FEBRUARY 1986

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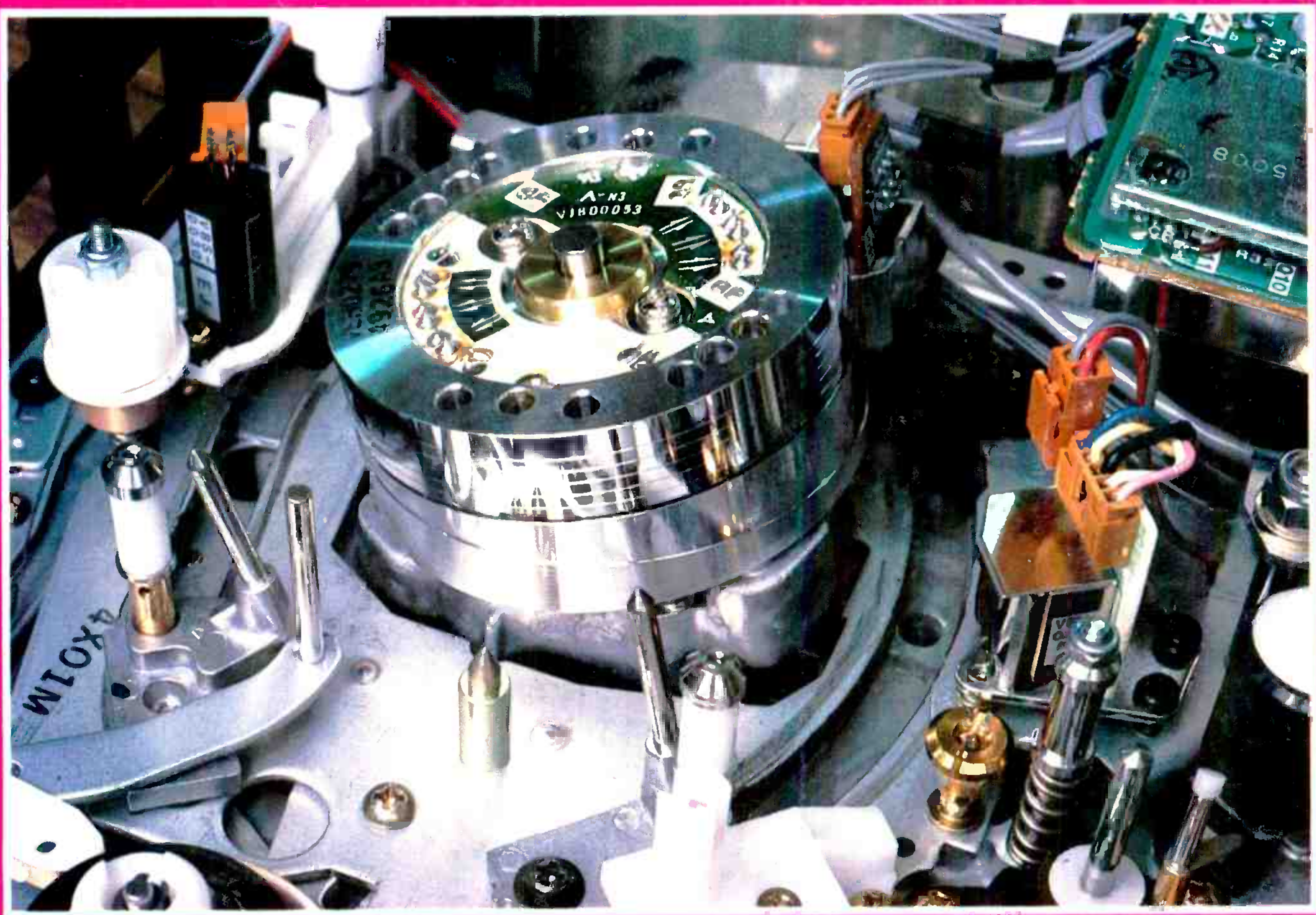
TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Developments in VCRs

The Decca-Tatung 160 Chassis

Amstrad CPC462 Servicing Notes

TV Fault Finding • DX-TV

Video Scrambling Techniques

VCR Clinic • Test Report

MANOR SUPPLIES

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TEST DEMONSTRATIONS AT 172 WEST END LANE

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★ 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	**£70.00**
Case (10″×6″×2¼″) app.	**£7.40**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£105.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.50
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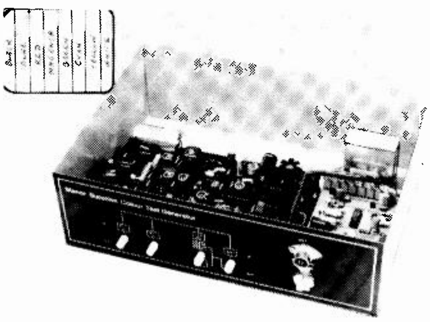
PAL COLOUR BAR GENERATOR (Mk4)



★ 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 £30.00. CASE £7.40. BATT HOLDERS £4.20. MAINS SUPPLY KIT £4.20 (Combined P&P £2.20).

MK 4 (BATTERY) BUILT & TESTED £58.00 + £2.20 P & P.
MK 4 (MAINS) BUILT & TESTED £68.00 + £2.20 P & P.
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Mullard Decorder panel + Interface **£35.00** p.p. £1.80
THORN TX10, PHILIPS G11 PRESTEL
Mullard Units VM 6230, 6330 plus Line Coupler & Interface **£48.00** p.p. £2.50

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THORN TX10 Facia Control Panel incl. Infra Red Remote Control receiver **£7.50** p.p. £1.50.
THORN TX10 Series Facia Control Panel with 8 position Channel Selector **£6.50** p.p. £1.50.
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TELEVISION

February 1986

Vol. 36, No. 4
Issue 424

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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

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BT119	3.66
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BU124	1.90
BU126	1.75
BU204	1.50
BU205	1.87
BU206	1.80
BU208	1.60
BU208A	1.65
BU208D	2.20
= BU800	
BUW81A	3.84
BU208/02	2.10
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BU407	1.70
BU426	3.07
BU500	2.50
BU526	2.46
BU508	3.20
BU806	1.40
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BUW84	1.45
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E1222	40
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MCR220	1.50
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MJ3000	1.98
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R2265	1.50
R2322	84
R2323	67
R2461	1.50
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RC4558	2.20
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RCA16029	1.18
RCA16039	1.18
RCA16092	1.18
RCA16040	96
RCA16041	84
RCA16334	90
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2SC495	1.10
2SC496	1.31
2SC643A	1.82
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2SC1307	3.00
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2SC1953	1.44
2SC2028	1.82
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2SC2078	2.90
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2SC2166	2.73
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THY15/80	2.20
THY15/85	2.20
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T6022V	1.80
T6026V	90
T6027V	63
T6028V	66
T6029V	3.98
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CA556	84
CA741	25
CA748	45
CA3065	1.80
HA1151	3.89
HA1342	2.49
HA1306N	2.60
HA1366WR	2.80
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HA11219	4.21
HA11244	4.04
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MC14011BCP	66
MC14049UB	43
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MC7812	1.35
ML231	
ETTR6016	2.20
ML232	2.20
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SAA1250	4.99
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SAA5020	5.90
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SL76544	2.05
SN76023N	2.00
SN76110N	1.42
SN76115N	2.27
SN76131N	2.00
SN76226DN	2.72
SN76227N	1.18
SN76533N	1.70
SN76033N	2.49
SN76544N	2.35

SN76650N	1.24
SN76660N	80
SN76666N	1.52
SN76530A	1.47
STK015	7.36
STK032 = STK078	13.25
STK043	15.25
STK433	5.65
STK435	9.06
STK436	6.50
STK437	7.85
STK439	8.40
STK459	9.50
STK441	11.57
STK461=465	12.60
STK463	14.30
STR441	6.50
STR451	6.50
STR6020	8.50
SW153	3.90
TA7050P	95
TA7051P	95
TA7063P	2.20
TA7074P	3.46
TA7108P	3.43
TA7120P	2.43
TA7129AP	3.76
TA7130P	1.93
TA7146P	4.67
TA7193P	5.67
TA7171P	8.90
TA7172P	8.90
TA7173P	8.90
TA7176P	2.50
TA7202P	4.27
TA7204P	3.77
TA7205AP	3.72
TA7208P	3.40
TA7210P	6.60
TA7222	2.42
TA7223P	3.74
TA7227P	5.98
TA7228P	5.98
TA7310P	2.78
TA7609P	4.39
TA7611AP	2.92
TAA570	3.98
TAA310	2.83
TAA320	2.00
TAA550	55
TAA630	3.90
TAA8400S1	1.96
TAA661B	1.20
TBA120A	1.49
(A),(S),(AS),(SA).	
TBA120B	1.30
TBA120SB	1.37
TBA120T	1.49
TBA120U	1.49
TBA395	1.75
TBA396	1.75
TBA440N	2.75
(TBA1441)	
TBA440P	2.50
TBA480Q	1.82
TBA510	3.00
TBA520(Q)	1.68
TBA530(Q)	1.38
TBA540	1.76
TBA550	3.20
TBA560(Q)	1.93
TBA570	1.79
TBA690	1.50
TBA641BX1	3.50
TBA673	2.45
TBA700	2.12
TBA720	2.64
TBA750	2.98
TBA800	1.62
TBA810AS	1.38
TBA820	1.70
TBA820M	1.25
TBA890	3.94
TBA920(Q)	3.00
TBA950(2X)	3.25
TBA970	4.09
TBA990	1.90
TBA14406	2.44
TCA760	2.30
TCA270SQ	2.50
TCA800	5.95
TCA830	3.44
TCA900	2.20
TCA910	2.20
TCA940	1.95
TDA440	2.20
TDA1002	1.95

TDA1003A	5.50
TDA1006A	2.50
TDA1005	3.60
TDA1010	3.30
TDA1011	4.00
TDA1035	4.70
TDA1037	2.95
TDA1044	4.37
TDA1060A	4.44
TDA1062	1.56
TDA1083	1.68
TDA1170S	3.00
TDA1190	3.50
TDA1190P	3.50
TDA1180	2.91
TDA1200	2.95
TDA1220A	2.12
TDA1270	3.95
TDA1327	1.70
TDA1352B	1.60
TDA1412	1.50
TDA1415	1.40
TDA1470	4.67
TDA1770	5.60
TDA2002	2.80
TDA2003	1.20
TDA2004	2.52
TDA2006	1.78
TDA2010	2.40
TDA2140	5.95
TDA2150	2.22
TDA2020	4.66
TDA2030	2.80
TDA2522	2.66
TDA2523	3.40
TDA2524	2.25
TDA2525	4.00
TDA2530	2.70
TDA2532	2.90
TDA2540	3.84
TDA2541	3.84
TDA2560	3.50
TDA2571	4.90
TDA2576	3.75
TDA2576A	3.75
TDA2577	4.73
TDA2581	3.30
TDA2582	2.60
TDA2590	3.25
TDA2591	2.95
TDA2593	2.95
TDA2600	6.90
TDA2610	3.20
TDA2611A	2.35
TDA2640	2.92
TDA2652	7.31
TDA2653	5.90
TDA2680	3.40
TDA2690	2.72
TDA2710	5.67
TDA2720/1	6.77
TDA3190	2.00
TDA3500	6.90
TDA3560	6.00
TDA3561	6.66
TDA3562	8.60
TDA3571	3.75
TDA3651A	4.50
TDA4420	5.55
TDA4600	2.95
TDA4600-2D	2.95
TDA9503	4.21
TEA1002	3.50
TEA1009	1.86
UPC554	2.63
UPC566H	2.95
UPC575C2	3.40
UPC576H	2.60
UPC587C2	2.34
UPC1025H	2.95
UPC1028H	2.52
UPC1032H	94
UPC1042C	1.56
UPC1156H	4.26
UPC1158H	3.50
UPC1163H	2.48
UPC1167C2	2.70
UPC1168C	3.20
UPC1176C	2.53
UPC1177H	3.15
UPC1178C	4.21
UPC1180C	1.84
UPC1181H	1.62
UPC1182H	2.95
UPC1183H	2.48
UPC1185H	3.66
UPC1186H	1.60
UPC1188H	4.99

UPC1190G	1.20
UPC1198C	4.00
UPC1200V	1.18
UPC1211V	2.70
UPC1212V	1.34
UPC1215V	1.66
UPC1216V	1.20
UPC1217G	2.24
UPC1218H	1.80
UPC1223C	2.20
UPC1225H	2.00
UPC1226C	1.50
UPC1227V	1.20
UPC1228H	54
UPC1230H	4.39
UPC1238V	1.89
UPC1245V	1.35
UPC1350C	4.15
UPC1353C	4.76
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

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74LS260	55
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6264	£9.50

VOLTAGE REG.

7805	78
7808	78
7812	78
7815	78
7818	78
7824	78
78L05	68
78L08	68
78L12	68
78L24	68
7905	98
7906	98
7908	98
7912	98
7915	98
7918	98
7924	98
79L05	72
79L12	72
79L15	72
79L24	72

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA317	26
BAX13	4
BAX16	8
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
BYX55/600	30
BYX71/600	90
BY224	2.00
OA90	10
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	10
IN4007	10
IN4148	5
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	20
ITT2002 = BAX16	
Y969 – Disc.	
REP BZX85 30V	
General Purpose Triac	95
SKE4F	£1.19
SKE5F	£1.19

ZENER DIODES

BZX61 130V	28
BZX61 Range (1.3W)	20
BZX79 Range (400mV)	10
BZY88 Range (400mV)	10
BZY93, 90 (18V)	1.18

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8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
24 way	34
28 way	45
40 way	84

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14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

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VA1040	75
VA8650	55
VA1039	35
GEC DUAL POS.	1.68
GEC DUAL THERM. CKI	1.98

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5.5MHz	74
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8.8MHz	1.48
9.94MHz	6.00
10.692MHz	6.00

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5mm Red, Green, Yellow	14
T1 3/4 Amber	22
T1 3mm Red, Green, Yellow	14
Flashing Red CQX21	62
CQX22	66
Panel Clips 3mm	04
5mm	04

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560 EGB	£62
560 CGB	£62
560 DMB	£62
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660 AB	£65
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THORN 9600 Line Panel	£12.00
G11 Decoder Panel	£12.00
POWER SUPPLY 731	£6.00
G11 611 Condenser 470/250V	89p
G9 Power Panel	£3.50
G9 Frame	£8.00
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HT520 METER 20,000 Fuse Diode Protector Logic Test Facility	£15.90
9000 SERIES Decoder 01 929 014 080 Thorn	£5.00
THORN TX remot panel. 51.C. ML923-SL490-MC14528B-MC14493P-SL470 & Main Trans	£5.00
HITACHI LOPT Split Diode 2432871	£7.00
RANK T20 Fouces Pot	75p
RANK 718 Foucs Pot	£1.00
THORN 9000 LOPT Panel	£12.00
26" **HITACHI** LOPT Split Diode 2432301	£8.00
16" **HITACHI** LOPT Split Diode 2433481	£6.00
HITACHI Transformer P2270851	50p
HITACHI AE Socket	30p
·1 **CONDENSER** Axail Leads 450 A/C 1200 D/C	15p
MAINS TRANSFORMER 240v in/20v/8v	£1
GREEN LED Flat 1000	£20. Type
CANON Tape Motor 6v	35p
MICROPHONE with Switch	25p
HITACHI 6 x 4 – 8Ω Speaker	50p
ET596 UHF V/CAP Tuner, small	£2.50
FIDELITY Panels with I.C.	£1.00
FIDELITY LOPT Split Diode AT2076/80	£3.00
FIDELITY FBS 1245AE LOPT Mono	£1.00
FIDELITY Split Diode FCC2015BE	£5.00
HI-FI MICROPHONE N8501 Philip	£8.00
G8 TUNER V/CAP on Panel	£3.50
THORN 9000 Sound OP Panel	£30p
THICK FILM, Hitachi RB-32 4A	£2.00
THICK FILM, Hitachi Frame	£5.00
K9 THORN Tuner Panel with ICS Pots	£3.00
80 Ω THORN Speaker	15p
9000 Speaker	£1.00
HITACHI Split Diode 2433752	£6.00
THORN CHASSIS 1600-1700 Series Mono	£10.00
THORN 1600 Rec- & Anode Cap	50p
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TYPE	PRICE (£)
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AN301	3.45
AN303	3.45
AN305	3.50
AN7110	1.93
AN7114E	2.33
AN7115	2.37
AN7116	2.35
AN7145	3.25
BA312	1.25
BA511A	1.95
BA521	1.85
BA532	1.95
BA536	2.55
HA1166	2.65
HA1322	2.10
HA1338	2.78
HA1339	2.40
HA1342A	2.20
HA1366 W/WR	1.95
HA1370	2.75
HA1374	2.45
HA1377	3.80
HA1388	4.20
HA1397	3.90
LA1201	1.75
LA1230	2.30
LA1365	2.45
LA3350	1.65
LA4031	2.45
LA4032	2.30
LA4101	1.50
LA4102	1.95
LA4400	2.50
LA4430	2.45
LA4440	3.55
LA4460	2.95
LA4461	2.95
MB3712	2.30
MB3713	2.25
ML231B	2.35
ML232B	2.55
ML237B	2.50
SAA1124	3.45
SAA1125	4.70
SAA1250	3.85
SAA1251	4.95
SAA5010	5.10
SAA5012	5.70
SAF1032P	3.25
SAF1039P	4.55
SAS560S	1.95

TYPE	PRICE (£)
SAS570S	1.95
SAS580S	2.40
SAS590S	2.40
SL1430	1.95
SL1432	1.75
STK0039	6.45
STK0040	5.95
STK0050	7.50
STK077	7.25
STK078	7.45
STK082	9.75
STK415	9.66
STK430	7.75
STK433	6.50
STK435	6.75
STK437	7.25
STK439	7.55
STK441	8.50
STK459	7.35
STK461	7.95
STK463	9.30
STK465	9.95
TA7193P	4.30
TA7202	2.25
TA7203P	2.25
TA7204P	1.90
TA7205AP	1.40
TA7208P	1.95
TA7222AP	1.85
TA7223P	2.85
TA7227P	2.95
TA7310	1.55
TA7313	1.45
TAA550	.43
TBA120AS	.95
TBA120SB	.90
TBA120T	1.25
TBA120U	1.00
TBA520	1.30
TBA530Q	1.00
TBA540	1.37
TBA550	2.45
TBA560	1.60
TBA720A	2.65
TBA750	2.45
TBA800	.80
TBA810	1.35
TBA820	1.40
TBA890	2.95
TBA920	1.50
TBA950	2.65
TCA270	1.55
TCA800	5.45
TCA940	1.55

TYPE	PRICE (£)
TDA440	3.25
TDA1002	1.50
TDA1003	2.80
TDA1006A	2.95
TDA1035T	2.75
TDA1037	1.95
TDA1044	3.10
TDA1170	1.80
TDA1270	2.20
TDA1470	3.65
TDA2002	1.85
TDA2003	2.33
TDA2004	3.15
TDA2006	2.25
TDA2020	2.95
TDA2190M	4.95
TDA2522	1.80
TDA2523	2.25
TDA2530	2.10
TDA2532	2.20
TDA2540	1.95
TDA2560	1.80
TDA2578A	3.25
TDA2581	2.15
TDA2582	2.20
TDA2591	2.30
TDA2593	2.30
TDA2594	2.95
TDA2600	5.95
TDA2611A	1.50
TDA2640	2.40
TDA3560	5.10
TDA3561A	5.35
TDA3562A	5.50
TDA4500	5.85
TDA4600	2.85
TDA4600-16PIN	3.95
TDA9503	2.35
UPC555C	.70
UPC566C	2.10
UPC585C	1.40
UPC1031H	2.95
UPC1032H	.95
UPC1156H	2.45
UPC1181H	2.20
UPC1182H	2.20
UPC1185H	3.30
UPC1230H	3.95
UPC1238H	2.35
UPC1350C	4.50
UPC1353C	2.60
UPC1365C	5.05
UPC2002H	1.85

TRANSISTORS

TYPE	PRICE
BC107	14
BC108	14
BC109	14
BC141	26
BC142	23
BC143	25
BC147	09
BC148	09
BC157	10
BC158	11
BC159	11
BC237	11
BC327	11
BC328	12
BC337	11
BC338	10
BC547	10
BC548	10
BC557	10
BC558	10
BD124M	1.05
BD131	.33
BD132	.33
BD201	.80
BD202	.70
BD203	.70
BD204	.83
BD222	.50
BD225	.55
BD235	.32
BD236	.43
BD237	.40
BD238	.39
BD410	.50
BD434	.50
BD437	.70
BD438	.78

TYPE	PRICE
BD439	.70
BD707	1.05
BF337	.28
BF338	.30
BF458	.30
BF459	.36
BF757	.75
BFR90	1.60
BR100	18
BR101	.32
BR103	.55
BR303	2.95
BT106	1.15
BT116	1.30
BT151/800R	1.10
BU126	1.78
BU205	1.42
BU208A	1.45
BU208D	1.85
BU326A	1.48
BU407	1.12
BU407D	1.45
BU500	1.80
BU508A	1.95
BU526	2.00
BU807	1.30
BU826A	3.20
R2010B	1.45
R2540	2.35
TIP31C	.46
TIP32C	.47
TIP33	.80
TIP34	.95
TIP41C	.48
TIP42C	.48
TIP47	.75
TIP2955	.70
TIP3055	.70

TYPE	PRICE
2N3055	.50
2N3773	3.45
15/80H	2.25
15/85R	2.25
2SA 771	2.35
2SA 835	1.55
2SB 618	2.45
2SC 867A	3.25
2SC 1034	4.85
2SC 1061	1.15
2SC 1114	4.75
2SC 1124	.97
2SC 1316	3.20
2SC 1413A	3 95
2SC 1739	2 45
2SC 1942	2.95
2SC 1962	1.65
2SC 1969	1.95
2SC 2078	1.55
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2SC 2369	3.25
2SC 257	2.45
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PY500A	2.25

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DECCA 80	7.20
DECCA 100	7.35
ITT CVC 20/30	6.85
PHILIPS G8-550	7.90
PHILIPS KT3	9.75
RBM T20/T22A	7.35
THORN 8500/8800	7.60
THORN 9000	8.70
Universal	5.95

DIODES

TYPE	PRICE
BY127	.10
BY133	.15
BY164	.40
BY179	.65
BY210/800	.30
BY223	.86
BY227M	.23
BY229/600	.87
BY298/400	.24
BY299/800	.25
BYX10	.20
BYX55/600	.26
BYX71/600	.93
SKE4F2/06	.80
SKE5F3/10	1.45
W005	.55
1N4001-7	.07
1N5401-8	.16

HITACHI I/Cs

STR 441	8.95
STR 451	8.95
STR 6020	7.90

SUNDRIES

G8 TRANSDUCTOR	2.25
G8 ON/OFF SW.	1.40
G11 E/W Coil	1.65
G11 Lin Coil	1.80
G11 Bridge Coil	1.35
G11 EHT Lead	2.25
PYE IF Gain MOD	7.85
ITT On/Off SW	1.10
THORN On/Off SW.	1.00
CUT OUT 2A	1.95
TX10 FOCUS UNIT	8.95
VCR Pilot Bulb	.70

TV ELECTROLYTICS

DECCA 30(400/400)350V	3.99
DECCA 80-80/100(400)350V (800)250V	3.99
PHILIPS G8(600)300V	2.65
PHILIPS G9(2200)63V	1.45
PHILIPS G11(470)250V	2.20
RBM A823(2500/2500)30V	1.65
RBM T20A(220)400V	2.35
THORN1690/1(4700)25V	.94
THORN3500(1000)70V	.99
THORN9000(400)400V	3.10

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DECCA/ITT 6 way	7.95
PHILIPS G8 S/L	14.90
PHILIPS G8 S/Q	12.00
PYE-G11 P/B	8.50
HITACHI 4 way	8.95
ITT CVC5 7 Button	10.40
ITT CVC8/9	12.80
1043/05	8.95
U321	8.35
U322	7.40

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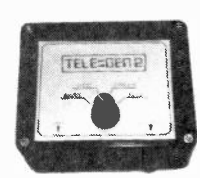
TELE-PART

Telegen-1

PRICE £18.35 (Inc. VAT)
- *EXCEPTIONALLY LIGHT AND DURABLE*
- *POCKET SIZE FOR OUTSIDE SERVICE*
- *PP3 BATTERY POWER SOURCE*
- *FIVE DIFFERENT TEST PATTERNS FOR COLOUR & MONO TV*
- *CROSSHATCH GRID * DOT MATRIX*
- *WHITE RASTER*
- *HORIZONTALS * VERTICLES*
- *3.5mm JACK SOCKET FOR OPTIONAL P.S.U.*

A lightweight, extremely portable and versatile pattern generator for black/white and colour T.V. alignment and service at the customer's home. At the turn of a switch, the generator can provide five essential test patterns for correct installation, fast checks and repairs. Pattern stability is first class and compares favourably with other more costly bulky generators only suitable for bench work. The generator is pocket size measuring 10 × 7.5 × 4 cm and weighs only 190 grams. Switched 3.5 mm jack socket allows use of external power supply with battery in situ.

Telegen-2



PRICE £34.45 (Inc. VAT)
- *EXCEPTIONALLY LIGHT & DURABLE*
- *COMPACT 10 × 12 × 4.5 cms*
- *RED RASTER * GREEN RASTER*
- *BLUE RASTER*
- *COLOUR BARS*
- *3.5 mm JACK SOCKET FOR P.S.U.*
- *PROVIDES UHF SIGNAL APPROX. CHANNEL 35*

Telegen 2 is a colour bar generator at a very modest price and yet is extremely effective, stable and durable. It is the perfect compliment to Telegen 1, giving colour bars arranged in the following sequence: white, yellow, cyan, green, magenta, red, blue and black. The unit provides a signal in the UHF band approx. Channel 35 and requires a supply of 14 to 18 volts D.C.

Power Supply

A switchable power supply ideally suited to Telegen 1 and Telegen 2.
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ALL ITEMS POST AND PACKING £1.44 (Inc. VAT)
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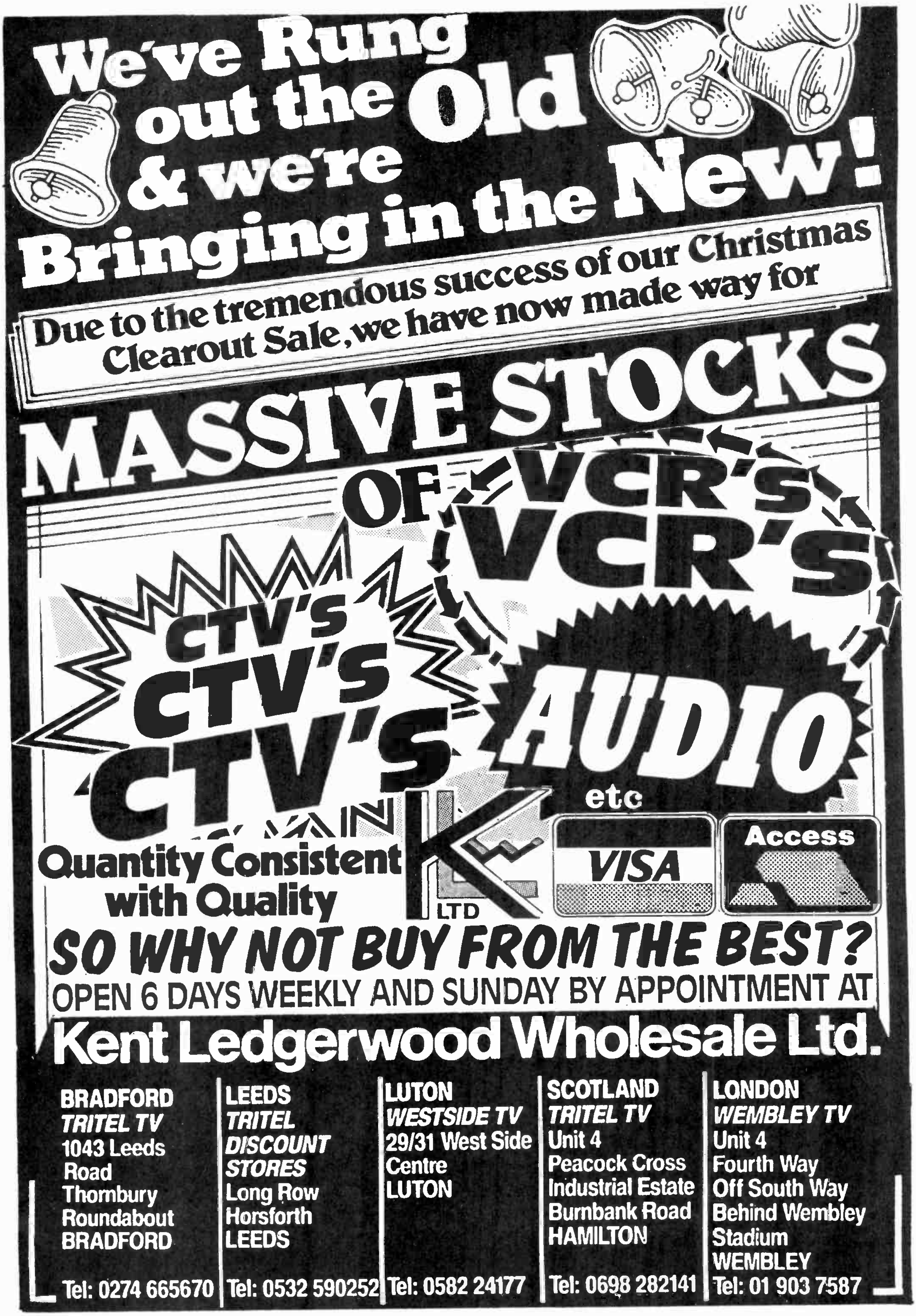

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VALVES

Type	Price (£)
DY802	0.95
DY86/87	0.66
ECC81	1.00
ECC82	0.92
ECC83	1.00
ECC84	0.80
ECC85	0.95
ECC88	1.25
ECF80	1.20
ECH81	1.40
ECH84	1.50
ECL82	1.10
ECL86	1.75
EF80	0.75
EF86	1.80
EF183	0.90
EF184	1.00
EH90	0.98
KT66(G.E.C.)	16.00
KT88(G.E.C.)	19.00
EL34	3.25
EL84	1.00
EL509	7.85
EM87	2.55
EY86/87	0.67
EY500A	2.50
PCC84	0.60
PCC85	1.75
PCC89	0.75
PCC189	0.85
PCF80	0.95
PCF86	1.25
PCF200	1.95
PCF801	1.05
PCF802	1.05
PCF806	1.20
PCL82	1.00
PCL83	2.50
PCL84	1.00
PCL86	0.90
PCL805/85	1.05
PD500	2.90
PFL200	1.85
PL33	1.50
PL36	1.75
PL81	0.85
PL82	0.75
PL83	1.20
PL84	0.75
PL95	2.00
PL504	1.40
PL508	2.70
PL509/519	5.25
PY88	1.80
PY500A	2.20
U26	1.90
UCH81	2.00
UCL82	1.80
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.28
AC128	0.30
AC128K	0.34
AC141	0.58
AC141K	0.38
AC142	0.56
AC142K	0.38
AC151	0.45
AC152	0.45
AC153	0.57
AC153K	0.46
AC176	0.30
AC176K	0.38
AC187	0.28
AC187K	0.38
AC188	0.28
AC188K	0.38
ACY22	1.50
AD142	0.88
AD143	1.10
AD149	0.72
AD161/162	1.20
AD162	0.52
AF114	1.20
AF115	2.10
AF116	2.10
AF121	0.56
AF124	0.42
AF125	0.58
AF126	0.58
AF127	0.38
AF139	0.40
AF178	2.28
AF239	0.50
AF279S	1.40
AL100	5.40
AL102	4.40
ASY80	5.20
ASZ17	2.00
AU110	2.80
AY102	4.40
B40C200	1.03
BA110	0.68
BA115	0.14
BA121	0.40
BA129	0.38
BA148	0.16
BA155	0.12
BA157	0.28
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12
BC108	0.10
A,B or C	0.13
BC109	0.10
A,B or C	0.14
BC113	0.42
BC115	0.12
BC116	0.12

Type	Price (£)
BC117	0.22
BC118	0.16
BC119	0.28
BC125	14
BC140	0.27
BC141	0.24
BC142	0.24
BC143	0.26
BC147	0.18
BC147B	0.14
BC148	0.10
BC148B	0.12
BC149	0.10
BC149C	0.14
BC157	0.10
BC158	0.12
BC159	0.12
B/C	0.14
BC160	0.30
BC161	0.30
BC168B	0.20
BC169C	0.12
BC170	0.16
A B or C	0.16
BC171	0.10
A or B	0.10
BC172	0.12
B or C	0.12
BC177	0.24
A B or C	0.24
BC182	0.10
A,B or C	0.10
BC182L	0.12
LA LD LC	0.10
BC183	0.10
A B or C	0.10
BC183L	0.10
LA LB LC	0.10
BC184	0.10
A B CL LC LB	0.10
BC207	0.15
BC212	0.10
A B or C	0.10
BC212L	0.09
LA LB	0.10
BC213	0.10
A B or C	0.10
BC213L	0.10
LA LB LC	0.10
BC237	0.11
BC238	0.12
BC251	0.14
A B	0.14
BC262	0.20
A B	0.28
BC301	0.30
BC302	0.30
BC303	0.30
BC307A	0.18
BC317A	0.12
BC323	0.90

Type	Price (£)
BC327	0.16
BC328	0.16
BC337	0.12
BC338	0.12
BC350A	0.24
BC351	0.16
BC440	0.36
BC441	0.40
BC461	0.58
BC478	0.24
BC516	0.48
BC547	0.12
A or B	0.10
BC548	0.10
A B or C	0.10
BC549	0.10
A or B	0.10
BC550	0.10
A or B	0.10
BC557	0.10
BC558A	0.10
BCY70	0.16
BCZ10	3.21
BCZ11	2.60
BD124P	0.70
BD129	0.90
BD130Y	0.68
BD131	0.36
BD132	0.36
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.28
BD142	1.26
BD145	1.82
BD150A	0.72
BD160	1.58
BD165	0.45
BD183	0.70
BD201	0.52
BD202	0.57
BD204	0.50
BD222	0.80
BD225	0.40
BD232	0.45
BD234	0.30
BD235	0.30
BD236	0.38
BD237	0.38
BD410	0.76
BD434	0.58
BD438	0.58
BD439	0.85
BD441	1.00
BD507	1.05
BD520	1.20
BD687	0.88
BD707	0.88
BDX18	1.00
BDX32	1.48
BF115	0.32

Type	Price (£)
BF117	0.50
BF119	0.82
BF120	0.38
BF125	0.42
BF127	0.41
BF154	0.14
BF157	0.46
BF158	0.30
BF160	0.23
BF167	0.32
BF177	0.42
BF178	0.26
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.30
BF185	0.28
BF194A	0.15
BF195	0.12
BF200	0.30
BF222	0.38
BF224	0.16
BF224J	0.20
BF240	0.30
BF241	0.30
BF244	0.34
BF244A	0.30
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF294	0.46
BF336	0.32
BF337	0.28
BF338	0.28
BF355	0.37
BF363	0.35
BF367	0.24
BF371	0.27
BF422	0.20
BF450	0.38
BF457	0.36
BF458	0.37
BF459	0.35
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.86
BFW11	0.84
BFW44	0.88
BFX29	0.28
BFX48	0.78
BFX80	6.46
BFZ85	0.35
BFY50	0.22
BFY51	0.22

Type	Price (£)
BFY52	0.22
BFY90	0.80
BFY90S	1.34
BR100	0.25
BR101	0.40
BR103	0.50
BR303	2.75
BRY39	0.50
BRY56	0.42
BSX19	0.32
BSX20	0.30
BSX59	0.78
BSX76	0.65
BSY52	0.45
BSY95A	0.25
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT108	1.25
BT109	1.15
BT116	1.20
BT119	3.30
BT120	3.50
BT121	2.99
BT138/600	1.30
BT151/560R	0.90
BTY79/400R	2.80
BU100A	2.30
BU104	1.80
BU105	1.20
BU105/02	1.55
BU108	1.75
BU124AE	0.98
BU126	1.40
BU133	1.90
BU204	1.30
BU205	1.30
BU206	1.50
BU208	1.40
BU208A	1.40
BU208/02	2.05
BU326S	1.75
BU407	1.10
BUX80	3.70
BUY20	2.75
BUY69A	2.60
BUY69B	1.98
BY100	0.80
BY103	0.50
BY122	0.60
BY126	0.10
BY127	0.08
BY133	0.06
BY135	0.35
BY164	0.45
BY179	0.56
BY182	0.80
BY184	0.38
BY187	0.65
BY189	6.75
BY198	0.64

Type	Price (£)
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/600	0.24
BY210/800	0.28
BY227	0.22
BY228	0.46
BY238	0.65
BYX10	0.20
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/600	0.30
BYX71/600	1.18
BYZ12	0.78
C106D (400V)	0.48
C106F (50V)	0.36
D40C1	1.08
D40N1	1.12
E1222	0.30
E5024	0.30
GET872	0.60
GET881	1.70
GET882	1.90
ITT2001	0.18
ITT2003	0.34
MCR106/5	1.20
ME0413	0.70
ME6002	0.26
MEU21	0.62
MJ400	0.45
MJ2955	1.00
MJ3000	1.80
MJE340	0.46
MJE520	0.44
MJE2955	1.60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSLO1	0.34
MPSUO5	1.05
MPSUO6	1.18
MR502	0.40
MR854	0.88
OA91	0.07
OA210	0.66
OC26	2.65
OC35	4.75
OC36	1.75
OC44	0.72
OC72	0.70
OC81	0.68
ORP12	0.85
R2008B	1.20
R2010B	1.20
R2540	2.71
TIC45	0.45
TIC47	0.70
TIC29	0.30
TIP30A	0.32
TIP31C	0.39
TIP32	0.35

Type	Price (£)
TIP33A	0.55
TIP34A	0.70
TIP41C	0.42
TIP42	0.44
TIP47	0.42
TIP121	0.63
TIP2955	0.70
TIP3055	0.58
TIS43	0.88
TIS88	0.50
TIS90	0.27
TIS20	2.45
Y728	0.14
Y969	2.80
ZE75	0.60
ZTX107	0.14
ZTX502	0.22
IN4001	0.04
IN4003	0.05
IN4004	0.05
IN4006	0.07
IN4007	0.07
IN4148	0.04
IN5400	0.12
IN5402	0.13
IN5405	0.16
IN5406	0.17
IN5408	0.19
IS44	0.06
IS920	0.07
2N1306	1.42
2N2122A	0.34
2N2222	0.30
2N2904A	0.16
2N2926G	0.14
2N3053	0.30
2N3054	0.60
2N3055	0.65
2N3703	0.10
2N3773	2.80
2N3904	0.20
2N3906	0.20
2N5294	0.80
2N6107	0.80
2SB337	1.80
2SC1098	0.84
2SC1172Y	1.70
2SC1173Y	0.88
2SC1279	0.50
2SC1306	0.92
2SC1307	1.50
2SC1413A	2.70
2AC1449	0.60
2SC1507	0.60
2SC1678	1.00
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC21953	0.70
2SC1957	0.70
2SC1969	2.80
2SC2028	0.73

Type	Price (£)
2SC2029	2.70
2SC2078	1.05
2SC2091	0.70
2SC2098	2.90
2SC122A	3.20
2SC2314	0.80
2SC2335	1.50
2SK135	3.80
3N211	3.52
3SK88	0.60
3SK88L	0.80
40636	1.65
40673	1.80

74LS

Type	Price (£)
74LS00	0.24
74LS01	0.24
74LS02	0.24
74LS03	0.24
74LS04	0.24
74LS05	0.24
74LS08	0.24
74LS09	0.24
74LS10	0.24
74LS11	0.24
74LS12	0.24
74LS13	0.33
74LS14	0.48
74LS15	0.24
74LS19	0.44
74LS20	0.24
74LS21	0.24
74LS22	0.24
74LS24	0.28
74LS26	0.24
74LS27	0.24
74LS28	0.24
74LS30	0.24
74LS32	0.24
74LS33	0.24
74LS37	0.24
74LS38	0.24
74LS40	0.24
74LS42	0.50
74LS47	0.79
74LS48	0.85
74LS51	0.24
74LS55	0.24
74LS73	0.30
74LS74	0.33
74LS75	0.44
74LS76	0.38
74LS83	0.88
74LS85	0.82
74LS86	0.35
74LS90	0.48
74LS91	0.90
74LS92	0.54
74LS93	0.54
74LS95	0.60
74LS96	1.20
74LS107	0.40
74LS109	0.44

Type	Price (£)
74LS112	0.44
74LS113	0.40
74LS114	0.39
74LS122	0.68
74LS123	1.00
74LS124	1.15
74LS126	0.50
74LS132	0.60
74LS135	0.26
74LS136	0.42
74LS138	0.44
74LS139	0.58
74LS145	0.93
74LS147	1.64
74LS148	1.28
74LS151	0.70
74LS153	0.70
74LS155	0.70
74LS157	0.45
74LS158	0.58
74LS160	0.62
74LS161	0.68
74LS162	0.70
74LS163	0.68
74LS164	0.74
74LS165	1.10
74LS166	1.50
74LS168	1.48
74LS170	1.40
74LS173	0.98
74LS174	0.75
74LS175	0.70
74LS190	0.82
74LS192	0.98
74LS193	0.98
74LS194	0.75
74LS195	0.74
74LS196	0.84
74LS197	0.96
74LS221	0.85
74LS240	0.80
74LS241	0.80
74LS242	0.94
74LS243	0.94
74LS244	0.80
74LS245	1.20
74LS247	1.00
74LS251	0.75
74LS257	0.73
74LS258	0.75
74LS259	1.20
74LS266	0.55
74LS237	1.20
74LS279	0.70
74LS283	0.80
74LS353	1.10
74LS365	0.50
74LS366	0.50
74LS367	0.50
74LS368	0.50
74LS373	1.00
74LS374	1.00
74LS375	0.70

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1¼" Panel Mounting	0.35
1¼" Chassis Mounting	0.12
Carline 1¼" holder	0.10

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Soldering Station complete with 30W or 40W Iron (state which)	67.95
XS25 W Iron kit/ complete with steel & plug attached	10.00
CS 18W, as above	9.90
Antex 15W iron	5.25
Antex 18W iron	5.50
Antex 25W iron	5.75
Antex elements	2.75
Antex bits	0.90
Antex stands	2.10
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

CAPACITORS

Metallised Paper

2n2F 600V AC	24p
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4010	0.39	4174	0.96
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4013	0.35	4501	0.38
4014	0.58	4502	0.58
4015	0.58	4503	0.38
4016	0.38	4507	0.45
4017	0.54	4508	1.28
4018	0.59	4510	0.54
4019	0.59	4511	0.54
4020	0.78	4512	0.54
4021	0.58	4514	1.10
4022	0.68	4515	1.20
4023	0.30	4516	0.60
4024	0.49	4517	2.70
4025	0.24	4518	0.48
4026	0.89	4520	0.05
4027	0.44	4521	1.10
4028	0.44	4522	1.20
4029	0.73	4526	0.58
4030	0.33	4527	0.64
4031	1.28	4528	0.68
4033	1.25	4531	1.20
4034	1.40	4532	0.64
4035	0.68	4536	2.50
4036	2.48		
4038	0.73		
4039A	2.70		
4040	0.58		
4042	0.48		
4043	0.42		
4044	0.48		
4049	0.38		
4050	0.34		
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4077	0.24		
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Philips G8	2.2R + 68 R	0.80
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RRI A816	302R + 70R + 6.2R	0.78
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	8000	400/350V	2.10
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DECCA 10/30		400+400/350V	3.20
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GEC	2047 2048 2083 2084 2104	200+200+150+50/300V	2.50
		600/250V	1.85
ITT/KB		200+200+75+25/350V	2.90
		220/100V	1.95
PHILIPS	G8	600/300V	2.20
	G8 G9	600/300V	2.10
	G11	470/250V	1.80
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John A. Reddihough

ADVERTISEMENT MANAGER

Roy Smith
01-261 6671

CLASSIFIED ADVERTISEMENTS

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Please note that the telephone numbers above are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 209.

COVER PHOTO

This month's front cover photo shows a close-up view of the head drum assembly used in the Panasonic Model NV870, which features VHS hi-fi sound. The cassette housing – it's a front loader – was removed to obtain a better view.

HELP WANTED

Does any reader know where spare parts/service data can be obtained for Nikkai colour sets, also the Perdio monochrome portable Model RP206?

TELEVISION

Here We Go Again

Ever since TV has been a practical proposition there's been debate about standards. As is well known, the debate in the UK had not been resolved by the time TV broadcasting started in November 1936. The Selsdon Committee, which had been appointed by the government to advise on TV standards, had been unable to come to a conclusion. So we started off with dual-standard operation, using the Baird 240-line and EMI 405-line systems on alternate weeks. It didn't take long for the operational advantages of the EMI system to become apparent: the Baird system was dropped in February 1937.

The debate in the USA went on rather longer. In early 1933 RCA demonstrated all-electronic TV, using a 240-line system. As the depression was at its height there was no great urgency to get TV broadcasting started. By June 1936 however the FCC, which had been set up two years previously, started to take an interest. The Radio Manufacturers Association (RMA) proposed to the FCC a 441-line system. In October 1938 the FCC assigned channels for TV use and the RMA put forward slightly revised proposals (vestigial-sideband operation came in). TV broadcasting started on April 30th, 1939 – but on an experimental basis only, using the RMA system. The FCC still couldn't make up its mind and held further hearings in June 1940. In addition to the RMA standard Philco proposed a 605-line system and Du Mont a 625-line system. The industry became involved in a standards battle and the FCC wouldn't come to a decision (the same thing was to happen with teletext and stereo TV sound many years later). To end this unhappy situation – since a full, commercial service couldn't start without an agreed standard – the RMA set up the National Television Standards Committee which held its first meeting on June 31st, 1940. The debate continued and it wasn't till January 1941 that the NTSC made its first report to the FCC. It favoured a 441-line system, with f.m. sound. The FCC wasn't happy with a line standard dating from 1936 and asked the NTSC to have a further think. Two months later the NTSC came up with the 525-line system.

It wasn't long before standards debates were to be with us once more. In the UK the problem was what standard to adopt for post-war TV. In the event 405-line transmissions were restored, though other proposals were put forward. The decision seems to have been taken on the grounds that the public had already invested in 405-line sets (about 20,000 of them!) and that the BBC was ready to go with its 405-line equipment. It was left to Europe to take up the argument about standards. France adopted 819 lines while the rest of Europe eventually adopted 625 lines.

The only time when there appears to have been little debate on standards was the start of colour broadcasting in the USA. An experimental field sequential system had been tried in 1948 but had not been a commercial success. The sets were unreliable and the programmes few. In particular the system was non-compatible – you couldn't see the programmes in monochrome on a black-and-white set. RCA had been working on colour since before the war and by the late forties had notched up a series of advances: it demonstrated the shadowmask tube to the FCC in March 1950. During July and October 1951 RCA publicly demonstrated compatible colour TV and by November of that year had agreed a set of specifications with the NTSC. There was no competing colour TV system in sight and when RCA petitioned the FCC in June 1953 the RCA/NTSC system was accepted.

When it came to colour for Europe we were back with standards battles once more. During the mid-sixties the argument raged over NTSC, PAL, SECAM – all in various forms – and a few other proposals. It was never resolved. Today one can perhaps say that neither PAL or SECAM has any particular advantage over the other – technological advances have made the earlier disputes seem almost irrelevant.

The field of TV and video has been dogged by debates on systems and standards ever since. Which VCR standard to use, which disc system and what standard for satellite TV? The VCR and disc battles have differed from previous ones in that the broadcasting authorities have not been involved. While it's sometimes said that Beta gives a better picture, once again technical developments have ensured that no system has any great advantage in the longer run.

The debate over a system for European DBS broadcasting seems to have been decided in favour of the IBA developed MAC system – in conjunction with sound systems of continental origin. One can't be too sure until DBS services actually start – variants on PAL and SECAM have also been proposed.

We're by no means at the end of the road however. High-definition TV with an aspect ratio change is the next step being considered and here there are already the makings of a hot dispute. The Japanese developed a 1,125-line, 60Hz system some while back. It provides superb results and has received the backing of the Americans. The Japanese and Americans are now pushing for its acceptance as a world-wide HDTV standard. This would of course overcome the old problems of standards conversion and simplify the provision of studio/broadcasting equipment. But it's not compatible with existing services – we're back with the old compatibility problem. The alternative "Enhanced MAC" system developed by the IBA has the great advantage of compatibility with basic MAC. The additional picture information required for a 5:3 aspect ratio display is incorporated in some of the space otherwise devoted to sound signals: higher resolution is achieved by using some IBA developed techniques about which little has been publicly said.

A decision about HDTV standards will not be essential for some while, though the issue is to be considered by the International Radio Consultative Committee in May. The argument is hotting up. Oh yes: we forgot to mention the various (at least four) competing stereo TV sound systems and the arguments about teletext systems . . .

Teletopics

JAPANESE-EEC AND INTERNATIONAL TRADE

The EEC Commission has increased the customs duty levied on imported VCRs (other than for professional use) from 8 to 14 per cent, effective from January 1st. To conform with GATT regulations, balancing cuts have been made on semiconductor device duties (down from 17 to 14 per cent) while duties on electronic calculators, portable radios, portable cassette decks and alarm radios have been completely removed. Most imported VCRs come from Japan of course though some are now coming from S. Korea. Talks with Japan on the extension of former agreements on export limitation to the EEC continue, though the Japanese Ministry of International Trade and Industry (MITI) has announced that these will be maintained – MITI will continue to monitor shipments of VCRs, also CTVs and tubes, cars, light commercial vehicles, forklift trucks and numerically controlled machine tools. For VCRs, MITI suggests that 1·5 to 1·7 million machines would be the appropriate export level for 1986. Japanese VCR exports to Europe during 1985 are expected to have been some 1·8m, well within the 2·25m level set by the previous voluntary export restraint agreement.

The next sensitive trade item is likely to be the compact disc player, which at present carries a 19 per cent import duty in the EEC. Japanese production capacity is understood to have grown by a factor of four last year to 4·3m units and is expected to more than double to 8·7m this year. A report by stockbrokers Vickers da Costa points out that such production levels are in excess of current demand: as a result price cutting is expected, especially in the EEC where prices are "relatively high". As if to emphasise the point, Sharp recently announced the first CD players in the UK at under £200. There are two models that differ only in styling: they both have a suggested retail price of £199. In the USA the price of CD players has fallen from around $1,000 in 1983 to just under $300.

Philips has doubled its share of the European VCR market since starting to produce and sell VHS machines. It claims to have 12 per cent of the UK market, which puts Philips in second place to Thorn EMI. Philips' share of the European market is estimated to have risen to 14 per cent last year. Its video business is understood to be close to break even point after past heavy losses. Production of V2000 system VCRs has now ceased – sales are expected to continue for a further six months or so while stocks last. Philips has also announced that the LaserVision disc player has been withdrawn from the W. German market. Its sale in the UK will continue.

NEW PLANTS

The S. Korean based Samsung Electronics group is understood to be close to a decision on where to establish a manufacturing facility in the UK. Sites in the NE and in the West Midlands have been under consideration. Samsung proposes to start manufacturing VCRs, television sets and microwave ovens in the UK. At present Samsung imports VCRs and microwave ovens from its Korean plants and 14in. colour sets from a plant in Portugal. Samsung has a 4·5 per cent share of the UK microwave oven market. The aim in the TV field would be to develop and manufacture in the UK large-screen sets for the European market.

Hitachi has announced plans to convert part of its CTV plant at Anaheim, California to manufacture of VCRs. Initial capacity will be 100,000 VCRs a year, rising to 5-600,000 machines annually within two years if market conditions justify this.

GIANTS PLAN MERGER

The US General Electric Company (GE) has signed a £4·46bn agreement to take over the RCA Corporation. The aim of the deal is to strengthen the competitive position of the companies in high-technology manufacturing. It will be the largest non-oil merger in US company history, creating a corporation with annual sales approaching $40bn, a workforce of over 400,000, and interests in aerospace, broadcasting, financial services, consumer and industrial electronics and heavy electrical manufacturing.

Both GE and RCA have a long history in consumer electronic equipment manufacture while RCA has broadcasting interests that include ownership of the NBC network. RCA demonstrated electronic TV broadcasting, using a 240-line system, in the early months of 1933 and in the forties developed the colour system that came to be known as the NTSC system. GE and RCA have both been major TV receiver manufacturers. GE now sells sets produced by Matsushita (see Teletopics, December 1985) while RCA assembles sets from parts imported from Mexico and Taiwan.

Both companies became conglomerates when this was fashionable in the sixties and seventies. GE's interests extended to cover coal mining and energy while RCA's extended to greetings cards, frozen foods and the Hertz car rental business. During the last few years both companies have been selling off businesses not related to their core activities. In 1984 GE had sales of $28·9bn (13 per cent consumer products) and RCA $10·1bn (22 per cent consumer products, 23 per cent broadcasting and 6·1 per cent records and video).

PHILIPS-DU PONT DISC VENTURE

Philips and the Du Pont Company of the USA have established a 50/50 joint venture company which combines their interests in optical information storage discs for the audio, video and data markets. The new company, called Philips/Du Pont Optical (PDO), aims to capture a major share of the world optical disc market, which is expected to exceed $4bn a year by 1990. It's expected to generate annual sales of about $900 within five years. Initial assets of the new company include 50 per cent of the PolyGram CD factory (the world's largest) in Hanover, W. Germany, and the LaserVision disc operation at Blackburn, Lancs. The company has announced plans to introduce a combined audio/video optical disc player to boost the consumer section of the optical electronics market. In addition to playing CD and video discs it will be possible to use the player with a microcomputer for data storage. The price of the player is expected to be around £370 initially.

THORN EMI TO SELL CABLE TV INTERESTS

Thorn EMI plans to sell off its cable TV interests which include the satellite delivered cable TV channels Music Box (50 per cent stake), Premiere (41·2 per cent stake) and The Children's Channel (wholly owned), also the cable franchises at Swindon (wholly owned), Coventry (51 per cent stake) and Ulster Cablevision (20 per cent stake).

It seems that all these operations are at present loss making, though Thorn EMI say that the decision to sell out is strategic – in order to concentrate on the firm's core business interests of technology, lighting, domestic equipment (including Ferguson) and the rental/retail outlets. Since our last column Thorn EMI has sold its cinema and film making business to a management-based group, leaving the cable interests rather out on a limb.

UK SATELLITE TV

The IBA's report on the prospects of establishing a UK DBS TV service was due to be presented to the government by the end of December. One of the companies that put forward proposals to the IBA is Carlton Communications, whose managing director Michael Green comments that he could put together a consortium of "significant companies" to run such a service – provided the operator could use a satellite system of his own choice and be given freedom over financing arrangements and programme scheduling (subject to normal decency standards). The IBA is expected to emphasis the need for an early start to DBS broadcasting and a completely commercial approach.

According to a Goodall Partnership survey sales of satellite TV receiving installations in the UK during the latter half of 1985 totalled some 1,800 – nowhere near this number of licences have been issued by the DTI however. It expects sales of about 30,000 installations over the next two years. The government has announced that from March planning permission will no longer be required to instal dish aerials of up to 0·9m at the front of a house – planning permission will still be required in national parks, conservation areas and areas of outstanding natural beauty.

THE 50MHz BAND

Terms for allocating the 50-50·5MHz band for use by radio amateurs have been finalised by the Department of Trade and Industry and become effective from February 1st, 1986. The conditions are as follows: the allocation shall be primary within the UK; class A licensees only will be permitted use of the band initially; maximum transmitting aerial height to be 20m above ground level, with horizontal polarisation; no mobile, portable or temporary-premises operation will be allowed; there will be no restriction on modes or hours of operation; no repeaters will be allowed; existing permits will be withdrawn. Use of the band by radio amateurs is based on non-interference to European broadcasting services.

FIFTH UK TV CHANNEL?

The Peacock Committee, which was set up to consider the future financing of the BBC, is to investigate the feasibility of starting a fifth TV broadcasting channel in the UK, also local city TV stations. The decision to commission independent research on the possibility of such services was made by the Committee on the basis that TV financing in the UK is related to the number of services available.

MULLARD SECAM-PAL TRANSCODER IC

Mullard have introduced a Secam to PAL transcoder i.c., type TDA3592A, which is able to convert a Secam input to a PAL signal. The input is identified by a built-in circuit. If a PAL signal is received this passes directly to the chroma output. If a Secam signal is received the PAL path is automatically switched off: the signal then passes via limiting/amplification, demodulation, clamping, de-emphasis, blanking and reinsertion circuits to a PAL modulator which produces a true PAL output.

A power-saving feature operates when the supply voltage falls below 5V. In this event the Secam processing shuts down but the non-Secam (PAL/monochrome signal path) remains active. The 24-pin chip operates from a 12V supply and requires typically 90mA.

NEC SATELLITE TV EQUIPMENT

According to Simon Orme of NEC Business Systems (Europe) Ltd. "everything is now in place" to deliver significant quantities of the NEC NESAT satellite TV receiver system to the UK market. The system is designed to plug into an existing TV set and is available through master distributors who will be responsible for installing the equipment, including the aerial. It's also available on rental through some branches of DER.

The NESAT system comprises a dish aerial to suit the location, a low-noise converter and an indoor tuner unit. Gallium arsenide devices are used in the LNC, which has been designed so that two units can be stack-mounted for reception of signals of either polarity. These are fed to an i.f. (0·7-1·7GHz) combiner unit before going to the tuner via a single cable. The approximate price of the NESAT system is £1,500. For further details contact Simon Orme, NEC Business Systems (Europe) Ltd., 35 Oval Road, London NW1 7EA (01-267 7000).

NEW BRAND

Judging by our post bag, one of the things that causes readers most problems is unknown brand names. So note Questar, which has just been launched by Asda for use on small appliances and brown goods sold in their ninety electrical departments nationwide. No TVs yet, but a VCR is promised. Servicing of Questar products, which come from Japanese and other Far Eastern suppliers, is carried out by Serviscope, a national organisation owned by Visionhire.

PUBLICATIONS/CATALOGUES

This year's IBA Yearbook of Independent Broadcasting *(Television and Radio 1986)* takes a new look in a larger format with 224 pages lavishly illustrated in colour. It's available from bookshops at £4·90 or direct from Independent Television Publications Ltd., Circulation Department, Whippendell Road, Watford, Herts at £7 including postage and packing.

Tandy's 1986 catalogue is available from Tandy Corporation (Branch UK), Tameway Tower, Bridge Street, Walsall, West Midlands WS1 1LA. Tandy claim to be the world's largest electronics retailer, with 215 stores and 135 dealers in the UK. The catalogue contains a vast array of equipment and components including two monochrome portable TV sets with LCD displays and a full-feature VHS VCR which is priced at £379·95.

VISNEWS ARCHIVE MATERIAL

All material in the Visnews Library is now available on one inch video tape. During the last three years technical experts at Visnews Facilities have been working their way through four million feet of historic archive material held at the library: the process, using the latest technology, has greatly enhanced the picture and sound quality. The material includes coverage of the coronation of Tzar Nicholas II (1896), the diamond jubilee of Queen Victoria (1897) and the 1911 Delhi Durbar.

Teamwork

Anne Avis

"What's it like to live over a TV repair shop?" ask new visitors to our home, their curiosity aroused by the constant sound of the shop bell and the persistent telephone calls. I suspect that they have their doubts, but for Chris and I as married business partners the arrangement has worked very well. I've noted a lack of contributions in *Television* from the many "other halves" of small businesses like ours – wives who've become business partners not only because the accountant thinks it expedient but because we have our own contribution to make, quite apart from feeding the engineer. Even Honeybunch doesn't say how she copes with Les Lawry-Johns.

Opening Shop

Our business partnership started three years ago when Chris had the opportunity to buy the business he'd worked in for ten years. We'd married three years previously and though we'd hoped for our own business eventually this unexpected chance seemed at first a less inviting "wedding". We had to sell our much loved and worked on first home in order to buy suitable business/domestic accommodation, and the more I saw of available property within our price range the more despairing I became. But at last we found a place I knew could be home and Chris knew was ideal for business. Despite the surveyor's opinion that it was a "rattlebag old property", despite nerve-racking planning permission delays and frustrating missing links in house purchase chains, we finally harnessed the muscle power of friends and family, hired a van and moved house and business in two chaotic weeks. Our ten month old daughter found the packaging and paraphernalia a marvellous adventure playground, but our pleasure and relief came when I was able to photograph Chris at the shop door with the "open" sign. Since then a lot more emulsion paint has flowed and we've suffered a heartbreaking family tragedy, but the partnership has survived and developed into a comfortable way of living.

What's Involved

My major contribution is bookkeeping. This was no easy task for an ex-nurse with an aversion to maths, but I have a good friend and teacher in the lady who previously worked part-time for the business and bequeathed me a sensible system when she retired. I've nevertheless endured hours of frustration chasing odd pence that won't balance, and suffered an anxious day trying to look busy with housework while the VAT inspector politely but persistently combed the books at the end of our first year. Thankfully the errors were small, but the whole process reinforced my resentment of the unrewarding time spent on VAT.

Books, cleaning and coffee-making apart, there are plants in the shop window to be tended (not geranium diodes, as Chris suggested) and well-meaning but time-wasting acquaintances to be siphoned off when they "pop in for a chat" – as well as the occasional lifting assistance required when a giant 26in. Dynatron in a fancy cabinet puts in an appearance (perhaps the hospital training helps with that, though the patients had softer edges).

And of course I have to hold fort when Chris has to answer an outside call. His absence guarantees the appearance of someone wanting an obscure part or technical assistance. I can manage plugs, batteries and fuses now, and can even demonstrate reconditioned sets, but have yet to graduate in styli, belts and semiconductors. It's sometimes difficult to stem the flow of a customer's technical jargon, though I suppose I should feel flattered when they assume I know about using TVs with computers and why their picture goes bright green. However falsely, I can actually sound quite knowledgeable on things like field collapse and ghosts.

Working on the spot meant that I didn't have to "give up work" to have our new baby girl and that we don't have to employ a child minder as we would if I'd resumed my old career – quite an advantage over some of my ex-colleagues who keep asking "when are you coming back?".

Snags

There are inevitable snags, like the customer who interrupted the Queen's Christmas Day broadcast and the intrusion of shop into house. I endeavour to limit the latter as gently as possible, but the dining table frequently has sets nestling beneath it and the coat cupboard recently housed a large TV set for two months while it awaited a guarantee-replacement part (thanks, Disastercare). My nest of tables spends more time displaying sets in the window than it does in the sitting room, and I nearly lost one to a passer-by who thought it was for sale.

Summing Up

Some might find themselves too much under each other's feet, but during the day we usually meet properly only for snacks, and even those are likely to be interrupted by the telephone or shop bell. Working so closely makes it almost impossible not to understand each other's problems, so there's no argument about Chris spending an extra hour or two in the workshop when the jobs waiting clip is bulging, nor about some help for me when the baby's been very demanding and visitors are expected.

We are fortunate to share common goals and to have our living in our own hands – so far as the government allows. What's more I get my TV mended for nothing – when there's time . . .

Chris and Anne Avis at RadioVision Exeter.

POST A PART ELECTRONICS

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CANVEY ISLAND, ESSEX SS8 0PQ.
Telephone 0268 690868
Telex 99305

BARCLAYCARD VISA

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ORDERS DESPATCHED SAME DAY
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ORDERS WITH AEROSOLS, PLEASE ADD 25p PER CAN.

Thorn 10Ω 20W (3500) R751 Safety Resistor	75p
Pye 713 Speaker 5" × 3" 70Ω	1.00
Pye 713 Complete Tube Base Panel with Focus Slider & Leads	2.75
Pye 725 Complete Tube Base Panel	1.25
TX9 Complete Tube Base Panel	2.75
TX10 Complete Tube Base Panel	3.75
TX90 Complete Tube Base Panel	4.75
Pye 713 Control Knobs	4 for 50p
Tube Base Socket ITT CVC32	45p
Tube Base Socket Thorn 3000/8000 etc	50p
IC Inserter 16 Pin	50p
Large IC Extractor	50p
Crystal 4.43MHz	65p
EHT Lead & Cap for Split Diode Lopt	90p
Anode Cap	47p
Sanyo Anode Cap Assy + Lead. 12TCD-CT-1G	65p
Degause VDR E299D/HP230 3000/8000	25p
Degause Thermister C8-RDH (TX90)	1.80
Control Knob Thorn TX90	4 for 2.00
On/Off Knob Thorn TX90	65p
Push Button Assy Thorn TX90	9.80
Tube Neck Correction Assy. 20AX AT1081	5.00
EHT Cable	Metre 25p
BF259 with Heatsink	14p
TIP110 with Heatsink	40p
L129/130/131 Coil	10p
6MHz Ceramic Filter	25p
DL700 (Philips) Chroma Delay Line	1.00
DL50 Chroma Delay Line	1.00
T9006A Lum Delay Line	1.00
8K5/9K Lum. Delay Line	65p
Plastic Cover for 3K5 SP8385	5p
TX9 Back Ground Control 10K	15p
TX9 Gain Control 100R	15p
Thorn 2000 Focus Pot	1.00
Thorn 9000 Focus Pot	3.75
Thorn 9600 Focus Pot	2.00
Thorn 8K5 Focus Pot	2.40
Thorn 4000 Focus Pot	2.75
Thorn TX10 Focus Pot (New Type)	9.00

SERVICE AIDS

Ambersil MS4 Silicone Grease	12oz	2.15
Ambersil Freezer	12oz	1.99
Ambersil Amberlube	6oz	1.89
Ambersil Ambertron	16oz	2.25
Ambersil Anti-Static Screen Cleaner	7oz	1.95
Ambersil 40+ Protective Lubricant	14.1oz	2.15
Ambersil Amberclens Foaming Cleaner	13oz	1.26
Ambersil Circuit Lacquer	14oz	2.15

THICK FILM RESISTOR UNITS

3500 Thorn (5 Pin Connection) video	1.70
4000 Thorn (4 Pin Connection)	1.90
725/731 Pye (6 Pin Connection)	2.20
713 Pye (6 Pin Connection)	2.20

FUSES

20mm		1¼"	
50MA	10 for 70p	250MA	10 for 65p
250MA	10 for 50p	750MA	10 for 65p
315MA	10 for 50p	7A	10 for 50p
500MA	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 Mains TX 9000 (T701)	10.00
Thorn Mains TX 9600 (T512)	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
Thorn LOPT 9000	10.00
Thorn LOPT 9600	12.00
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
Thorn LOPT TX10	19.00
Thorn LOPT TX90	13.75
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
Diode Split LOPT AT2076/35	14.75
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
Thorn Line Drive TX. TX9 (T2)	3.00
Thorn Line Drive TX. 8K etc. (T402)	1.85
Thorn Line Drive TX. 9K (T705)	2.00
Thorn Switch Mode TX. 9K6 (T511)	3.75
Thorn Input Choke TX9 (L64)	4.00
Thorn Choke TX90 (L120)	2.95

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

						BF154	25	BFR52	31	NKT276	20
						BF167	24	BFR62	29	NKT453	1.65
AC128	39	BC174B	23	BCX33	22	BF173	29	BFR81	29	DT112	1.92
AC131	40	BC177	24	BCX34	11	BF179	32	BFR87	25	OT121	2.08
AC138	40	BC182LB	12	BD115	49	BF180	33	BFR90	1.74	R1038	80
AC141K	39	BC183L	12	BD131	30	BF181	30	BFR91	2.08	R1039	80
AC142K	38	BC184L	13	BD132	46	BF184	30	BFT42	30	R2008B	1.40
AC153	39	BC187	24	BD133	59	BF185	30	BFT43	30	R2010B	1.10
AC176	33	BC204	15	BD139	36	BF194	16	BFX38	40	R2030	70
AC176K/		BC208	9	BD140	38	BF195	16	BFY50	30	R2265	1.30
AC128K	93	BC212L	9	BD144	1.70	BF196	16	BFY51	34	R2305	80
AC188	38	BC213L	12	BD150	50	BF197	15	BFY52	34	R2322	50
AD142	1.18	BC237	12	BD163	98	BF198	19	BRC116	1.50	R2443	25
AD143	1.08	BC238B	8	BD201	74	BF199	15	BRC1693	1.43	RCA16446	30
AD149	98	BC238L	8	BD203	78	BF223	18	BU105	1.00	RCA16599	1.25
AD161	32	BC250A	15	BD204	99	BF224	19	BU126	1.10	RCA16600	1.40
AD162	32	BC251	8	BD222	48	BF238	20	BU207	1.85	RCA16799	1.13
AD263	1.05	BC252A	20	BD225	52	BF240	9	BU208	1.15	RCA16800	1.42
AF127	45	BC294	37	BD232	50	BF241	21	BU208A	1.15	RCA16802	1.38
AF139	38	BC301	32	BD233	60	BF255	10	BU326A	1.30	RCA16815	1.20
AF239	41	BC303	31	BD234	60	BF256LB	38	BU407	1.70	SP8385	2.65
BC107	15	BC307	10	BD237	55	BF256S	20	BU408	2.76	S1299	2.25
BC108	15	BC308	8	BD238	65	BF257	28	BU500	2.30	S2800D	1.25
BC109	15	BC309	14	BD241	59	BF259	28	BU526	2.46	T6050V	1.30
BC115	16	BC327	18	BD244	85	BF271	25	BU806	1.80	T6052V	1.30
BC117	21	BC328	18	BD278A	81	BF274	11	BU807	2.94	T9003V	1.25
BC125	26	BC337	17	BD386	68	BF337	29	C1129	9	T9010V	1.45
BC126	23	BC338	17	BD433	71	BF338	34	C1172B	9	T9053V	1.30
BC139	27	BC347	8	BD437	83	BF355	40	E5386	54	T9054V	1.00
BC141	34	BC394	8	BD592	1.20	BF362	50	E9003	28	T9039V	1.10
BC142	30	BC454	8	BD589	1.20	BF391	21	E9005	25	TIC45X	50
BC143	31	BC455	8	BD677G	1.35	BF394	16	ME0404	10	TIC46	48
BC147	12	BC456	10	BD679	1.42	BF422	47	ME0412	10	TIC106C	40
BC148	12	BC460	40	BD701	1.04	BF423	53	ME6002	10	TIP29	42
BC149	12	BC463	22	BD702	1.12	BF450	43	MJ2501	2.36	TIP30	42
BC153	16	BC546	8	BD707	95	BF453	53	MJ3001	2.21	TIP31	35
BC1540R	16	BC547	12	BD708	95	BF458	37	MJE340	50	TIP32	43
BC154YL	16	BC548	12	BD839	1.30	BF459	40	MJE520	50	TIP33	61
BC157	12	BC549	8	BDX10	93	BF461	59	MJE2955	1.40	TIP41	42
BC158	12	BC557	10	BDY20	1.09	BF556B	35	MJE3055	1.50	TIP42	45
BC159	15	BC558	10	BDY82	99	BF596	15	NKT241W	8	TIP110	61
BC171	9	BC559	8	BF137	20	BF694	16	NKT241G	8	TIS91	25
BC172	9	BC595	8	BF153	20	BF757	62	NKT241Y	8	ZTX550	30

INTEGRATED CIRCUITS

				TBA530	1.26	TDA2030	2.10
BRC1330	1.40	SN76013ND	1.80	TBA540	1.00	TDA2522	2.10
BRC3064	1.00	SN76023N	1.80	TBA550Q	1.82	TDA2530	2.61
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.50	TDA2540	3.50
BRC/M/300	1.00	SN76115	2.00	TBA641	2.05	TDA2560	3.50
CA3060	1.58	SN76131N	1.58	TBA651	2.50	TDA2581	3.00
LM1303P	1.48	SN76226N	1.25	TBA720A	2.49	TDA2591	1.96
ML231B	2.20	SN76227N	1.00	TBA750	2.20	TDA2611A	1.95
ML237B	2.00	SN76530P	1.30	TBA800	1.62	TDA2640	2.90
ML239B	2.86	SN76622N	1.00	TBA810S	1.00	TDA2690A	1.50
MC1327AP	1.25	SN76660N	80p	TBA810AS	1.00	TDA3560	6.00
MC1358P	1.30	SN76666N	75p	TBA920	2.08	TDA4500	5.40
MC1455P	18p	SN76744	1.92	TBA950	2.54	TCEP100	2.90
MC14516BCP	60p	SY153A	2.50	TBA1440	1.92	TEA1009	3.48
SAA1025	7.20	TA7117P	1.00	TCA270SA	1.05	MC14426P	1.95
SAA1124	4.50	TA7109AP	2.80	TCA270C	1.05	MC14429P	4.80
SAA5010	6.00	TAA611	1.40	TCA270CQ	1.05	MC14514	4.50
SL432A	1.80	TBA120B	1.20	TDA1035T	3.50	UA758PC	5.00
SL1430	2.50	TBA120C	1.20	TDA1037	2.72	UAA1008A	2.50
SL1432	2.50	TBA120CQ	70p	TDA1170	2.15	ULN2165	2.66
SN15846N	60p	TBA120S	70p	TDA1170S	1.76	ULN2216A	1.30
SN74123N	65p	TBA120U	1.00	TDA1200	2.42	UPC1365C	1.25
SN74154N	1.40	TBA395	1.00	TDA1270	2.76	SC9488P	5.75
SN76001N	1.40	TBA480Q	1.40	TDA1327	2.53	SC9511P	1.40
SN76110N	1.14	TBA510	1.90	TDA2002	2.80	SW153	1.40

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

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

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75
Autovox Decoder FG/01 new boxed	5.00

Thorn 4000 Convergence panel ex-factory	3.75
Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1.75
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

UHF TV Aerial for portable	50p
Indoor Aerial With Reflector to Help Combat Ghosting Problems	2.50
Line Connectors	38p
Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Coax Cable Low Loss	per Metre 22p
Switched Flush Fitting Aerial Outlet	1.00

Pye 78+161	50p
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 6+1+100	92p

Thermal Cut-Out	
Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	4.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Thorn 1500 3 stick	2.40
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

220+47	350V	65p
200+150+50	350V	60p
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	60p
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 Weldel Type Philips G11		1.71

CAN TYPES

0.2MF 250V	50p
2MF 250V	50p
22MF 275V	50p
50MF 275V	50p
100MF 150V	65p
100MF 250V	70p
220MF 450V Thorn 4K	1.30
400MF 350V Thorn 8K	1.00
400MF 400V Thorn 9K	2.95
800MF 250V	70p
1000MF 100V Thorn TX90	2.90
1250MF 40V	50p
1250MF 50V	50p
1500MF 100V	1.05
2000MF 30V	50p
2200MF 40V Thorn 4K	95p
2200MF 63V Philips G9	1.25
2500MF 35V	65p
2500MF 40V	65p
3000MF 30V	65p
3300MF 16V	50p
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 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
Thorn TX90 On/Off Switch	1.85
10K Lin Pot. TX9/TX90	75p

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
BT106	1.50	IN5254B	8p
BT116	1.00	IN5349	14p
BT119	2.56	IN5400	12p
BT120	2.82	IN5401	12p
BT151 650	1.00	IN5402	14p
BY127	12p	IN5404	12p
BY188	16p	IN5406	16p
BY204	26p	IN5408	16p
BY206	16p	IS025	8p
BY207	16p	IS131	8p
BY208/800	38p	IS1658	8p
BY223	95p	MR854	35p
BY225	1.20	SKE1/02	20p
BY227	28p	MCR106/1	1.00
BY298	22p	MCR406	35p
BYX22/400	30p	2N4444	1.50
BYX55/600	30p	Y827	80p
BYX71/350	80p	Y969	75p
BZV15 C12R	1.16	ZX150	12p
BZV15 C24R	1.16	OA91	5p
IN60	8p	MCR106/7	1.00
IN2070	8p	MCR106/8	1.50
IN4001	4p	BY255	30p
IN4002	4p		

LINEOUT TRANSFORMERS

3600	DECCA 100	7.95
3601	DECCA 110	9.80
3604	DECCA 1730/1830	8.50
3599	DECCA 80	7.22
3727	DECCA MS1700-2420	10.13
3729	FIDELITY FTV12/TVR120	5.50
5529	FIDELITY ZX3000 22"	13.95
3808	FIDELITY ZX2000/3000	13.95
3731	GEC 2100/2040	5.50
3732	GEC 2114	9.72
3734	GEC 3133	3.60
3733	GEC M1201/M1501H	12.80
3614	GRUNGIG 5010/6010ETC	12.95
3755	INDESIT 24EGB	11.25
3617	ITT CVC30	7.95
3619	ITT CVC45	9.75
3615	ITT CVC5-8	10.25
3620	KORTING A21100 90° HYBRID	14.95
4508	PHILIPS E2 CHASS	10.00
2861	PHILIPS G8	7.00
2862	PHILIPS G9	9.95
5305	PYE 691 WIRED	5.00
3628	PYE 725 90°	9.25
3629	PYE 731 110°	8.95
3632	RANK A823	5.50
3634	RANK T16A	8.95
3636	RANK T20A	12.95
3726	RANK T26A	15.50
3637	RANK Z179	11.95
3639	RANK Z718 22"	21.75
3770	REDIFUSION MK1 CHAS	9.38
3771	REDIFUSION MK3 CHAS	12.00
3775	SANYO CTP5101	15.50
3643	THORN 1400 SERIES	5.95
3644	THORN 1500 20"	5.95
3645	THORN 1500 24"	5.95
3646	THORN 1590 SERIES	10.85
3647	THORN 1600 SERIES	10.85
3648	THORN 1615 SERIES	10.94
3649	THORN 1690/91 SERIES	10.42
3713	THORN 1790	8.95
3714	THORN 3787	15.23
3652	THORN 3K 3K5 EHT TX	8.95
3651	THORN 3K 3K5	8.96
6172	PHILIPS G8 SPECIAL	7.85
2868	PHILIPS KT3	10.95

EHT TRAYS

5400	BG1895-641	7.50
5403	BG1897-642	7.50
5404	BG2097-642/333	7.50
3663	DECCA 100	7.25
3665	DECCA 1830	3.00
3662	DECCA 80	5.25
3667	GEC 1028/CS108	3.50
3677	ITT CVC45	7.95
3675	ITT CVC5/9	3.50
3678	KORTING HYBRID	7.95
3683	PHILIPS 550 G8	6.50
3681	PHILIPS 570 (5 LEAD)	9.00
3684	PHILIPS G9	4.00
3685	PHILIPS KT3	9.95
3686	PYE 691/697	6.95
3688	PYE 725/731/741	6.95
5395	SEIMANS TVK186/5	8.50
5393	SEIMANS TVK52	8.50
4696	SEIMENS TVK196/17	11.95
5406	TCE 1400 LARGE SCRN	4.95
3696	TCE 1500 17"-19"	5.65
3697	TCE 1500 23"&24"	4.95
3698	TCE 1600 SERIES	2.95
3700	TCE 4000	4.50
3703	TCE 9000	7.85
3699	TCE3000/3500	7.75
3706	TV11 EHT STICK	0.95
3709	TV20 EHT STICK	0.95
5275	TV45 EHT STICK	2.45
3705	UNIVERSAL EHT TRAY U.K.	4.95

TV ELECTROLYTICS

3547	DECCA 10/30 400X2/350V	2.90
3549	DECCA 100 400+800 350/250V	2.90
3548	DECCA 80/100CHAS 100/400V	2.90
5304	FIDELITY ZX2000 330 385V	3.98
5303	FIDELITY ZX3000 220 385V	3.98
3557	ITT CVC20/RRI T20 220/400	1.20
3556	ITT CVC5/9 200X2+25+75ETC	2.60
3560	PHILIPS G11 470UF/250V	1.65
3559	PHILIPS G9 2200/63V	1.55
3561	PHILIPS KT3 200+25X2/385V	1.95
3554	PHILIPS G8/GEC 2110 600/300V	1.90
3558	PHILIPS G9/PYE 731 600/300 PC	3.16
3565	PYE 725/731 800/250V	1.90
3564	PYE 691/697 200+300/350V	2.00
3576	RRI AB23 2500X2/25V	1.48
3588	TCE 3000/3500 1000/70V	0.89
3585	TCE1500 150X2+100/300V	1.90
3587	TCE3000 200+100X2/350V	2.86

MIXED DIALECTRIC CAPACITORS

4270	0.01 600V X5	0.75
4272	0.022 1KV X5	1.40
4273	0.033 1KV	1.40
4274	0.047 600V X5	0.85
4275	0.047 1KV X5	1.80
4276	0.1 600V X5	1.20
4277	0.1 1KV X5	1.90
4278	0.1 1250V X5	0.44
4279	0.1 2KV X1	0.75
4280	0.22 600V X5	1.45
4281	0.22 1KV X1	0.74
4282	0.47 1KV X1	1.82
4283	4700PF 1.5KV X5	1.50
4271	0.01 1KV X5	1.60

SLIDE CONTROLS

4883	100K LIN STD TV	0.55
4884	150K LIN STD TV	0.55
4874	1K LIN STD TV	0.55
4880	22K LIN STD TV	0.55
4881	22K LOG STD TV	0.55
4875	3K3 SEMI LOG STD	0.55
4885	470K LOG STD TV	0.55
4720	470R LG STD	0.99
4719	470R LM STD TV	0.99
4876	4K7 LIN STD TV	0.55
4877	4K7 LOG STD TV	0.55

PRESETS

STANDARD RANGES

	VERTICAL STANDARD X 5	0.60
	HORIZONTAL STANDARD X 5	0.60
	VERTICAL MINI X 5	0.60
	HORIXONTAL MINI X 5	0.60

TUNER UNITS

4662	DECCA 30 SERIES MECHANICAL	4.95
4664	ELC 1043/05 EXCH TUNER	6.00
4663	ELC 1043/05 NEW TUNER	8.25
4666	ELC 1043/06 EXCH TUNER	6.00
4665	ELC 1043/06 NEW TUNER	8.25
4972	ELC 2003 EXCH TUNER	12.50
5534	GEC 2100 TYPE REPAIR CHGE	10.25
4675	PHILIPS G8 EXCHANGE TUNER	7.25
4679	RRI RANGER1/2 EXCH TUNER	9.75
4680	RRI 720 NEW TUNER	10.25
4678	RRI RANGER2/3 NEW TUNER	11.25
4668	U321 EXCH TUNER	6.50
4667	U321 TUNER NEW	7.95
4670	U322 EXCHANGE TUNER	6.50
4669	U322 NEW TUNER	7.95
4673	U341 EXCHANGE TUNER	7.25

VALVES

3883	DY802 VALVE	0.89
3932	PCF802 VALVE	0.95
3938	PCL805	1.00
3935	PCL82 VALVE	0.95
3936	PCL84 VALVE	0.85
3937	PCL86 VALVE	0.95
3940	PFL200 VALVE	1.20
3943	PL504 VALVE	1.40
3944	PL508 VALVE	2.06
3945	PL509 VALVE	5.95
3946	PL519	5.95
4870	PL802 VALVE	4.95
3950	PY500A VALVE	2.25
3951	PY801 VALVE	0.95

THORN SPARES

2897	T1590 MAINS TRANSFORMER	9.80
2920	TX10 FOCUS UNIT	7.54
4590	T1600 MAINS TX	7.92
5430	T1690 MAINS TRANSFORMER	9.00
4973	T1690 SLOW MOT. TUN. POT	3.99
2926	T3000/3500 A1 SWITCH	1.15
2906	T3000/3500 MAINS TX	5.00
2908	T3000/3500 METAL CUT OUT	2.34
4587	T3500 100R CONVERG POT	0.85
4588	T3500 200R CONVERG POT	0.56
3278	T3500 500R CONVERG POT	0.56
4585	T3500 50R CONVERG POT	0.65
2905	T3500 5MEG A1 POT	1.17
4589	T3500 SPARK GAP .1/1500	0.51
2907	T3500 THICK FILM VIO LOAD	1.40
4563	T3800 MAINS ON/OFF SW.	3.10
4412	T4000 FOCUS CONTROL UNIT	7.60
3273	T6818 220K BRIGHT CTRL	2.18
2909	T8500 FOCUS CONTROL UNIT	2.56
2911	T8500 MAINS CHOKE	17.45
4415	T8500 MAINS TX	12.75
2910	T8500 PLASTIC CUT OUT	3.72
2918	T9000 FOCUS UNIT	3.95
4586	T9000 FR1 THICK FILM	1.65
2919	T9000 OVER VOLT THICK FILM	3.95
5300	T9000 T701 CHOPPER TX.	13.75
4982	T9600 0.33 2KV CAP	2.35
2914	T9600 CHOPPER TX T512	17.65
2916	T9600 FOCUS UNIT	2.95
2913	T9600 SWITCH MODE TX T511	9.98
2917	T9800 FOCUS UNIT	5.93
4429	T9800 MAINS CHOKE	0.00
4437	TX10 0022 2KV	0.27
4658	TX10 100K TUNING POT	0.64
2938	TX10 CHOPPER ORIVER TX	3.27
5427	TX10 SW NONREM CONT.	2.32
2922	TX10 TUNER DRAWER ASSY	1.95
4859	TX9 4" RND 15R SPEAKER	3.56
2937	TX9 INPUT CHOKE L65	12.05
2936	TX9 L64 BILIFAR CHOKE	4.25

DECCA SPARES

4616	DECCA 100 0.01 2KV CAP	0.98
2933	OECCA 100 BEOIGE TX	2.65
2932	OECCA 100 FOCUS CONTROL	2.65
4615	DECCA 100 LINE DRIVE TX	2.25
2928	DECCA 10SER 470K SH+VOL	2.15
4603	DECCA 2230 10R FUSIBLE	0.65
2930	DECCA 2233 PSH PSH SH	5.14
2931	DECCA 2263 PSH PSH SH	4.20
2926	DECCA 30 SER 3R9 RESIS.	0.50
2924	DECCA 30 SER MAINS TX	11.18
2929	DECCA 30 SER 47K SH+VOL	2.43
2939	DECCA 80 470R SH+VOL	2.45

RESISTORS

CARBON

STANDARD RANGES

	1/4 WATT X 10	0.29
	1/2 WATT X 10	0.29
	1 WATT X 10	0.45
	2 WATT X 10	0.60

SAFETY CERAMIC

STANDARD RANGES

	5 WATT X 5	0.70
	7 WATT X 5	0.80
	11 WATT X 5	0.95
	17 WATT X 5	1.15

OTHER RESISTORS

3279	2M2 H/V FOCUS RESISTOR	0.43
3280	22M H/V FOCUS RESISTOR	1.50
3281	33M H/V FOCUS RESISTOR	1.50
3282	47M H/V FOCUS RESISTOR	1.50
3283	56M H/V FOCUS RESISTOR	1.50

MAINS DROPPERS

3025	MAINS DROPPER RANK A640	1.20
3013	MAINS DROPPER DECCA 80/100	1.60
3016	MAINS DROPPER GEC 2010	0.90
3031	MAINS DROPPER THORN 3600	0.98
3030	MAINS DROPPER THORN 1600	1.45
4910	MAINS DROPPER DECCA 100 2R5	0.82
3034	MAINS DROPPER THORN 9800	1.48
3027	MAINS DROPPER THORN 1400	1.45
3026	MAINS DROPPER RANK A823	0.89
3028	MAINS DROPPER THORN 1300	1.60
3029	MAINS DROPPER THORN 1500	1.63
3018	MAINS DROPPER PHILIPS G8	0.84
3022	MAINS DROPPER PYE 725/731	1.40
3017	MAINS DROPPER PHILIPS 210	0.98
3019	MAINS DROPPER PHILIPS G8 47R	0.48
3033	MAINS DROPPER THORN 8500/8800	0.98
5385	MAINS DROPPER DECCA 80	2.97
5386	MAINS DROPPER DECCA 100	1.98
5533	PYE CT200 PHILIPS 579 DROPPER	3.45

UNIVERSAL CONVERGENCE POTS

	5R, 10R, 22R, 20R, 25R, 50R, 75R, 100R, 200R, 250R, 500R	0.48

FIDELITY SPARES

2940	CHOPPER TX FIDELITY CTV14R	4.50
2942	DRIVER TX FIDELITY CTV14R	2.25
2941	FOCUS UNIT FIOELITY CTV14R	0.50
5408	MAINS INPUT CHOKE ZX2000	3.45
5504	MAINS FILTER TX CTV14R	2.95
5505	DRIVER TX ZX3000 404387	2.95
6162	ON/OFF SH FIDELITY CTV14R	3.65
6163	ON/OFF SH FIDELITY CTV14S	1.65

GEC SPARES

2965	GEC 1401 CHOPPER TX	16.56
2964	GEC 1401 INPUT CHOKE	9.63
5531	GEC 1501 MAINS TX	5.25
4758	GEC 2100 3R FUSIBLE RES	1.45
4759	GEC 2110 SH2 2KV CAPS	2.39
2959	GEC 2100 ETC FOCUS VDR	1.60
2958	GEC 2100 THERMAL CUT OUT	0.97
2962	GEC 2110 10K CONTRAST CTRL	3.95
2961	GEC 2110 1K BRIGHT CTRL	2.25
4760	GEC 2110 FOCUS CONTROL	5.98
4771	GEC 2110 LUM. DELAY LINE	1.83
4728	GEC 2110 MAINS CHOKE	7.05
4996	GEC 2110 NEONS	0.20
4751	GEC 2114 VOL+SWITCH CONT	1.98
4656	GEC 22K MULTI TURN POT	0.64

GRUNDIG SPARES

2949	GRUNDIG 5010 FOCUS VDR	3.25
4633	GRUNDIG 5010 CONTROL TX	4.76
2948	GRUNDIG 5010 FOCUS UNIT	3.75
4865	GRUNOIG 5010 L515 CHOKE	1.63
4744	GRUNDIG 5010/6010 LID	2.62
4745	GRUNDIG 5011 LID	2.50
4637	GRUNDIG 5011 SH+SLIDERS	11.60
2952	GRUNDIG 6010 MIXIE MOD	22.50
4630	GRUNDIG 6011 MAINS SH	3.00
4631	GRUNDIG 6110 MAINS SH	4.86
2947	GRUNDIG A6400 MAINS SH	4.95

REMOTE CONTROL UNITS

PLEASE STATE MODEL NUMBER

4311	DECCA 100 NONTEXT RCU	20.78
4314	DECCA 100 (TEST+PREST) RCU	20.78
4310	DECCA 80/100 SERIES RCU	19.20
4315	DECCA 90/100 N/TXT RCU	20.78
4324	GEC 2 FUNCTION RCU	18.45
5325	GEC C2057H/2067H RCU	19.20
4326	GEC TELEMASTER 12 RCU	20.03
4327	GEC TELEMASTER 16 RCU	20.03
4328	GEC TELEMASTER 8 RCU	22.13
4332	GRUNDIG TELEPILOT 12 RCU	26.25
4333	GRUNDIG TELEPILOT 16 RCU	25.85
2955	GRUNDIG TELEPILOT 7	29.95
4334	GRUNDIG TELEPILOT 8 RCU	20.83
4357	KORTING 12 CHANNEL RCU	22.13
4358	KORTING 16 CHANNEL RCU	22.50
4380	PHILIPS G11 NONTEXT RCU	19.20
4378	PHILIPS G11 T/TEXT 8CH RCU	20.78
5409	PHILIPS G11 T/TEXT U/SONIC	24.50
5453	PHILIPS KT3 REMOTE RC4001	16.00
4379	PHILIPS/PYE G11 2 FUNC RCU	18.90
4359	PHILIPS/PYE KT3/KT30	16.13
4385	RBM 16CH NONTEXT RCU	19.20
4386	RBM 8CH NONTEXT RCU	19.20
4387	RBM TEXT&V/DATA RCU	20.78
2980	REMOTE CTRL UNIT PHILIPS G9	8.97
4390	TCE 9000CHAS 2 FUNC RCU	20.24
4398	TCE TX10(9653)+TEXT RCU	20.78
4400	TCE TX10(9670)+PREST RCU	20.78
4397	TCE TX9/TX10	19.20

PUSH BUTTON UNITS

2870	4 WAY DECCA ETC	7.50
4871	6 WAY DECCA	9.40
2873	4 WAY HITACHI ETC	8.94
2875	4 WAY PYE/TCE	10.87
2877	6 WAY GEC 2110	11.25
2878	4 WAY GEC 2112	12.95
2879	6 WAY T3500	2.75
2880	6 WAY PYE 713	15.30
2881	6 WAY T9000	3.95
2882	4 WAY BUSH A823	10.65
2884	6 WAY MOD CVC9	12.85
2885	6 WAY 520 PHILIPS	16.46
2886	6 WAY PHILIPS 550	14.98
2887	T1P SWITCH UNIT PHILIPS G11	24.95
2888	6 WAY PHILIPS G11	6.95
2889	PIANO KEY MOD DECCA 2631	22.48
4935	7 WAY ITT CVC5	12.90
5278	GEC 2136 TAPEREO	10.95
5279	ITT 6 WAY +VCR	10.70
5280	6 WAY BUSH T20	11.50

ITT SPARES

2972	ITT CP340 PB ASSY	31.50
4501	ITT CP340 SLIOER ASSY	7.58
4683	ITT CV40 FOCUS UNIT	1.95
5543	ITT CVC20 LINE ORIVE TX	3.05
4571	ITT CVC20 MAINS SWITCH	1.36
4787	ITT CVC25 6N2 2KV CAP	1.35
4786	ITT CVC25 8N2 2KV CAPS	2.15
2970	ITT CVC25 BRIDGE COIL	3.95
4789	ITT CVC25 E/W LOAD COIL	1.92
4567	ITT CVC25/30 MAINS SW.	6.89
2969	ITT CVC32 DRIVER TX	2.55
4568	ITT CVC32 REMOTE MAIN SH	6.84
2971	ITT CVC32 SH MODE TX	6.35
4795	ITT CVC45 ON/OFF SWITCH	2.09
3286	ITT CVC5 1MFD 250V CAP	0.40
4569	ITT CVC5 MAINS SWITCH	2.83
4781	ITT CVC5 SHIFT POT 25R	1.82
4780	ITT CVC5 SLIDER BANK	7.41
2967	ITT CVC5-9 MAINS TX	8.48
4570	ITT CVC9 MAINS SWITCH	5.61

FUSES

STANOARD RANGES

	20MM Q/B FUSE X 10	0.50
	20MM A/S FUSE X 10	
	63MA - 160MA	1.98
	200MA - 5A	1.20
	1.25" Q/B FUSE X10	
	250MA - 800MA	0.95
	1A - 5A	0.70
	1.25" A/S FUSE X 10	
	250MA - 2A	1.50
	2.5A - 5A	2.30
	PLUG TO P FUSE X 10	
	2, 3, 5, 7, 10, 13A	0.95

SERVICE MANUALS

5011	DECCA 101/100	6.00
5047	OECCA 80 CHASIS	4.50
5442	DECCA/TATUNG 120	7.00
5022	GEC C2055H-C2255H	6.00
5023	GEC C2065H-C2265H	4.95
5026	GEC C2110-C2149	6.00
5068	HITACHI CPT2024	3.00
5074	HITACHI CPT2234	3.00
5094	ITT CVC20	2.00
5095	ITT CVC25+30	9.08
5096	ITT CVC40	5.00
5097	ITT CVC45/1	4.75
5513	ITT CVC800/801	3.00
5093	ITT CVC9	4.00
5123	MITSUBISHI CT200B	1.50
5527	PANASONIC TC2205	4.00
5116	PANASONIC TX2234	3.00
5127	PHILIPS G11 CHASSIS	4.00
5126	PHILIPS G8 CHASSIS	6.00
4515	PHILIPS KT3 SERV.	5.00
5135	PHILIPS T8-E	1.00
5136	PHILIPS TX	2.00
5143	PYE 725 731 SER	4.00
5145	REDIFFUSION MK1	3.00
5146	REDIFFUSION MK3	9.90
5147	REDIFFUSION MK4	4.00
5148	REOIFFUSION MK5	3.00
5167	THORN 1500	1.50
5168	THORN 1600	1.50
5171	THORN 1615	3.00
5172	THORN 1690-1691	3.00
5184	THORN 38030	2.00
5187	THORN 3V01	12.00
5188	THORN 3V16	12.00
5178	THORN 9000	6.00
5182	THORN 9800	10.00

RANK RADIO SPARES

4650	RRI T20 SPEAKER	2.36
5524	RRI T24E ON/OFF + VOL SH	2.35
4842	RRI 1122 SH+VOL 22K PULL	3.10
4843	RRI A823 100K TUNER POT	1.78
4847	RRI A823 FOCUS ASSEMBLY	6.03
2998	RRI A823 PLASTIC CAM	0.48
5300	RRI A823ETC RING SPK GAP	0.55
4988	RRI T20 (TYPE) FOCUS ASY	0.60
3001	RRI T20 3K3 SH+VOL CTRL	2.67
4852	RRI T20 9N1 2KV CAP.	1.98
4853	RRI T20 CONTRAST+AFC POT	3.23
3003	RRI T20 E/W CORR. COIL	3.41
3000	RRI T20 FOCUS ASSY	4.95
3004	RRI T20 SH MODE TX	11.20
4849	RRI 2718 3K3 SH+VOLUME	3.15

PHILIPS PYE SPARES

4969	PHILIPS 128711 4K7 VOL+SH	3.23
3288	PHILIPS 300 470L VOL+SWITCH	2.87
4449	PHILIPS 570/713 IF MODULE	7.00
5425	PHILIPS CTX-S EHT LEAD	8.95
5418	PHILIPS CTX-S FOCUS UNIT	4.04
4655	PHILIPS G11 100K TUNER POT	0.64
2983	PHILIPS G11 CVC32 B/COIL	2.31
2984	PHILIPS G11 E/W CORR COIL	1.92
2985	PHILIPS G11 FILTER COIL	8.89
2986	PHILIPS G11 FOCUS UNIT	8.40
2987	PHILIPS G11 G2 CONTROL ASSY	7.98
4575	PHILIPS G11 RND SHAFT SH.	2.32
4576	PHILIPS G11 SQ SHAFT SWITCH	2.32
4645	PHILIPS G11 TDA2600 HOLDER	0.65
5284	PHILIPS G8 100K TUN P/SET	0.84
2977	PHILIPS G8 10K COLDUR CTRL	0.98
4525	PHILIPS G8 10K CON PDT (550)	0.87
4524	PHILIPS G8 15R CON POT (550)	1.07
2975	PHILIPS G8 2K2 BRIGHT CONTL	0.85
4526	PHILIPS G8 2H A1 POT (550)	3.80
4522	PHILIPS G8 5N1 1500V CAP.	1.88
4523	PHILIPS G8 5R CONV POT (550)	0.64
4858	PHILIPS G8 6×4" 70R SPKR	5.98
2979	PHILIPS G8 EQUALIS. COIL	2.25
4503	PHILIPS G8 METAL SH	1.72
2978	PHILIPS G8 RED/GRW SYM COIL	3.33
4504	PHILIPS G8/G11 NON REM SH	1.72
5307	PHILIPS K12 THICK FILM UNIT	12.96
4649	PHILIPS KT3 4X4 SPEAKER	2.85
4566	PHILIPS KT3 MAINS SWITCH	8.60
4907	PHILIPS KT4 THICK FILM UNIT	10.29
4564	PHILIPS T173 MAINS SWITCH	3.45
4648	PHILIPS G11 6X4 SPEAKER	2.85
2992	PYE 169 LINE OSC COIL	3.45
4839	PYE 731 3R3 50W RESISTOR	1.29
4535	PYE 731 47K VOL. SWITCH	3.11
2992	PYE 731 FOCUS UNIT	4.05
5545	PYE 731 L/H 3X 100K PSET	3.20
5546	PYE 731 R/H 3X 100K PSET	3.20
2994	PYE 731 THICK FILM ASSY	1.55
4938	PYE KT2 FOCUS UNIT	2.85
4864	PYE T194/6 SPEAKER	5.05
5556	PHILIPS G11 SHORT SHAFT SH	1.98

THORN VIDEO SPARES (OVER 450 PARTS)

QUOTE THORN PART NUMBER IF POSSIBLE

5561	T3292 BOOSTER	44.62
5562	T3292 CAPSTAN BELT	3.48
5563	T3292 CAPSTAN MOTOR	51.16
5568	T3292 CASSETTE LAMP	1.62
5569	T3292 COUNTER BELT1	0.60
5571	T3292 COUNTER BELT2	0.60
5575	T3292 DRUM MOTOR	47.70
5577	T3292 F/F IDLER	2.02
5582	T3292 GUIDE ROLL ASSY	11.40
5585	T3292 LOWER DRUM ASY	80.48
5587	T3292 PINCH ROLL ASSY	9.84
5591	T3292 REWIND IDLER ASSY	7.04
5592	T3292 REWIND RUBBER TYRE	0.60
5621	T3292 UNLOADING BELT	0.60
5622	T3292 UNLOADING IDL. ASSY	6.43
5624	T3292 UPP/DRUM KIT+MOD	35.94
5629	T3V00 CAPS. MOTOR BELT	0.60
5635	T3V00 COUNTER BELT 1	0.60
5637	T3V00 DRUM MOTOR	49.39
5646	T3V00 PINCH ROLLER ASSY.	7.31
5648	T3V00 RECORDING LAMP	2.00
5650	T3V00 SERVICE MANUAL	17.51
5655	T3V00 T/U IDLER ASSY	5.58
5657	T3V00 UPPER DRUM+MOD KIT	35.94
5663	T3V16 PINCH ROLLER ASSY	7.31
5666	T3V00 CAPSTAN MOTOR	51.16
5688	T3V00 TENSION BAND	1.86
5689	T3V00 TIMING GEAR	4.12
5692	T3V00 UNLOAOING IDLER ASSY	6.43
5710	T3V01 TENSION BAND	1.86
5716	T3V16 CAPSTAN BENT	3.48
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Decca-Tatung Chassis Up-date

Part 2: The 160 Series

Ray Wilkinson

The introduction of the 160 series chassis marked a number of milestones for Deccacolour/Tatung CTVs. It was intended to drive 90° tubes in screen sizes from 14 to 22in. and the original concept included neither remote control nor export versions. In the event the chassis proved to be so successful that such versions were subsequently called for.

In conjunction with the Production Engineering and Test Instruments departments in the factory the PCB size and shape were carefully worked out so that a new in-line production line could be designed specifically for the chassis. The test equipment is even more automated than before to increase the reliability and consistency of the sets.

As with the 140/145 series all the circuitry apart from that on the tube base panel is arranged on a single PCB. Two tube base layout designs are required however: while the 20 and 22in. tubes have standard necks, as in the 140 series, the 14 and 16in. tubes have mini-necks and different pin connections. The bare PCB has both types of tube base panel attached with perforations, like postage stamps. The production schedule determines which model is to be made at any particular time. After assembly, test and alignment of the whole panel and the appropriate tube base section the base sections are broken away and the main panel is fitted in the cabinet. The unwanted base section is either discarded or used for spares.

Test Equipment

All the test equipment used in the production of the chassis was designed and built by the factory's Test Instruments department. It consists of six sequential in-line stations placed after the flow-solder and inspection sections. Each station carries out component checks, voltage or current measurements, waveform checks and adjustments to coils or preset potentiometers. Most of these tests are carried out automatically under microprocessor control. Where an operator is required, for example to check a critical waveform, the test gear will be making other checks at the same time.

The chassis is supported by a pair of tapes as it moves along the assembly line. These tapes carry the chassis to each test station in turn. As the chassis stops over the test equipment the pin bed beneath is raised by pneumatic rams so that the pins contact the appropriate test points on the copper track.

Automatic Adjusters

Each automatic adjuster for a coil or preset potentiometer is driven by a precision motor and gearbox included within a servo feedback loop, the motors and gearboxes being supported above the chassis in a transparent plastic safety cover. It's fascinating to watch one of these adjusters in operation. For example, to adjust the coupling between the tuner and the i.f. strip the system injects a frequency sweep at the tuner test point and displays the response on the monitoring oscilloscope. Then, as the system measures the amplitude of the response at four critical frequencies, the adjuster automatically tweaks the core of the coupling coil in the tuner. You can see the result on the scope, as the response curve gradually takes on the correct shape.

The tests are split up so that the time spent at each test station is the same. This is essential since the assembly line

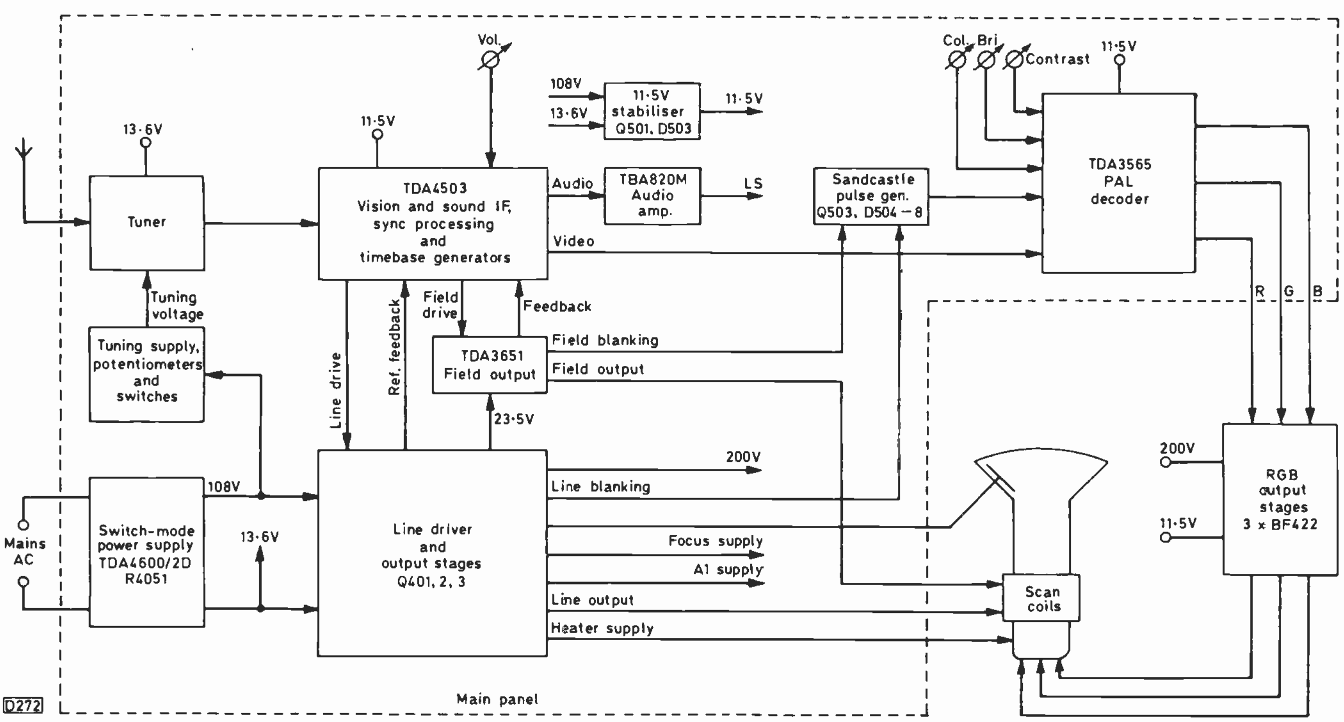
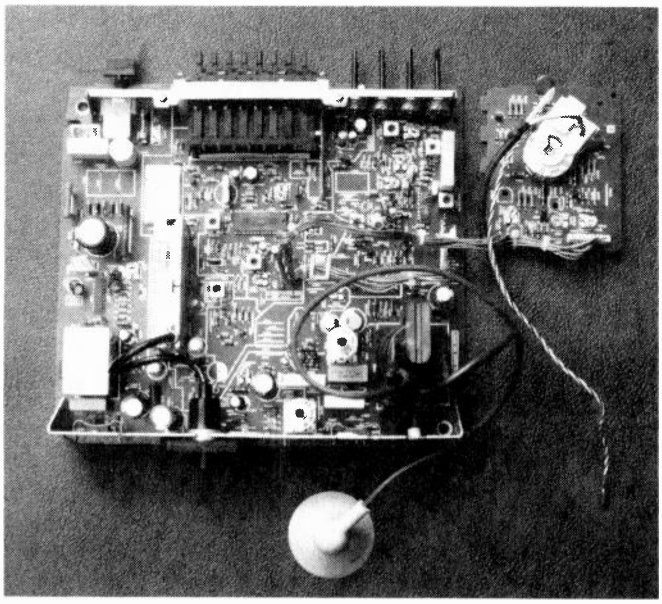


Fig. 1: Simplified block diagram of the 160 series chassis.



The basic 160 series chasssis.

moves continuously.

The 160 Chassis

Now to the 160 chassis itself. If you compare the accompanying photo with the 145 chassis shown last month you can see the simplification that's been achieved. The main contributory factor to this simplification is the TDA4503 chip that became available at the time we started to design the chassis. You can see from Fig. 1 how many circuit sections are incorporated within this chip.

The vision i.f. section of the chip is based on the TDA2540/1 series chips we used previously, so we were able to make use of our earlier experience in the development of this part of the set. A significant difference however is that there is only a single coil to serve the dual purpose of detector tank and a.f.c. coil. The phase shift required for a.f.c. operation is generated within the i.c.

The sync processor section of the chip is based on the TDA2578, but the second phase-locked loop is not present. This is the loop that would control the possible shift in flyback pulse phase as the beam current, and hence the collector current and switch-off time of the line output transistor, change. In other words you could get sideways kinks in the picture as the brightness varies. We've minimised this effect by ensuring that the line output transistor just stays out of saturation, making its switch-off time much more consistent.

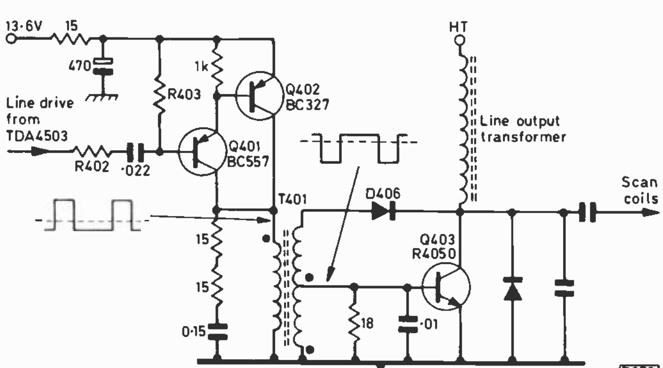


Fig. 2: The line driver stage and the line output transistor's base circuit. The values of R402 and R403 depend on the size of the tube.

Fig. 2 shows the line output transistor's base drive circuit. The line driver transformer T401 drives the line output transistor Q403 hard on but the combination of D406 and the few extra turns on T401 prevent its collector voltage going too low – the extra turns provide enough voltage to turn on D406. This extra winding is designed so that Q403 remains just on the edge of saturation during the scan period, thus reducing its dissipation to a minimum.

The other main simplifications achieved are in the colour decoder and RGB output stages. The TDA3565 PAL decoder chip is an 18-pin version of the TDA3561A (used in the 145 chassis) without provision for RGB inputs or teletext. We've removed the preset adjustments we had on the customer controls in the 140/145 series. This means that we can't adjust for spreads between i.c.s, but with care in the design and the choice of test limits this hasn't been a problem – and it does simply the test procedure.

Another alignment operation that's been simplified is the previously mentioned tuner coupling. In earlier designs we always had an adjustable coupling coil in addition to the one in the tuner: it formed part of a bottom-capacitance coupling between the tuner and the SAWF driver transistor – this arrangement was explained in detail in my previous series of articles. In the 160 chassis the second coil is fixed – it forms part of the printed circuit track. Its value is thus very consistent between sets. A screen is necessary to reduce interference but this is simply fitted as a hand-inserted component.

The PAL decoder has no luminance delay line. This is because we were able to use a SAWF that incorporates the required delay.

Two other features that ease assembly are the single heatsink/strengthening rail at the back of the chassis and the use of a mains switch that fits straight on to the PCB.

Remote Control – the 165 Chassis

The success of the 160 chassis in its basic form prompted the marketing department to ask for a remote control version that would complement the existing range of remote control chassis described last month. The i.c. chosen for this purpose is a single-chip version of the M104/M293 combination used in the 145 series.

From the system block diagram shown in Fig. 3 you can see that most of the circuitry, including the display driver, is contained in the M491, a 40-pin NMOS LSI chip. This i.c. provides voltage-synthesis tuning for sixteen programmes, in a similar manner to the System 40 arrangement, with remote control of channel selection, volume and on/off (standby).

The TDA8160 infra-red remote control receiver chip is a small 8-pin device we've been able to fit on the main PCB with its own screen around it.

The system's mode of operation is very similar to the M104/M293 arrangement described last month but the action of some of the circuitry may not be immediately apparent.

Diodes DR02/3/4 decode some of the seven-segment display driver lines so that on channels 14/15/16 QR04's collector voltage falls. The collector of this transistor is connected to the coincidence detector pin in the sync processor section of the TDA4503 chip to give a short line time-constant for VCR use.

When you switch the set on you normally want it to come on fully rather than in standby. If pin 25 is connected to 0V the standby output at pin 26 will be set to

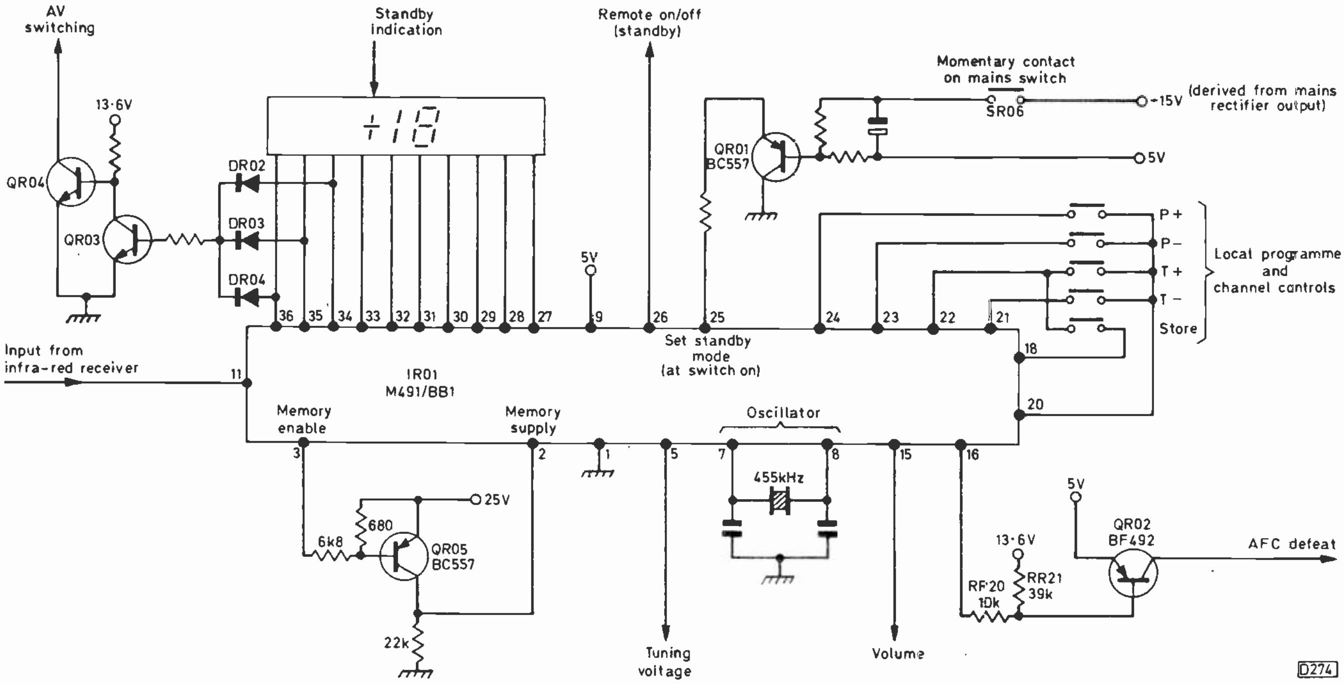


Fig. 3: The tuning and remote control system used in the 165 series chassis.

"on" as soon as the 5V line powers up. If pin 25 is connected to 0V permanently however then with the set in standby a mains interruption would result in the set coming on when the mains supply returned. This is obviously unsafe. Hence the need for QR01 and its associated components. When the mains switch is pressed the momentary make contacts (SR06) on it connect a −15V supply, potted down directly from the mains reservoir capacitor instead of from the switch-mode power supply, to QR01's base. This ensures that pin 25 is connected to 0V when the 5V supply appears: the signal at pin 26 is then set to on. For any mains supply interruption other than pressing the switch, SR06 will not close and the set will come on only in standby.

A BF492 was chosen for use in the QR02 position because of its reverse base-emitter voltage rating. Its collector is connected to the a.f.c. line and so needs to swing through about 9V under normal operation. The signal available at pin 16 of the M491 chip is only 0V or 5V however. Consequently RR20 and RR21, connected to the 13·6V line, need to ensure that QR02's base is taken above the maximum a.f.c. voltage when this transistor is switched off. QR02's emitter must be connected to the 5V line since this is the centre voltage of the a.f.c. line – QR02 is switched on between channel changes and whilst tuning.

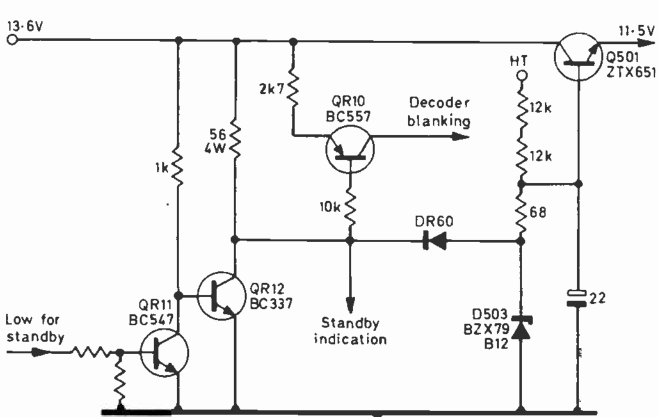


Fig. 4: 11·5V regulator with standby switching (165 series chassis).

On this chassis we were able to use a much simpler method of switching the set to standby. This was made possible because a zener diode and transistor, with a lot of care in the tolerancing, are used to stabilise the main l.t. line (11·5V) instead of an i.c. voltage regulator. It was a simple matter to design a circuit to switch off the stabiliser transistor (Q501) when the standby signal is received from the remote control system (see Fig. 4).

Since the TDA4503 is operated from the 11·5V line all the vision and sound i.f. functions and, most importantly, the sync processing/timebase generator functions are switched off in standby. With the removal of the line drive signal from this i.c. the line driver and output stages remain off although the supplies are still present. Since there are no e.h.t., first anode or heater supplies the tube remains blanked and the only current taken from the power supply is the small amount required to maintain the remote control system in standby. QR10 (Fig. 4) switches the decoder's blanking pin high to avoid a nasty, jagged bright line when the set is switched to standby.

The M491 and TDA8190 are supplied from a 5V stabiliser chip to ensure that their supply is kept within close tolerances.

You can see from the photo on the front cover last month how well the design engineers were able to fit the extra circuitry into the space vacated by the 160 chassis' channel selector unit. The front control panel, with its programme and channel selector buttons and seven-segment display, is fitted on the main chassis in a similar way to the versions of the 145 series with integral controls. The infra-red remote control beam passes through a plastic lens that pokes through the front panel (this increases the angle of reception) before it hits the receiving photo diode.

The extra tests required for the 165 chassis were provided by adding another test position after the six already used for the basic 160 chassis.

In Conclusion

With its reduced component count and more automated production the 160 series has proved to be a popular chassis within the factory. It's giving even more consistent performance and reliability in the field than its predecessors – and we thought they were good!

Finally, I would like to take this opportunity to thank all my colleagues at the laboratory and the factory for their help and friendship over the years. Also my thanks to the management of Tatung (UK) Ltd. for their permission to publish these articles.

Quick Tests: Philips Solid-state Chassis

S. Simon

This time we'll report on some of the solid-state Philips CTV chassis that often come into the workshop – the G8, G9 and KT3. We'll skip over the G11 (20AX chassis) since it was thoroughly covered in these pages quite recently – see the October 1985 issue.

THE G8 CHASSIS

The G8 has also been extensively covered in the past, so we'll just provide some notes that may be of help.

As the tube's heaters are supplied by the mains transformer the first check to make is a visual one – are the heaters alight? If they are we know that the mains supply to the set is intact and that the 3·15A mains fuse (anti-surge type) is o.k. If the tube's heaters are not glowing, check the mains supply to the on/off switch and the condition of the mains fuse. It's on the extreme left side, under a cover. Remove this and check the appearance of the fuse. If it's blackened, check the mains rectifier thyristor. This is roughly in the centre of the power panel (left side) and is usually a BT106 on a stud mounting though occasionally a flat type, e.g. a BT116, will be found. Check for shorts. The mains filter capacitor is rarely at fault in this chassis: it's located bottom left, on the inside (C1366).

Also check the condition of the large h.t. reservoir capacitor (600μF – C1385) at the bottom left. The tags are to the front and a mirror can be used to check the appearance of the business end. Any burn marks, corrosion or bumps should condemn it to the waste bin. This capacitor is now failing more regularly and should be a "first check" in these sets.

Very often no shorts or other reasons for fuse failure will be found and a replacement will bring the set back to life. Suffering from the rigours of a spiky mains supply over a long period of time tends to kill off these fuses.

If the mains fuse is intact and the tube's heaters are alight but the set is otherwise dead, check the voltage at the rear edge h.t. fuses. Some 200V should be found here. If this voltage is present, transfer attention to the right side line output panel and check the 800mA fuse roughly half way up the rear edge. If this fuse is intact (200V at both ends) proceed to the front end and locate the large 47Ω wirewound, vertically mounted anti-breathing resistor R5535. There may be 200V at one end but not at the other. If this is so you're lucky, a replacement being all that's necessary. If however there's 200V at both ends you will probably have to look for a dry-joint. Most often the poor contact will be found on the top line drive panel where the black wires join to the earth tag. It may be necessary to remove this small panel in order to resolder the contacts on the print side. This will normally restore the operation of the set.

If the 800mA line scan panel fuse has failed – and this is the usual situation – the chances are that the line output transformer has failed. This must not be assumed however. Disconnect the tripler – remove the plug from the nipple on top of the transformer – and check the current drawn (meter across the fuse). If the current is still over 500mA, switch off and check the resistance to chassis from the top end of the 47Ω resistor previously mentioned. If the reading is low, check the line shift control (shorted to case?) and the two line output transistors. Check these anyway.

If the transistors are o.k., examine the transformer to see if there are any signs of burning on the top (not essential) winding. If so, cut the winding out and run the nipple from the original feed tag. Check the current drawn and if this is normal refit the tripler plug and try again (in case the tripler was the cause of the failure in the first place). The top winding is not usually at fault however. The majority of transformer failures are due to shorts in the main winding. This necessitates a new transformer – an extremely common occurrence with the G8, as most of us in the trade know only too well. The imported type of replacement transformers (brown) seem to be more reliable than the original ones.

If the tube's heaters are alight but there's no voltage at the left-hand h.t. fuses, note the front end, long vertical dropper resistor. There should be a.c. at the two bottom tags and h.t. (d.c.) at the upper two. It's common for a section to fail. The value of the bottom, surge limiter section is 2·2Ω while the upper, h.t. smoothing section is 68Ω. If the lower section is intact, don't put the meter across the upper two tags to check it. Switch the meter to 250V or so and then apply the leads. The reason for doing this is that if this section has gone open-circuit one tag may still be fully charged by the 600μF reservoir capacitor which must be discharged before risking an ohmmeter check. If in doubt connect a resistor of say 50Ω value across the tags to discharge the electrolytic. You've been warned! If both sections are intact check the print side of the lower panel – poor connections here are not unknown.

So much then for dealing with a "dead" G8. For further information on servicing this chassis refer to the May and July 1985 issues.

THE G9 CHASSIS

The G9 chassis can be looked upon as a 110° version of the G8. The signals panel is the same and the power supply panel follows similar lines but the rest is quite a bit different. The approach required is also different.

The left side power supply panel is obscured by the convergence board and some care is required if this is moved with the set on. Be very careful – don't let it flop around. The mains fuse is the one at the bottom of the power supply panel and is again a 3·15A anti-surge type. The h.t. fuse is the 1A one near the top of the panel. The voltage here should be 205V and usually is.

The main source of trouble in these sets is over to the right, on the line output panel. You'll find a 2,200μF capacitor here, C5138. It's subject to the strain of trying to hold a steady supply of about 45V across the two resistors in series with the emitter of the line output transistor. This 45V supply is available only when C5138 is in good order. All too often it isn't, and it should be the first suspect when a variety of symptoms present themselves – rapid variations in picture size etc. Much time in the past has been spent in checking the power supply for a fault only to find that the culprit was this large electrolytic over on the line output panel. The associated zener diode D5134 is also a possible suspect – type BZX79/C51. Dry-joints here are a bit of a pain and can occur on both sides of the panel. The audio output stage feed resistor R3141 (39Ω) takes its supply from C5138 and can suffer when the electrolytic is defective – it's on the signals panel.

The G9's line output transformer is also suspect, but not to the extent of the one on the G8. It's smaller but retains the tripler nipple which makes disconnection easy if this item is suspect – note that the G8 and G9 use a different type of tripler.

Just one word about the power supply. There's no surge limiting resistor in the feed to the thyristor (which has a soft-start circuit), just the bottom right filter choke. The front end "dropper" is the h.t. smoothing resistor and has a value of 56Ω.

Sorry, but that's all I have to say about the G9. Further information on the chassis can be found in the August 1981 issue.

THE KT3 CHASSIS

Finally this month a few words on the KT3 chassis. Not many because this is a reliable design spoilt by the tendency of just one item to fail. Had the design of the KT2 (the earlier 14in. chassis) been followed this one item would not have been included. The KT2 had a surge limiter in the supply to the h.t. rectifier: it consists of two 10Ω resistors in parallel. The KT3 has a single 4·7Ω surge limiting resistor that follows the main bridge rectifier. It fails time and time again. The circuit reference number is R6191 and it's on the bottom right subpanel.

The KT3 chassis was used in a variety of models ranging from 14 to 20in. sets. The K30, used in larger screen sets with 110° scanning, is similar. Later came the CTX chassis with its single, horizontal board. All these chassis have the devilish 4·7Ω resistor, so be prepared to find it open-circuit in the various models in this range.

Three sixteen-pin i.c.s that have control over the twelve channels are to be found at the rear of the selector drawer used in some of these models. If some channels can be selected and perform well but some can't, one of the i.c.s is usually responsible. Care is required when handling these i.c.s – fingers and tools should be discharged to earth to prevent any i.c. touched being ruined by static. Most standard models have a tuning assembly in the side of the cabinet. Access is by removal of a panel. This is pretty obvious however: most of the troubles are caused by plug and socket contacts and the occasional dry-joint.

Some servicing notes on the KT3/K30 chassis appeared in the November 1983 issue (where R6191 was incorrectly shown in Fig. 1 as R6291).

Developments in VCRs

Part 1

Steve Beeching, T.Eng.

Two major developments in VCRs over the last year or so have been dual-speed operation, giving up to eight hours of recording and playback, and hi-fi stereo sound, with the sound signals laid down on helical tracks along with the video signal. These and other features are all part of the specification of the JVC Model HRD725 which we'll use as an example in describing recent VCR developments.

With the HRD725 JVC came up with not just a hi-fi VCR but one that has other capabilities above and beyond previous models. Apart from the hi-fi sound there are normal stereo sound tracks with Dolby, as in previous models. These tracks can be post-dubbed together as a stereo pair, or individually for bilingual use, or used to keep the original background sound with a post-dubbed commentary added.

Six-head Drum

The HRD725's head drum has six head tips, two for hi-fi audio, two for standard video recording/playback and two for long-play video. Considerable thought was put into the use of the long-play (LP) and standard-play (SP) heads to provide noise-free visual search, still field and step-field variable playback. We'll look into all these modes of operation in some detail. I'd like to make the point at the outset that various low-cost "equivalents" of the HRD725 don't incorporate the full electronic playback processing: because of this they have noise bars in visual search and omit the variable-speed playback feature. Another point worth noting is that several machines with hi-fi sound have monaural standard audio tracks, making them non-compatible with previous stereo sound models.

The positions of the six heads in the drum are shown in Fig. 1. The audio heads are mounted 138° in advance of the following video heads. Each is 26μm thick, so the audio tracks are 26μm wide. In addition the audio heads are mounted on a plane higher than the video heads, so that the 26μm wide audio track lies within the 49μm wide

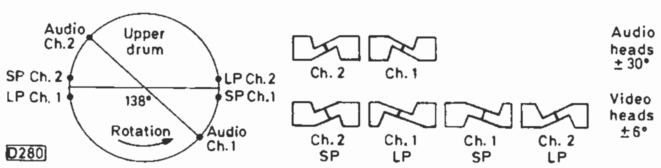


Fig. 1: Arrangement of a VHS head drum for standard/long play and hi-fi audio record/playback.

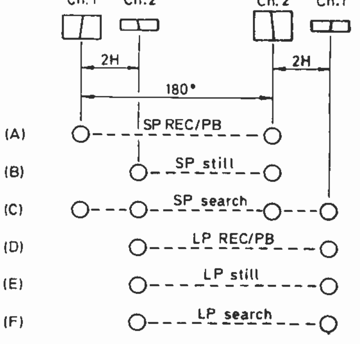


Fig. 2: Use of different heads in the various modes of operation. For SP stills one LP and one SP head is used. All four video heads are used in the SP search mode.

track traced by the following video head. The audio heads record the audio tracks prior to these being traced over by the video heads. This is one of the principles of the depth multiplex recording system used for video hi-fi sound.

The pairs of video heads are constructed as a single unit, each head having its own winding. For a reason that will become clearer later, an LP and an SP head of opposite azimuth are mounted together: they are precisely two lines apart when recording or playing. The Ch. 1 SP head is slightly thicker than 49μm while the Ch. 2 SP head is much thicker – more like 56μm (an estimate) – though each records a standard 49μm track since one head over records the excess track of the other head. To ensure this, the tape speed is such that the tape moves 49μm along during each head scan. The LP video heads are 25μm thick and record 25μm wide tracks. The advantages of having a thicker Ch. 2 SP head to get noise-free still pictures will become clearer later.

Visual Search and Still Picture Modes

Before getting involved in the electronics, let's consider the use of the multiple heads to read the recorded video tracks in the visual search and still picture modes. Slow motion is simply the use of the capstan motor in the stepping mode to provide sequential frame displays, forward or reverse.

The head selection chart (Fig. 2) shows the differences in head thickness and gap tilt (azimuth offset). (A) shows normal record/playback, using the Ch. 1 and Ch. 2 SP heads alternately. (D) shows slow-speed record/playback, using the Ch. 1 and Ch. 2 LP heads alternately. The LP heads are also used for LP still pictures (E) and picture search (F). Noise bars are apparent therefore during the LP picture search and still frame modes. Note that it's still frame as opposed to still field.

In the SP still picture mode (B) the thicker Ch. 2 SP head is used in conjunction with the Ch. 2 LP head. The result is a still field with the same track read alternately by these two heads. This is illustrated in Fig. 3, where the advantage of using the thicker Ch. 2 SP head to cover the Ch. 2 track without missing any f.m. video signal can be seen. With the tape stationary the heads scan the tape at a more acute angle than when the tape is moving during record. The replay path is thus longer, covering at least some portion of three adjacent tracks, though the head azimuth matches only the central track. The adjacent tracks are ignored. Since it's thinner, the Ch. 2 LP head doesn't cover so much track. It can lose out at the very top and introduce noise if the tracking is not spot on. For this reason the machine's still picture quality is perfectly noise free only with its own recordings and is not necessarily clean with a library tape. This is true of most machines with still-picture and slow-motion modes.

All four heads are active in the SP picture search mode (C), in forward or reverse. At nine times normal speed each head crosses a number of tracks, some eight-nine (see Fig. 4). Each head can replay only alternate tracks since those between have the wrong azimuth. Hence the noise bar with traditional machines. The HRD725 how-

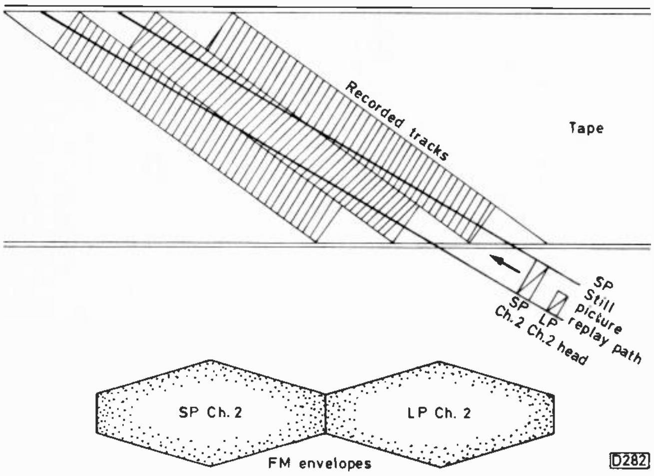


Fig. 3: SP still playback.

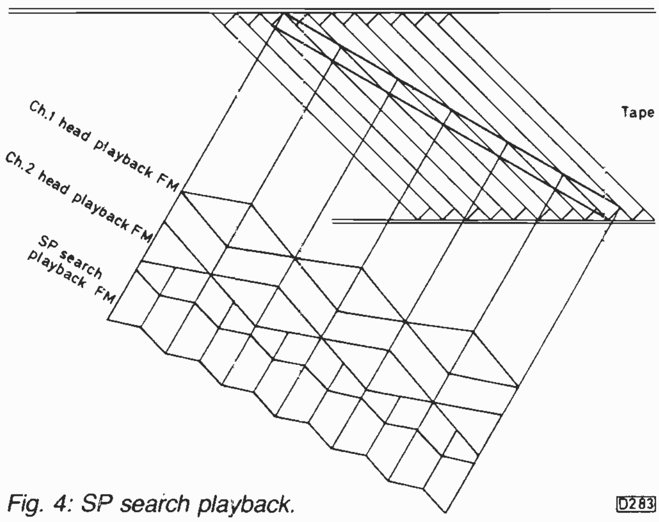


Fig. 4: SP search playback.

ever incorporates a circuit that selects the best f.m. carrier of the four at all times during the visual search mode, giving noise-free SP visual search.

Noise-free SP Search

Fig. 5 shows how this is achieved. Transistor switches Q1 and Q2 switch off the SP heads in the LP mode or earth the playback side of the windings in record. Q5 and Q6 provide the same action with the LP heads. For SP visual search Q1, Q2, Q5 and Q6 are all open. Selection of the outputs from the preamplifiers in IC1 and IC2 is done by the drum flip-flop signal. This is in antiphase between the LP and SP heads. IC3 selects the outputs from the SP or LP heads and routes the signal to the playback f.m. demodulator circuitry. IC4 monitors the f.m. signals from each set of LP or SP heads: its output at pin 7 is low if the signal level from the SP heads is greater than that from the LP heads and vice versa. IC405 produces a pulse that corresponds to the peak f.m. carrier from the LP or SP heads, this pulse being used by the automatic tracking system to detect the position of the noise bar within a still picture and remove it.

The microcomputer chip IC413 controls the head switching and selection. During visual search it selects the LP or SP heads via IC419 according to the highest value of f.m. signal detected by IC4. As IC419 is clocked by the playback line sync pulses switching between heads occurs at the start of a line. The result is a noise-free SP visual search – only thin switching lines with a slight horizontal

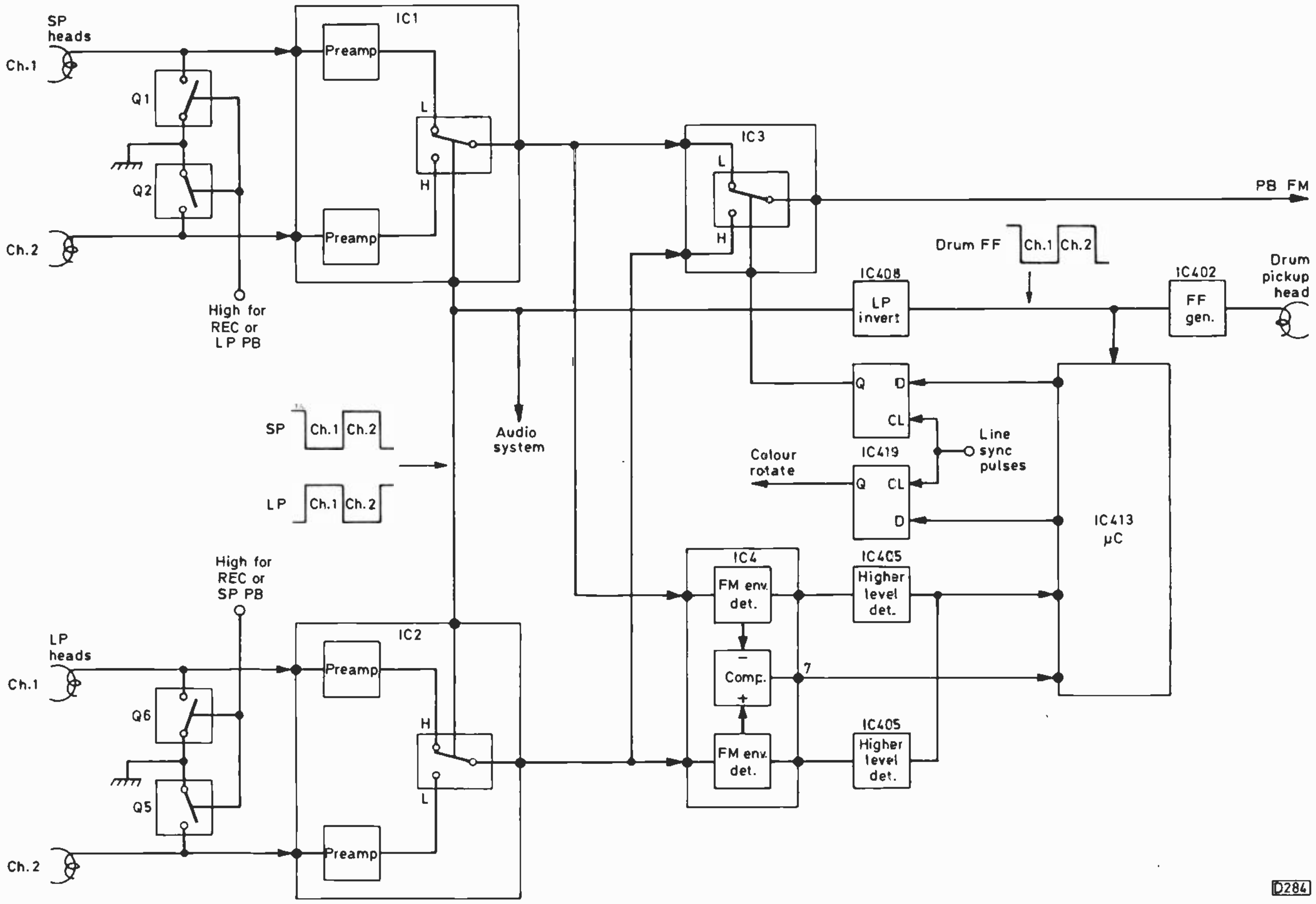


Fig. 5: Block diagram of the video head selection system.

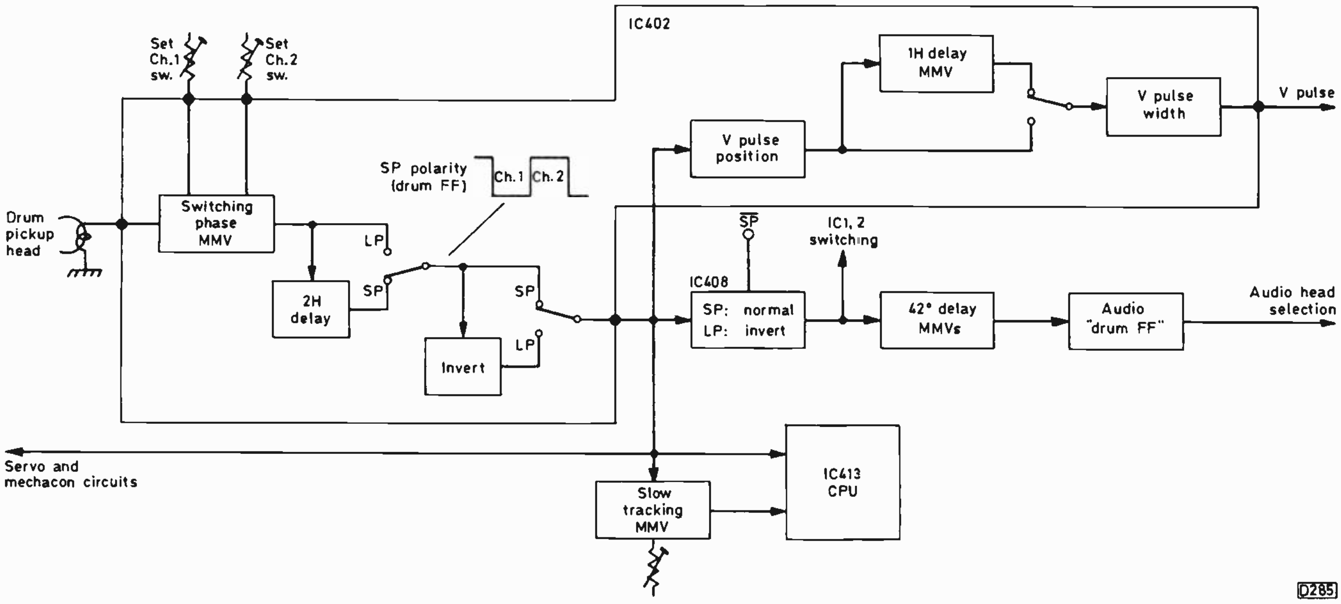


Fig. 6: Block diagram of the switch timing system.

displacement can be seen. IC413 also controls the colour phase via IC419, by issuing a colour rotate signal to the chroma circuits when head switching occurs.

Head Switching Control

In a standard VCR the video heads are mounted 180° apart and take 40ms to complete a single revolution. Thus each head scans the tape during half a revolution, i.e. 20ms. It follows that 40ms = 360° of drum rotation and any scan angle can be expressed as an equivalent time period. The r.f. switching pulse, or drum flip-flop as I prefer to call it, is generated by the drum servo as a symmetrical squarewave. In a hi-fi/LP VCR three flip-flop trains are required – for the SP, LP and hi-fi head switching. As we saw earlier the LP heads are displaced from the SP heads by two TV lines (2H). Thus a two-line time shift is required between the SP and LP head switching flip-flops. The audio heads are displaced by a 138° advance, so a 42° delay will bring the flip-flop switching edges to the correct time.

Fig. 6 shows in block diagram form the circuitry used for this. The LP heads are the most advanced and coincide with the primary timing edges from IC402. The SP timing edges are delayed by 2H. Since the azimuths of the SP heads are opposite to those of the LP heads, inverted flip-flop pulses are required for one lot with respect to the other: the LP flip-flop pulses are taken via the inverter.

From this point the flip-flop pulse train is distributed to the other parts of the system that require head timing information. For the audio head selector circuits the flip-flop is given a 42° delay to time the edges correctly. There is also an inverter to get the switching polarity correct for audio in the LP and SP modes.

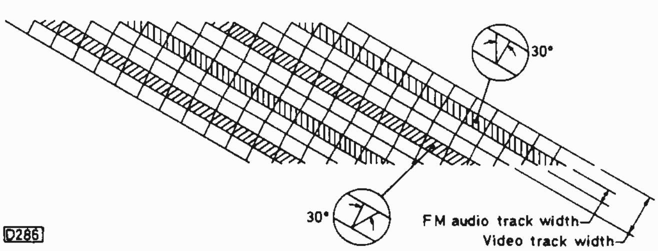


Fig. 7: VHS hi-fi track pattern.

The V-pulse output circuit provides synthesised field sync pulses for use in the slow/still and visual search modes to ensure stable field locking with the tracking noise bars out of the picture area, i.e. pushed into the field sync period.

Hi-fi Audio

For hi-fi audio recording the two left and right channel signals are frequency modulated on to two carriers at 1·4MHz and 1·8MHz respectively, the heads (see Fig. 1) having an azimuth offset of ±30°. The 26μm wide audio track is centred on (beneath) the corresponding video track as shown in Fig. 7.

Fig. 8 illustrates the depth multiplex recording principle. As the audio head has a wider gap (not track) than the video head its recording penetrates the 4μm magnetic layer on the tape to a greater depth than the corresponding video signal. The surface portion of the audio recording is then erased by the following video head as this records to a depth of only about 1μm. This leaves a two-layer magnetic recording with the audio signal below the video signal. The attenuation of the audio signal by the erasure of its top layer is only some 12dB – this varies depending on the tape energy level. Separation of the audio and video carriers during playback is achieved through the azimuth difference between the audio and video heads – the video heads at ±6° and the audio heads at ±30° "see" only their own carriers.

The f.m. deviation for hi-fi audio recording is ±150kHz. Incidentally, for Beta hi-fi the carriers are at 1·44MHz and 2·1MHz, the deviation being ±500kHz. Fig. 9 shows the VHS video and audio signal spectrums with hi-fi sound.

Record/Playback System

The basic hi-fi record/playback system is shown in Fig. 10. The input is selected by IC5 which can accommodate simultaneous TV and f.m. radio broadcasts by allowing the machine to record TV from its tuner and hi-fi audio via an external f.m. radio input. There's a choice of a.g.c. or manual recording level, selection of the latter being indicated on an LED ladder array. The a.g.c. is of the limiter type so that noticeable variation in level with

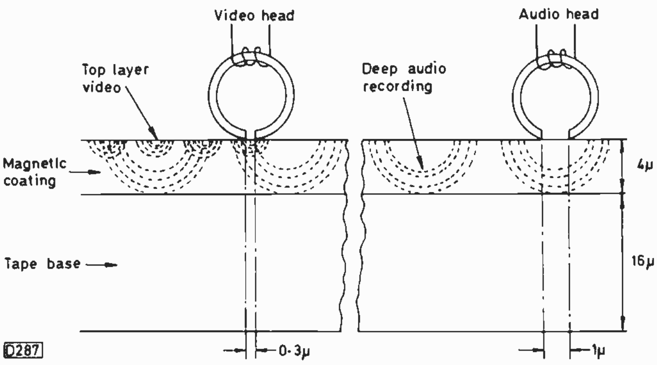


Fig. 8: The principle of depth-multiplex recording.

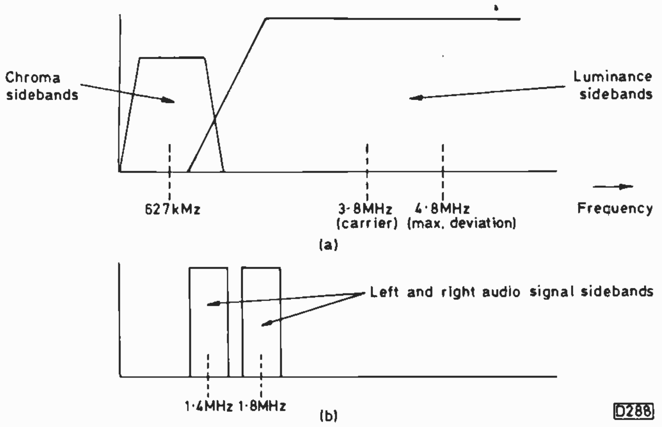


Fig. 9: Frequency spectrum for VHS hi-fi: (a) video signals, (b) the two f.m. audio signals.

sudden changes in input level – often called "breathing" – is avoided.

IC9 provides muting on power up and power down to prevent spurious noise. IC13 also contains muting control, mainly for playback purposes.

In the record mode the dynamic range of the signal is reduced by a compressor arrangement in IC15 – we'll return to this later. Pre-emphasis is next carried out by IC12 in conjunction with the *RC* network connected to pin 6. The signal is then limited and passed via a low-pass

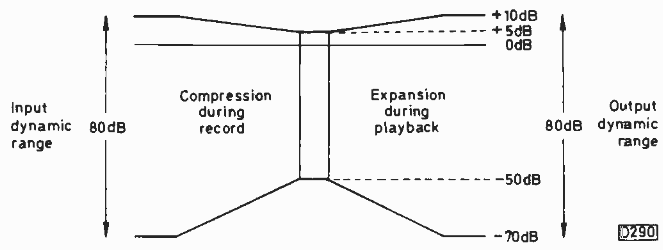


Fig. 11: Audio compression/expansion for noise reduction.

filter to the f.m. modulator in IC13. A voltage-controlled oscillator is used as the f.m. modulator. The record level control is incorporated to prevent over-recording (the f.m. modulator being driven to a deviation in excess of 150kHz). The low-pass filter cuts off at 20kHz – this reduces harmonic intermodulation, particularly from the f.m. broadcast stereo pilot tone at 38kHz. After modulation the left signal at 1·4MHz is added to the right 1·8MHz signal. The two signals are then sent to the audio heads via the record drive amplifier.

In playback the 1·4MHz and 1·8MHz signals are amplified, with a.g.c., by IC1, Q4 and Q13 and are then separated by bandpass filters before passing to their respective demodulator and dropout compensator circuits. Demodulation is performed by making use of the voltage-controlled oscillator as part of a phase-locked loop – the error signal produced by a phase comparator is the recovered audio signal. The following hold circuit eliminates audible glitches caused by dropouts and the head switching pulses – we'll return to this. De-emphasis is then applied before the signal goes to the expander circuit to correct for the compression applied during recording.

Signal Compression/expansion

Signal compression/expansion (see Fig. 11) is used to improve the signal-to-noise ratio significantly while maintaining an 80dB dynamic range. Compression is applied during the recording process, the playback signal being subjected to a corresponding expansion. The processes are logarithmic and a special i.c. has been developed to

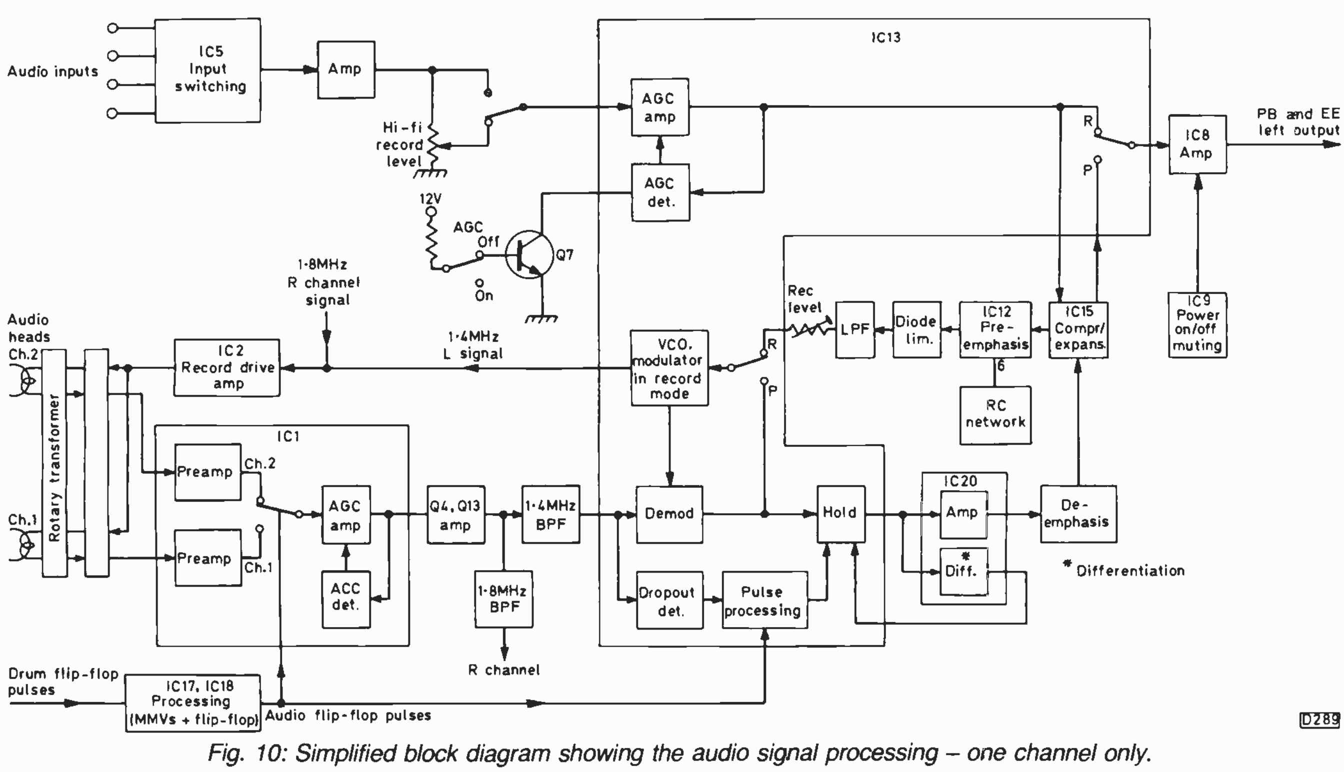


Fig. 10: Simplified block diagram showing the audio signal processing – one channel only.

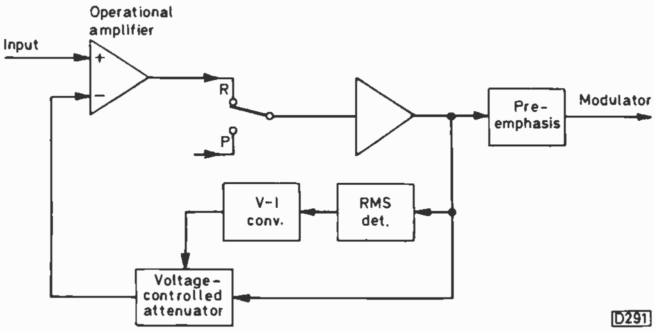


Fig. 12: Block diagram of the record compression system.

perform these operations.

In the Dolby noise reduction system only the high-frequency components of the signal are modified during record/playback. Low-level, high-frequency signals are amplified before being recorded then attenuated during playback. This reduces the tape noise level during playback. The compander/expander used in the JVC HRD725 works at all frequencies and signal levels, the frequency response being tailored by the pre-emphasis/de-emphasis networks. It provides a 10dB compression/expansion of the signal for every 60mV change with respect to a set 0dB level.

A block diagram of the record compression system is shown in Fig. 12. The input signal is applied to the non-inverting input of an operational amplifier, then to a further amplifier, before being subjected to pre-emphasis. Compression is carried out by applying feedback to the inverting input of the operational amplifier. A voltage-controlled amplifier/attenuator (VCA) is included in the feedback circuit. It's controlled by an r.m.s. detector which converts the level of the audio signal to a d.c. control voltage. This is transformed to a control current to control the gain of the VCA.

During playback the VCA is in series with the signal path (see Fig. 13). It now works in reverse to the record mode. All frequencies that were compressed are expanded with the result, in conjunction with the pre-emphasis/de-emphasis applied, that tape noise is reduced over a much wider frequency range than that achieved with Dolby. It's not unlike the DBX system.

An r.m.s. (root mean square) detector is used since neither a mean-level nor a peak level detector will give an accurate output when a complex signal input is applied. What the r.m.s. detector does is to take the peak value of the input, square it, then take the square root of the mean value of successive squared peaks to produce an "effective value" output.

Audio Head Switching

The drum flip-flop pulses are used to switch between the outputs from the two heads during playback. This is done to eliminate noise from the head not actually scanning the tape. As the audio heads lag the video heads by 42° the drum flip-flop pulses cannot be used directly to carry out the switching. Two monostables triggered by the drum flip-flop pulses are used in conjunction with a flip-flop multivibrator to introduce the 4·7ms delay required for the switching pulses.

Dropout System

If a tape dropout occurs the level of the playback audio f.m. carrier falls to a level where it's insufficient to recover the audio without distortion or noise. Further noise and distortion occur during the switching between the outputs of the two heads. Both dropout and switching noise must be removed without affecting the quality of the sound reproduction. This is done in IC13 (see Fig. 10). A switched hold circuit is used. In the event of a dropout the hold circuit, activated by a pulse from the dropout detector, holds the demodulated audio level at about 75 per cent of peak level for the duration of the dropout. De-emphasis and filtering smooth the effect of this hold action. Filtering is assisted by differentiating the audio signal and feeding the result back to the hold circuit. The audio flip-flop pulses are used to activate the hold circuit during the head switching periods.

As a check on the quality of the sound I've recorded the output from a compact digital disc on the tape. It's difficult to tell the difference between the output from the disc itself and that obtained from tape playback. In fact the system works very well.

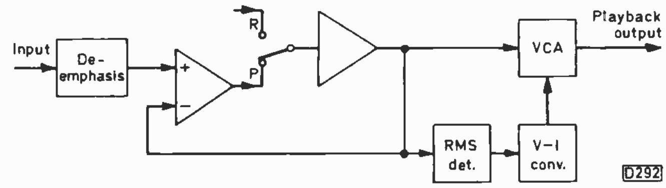


Fig. 13: Block diagram of the playback expansion system.

Next month we'll look at the long-play system in more detail.

TV Fault Finding

Reports from Alan Shaw, Steve Illidge, Philip Blundell, Eng. Tech., Hugh MacMullen, Jeff Herbert, J. G. Grieve, Malcolm Burrell and Steve Leatherbarrow

Toshiba FST Sets

We've had the following faults with the latest Toshiba sets with FST tubes.

First there was a Model 211E with tuner drift. A common enough fault maybe, but when we removed the 33V stabiliser i.c. DA05 it was found to be a 1N4148 diode. Fitting a ZTK33B cured the fault. Over the next few weeks we came across many new sets with the wrong part fitted in this position. A phone call to Toshiba confirmed that there had been a production boob – maybe the symptom shows up only when a set is tuned to the higher channels?

The second problem we had with this model was purity errors. The set would degauss, but a few days later there would be another service call for the same complaint. The degaussing arrangement in this set consists of just one coil around the c.r.t.: Toshiba now supply a conventional pair of coils with connecting leads and plugs – fitting this completely overcomes the problem.

A blown mains fuse is usually caused by the 2SC3409 chopper transistor Q802 but beware – the SI8100D control chip IC801 will probably also be dud.

Video faults such as a smeary, negative-looking picture should cast suspicion on the TA7699AP chip IC501, though we did have one very peculiar negative-looking picture due to R210 (1·6kΩ) being open-circuit.

Overall the FST Toshibas give an excellent picture but the 211E's sound quality leaves something to be desired as a result of its rather small loudspeaker. The plate glass screen needs to be removed quite frequently for cleaning. Be very careful when transporting these CTVs as the light grey cabinet finish on some versions is easily damaged. **A.S.**

Tandberg/Lowe-Opta CTV4

This example of a rare breed had been fitted with a new tuner the week before. Now when switched on from cold it wouldn't tune in a station though the frequency-synthesis circuit was trying very hard to find something. For the first ten minutes the tuning voltage ramped furiously, then suddenly the picture would appear and would be fine for the rest of the day.

Freezing the tuner and the frequency-synthesis tuning module had no effect but the frequency divider module was found to be temperature sensitive: freezing the BC557 in this can brought the fault on, but replacing this transistor had no effect. Scope checks then revealed that the divided signal was being modulated by a line-frequency component which was coming in on the 5V line. This supply comes from a winding on the line output transformer: the associated reservoir capacitor had dried up. **P.B.**

ITT CVC820 Power Board

The problem with this set was no sound or vision and a quick check showed that the chopper output was very low at 40V instead of 124V. When the line output transistor was unplugged and a dummy load was connected the 124V line returned to normal, so battle commenced in the line output stage. The diodes fed from the line output transformer were all blameless, so in went a new transformer (diode-split type). This failed to restore normal operation and the cause of the trouble was eventually found to be the horizontal shift transformer TR404. **P.B.**

Bang and Olufsen 7530/7802

Several of these sets have come to our attention with a faulty character generator chip (IC3). The fault shows up as horizontal green lines in the bottom right-hand corner of the screen – in one case it built up over a few minutes to a green square that covered the lower right-hand corner. **S.I.**

Grundig 5010

The unusual fault with this set was field collapse after about ten minutes. As a first check we found that by just moving the field collapse service switch the fault would clear, only to return some ten minutes later. So we shorted out the switch, which quite often becomes intermittent due to dirt, but after the same period we had field collapse again. Whilst checking voltages under the fault condition we found that touching almost any point in the field timebase circuit with the meter probe restored the field scan. By being very careful we noted that under the fault condition the two GD241 output transitors were cold and had 30V at their collectors. We eventually found that a gentle squeeze on the BD135 emitter-follower driver transistor would restore the field scan. Changing this transistor cured the trouble, though no fault could be found with it. **H.MacM.**

Hitachi CPT1471

This set had all the usual faults involving the chopper and field output chips and the field flyback transistor, with burnt resistors. But after exactly four hours the set would switch off with the customary chopper chip symptoms. After lengthy checks with the cabinet on and off heat was found to be the basic cause of the problem, mainly on the long, thin tin heatsink for the chopper and the line output transistor. By bolting on a fairly heavy piece of 5 × 2in. aluminium above the chopper itself to spread the heat upwards the fault was completely cured. The chopper chip is much too expensive to keep on having to change it, and the manufacturers don't take kindly to the return of solid-state components. **H.MacM.**

Purity Problem

Despite checking the auto-degaussing circuit and manually degaussing this set (a Sony KV2020UB) there were intense purity errors. On a red raster test signal ninety per cent of the screen was blue, with lighter bands at the top and bottom – the only red was a small round blob on the right-hand edge of the screen. I concluded that the tube's shadowmask must have become detached but on fitting a replacement almost identical results were obtained.

Sony technical suggested that there was a scan coil fault and mentioned that they'd come across a case where a lightning strike had left the metal shield around the tube heavily magnetized. Sure enough by manually degaussing the shield, taking the coil over the top, sides and bottom of the cabinet, good purity was restored. The normal method of degaussing with the coil in front of the set had no effect on the purity, so the shield must have become permanently magnetised. Be sure to degauss the shield before suspecting the tube itself if there are persistent purity errors – it turned out to be an expensive lesson! **J.H.**

Philips CTX-S Chassis

This set suffered from low voltages – the e.h.t. was only 10kV and the chopper's 125V output was low, as was the line output transformer derived 150V supply. The supply to the chopper was high. Replacing the two transistors in the chopper control circuit restored normal operation – Tr7322 (BC548) and Tr7323 (BC558). **J.G.G.**

Some Quickies

Rank T20 chassis: A two-inch high picture was found to be due to one of the field output transistors being open-circuit. Fortunately they're easy to change.

Sony KV1810UB: This one had a bright, smeary display. The 4·7μF reservoir capacitor for the h.t. supply to the RGB output transistors was found to be the cause (C543 in earlier sets, C596 in the Mk. II version).

Körting hybrid CTV chassis: An intermittently dark picture was found to be the result of varying c.r.t. first anode supplies. These arrive at the tube base via a plug and socket arrangement at the front of the chassis (from rear). The Paxolin panel here was discoloured: scraping the carbonised sections provided a cure.

Recent Finlux chassis: This set was dead with a short-circuit chopper transistor. A circuit wasn't available but visual examination revealed a discoloured 270kΩ resistor that read 1·5MΩ. Replacing this produced some of the best pictures we've ever seen on the face of a c.r.t. The resistor was of course the usual one that gives this symptom in a power supply of this type – for example the 150kΩ resistor in the GEC 20AX chassis and the ITT CVC20 etc. chassis. **S.L.**

GEC C2110 Series

We still have a number of these sets out on rental, many still giving good results. Whilst field roll is usually due to C452 (4·7μF) we recently had a case where it was due to the oscillator timing resistor R455 (470kΩ). Incidentally, opening of the thermal resistor R601, giving a bright raster with flyback lines and no sound, has in our experience always been due to a power supply fault – usually the thyristor giving a high h.t. voltage. **S.L.**

Decca 30 Series Chassis

Slowly decreasing width with a Decca 30 series chassis, coincident with brightness reduction and eventual springing of the line output valve's screen grid feed resistor, was caused by two old favourites – the line oscillator valve's 33kΩ anode load resistor and the 330kΩ resistor in the width circuit. **S.L.**

Sony KV2704UB

One day this set developed what seemed to be a standby fault. When standby was pressed on the remote control unit the set went completely dead and the red LED at the front went out. Repeated operation of the on/off switch could bring the set to life but this required a certain knack. I lived with it for about a year (it's my own set) but friends found the set impossible to use. Investigation on board M (remote control etc.) showed that there were no supply voltages in the standby mode. This suggested a fault on power supply panel F2, which was removed for investigation. Since most modern sets are fairly reliable I tend to suspect high-value resistors. The circuit is the Siemens self-oscillating type chopper, with the start-up circuit consisting of D605, R605 (330kΩ), R606 (470kΩ), C609 and R607 (100Ω). A check on the values of R605 and R606 showed that they were both open-circuit. It was a relief to find that the set was fully operational once these resistors had been replaced and the board refitted. **M.B.**

Sony KV1810UB

I'm sure we all know these sets, by reputation if not by experience. It was with some trepidation that I received a call from a friend to look at one of them. "It smoked" he said, "so we switched it off". R608 in the start-up circuit and R642 in the switch-off protection circuit were clearly distressed, but the associated components D604, D605 and Q602 read o.k. when checked with a meter. Replacing the defective resistors and powering up resulted in a burst of smoke from R642, which disintegrated, leaving the set apparently working happily though R608 was noticeably hot.

There's not a lot in this part of the circuit. The start-up GCS Q602 also turns on when the set is switched off so that the pulse-width modulator monostable in the chopper power supply continues to operate to the very last – otherwise the line output GCS Q510 can suffer. Q602 is switched on and off by Q601. It's also necessary to keep the line oscillator running as long as possible at switch off, again to protect Q510. To this end D604, which is reverse biased during normal operation, is connected between the chopper output and the anode of Q602 to maintain the 19V rail from which the line oscillator is run.

In normal operation the voltage at the anode of Q602/cathode of D604 should be high – about 280V. In this case however the voltage was very low. Clearly Q602 was not being switched off as it should have been following the start-up action. Its base resistor R609 was found to be open-circuit while Q601 itself was short-circuit. A BC184 was found to work well in this position – Q602 was replaced as a precaution. This restored normal operation after a check for other impending troubles in the power supply and replacement of C605 (22μF) in the chopper driver start-up circuit – it had lost some of its capacitance. **M.B.**

The Human Element

Nick Lyons

Who said "we're all in this together"? I can't remember, but he should have been in the TV trade. Now we can all make mistakes (like criticising PCL86s for example) and I'm not alone in this respect. We humans also tend to get into jams not of our own making – when wholesalers for example don't have in stock the parts they should. The individual dealer can't keep in stock every obscure part for every set, but the importers/agents for the relevant specimens might have the decency to do so – always assuming that you can find out who they are. When one's own and the agent's stock control and competence fail, what's one to do?

Help with a Decca 100

Sometimes on the other hand one gets unexpected help. One Saturday morning some time ago I was in attendance on a Decca 100. I found myself caught short on high-voltage zeners – there's a 186V one on the power panel. No wholesalers were open of course so it looked like a loan set for the weekend. It then occurred to me that I could perhaps prevail on the chaps on Burley Road. Now it's a little bit off my patch and I'd never set foot in the place before, much less did I know any of them.

I strode into the shop and explained my predicament to the chap who said he didn't repair many Deccas and didn't have one of them in stock. But he did have an 80 "on the pile" and I was welcome to anything off that. He then proceeded to remove the relevant component from the set and point blank refused any payment for it.

The day was saved and they have my thanks: what a pity not everyone subscribes to the same ideals! On the phone the other day to a rather close neighbour in the business I was lectured in the most haughty manner on my naivety in expecting any such assistance and was made to feel rather like something you might tread in whilst walking the dog. Never mind, next time they want something – every dog has his day!

An Ageing Rank A823

Later that week an ageing (aren't they all?) Rank A823 chassis appeared, bearing Co-op livery and attempting to display a picture on its 19in. tube. The owner said it made loud cracking noises. He realised that the picture was poor but said it would do. The cracking worried him however.

Well, in the dry atmosphere of our workshop it never murmured for hours on end. While I was waiting for something to happen I though it might be an idea to cure some of the more obvious faults. The poor convergence was easily put right by replacing the relevant potentiometers. In fact the convergence was so good that I decided to "blast" the tube.

At this point I should say that on the appearance of my home-brew "blaster" the other members of the staff are usually to be seen cowering behind substantial pieces of furniture. The blaster has an enviable record of success however, and this set was no exception. I was confronted with an A823 displaying one of the finest pictures I'd ever seen on one of these sets. My mind began to tick over: what had caused that original cracking? Perhaps, I surmised, the customer's living room suffers from a lot of condensation due to a gas fire, or maybe the kitchen is close by? If I cleaned around the cavity connector and dried it off well it should be all right.

So I reached forward to pull off the cavity connector. Zapp – a very nasty shock. After recovering from this I came to the conclusion that the cavity connector had decomposed. It seemed wise to prod around the cavity with a shorting lead to deck. Touching the plastic didn't produce any response, but when the lead strayed near the Aquadag – crack!

Having made sure that the 'dag and the cavity proper were fully discharged I set about examining the tube. The Aquadag earthing had all been removed. On trying to clean around the cavity connector I found that the glass was cracking in zig-zags for about two-three inches from the cavity while chips of glass were missing from the surface. Clearly the tube had been severely tracking across from the cavity to the Aquadag and some lunatic had thoughtfully "cured" the problem by disconnecting the earth from the 'dag and just allowing it to charge to the e.h.t. potential. The loud cracking noises the customer had heard were not actually the tube itself flashing over but the charged Aquadag flashing across to the metal tube shield!

On explaining the situation to the customer he said that as he had two small children who often played around near the set the possibility of the tube imploding was not something he could risk. Could we dispose of the set as we thought fit?

Well, the more we looked at the cracks in the tube's glass cone the more nervous we got. Ken said he didn't fancy having to carry it outside as it was somewhat colder there and the glass contracting suddenly might finish the thing off whilst he still had hold of it. In the event we dispatched the tube in the workshop, with a couple of old coats thrown over it and a length of Dexion – a long length.

The most worrying aspect of this little tale is that there are people who will carry out such work as was performed on this set, leaving the potential (no pun intended) risk of death or serious injury from severe shock and/or the effects of the tube imploding. In my view "cowboy" is not a strong enough term for such people.

Letters

THE NORDMENDE FIV CHASSIS

Pete Saunders' article on the NordMende FIV chassis (December issue) was comprehensive but I'd like to add a few notes – incidentally, the FC25 is the later version incorporating a Full Check 25 point diagnostic connection system.

The first step when working on one of these sets should always be to check the mains connection. Ensure that the neutral lead goes to chassis and the live lead to the fuse. Earlier sets have black and blue leads but the later ones with brown and blue are as often as not incorrectly connected.

In a technical circular NordMende stated that the M010 protection module must always be removed. At the same time D532, which is not present in early sets, must be added in series with the mains rectifier thyristor. It's type SSCIC0880. Whilst I was told by NordMende that a 3A, 1kV type would do a number of 1N5408s I fitted subsequently failed, leaving a charred mess and often damaged print. I now use a BY223. To fit, cut the print adjacent to the thyristor's anode and drill one hole: fit the anode leg of the diode through the hole and bend the cathode leg up to solder it to the thyristor's heatsink.

A more reliable replacement for the EW modulator driver transistor T410 when this fails is the TIP42. Mount it upside down on the heatsink, with extension wires down to the PCB for the base and emitter. The collector lead can be snipped off – the heatsink will make this connection.

I've found that a full linear scan is seldom obtainable when a 2N3055 is used as a replacement for the SM5C field output transistor. A TIP35C always works satisfactorily in this position. Intermittent height variation was traced to a dry-joint on R408 in the U2 supply circuit.

Loss of sound is occasionally caused by short-circuit turns in the sound output transformer. Intermittent sound has also been caused by the loudspeaker – this is annoying after confidently replacing the audio module only to hear the phone ring next day with the same complaint!

In common with some other continental TV sets tuning drift is made worse by having the tuning supply stabiliser (TAA550/ZTK33) dissipate too much power. NordMende changed the feed resistor (R219) from 11kΩ to 16kΩ. I always use an 18kΩ resistor but then I've plenty of these removed from Grundig sets – I replace these with a 27kΩ resistor. A green or grey metal-oxide type must be used.

Sticking on a particular channel can be caused by CB31 (0·01μF) in the case of channel one or the equivalent 0·0033μF capacitor in the case of channels 2-8 (CB35/41/45/51/55/61/65) going leaky. This will show up using an Avo on the high ohms range.

If R128 in the 24V supply fails replace it with a 27Ω resistor as in later sets – I use the 1/3W metal-film type.

That loud buzz, generally due to the mains filter choke L531 being in need of replacement, foxed me once. A new choke provided no cure and I eventually found that R557 (470kΩ) in the active filter circuit was open-circuit. Remove to test. R557 has also been found to be responsible for ripple on the U1 h.t. line, though the more common cause of this is the active filter transistor T506 (MJ3000 in earlier sets, MJ3001 in later ones).

Occasionally a set won't start up due to a "lazy" thyristor: the same thyristor will normally work perfectly in another set . . .

A moiré like patterning, sometimes with colour running through, has been traced to the 11·5V stabiliser transistor T203 – d.c. conditions o.k. but a scope check will show "grass".

Instant BU208 line output transistor deaths have cost me on occasions. No definite reason for this has been traced but the cause is probably poor plug-socket contact in the line scan circuit. As well as the BU208, D543 (TAA550/ZTK33), T501 (S6002), T506 (MJ3000/MJ3001) and sometimes the mains rectifier thyristor D538 (TAG6-600 recommended replacement) are simultaneously killed.

A spare male pin stuck in a wooden handle can be used to check for a good fit of all the females in the line scan plug/socket connections. If you find a bad one, don't attempt to tighten it by squeezing. Find a better one – there are dozens of unused connectors on the various cables running round the set.

Another warning: note if any of the plastic location spades are missing when plugs are removed. If they are, mark them with a dab of paint. If you're not familiar with this chassis it's very easy with missing spades to reconnect plugs in the wrong place – it's impossible to find a place for *all* the plugs if any are wrong when the spades are present and correct.

Odd N/S correction faults can be caused by R461 (2·7kΩ) going either open- or short-circuit.

No mention was made of the awesome remote control system used with the NordMende FIV. It has as many wires inside as the early Dynatron remote control systems (but only two screws on the back – Les L-J.). The circuitry seems frightening, with an extra nineteen integrated circuits. To read the technical description in the manual is too much. Fortunately every "funny/intermittent" fault I've encountered has been on the 5V line – due to the bridge rectifier or the 5V stabiliser i.c.

Another bloomer: some of the remote control sets have a 240:220V autotransformer to supply the remote control circuits and many of these were wired incorrectly. Instead of 220V, approximately 260V is presented to the transformer. This doesn't seem to cause problems but rewiring is obviously desirable.

Finally, while we all know that L. L-J. hates/fears NordMendes some of us think that the FII, FIII and FIV were well ahead of their time. Does anyone know where I can find one of the four-screen sets? – I want one to play with. Or a teletext adaptor for the FIV remote control sets as a pressie for my favourite typist, who prefers the NordMende to the much more modern Grundig teletext set we're now watching.

Les Austin, Managing Director,
Ochre Mill Technical Services Ltd.,
Lower Moddershall, Stone, Staffs.

ELECTRON PATTERN PROGRAM

Users of the Electron microcomputer test pattern program (page 96, December 1985) can solve the aspect ratio problem mentioned in your editorial note by changing line 2010 as follows:

2010 Y = 0·923*(SQR(ABS(R*R)−(X*X)))

If, like me, you prefer to work with a larger circle try R = 500 in line 1960, and for tidier text displays change line 20 to:

20 VDU 23,1,0;0;0;0;

Line 630 should read "IF INKEY . . ." of course.

Colin McLaughlin,
Harlaxton, Grantham.

SPECTRUM 48K COLOUR BARS

The following program for the Sinclair Spectrum 48K produces five colour bar patterns that fill the entire screen, including the border. Pressing and releasing the space key will sequence through them.

Lines 20-30 put the code into the memory. Line 40 checks for correct checksum but is not infallible, so save the program before trying it out. Lines 50-110 produce the patterns by using the machine code routine located at address 32976.

Poking address "A" switches the reference bar on or off (1 to 54).

Poking address "B" changes the colour of the reference bar (0 to 7).

```
 10 LET A=33104: LET B=33114: LET C=0
 20 FOR X=32976 TO 33177: READ N
 30 POKE X,N: LET C=C+N: NEXT X
 40 IF C <> 22074 THEN PRINT "CHECK DATA LINES":
    STOP
 50 POKE A,54: POKE B,0: GOSUB 100
 60 POKE A,1: POKE B,7: GOSUB 100
 70 POKE B,2: GOSUB 100
 80 POKE B,1: GOSUB 100
 90 POKE B,4: GOSUB 100: GOTO 50
100 IF INKEY$ = CHR$32 THEN GOTO 100
110 RANDOMIZE USR 32976: RETURN
120 DATA 33,251,201,34,34,128,62,7
130 DATA 50,141,92,50,72,92,205,178
140 DATA 13,62,10,237,71,237,94,33
150 DATA 0,88,62,7,14,1,205,7
160 DATA 129,61,6,6,197,14,5,205
170 DATA 7,129,61,193,16,246,14,1
180 DATA 205,7,129,205,31,129,201,245
190 DATA 203,39,203,39,203,39,17,32
200 DATA 0,229,6,24,119,25,16,252
210 DATA 13,225,35,32,241,241,201,118
220 DATA 6,27,16,254,6,62,205,116
230 DATA 129,221,35,134,16,248,14,192
240 DATA 62,7,211,254,6,9,16,254
250 DATA 62,0,211,254,6,3,16,254
260 DATA 237,68,13,32,235,35,205,16
270 DATA 129,14,0,237,68,237,68,6
280 DATA 54,205,116,129,221,35,78,16
290 DATA 248,62,7,211,254,62,127,219
300 DATA 254,31,48,2,24,185,62,62
310 DATA 237,71,237,86,62,0,211,254
320 DATA 205,107,13,201,62,7,211,254
330 DATA 211,254,62,6,211,254,62,5
340 DATA 211,254,0,62,4,211,254,62
350 DATA 3,211,254,0,62,2,211,254
360 DATA 62,1,211,254,0,62,0,211
370 DATA 254,201
```

M. J. Edis, G4RPT,
Broughton, Nr. Kett, Northants.

G9AED – POSTSCRIPT

I think I can provide some information of interest to Andrew Emmerson whose article on G9AED appeared in the December issue. If I'm right, the vehicle is still in everyday use.

Its last operational job for the IBA was at the Dover transmitter site (Church Hougham). In about 1964/5 my friend and mentor Geoffrey Hutson was instrumental in

persuading the IBA to donate the caravan to the Canterbury College of Technology where Geoff used it to run the first colour TV courses in Kent. Eventually, when a colour TV laboratory became available, "The Caravan" became a development laboratory and office for members of the Electronics Section.

In about 1978/9 the caravan was donated to the Canterbury and District Model Engineering Society at Sturry near Canterbury, where it's in regular use as a store and committee room cum tea-bar.

Geoff Lewis,
Canterbury, Kent.

VIDEO FADER CORRECTION

Here's a correction note on the video fader unit featured in the May 1985 issue, page 376. The sync separator transistor Tr9 is shown as type BF178 in the components list. This is an npn type, while the circuit shows that a pnp transistor is required in this position. I've found that a BFX88 works all right – the base connections are the same.

Mark Lamb,
Birkenhead, Merseyside.

RANK Z718 CHASSIS

Reader J. Thomas of Durham (full address not supplied) asks if we've published anything on servicing the Rank Z718 chassis, pointing out that information is difficult to obtain since Rank withdrew from the domestic radio/TV field. Readers with this problem will find a detailed article in the August/September/October 1982 issues of *Television*.

Test Report: The Portasol Soldering Iron

Eugene Trundle

The denigrators of sound broadcasting often refer to it as "steam radio". What would they make of the subject of this review – a gas soldering iron, in portable and rechargeable form? It works with ordinary butane gas, dispensed from the sort of pressurised refill cylinder you can buy at a tobacconist: one fill of gas is sufficient to run the iron for up to an hour, depending on the heat setting used.

The Portasol iron is 173mm long and 19mm in diameter. It has a removable protection cap incorporating a pocket clip and uses an ignition system that consists of an abrasive wheel and an ordinary cigarette lighter type flint. Replacing the cap automatically shuts off the gas valve and shrouds the bit to prevent risk of burn damage when the iron is put down.

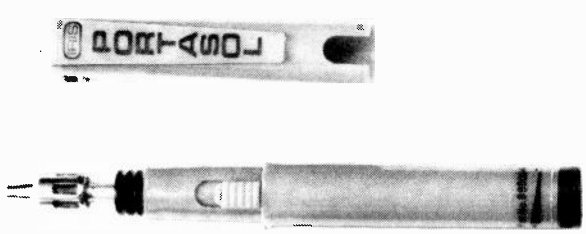
The bit is nickel plated and incorporates the burner system and three cooling fins to prevent heat conduction to the plastic body. It screws in for easy replacement and is available in two tip sizes, 3·2 and 2·4mm – the latter is supplied as standard. Bit life is quoted as up to thirty hours. At the opposite end is the filler valve and regulator wheel to control the heat output. The instrument is finished in bright orange and weighs about 65 grams when fully charged.

On Test

I started at the newsagents where seventy odd pence bought me a big refill – enough I would think to run the iron for many months in normal use. This dispenser came with several adaptors, one of which fitted the Portasol. The fuelling time was four seconds.

It's easiest to light the tip with the iron's regulator at maximum. This also gives the fastest warm-up time of course. From lighting to reaching the melting point of solder took about seventeen seconds at normal room temperature. I found that the heat regulator's range was quite wide, and would agree with the quoted equivalent dissipation range of 10-60W.

When used flat out the heat developed was sufficient to make a good hot puddle of molten solder on the top casing of an ELC1043 varicap tuner – this is the most practical and familiar illustration I can make of its capabilities. When turned to minimum the iron was well able to deal with small work on fine PCB tracks etc. – I did some repairs to a cracked panel at the minimum heat setting with good results, bridging the cracks with 5A fuse wire.



The Portasol soldering iron.

Out of doors next to see how it performed in the open. Once lit even a howling gale (simulated on this still evening by running round the garden with the iron held aloft in Olympic style) failed to extinguish it. The great outdoors did not diminish its soldering capability, though higher heat regulator settings were required. The man next door, already suspicious of my eccentricity, must have become convinced that I'm ready for the Funny Farm – he's probably right.

Applications

The iron wouldn't be used for bench repair work in normal circumstances because of the need to refuel it, ignite it and wait for warm up. Since it has no element or electrical connections however it can't cause trouble with voltage spikes or current surges, while the absence of an earth permits its use on floating or isolated components. These are points worth remembering. The Portasol really comes into its own for outdoor work where no convenient electric power source is available. Such pastimes as maintenance of cable TV distribution networks, mending TV surveillance cameras in situ, dealing with masthead and microwave dish mounted amplifiers and terminations, and telecommunications field work suggest themselves.

The iron should be a boon to those who deal with in-car or marine electronic equipment. Irons that operate at 12 and 24V are available, but it's not always easy or convenient to hook up to the battery and the high current connecting wire required for low-voltage irons is heavy and inflexible. It's not easy to trail a wire to the car's rear speaker mountings, down to the cruiser's bilge or up to the cabin roof! Perhaps it's me, but operation from a large lead-acid battery seems to produce more spitz-and-sparken, bangs and burns per hour than the average Guy Fawkes night . . . The other advantage of the Portasol in these situations is that its wide 10-60W capability enables it to replace two sizes of conventional soldering irons.

Conclusion

While it's not suited to bench work the gas iron seems to me to be excellent in all other situations. It's far cheaper in first cost than a rechargeable electric soldering iron, needs less maintenance, is lighter and has a greater thermal capacity than most. It's the most "ready" soldering iron possible, with little to go wrong and an ability to work anywhere from the chimney stack to the river bank or down a mine if required. Provided it never develops a gas leak – as cigarette lighters sometimes can – it should have a long service life.

A lot of thought and ingenuity has gone into this patented design, and it shows. At its cost of about £17·50 plus VAT to the trade it's well worth considering – unless you're tied hand and foot to the indoor bench. The price quoted includes two interchangeable bits, 3·2 and 2·4mm: replacement bit-burner assemblies cost about £2·70 each plus VAT. Wichita and Watford linemen, ICE vendors and mobile menders take note! I can also thoroughly recommend this iron to aerial erectors and dish riggers, field engineers and cablepersons.

The review iron was lent to me by SEME Ltd., Units 2E and 2F, Saxby Road Industrial Estate, Melton Mowbray, Leics. LE13 1BS (0664 65 392). The Portasol is also available from Anglia Components and Phab Electronics.

And There's Another Funny Thing

Les Lawry-Johns

What strange things some sets can do. When Miss Converge brought in her Pye T194 portable (Philips TX chassis) I thought it would be another quick job. So she stood there while I fumbled about. She said it was the on/off switch and I wanted to show her that it wasn't. The supply was reaching the series regulator transistor but its output was only about 2V. So I checked the control circuit and everything seemed to be o.k. I took the tube base off to check for shorts or heavy loading but found nothing.

"Try the switch again" said Miss Converge.

"It won't make any difference" I growled.

Just to show her I switched the set on again and the sound burst out loud and clear. The only thing that was different was the disconnected tube base. I put this back on and the heater glowed merrily, followed by a raster. She smirked.

"It's not the switch" I insisted.

"All right then, try it again."

So I switched off, waited a while and switched on again. Nothing happened. I removed the tube base and the sound burst out. Put the tube base back on again and a picture appeared.

"If you fit a switch it'll be all right."

"Yes dear, if I fit a switch to turn the tube's heater off until the set has started up it'll be all right."

"Well do that then."

I was in no mood to argue, so I fitted a single-pole switch on the back cover and wired it in series with the tube's heater. I realised I was doing something wrong, but if that's the way she wanted it at least this would save me having to think. We could now switch the set on with the rear switch off, then close the rear switch and the tube would light up and everything was fine. I made sure she understood the procedure – keep the rear switch in the off position until the sound comes through.

After she'd departed, feeling satisfied that she'd been right all along, I was left to wonder what part of the control circuit had been at fault. I'd checked everything (I thought). Have you had a funny feeling like that? You probably found out what it was, like I should have done.

To Sweat or Not to Sweat

It's not often that a G11 makes me sweat, but one did the other day. The chap said he didn't want to spend more than twenty quid on it and I told him I didn't think that would be necessary.

I checked the h.t. line for a start. There was a short that disappeared when I removed the BU208A's plug, from the top. So I removed the line output transistor subpanel, fitted a new one and also a 1A fuse in the h.t. fuseholder (the one in there was 2·5A). Both the 3·15A mains fuses were intact.

With the new panel fitted I switched on. There was a flash from the 3·15A mains fuses and I found that two of the bridge rectifier diodes were dead short. I wondered about this but fitted two BY127s and new fuses and tried again. There was a brief rush of sound and a spark from the tube base, then nothing. The glow switch on the power panel glowed and some smoke came from a resistor. The 1A fuse had failed and the new BU208A was short-circuit. Oh yes, I'd also taken out the green 470μF h.t. reservoir electrolytic and fitted a nice blue one.

The price was beginning to escalate so I thought I'd better check the tube. It was cracked. I took my blue 470μF electrolytic out and wrapped the whole thing up.

"Sorry sir, it'll be a lot more than twenty quid I fear."

Sam Boy

Sam is a local character who is slipped the odd pound by everyone who receives his "Morning Guv" greeting. This enables him to live comfortably without the need to work – except to clean the occasional car or something. He reminds me of a song we used to sing during the last war.

"Sam boy was a lazy goon
who never would work in the afternoon,
too tired was he, too tired was he.
Into the woods he used to go
just to get his head down low
under a tree.
When along came a bee
making this noise
bzz, bzz, bzz, bzz.
Go away you bumble bee
I ain't no rose, no silly little flower,
get off my (censored) nose, away from here.
If you want a bit of . . . .
you can . . . .
but you'll get no . . . . . here.

A silly song maybe, but an evocative one. It brings back memories of the pubs in Gib (Main Street) and Alex (Beer Street) . . .

Prodnose: I don't see the point of all this and suspect you're merely trying to be vulgar. Your editor has been consulted and you are asked to stick to TV matters.

Myself: I'm sorry. I'll try to do just that.

Nobody Told Me

So where do all the turkey eggs go? The question occurs to me at this time of year and no one's ever been able to shed any light on the matter. Until the other day – in the pub this Sunday lunchtime.

"I asked him why you can't buy turkey eggs. The farmer said they only lay fertile ones which are hatched. The rest of the time they just gobble."

Well I never. Not like chickens after all. I also heard it said that farmers don't know how long pigs would live if they were allowed to. Then they turned to me and asked how long a TV set lives? I had to say that after ten years it's anybody's guess.

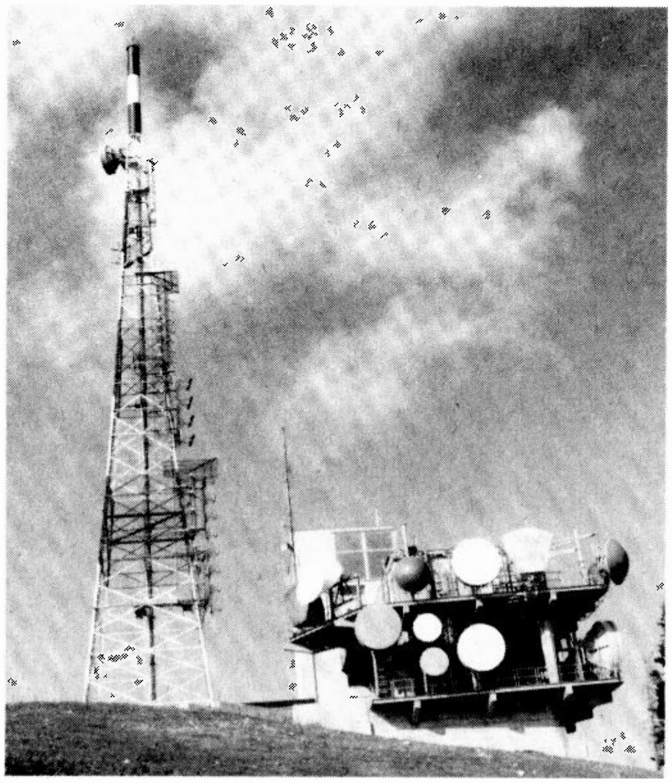
Long-distance Television

Roger Bunney

November was an extremely gloomy month – with reception matching the weather. Very few Sporadic E signals were received: Iain Menzies (Aberdeen) noted RUV (Iceland) ch. E4 on the 5th, late in the evening, and that's about the only item of importance. The Leonids Meteor Shower produced lively results here in the Southampton area, with many pings of miscellaneous material in Band I, particularly on the morning of the 17th. You'll get very short pings of signal via MS reflection in Band I on most mornings of course – if you're prepared to wait with a receiver on tune and with good sync locking. The lack of signals is depressing but is to be expected during the winter months, with only Belgium ch. E3 and Holland ch. E4 rising at times here above the noise level to confirm that the receiving system is actually working!

Robert Copeman (Sydney) reports that the Australian SpE season has started, with many Australian ch. 0-2 signals present, also Dunedin ch. 2. The new sunspot cycle has commenced, with a count of 32 on the 8th rising to 50 on the 14/15th then dropping towards the end of the month. Hopefully we'll in due course experience another record peak of solar activity, with world-wide reception of the low v.h.f. channels, as we experienced in the late seventies.

During the October tropospheric openings Keith Chaplin (Barrow-on-Soar, Leics.) received a suspected MTV-1 (Hungary) signal in Band III. It was photographed at 1842 GMT on October 27th. The ch. R9 signal couldn't be identified at the time but the "Video Reklam" caption suggested MTV. It's now been identified by Igor Hajek as an advertisement for a domestic furniture factory at Kanisza, Hungary. From this information it appears that the transmitter was the 5kW outlet at Miskolc, north east of Budapest. A remarkable catch! Apparently an ARD-1 (W. German) signal faded and the stronger MTV signal came up for some two minutes before fading back again beneath ARD-1.



The transmitting site at La Dole, Switzerland.

The log of October tropospheric reception received from Ryn Muntjewerff (Holland) is more like a list of EBU TV transmitters: 21 E. German, 9 Swiss, 2 Austrian, 15 Polish (including TVP-1 Ploc ch. R29), 11 Czechoslovakian, 17 Danish (inclduing 2 regional), 18 Norwegian, 49 Swedish and 10 Russian stations were received in Band III and at u.h.f. The Norwegian signals all came from low-power relays. The most impressive Russian reception was from Vilnius on ch. R31 (600kW e.r.p.) at a distance of 1,350km. This was on the 17th at 0957-1120. Other transmitters received include Slonim, Kaunas, Klaipeda, Srodno and Kalingrad, mostly on the 27th from 0630 onwards. Ryn comments that many of the signals were S5. Ducting was present since they were swamping the nearer stations. Ryn lives in an excellent, flat area of course and has a high lattice tower with stacked multiple director u.h.f. arrays for each group.

News Items

Switzerland: A correspondent recently visited the La Dole transmitting site and took the accompanying photograph of the mast. The Telecine aerial panel is just below the u.h.f. cylindrical shroud (which houses the SRG/TSI arrays), on the opposite side to the microwave dish, and appears to be horizontally polarised. There are also Band I/II/III arrays on the mast – the use of the Band III system is not known.

New Zealand: Four regional "warrants" are being offered for New Zealand's third channel, which is to be commercially financed. Three warrants will cover the North island, comprising the Auckland, Bay of Plenty and Wellington regions, while the South island will be offered as a single region. A fifth warrant is on offer to provide a news service. A Maori group, the Aotearoa Broadcasting System, which has NZBC support, is applying for one warrant and says that if successful a third of its programme output will be in the Maori language.

S. Korea: Three of the five TV networks started stereo/dual language transmissions last October, using a modified (for the system M standard) version of the W. German system. The main sound is at 4·5MHz, as usual with system M, the second carrier being at 4·724MHz. The Japanese single carrier f.m.-f.m. system was tried but dropped in favour of the W. German two-carrier system. Dual-sound receivers are available at typically £350 for a 16in. colour set, and for about £50 you can get a sound tuner for use with an older set. My thanks to Jean-Louis Dubler for this and other information on Korean TV.

Satellite news: The Orbita Technologies Corporation of New York is offering a terminal capable of tracking the Russian Molniya craft, which is in an elliptical orbit. The terminal costs some $56,000 and is intended for use by universities to provide Russian first programme material for language studies. The system includes a 15ft dish with head electronics and standards conversion to system M for feeding to a standard US TV set. Though Gorizont is visible along the eastern seaboard no geosynchronous

Russian craft that carries TV can be seen farther west. Molniya operates in a non-geosynchronous orbit to provide TV coverage of far northerly Russian outposts that can't receive signals from a satellite in orbit over the equator.

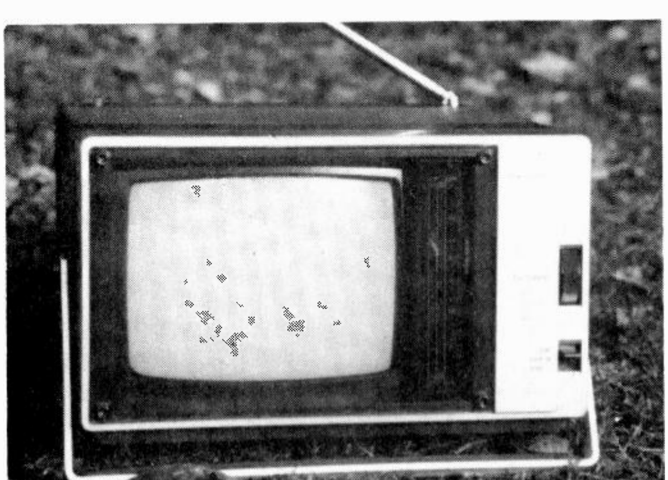
In brief: The NOS Goes transmitter has been seen using the FUBK pattern with a "Goes" identification during the early morning period. . . . A decision on how to operate the Swedish third channel, either as a commercial or Pay-TV service, has still not been made though a start is due later this year. . . . Despite funding problems the third Egyptian channel has now opened, with two hours of transmissions on most days, four hours on Thursdays and Saturdays.

Tandy Dual-standard Portable Review

We were recently able to test the new Tandy dual-standard 5in. monochrome portable Model 16-9030 – the "Portavision". At the time of writing this set is in short supply, but it should be readily available in Tandy stores from late January. The UK version features full coverage of Bands I/III/IV/V system I (UK), with switching for system L (French standard). A variant that initially came into the UK by mistake (in very small numbers) is a 220V version for systems B/G/L.

It's an attractive set measuring $8 \times 4\frac{7}{8} \times 10\frac{7}{8}$ in. Power is from a 240V a.c. mains supply (lead supplied), an external 12V d.c. source (lead not supplied) or nine HP2(D) internal batteries. A standard 3·5mm earpiece jack with speaker muting is fitted. The seven-section telescopic aerial extends to $31\frac{5}{8}$in. A flush, coaxial socket is fitted on the left-hand side and adjacent to this are switches for internal/external aerial selection and system changeover (I/L).

For tuning there's a vertical thumbwheel and a band switch for u.h.f., v.h.f.-H (Band III) and v.h.f.-L (Band I). The tuning control is positive in action with no backlash. Tuning indication is via vertical tuning scales and a moving centre strip – which proved accurate. The scales are marked 2, 3, 4 (chs. E2/3/4), 5 through 12 (chs. E5-12), 1 through 6 (chs. L1-6) and at u.h.f. chs. 21-68. The numbering for 1-6 is based on the provisional French channel numbering when the Band III services were being re-engineered: in practice the channels are L5-10 (L2-4 are in Band I). Since the French Band I channels have reversed sound/vision spacing, Band I reception of French signals will not work correctly (there's no reference to French Band I reception in the instruction book).



The Tandy 5in., dual-standard Portavision Model 16-9030.

Measurement showed the following coverage: Band I 46·5-70·25MHz, Band III 175-228MHz, Bands IV/V 456-872MHz. Internal (non-user) adjustments are provided for l.f. and h.f. tracking, so it's possible that the u.h.f. coverage could be extended downwards to take in the 435MHz ATV band.

The construction of the electronics is relatively good. The two tuners are minute, each measuring $1\frac{5}{8} \times 1 \times \frac{1}{2}$in. Both have varicap tuning and three stages – r.f. amplifier/mixer/local oscillator. The u.h.f. tuner's i.f. output is taken to the v.h.f. tuner for further amplification and both tuners have a.g.c. The i.f. strip consists of a fixed-gain preamplifier, a SAW filter and an i.c. for gain/ a.g.c./detection etc. Switching for positive- or negative-going vision is via a buffered phase inverter. On the sound side there's switch selection between a system I intercarrier circuit and a tuner-fed system L i.f. strip.

The gain was found to be good, the screen being very lively and the contrast adequate. The i.f. selectivity, given the wide i.f. bandpass characteristic, showed a very sharp fall at h.f., indicating an excellent SAWF skirt response. A degree of adjacent channel interference will be inevitable under strong SpE conditions with the transmitted carriers 2MHz or so apart. For fringe reception at u.h.f. the selectivity was found to be good, the gain high and the picture quality sharp. The receiver responded well to weak Band I MS signals, with immediate locking. Timebase locking showed a wide pull-in range, even on weak signals. Slightly different line lock positions were noted for positive- and negative-going vision signals.

When used for Band I reception the telescopic aerial produced instability across the entire band, but perfectly stable results were obtained with an external aerial. In any event the telescopic aerial would not be used for efficient reception – the enthusiast would use a more conventional aerial array. There's a clear circuit diagram in the booklet supplied.

I felt that the flush-mounted coaxial socket was rather fragile – it could possibly cause intermittency in time. It might be better to use a short coaxial lead terminated in a line socket to avoid wear on the panel-mounted socket. It seems a pity that the three W. European standards (I, B/G and L) are not covered – no mention is made of the scrambled Canal Plus Band III signals.

In conclusion I was very impressed with the performance and potential of the receiver – in fact I bought one. Available from Tandy stores at £89·95 inclusive.

1986 Meteor Shower Dates

The Quadrantids Shower occurred on January 1st-6th. The rest of this year's meteor showers will take place as follows:

Lyrids, April 19-25th peaking on the 22nd.

May Aquarids, April 24th-May 20th, peaking on May 5th.

Delta Aquarids, July 15th-August 20th, peaking on July 29th.

Perseids, July 25th-August 20th, peaking on August 12th.

Orionids, October 16-27th, peaking on the 21st.

Taurids, October 20th-November 30th, peaking on November 1-10th.

Leonids, November 15-20th, peaking on the 17th.

Geminids, December 7-15th, peaking on the 13th.

Ursids, December 17-25th, peaking on the 22nd.

Our thanks to the British Astronomical Association (Meteor Section) for the above information.

An unusually high peak of intense MS activity was produced by the Draconids/Giacobinids Shower (which is not expected to produce activity this year) on October 8th, 1985 between 0730-1300 GMT. The receiver system used for monitoring (a BAA forward-scatter radar tuned to 70·312MHz) saturated over the 0915-0955 period. Dr. J. W. Mason would like to receive reports of identified reception and any observations at 51 Orchard Way, West Barnham, West Sussex PO22 0HX – not questions or requests for information please, just reports which will enable enthusiasts to contribute to original research. Send details of reception, time and location.

New Aerials

Three new aerials have become available in the UK over the past few weeks.

The South Midland Communications Ltd. (Rumbridge Street, Totton, Southampton) HS965V is a vertical, colinear sleeved receiving system housed in a fibreglass tube some 1·86m long. It clamps at the base end to a support mast while the upper end features a form of top-capacity hat. This takes the form of three horizontally positioned fins. The base stub has three ground-plane radials. It's intended to cover the range 60-950MHz (the suppliers say it provides useful gain down to below 50MHz). The gain is 3dBd over the upper part of the coverage.

Revco Electronics Ltd. (Modbury, Devon) have introduced the Radac wideband 25-550MHz system which is intended for use with scanners. Revco describe it as a "nest of dipoles" – it has twelve elements arranged around a central support insulator. The lower-frequency elements are inductively loaded.

The above aerials have SO239 terminations. The Radac can be obtained from Garex Electronics, 7 Norvic Road, Tring, Herts. – we hope to review a sample shortly.

The Wolsey Colour King and Triax BB Grid are familiar aerials to most TV enthusiasts, comprising four full-wave dipoles stacked one above the other with a large reflector plane. This arrangement gives a wide operating bandwidth. Jaybeam Ltd. (Kettering Road North, Northampton) have now introduced a similar system called the Aluminium Billboard (Model JBB/4). This covers 470-860MHz with a peak gain of 13dBd, a typical front-back ratio of 25dB and a horizontal beamwidth of 48° (−3dB points). A balun is fitted.

French System L Channels

The French System L channel allocations are as follows:

Channel	*Bandwidth (MHz)*	*Vision carrier (MHz)*	*Sound carrier (MHz)*
L2	49-57	55·75	49·25
L3	53·75-61·75	60·5	54
L4	57-65	63·75	57·25
L5	174·75-182·75	176	182·5
L6	182·75-190·75	184	190·5
L7	190·75-198·75	192	198·5
L8	198·75-206·75	200	206·5
L9	206·75-214·75	208	214·5
L10	214·75-222·75	216	222·5

French Fifth Service Channel Allocations

The following list indicates when channels allocated for the new fifth French TV service will become available for use. Actual service starts may take a considerable time but throughout the coming year we should be able to receive an increasing number of French private (commercial) TV stations, particularly during tropospheric openings.

Channels allocated at end 1985:

Lyon – 22, 25, 28
Toulon – 57, 60, 63
Grasse-Cannes – 63
Cherbourg – 35
Lille – 47
Grenoble – 34, 37, 4
Montpellier – 31, 37, 34
Nimes – 31, 37, 58

First quarter, 1986:

Paris – 33, 36, 35
Marseilles – 32, 38
Nantes – 65, 21, 58
Lens/Bethune/Douai/Arras – 51, 54
Nancy – 49, 52, 55
Le Havre – 4, 53, 56
Dijon – 46, 57
Reims – 58, 64, 61
Metz – 47, 50
Poitiers – 41, 44, 47
Perpignan – 41, 44, 47
Sant Nazaire – 49, 52, 55
Besancon – 37, 21
Maubeuge – 32
La Rochelle – 48, 51, 54

Second quarter, 1986:

Bordeaux – 40, 43, 46
Toulouse – 29, 32, 34
Valenciennes – 49, 37
Saint Etienne – 2, 28
Tours – 30, 33, 36
Rennes – 31, 34, 55
Orleans – 35, 32, 47
Brest – 57, 60, 63
Angers – 51, 54, 39
Dunkerque – 59, 62
Le Mans – 59, 62, 65
Le Creusot – 23, 60, 63
Bayonne – 30, 33
Troyes – 50, 53, 56
Valance – 65, 53
Caen – 38, 60, 63
Avignon – 51, 54, 57
Limoges – 38, 45
Amiens – 49, 52, 55
Thionville – 59
Lorient – 59, 62, 65
Angouleme – 31, 34, 37
Saint Quentin – 30, 33, 36
Montlucon – 49, 52, 55
Nevers – 41, 46, 36
Bourg-en-Bresse 38, 52, 32
Pau – 57, 60, 63
Aix-en-Provence – 59, 62
Hagondange – 56

Servicing Notes on the Amstrad CPC464

Christopher Holland

Following last year's series of articles on microcomputers, which used the Amstrad CPC464 to illustrate the techniques involved, the following servicing notes should be of interest: they are based on eighteen months' experience of this computer and its accompanying monitors, the colour CTM640 and the green screen GT64.

First, the good news for all TV technicians is the fact that the great majority of problems encountered with these units relate to the monitors and tape decks, which should be familiar territory. Microcomputer faults as such are relatively rare and tend to show up early in the warranty period. The fault-finding principles here are similar to those required with modern microcomputer-controlled VCRs, although the relationship between the symptoms displayed on the monitor's screen and the actual fault is not always obvious. The i.c.s used in the computer are very reliable, which is just as well since most of them are soldered directly into the double-sided print: a useful rule of thumb is that the i.c.s that normally give trouble are the ones the designer has decided to fit in i.c. holders.

Computer Faults

The most common computer fault is that at switch on the monitor's screen is either blank or full of garbage. The cause is usually failure of the ULA chip IC116 (20RA043) or the microprocessor chip IC111 (Z80A). If possible, substitution is the simplest check as both are pluggable. If this fails to effect a cure, try the following steps:

(1) Check the 5V supply and earth lines to the major chips, particularly the ULA, the Z80A and the ROM i.c. (IC103, TMM-23256P-1950). In the event of an intermittent 5V supply, check the socket for the supply lead from the monitor.

(2) Check the clock pulses – a frequency counter is needed for this. Note that the 16MHz crystal X101 rarely gives trouble, also that the wire link soldered across the body of the crystal is a convenient earth connection point for probes etc. (the ULA's heatsink is not earthed). Check for the 16MHz clock pulses at pin 8 of the ULA: if absent suspect the ZN7400 clock oscillator IC125. The Z80A is clocked by a 4MHz pulse at pin 6: if missing check transistor Q103 (ZTX312L – shown as TR3 on the PCB) and confirm that 4MHz pulses are leaving the ULA at pin 39.

(3) Check the reset pulse. This is fed to pin 26 of the Z80A, pin 35 of the PIO chip (IC107) and pin 37 of the ULA. Failure of these reset pulses is normally due to IC110 (74LS132).

Other problems experienced with the computer include the following.

If any of the keyboard buttons fail to respond or do so intermittently, suspect dust or dirt on the keyboard contact PCB: this is a fairly robust panel and is not prone to broken tracks.

The complaint "crashing out", or in layman's terms a program that stops at some point while it's running, accompanied by failure of the computer to respond to any instructions, is invariably caused by the ULA i.c.

Liquid spillage normally seems to occur via the printer and disc ports. While the most common liquid spilt into VCRs seems to be beer, home computer users seem to be coffee drinkers. I'm not sure what conclusions we can draw from this! While I've seen a few VCRs effectively written off by beer, the CPC464's PCB seems to be fairly tolerant of coffee and cleaning the areas affected should provide a cure.

The Cassette Deck

As previously mentioned, problems with the computer section of the CPC464 are fairly rare: much more common are faults with the tape deck causing programs not to load or to load partially or intermittently. This shows up on the monitor as "read error A" or "read error B" messages. The first steps to take are to clean the tape deck heads and to confirm that the problem is not due to poor quality tapes – watch out for distinctly second-hand looking C90 tapes that have provided years of audio use before being acquired for the computer.

Once the heads have been cleaned, check the head alignment by attempting to load a good quality prerecorded software tape – the "welcome tape" that comes with each CPC464 is suitable as it comprises eleven blocks of data. If "read error" messages appear as soon as loading commences, realign the head while monitoring the data being loaded at pin 7 of IC302 on the cassette recorder PCB.

Should the tape load perhaps seven or eight blocks of data before a "read error" occurs, or even intermittently load the whole program, suspect a faulty cassette motor. These can develop wow and flutter after a period of use – in some bad cases this can be heard from the internal loudspeaker and be seen on a scope.

"Read error A" is usually caused by a faulty motor while "read error B" is due to incorrect head alignment. This should be taken as a guide however, not as a hard and fast rule. Failure to load anything usually means that the heads are way out of alignment. Note that the heads themselves don't usually give trouble.

Monitors

Finally the area where TV technicians will feel most at home, the CTM640 colour monitor and the GT64 green screen monitor. The circuitry used is straightforward but the following notes may be of help.

With a dead colour monitor the usual culprit is the switch-mode power supply chip IC501 (SKT7308). If this should fail be sure to check all the following components unless you want to see the replacement i.c. disintegrate at switch on: resistors R501 (5·6Ω, 5W), R502 (1Ω, 3W), R511 (10Ω, 0·25W), R521 (1Ω, 0·25W) and zener diodes D507 (RD3·6FB1) and D510 (SR2M). With a dead set whose power supply is functioning normally, check zener diode D402 (RD11EB2) in the protection circuit if there's no line timebase activity.

The only other problem likely to be encountered is one of the primary colours missing. In this event check the relevant output transistor on the tube base panel.

The only thing to watch out for on the green screen monitor is the complaint "goes into lines after a few hours". In this case check the adjustment of the line hold control L703. We've had to reset this on a number of monitors after they've been in service for about a year. The easiest method of doing this is to centralise the picture with L703 after programming in a border of a different shade of green to the rest of the screen. Lack of line and field sync, as well as video problems, is often due to the lead that connects the keyboard to the monitor – these leads can have a hard life.

Video Scrambling Techniques

Andy Emmerson, G8PTH

The main reason for encoding or scrambling a video signal is to prevent unauthorised viewing. Whether the material is being broadcast or distributed via cable it's likely to be available to those not supposed to watch the programmes. In the USA, receiving and decoding subscription signals without payment is legally "theft of service". In addition to the commercial aspects there are also political reasons for scrambling. For example, several European governments have insisted that satellite TV signals are encoded to prevent their reception by domestic viewers – this is the reason why Sky Channel uses such an elaborate scrambling technique (Oak-Orion) which I believe has not to date been cracked by enthusiasts. Other scrambling techniques are usually less sophisticated and present little challenge to those prepared to experiment or alternatively buy a ready-made pirate decoder. It's estimated that in the USA between 25 and 30 per cent of subscription TV viewers are pirates.

To the broadcast professional any form of scrambling is a profound nuisance. Not only is the encoder another piece of equipment to go wrong, it also introduces deliberate video signal distortion. No broadcaster likes to transmit a degraded signal, particularly if he has no control over its linear restoration at the receiving end.

Basic Scrambling Arrangements

Video signal encoding systems can be classified in several ways. The simplest division is between off-air and cable-only arrangements. The former tend to be more sophisticated. Scrambling implies the need for a key or reference signal to be sent to make descrambling possible. If this signal can be sent along the same cable, disguised by being at a different frequency, the decoding circuitry can be much simplified and the cost to the operator reduced. This option is not available to off-air broadcasters however, making the decoders much more complex.

A more interesting method of classification is by the technique used. These include (1) concealed channels, (2) traps, (3) reverse traps, (4) video inversion, (5) sinewave sync suppression, (6) outband gated sync suppression, (7) inband gated sync suppression, (8) variable line delay and (9) active line rotation. These techniques can all be applied on either a static, pseudo-random or dynamic basis. In addition they can be used singly or in various combinations. The accompanying audio signal can also be handled in a number of ways.

With dynamic encoding an incomplete signal is transmitted. A complex algorithm is required at the receiving end to reconstitute the signal in its original form. The algorithm can be supplied in the form of a magnetic card which the subscriber inserts in his decoder – this "smart card" would be supplied only to paid-up subscribers. Further, the algorithm/card can be changed regularly.

Many systems use addressable decoders which require a signal supplied by the broadcaster to turn them on. Each decoder has a digital "serial number" and is activated by a code transmitted during the field blanking interval. Stolen decoders and defaulters can have their service instantly withdrawn from the broadcaster's central computer.

The Concealed Channel Technique

The concealed channel technique is simple but effective so long as viewers have normal TV sets. It involves using "mid-band" channels on cable TV networks. Many frequencies cannot be used for broadcasting since they are allocated to other radio services. There is no reason why a subscription cable TV service should not use them however. They can be made viewable to customers by means of an r.f. converter. This technique is becoming less popular as TV sets and VCRs in both Europe and the States are increasingly being supplied as "cable ready" with all-band tuners that cover the between band frequencies.

Traps and Reverse Traps

Traps and reverse traps are cable TV techniques. The trap is nothing more than an effective notch filter tuned to whatever channel is used for the premium programme. When placed in shunt across the customer's feeder cable he's prevented from seeing this programme: it's simply removed when the customer pays the subscription fee. Clearly a secure housing is required for the trap – generally a locked case.

The reverse trap is just as crude. With this technique a "spoiler" signal is injected in the guard band between the upper end of the vision bandwidth and the audio subcarrier. It distorts both signals, making the subscription channel unusable unless the cable company inserts a notch filter to remove the spoiler. In this case however the knowledgeable viewer can provide his own notch filter.

Video Inversion

Static video inversion is a simple technique and requires the decoder to turn the signal the right way up again. When performed on a quasi-random, line-by-line or frame-by-frame basis, as in the Oak-Orion system, it is much less simple to deal with. The clue to decoding this mess may be supplied by signals in the line or field blanking intervals or by an algorithm in the decoder itself.

Sinewave Sync Suppression

With a standard video signal the most negative-going part of the signal excursion is the sync section that's used to control the scanning. If a line-rate sinewave is added to the signal – see Fig. 1 – the receiver will instead lock to the deepest part of the video waveform, with most unattractive results! The sinewave required for decoding is transmitted as low-level a.m. on the audio subcarrier. Unscrambling the video involves demodulating the sinewave, inverting it and using it to "straighten out" the distorted video signal.

Gated Sync Suppression

Outband gated sync suppression is another cable TV only technique as it requires a separate pilot frequency for the decoding signal. As we've already noted, a TV set relies on a negative-going sync signal to time the line and field scanning. If we suppress the sync pulses by 6dB in amplitude the receiver will lock to random video information, producing a scrambled picture (see Fig. 2).

To restore the picture to normal, the scrambling waveform is inverted and transmitted as a.m. on a separate frequency known as the pilot frequency. This pilot frequency is generally hidden in a section of the r.f. spectrum not used for TV, often between 93-114MHz. The demodulated signal is added to the scrambled waveform to boost the sync pulses by 6dB.

The inband gated sync suppression technique is similar to that just described, only in this case the descrambling signal is contained within the bandwidth of the TV channel as amplitude modulation of the audio subcarrier, as in the sinewave sync suppression technique previously described. This makes it suitable for broadcast use.

Variable Line Delay

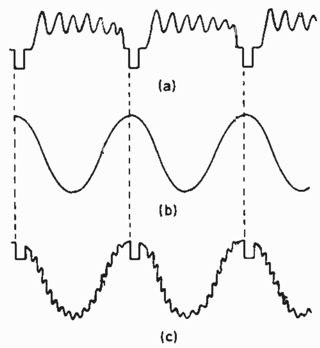
Variable line delay is the technique used for scrambling the French Canal Plus signals. It's also used in N. America. The principle is to delay some lines of the TV frame to a greater or lesser extent, on a pseudo-random basis (see Fig. 3). This creates a picture with much reduced definition. The decoder has to switch in delay lines of variable length in the correct sequence in order to reconstitute a clean picture. Further information on the system used for Canal Plus and a pirate decoder design that hit the headlines was given in the December 1984 and June 1985 issues of *Television*.

Active Line Rotation

Active line rotation is a BBC technique proposed for DBS use. It's the most ingenious of those described in this article since the TV line is sliced across its length at up to 256 points. The resultant line segments are then transmitted in quasi-random sequence. A decoder provided with the appropriate algorithm has the task of reassembling the line segments in the correct order. The algorithm would be provided by a "smart card" and the subscriber would need both the card and a personal identity number (PIN) to make his decoder work.

New Ideas

New scrambling systems are being devised all the time to defeat the signal pirates. Here's a plaintive note from a Canadian experimenter. "They go positive and negative and put a sinewave into one of the fields. The result is that the picture flashes like hell. That's not all. They go positive and negative with a twist: one field is all positive, the other all negative – odd and even lines are not of the same polarity. And they switch merrily at different speeds between all these modes." No wonder it's called dynamic encryption!



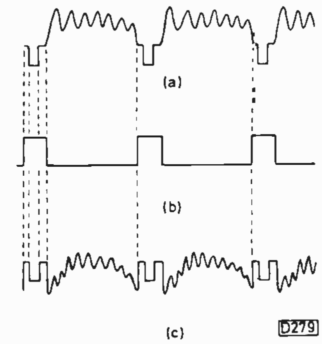


Fig. 1 (left): The sinewave sync suppression technique. (a) Normal video signal. (b) Line-frequency sinewave. (c) Result of combining signals (a) and (b).

Fig. 2 (right): The gated sync suppression technique. (a) Normal video signal. (b) Sync suppression signal. (c) Result of combining (a) and (b).

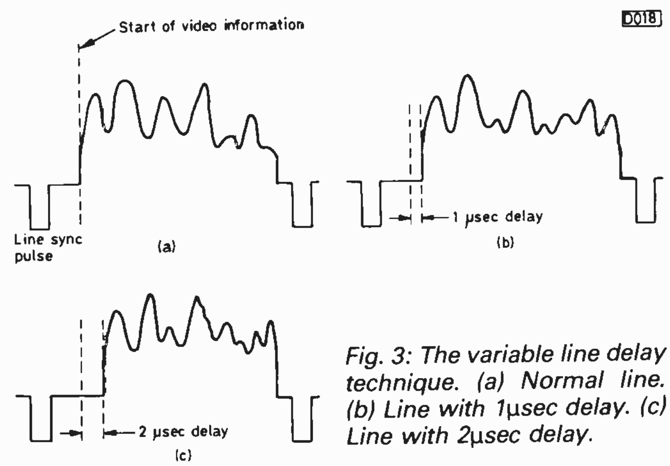


Fig. 3: The variable line delay technique. (a) Normal line. (b) Line with 1μsec delay. (c) Line with 2μsec delay.

The Audio Signal

Several audio scrambling systems are in use. After the video signal chicanery previously described these may sound a bit tame. One system is to transmit the audio signal on a subcarrier in the same way that US f.m. radio stations transmit an auxiliary uninterrupted music service or bleeps for radiopaging. The audio signal frequency modulates a 32 or 62·6kHz subcarrier: you can't hear 32 let alone 62·5kHz, nor can the TV speaker reproduce these frequencies, so a special decoder must be used.

Another system is to transmit the sound in the form of suppressed carrier a.m. on a 12·8kHz subcarrier – this is the technique used for Canal Plus. One dodge is to treat the audio as a stereo signal and transmit the difference between the identical left and right channels on a 19kHz subcarrier.

In all cases the normal audio channel can be used as a "barker" service, advertising what's being missed by not subscribing to the premium service, or for community news and information.

The latest systems use digital techniques. The conventional audio subcarrier is not present: instead, two digital audio channels are carried in the line sync period. The sound is digitised into twelve-bit words which are then compressed into eight bits. This technique gives total security and enhanced signal quality at low carrier-to-noise levels.

Vintage TV: The Bush T91

Chas E. Miller

Most older engineers will remember the "Bush 9in." with affection. The small Bakelite-cabinet models from the TV12 onwards set standards of reliability and ease of servicing that were seldom equalled for many years. This vintage piece takes us back farther however, to the first post-war Bush television set, the Model T91. It was a solidly built a.c. only receiver with a number of interesting features. It had a total of eighteen valves plus the c.r.t. and employed the twin-chassis arrangement that was to become a feature of Bush sets for many years thereafter.

Vision Receiver

The vision receiver was of the t.r.f. type, using the well-known (notorious?) EF50 r.f. pentode, fresh from its triumphant or otherwise appearance in World War Two radar equipment. To be fair, apart from the poor base connections due to the short pins the valves had a useful performance, with a slope of 6·5mA/V. Stagger tuning was used to get the required bandwidth.

Four EF50s were used to provide r.f. amplification in the receiver section, the first two handling both the sound and vision signals. The strip was designed for dual-sideband reception from the Alexandra Palace transmitter, the alignment frequencies being 43MHz and 47MHz, i.e. 2MHz on each side of the vision carrier. Curiously enough there were no sound rejectors as such, the alignment instructions stipulating that the first two common r.f. amplifier stages should provide a gain of at least ten at the sound carrier frequency of 41·5MHz – if this was not achieved you had to retrim the stages until satisfactory results were obtained at the vision and sound frequences. Thereafter we must assume that the sound take-off coil provided adequate rejection before the signal was passed to the other two vision only r.f. amplifier stages.

The arrangement of the coils in the t.r.f. strip was simplicity itself. Tuned anode, tuned grid coupling was used for all except the second stage, the coils being designed to produce the required bandwidth without being shunted by other components.

The decoupling arrangements used in the t.r.f. strip were characteristically elaborate, a forest of 500pF decouplers being connected between just about everything in sight and chassis. Following the normal practice of the time, each valve had a common earthing point to avoid spurious inductances being established via badly arranged chassis connections.

Tube Drive

The vision detector was a miniature diode, type EA50, another fugitive from radar sets. Another EF50 was used as the video amplifier, with the very low-value anode load resistance of 3·3kΩ (R22, Fig. 1). The output was d.c. coupled to the c.r.t.'s grid, so no d.c. restoration was required.

The cathode of the MW22-7 c.r.t. was strapped to the heater (no naughty heater-cathode leaks for Bush owners!) and was isolated from direct earth by a separate mains transformer winding which was returned to an h.t. potential divider: it was set to 160-270V by the action of the brightness control. The tube's first anode was supplied with around 200V from a tap on a bleeder network across the e.h.t. supply. The latter employed a separate mains transformer which delivered 3·7kV to the anode of an HVR2 rectifier and 2V to this rectifier's highly-insulated heater. The e.h.t. obtained from this arrangement was 4·5kV, with a brace of 0·02μF reservoir/smoothing capacitors capable of holding a nasty shock for the unwary engineer.

The contrast was controlled by means of a potentiometer which set the cathode bias applied to the second and third r.f. amplifier. An additional local/distant switch varied and bias supplied to the first r.f. amplifier by a large factor.

Sound Receiver

For the sound strip the Bush designers decided to use a superhet circuit. The sound signal from the second r.f. amplifier was fed to a standard radio type ECH35 triode-hexode frequency changer. To prevent breakthrough of the local oscillator signal into the vision strip a rejector was fitted close to the hexode's grid coil. The i.f. was 725kHz, with an average bandwidth of 40kHz. Thus the full a.f. radiated by the transmitter could be realised with ease, and in Alexandra Palace days the sound didn't have to travel via frequency-limiting land lines (as radio programmes did!).

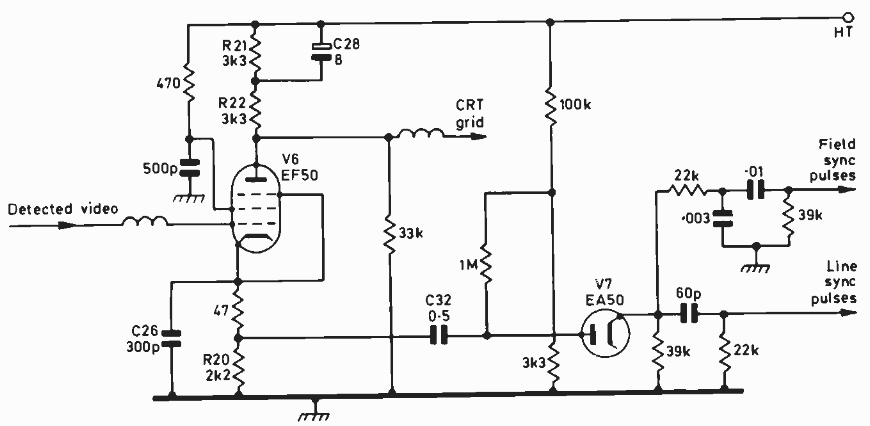
The ECH35 was followed by an EF39 i.f. amplifier stage, then an EBC33 double-diode-triode which provided detection, a.f. amplification and a.v.c. clamping. All akin to standard radio practice of the period. The output stage used an EL33 to provide approximately 4W of audio. A tone control was fitted, no doubt so that those unfamiliar high a.f.s could he reduced to the comfortable "mellow bellow" apparently beloved by contemporary radio listeners.

Sync Separator

The sync separator was simplicity itself (see Fig. 1), consisting of another EA50 diode (V7) which produced the line and field sync pulses at its cathode. The video signal, with positive-going sync pulses, was capacitively coupled to its anode from the cathode circuit of the video output pentode. A side benefit of this arrangement was reduced capacitive loading on the tube's video feed. In fact quite a bit of care went into the design of the video output stage. There was frequency-selective negative feedback in the cathode circuit and, in the anode circuit, a series peaking coil and l.f. boost.

Timebases

Both timebases employed thyratron oscillators, either a Mullard EN31 or Mazda T41 according to availability – minor adjustments to one or two component values were required depending on which type of valve was used. The



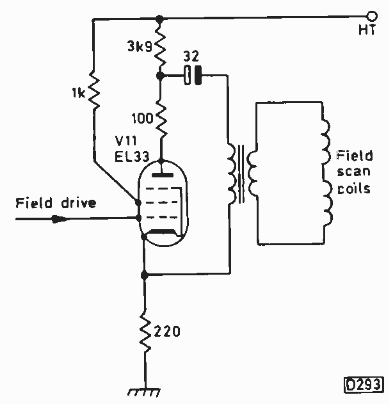


Fig. 1 (left): The Bush T91's video amplifier and sync separator circuits. A simple diode (V7) sync separator was used, the video signal developed across R20 being coupled to its anode via C32, but what a lot of trouble went into the design of the video output stage! At very low frequencies R21/C28 form part of the output valve's anode load, increasing the l.f. gain. The small-value screen grid and cathode decoupling capacitors introduce selective (medium-/low-frequency) negative feedback however. The stage's frequency response was obviously given careful consideration by the designers.
Fig. 2 (right): The T91's field output stage. Linearising negative feedback was introduced by returning the scan coupling circuit to the cathode of the output pentode.

gas-filled triode makes a simple oscillator circuit that's easy to synchronise. The problem occurs when the valve ages and becomes somewhat erratic in its firing.

An EL33 was used in the field output stage and an EL38 in the line output stage. The field output stage used *RC* plus transformer coupling (see Fig. 2) with negative feedback in the cathode circuit. A simple two-winding transformer was used for coupling in the line output stage, which looks particularly uncluttered to the modern eye in the absence of boost and flyback e.h.t. circuitry. Low-impedance scan coils were used for both line and field deflection.

One snag with the type of set where the e.h.t. continued unabated in the event of line timebase failure was the vertical white line that would be displayed if the set was left running in the fault condition. Fortunately the low e.h.t. voltage and the vigilance of early TV owners reduced the likelihood of a permanent burn on the screen.

The Power Supply

The hefty power supply had two mains transformers, one for the e.h.t. and the other for the h.t. and heater supplies. 310V was presented to the anodes of the two IW4/350 h.t. rectifiers which were used in a full-wave circuit. There was a great deal of h.t. smoothing employing no fewer than six large value electrolytics, two chokes and the focus electromagnet. The latter fed the h.t. to the line timebase and was shunted by a focus control network. Anyone who had experience of this type of focusing will recall that the heating-up effect of the electromagnet caused the sharpness of the picture to deteriorate frequently during an evening's viewing, calling for much adjustment. One could never bring oneself to leave the setting alone when the set was next used from cold and rely upon the warm-up to bring the picture into focus, because the programmes were so sparse one couldn't afford to miss out on anything!

Later Bush Sets

The T91 was one of the last TV designs to have a "traditional" power pack. The following TV1 (9in.) and TV2 (12in.) were of the live chassis type. While most of the circuitry remained as in the T91 an important change was the move to flyback derived e.h.t. These sets retained the focus coil and required even more electrolytics because a half-wave mains rectifier was used. They were followed by the TV12, the first of the classic Bakelite cabinet 9in. sets, which had lots of EF50s (again) and was of the a.c./d.c. type (but still had the focus coil!). This model and its companions were followed by the TV22 series, which employed mostly miniature valves and a circuit that remained largely unchanged for many years, even when Band I/III models appeared.

A Vintage Restoration

405 may be dead but it won't lie down! Vintage sets are still being used to display vintage pictures, thanks in no small measure to articles that have appeared in *Television* on recording 405-line material. Steve Rowley tells me he's just restored a 1939 Ekco Model TA201. This was a small (7in.) table model that provided a vision display only – the accompanying sound had to be fed to the pickup sockets of an ordinary radio receiver. Steve's set up consists of a Philips VCR and a professionally made modulator. It enables him to view genuine archive material, including good old Andy Pandy and the Flower Pot Men, as well as the fondly remembered BBC Test Film of the early fifties. Congratulations Steve – may your success encourage others.

Thirty Years of Independent TV

On September 22nd last Independent Television celebrated its thirtieth birthday. It was on that day in 1955 that the then ITA came on air for the first time from the Croydon Ch. 9 transmitter. The occasion was marked by special compilations of archive material on Channel 4 and S4C, mostly of official opening ceremonies but interspersed with actual programme extracts and early commercials. This was followed by a special showing of the first episode of the made-for-TV Robin Hood series.

Sadly, the man who played the hero in this series, Richard Greene, didn't live to see this replay. He passed away earlier last year after a lengthy illness, in his 67th year. For those of us who were around when ITV started Richard Greene's Robin Hood will always typify the occasion. Episode one was shown in the Midlands area on the very first night, 17th February 1956, and seemed to revolutionise television for us. It's difficult to believe now that this was the first filmed series to be seen on our screens, opening up a vast new dimension. Prior to this, drama productions had been made in comparatively cramped studios, with all the limitations that this implies. Technicalities alone wouldn't have made the new series succeed however: Richard Greene brought to the part the experience of nearly twenty years in films, much of his time having been spent in Hollywood – a thoroughly professional and engaging performance.

An Early Home-built Set

Reader E. Bligh has sent me details of a home-built set he made in the late forties – from the floor up, including the mains transformer. It used the well-known VCR67 radar tube which gave a green picture with a diagonal measurement of about 6in.

Much of the circuitry is reminiscent of the Bush T91 we've been considering, with EF50 vision and sound t.r.f. strips and EA50 detector diodes. The video amplifier used another EF50 while the sound was taken care of by a 6J5 driving a 6V6 output tetrode. The sync circuit was rather more elaborate, with a brace of EA50s and yet another EF50. Both timebases used T41 thyratrons followed by 6SN7 push-pull output stages.

The power supply was a most impressive piece of work – winding the transformer must verily have been a labour of love! It provided all the voltages required in the set, including the e.h.t. – according to Mr. Bligh's notes the e.h.t. winding alone required some 12,000 turns of wire. The five other secondary windings provided 2V at 2A for the heater of the e.h.t. rectifier, 4V at 1A for the c.r.t.'s heater, 6·3V at 3A and 4V at 4A for the valve heaters, 400-0-400V at 150mA for the h.t., and 4V at 2·3A for the h.t. rectifier. The vision and sound stages were operated at 280V h.t. while the timebases received the full 400V. The loudspeaker field coil formed part of the smoothing network. A U21 was used as the e.h.t. rectifier and an MU14 as the h.t. rectifier.

Interestingly, the contrast control varied the h.t. applied to the first three r.f. amplifiers. An 0-1mA meter was wired into the video amplifier's grid circuit, presumably to monitor the strength of the incoming signal. Mr. Bligh used the set in Cricklewood, London NW2, so reception from Ally Pally must have been excellent at a distance of only four-five miles.

Comments Welcome!

One can imagine Mr. Bligh's sense of achievement when he first saw pictures on this genuinely home-constructed set. I'm most grateful to him for letting me see the circuit, and would welcome letters from other readers on such sets and vintage topics generally.

VCR Clinic

Reports from Christopher Holland, Philip Blundell, Eng. Tech., Les Harris, John Cahill and Eugene Trundle

JVC HRD120/Ferguson 3V35

With the exception of the troublesome cassette loading mechanism, mechanical problems have been virtually non-existent with this generation of JVC machines. So when I was confronted with the "no fast forward or rewind" condition I was inclined to suspect an electronic fault. On these machines fast forward and rewind drive are provided by the capstan motor, the direction being altered by reversing the polarity of the voltages at pins 1/2 of connector 28 on the main servo/mechacon panel. A check here showed that no voltage was present, and since the front indicators lighted when the relevant function was selected I felt that the operation i.c. and the microcomputer chip were probably in order. The main suspects were Q206, Q207 and IC206 which functions as a series of switches controlled by the microcomputer i.c. These switches route the capstan motor current in the required direction, the current being supplied by Q207.

Since the switching control voltages appeared to be correct the voltages at pins 2 and 8 of IC206 (input from Q207) were checked and found to be absent. Q207 was checked out of circuit and appeared to be fine so IC206 was replaced. This seemed to do the trick but while the spools turned in the fast forward and rewind modes when asked to do so they did this very slowly. It turned out to be my fault: when I replaced Q207 and refitted its heatsink I somehow managed to break the print to its collector. A few minutes spent with the soldering iron and everything was once more in order.

I've since had a further problem in this area. A machine intermittently damaged tapes because they were not being wound back into the body of the cassette during unloading. Checks in the drive circuit just mentioned showed that adequate voltage was being made available to the drive motor at all times, so the belt that transmits this drive from the motor was checked. It turned out to be o.k. Consistent loading torque was restored only after fitting a new motor. **C.H.**

Ferguson 3V29

A slow, rolling noise bar appeared every few seconds during playback. I've encountered the symptom on a number of occasions, due to the capstan servo not locking because the control pulses are missing. Cleaning the control head normally provides a cure but on this occasion a scope check showed that the problem was in the drum servo – a trapezoid with no reference pulse was present at TP4.

I'd encountered this once before and a note in the corner of the circuit mentioned that the cause had been an open-circuit tracking control. Not this time however: the control declared its innocence when checked with an ohmmeter. Checks were next made around IC3 (HA11711). This showed that pulses were absent at pin 10. So the i.c. was very carefully removed – I've falsely accused HA11711s before. Sure enough a replacement i.c. made no difference.

Further checking finally brought me to the record phase switch preset R35 – its wiper had somehow become pushed in and no longer made contact with the track. Since the video heads appeared to have been changed at some stage I can only presume that the wiper was dislocated by someone going through the head alignment procedure. **C.H.**

JVC HR7200/Ferguson 3V29

The card simply said "no picture" and my immediate reaction was that a simple head cleaning job would be all that was required. At switch on I was confronted with a blank raster however. As a first step I checked the camera/TV switch – most customers seem to flick this to the auxiliary position whenever anything goes wrong – but this one was in the correct position. I then noted that the channel indicator lights were o.k., and when the monitor's volume control was turned up there was good E-E audio. Off with the top cover for a quick check for foreign objects in the mechanism, then a check with the test tape. This showed that I could forget about head cleaning – a grey, unmodulated raster appeared, similar to that in the E-E mode.

Having confirmed that Ch. 4 was showing its test pattern a scope check was made at pin 24 of IC201. A good signal was present here but it was not re-entering the i.c. at pin 13. At this point I came unstuck because the circuit ceased to resemble the diagram. Then from the recesses of my mind I recalled a modified and revised diagram that JVC had kindly supplied some while back. This soon led to Q221, which had gone open-circuit base-to-emitter. **C.H.**

Sharp VC9700

These machines are renowned for not recording the sound every time. Changing the relays will often effect a cure but Sharp recommend changing C648 to 0·01μF and R693 to 10Ω (0·25W) as well. **P.B.**

Sharp VC581/2/3

The loading motor circuit in these machines has been modified to prevent intermittent system control faults such as won't play after going into search, the LED lights up when a function command is given but the machine won't carry out the command, and the mechanism won't go to a given position. The modification is simply to remove C8001 (47μF) which is connected across the loading motor – on PWB-W. **P.B.**

ITT TR3913

Rewind and fast forward were o.k. but when play was selected the play LED lit, the brake solenoid clunked and nothing else happened. The cause of the problem turned out to be the cassette lamp – the vibration when the brake solenoid pulled in interrupted the lamp's filament – but only on playback! Which fool took this machine back to the workshop for a new cassette lamp . . . **L.H.**

Ferguson 3V29

The machine was tried out after fitting a new cassette lamp. A recording was made and this played back all right. The machine was stopped, rewound and playback was then selected again – but this time the pause, audio dub and play LEDs lit! As the fault was found to be intermittent the mechacon panel was replaced in an attempt to speed up diagnosis. This made no difference and control via the remote handset was found to give correct operation. So the playback switch was replaced. This cleared the fault, though an Avo check on the switch failed to show the suspected high resistance. As a check the switch was fitted to another machine – the fault then showed up on this one! **L.H.**

Mitsubishi HS303

No sound erase, intermittent sound recording or no sound at all seems to be a stock fault on this machine though I've not seen it mentioned in VCR clinic. The cause is plug VK: Mitsubishi recommend soldering the wires straight to the print. **J.C.**

Mitsubishi HS302

The fault was noise bars on the screen after about two hours use. As the machine was completely enclosed in a timber cabinet I suspected heat to be the cause of the problem. A lot of time was wasted in the workshop before I found, using a hairdryer and freezer, that IC402 was faulty. **J.C.**

Fisher FVHP615

This machine ejected the tape immediately and there was no rewind. Examination showed that the tape was spilling out of the take-up spool because the take-up pulley was jamming under the chassis. A drop of oil on the pulley bearing cured the problem. **J.C.**

Mitsubishi HS303

The customer complained of a whirring noise and wobbling picture. It turned out that the capstan flywheel has a type of rubber glued to the bottom: some of this was loose and was rubbing as the capstan rotated, causing the noise. The wobbling was due to VR4A0 in the drum servo being misadjusted. **J.C.**

Toshiba V57

This machine was dead and on examination the mains fuse, located in a plastic box, had shattered. The cause was a short-circuit mains filter capacitor (0·022μF, 250V). I later discovered that children had been switching the machine on and off continuously with the remote control unit. Presumably this had produced spikes to cause the fault. **J.C.**

JVC HR3660/Ferguson 3V16

This one would apply to any Ferguson/JVC piano-key machine. The problem was no colour in record or playback, first intermittent then permanent. Checks showed that the chroma signal was reaching pin 13 of IC202 (AN305) which contains, amongst other things, the a.c.c. circuit and the main mixer, but there was no output at pin 11. Burst gating pulses were present at pin 1 but there was obviously no chroma feedback to pin 15. The voltage at pin 11 was abnormally high at around 10V. A bypass capacitor connected between pins 13 and 11 didn't restore colour – until pin 11 was disconnected from the print! The chip was faulty, with a low-impedance path from pin 11 to some signal-earthy point within the device. It's important to set up R216 (converter balance) and R335 (a.c.c.) when IC202 is replaced. **E.T.**

Servicing Teletext Receivers

Part 2

Mike Phelan

This month we'll consider the functions of the VIP (video input processor) and TIC (timing chain) chips in the Mullard/Philips teletext decoder.

The VIP is an SAA5030 or, in earlier versions, an M913 – the pin connections of these devices are the same. A block diagram is shown in Fig. 1. The incoming video is fed to pin 16 – the input comes via a 6MHz notch filter to remove the sound carrier which would create problems in a chip containing a 6MHz oscillator! It then follows three different paths.

The shortest one leaves the i.c. at pin 12, provided pin 10 is low as it is in the G11's teletext decoder. When pin 10 is high, an AHS (after hours sync) output is obtained at pin 12 – this is generated in the TIC by division of the 6MHz signal. The G11's decoder doesn't use this facility.

The second path takes the video to an adaptive data slicer. The input to this is a.c. coupled so that the ones and zeròs of the data signal become positive- and negative-going excursions. The amplitude and quality of the signal can vary enormously at this point (see Fig. 2). After rectification each half of the signal charges the capacitors connected to pins 23 and 24: these maintain the slicing level at half of each opposite-going excursion of the signal. This gives us a much cleaner signal, though still one of varying amplitude – approximately half the original data signal amplitude. What we require is a TTL compatible signal of 5V peak-to-peak, with fast rise times, suitable for driving logic circuitry. The answer to this requirement is to pass the signal through a series of limiting amplifiers to square the signal before it emerges at pin 19.

It's important to appreciate that the data signal leaving the VIP at this pin still contains the remains of any low-level composite video as no attempt has so far been made to gate this out – this is done in the TAC (text acquisition and control) chip. The signal will not contain chroma information since this would be of sufficient amplitude to be removed by the slicer. The burst would still be present however: we'll see how this is removed later.

The data signal from the slicer/squarer is also passed to the high-Q tuned circuit C1/R1/L1 connected to pin 21. The clock run-in at the beginning of each row (10101010) causes this to ring – it continues to do so until the arrival of the next clock run-in – shades of the passive chroma subcarrier generator used in the Rank A823 chassis! This signal is very important: after squaring, it's fed to the TAC chip.

The final path for the video input at pin 16 is to a sync separator. The field sync output obtained at pin 13 is adjustable in phase – this is necessary because it resets the line counter in the TIC chip. The line sync output is used to phase lock the 6MHz crystal oscillator (dot clock). Part of the phase-lock loop is in the TIC which (see Fig. 3) divides the 6MHz signal by six, then by 64, to obtain a 15,625Hz output. A sandcastle pulse is produced from this – externally to the TIC. This is fed back to pin 5 of the VIP.

The sandcastle pulse is separated into its two components within the VIP. The portion between 2·5V and 5V (CBB – colour burst blanking) goes to the adaptive data slicer to remove the burst from the video signal before slicing – a low-level 4·43MHz signal with no luminance content would upset the operation of the slicer. The bottom half of the sandcastle pulse (0-2·5V – PL, i.e. phase lock) is used as the reference signal for the phase

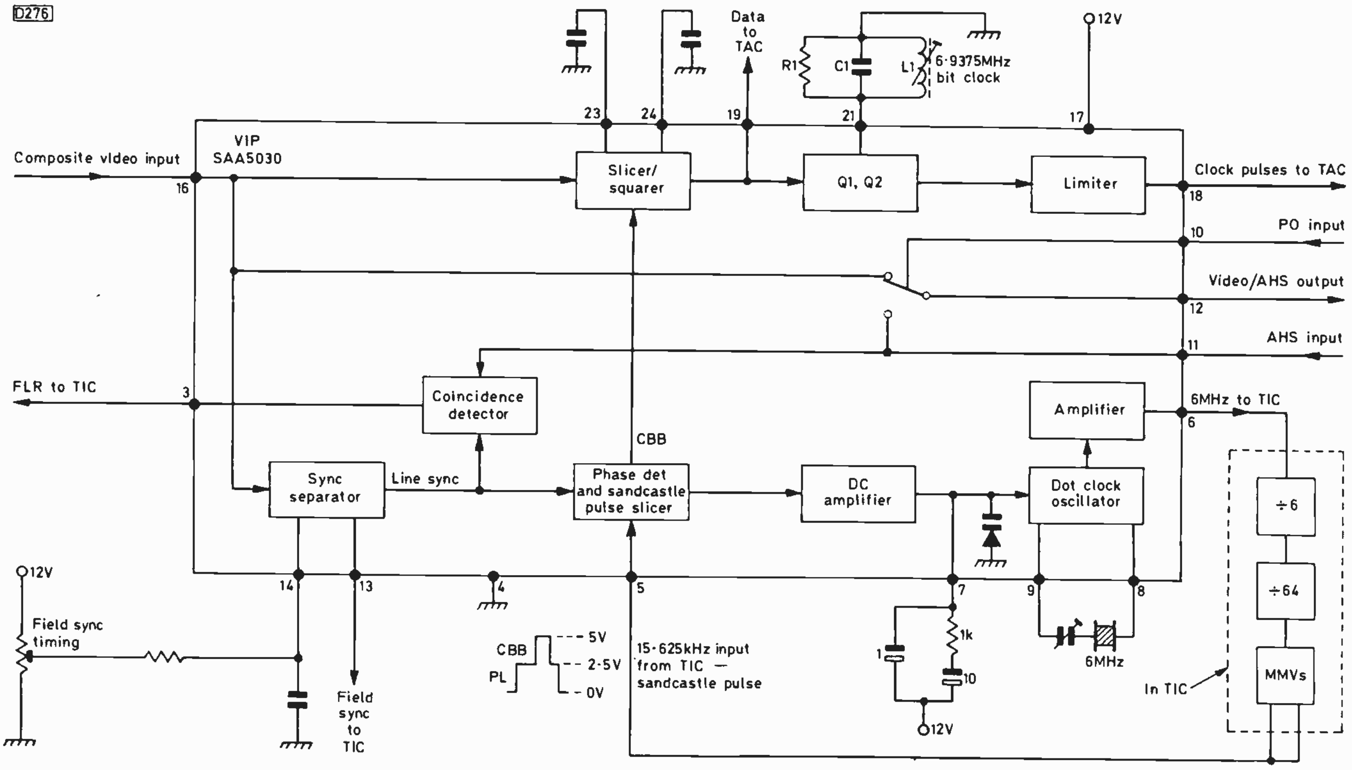


Fig. 1: Block diagram of the SAA5030 video input processor i.c.

detector. This is followed by the customary d.c. amplifier and varicap diode and what should be a familiar looking network hung on pin 7 (loop filter).

As you probably know, any phase-locked loop has the conflicting requirements of a wide pull-in range and stability. Most flywheel line sync circuits, VCR servo circuits etc. use a two-stage process to avoid the need for a compromise. The SAA5030 achieves this by using the AHS output from the TIC i.c. This enters the chip at pin 11: it's a composite sync signal produced by processing the 6MHz dot clock signal and, when the loop is locked to the incoming video, should be an exact facsimile of the off-air sync. The two signals are compared in a coincidence detector in the VIP: if they differ, a 4·6μsec pulse is produced at pin 3 of the chip. This is used to reset the counter in the TIC i.c. so that the sandcastle pulse falls within the pull-in range of the loop. The reset pulse is called FLR (fast line reset) and should be present only at initial switch on or after a channel change.

A block diagram of the SAA5020 TIC i.c. is shown in Fig. 3. As we've already noted, this chip generates various pulses, most of them by dividing the 6MHz dot clock signal from the crystal oscillator in the VIP i.c.

The 6MHz signal enters the TIC chip at pin 2. After buffering it emerges at pin 3 and is passed to the TROM (teletext ROM) chip to control the pixel (dot) repetition rate. Within the TIC the 6MHz undergoes three stages of division, first down to 1MHz. This signal is used by the TROM chip to control the repetition rate of the characters displayed, also by the TAC chip to process the remote control signals received by this i.c.

The next stage provides division by 64 to give line-frequency pulses. This is followed by 625 division to produce a field-frequency output. These two sets of pulses are processed in a sync generator to produce a normal sync signal – AHS. The line-frequency pulses also go to a couple of monostables to produce the PL and CBB signals – these are added externally via a 6·8kΩ resistor to provide the sandcastle pulse for the VIP. The sync generator can be reset by the previously mentioned FLR pulse.

The off-air field sync pulse from the VIP enters the TIC at pin 10 – this maintains the correct relationship between the generated and off-air field sync signals. The field sync pulses are also differentiated and divided by two to produce a 25Hz squarewave called CRS (character rounding select). We'll return to this when we get to the TROM.

Most of the intermediate signals produced by the chain

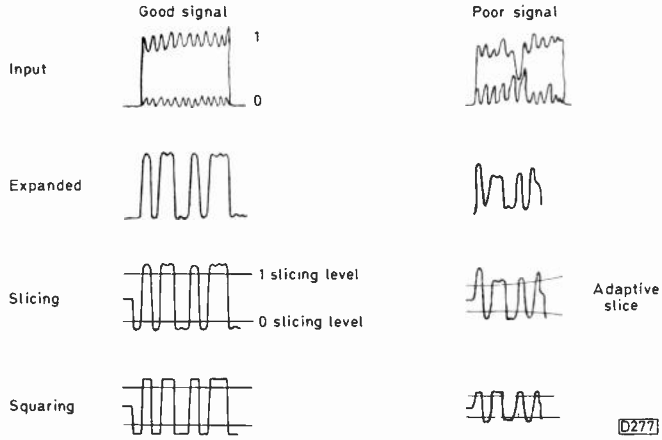


Fig. 2: The principle of adaptive slicing.

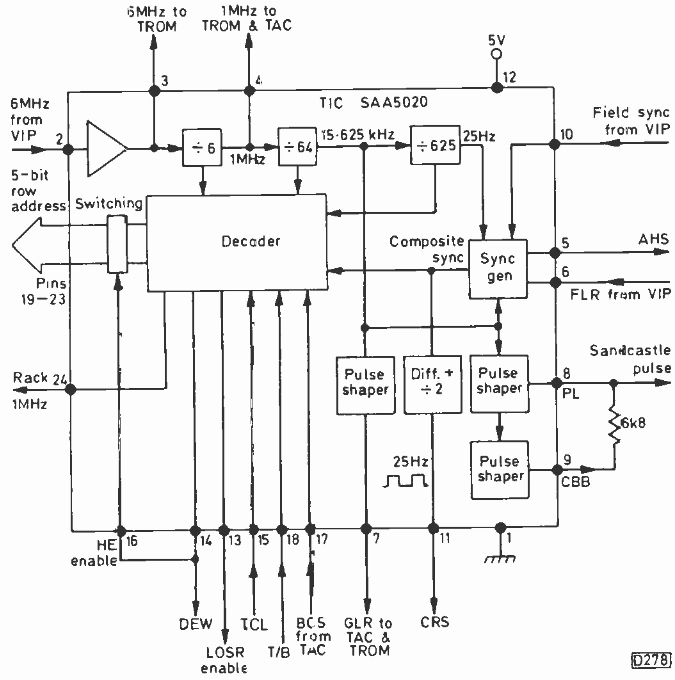


Fig. 3: Block diagram of the SAA5020 timing chain chip.

of dividers are fed to a decoder which consists of a collection of counters and monostables. Another group of inputs to this decoder arrive at pins 15, 17 and 18. They are all to do with the double-height character function. As you probably know, double-height characters can be transmitted by preceding the character with the appropriate control code (serial attribute), the result being that instead of the whole character being displayed only the top or bottom half appears on the screen depending on whether the row of characters is odd or even. The attribute remains in force until the end of the row or until a normal height attribute is sent, whichever occurs first.

In addition to this the user can select double height for the complete page, with the option to display either the top or the bottom half of the page. Pin 17 received a BCS (big character select) signal from the TAC chip when either of these options is selected. The BCS signal also goes to the TROM. Pin 18 T/B (top/bottom) tells the TIC which half of the page is required (low for top). This signal also comes from the TAC: there's no need to tell the TROM this – the signals sent from the TIC to the teletext decoder's RAM determine which bits of page are read out. The signal at pin 15 (TCL – text character large) goes low when the TROM detects a broadcast large-character attribute.

The decoder produces several outputs. The DEW (data entry window) output at pin 14 goes high for sixteen lines of each field – this output is used by the TAC chip to gate out the data and by the TROM to reset its counter. It's also divided down in the TROM to give the flashing character attribute.

The five-bit row address is fed out to the teletext decoder's RAM i.c.s when pin 16 goes low. As pin 16 (HE – high impedance enable) is connected to the DEW output the row address is switched off during the data entry period and on during the read period (the active part of the field when the teletext is displayed). During the DEW period the address lines go high impedance and the RAM is "written into" by the incoming data. RAM i.c.s need clock inputs to clock data in and out. The out clock is provided by pin 24 of the TIC chip: this is called RACK – read address clock. It's at 1MHz (the character rate) and is switched off during the DEW period when WACK (write address clock) from the TAC chip takes over. Don't forget that a teletext decoder has two functions which don't occur simultaneously – to receive and store signals, and to produce the teletext displays.

The final output, at pin 13 – LOSR enable (load output shift register enable) – goes to the TROM chip to reset its control character flip-flops prior to the start of each line of the display. This signal also defines the character display period. At the end of this series we'll provide a glossary of all these strange mnemonics and abbreviations as a quick reference guide.

Computer Aided PCB Design

Malcolm Burrell

In the early days of electronics the components were hand wired to tagstrips which were usually mounted on a solid metal chassis. The assembly process required manual soldering of each connection, involving a large labour force, and not infrequently resulted in connections that were either left unsoldered or were badly made – dry-joints. Interconnections were made with insulated copper wire.

Enter the PCB

By the fifties the concept had evolved of preconfiguring the wiring in the form of thin copper tracks on a flat surface. The desired pattern of tracks is photographically transferred to a thin layer of copper on a paxolin or fibreglass base: etching away the unwanted areas of copper leaves what we call a printed circuit. Holes can then be drilled and the components inserted in their correct positions, with each connection made to a portion of track that links it to the other associated components. The entire assembly is passed over a bath of molten solder which can make perhaps hundreds of connections in a single operation.

Early printed circuit boards were notorious, due to hairline cracks and poor connections. They were not well suited to the high temperatures produced by thermionic valves in confined spaces, though perhaps much of the problem was basically due to the aesthetic demands made on designers of consumer electronics products at the time.

Modern techniques and solid-state circuitry, together with double-sided boards having independent wiring on both sides, have resulted in highly reliable products. Extremely complex electronic circuits can be assembled at a much lower cost.

PCB Layout

Designing the layout of a printed circuit board used to be something of a hit-and-miss process. With a fairly large number of discrete components, a certain amount of compromise was necessary. For example a supply rail might be conveniently run along one edge of the board, just out of reach of a resistor on the far side. To make contact with this one component it might be necessary to use longer connecting leads, vary the hole spacing and/or realign the tracks. Alternatively you could use additional pads with wire links between. Double-sided boards largely overcame this problem but created a design constraint similar to three-dimensional chess!

The use of integrated circuits and microprocessors changed many design concepts. Most chips don't come with long connecting leads, and although few peripheral components are needed with digital circuitry each i.c. pin will have a separate function. These connections are arranged in neat rows, with as few as eight pins on a timer chip to perhaps sixty on a microprocessor. The circuit designer is not always aware of the problems involved in interconnecting a dozen chips, each having say sixteen connections. He designs the interconnections required to make the circuit work from a theoretical point of view. The PCB designer has to find ways of linking these 192 connection pins according to the original instructions. If an unforseen problem or error occurs it may well be "back to the drawing board".

CAD Systems

Various CAD (computer-aided design) systems are available. They usually employ a VDU, keyboard and joystick interfacing with a computer which has a documented memory of component pin-outs and the physical profiles of the components to be used.

The designer presents his initial circuit diagram to the operator who then calls up the components by reference numbers from the data base. Having entered the information on the required interconnections between each component the operator plots the physical positions on the display and checks that the position of one component won't affect the placing of another. The autochecking facility assists in locating design errors by drawing attention to such things as any attempt to duplicate the number of a connecting pin.

Rubber Banding

Once the interconnection format has been inserted the operator moves on to the stage of "rubber banding". This gives on the VDU's screen a spaghetti-like presentation of all the component connections. By moving the cursor he can optimise the layout and separate the tracks that are to be on the top or bottom sides of the board. Since it's an interactive process, he can chose to vary the track widths to suit the circumstances – increasing the widths of supply rails for example.

Tracks can be laid vertically, horizontally or at an angle of forty five degrees. It's normal practice to run tracks vertically on one side and horizontally on the other. Where tracks on the top and bottom connect, a "via" hole is inserted.

To Final Artwork

Autochecking allows the operator to ensure that all programmed tracks have been laid. Track widths are checked and drilling information is produced. Four "films" are produced for the artwork in the case of a double-sided board: two give the top and bottom track information, a third gives the silk screen information and the fourth defines the solder resist pattern. Stored on disc or tape, the information can then be fed to a photoplotter that produces the final artwork.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon 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.

ITT CVC9 CHASSIS

There's intermittent loss of picture and sound signals, with only a blank raster and buzzing sound (occasionally sound from a foreign station is heard breaking through the buzz). The fault lasts for only about five seconds, its intermittent nature making it very difficult to make any conclusive checks.

We've had this fault on one or two occasions and have found it to be the result of one of the i.f. amplifier transistors T15/16/17 going open-circuit between the base and emitter. In view of the difficulty of diagnosis and access we'd suggest replacing all three transistors. T15/16 can be replaced with BF196s and T17 with a BF197. These lockfit types will fit directly. Ignore the original earth (screen) holes in the print – and beware of solder blobs.

PYE 725 CHASSIS

A stable picture can be obtained only with the brightness and contrast controls turned well down. Any increase in the setting of either control first affects the top two inches of the picture, where shading appears with verticals kinking at the intersection and slight hum on sound; further increase introduces field roll with the field then reducing to about half scan while the trip rate increases. The greater the white content of the picture the greater the effect. The h.t. is correct.

The earthy end of the contrast control is taken to the beam limiter sensing point in the line output stage. This point is smoothed by C573 (4·7μF), failure of which is the usual cause of this fault. It's beside the gun switches on the line timebase panel.

MITSUBISHI CT180B

The problem is lack of width – about an inch or so on either side. Initially the h.t. was slightly low with no control: replacing the 12V zener diode D901 in the error detector circuit put that right. The adjustments on the pincushion correction board have no effect on the fault.

An oscilloscope will be required to check the duration of the line flyback pulse. If it's less than 11μsec one of the bunch of flyback tuning capacitors C531/2/3/4 may have gone open-circuit. If it's correct check the boost diode D576 (SB-2) before suspecting short-circuit turns in the line output transformer.

FERGUSON TX10 CHASSIS

The mains fuse was open-circuit and the chopper transistor short-circuit. Are there any stock faults that could cause this? Some checks have been made on the components on the primary side of the chopper transformer but everything appears to be o.k.

We don't know of any stock faults for this condition but we did have the same fault on one occasion and spent a lot of time before we found that the TDA2582 chopper control i.c. was faulty. Check also for shorts on the h.t. line. It's always worth replacing the focus control assembly on these sets. It tends to flash over, with dire consequences in various parts of the set. An improved type is now supplied.

SHARP VC6300

First the machine switched itself off during a recording. Now every time it's switched on it goes off again after the tape has moved about six inches.

There's either no take-up reel rotation or the machine thinks so. Check that the reel isn't stopping – if it does clean all belts and tyres and if necessary replace the clutch. If the reel isn't stopping check the output from the sensor at socket AF4: it should be 5-10V peak-to-peak – if not replace the opto unit under the take-up reel.

PYE V2000 VCR

This machine is working but produces a rather grainy picture with new tape and cleaned heads. A good service would seem to be required: any suggestions about what should receive attention?

Little preventive maintenance is possible with these machines, a good motto being to leave well alone! The symptoms of a worn head are snowy recordings while known good tapes are played back satisfactorily. To clean the heads properly, use isopropyl alcohol on chamois leather. Press the moistened leather against the heads on the drum and, keeping the finger still, rock the drum to and fro across the leather. Ingrained base material sometimes takes a long time to shift.

GEC V4000H

This machine is basically the same as the Hitachi VT8000-8500 series. It has the following intermittent fault. Whatever mode is selected – play, record, fast forward or rewind – the machine goes to stop after five-ten seconds (in play or record the machine first unlaces).

First check the operation of the after-load switch, which is not the most accessible of components in this machine. Towards the end of the loading sequence the load on the threading motor increases considerably and a loading belt that slips will prevent load completion – check visually that the loading poles go fully home. If the loading belt is in good condition it should be possible to stall the loading

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motor by grasping the large white nylon pulley. If the above points are in order a scope will be required to check for the presence of drum tacho pulses to the mechacon: absence of these shuts the machine down as a safety feature.

TEST CASE

278

Each month we provide an interesting case of TV/video servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

Current TV technology has greatly improved the performance and reliability of today's sets while considerably reducing their cost in real terms. What it hasn't done is to ease the difficulty of diagnosis when something goes wrong. A self-destruct situation is often present, particularly in power supplies and timebases, giving rise to the problem of how to attempt a diagnosis in the milliseconds (microseconds?) that it takes for a semiconductor device – often a large/elusive/expensive one – to be destroyed.

There are ways of countering this situation – cold checks, the use of external power supplies/variacs, dummy loads and current-limiting resistors – but occasionally a set that seems to defy all attempts at logical diagnosis comes along. This month's test case is one such example.

The guilty party was a Decca set fitted with the 70 series chassis. It arrived in the workshop with a job ticket bearing the single word "dead". And dead it was, with the 1AT fuse F601 (in series with the chopper transformer's primary winding) shattered and blackened. It was no surprise to find that the BUW81A chopper transistor was dead short. This sometimes happens in these sets for no particular reason, so a new BUW81A was fitted. The items in series with its emitter – diodes D608 and D610 and resistor R636 (0·39Ω) – were also faulty and had to be replaced. Quick in-circuit checks on the driver pair Tr603/4 then proved that neither was short-circuit, so in with a new 1A fuse and switch on.

Pow! Bang went the fuse, a wisp of smoke arose from the new R636 and the technician's morale plummeted. He'd enough problems without this! Diodes D608 and D610 (1N4007) had this time survived but were nevertheless replaced, along with the still gleaming BUW81A and R636. A more careful check on the chopper driver transistors revealed that the top one, Tr603, had some leakage. A new driver pair was fitted and L601, the coil in series with the base of the chopper transistor, was checked for continuity and good jointing. Since it was o.k. the decision was taken to apply the mains power – from a safe distance! It was a relief to hear the e.h.t. rustle up and the loud sound (why do people always turn the sound and brightness up when a TV set fails?).

It would be nice to think that that was the end of the story, but that's not the stuff of a test case item, is it? Here's the nasty sequel. The receiver was set up and put on soak test, displaying a nice Ch. 4 test pattern. The next patient (a Ferguson camcorder, such is the variety of workshop life) was being anaesthetised on the operating table when a sizzling noise attracted our technician's startled gaze. He just had time to register that the picture on the screen of the Decca set had expanded to about 120 per cent of normal width before the splat of the blowing fuse signalled disaster.

After some totally undeserved comments about the parentage of the Decca design team, the shortsightedness of the storesman in having only three BUW81As in stock and the state of the world in general our harassed repairman went back into the Decca. The only clue he had to go on was that a vast increase in the 120V h.t. line voltage obviously occurred when the fault condition arose. This removed several possible suspects – it was unlikely for example that any of the rectifier diodes (D614/5/6) connected to the chopper transformer's secondary windings were faulty. Why wasn't the over-voltage facility in the highly intelligent TDA2581 chopper control chip being invoked? This depends on the action of zener diode D602, which was tested and exonerated. So what was going on? We'll explain next month.

ANSWER TO TEST CASE 277
– page 187 last month –

The diagnostic procedure adopted to track down what appeared to be a straightforward fault in a Fidelity CTV14 was somewhat shaky. The set had no line lock, and no amount of adjustment and component replacement in and around the line oscillator circuit had any effect on the display.

Careful study of the circuit diagram at the outset would have revealed that the line oscillator in the TDA1180 i.c. is not used to drive the line output transistor directly, and here lay the key to the solution to the fault. The line drive output from the TDA1180 is used to synchronise the oscillator in the TDA2581 chopper control i.c., the line output transistor being driven by a secondary winding on the chopper transformer. If for some reason the TDA2581 chopper control chip doesn't lock to the sync from the line oscillator the scan frequency depends on the timing components R816 and C818 connected to pin 13 of this i.c. Though the problem could have been caused by failure of one of the line drive/sync coupling components R616/C811, the cause of the trouble actually lay within the TDA2581 itself. This was the item that had to be ordered, the replacement providing a complete cure.

To think that every time we wound the line hold control to and fro everything was happening correctly within the TDA1180 – a scope or counter connected to pin 3 (line drive output) of this i.c. would have revealed all!

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by The Riverside Press Ltd., Thanet Way, Whitstable, Kent. Distributed by IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £13, overseas (surface mail) £15 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

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BA318	£1.30	HA11710	£5.50	LA4500	£2.50	STK5211	£6.75	UPC561C	£2.00	UPC1366C	£1.50	2SC930D	£0.30	2SK19	£0.50
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- LA-4400 190p
- LA-4420 140p
- LA-4422 130p
- LA-4430 130p
- LA-4460 170p

- LA-4461 180p
- LA-5112 120p
- LM301 26p
- LM311 35p
- LM324 35p
- LM325 45p
- LM339 40p
- LM348 60p
- LM380 100p
- LM381 160p
- LM382 130p
- LM387 100p
- LM709DIL 30p
- LM723 40p
- LM741DIL 18p
- LM741 MET 45p
- LM747 58p
- LM748 35p
- LM1458 33p
- LM3900 30p
- M-51513L 180p
- M-51515BL 270p
- M-51516 280p
- M-51517L 280p
- MB3712 150p
- MB3730 260p
- MB3756 260p
- MC1327 70p
- NE555 20p
- NE556 40p
- SAS560 110p
- SAS570 110p
- SN76003N 140p
- SN76013N 140p
- SN76023N 140p
- SN76033N 150p
- SN76110N 70p
- SN76115 70p
- T2800D 52p
- TA-7120 55p
- TA-7137P 83p
- TA-7146P 400p
- TA-7193P 400p
- TA-7200 200p
- TA-7201 200p
- TA-7203 180p
- TA-7204 110p
- TA-7205 80p
- TA-7210 200p
- TA-72222AP 120p
- TA-7310P 100p
- TA-7609 270p
- TAA550 16p
- TBA120S 45p
- TBA395 60p
- TBA396 60p
- TBA520 100p
- TBA530 100p
- TBA540 100p

- TBA560 100p
- TBA750 100p
- TBA800 35p
- TBA810S 60p
- TBA820 75p
- TBA920 100p
- TBA950 100p
- TBA990 100p
- TCA270 40p
- TCA800 200p
- TCA940 100p
- TDA1170 100p
- TDA1412 60p
- TDA2002 80p
- TDA2003 150p
- TDA2020 140p
- TDA2030 140p
- TDA2522 90p
- TDA2530 100p
- TDA2532 100p
- TDA2540 100p
- TDA2560 100p
- TDA2593 100p
- TDA2690 100p
- UPC-555H 60p
- UPC-556H 80p
- UPC-575C2 100p
- UPC-577H 64p
- UPC-592H2 95p
- UPC-1001H 220p
- UPC-1025H 230p
- UPC-1026C 105p
- UPC-1028H 90p
- UPC-1031H2 180p
- UPC-1032H 70p
- UPC-1155 200p
- UPC-1156H 140p
- UPC-1181H 115p
- UPC-1182H 150p
- UPC-1185H2 250p
- UPC-1350C 150p

74LS SERIES

- 74LS00 17p
- 74LS01 17p
- 74LS02 17p
- 74LS03 17p
- 74LS04 17p
- 74LS05 17p
- 74LS08 17p
- 74LS09 17p
- 74LS10 17p
- 74S11 17p
- 74S12 17p
- 74S13 26p
- 74S14 30p
- 74S15 17p
- 74LS20 17p
- 74LS21 17p

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- 74LS24 38p
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- 74LS27 17p
- 74LS28 17p
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- 74LS33 17p
- 74LS37 17p
- 74LS38 17p
- 74LS40 17p
- 74LS42 39p
- 74LS47 70p
- 74LS48 60p
- 74LS51 17p
- 74LS54 17p
- 74LS55 17p
- 74LS73 28p
- 74LS74 26p
- 74LS75 32p
- 74LS76 28p
- 74LS78 34p
- 74LS83 46p
- 74LS85 50p
- 74LS86 30p
- 74LS90 39p
- 74LS91 75p
- 74LS92 46p
- 74LS93 40p
- 74LS95 52p
- 74LS96 63p
- 74LS107 35p
- 74LS109 36p
- 74LS112 38p
- 74LS113 32p
- 74LS114 38p
- 74LS122 44p
- 74LS123 50p
- 74LS124 85p
- 74LS125 36p
- 74LS126 42p
- 74LS132 44p
- 74LS133 34p
- 74LS136 35p
- 74LS138 38p
- 74LS139 40p
- 74LS145 83p
- 74LS147 120p
- 74LS148 110p
- 74LS151 38p
- 74LS153 42p
- 74LS154 100p
- 74LS155 51p
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TOP 50 VIDEO SPARES

CASSETTE LAMP (FERG/JVC)	£1.80	PINCH ROLLER (SANYO)	£7.95
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ITT S/STATE £25
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PHILIPS KT3 .... **P.O.A.**
THORN TX9/TX10 .... **P.O.A.**

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Working sets From **£12.00**

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Now in stock V.H.S. V.C.R.s from £60 plus full range of Thorn remote control including T/Text

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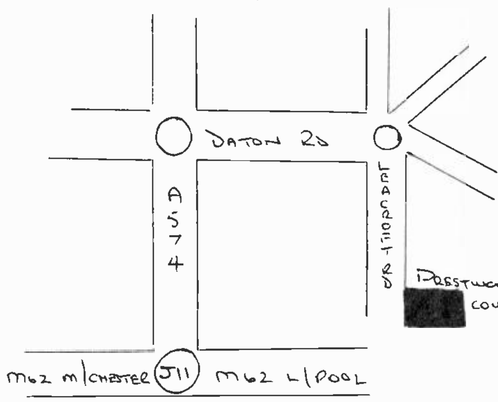

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Open 6 days 9 - 5.30 (later by appointment)

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WITH MONOLITH MAGNETIC TAPE HEADS

DOES YOUR VCR GIVE WASHED OUT NOISY PICTURES – ITS PROBABLY IN NEED OF A NEW HEAD – FAST FROM OUR *EX-STOCK* DELIVERIES. SAVE £££'s ON REPAIR CHARGES.

Our universal replacement video heads fit all models of VHS or Betamax VCR's. Following our replacement guide and with a practical ability, you can do the whole job in your own home with our head replacement kit.

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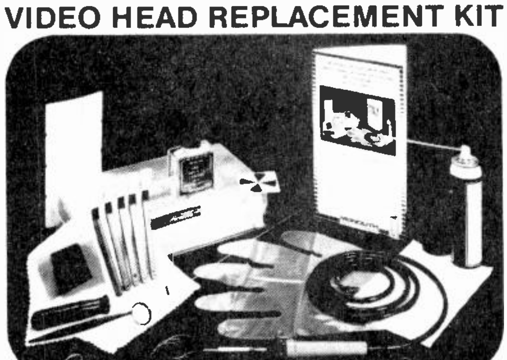

VMC-02 KIT ONLY £19.95 inc. VAT. + £2.50 p&p

TELEPHONE US NOW FOR INFORMATION OF THE REPLACEMENT HEAD FOR YOUR VIDEO RECORDER.

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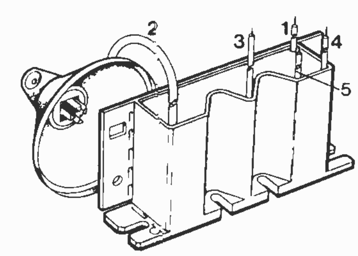

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Bush T20	X	12	16	15	12
Bush T26	X	16	18	15	X
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THE COMPANY THAT CARES

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Colour TV from **£5**, Videos from **£25**, G8's from **£7**, G11's from **£29**, Remotes from **£35**.
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AND OUR SPECIAL JANUARY DEAL
SPEND OVER £250 ON SELECTED TV IN JANUARY
AND GET A CASE OF WINE FREE
GIVE YOURSELF SOMETHING TO CELEBRATE WITH

So grab the cash £££ wagon and head in our direction

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FOR M18 – M1

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Thorne 9000 Remote Control	£42.50
Pye G11	£47.50
Rank T20	£42.50
Pye Chelsea 6 Button	£27.50
Pye 725	£37.50
Pye 721	£27.50
Thorne 9600	£45
Thorne 9200	£42.50
Bush T20 Remote Control	£49.50
Bush T24	£55.50

All above prices include hand sets if available
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Phone now, limited number each month. All the above off the pile, less a 3rd

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RANK BUSH MURPHY
TRANSFORMERS

Line Ouput
Z718 (T703A, T706A)

New (Complete)	**£19.00**
Less Focus Module and Rectifier	**£10.50**
T20, T22 (T705A)	**£11.00**
T26 (T705B)	**£11.00**

TDA2190 Plug-in Replacement module suitable for Bush T22/26 and any set using same device **£6.00**

Switch Mode
T114A **£6.00**

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25 YEARS SUPPLYING THE TRADE

COLOUR TV'S AND VIDEOS
H.P. REPOS AND EX. RENTALS

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(NOT D.E.R. Etc.)...........£65
GEC 2010..........................£20
PYE 222............................£20
PHILIPS 550......................£15
BUSH 718.........................£20
BUSH 2 CHIP.....................£8
GRUNDIG 5010...............£10
PYE KT3..........................£50
GEC 2213.........................£30
THORN 3000.....................£7
GRUNDIG G415/4206

Best Stock in the Country — over 2000 in stock (90% of our TV's Switch on)

Special Price Quoted For Bulk Purchases From Source.

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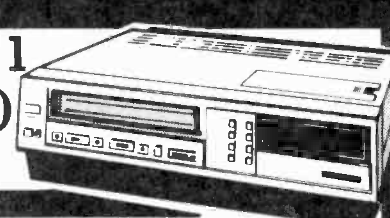
PYE KT3......£70, Others done to order.
DISCOUNT FOR QUANTITY

VIDEO

SHARPS 7300,8300,9300,HITACHI,VT11
FERGUSON 3V29 (Not Ex D.E.R. etc.)
SANYO, SONY, BETA



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THORN 8/8½	–	–	10.00	5.00	–	5.00
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*Please specify prefix A or Z.

Please add 15% VAT to above prices, then add post + packing.
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Hybrid panels do not include valves. *Terms cash with order.*

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ALL SETS TESTED & WORKING

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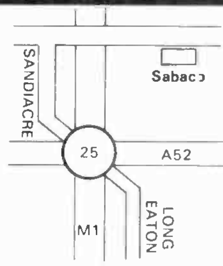

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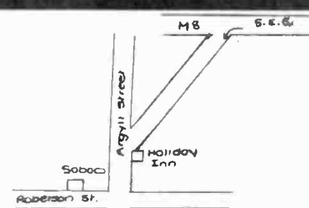

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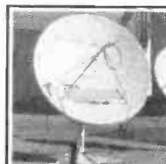

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VM6501 £6
Designed to work at 1200/75 or 1200/1200. Diagram and Connection Data Supplies
Indicator Tube
ITT 58705 £1
8 Seg Display FND500 20p
Mullarad 12.5V/170 Mc/s 45 watts
BLW60C £4.00
Mullard Broadband R.F. power modules UHF. BGY22E £10.00
PT4236C, PT8706C, PT9783 £3
ITT Micro Phone M5 50p with switch
Sub-min Relay low voltage 50p
Mains relay coil 230v 30p
Philip PP3 batterys 10 for £3
12v battery holders A.A. 50p 1.5 battery
T/V 12v 2 pin battery lead 30p

Various Tools and Accessories
T/V V/Aerial 300Ω or 75Ω £1.50
L.C.D. clock display with alarm 75p
* D/P push mains switch 20p each
Mains lead & two pin socket for radio cassette 35p
3 Video Leads £1.00
Xcelitr cutter £3.90
T/V loop aerial 75p
Radio Telescopic Aerial £1.00
Philips Neon Lamps for TV sets 5p
Freeze £1.20
Foam Cleaner £1.20
Contact Cleaner £1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona All at £1.20
Push Button Mains 75p
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt £1.00
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket £3.00
Sellotape PVC Electric Insulation 50mm × 20M 70p
Screen locking agent, large can £1.50
20 GEC Service Manuals £5.00
Red E.H.T. LAED and Anode Cap £1.00
10 × G11 Cap 470/250 £15.00
Weller solder iron 15 watt/25 watt £5.00
2 way baby alarm/intercom with long leads £5
Phillips universal battery tester/charger, fuse/bulb tester To Clear £4
12V Nicad pack. "AA" £2.50
Hitachi 7.2v/1.8A Nicad pack £6.00
Hitachi TP 007 Battery pack 7.2v/1.6A £7
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 60p
70ML Silicone Sealer (clear) £1
100 Coax Plugs £12.00
De-solder pump + 2 nozzels £5.20
Plastic box for i.c.s 6″×3″×½″ 50p
Can of handy oil 'mobil' 40p
Flat Red LED 12p
500gm 60/40 solder reel £7
Clearweld glue pack 30p
Dual v/u meter -20 – +10db £1
K30 thermistor 232266298009 75p
GEC Mains Power Supply R.E.G. £3.00
1Kg reel of solder £8.00

75R/25 Watt 25p
18R/11 Watt 25p
Front End Music Center. VHF/MW/LW 13″×3½″ £3
Output Stage for music center £5
SONY 1400KV Chroma Panel £6
SONY 1400KV Tuner unit £3.50
SONY 1400KV Touch button unit £3.50
12 Volt Mains Trans 500M/A £1.00
18V or 12 Volt Mains Trans 500M/A 75p
Texas Viewdata Decoder VDP 12/80 Issue 3 with all IC's £10.00

Quantity Reductions
BY204/4 25 for £1.00
BY206 25 for £1.00
W005 bridge 20 for £2
KT3 touch button black 6 for £1
G11 touch button red 6 for £1
K30 full remote Dawer Ass with 3 I.C. £7.00
K30 VHF. UHF Dawer Ass £6.00
BY298 3 amp/fast/R 20 for £1.50
BU126 10 for £6.00
BU205 10 for £8.00
BU105 10 for £6.00
2SC2122A 10 for £8.00
BF458 10 for £1.00
BD136 10 for £1.25
BF224 20 for £1.40
OA90 40 for £1.00
BYX10 100 for £4.00
KT3 multicaps 10 for £7.50
50 Ceramic Condensers £1.50
Mixed Mounting Kit for Power Transistors 50p
300 Condensers £1.50
300 Resistors £1.50
150 Electrolytics £2.00
15 Bulbs 40p
Antistatic Discloth 5 for £1
100 Diodes £1.50

Plastic Boxes 4¾ × 4 × 1 × ¾ 50p
100 Fuses £2.00
100 W/W Res. £1.50
BF 199 20 for £1
10 × 20 Turn 100k pots. Rank £2
Thorn 9 volt power supply regulated £3.00
BF 470 20 for £2
20 Slider Knobs 70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

Mixed Packs
TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits £1.00
50 Mixed AC series Transistor £4.50
15 Panel mount rocker switch 250V/10A £1.50
25 Panel Mount Bulbs & Neons 10A £1.50
25 LED red/yellow/green £1.50
20I/C Holders £1.20
20 Large LED Red £1.00
20 Small LED Red £1.00
10×20 Turn 100K Pots £1.00
100 Transistor £2.50
20 Convergence Pots 80p
10 Thermistors 50p
20 Slider Pots £1.00
30 Presets 50p
15 VDR + thermistors, degaussing, HT, etc. £1.00
40 glass reed switch £1
10 press to make switch 70p
40 Pots £1.50
5 Tube Bases £1.00
1,000 Diodes, Condensers, Resistors on Bandolier £2.00
Lucky Dip 600 gram £1.00
Jungle Bag 5Kg £5.00
20 Knobs £1.00
20mm Fuse Holders Chassis Mount 20 for £1
IN4001/6 100 mixed £2.50
EHT Diodes, small 20 for £1
20 Mixed Switches £1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Thorn Spares

New 9000 Decoder £8.50
9000 Frame panel £8
9000 Cyclops panel £1.50
8000/8500 timebase panel £8
8800 convergence panel £6
8500 convergence panel £6
4000 Power supply £3
1600 Mains lead, switch
3500 6 push button + cable form £1.50
T605 1vNPN T066 80v/6A 10p
9000 Sound output panel £1
3500 Focus unit £1.50
3500 Mains Trans £4
3500 cut outs 10 for £4
3500 IF panel £2
3500 Frame panel £3
3500 Line panel £3
3500 A1 Diode 20p
Export 3500 IF panel £2
IC board with set of SN74LS £1
4000 Tube base £4
3500 A1 pots 50p
Beam limiter panel £1.50
3500 Power panel with Y969 £1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA £3.50
Rank/Toshiba preh unit 0354 £9.50
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 fits GEC & Decca etc. £6.00
Hearing aid unit £3
Rank Z718 + P/B/Unit MECII £4
7 Button Unit GEC with Lamps £7
Bush T515A 6 button unit with Pos & mains lead, 6 bush buttons, Bush £6.00

Mains Droppers

G8 2R2+68R £1.25
G8 47R 15 watt 75p
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
7×3¾ Thorn £1
Thorn 1600-1700 £1.50
Rank Toshiba Tube Bases 30p

Speakers

Pair 25 watt 4Ω speaker & tweeter in cabinet £15.00
6×4 G11 25 ohm £1.00
5½×2½ 3 ohm £1.00
5×3 80 ohm 70p
5×3 50 ohm 50p
5×3 35 ohm 70p
6×4 15 ohm £1.00
7×3 70 ohm £1.00
8×5 8 ohm 15 watt £2
8×5 8 ohm £1
5×3 8 ohm 70p
7×3 16 ohm £1.00
5" dia 16 ohm £1.00
5" dia 8 ohm £1.50
6½" dia 4 ohm £1.50
6½" dia 3 ohm £1.50
2¾" dia 8 ohm 75p
3" dia 8 ohm 75p
4½" sq. 15 ohm 75p
KT3 speaker K30 75p
3" dia 15 ohm 60p
1690 5×3 12 ohm £1
K45 Philip 15 ohm 75p
K30 15 watt £1

KT3-K30

OF-550 E.W. 10p
OF-513 correction 10p
OF-557 50p

DIODES

BY 126 10p
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 210/800 10p
BY 223 60p
BY 224/600: 4.8A/600v bridge 50p
BY 226 15p
BY 227 15p
BY 229/400 30p
BY 237 5p
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

International Rectifier EHT Diodes G770/H1V34 6KV 3 for 8p
6A/600V Stud Diodes 20p
6A/1000V Stud Diodes 20p

KT3 Decoder £8
K30 Sound OP £4

Hitachi 2A/1500V metal case wire end FARST/REC 10p

Fidelity Tube Base with transitor & focus pot £1.50

Bush Tube Base on panel £1.00

Line Transformers

1690 Lopt £6
Hitachi Split Diode and GEC 1981 to 1984 £13
2 J/Pots 3,500 1 off each type £3.00
G8 Symmetry Coil £2.00
G8 Trans. Philips £7.00
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B W AD5308F + Stik + Lead £1.50
1690 Thorn EHT over-wind with diode lead & anode cap £2.50
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
Split Diode Trans £7.00
GEC 20 AX Rank Z522 £3
Rank L.O.P.T. Z970 £3
CVC 5-8-9 £3.00
CVC20 ITT £3.50
AT2080/15 £5.00
CVC30 ITT £5.00
CVC32 Line Tran £4.75
CVC800 Line Trans £6.00
CVC40 Slip/Diode £12.00
CVC 45 £5.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
FHT Split Diode Leads ITT £1.00
3500 L.O.P.T. & HT Trans each £2
LOPT Rank Z763 £5

Triplers

ITT CVC 5-8-9 £3.50
Rank T25LE Tripler £2.00
Rank 11TCP A823 £3.50
TU 25 30K Rank £3.00
11 TFZ Rank £3.00
G9 Philips £4.00
GEC 2110 £4.00
3500 Thorn £3.00
9000 Thorn £5
9500 Thorn £4.50
2040 GEC £3.50
GEC TVM25 Tripler £2.00
Universal Tripler £5.00
TVK 76/9 £3.00
G8 £4.00
CVC 825 ITT CVC 20/25/30/32 £3.50
Decca 80 100 £4.50
Grundig TVK 52 £2.50
11TBQ Pye 731 £3.00
11TBY £4.00
D22 for Pye 18" colour portable £4.00
LP 1193/63 £4.00
BG 100/41 £3.25
T/text ultrasonic rec'r panel £14.00
Video cassette lamps on lead 12-14V 50p or 3 for £1.00
20 for £5.00 200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
G11 E W. Transformer 50p
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 £1
K30 drawer unit with IC's (home) £10
K30 drawer unit with IC's (export) £10
KT3 AE Sockets 50p
KT3 receiver panel £8
KT3 line driver transformer 50p
Pye, K30, GEC, etc. Pre-mains stand-by switch £1
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
KT3 Front Panel Control Assy. £2.50
BTW 30/50 50p

TELETEX DECODER

I.C. SAA 5051 K30
I.C. SAA 5042
I.C. SAA 5030
I.C. SAA 5020 etc. £8.00

BTW 92/800R £3
2SA473 PNP C/P 10p

NEW 1617 THORN Chassis with ICs & AU113 £8.00
30V Power Supply 500M/A 4×2¼ £2.50
Pye 731 Power Panel £13
6 Diode Universal Triplers £4.00
NEW PYE 725 line O/P panel with L.O.P.T. & Tripler £10.00
NEW GEC 20AX Power Supply Switch Mode £12.00
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 205 T/unit £3.90
Pye 205 Line op panel £7.50
Pye 713 IF panel and tuner £7.00
Pye 713 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 Chroma £10.00
Pye 731 IF panel + tuner £10.00
Pye CDA/205 panel £6.00
GEC portable chassis + LOPTI 2114 New £4.00
Thorn 1613/1713 chassis 9.75
G9 Power Panel £6.00
Mono RANK Chassis 127A NEW £10.00
NEW G9 Frame Panel £10.00
NEW G11 IF Panel £10.00

NEW MULLARD TELETEX

Panel 6101 £6.00
G8 Tuner Unit + Panel £4.00
G8 Power Supply £5.00
G8 6 Sloping PBU £8.00
G8 IF & Chroma £10.00
G8 Chroma £3.00

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 1 I.C. SL437F £3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q £2.50
K35 IF £6.00
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
Pye 6 button switch portable £1.00
GEC V/cap VHF/UHF tuner and IF+sound O/P PC 706B3 (Export) £12.00
GEC Line O/P PC 659B3 £6.00
2110 GEC Power Panel £8.00
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
CVC9 slider pots panel 50p
CVC 5 Mains on/off + 5 pots £2
Universal Focus. Fits Pye, Thorn and Decca Units.
T147 Rank tube base on panel £1.00
Z718 Focus Unit £1.50
T20 Focus Unit £1.00
Large Type 75p
Decca Small 75p
KT3 Focus Unit 75p
K30 Focus Pot 75p
K30 Tube base on panel £1.00
TX10 Focus Units £7.00
CVC 32 Focus Unit 75p
Fedility Focus Unit 14R–14S 30p
3500 Thorn Focus Unit £1.00
ITT Small for use with Split
Z718 Bush Focus £2.00
Diode 50p
TV11 50p
Remo TV12SP 50p
1600 Thorn EHT Rec and Lead 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 rec stick 5p

G7000 Philips Video Games Packs 11 types £5

G11 drawer ASS 3 pots Mains switch and lead £2.00

Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228 £10

CLOCK DISPLAY

4 SEG ACDM45 £1 00

4000 thick film £2 00

DISPLAYS

4040 Clock £1.00
7seg Red LED 50p
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
300 300/300V 80p
800/160 50p
.1/250 Pulse 5p
2,2 250v 10p
3n3/250 A.C. 10p
.33/250V 20p
.39/250V 15p
4n7/250 tested 5KV 25p
.91/250 35p
.91/400 30p
22/250 15p
47/250 10p
100/250 20p
G11 470/250V £1.75
GEC600/250 60p
700/250 £1
300+300 MFD 350v £1.00
800/250 40p
32/300 20p
4/350 5p
8/350 8p
4.7M/350v 10p
33/350 20p
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
0.1/1200V wire end 20p
0.1/450 A/C wire end 20p
.047/600 15p
0.047/1000 10p
0.01/1000 10p
0.1/1000 10p
.47/1000v 65p
.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
.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
3000PF/3000V 10p
4n7/2KV 15p
8n2/2KV 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
.47/100V 80p

CVC 20-25-30 Mains Switches 75p
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
Mains Switch ITT Long Type Print 75p
Mains Switch Philip Long Type TAG 75p
Mains Switch GEC Long Type TAG 75p
Thorn 12 or 24 volt battery convertor for portable colour T/V £6.00

Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF T115A £13.00

Multi-Caps

4,700/75 6 amp Rip £2.00
350V 300M + 300M £1.00
400V 400M 60p
350V 400M 60p
Thorn 3500
175/100/100/350v £1.00
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
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
225+25/380 GEC 70p
200/100/100/350v £1.50
500/500/25v 50p
150/150/100/300v 75p
200/150/150/300v 1.00

ITT Panels

CVC 40/2 Chassis, new £30, complete with intrfase panel
CVC 820 Line O/P Panel
CVC20 Mains Panel £3.00
ITT 8 & 6 Push Button Unit £1.00
CVC40/2 New Chroma Panel £10.00
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
CMD 800 £10.00
CMF 25 £2.00
CMF 26 £2.00
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 40 £2.00
CMS 11 £2.00
CMS 40 £2.00
CMU 12 £10.00
CMU 14 £8.00
CMU 30 £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

G11 Ultrasonic Teletex Handset £24.00
8 C H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £24.00
Rank, Infra-red £10.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18
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
Philips Key Pad set KT3.K30 £3.00
KT3/K30 T/Text £15.00
KT3/K30 Full remote £15.00
KT3 Power supply £4.00
Hitachi 8 button unit with resistor unit. Last year mod. £7.00
GEC infra-red 2236-2026 £4.00
GEC push pad hand set button blobs **10p each**
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177
Special Price £13.00
ITT Hand Set with TV-Teletex-VCR £12.00
RC4001 £17.00
Philips Tops for Teletext & Full Remote KT3-K30 £9.75