other half to be used as a differential amplifier. These amplifiers have quite high gain, so the large outputs from the Spectrum had to be reduced. This is fortunate, as it enables the bias levels to be set correctly.

Obtaining sync pulses from the Y signal was straightforward. The signal from the Spectrum has positive-going sync pulses. An npn transistor (Tr1) with no bias produced negative-going pulses which are fed via an emitter-follower (Tr2) to provide a low-impedance output for the monitor.

The rest of the circuitry external to the SL901B is

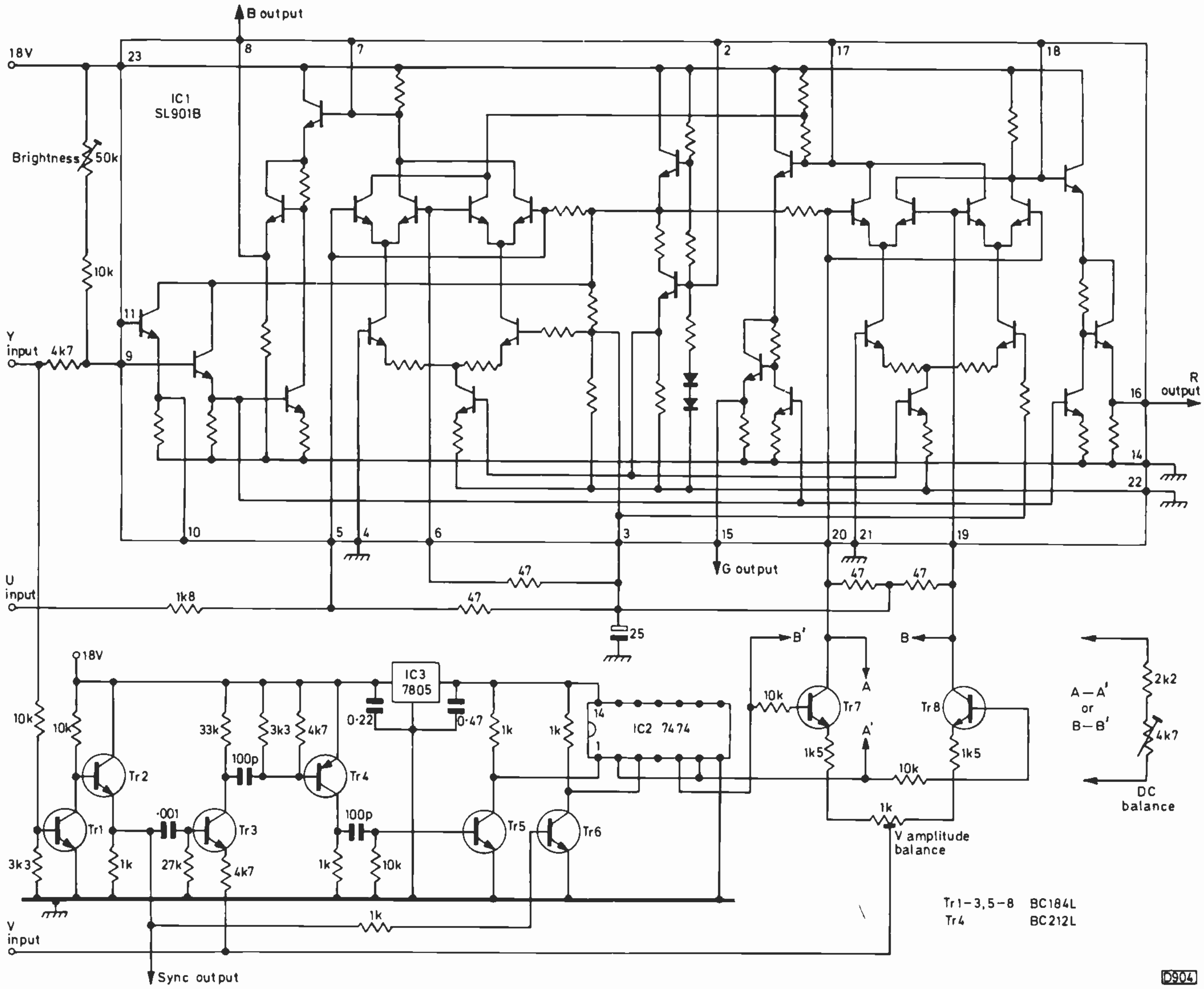


Fig. 1: Spectrum-monitor interface circuit for RGB drive.

concerned with removing the V signal PAL swings. This is done by feeding the V signal to pins 19 and 20 of the i.c. on alternate lines, via the switching transistors Tr7 and Tr8. The latter are switched on and off by the outputs from a D-type flip-flop in the 7474 i.c. For ident synchronisation, Tr3 is switched on during the burst periods by differentiated line sync pulses, thus passing the "V bursts" present at its emitter. The ident signal thus obtained is further processed by Tr4 and Tr5 and is then applied to the flip-flop's clear input – the flip-flop's clock input is driven by sync pulses after inversion by Tr6. To get the circuit working, some adjustment to the value of the resistance in Tr4's base circuit was required.

A d.c. balance control is necessary to prevent the switching waveform appearing at the output. Depending on component tolerances, this may have to be connected between either AA' or BB'. A V amplitude balance control is also provided. These controls can be set up by getting the Spectrum to produce colour bars (there's a programme for this in the Spectrum manual), using an oscilloscope or observing the result on the screen. Brightness is controlled by applying d.c. bias to the SL901B's luminance input pin. The signal circuits are d.c. coupled throughout.

The signals from the Spectrum contain some computer noise, so it's not advisable to use speed-up capacitors to increase the picture sharpness.

The monitor I adapted was intended for use with TTL RGB signals, i.e. either on or off. The Spectrum has two levels of brightness however as well as colours. The TTL chip at the monitor's input was therefore removed, giving input via emitter-followers. These were biased by a preset brightness control which was disconnected. The monitor incorporates an 18V line which feeds a 12V regulator. It's derived from the line output stage and was used to supply the interface circuit.

Teletopics

MAJOR RENTALS MERGER

British Electric Traction, parent company of Rediffusion, has reached an agreement to sell the Rediffusion TV rentals operation to Granada. The combined TV rental group would have an estimated 19 per cent of the market. There are over 850 Rediffusion and Grenada rental branches and it's expected that 100 or so would be closed following the merger. Job losses are put at some 700. The rental market has not been a happy one recently, with the increasing tendency to own both VCRs and TV sets outright. Added to this, Granada manages to make appreciably greater profits from its outlets than Rediffusion. From Granada's point of view benefits will come from economies of scale and the cash flow that investment in VCRs in recent years will produce in the future. BET is to retain the Rediffusion setmaking capacity.

PHILIPS' VHS POLICY

Philips' VCR policy keeps changing. Having decided to manufacture VHS machines, it was initially announced that the only W. European market in which these would be sold would be the UK. A new announcement states that Philips' VHS machines are to be distributed throughout W. Europe from the autumn. What next?

MONITORS AND RECEIVER-MONITORS

The growing use of home computers and video games has brought with it an increasing demand for monitors and receiver-monitors for display purposes. To meet this demand, several companies specialising in monitors and ancillary computer equipment have been set up in recent times while most TV setmakers have either introduced or plan to introduce monitors and/or receiver-monitors. Many users of home computers and video games units link their equipment to the TV display unit via the aerial socket. The disadvantages of this include drift (computer/games modulators are not exactly on a par with those used by the broadcasters!), patterning and bandwidth limitations. Similar problems arise with VCRs and discs. In all cases an RGB or composite video link gives greatly improved results.

The Ferguson Model MC01 14 in. receiver-monitor, which is based on the TX90 chassis, is due for release at the end of August at a suggested price of around £229. In addition to the aerial socket there are separate DIN sockets for composite video and RGB inputs – linear or TTL (on/off) RGB inputs are accepted. To cater for the different composite video signal levels from different equipment, a preset video gain control is included. An added benefit of having separate input sockets is that several items can be connected to the receiver-monitor simultaneously. The MC01 senses the signal selected and switches over automatically. There's automatic sensing of sync polarity with RGB inputs, and sound signals can be fed into the MC01 with both RGB and composite video inputs. A 3·5mm headphone socket is also provided, and a specially designed battery adaptor with automatic adjustment for 12V/24V d.c. operation is available. The latter gives a typical running time of eight hours when used with a standard 40AH battery.

Because there's no standard connector for home computers, a range of leads to connect to most popular units is being made available through Ferguson dealers. A further range of leads provides connection with the Ferguson Videostar range of VCRs.

Ferguson will also be introducing a 12in. monochrome monitor, Model MM02, for business and home computer enthusiasts. This has an 80 character per line capability – the standard for word processors and some computers, as opposed to the 40 characters per line standard used for teletext and many low-priced computers. Technical features of the monitor include dynamic focusing to maintain clarity right across the screen, video rise and fall times of better than 20nsec for clean character edges (the average domestic TV receiver has video rise and fall times of around 100nsec), picture geometry better than 2 per cent and flywheel sync for good character verticals in the presence of noise and interference. The flyback time of only 8μsec means that up to 100 characters per line can be displayed if necessary. The tube has a P31 green phosphor screen which gives clear characters with minimal eye strain (tubes with alternative phosphors can be fitted, subject to negotiation). A further feature is multistandard (US/UK/Continental) operation to enable the monitor to handle a wide range of software/hardware. The price is expected to be less than £80.

Ferguson will also be introducing a cassette recorder, Model 3T31, designed specifically for use with microcomputers. The suggested price is £29.

An Advisory Service has been set up by Ferguson to aid dealers and users with queries on computer-monitor compatibility and upgrading from one home computer to another. The telephone number is 01-807 3060.

ITT's first receiver-monitors were mentioned in this column last March. Several additions to the range have since been made. The 14in. RL2315, which has a suggested price of around £299, accepts u.h.f., composite video and RGB (both linear and TTL) inputs, with separate DIN sockets for the video signals and an easy to operate VCR/video/RGB switch. For those who require larger screen sizes, the CT2600/R is fitted with a 22in. tube and the CT2700/M has a 26in. tube. These two models use BNC sockets for the composite video and RGB inputs and in addition have an audio channel. The dot resolution is 420 with the 14in. tube, 540 with the 22in. tube and 630 with the 26in. tube.

Most new TV chassis have either as standard or as an optional extra a SCART socket to enable composite video and RGB inputs to be fed in. This 21-pin socket is also known as a Euroconnector or peritelevision socket.

CETEX

On the TV side the trend at this year's Consumer Electronics Trade Exhibition was towards isolated chassis fitted with SCART sockets to provide video and audio input/output connections, while the first models to be fitted with the new FS type tubes were shown. FST sets were included in the Mitsubishi, Panasonic, Philips, Pye and Toshiba exhibits. Philips and Panasonic were amongst the larger setmakers showing small screen monitors. Centrepiece of the ITT stand was the new Digivision Model D1000 – see separate note. The latest portables in the Philips range, two 12in. models (one with remote control) and a 14in. model, are fitted with the new TX3 chassis. On the video side, JVC were showing their Video Movie camcorder Model GRC1, the recorder section being to the VHS-C standard. This extraordinarily compact piece of equipment is just 13in. long and weighs less then 5lb. The Ferguson version is the 3V41. Price is around £1,000. JVC also introduced their first VCR featuring the hi-fi sound system – Model HRD725EK (Ferguson 3V42). These are top-loading machines with two speed operation. The Konica CV is claimed to be the world's smallest and lightest colour camera, and can be used with most VCRs. The compact design has been achieved by mounting the ½in. Cosvicon tube vertically in the camera's handle: the optical system consists of a 3:1 manual zoom lens, through-the-lens viewfinder and a mirror/prism arrangement to deflect light on to the tube's faceplate.

TUBE SIZE SPECIFICATION

The tradition of specifying tube sizes by the overall diagonal measurement in inches is to be phased out. The change follows an international agreement amongst tube makers to use the visible picture diagonal as the standard measurement for screen size, and pressure from trading standards officers who have argued that the present practice infringes the Trade Descriptions Act (Philips were fined a nominal sum when a test case was brought last year). The packaging for sets fitted with standard types of tube is now supposed to show the diagonal visible screen size in centimetres in brackets, with the word "visible" or the letter "V", following the inch meaurement. For example, a 16in. set should be described as 16in. (38cm V) or 16in. (38cm Visible). This interim arrangement is expected to last for two or three years. The aim with the new FS tubes is to use centimetres only, though inch sizes are being widely quoted at present.

DIGIVISION IS HERE!

CETEX saw the UK launch of the ITT Digivision system in the form of their 26in. Model D1000. The set is unique to date in that after detection the signals are AD converted and processed in digital form, under the control of an eight-bit microprocessor central control unit, then DA converted to drive the deflection output circuits, the c.r.t. drive and the audio output stages (the set is stereo capable of course). The basic system was described in our November 1981 issue. Model D1000 is a full-specification set with infra-red remote control, teletext, 15W audio output per channel from twin three-speaker systems with double chamber bass reflex loading, and sockets for AV and RGB inputs and headphone/audio outputs.

From the servicing point of view, how do you set up a receiver with only one preset potentiometer? Adjustment is done digitally with a service computer, which ITT call an "electronic screwdriver". The service computer is linked to the receiver via a socket and issues commands to the MAA2000 central control i.c., allowing the service engineer to change the data stored in an EAROM. When reprogramming is complete, control is returned to the MAA2000. The c.r.t. drive conditions, the timebases and picture geometry can all be set up in this way. The SP010 service computer does not come cheap however – it costs £125. To offset this ITT have announced a special introductory offer: with each Digivision set purchased, the dealer will receive a £25 voucher towards the cost of a service computer.

POLAROID-TOSHIBA 8mm VIDEO DEAL

The US photographic products group Polaroid is to market an 8mm portable video system produced by Toshiba. It's due for release in the USA this summer.

DBS UP-DATE

The government has announced that legislative changes will be introduced to enable a DBS service to the UK to start in the late 80s. The cost will be around £400m and the service will be operated by a consortium comprising the BBC, ITV companies and outside operators. There are likely to be three channels, one for films and the other two with mixed BBC/ITV programming.

Where is the money to come from? The BBC is to be barred from using extra cash obtained through licence revenues, while the ITV companies will be unable to count losses against their annual levy. The government seems to think that the consortium will be able to raise the required risk capital: as an inducement it will be given a three-year monopoly, while the IBA will be authorised to extend the franchises of ITV companies participating in the scheme. It's understood that the BBC will have a 50 per cent stake in the venture, with the ITV companies having a 30 per cent stake and the rest held by one or more outside companies. At the end of the three-year monopoly, the IBA will be able to advertise for participants in a competitive DBS service.

Agreement has been reached between the Luxembourg government and a private consortium to establish a satellite TV distribution company called Societe Luxembourgeoise des Satellite. The plan is to beam 16 TV channels over Europe, mainly for cable networks but also as a DBS service. The project is called Coronet and the satellites will use the Luxembourg orbital position (19°W). It's hoped to launch two medium-power satellites late next year. Financial backing is being sought in several European countries, including the UK.

HITACHI HIRWAUN

Radical changes have been introduced by Hitachi at the Hirwaun TV factory in an effort to build up production and change the loss making plant into a profit earner. The labour force is to be reduced by 500, from 1,300 to 800, and the production lines will be modernised. As in Toshiba and Sanyo's UK plants, there will be a single-union agreement with the EEPTU. A "company members board" is to be set up to settle disputes without resort to strike action or lock-outs, and a "single status" employment policy will be introduced, i.e. a single canteen, common working hours and uniform etc. A seven per cent wage increase has been agreed.

THOMSON IN UK

TV sets and VCRs produced by the French government owned consumer electronics firm Thomson are to be marketed in the UK by Heron Electronics Ltd. Thomson is Europe's second largest consumer electronics manufacturer (after Philips), with substantial interests in W. Germany – its subsidiaries include Saba, NordMende and Telefunken.

POCKET COLOUR TV SET

The Japanese electronics concern Seiko has demonstrated a pocket colour TV set with a 2in. screen. Marketing is expected to begin in Japan and the USA later this year. The set has a liquid crystal display and weighs 450 grams. A price of around $500 has been suggested. Seiko's wrist-watch sized monochrome TV set, which also has an LCD, was introduced in December 1982 and will be superseded by the new colour set. Some 70,000 of the monochrome sets have been sold.

VCR SERVICING COURSES

Steve Beeching is planning to run a further series of his VCR servicing courses this autumn. Enquiries should be sent to the Newark Video Centre, 108 London Road, Balderton, Newark, Notts.

NEW PLESSEY TV TUNING SYSTEM

The Plessey SP5000 i.c. is now in volume production: used in conjunction with a varicap tuner, it forms a complete phase-locked loop frequency-synthesis tuning system intended primarily for TV and cable TV applications. External circuitry is reduced to a minimum by incorporating a 1GHz prescaler, a multimodulus divider, storage register, crystal reference oscillator with divider chain, phase comparator and drive circuitry in the single chip, which requires only a 5V, 50mA supply. The circuit can select frequencies from 30MHz to 1·024GHz in 62·5kHz steps.

The SP5000 is controlled by a four- or eight-bit microprocessor which also decodes the remote control and keyboard commands. Plessey offer a series of PIC1655 microprocessors for this purpose to ensure that all common broadcast and cable TV requirements can be met. The microprocessor also controls a memory i.c. if program storage is required, and can drive two seven-segment displays directly for channel or programme number.

The SP5011 and SP5012 i.c.s are in production for cable TV use, offering up to eight options of up or down conversion to frequencies appropriate for connection to a TV receiver's aerial input: these are fixed frequency options of the SP5000, with an aluminium mask variant, so that no microprocessor is required.

Further details are available from Plessey Semiconductors Ltd., Cheney Manor, Swindon, Wilts SN2 2QW.

TELETON'S MOVE

Teleton Electro (UK) Co. Ltd. has moved from Westcliff-on-Sea, Essex to Hatfield, Herts. The new address is 154 Great North Road, Hatfield, Herts AL9 5JN, telephone number 070 727 2841.

VCR PROTECTION

An ingenious device has been introduced by Videotek Ltd., Unit 20/21, Royal Industrial Estate, Jarrow, Tyne and Wear NE32 3HR for the protection of unattended VHS VCRs. The device is in the form of a cassette which can be loaded into the machine. It's locked on partial insertion and can be removed only after being unlocked – 1,000 key patterns are available. The built in tremor switch triggers a 98dB alarm if the machine is moved or disturbed. The retail price is around £24·95.

SET TOP AERIAL WITH AMPLIFIER

Electronic Mailorder (Bury) Ltd., 62 Bridge Street, Ramsbottom, Bury, Lancs have introduced a combined set top aerial and amplifier at £9·70 plus 30p post and packing. The amplifier is a tuned type that may require adjustment – this is easily done by means of a small trimmer in the aerial base. The amplifier runs off eight HP3/AA type batteries which will last for about a year if the amplifier is switched off after use.

SATELLITE TV COMPANY

A new UK company, Satellite TV Antenna Systems, has been set up to develop and manufacture satellite communications equipment. The technical director is Steve Birkill, who has designed what the company refers to as a "radically new" receiver for which a number of orders have already been taken. Production has started at the company's factory in Builth Wells, Powys: initial production will be mainly for the US market, though European orders are also expected.

SLOW-SCAN CCTV SURVEILLANCE SYSTEM

The latest introduction by Frowds Ltd. (4 Northarbour Road, Cosham, Portsmouth, Hants PO6 3TJ) is Surveyorscan, a slow-scan TV system for operation via the telephone network. It was designed and developed by British Telecom and is being manufactured under licence and marketed by Frowds. Surveyorscan gives the user an unattended surveillance capability to virtually any site worldwide via the normal dial-up telephone network. Up to four cameras can be used to obtain still pictures at one or serveral different sites, the system also providing remote control of the cameras. The pictures can be displayed sequentially or all four together on a single monitor. Other features include movement detection where changes in pictures are noted, automatic activation of alarms, and remote control of such on-site facilities as gate locks, sirens, etc. The system is easy to operate and can be installed quickly and simply.

Servicing the Grundig 2 × 4 Super

Part 1

Mike Phelan

It's perhaps fortunate for some of us that the V2000 system hasn't turned out to be as successful as it might have been: even late model V2000 VCRs are now available at very low prices. If you intend to use your VCR for recording TV programmes, which after all is the primary purpose of such machines, the Grundig 2 × 4 Super, at present available for less than £200 from some outlets, must represent one of the best buys ever. The picture quality is superb, the dynamic track following giving noise-free shuttle search, slow motion and freeze frame.

Features

The machine is a front loader, with an attractive chocolate brown and gold finish. The front panel is uncluttered, with two groups of pushbuttons. Those on the left are a numerical keypad for entering data, plus controls for making timed recordings. The eight buttons in the centre are for the tape transport functions. The nomenclature here is a little odd, "stop" being still/pause and "tape" what we'd normally regard as stop.

Below this are two flaps covering more buttons. Those on the left are search and store for tuning (Bands I, III or u.h.f.). The other group are "go to", "slow" and "APF". The latter winds the tape either way until the beginning of a recording is found, then goes to still frame. There's also "time left", which we'll explain shortly. Although green, the clock display uses LEDs. When the machine is switched on, the clock data is replaced with either "CASS" (no tape in the machine) or "P TIME". In spite of the rather amusing definitions I've heard for this, it's how far along the tape is in hours or minutes. Also displayed is the length of the tape inserted, e.g. 1, 2, 3 or 4 hours (per side). When "TIME LEFT" is pressed, "P TIME" is subtracted from this.

There's no record switch. To record, you have to type in the channel followed by "PROG/DAY" and "START/STOP". You cannot record unless the clock has been set – done by typing in hours and minutes then pressing "CLOCK". If a mistake is made in entering data, the display shows "F"! Five timed recordings can be made over a 99 day period, from 32 channels. If you attempt to enter more time than there is on one side of tape the display shows "FULL".

At the rear of the machine there are sockets for video/audio input/output, remote and camera. The infra-red remote receiver clips on the side of the cabinet and is controlled by a very slim hand-held unit. If you have one of the current Grundig TV sets, one hand unit will control both the VCR and the set via an adaptor that replaces the remote receiver.

Mechanical Arrangements

To remove the top of the machine, take out two screws at the rear. All is then revealed – the mechanical construction is up to the usual Grundig standard. Six modules of identical size are plugged into the mother board at the bottom of the cabinet. From the left these are the power supply, chrominance, luminance, servo, DTF and audio panels. The tuner and i.f. modules reside to the right of these in cans. The tuner is the usual Grundig type used in their TV chassis until recently.

In front of this group of modules is the self-seek board, then the keyboard module which is attached to the front of the cabinet. This contains the two microcomputer i.c.s that look after the mechanical and clock functions. The tape deck is on the right and can be removed after taking out three screws. Behind it is the motor connection board containing the direct drive head motor circuit, autostop, reel and loading motor drive circuits. To gain access to the deck, unclip and draw forward the cabinet front, then remove the "tea tray" – the massive screening can above the deck. It's no small thanks to this can that we've never had one of these machines with last night's supper all over the mechanics!

Although the Grundig machine is cassette compatible with the Philips V2000 series machines it uses a C-wrap rather than an M-wrap system. The motor that turns the loading ring also ejects and loads the cassette, using a very ingenious gear system with a rack and worm. The capstan motor is very small, the reel motors are very large and the drum motor is of the direct drive Hall-effect type. There's but one solenoid, for the reel brakes.

The Power Supply

Now for the problems, which are fortunately not many. We'll start with the power supply – see Fig. 1. This is a fully isolated self-oscillating chopper circuit of the Siemens type, with a BU208A chopper transistor and a TDA4600 control i.c. It's reasonably reliable, but the TDA4600, BU208A and the base drive coupling capacitor C401 must all be replaced together if any of them should fail. If this should happen the usual result is a completely dead machine, but if the 1·25AT mains fuse has failed the bridge rectifier should be checked for shorts. In the event of a dead machine also ensure that the start-up voltage (about 8V) from D418/R418 is present at pin 9 of the i.c. Once the circuit has come into normal operation the i.c. is supplied by D419/C419.

A common fault is that C401 goes leaky, the power supply switching on and off at approximately 1Hz intervals, sometimes clearing after a minute or so. Replace C401, the BU208A and the i.c. to be safe. The BU208A must be coated in heatsink grease and the nuts must be *tight*.

When working on the power supply, C435 and C485 should first be discharged – they both charge to 150V with no chassis leakage path and a nasty surprise can be had some minutes after switching off!

On the secondary side of the chopper transformer most of the supplies pass through the relay, which should energise at switch on (at the front panel switch) and de-energise fifteen seconds later if no functions have been selected. If the relay fails to operate, check that transistor T443 (near the bottom) has been turned on. If there's no base bias, R443 (390Ω) is probably open-circuit – it's not present on early panels. This bit of circuitry bypasses the

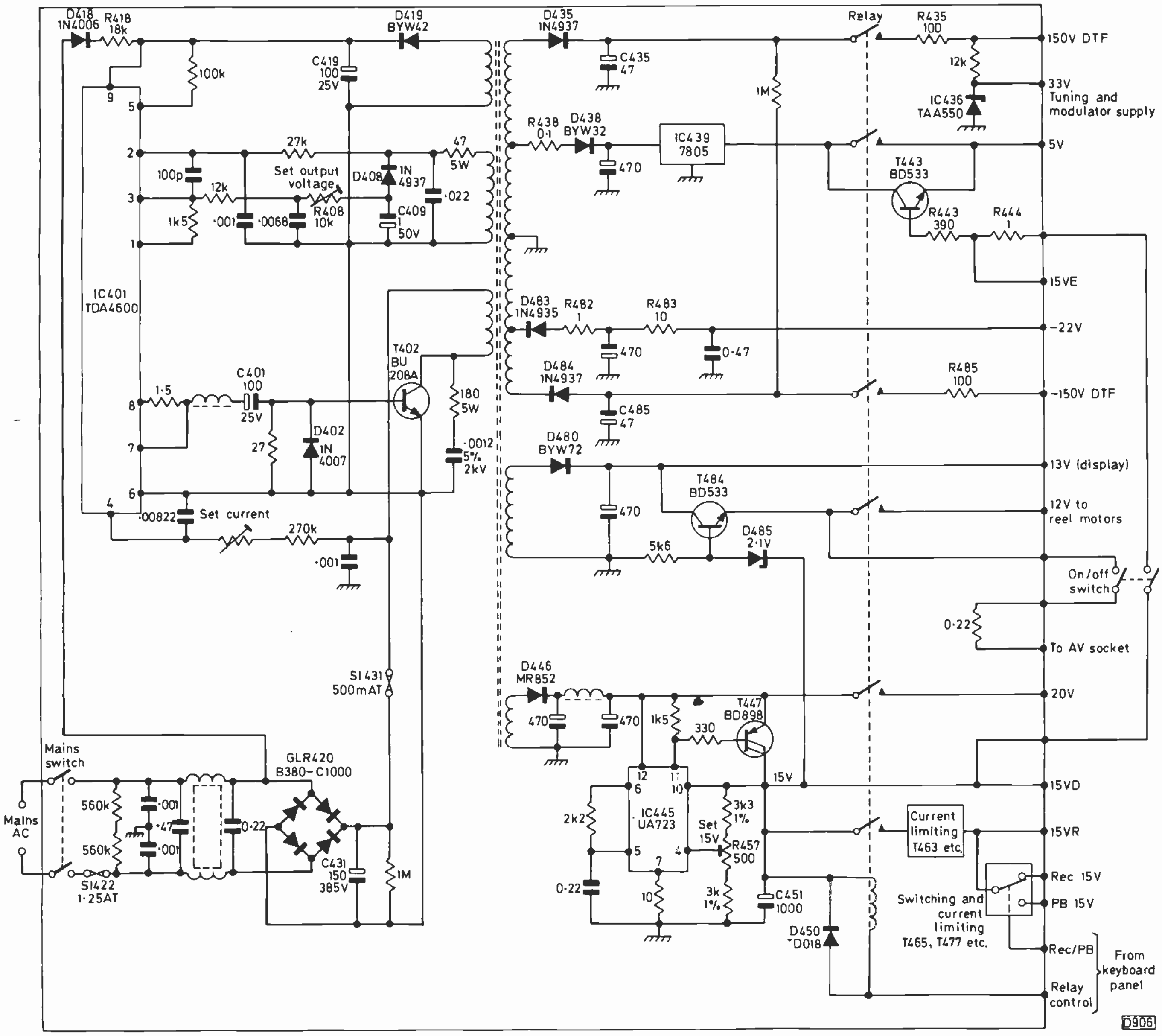


Fig. 1: The power supply – simplified circuit.

relay to provide the 5V supply for the microcomputer i.c. IC439 sometimes goes short-circuit, burning out the 0·1Ω surge limiting resistor R438 which again is not present on early machines.

Loss of the 15V supply shows up with the stop LED illuminated and the orange LED at the on/off switch barely visible. In almost every case you'll find that transistor T447 (BD898) is either dry-jointed or that one or more of its legs have broken off. This is the power transistor on the large heatsink at the front.

Loss of power to the reel motors – symptoms are slow or no fast wind and looping tape on playback – is caused by the 2·1V zener diode D485 at the top edge of the panel being open-circuit or dry-jointed. If the power transistor (T484) below it runs very hot, check the reel motor drive i.c. – more on this later.

The most common fault of all is failure of either of the 100Ω safety resistors in the 150V lines (R435 and R485). Symptoms are complete loss of DTF, i.e. noise bars on search and still frame, with a voltage of + or − 70-80V on the slip-ring brushes above the head. If R435 is open-circuit there'll also be loss of tuning voltage – and the modulator output will be down at about ch. 21. Replace both resistors and remove C484 and C437 (if fitted).

The primary side of the power supply – up to the relay – can be checked with only the mains connected, but extreme care is required.

The Keyboard Module

If the power supply is o.k. but the relay fails to operate, there's probably a fault on the keyboard module (see Fig. 2). As previously mentioned, the two microcomputer i.c.s are to be found here. They operate from different supplies and have different clock rates, so they cannot "talk" to each other directly. A shift register (IC270) and associated bits are used to transfer information either way.

In the case of no relay operation, check that pin 7 of IC280 goes high at switch on and that pin 16 of IC285 goes low. If the latter stays high, IC285 is probably faulty. Before you replace it, check the diode (D450) across the relay winding in the power supply. If pin 7 of IC280 doesn't go high, check the supplies and clocks at both microcomputer i.c.s. Dry-joints are common on this panel, especialy along the bottom where the ribbon cables connect.

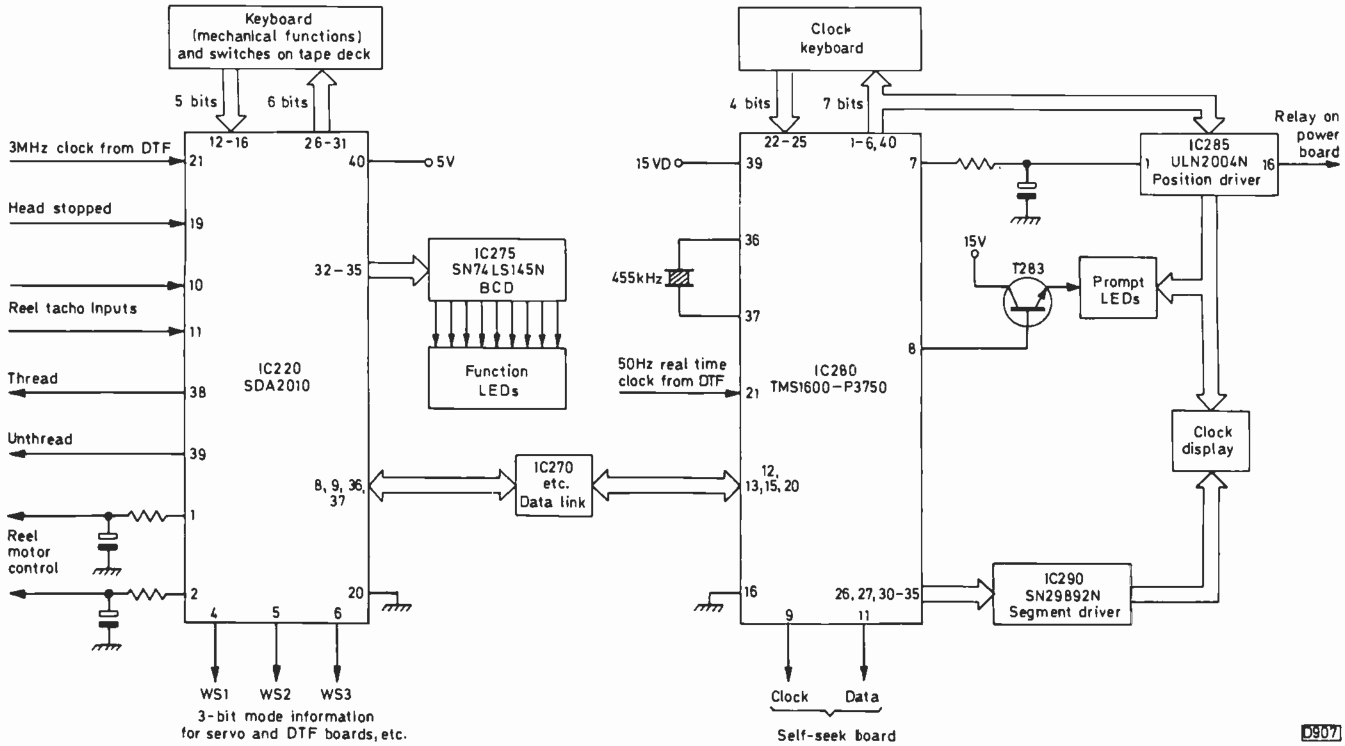


Fig. 2: The keyboard module – simplified block diagram.

We've occasionally had no switch on due to failure of IC220. The three WS outputs have also caused problems. These tell the servo, DTF etc. which mode the machine is in – if one bit is wrong you can get all sorts of strange results, like record in slow motion etc. More on the WS codes when we come to the servo board.

Sometimes the seven-segment displays give trouble: internal leakage can result in segments being lit that shouldn't be, or segments being dim or missing. R284-R293 always look cooked on machines that have had much use.

Next month we'll look at the signals section.

The Ferguson TX100 Chassis

In the past a new chassis from Thorn has usually involved the introduction of something radically different by way of circuitry or overall chassis arrangement. Think of the switch-mode power supply in the 3000 series, Syclops in the 9000 and so on. The theme of the new TX100 chassis however is evolution. It's been developed as a flexible, basic high-performance chassis to replace the TX9 and TX10 – flexible and basic in the sense that it's able to drive a wide range of tubes and is capable, with interfacing panels, of meeting all likely requirements over the next few years. Such requirements include remote control and teletext (of course); viewdata; frequency-synthesis tuning; RGB, composite video and stereo sound inputs; and SECAM colour capability for export models. The need to operate with cable and satellite signals has been taken into account in the design, and provision is made on the board for fitting the components required for stereo TV reception. The chassis may not look particularly innovative at first sight, but the design is elegant from a production viewpoint in the range of its capabilities.

Physically the new chassis is compatible with the TX9. This makes it possible to use existing chassis/cabinet mouldings. The new chassis is mains isolated however, which was never the case with the various versions of the TX9. As a result, for safety it was necessary to ensure that the chassis is not plug compatible with the TX9.

At a time when tube technology is in a state of change, it's desirable that a new chassis should be capable of driving tubes of various types. The TX100 can drive tubes with 90° or 110° deflection angles in screen sizes 14-26in. and with neck diameters of 22·5, 29 and 36mm, also the new generation of FS (flat, square) tubes and the higher resolution types that are likely to be increasingly used. This has been achieved my making it simple to introduce modifications in the scanning areas of the chassis – alternative line output transformers and field output i.c.s and component changes by means of links. The EW correction circuit is on a subpanel fitted to 110° sets only.

The chassis has been designed to interface with the latest digital peripheral circuitry for tuning, remote control and text facilities. The SCART/Peritelevision input socket is an optional extra mounted on a panel with interfacing circuitry. It enables RGB, composite video and audio signals to be fed into the receiver, making the chassis capable of handling home text and graphic displays from computers or sophisticated games, also satellite TV and interactive cable signals.

Block Diagram

A block diagram of the basic chassis is shown in Fig. 1. The chopper power supply is of the Siemens self-oscillating type as used in later versions of the TX9, but in this case providing mains isolation. The safety cover over the

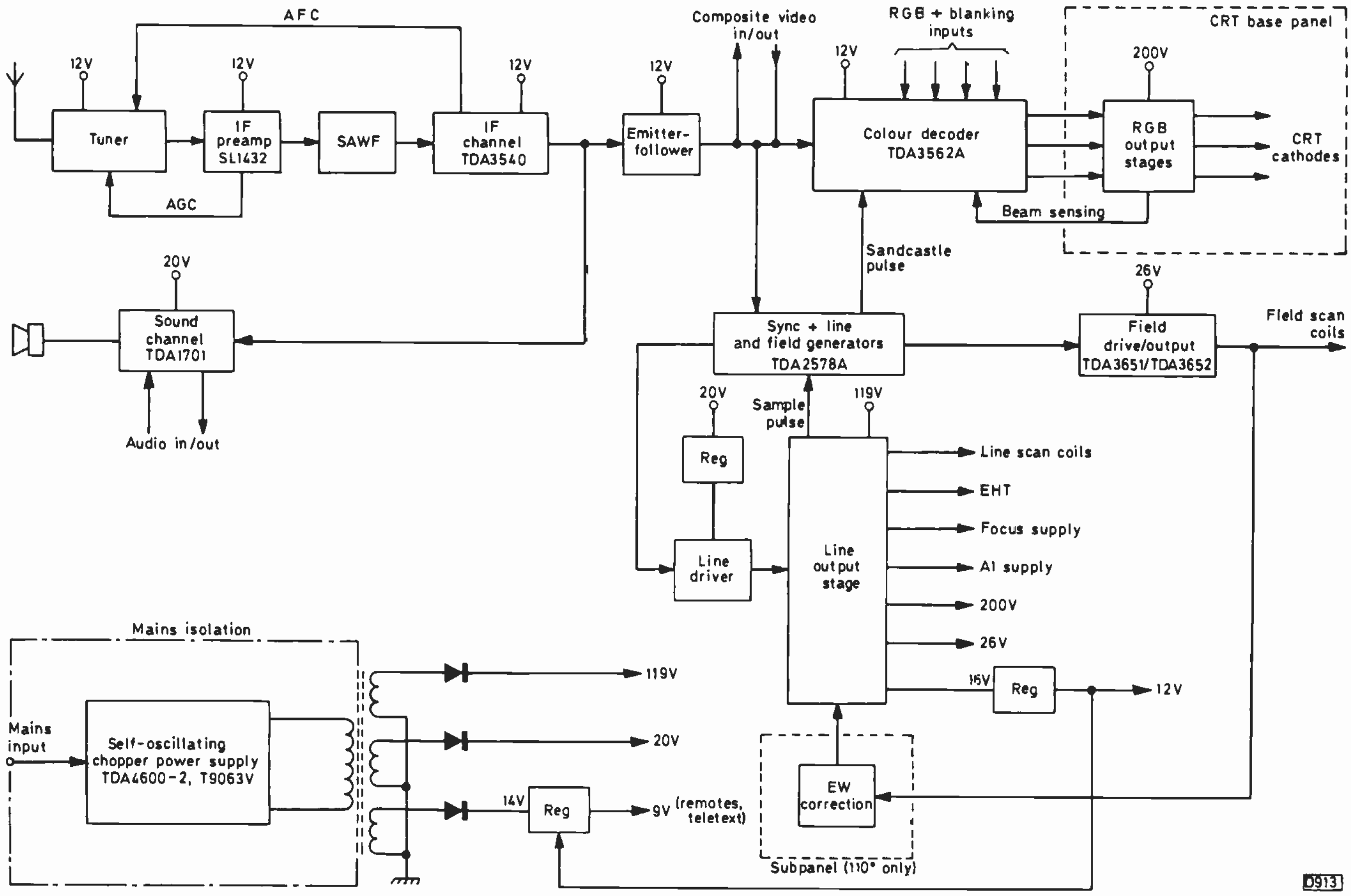


Fig. 1: Block diagram of the Ferguson TX100 chassis. A relay in the 119V line gives remote standby.

live section is colour coded – red for sets produced to drive 110° tubes, yellow for standard 90° tubes and blue for mini-neck (22·5mm) 90° tubes. The control i.c. is a TDA4600-2 and the chopper transistor a T9063V: a thyristor is used in the start-up circuit.

The i.f. strip is basically the same as with the TX9/10, though an improved i.f. i.c. has been adopted (TDA3540). An emitter-follower at the output of the i.f. strip facilitates interfacing. The TDA3562A decoder i.c. differs from the TDA3561 used in late versions of the TX10 in incorporating black level correction. Each RGB output stage incorporates a beam sensing circuit that provides feedback for this purpose. Only a single feedback connection is required as the i.c. samples the black currents of the three guns sequentially line by line. At first sight the RGB output stages look like the now conventional class AB circuits. The beam sensing circuits enable the circuitry to be subtly rearranged however. The first transistor in each channel is a conventional class A voltage amplifier with a high-value (15kΩ) load resistor to reduce dissipation. This is followed by an emitter-follower transistor to give optimum transient response on the positive-going edges of the video waveform. The transistor included for black-current sensing also acts as an emitter-follower to provide a discharge path for the tube capacitance on the negative-going edges of the video waveform. The new circuit provides good high definition and grey-scale performance.

The sync/timebase generator and field driver/output i.c.s are the same as those used in later versions of the TX10, though the TDA3651 replaces the TDA3652 in 90° chassis. The line output transistor, transformer, tuning capacitor and other components also vary for 90° and 110° operation. An unusual circuit in this area is the line driver stage (see Fig. 2). This is a low-voltage stage using a BC372 Darlington transistor. A 15V regulator is incorporated and the supply to the driver transformer is altered for 90/110° operation, an example of the timebase flexibility we've referred to above.

Model Numbering

Sets using the new chassis will be added to the Ferguson range this autumn. They will be easy to spot as a new system of model numbering is to be introduced. The first two digits will indicate the screen size. This will be followed by A to indicate that a 90° tube is fitted or B for a 110° tube. The final digit indicates either 1 a standard set, 2 a set with remote control, 3 a teletext equipped set, 4 a set with teletext and stereo sound and 5 a component set. So 20A1 will indicate a standard 20in. set with a 90° tube. We shall also have to get used to referring to this as a Ferguson rather than a Thorn chassis.

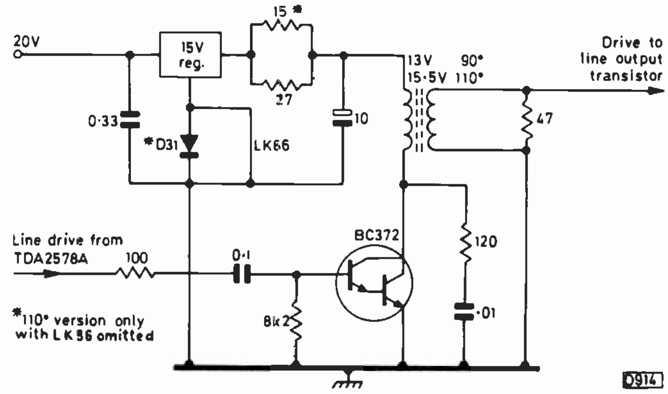


Fig. 2: The low-voltage line driver stage.

TV Fault Finding

Reports from Mick Dutton, John Coombes, Malcolm Burrell and Tony Thompson

Thorn TX9 Chassis

The problem with this set (PC1044 main panel, i.e. chopper version) was field roll, approaching double speed. It was cured by replacing the oscillator timing capacitor C206 (0·47μF) connected to pin 9 of the TDA1170S field timebase i.c. **M.D.**

Fidelity 20in. CTVs

A problem with these models is that the tuner presets are very touchy. There are two different types: thumbwheel controls or rotary potentiometers with a special adjuster that has a built-in gearbox to make adjustment easier. It's the latter type that seems to cause most problems. We had one set that was particularly sensitive on the first preset on BBC-1. This wasn't due to the tuner potentiometer assembly however but to very slight misadjustment of the video detector coil L1. **M.D.**

Philips KT3/K30 Chassis

Something I've often had recently is one colour dropping out as a result of corrosion on the pins of the decoder i.c., where it plugs into its base. It's possible to clean the pins, but a more permanent cure is to solder the i.c. direct. The same problem can also be responsible for running colour. **M.D.**

Thorn TX9 Hint

A TX9 Moviestar portable came in recently with the complaint of fuse blowing, something that's been mentioned in these pages before. Whilst testing we found that we were accumulating quite a tidy pile of small black fuses. This is wasteful. I eventually tried hooking the cutout from a Thorn 3000 chassis in place of the mains fuse. This blew quite readily from time to time until the cause of the fault was located after which the correct fuse was fitted. **M.B.**

Hitachi Models CPT1471/1473

The STR6020 chopper i.c. (IC901) bolted to the chassis is a prime suspect that can cause various faults on these sets. The trouble we had with two of them was a slight intermittent picture break-up accompanied by a sound rather like internal arcing. A couple of other sets would work normally then suddenly return to standby, the sudden loss of e.h.t. making it seem as if a flashover was responsible. **M.B.**

Pye 731 Chassis

The complaint with an Ekco Model CT262 (Pye 731 series chassis) was that the "picture goes off". Not very enlightening! We soak tested the set for several hours over three days but the fault wouldn't put in an appearance for us – despite efforts at prodding around. The set was then returned but came back a few days later, when it again performed faultlessly for hours on end. Whilst I was out my customer liaison/bookkeeper/soak tester/wife noticed that it went off "just for a few seconds – no sound or picture, just snow and loud hissing, as though the aerial had been disconnected". At last a clue. With this problem the i.f. gain/selectivity module is always suspect on these sets. But I'd already tapped and prodded around, and even flexing the panel didn't help.

I then noticed the wire link that carries the tuner's output to the module. It was this link that was the trouble, due to being positioned so close to the tuner's screening can that an intermittent short was occurring. Why it happened so intermittently, and why tapping had no effect, remains a mystery. I've not come across another of these sets where the link was so critically close: possibly a replacement tuner with an oversized screening can had at some stage been fitted. **T.T.**

Thorn 1500 Chassis

The problem with a set fitted with the Thorn 1500 chassis was excessive height. Adjustment of the height control only made things worse, including the linearity. Voltage checks around the PCL805 field timebase valve revealed grossly excessive voltage at the anode of the triode section of the valve. We expected to find a low-value feed resistor, but in fact the filter capacitor C89 (1μF) was open-circuit. **T.T.**

Pye 725 Chassis

The complaint with a Dynatron set fitted with the Pye 725 chassis was low, distorted sound, worsening the longer the set was left on. The audio output stage showed no signs of distress – nothing overheating – so I suspected the TBA750Q intercarrier sound chip, which can sometimes be responsible for this fault. A replacement made no difference, as I should have known since freezing the original one had not affected the fault. Voltage checks then revealed that the chip's supply pin was at only about 6·5V instead of 11·5V. The feed resistor is R218 (560Ω), and though it looked o.k. it had risen in value, replacement clearing the fault. **T.T.**

Thorn 3000 Chassis

Like many engineers, I get a lot of trouble with the first anode supply switches used in these sets. They are of the metal kind, the body of the switch being earthed via print lands on the panel. What actually happens is that the switches leak internally, taking the first anode supply to earth. The switch can of course be replaced – but only if you happen to have one with you, and I rarely seem to be in that position. Or you can remove the switch entirely, linking the print with stout, single-strand copper wire; or sever the print in such a way that the body is no longer earthed. I don't personally favour the latter approach: I think that once a switch has given trouble it's likely to be impaired and should be removed – and don't forget that any switch dealt with in this way would have a metal body with up to 1kV on it just waiting for some unsuspecting service engineer . . . It's best I think to link the supply permanently with copper wire.

The problem I had recently on one of these sets was very bad field linearity. I tried all the usual things but drew a blank. In the end, because of a hunch rather than any scientific reasoning, I changed the field output stage h.t. feed resistor R442 (58Ω). It's a wirewound component mounted on the field/audio board, at the top rear. It read all right out of circuit, though the problem would I suppose have been apparent had I checked the voltage across it – probably an instance of familiarity breeding contempt . . .

If you've got one of these sets fitted with the later type of power board and it keeps going dead for no apparent reason, check the two top fuses: lift them and measure the resistance, since you may be misled by voltage checks. If one of the fuses is open-circuit the set can continue to function, but with the intermittent dead effect.

One last point on this chassis. When the dead set symptom can be cured by pressing the cut-out, this item is not above suspicion. In fact the cut-out is often responsible for the fault nowadays, years of running having burnt away the contact areas until at least one of them has a hole clean through it. You can confirm this by taking the cut-out apart. Don't attempt to reuse it: fit a replacement.

T.T.

Thorn 1615/1715 Series

If the problem is bent verticals at the top and bottom of the picture, check for a dry-joint on the tube base – on the earth lead to the Aquadag c.r.t. earthing spring. **J.C.**

TV Test Pattern Generator

Part 3

Tony Jenkins, G8TBF

This month we'll deal with the assembly of the PCBs. The layout of the logic board is shown in Fig. 9: this is the most complex board and in order to reduce construction time and errors has plated through holes. It needs to be soldered on the inside only and hasn't any through board links. When an i.c. is soldered on to this type of board the solder tends to run into the through holes, making subsequent extraction more difficult. We therefore recommend that extra care is taken when constructing the board and the use of i.c. sockets or soldercon terminals for the ZNA234E and EPROM i.c.s. Several ceramic and electrolytic capacitors provide local decoupling – see Fig. 9. These should be soldered in last of all.

The encoder and power supply boards are single-sided types and construction is straightforward. An i.c. socket is suggested for the TEA1002. Layouts next month.

A set of the three PCBs will be available in late July at £27 inclusive of VAT and postage/package from Coombe Martin Electronics, King Street, Coombe Martin, North Devon, EX34 0AD. Please note that the boards will not be available individually.

A set of the three pre-programmed EPROMs will be available from JRW Developments, 13 Baulk Lane, Worksop, Notts, S81 7DF at £29 inclusive of VAT, postage and packing.

In next month's concluding article we'll describe the construction of the complete instrument in a suitable case and provide setting up instructions and fault finding hints.

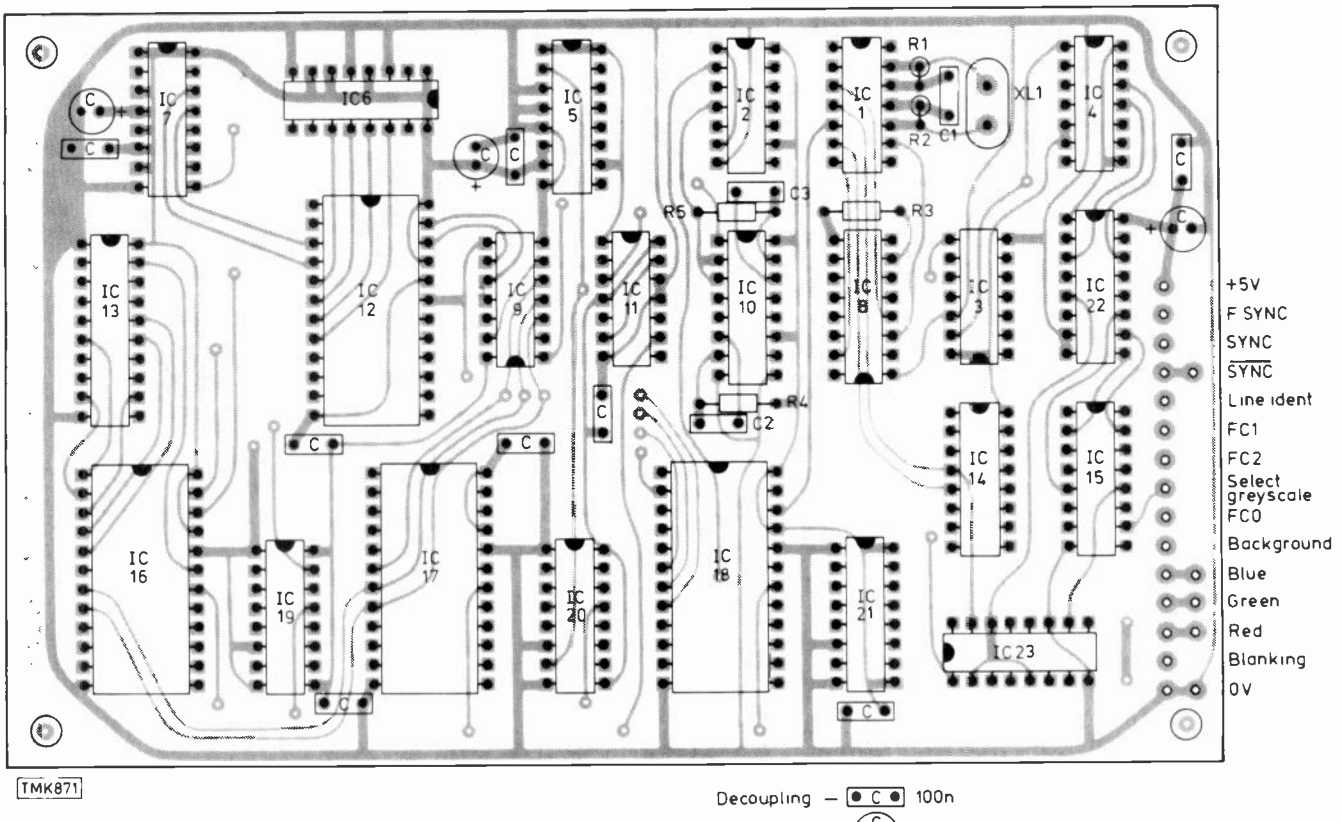


Fig. 9: Logic board component layout.

Long-distance Television

Roger Bunney

April was a great improvement on March, which had been unusually quiet. When Sporadic E activity perks up during April it usually means a good season ahead: the signs are certainly auspicious. Ionospheric conditions have been disturbed by solar flares however. These produced magnetic storms and blackouts from 24-28th April – the largest disturbances for several years. This resulted in auroral activity on the 25th and 26th. The m.u.f. rose prior to the 24th, Cyril Willis (Ely) logging Zimbabwe ch. E2 vision during the late afternoon via trans-equatorial skip. SpE propagation in Band II was noted on the 28th. The main loggings of the month were as follows:

8/4/84 RTVE (Spain) chs. E2, 3, 4.
15-16/4/84 Short-duration Band I SpE signals throughout the day.
17/4/84 CST (Czechoslovakia) R1.
20/4/84 RAI (Italy) IA; ZTV (Zimbabwe) E2 (TE).
22/4/84 RTP (Portugal) E2; RAI IA, IB.
23/4/84 TSS (USSR) R1.
24/4/84 ZTV E2 (TE).
25-26/4/84 Unidentified auroral signals in Band I during the evening – characteristic "rumbling" noises, hum on vision and poor sync.
27/4/84 TSS R1.
28/4/84 RAI IA, IB; EPT E3 (see below); Italian cordless phones at 49MHz!
1/5/84 TSS R2.
3/5/84 CST R1; many short-duration Band I signals during the morning.
5/5/84 Many short-duration SpE signals throughout the morning, with DFF (E. Germany) ch. E4 and signals on chs. R1 and 2 logged.

The Greek ch. E3 signal logged by Cyril Willis on the 28th lasted for over an hour, from 1830, the EPT identification appearing at 1900. The signal had no vertical test signals and tends to confirm a previous suspected Greek logging. There's no official Greek ch. E3 listing however. Well done Cyril!

MS activity was not particularly noteworthy, though the Lyrids shower arrived on schedule, with numerous dense bursts especially on the 22nd.

A static high-pressure system dominated the second half of the month, giving record temperatures and sun. For those in the south however the tropospheric conditions failed to produce a good opening, due in part to a gentle breeze on most days. Conditions were better farther north, a good opening being experienced in Scotland. Reception began to improve on the 22nd, with signals from the east and south east being widely logged. By the 24th, DXers along the east and north east coasts were receiving signals from Swedish, Norwegian and Danish transmitters in Band III and at u.h.f., the peak days being the 24/25th. Iain Menzies (Aberdeen) reported Band III and the u.h.f. spectrum jammed on the 24/25th, with W. German stations on all channels and from all three networks. Cyril Willis noted only "several W. German u.h.f outlets" on the 25th, while here at Romsey only French and Benelux stations were logged.

For once the north did best. While a circulatory breeze was present in the south, most days in Aberdeen produced fog banks that rolled in from the North Sea. The good conditions in the north continued until the 28/29th, producing signals from Norway, Sweden and Denmark in Band III and at u.h.f. During the first few days of May however the high-pressure system moved, rain fell and conditions returned to normal.

At least three of the new French Canal Plus transmitters – Lille, Paris and Rouen – are now on test, with daily transmissions from approximately 0900 to 1800. Excellent signals have been received from Lille – a grey scale and the PM5544 pattern (identification TDF and CENEX-BCH). Paris is somewhat weaker, while Rouen has a very distinctive pattern (see photograph).

A smaller tropospheric opening occurred on the 13/14th. This was particularly noticeable in the south, with signals from W. Germany and the Benelux countries.

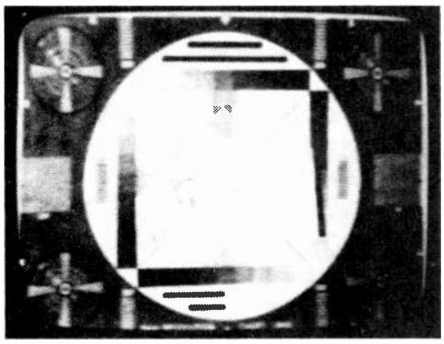
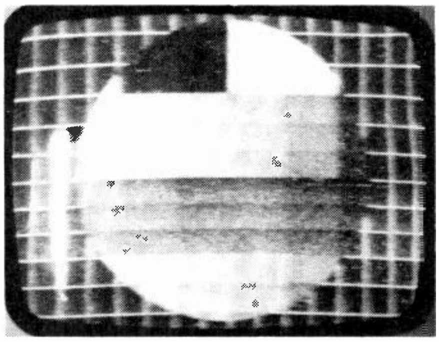
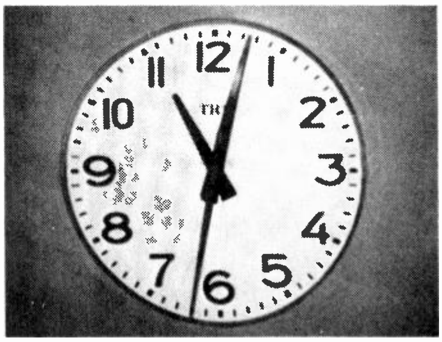
Many thanks to the following for their reports: Tony Privett (Basingstoke), Iain Menzies (Aberdeen), Cyril Willis (Ely), Paul Barton (Harrogate), Gareth Foster (London) and Hugh Cocks (E. Sussex).

News Items

USA: The Broadcast Television Sound Committee (BTSC) has adopted a standard that could result in stereo TV sound transmissions before the end of the year, subject to FCC approval. Zenith's proposal for coding was selected following several years of tests and the evaluation of three basic systems.

Kampuchea: Test transmissions from a ch. A10 (system M) transmitter at Phnom Penh started in January. Regular transmissions are expected to start early next year.

France: The Canal Plus service is to be inaugurated on November 1st in the Paris, Lyons and northern regions.

Left: The RETMA test card used by G1APD (Southampton) – ATV reception in Romsey at 437MHz. Centre: Canal Plus on test from Rouen, received at Romsey. Right: Clock used by TRT (Turkey).

Descramblers to connect via a SCART socket will be available after payment – adaptors for older sets without such a socket will be available.

New DX Publication

Simon Hamer has written a useful nine-page (A5) booklet entitled "TV-DXing for Beginners". It covers the basics of DX-TV reception, signal propagation, channel allocations and methods by which a standard u.h.f. TV set can be used for the purpose. Enquiries should be sent (include a s.a.e.) to the North England Radio Club International, 4 Bryn Bank, Wallasey, Merseyside L44 1AU.

Transmitter News

AFNTV is operational in Holland on ch. A80 (between E70/71), at 20kW e.r.p. with horizontal polarisation and a 40m mast. This provides a strong signal in Rotterdam.

The Polish transmitter network has been increased as follows: Siedlce R1 50kW e.r.p., Przemysl R24 300kW, Opole R40 500kW, Siedlce R52 300kW (all TVP-1), Przemysl R41 300kW (TVP-2).

Regional programming will be carried by the following Norwegian transmitters from September: Greipstad E2; Bjerkreim E6; Lyngdal E9.

Satellites

ARABSAT is to be launched in November to provide services (DBS and point-to-point) to the Arabic countries at 2·5GHz. It will have 25 output transponders... Thames Television/Granada TV are planning a satellite service via ECS to compete with Sky Channel... The general trend at 4GHz in the USA is for increased downlink EIRP levels, now reaching 37dBW compared to the first generation 34dBW. As a result, TVRO terminals can operate with 6ft diameter dishes. At 12GHz Anik-C provides up to 48dBW on its downlink to the eastern USA, allowing 3·5ft dishes to be used. Plans are for future EIRP levels of up to 55dBW so that 2ft dishes can be used.

Pirate FM Radio

Several unlicensed, commercial f.m. radio stations have been in operation recently, mainly in the London area. The transmitter is normally sited atop a block of flats or at some similar vantage point with a radio link from the studio. Gareth Foster reports that Radio Jackie is using 209MHz for its link and Skyline Radio 203MHz. Other operators are likely to use this spectrum for the same purpose. The idea is to avoid seizure of the relatively much more expensive studio equipment: the transmitter may be moved around from day to day to avoid detection by the DTI/BT Radio Services.

Aerial Mounting Problems

Ian Moody comments that the boom of his Antiference XG14 u.h.f. array is exactly the correct length for a ch. E4 dipole and wonders whether it could be used for this purpose. I don't think that such a dual use would be feasible even with correct matching, but this does raise an interesting subject. If the boom is mounted so that it's parallel with a Band I aerial and the distance between the two is less than one wavelength (at Band I), there will be a degree of absorption. This will increase as the separation between the two is reduced. The moral is to avoid mounting arrays so that a boom is in parallel with a close proximity aerial element of similar dimension.

A similar problem occurs when say two aerials rather than a single wideband aerial are used to cover a certain band and are mounted close together. Two narrower bandwidth aerials will be more efficient – provided they are mounted a wavelength or more apart. This can be a problem – a wavelength is 17ft in the case of ch. E3! The higher the gain, the worse the problem, as a study of stacking information will show. The minimum tolerable distance for stacked arrays is usually quoted as being 0·75λ, one wavelength being suggested as the best compromise. In many cases therefore a single wideband array will be more efficient despite its lower gain. Any observations?

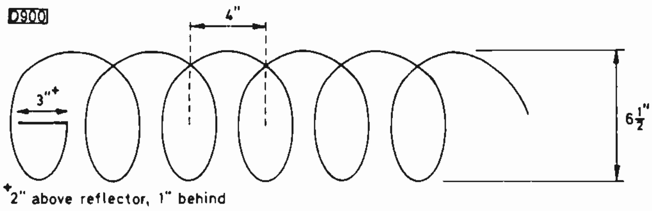


Fig. 1 (above): Helix details.

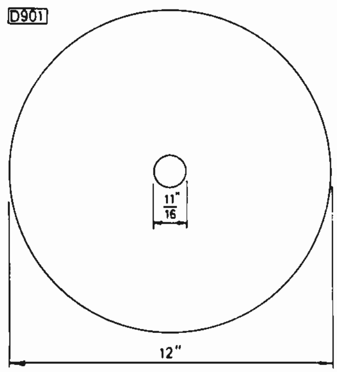
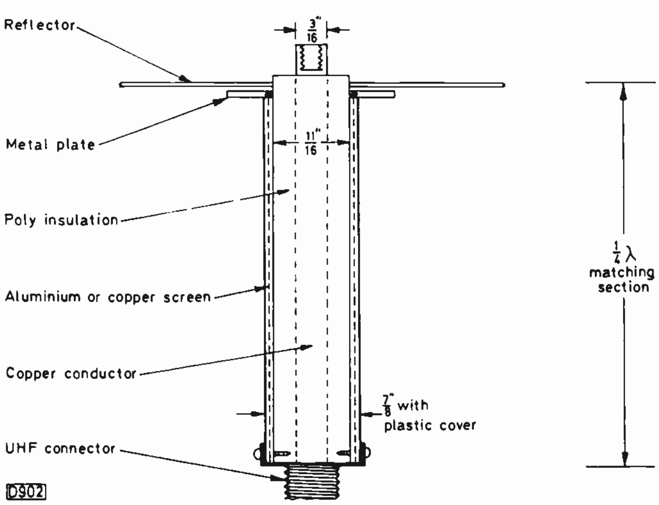


Fig. 2 (left): Reflector dimensions.

Fig. 3 (below): Details of the matching section.



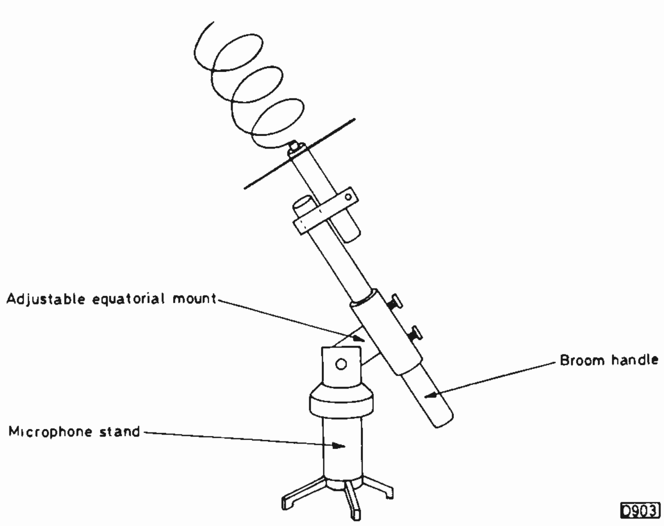


Fig. 4: The helical aerial mounted on its stand.

Interference

I've recently encountered a new type of interference that presented itself as heavy patterning with a synchronised white square throughout most of Band I. It was traced to a Sinclair ZX81 on program playout, and despite being nominally on ch. 35 there was sufficient radiation to reach a Band I aerial at a distance of over 70 yards. Fitting a replacement coaxial lead with efficient screening between the ZX81 and the TV set reduced the problem.

Dave Lauder's DX-TV Newsletter recently reported an interesting case of teletext breakthrough with a DX-TV receiving installation. In this case the problem was overcome by fitting ferrite toroids to the aerial feeder and mains lead supplying the teletext receiver. Dave comments that computers etc. could produce similar problems and that fitting ferrite toroids to all connections should provide a cure. Ambit have a wide range of toroids – use v.h.f. types (i.e. dust iron) such as the T50-10, T37-12 and T50-12. The large ferrite toroids used as braid breakers can be obtained from amateur radio suppliers – in this case two similar toroids should be placed together and the mains cable or whatever wound through the centre several times. Let us know of any similar problems – or solutions!

Simple Helical Aerial

Chandra de Silva (Colombo, Sri Lanka) has built a simple helical aerial (see Figs. 1-4) at virtually no cost for the reception of the 714MHz signals from the Ekran satellite (Stationar-T) at 99°E. This satellite transmits the Moscow-1 service with a 24MHz wide f.m. video channel, 6·5MHz sound subcarrier and right-hand circular polarisation, and is well received in Sri Lanka, India and the Gulf. Unfortunately it's over the horizon in W. Europe.

The helical element consists of six turns of 3/8in. aluminium tubing, with 4in. spacing between turns (looking clockwise from the connection end). The latter is bent to give a spacing of just over 2in. between the end of the helix and the aluminium reflector. The matching section consists of a metal tube with a thick 50Ω coaxial inner that passes to an SO239 connector.

The main problem at the feed point is to obtain matching to the cable. Typically the feed impedance is some 130-140Ω. This requires a 102Ω quarter-wave section to match to 75Ω, or an 83Ω quarter-wave section to match to 50Ω. It might be better to make a direct connection at the feed point to a low-noise transistor amplifier such as that shown in the April issue (page 303) – a tapped coil could be used at the input for optimum noise matching.

The aerial has a beam width of about 36° (−3dB points) and a gain of 11dBi (8·8dBd). Comments and findings from anyone constructing an aerial of this type would be welcome.

Service Bureau

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

RANK T20 CHASSIS

There's an odd effect on this receiver: the verticals at the top and bottom flare outwards, with some vertical compression. The EW pincushion control affects only the main portion of the display, not the top and bottom.

We've come across this effect on several occasions on various chassis and have usually found the cause to be loss of inductance in the EW loading or bridge coils – these are 5L1 and 5L5 in the T20 chassis. Inspect them for signs of overheating, broken or damaged ferrite etc. and replace as necessary.

PHILIPS KT3 CHASSIS

There's misregistration of the colour with respect to the luminance, seen most clearly with saturated colours. Colour from a left-hand object spills about 4mm across to the right. Otherwise the colours are correct, there are no blinds and all is well.

The colour fit can be improved by realignment of the chroma coupling circuit on panel U3430. Use a test pattern – Ch. 4 is ideal. Screw the core of the 2·2MHz trap U194 right down then back half a turn. Then tune the bandpass circuit U195 for best transition between the green and magenta bars without producing ringing. The effect of this is to widen the chroma response without spoiling the pulse response of the luminance channel.

HITACHI CNP190

I'm having difficulty with this fault due to its intermittent nature. About two or three times a night the picture contracts all round by about three inches, with loss of colour and sound. The problem doesn't seem to be temperature dependent and the picture may return to normal either suddenly or slowly. In the latter case the picture will expand and contract several times before settling down.

The likelihood is that the h.t. voltage is falling from time to time – this can be confirmed by leaving a meter connected across the 120V rail. Suspect components are the zener diode CR40 (HZ-7), the set h.t. potentiometer R911 and the three transistors (TR41/3/4) in the series regulator circuit.

RANK T20 CHASSIS

There's an unusual fault on this set – the picture contracts at the sides at points of high brightness. Any ideas?

We suggest you start by checking diodes 4D9 and 4D10, since these affect the breathing performance. If all is well, check the earthing of the c.r.t.'s Aquadag coating then if necessary set up the line output stage fifth harmonic tuning as detailed in the manual.

HITACHI NP6C CHASSIS

We're having trouble with the 2SC1942 chopper transistor used in this chassis. After a few days of normal operation the set goes dead. If left for a while it will come on again. This happens several times then the transistor goes, severely blowing the 800mA chopper circuit fuse. A BU208A used as a replacement lasted for about a week before going in the same way.

In our experience a BU208A is not suitable in this position and a 2SC1942 will have to be used. To prevent it blowing up again, replace the two HM9102 thick-film modules T901/2 in the power supply and check this area carefully for dry-joints. Also ensure that the two 22Ω resistors R925/R936 in the chopper transistor's base circuit have not changed value.

THORN 1590 CHASSIS

The field hold control is at one end of its track and the frame slips at intervals. Are there any "stock items" to go for?

If the l.t. supply is exactly right at 11·6V, and the field hold control and its series resistor R79 haven't changed value (this does happen), the most likely culprits are transistor VT15 on the output side of the multivibrator circuit and the field sync isolating diode D24.

RANK T20/22 SERIES

There seems to be some difficulty in supplying replacement overvoltage crowbar thyristors for these sets. Advertisers don't appear to stock the S2062D.

There's nothing very critical about 7THY2: a Thorn BRC4443 can be used in this position with no problems.

SONY KV1820UB

The initial trouble was intermittent start-up. At switch on the sound would come up but a few seconds later, before the picture appeared, the set would go dead (apart from the indicator neon being lit). Switching on and off would produce the same sequence, but after a few attempts normal operation would be obtained. The fault has subsequently become solid, with the set refusing to start, though if left for ten minutes or so the earlier sequence will occur, with the addition of a brief multi-coloured flash at screen centre as the set goes dead.

It's very common for these symptoms to be caused by an internally open-circuit gate in the line output device (Q901). This diagnosis will be confirmed if Q901 has h.t. at its anode and line drive at its gate. If there's no h.t. at Q901's anode when the fault is present, check the efficiency diode D806 for being short-circuit, then concentrate on the power supply. Check for voltage at the mains bridge rectifier's reservoir capacitor C606, then check the operation of the chopper transistor Q607.

QUERY COUPON

Available until 18th July 1984. One coupon, plus a £1·00 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice above.

TELEVISION JULY 1984

RANK A823A CHASSIS

The problem is very bad patterning on the colour – it's not present on a monochrome picture. The decoder and i.f. panels have been replaced and the cause is not r.f. interference – it doesn't happen with a similar set.

A common cause of this problem is indifferent decoder panel earthing. This depends on contact between the panel earth print and the metal chassis bar. Ensure that both surfaces are clean and that the panel securing screws are tight. If this fails to cure the fault, check the i.f. panel earthing and that of the earth braids of the interconnecting leads. If necessary carry out decoder alignment as laid down in the manual, paying particular attention to the settings of the harmonic rejectors 3L12/13/14 and the items associated with the oscillator crystal (3TC1 and 3L1).

TEST CASE

259

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.

All was tranquil in the workshop one Tuesday morn. The field engineers had left on their rounds, the phone was quiet, and our Jack-of-all-trades was dividing his attention equally between a recalcitrant VCR and the engineering announcements on Channel 4. Suddenly this somnolent scene was disturbed by a flood of light from the screen of a soak-testing ITT colour set – one of the CVC20 type. The job card showed that it stood accused of a "bright blank raster after thirty minutes". Just so!

Two checks with the Avo were made straight away. These showed that the first anode voltage was normal but that there was virtually zero voltage at the cathodes. This established, the set was put on the operating table, the VCR and TV programme being forgotten in the excitement – we had to tackle the fault before it disappeared, as experience had taught us it might.

Our first suspicion was that the 225V supply to the RGB output stages might be missing, but the heat rising from the collector load resistors indicated otherwise. The three BF458 output transistors were obviously hard on, with about 8V at each emitter. It didn't take long to find that this was because the TCA800 demodulator/matrixing chip was driving them to saturation, with over 9V coming from pins 3, 5 and 7. It became plain at this point that the job wasn't going to be a two-minute affair, so the c.r.t.'s heater feed was disconnected. Turning off the tube in this way would remove the strain on the tube, the tripler and the line output transformer. At the same time the decoder panel was refitted on the print side of the panel to give easier access for our Sherlock Holmes.

The TCA800 is a straightforward chip. The luminance signal together with a d.c. bias voltage is fed in at pin 1. We confidently expected to find an outlandish voltage here, but it was almost exactly as specified at 1·9V. Voltage measurements were then made at the other relevant pins: these were a bit low at the clamp reservoir capacitor pins 2, 4 and 6, while there was about 1·6V instead of 1·8V at the pulse input pin 8. All other voltages were within a few per cent of normal. So after checking that the earth pin 16 was firmly grounded the chip itself was changed.

The new TCA800 produced the same results, and continued to do so when reduced to Arctic-like conditions with freezer. Back round the pins, with readings as before. Check that the clamp reservoir capacitors are grounded. Yes. R553 which is in series with the drive to the red output stage was then disconnected, bringing relief to this output stage. This proved that the trouble was at the chip side of things, though the primary cause could lie elsewhere . . .

The cause of the trouble was traced after a bit of scoping. If you should consult the block diagram of the TCA800 i.c. given in the service manual, the next step we took, don't be fooled by the absence of a connection that should have been shown but isn't. We'll explain this and the cause of the fault next month.

ANSWER TO TEST CASE 258
— page 447 last month —

Last month we were deep into the decoder of a Grundig Model 2222GB with no colour. We'd discovered that the basic cause of the fault was an unlocked reference oscillator, and had eliminated various possible causes. The set follows conventional practice, with the crystal reference oscillator controlled by a phase-locked loop. The heart of this is a discriminator that compares the oscillator's output with the burst signal. The discriminator produces an error voltage which biases a varicap diode in the oscillator circuit, pulling it into phase lock. Not when the discriminator diodes are leaky however! The items concerned are Di863 and Di868, type AA119. Being germanium devices, their leakage resistance is difficult to specify. These two had very different reverse readings however. The decoder seemed happy enough when a matched pair of OA90s was fitted, so we left it at that – after setting up the loop.

Finally the business of the test card clue to the colour-killer operation. As with a number of chassis, the 4·43MHz filter in the luminance channel is switched. The switch is within the TBA970 luminance chip: it's used to open-circuit the filter on a monochrome signal. The fact that the fourth frequency grating (4MHz) on the test pattern could be seen revealed that the trap was not in operation. We can't rely on the next grating (4·5MHz) for this, as not all shadowmask tubes can resolve it.

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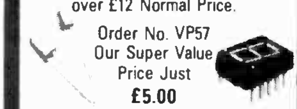

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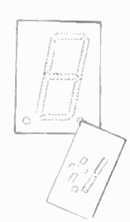

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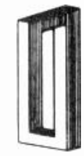

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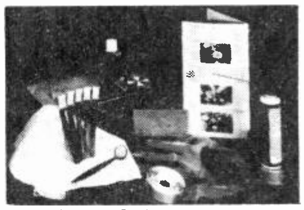

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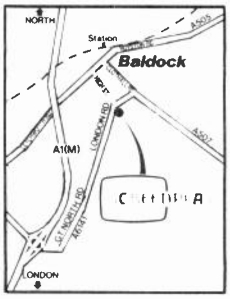

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7/84

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2 banks of 3 PB unit. Pye 731 £2
4 Push button unit preh £1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
KT3 12 Push button unit £2.00
KT3 (Export) 12 P.B.u £2
6 Push button Unit Thorn £1.00
6 Push button unit for GEC 2040 and ELC 1043/05 £6.00
Hearing aid unit £3
6 Push button unit PYE 713 £7.00
7 Lamps for P.B./Unit 10p

Mains Droppers

Pye 731 3+56+27R 50p
Pye 3R5/15R/45R 50p
Thorn 50/17/1K5 £1.00
120/20/20/48/117 £1.00
270/10/6 for Thorn 4000 50p
18/320/70/39 £1.10
Thorn 50-40R-1K5 50p
Ae Socket & Lead
GEC, ITT, Philips, Pye 25p
7×3½ Thorn £1
Rank Toshiba Tube Bases 30p

Speakers

6×4 G11	25 ohm	70p
5¼×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
5×3	15 ohm	80p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6¼" dia	4 ohm	£1.50
6¼" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
KT3 speaker		75p
3" dia	15 ohm	60p

Diodes

BY 127 10p
BY 133 10p
BY 134 10p
BY 164 50p
BY 176 25p
BY 179 40p
BY 184 25p
BY 187 10p
BY 190 40p
BY 196 30p
BY 198 10p
BY 204/4 8p
BY 206 8p
BY 208/800 8p
BY 210/400 5p
BY 210/600 8p
BY 210/800 10p
BY 223 £1
BY 224/600: 4.8A/600v bridge 50p
BY 226 15p
BY 227 15p
BY 228 20p
BY 229/400 30p
BY 234 10p
BY 237 5p
BY 238 15p
BY 254 10p
BY 255 30p
BY 298 10p
BY 299 10p
BY 406 8p
BY 527 20p
BY 407a 10p
BY 602 10p
F 247 10p
XK 3102 50p
XK 3123 50p
Hitachi 2A/1500V metal case wire end 20p

Line Transformers

G8 Trans. Philips £6
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W AD5308F + Stik + Lead £1.50
GEC 2040 £3.00
GEC 2110 £7.00
Mullard AT 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono T704A £3.50
CVC32 ITT £7.50
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
EHT Split Diode Leads £1.00
EHT Cable/Metre 20p
Ex panel "14" Fidelity portable £5

Triplers

11 TEZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
9000 Thorn £6
9500 Thorn £4.50
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £6.00
TVK 76/9 £3.00
G8 Philips £4.50
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBQ Pye 731 £3.00
11THY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
BG 100/61 £3.25
KT3 BG200/43 £3.50
T/text ultrasonic rec'r panel £14.00
Video cassette lamps on lead. 12-14V. 50p or 3 for £1.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E.W. coils £1.00
G11 Transient Suppressors 245V 10 for £1.00
G11 Scan Coils £5.00
G11 100K tuner pots 12 for £1
KT3 IF panel £6.00
KT3 line OSC transformer £1
KT3/K30 infra-red receiver head £3
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 25p
KT3 receiver panel £8
KT3 line driver transformer 50p
Decca 80/100 IF panel £5
NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
5 button touch tuner BBC1/2
ITV1/2 video with ic SAS 560T/570T £7.00
Control panel 5 sliders + mains lead £1.50
G11 8 touch button unit replaces old 6 P.B.U. £24
Tube base + base unit for 820
Euro chassis £4.00
GEC Line O/P Trans. & Rec Stick for Portable £3.00
CVC 20/25/30/35/40 decoder panel £10
CVC 20/25/30/35/40 decoder panel (untested) £5
CVC 40/45 IF panel £5
40K Transducer 50p
PHILIPS NE511N £1.20
LM337M Reg. 30p
20 GEC Black Spark Gaps £1.00
G11 Line Driver Transformer 35p

BTW 30/50 50p
International Rectifier EHT Diodes G770/HV34 6KV 3 for 8p
6A/600V Stud Diodes 20p
BTW 92/800R £3
6A/1000V Stud Diodes 20p
25A473 PNP C/P 10p

Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI £10
Field + Jungle panel for GEC 3133/3135 £1.50
GEC 2110 line panel with transformer £7.00
GEC 2110 tuner unit + IF Panel £12.00
Pye/Chelsea Line op panel £12.00
Pye 713 IF panel and tuner £7.00
Pye 7:3 Chroma £10.00
Pye/Chelsea Timebase panel with LOPTI £10.00
Pye 731 Frame Panel £5.00
Pye 731 Convergence Panel £5.00
Pye 731 line O/P panel with transformer + tripler £12.00
Pye 731 Chroma £10.00
Pye 731 IF panel + tuner £10.00
Pye 607/205 Line panel with transformer £10.00
Pye CDA/205 panel £6.00
GEC portable chassis + LOPTI 2114 New £4.00
Thorn 1613/1713 chassis 9.75
Hills 520 multimeter + case. 20,000Ω/volt, fuse diode protected + logic test facility. 10meg/1200 volt £19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230) £15.00
Panel 6101 £15.00
Panel 6330 £15.00
G8 Tuner Unit + Panel £8.00
G8 Convergence Panel (late type) £12.00
G8 Line O/P Panel £12.00
G8 Power Supply £6.00
G8 6 Sloping PBU £12.00
G8 IF & Chroma £12.00
G8 Chroma £6.00
G11 IF Detector £3.00
G11 Selector gain module £3
Complete CVC 825 Chassis (both panels) £40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
Z714 RANK IF Panels 6MHz I
I.C. SL437F £3.00
Z909B RANK IF Panels
Export 5.5MHz 2 I.C.'s
TBA1205B TCA2705Q £2.50
Z743 RANK IF Panel
Export 5.5MHz 3 I.C.'s
TBA750+SC9504P+SC9503P £1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £10.00
GEC Power Supply (Export) £10.00
G11 dynamic correction panel £6
CVC 20 Front panel with sliders + mains input panel £4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £14
CVC 5 Mains on/off + 5 pots £2
GEC Convergence panel £1
Universal Focus. Fits Pye, Thorn and Decca Units.
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
CVC 32 Focus Unit
Focus Rod 25p
G11 focus £2.00
ITT Small for use with Split Diode 50p
TV11 50p
Remo TV12SP 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 rec stick 5p
16 Button Key Pad 1 to 0 + * + #+ 4 blank (Cherry) £3.00

Condensers

470/16 6p
1500/16 20p
3300/16 20p
10000/16 25p
15000/16 50p
3300/18 20p
47/25 5p
470/25 5p
680/25 5p
1000/25 Radial 10p
1500/25 10p
3300/25 20p
4700/25 25p
5000/25 25p
3500/30 20p
470/35 6p
2200/35 25p
100/40 5p
220/40 5p
400/40 20p
1250/40 20p
1500/40 20p
2500/40 25p
1000/50 20p
1250/50 25p
2000/50 20p
3000/50 25p
3300/50 25p

TELETEX DECODER

I.C. SAA 5051
I.C. SAA 5042
I.C. SAA 5030
I.C. SAA 5020 etc. £18.00

DISPLAYS

4040 Clock £1
7seg Red LED 50p
4 digit LCD 88:88 £1.00
2 digit LED 8.8 50p
2 digit LED ÷1.8 with panel + MC14511 £1.00
4700/63 £1.50
250/64 10p
3300/70 50p
.1/100 5p
1/100 × 10 30p
22/100 10p
4.7M/100 5p
470/100 20p
2000/100 70p
4700/100 75p
47/160 10p
800/160 50p
.1/250 Pulse 5p
G11 0.47/250 10p
2.2 250v 10p
3n3/250 A.C. 10p
.39/250V 15p
4n7/250 tested 5KV 25p
22/250 15p
47/250 10p
100/250 20p
G11 470/250V £1.75
500/250 50p
GEC600/250 60p
700/250 £1
800/250 40p
32/300 20p
4/350 5p
8/350 8p
12/300 10p
4.7M/350v 10p
16/350 25p
33/350 20p
50/350 10p
220/350 30p
300/350 40p
400/350 50p
10/375 10p
22/375 15p
220/385 75p
330/385 CVC 820HT 60p
0.1/400 15p
KT3 E/W .39/400 20p
.56K/400v 20p
4700pf/400 10p
.22/400 10p
8/400 15p
33/400 20p
400/400 40p
394K/400V 20p
220/450 40p
.47/500 25p
0.1/600 15p
.047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.15/1000 20p
.47/250V A.C. 10p
.001K/1250 10p
0.0047/1500 10p
.005/1500 10p
.0105/1500 10p
1n8/1500 15p
2n0/1500 10p
2n2/1500 15p
G11.11000/1500 15p
.01/1600 15p
G11.8200/2KV 15p
0.1/2KV 20p
10n/2KV 15p
3n9/2KV 15p
0.0015/2KV 10p
5n2/2KV 10p
6n2/2KV 15p
2n0/2KV 15p
2n2/2KV 15p
7500pf/2KV 10p
4n7/2KV 15p
8n2/2KV 15p

Infra Red and Ultrasonic G11 Teletext Decoder Panel £30
RANK & ITT Mains Remote On-Off Switch (720R) £1.50
RANK & ITT Mains Remote Switch 2865 ohm £1.50
RANK & ITT Remote Switch 2800 ohm £1.50
G11 Mains Switch 50p
4 amp Mains Switch 25p
GEC Mains Switch 4 amp 30p
KT3 Mainswitch £1.00
THORN Rotary Mains Switch 50p
G8 Mains Switch 75p
Thyristor 600/4 amp C106/2 24p
G11 Preh Red LED P/Button for C.H. Change 20p
RANK TOSHIBA Transductors TPC-2011 50p
CVC 5 Mains on/off
+250K+100K+500K+50K+500K Pot on Panel £2.00
Thorn 12 or 24 volt battery convertor for portable colour T/V £12.00 Post £1

20n/2KV 15p
0.0082/2500 15p
150/3500 10p
1800/4KV 5p
4.7nf/5KV 10p
170/8KV 10p
180/8KV 10p
210/8KV 10p
1000/10KV 10p
210/12KV 10p
1000/12KV 10p
1200/12KV 10p

Multi-Caps

Thorn 3500
175/100/100/350v £1.75
KT3/200/25/25/385v £1.00
300+300+150+100+50MFD 350V £2
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
470/470/250v 50p
150/200/200/300v 70p
400/400/200v £1.70
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
Jelly pot Thorn 00D4/013 £3
150/150/100/100/320v £2.00
100/350 + 300/200/100/16/275v £2.00
300+300/300 £1.00
225+25/380 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT Panels

ITT 8 & 6 Push Button Unit £1.00
CMA 10 £2.00
CMA 11 £2.00
CMA 30 £2.00
CMA 40 £1.50
CMC 10/2 £5.00
CMC 16 £4.00
CMC 38 £8.00
CMC 45 £1.50
CMC 47 £1.00
CMC 52 £15
CMC 57 £6.00
CMC 58 £8.00
CMC 59 £8.00
CMC 67 £3.75
CMC 67/2 £4.00
CMC 68 £4.00
CMD 12 £10
CMD 32 £5.00
CMD 33 £5.00
CMD 40 £5.00
CMD 41 £5.00
CMF 25 £2.00
CMF 26 £2.00
CMF 31 £1.50
CMF 40 £2.00
CMH 10 £1.50
CMH 31 £1.00
CMK 12 (untested) £4.00
CMK 30 (untested) £4.00
CMN 20 £1.50
CMN 21 £1.50
CMN 40 £1.00
CMN 45 25p
CMP 10 £2.00
CMP 11 £4.00
CMP 30 £2.00
CMP 40 £2.00
CMS 11 £2.00
CMS 40 £2.00
CMU 12 £10.00
CMU 14 £8.00
CMU 30 £7.00
CMU 40 £7.00
CMU 45 £7.00
CMZ 30 £5.00
GMA 90 £5.00
GMC 120 £2.50
GMR 64 £5.00
TMN 2 £2.00
VCA 20 £10
VCA 21 £10.00
VMC 26 £3.00
VMC 34 £5.00
VMC 44 + 45 £4.00
VMC 51 £5.00

Hand Sets

Transducer Hand Set Insert, crystal, transducer, SAA 1124 & lead £3.50
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £15.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £19.00
C11 Ultrasonic full teletext for G26c 674/02 and G22c 66/02 £16.00
Philips, 2 button £8.00
Rank, Infra-red £10.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
G11, Full remote top button assy. £12.00
G11, Full remote repair service (exchange unit) £12.00
Philips infra red full remote 9 channel for 60 CP2605 £6.00
Philips infra red full remote 12 channel for 60 CP2605 £12.00
KT3/K30 T/Text £15.00
KT3/K30 Full remote £15.00
KT3 Power supply £4.00

SENDZ COMPONENTS

63 Bishopsteignton, Shoeburyness, ESSEX SS3 8AF
SAME DAY SERVICE
All items subject to availability.
No Accounts : No Credit Cards
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Add Postage for overseas
Callers: To shop at 212 London Rd., Southend. Tel. 0702-332992
Open 9-1/2.30-6. GVMT + school orders accepted on official headings add 10% handling charge.

Tuner Units

GEC or Hitachi 6 push button unit	£12
GEC 2110 V/Cap	£6
ELC 1043/06 (AEG)	£6
ELC1043/05 Mullard	£6.00
ELC1043 (Ex Panel)	£3.75
ELC1042 ,,	£5.00
ELC2000 ,,	£7.00
ELC2004	£10.00
ELC2006	£10.00
GEC Tuner V/Cap Hitachi After 1979 ET548	£10.00
U322 (UHF) ,,	£4.00
V314 (VHF) ,,	£5.00
U321	£7
U341 UHF	£7.00
ELC1043/05 Thorn	£5.90
Small V/Cap Mitsumi UHF ,,	£4.00
VHF ,,	£3.00
Portable & rotary Tuners Sanyo & Mitsumi UHF	£5.00
6003 Bush V/Cap Tuner	£10.00
NSF-UHF/VHF Varicap (old type)	£10.00
Mosfit UHF/VHF (new type)	£10.00
SONY 1400KV Tuner unit	£3.50
Thorn Tuner PANEL with 6×100K pots + cursors NO TUNER	£1.00
U321 on panel ITT 40	£6.00
Tuner unit VHS Sylvania GTR Videon MTS 900	£2.50
Thorn 3500 tuner panel with ELC 1043/05+pots	£7.00
Mullard Video Modulator. Application, video tape recorders, TV cameras, video games, closed circuit T/V, C.C.I.R. system. Data supplied.	£10.00
VT 100 Sound Tuner Kit, TV. Viosound. The latest design in low noise fitted with DNR, RF output and audio	£30.00
Sylvania UHF VHF F6013 (Fits Rank)	£6.00
Sylvania F6003	£6.00
Sylvania UHF F4720B	£6.00
Sylvania VHF 900	£6.00
Decca Bradford Tuner 5 Button	£4.00
Small Tuner DX 175-220MHz Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00
D.P.D.T. switch Black knob: Chassis or PCB mount	4p each or 40 for £1.00

THORN 1400 4P.B. Mech. Tuner
THORN 1500 4P.B. Mech. Tuner
THORN 1590 4P.B. Mech. Tuner
THORN 3500 4P.B. Mech. Tuner
THORN 8000 4P.B. Mech. Tuner
THORN 8500 4P.B. Mech. Tuner
All new & boxed. £4.00 each

Delay Lines

DL20A	80p
DL600	£1.00
G8 (Old Type)	£1
DL700	£1.00
UDL11	30p
KT 3 Luminence	75p
Luminance Delay Line (CVC 45)	
10×630ma fuse	25p
10×2A fuse	50p
10×3.15 fuse	50p
Co-Ax Joint	15p
Co-Ax Belling Lee Plug	15p
Co-Ax Splitter	£1.00
UHF Modulator CCIR	£3.00
Infra Red Emitting Diode	20p
NE286H Small Neon Lamps GEC	5p
Mullard 5 Watt Amps. LP1162 New	75p

T.V. Tubes

12" A31/300 Hitachi	£10
15" A38/170W Hitachi	£8
18" Hitachi PIL tube with scan coils	£25

Integrated Circuits

AC76003	£1.50
AM25LS23PC	10p
BAV40	40p
BRC-M-200	40p
BRC-M-300	50p
BRC 1330	75p
BTT822	£1.00
BTT6016	£1.20
BTT6018/ML237B	£1.50
BTT6218	£1.50
BTT8124	£1.00
BTT8224	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AE	£1.00
CA1310	50p
CA3065Q	50p
CA3089Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBF16848	50p
CD4510	30p
DM7492	50p
HA1196	40p
HA1370	£2.00
HA11223	40p
HEF4001	10p
HBF4011AF	10p
HEF4053B	30p
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
MC476p	£1.00
MC1307	75p
MC1330	75p
MC1349	50p
MC1352	£1.00
MC1358	£1.00
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14069	15p
MC14514	50p
MC1748	80p
MCM2114	75p
MEM4956	£1.00
ML231	£2.50
ML232	£1.20
ML236E	£1.50
ML237B	£1.50
ML238B	£4.00
ML239	£3.00
MM5387	£1.00
MM5611	£1.00
MM5840	75p
N64100	£1.00
NE545B (Dolby)	75p
NE555P	60p
NE555	60p
IL-1	30p
OPT600	30p
OPT601	30p
SAA611	£1.00
SAA661	£1.75
SAA1020	£4.00
SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
SAA1176	£3.00
SAA1250	£3.00
SAA1272	£3.00
SAA1276	£3.00
SAA5000	£1.50
SAA5000A	£1.50
SAA5012A	£5.00
SAA5020	£3.50
SAA5030	£5.00
SAA5040	£3.50
SAA5040A	£4.40
SAA5050	£3.50
SAF1032p	£2.50
SAF1039	£2.00
SAS560	£2.00
SAS570	£2.00
SAS660	£1.00
SAS670	£1.00
SL901B	£5.00
SL918	£6.20
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	£1.50
TAA621	£2.00
TAA661	£1.75
TAA641	£1.50
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7607AP	40p
TA7609P	50p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1441	£1.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA510	£2.00
TBA510Q	£2.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA550Q	£2.50
TBA560CQ	£2.00
TBA570	£1.50
TBA625	50p
TBA641	£2.00
TBA651	£2.00
TBA673	£1.00
TBA720A	£1.50
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AS	60p
TBA810S	60p
TBA820	60p
TBA890	£1.00
TBA900	£1.50
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.50
TBA990Q	£1.00
TMS1000NL	£4.00
TMS1943 (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2716JL	£1.00
TMS3529	£1.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
UPD2114C 4K RAM 400ns	75p
ULN2216	75p
SN29848	50p
SN29770BN	£1.00
SN29771BN	£1.00
SN29772BN	£1.00
SN7402N	£1
SN7472N	£1
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76013ND	£1.50
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50
SN76033	£1.50
SN76110N	£1
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	60p
SN76228N	£1.00
SN76270	£1.00
SN76532N	50p
SN76544N	£2.00
SN76545	£3.50
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76650	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£1
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA640	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£2.00
TCA830	£1.00
TCEP100	£2.25
TCE120CQ	£1.00
TDA440Q	£1.00
TDA1003A	£1.00
TDA1010	£1.00
TDA1060A	£1.50
TDA1072	£1
TDA1151	30p
TDA1170	£1.00
TDA1190	£1.00
TDA1327A	£1.00
TDA1412	50p
TDA2003	80p
TDA2004	£2
TDA2010	£1.00
TDA2140	£3.50
TDA2522	£1.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2571AQ	£2.50
TDA2575A	£1.00
TDA2581	£2.50
TDA2590	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£5.00
TDA2611	£1.00
TDA2653	£1.00
TDA2002	£1.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3500	£2.00
TDA3560	£3.50
TDA3571Q	£1.50
TDA9403	£3.00
TDA3651AQ	£3
SN74LS 125AN	30p
SN74LS 248	50p
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
RGP30G	10p
MPSA14	10p
MPSA43	10p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	30p
Sanikron Diode SKE2G2/04	30p

Transistors

AC106	15p
AC121	15p
AC124	15p
AC128	15p
AC137	15p
AC151	15p
AC131	15p
AC138	15p
AC152	15p
AC153K	15p
AC142K	15p
AC169	15p
AC176	15p
AC176K	15p
AC178K	15p
AC179	15p
AC186	15p
AC187K	15p
AC188	15p
AC188K	15p
ACY21	25p
AD143	50p
AD149	50p
AD161/162	pair 40p
AF139	25p
AF181	£1.00
AF239	25p
AF367	25p
AL102	£1.75
BC161	30p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p
BD646	50p
BD676A	30p
BD678	50p
BD681	25p
BD807	20p
BD826	50p
BD948	30p
BDX75	20p
BDX32	£1.25
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF256	10p
BF257	20p
BF258	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF423	15p
BF448	30p
BF450	20p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	20p
BF480	50p
BF594	10p
BF597	10p
BF694	10p
BF758	30p
BF760	30p
BFT34	15p
BFT43	10p
BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BLY49	25p
BPW41	25p
BRC116	25p
BRX43	15p
BRX48X	10p
BRY56	30p
BSS68	10p
BSY79	10p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
FT3055	30p
TCE82	30p
2N930	5p
2N2221	8p
2N2222	8p
2N2906	10p
2N3055	40p
2N3566	10p
2N3702	10p
2N3711	10p
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2N4442	£1.00
2N4444	£1.00
2N5296	40p
2N5983	30p
2N6099	40p
2N6109	40p
2N6130	50p
2N6133	20p
2N6348	20p
2N6399	10p
2X 2N6099 on heat sink	50p
2SA437	20p
2SB407 Sanyo TO3	10p
2SB474	30p
2SB566	10p
2SC381	10p
2SC458	50p
2SC515	10p
2SC732	10p
2SC733	10p
2SC828	10p
2SC1030	£1.00
2SC1172A	10p
2SC1173	10p
2SC1419	20p
2SC1546	20p
2SC1725	20p
2SC2068	20p
2SC2073	8p
2SC2122A	£1.00
2SC2229	15p
2SC7350	15p
2SD180 TO3 80v/6A	15p
2SD200	£2.00
2SK30A	10p
BC107	10p
BC108	10p
BC109	5p
BC113	10p
BC114	10p
BC115	10p
BC116	10p
BC117	20p
BC119	20p
BC125	10p
BC126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC183	10p
BC184	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
BCX31	25p
BCX32/36 Pair	75p
BCX32	25p
BD116	25p
BD124	50p
BD124 (metal)	60p
BD130Y	25p
BD131	30p
BD132/238	30p
BD135	25p
BD136	30p
BD138	30p
BD175	30p
BD176	25p
BD182	£1.00
BD183	70p
BD202	60p
BD204	60p
BD221	20p
BD222	30p
BD228	30p
BD226	20p
BD233	30p
BD235	30p
BD238	30p
BD239	15p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD332	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD439	50p
BD501	30p

Filters

5-5MHz	15p
6MHz	30p
BFU455K	5p

Thyristors

TD3F800	£1.50
BT106 Plastic	30p
BT106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
G11 Thyristor	60p
Decca 80-100	60p
2N4444	£1.00

Thermistors

VA1104	50p
ITTP7266312	15p
PTH451 AOR	15p
PT37P Fits Pye & PT34	20p
Degausing Thermistor (fits most sets)	20p
GEC Double Thermistor	75p

3 Pin Blue Thermistor (fits most sets)	20p
BLY49	50p
I.C. Heat Sink	20 for £1
20×TO5 Heat Sink	£1.00
CVC 9 power supply board	£1.50
CVC 20/2 mains panel	£2.00
ITT Mains Filter .1/250v/	
CVC 20 to 45 chassis	50p
Pots 10 k with Switch	25p
Pots 47 k with Switch	25p
Mullard Surface Wave Filter RW 153P Colour TV Filter	40p
Mullard Surface Wave Filter RW 154 Colour TV Filter	40p
G11 Line Scan P.C.B.	£1.00
ELC 1042 P.C.B.	30p

TV Crystals

4MHz
4.433-619
6MHz
8.867238
Large or small 50p each

GEC Power Panel TV106 Thermistor PT34 New £1.00

I.C. Holders

DIL - DIL		DIL - QIL	
40 Pin × 4	£1.00	16 Pin × 10	£1.00
42 Pin × 5	£1.00	18 Pin × 10	£1.00
28 Pin × 5	80p	28 Pin × 4	£1.00
16 Pin × 10	70p	8 Pin × 10	50p
24 Pin × 5	75p		
14 Pin × 10	70p		
18 Pin × 10	80p		