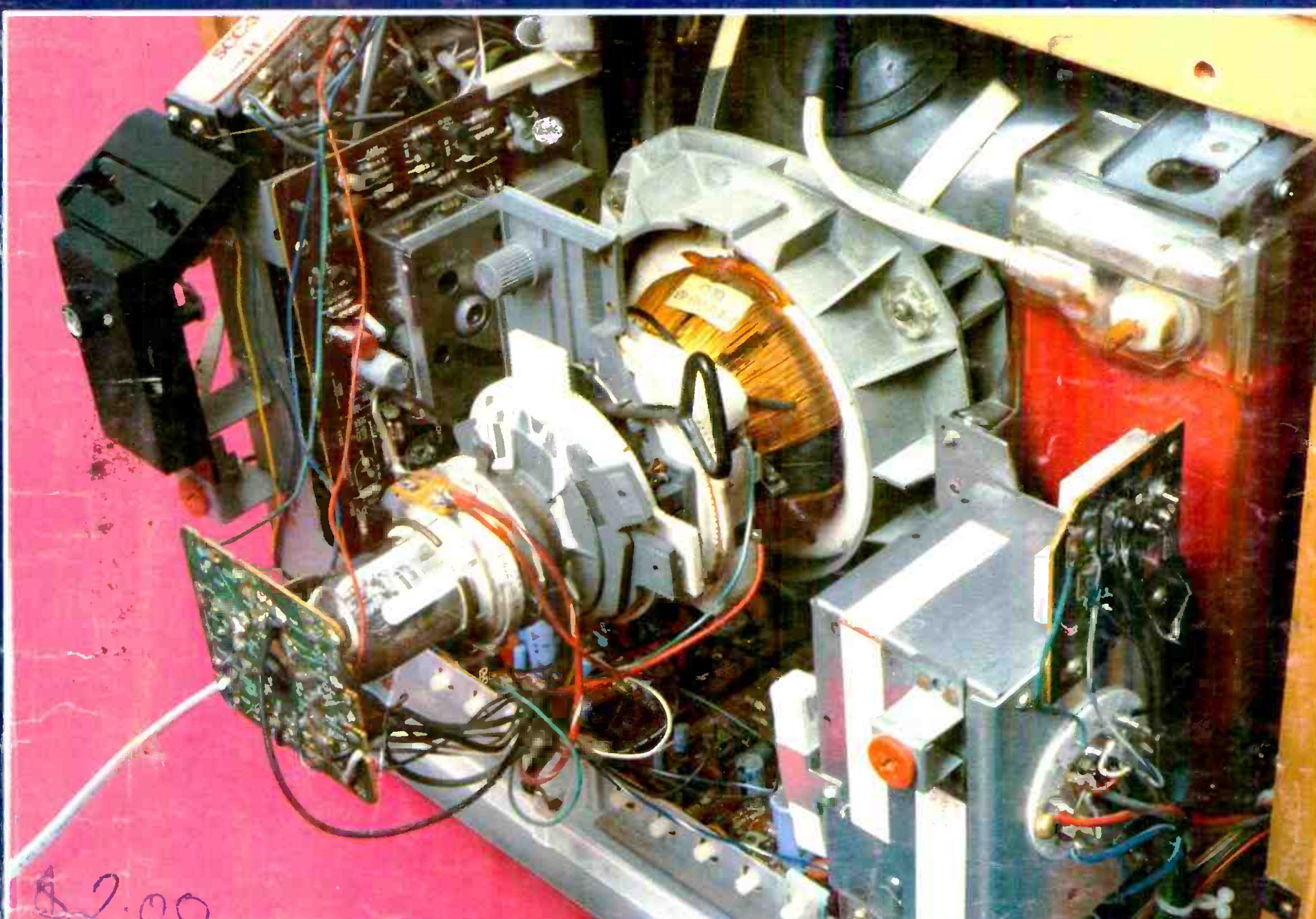
JANUARY 1987

Australia $2, New Zealand $2·75 (inc. GST), Malaysia $5·75 £1·20

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Servicing the Sony KV1800UB

TV Behind the Curtain

CRT Heater Voltage Checker

Brushless DC Motors • DX-TV

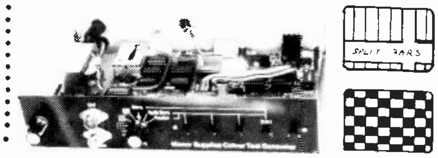
Designing Active Deflectors

TV Fault Finding • VCR Clinic

MANOR SUPPLIES

MKV PAL COLOUR
TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE



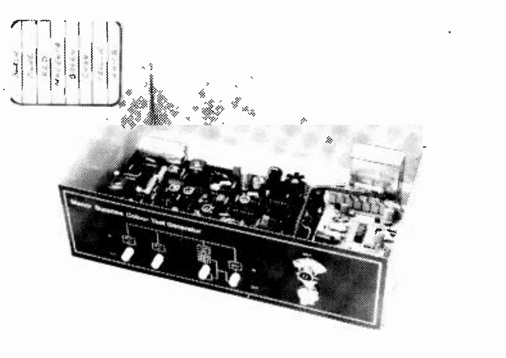
- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
-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

Price of Kit	**£70.00**
Case (10″×6″×2¼″) app.	**£8.60**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£108.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

Post/Packing £2.50
Add VAT 15% TO ALL PRICES

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 £8.60. 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.
VHF MODULATOR (CH 1 to 4) FOR OVERSEAS £5.75.
EASILY ADAPTED FOR VIDEO OUTPUT & C.C.T.V.

ADD VAT 15%

THORN TX9 MK2/3, TX10, teletext
Mullard Decorder panel + Interface **£35.00** p.p. £1.80
THORN TX10, PHILIPS G11 PRESTEL, TELETEXT
Mullard Units VM 6230, 6330 plus Line Coupler & Interface **£38.00** p.p. £2.50

EXTERNAL TELETEXT ADAPTOR
(RADOFIN) with cable remote control. Fully tested. **£150.00** p.p. £3.00. Plugs into aerial socket of any T.V.

TV SERVICE SPARES

BACKED BY TWENTY YEARS EXPERIENCE & STAFF OF TECHNICAL EXPERTS

LOPTs, TRIPLERS, PANELS, TUNERS, SELECTORS ETC.

SPECIAL OFFER Mullard/Philips quality UHF modulator (audio & video input) ex new equipment **£5.00** p.p. £1.00.
PHILIPS G11 6 position touch tune channel selector units **£16.00** p.p. £1.80 (can replace earlier mechanical selector unit).
PHILIPS G11 PANELS (tested).
Power, frame, IF decoder **£18.00** each p.p. £2.00. Scan Panel **£28.00** p.p. £2.80.
PHILIPS G11 PANELS ex rental (untested).
Power, frame, IF, decoder **£10.00** each p.p. £2.00.
PHILIPS HANDSETS Ex rental. Teletext, Untested. KT3, K30, CTX, KT4, K35 etc. **£3.50** p.p. £1.00.
FERGUSON Video Manual 3V24 **£8.50** p.p. £1.50
COLOUR MANUALS p.p. 50p.
FERGUSON 9800 **£2.00.**
PHILIPS G11 **£3.80,** KT3 **£3.80,** CTX-E **£1.50,** CTX-S **£1.50.**
GRUNDIG incorp. GSC200, 1644GB, 1645GB, 4245GB, 4445GB, 6245GB, 6445GB + CUC95 **£2.00**
THORN REMOTE CONTROL HANDSETS
TX9 ULTRASONIC (3-button) **£15.00; TX9, TX10** Infra red **£18.00; TX9, TX10** Infra red Teletext **£20.00,** p.p. £1.20.
THORN ex rental handsets untested 9600, TX9, TX10 **£5.00** p.p. £1.00.
TX9 Ultrasonic remote handset transducer **£2.00,** switches 3 for **£1.50** p.p. 50p.
TX9/TX10 Teletext interface panel (1524) **£5.00** p.p. 80p.
THORN TX9 Ultrasonic Remote/Control/Receiver panels. **£8.50** p.p. £1.50.
THORN TX10 Series Facia Control Panel with 8 position Channel Selector **£6.50** p.p. £1.50.
TX9, TX10 Facia control panel incl. infra-red remote control receiver **£8.50** p.p. £1.80.
TX9, TX10 Remote & tuning control panel (1515) **£10.50** p.p. £1.80.
SAW FILTER IF AMPLIFIER PLUS TUNER complete and tested for T.V. Sound & Vision. **£28.50** p.p. £1.20.
THORN TX9, TX10 Saw Filter IF Panel. **£5.00** p.p. 80p.
PAL DECODER KIT (Video to RGB) for Monitors **£27.00** p.p. £1.00.
PAL ENCODER KIT (RGB to Video) **£18.50** p.p. £1.30.
TELETEXT DECODERS New & Tested Mullard VM 6101 **£30.00,** Texas XM11 **£28.00,** KT3 Tested **£30.00,** Untested **£5.00** p.p. £1.60
CROSS HATCH UNIT KIT, Aerial Input type, incl. T.V. sync. and UHF Modulator. Battery Operated, also gives Peak White & Black Levels, can be used for any set. **£12.00** p.p. 80p. (Alum. Case **£2.90** p.p. £1.40.) **ADDITIONAL GREY SCALE** Kit **£2.90** p.p. 45p.
UHF SIGNAL STRENGTH METER KIT £22.00 Alum. Case **£2.90.** De Luxe Case **£8.60** Built & Tested **£48.00**) p.p. £2.30.
CRT TESTER & REACTIVATOR KIT For Colour & Mono complete with Case, Panel Meter Indicator – can be adapted for latest CRTs **£29.50** p.p. £2.80.
BUSH A823 Convergence, Time Base Panels **£5.00** each. p.p. £1.80.
GEC 2110 PANELS Sound **£2.50** (tested) p.p. 80p.
GEC 20AX Line Time Base **£18.00** p.p. £2.00.
THORN TX9 Panels ex factory for small spares. Includes I.Cs & Semiconductors etc. **£3.00** p.p. £1.80.
THORN TX9 Panels salvaged ex factory for spares incl. LOPT & Mains Transformers. **£10.00** p.p. £3.00.
THORN TX9 Panels ex factory salvaged complete cond. **£20.00** p.p. £3.00.
THORN 8000, 8500, 8800 IF Decoder Panels Tested **£10.00** p.p. £2.30.
THORN 8000/8500 IF/Decoder Panels salvaged **£3.20** p.p. £1.80.
THORN 9000 IF/Decoder Panels Salvaged. For spares **£2.50** p.p. £1.80.
THORN 9000 Frame Time Base **£8.50** p.p. £1.80.
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U321 VARICAP £7.80 p.p. 80p. Makers Controls PYE CT200 4PSN **£8.50,** BUSH 4PSN **£4.80,** DECCA 4PSN **£5.80,** 6PSN **£6.80** p.p. 80p. etc.
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DECCA 1700, 2001, 2020, 2401, 2420	**£3.80**	**PYE** 725 (90°) 731 to 741	**£9.20**
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SPECIAL OFFER TRIPLERS
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6·3V CRT Boost Transformers for Colour & Mono **£5.90** p.p. £1.40.
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TELEVISION

January 1987

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Issue 435

On sale December 17th

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

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Some back issues published during the last six months are available from the Editorial Office at £1·40 inclusive of postage and packing. Address as above.

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

this month

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SEMICONDUCTORS

AC107	35
AC126	34
AC127	34
AC128	34
AC128K	40
AC141	62
AC141K	39
AC176	35
AC176K	35
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AF126	53
AF127	53
AF139	63
AF178	1.54
AF239	60
AF279	1.56
AL102	4.90
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AU113	5.20
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BC108	20
BC109	20
BC114	12
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BD150	60
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BD160	1.60
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BD202	91
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BD510	86
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BD697	1.63
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BF225	20
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BF256	60
BF257	34
BF258	34
BF259	34
BF262	84
BF263	81
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BFX85	30
BFX86	30
BFX88	46
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BFY51	32
BFY52	32
BFY90	95
BR100	34
BR101	95
BR103	83
BR303	1.46
BRC4443	94
BRC4444	98
BRY39	56
BRY55	45
BRY56	57
BSR59	1.80
BSV57B	89
BT100	1.65
BT101	1.20
BT106	1.60
BT108	1.69
BT109	1.31
BT116	1.87
BT119	3.66
BT120	3.66
BT151/800	2.07
BU104	2.00
BU105	1.58
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
BU326A	2.00
BU407	1.70
BU426	3.07
BU500	2.50
BU526	2.46
BU508	3.20
BU806	1.40
BU807	2.94
BU826	4.95
BUW84	1.45
BUX84	1.50
E1222	40
ME0411	20
MJE340	68
MJE520	50
MJ3000	1.98
MPSA92	35
MR814	45
MR854	55
MR475	4.85
MR479	4.85
MR477	4.90
OT121	1.91
R2008B	1.90
R2010B	1.92
R2265	1.50
R2322	84
R2323	67
R2461	1.60
R2540	3.20
RC4558	2.20
RCA16334	90
RCA16029	1.18
RCA16039	1.18
RCA16092	1.18
RCA16040	96
RCA16041	84
RCA16334 =ON447	90
RCA16335 =ON448	90
RCA16957	2.88
TIC45	90
TIC46	60
TIC47	72
TIL32	65
TIL78	48
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP34B	1.06
TIP41C	47
TIP42C	50
TIP47	93
TIP120	65
TIP161	2.15
TIP2955	90
TIP3055	63
TIS91	32
TU106/02	1.80
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3054	60
2N3055	79
2N3702	16
2N3703	16
2N3705	10
2N3706	10
2N3708	17
2N5294	48
2N5296	48
2N5298	69
2SB337	1.86
2N5496	53
2N6107	75
2N6109	81
2SA715	1.98
2SC495	1.10
2SC496	1.31
2SC643A	1.82
2SC1096	1.72
2SC1172Y	5.50
2SC1173Y	1.69
2SC1306	2.73
2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC1986 =2SC1061	2.94
2SC2028	1.82
2SC2029	2.60
2SC2078	2.90
2SC2091	1.34
2SC2166	2.73
2SD870 (Sony)	6.35
DEC1	2.20
DEC2	2.20
THY15/80	2.40
THY15/85	2.40
Transistor mounting kit TO66, TO3, TO220AB	30

INTEGRATED CIRCUITS

AN214Q	3.91
AN240	3.84
AN318	6.37
AN262	4.10
AN301	5.15
AN715Q	3.97
AN6341N	8.97
AN6344	7.85
BA521	2.80
BA536	3.00
CA555	46
CA556	84
CA741	25
CA748	45
CA1532	4.20
CA3065	1.80
HA1151	3.89
HA1342	2.49
HA1306N	2.60
HA1366WR	2.80
HA1377	3.20
HA11219	4.21
HA11244	4.04
LA3350	1.59
LA4031P	3.21
LA4032P	3.15
LA4102	3.37
LA4112	3.25
LA4400	3.05
LA4422	3.28
LA4440	4.07
LC7130	5.93
LC7120	5.87
LC7137	5.50
LM1011	3.25
LM1340T	75
LM8361= MM5387ANN	4.15
MB3712	2.60
MC1307	1.99
MC1310P	1.84
MC1327	1.70
MC1330P	1.84
MC1351P	2.93
MC1349	1.99
MC1350	1.50
MC1352	1.75
MC1358P	1.50
MC1495L	3.00
ML231 ETTR6016	2.20
ML232	2.20
ML237	2.50
ML238	6.00
ML239	2.50
ML922	3.29
ML928	2.18
NSM5807	7.87
MS1513L	2.80
MS1515L	3.28
SAA1025	8.50
SAA1124	5.34
SAA1250	4.99
SAA5000	6.15
SAA5010	6.30
SAA5012	6.50
SAA5020	5.90
SAA5030	8.25
SAA5050	8.50
SAF1032	6.30
SAF1039	7.77
SAS560S	2.07
SAS570S	2.07
SAS660	3.25
SAS670	3.25
SAS580	2.90
SAS590	2.90
SL901B	7.00
SL917B	9.25
SL1310	1.80
SL1327Q	1.20
SL1430	1.58
SL1432	3.36
SL76544	2.05
SL490	1.89
SN76115N	2.27
SN76131N	2.00
SN76226DN	2.72
SN76227N	1.18
SN76533N	1.70
SN76033N	2.49
SN76544N	2.35
SN76660N	80
SN76666N	1.52
SN76530A	1.47
STK015	7.36
STK032 = STK078	13.25
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
STK2129	13.20
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
TBA120AS/SA	1.49
TBA120B	1.30
TBA120SB	1.37
TBA120T	1.47
TBA120U	1.49
TBA1440G	2.20
TBA395	1.75
TBA396	1.75
TBA440N (TBA1441)	2.75
TBA440P (TBA1440G)	2.50
TBA480Q	1.82
TBA510	3.00
TBA520(Q)	1.68
TBA530(Q)	1.38
TBA540	1.76
TBA560(Q)	1.93
TBA570	1.79
TBA690	1.50
TBA641BX1	3.50
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
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
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TDA2002	2.80
TDA2003	1.20
TDA2004	2.52
TDA2006	1.78
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TDA2140	5.95
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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
TDA2576A	3.75
TDA2577	4.73
TDA2581	3.30
TDA2582	2.60
TDA2593	2.95
TDA2600	6.90
TDA2610	3.20
TDA2611A	2.35
TDA2640	2.90
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
TDA3950	4.37
TDA4420	5.55
TDA4600	2.95
TDA4600-2D	2.95
TDA9503	4.21
TEA1009	1.86
UPC554	2.63
UPC566H	2.95
UPC575C2	3.40
UPC576H	2.60
UPC585	3.06
UPC587C2	2.34
UPC1025H	2.95
UPC1026H	1.24
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
UPC1245V	1.35
UPC1277	4.81
UPC1350C	4.15
UPC1353C	4.76
UPC1365C	6.38
UPC1356C2	2.08
UPC1367	2.00
UPC1378H	2.70
UPC1358H	1.88
UPC1360C	2.20
UPC1363C	2.16
UPC1368H2	2.15
UPC1370C2	2.58
UPC1382C	1.08
UPC1384	3.78
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UPC41C	2.80
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2732	3.30
2764	1.87
27128	3.13
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4164	1.60
6264	2.75
6522	4.09
Z80A CPU	1.70
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ZTX213	17
ZTX313	27
ZTX650/1	35
LM1889	2.00
74LS260	0.55

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

BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA157	20
BA318	26
BAX13	4
BAX16	8
BB105G	30
BY122	96
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
BY229	1.06
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX55/600	30
BYX71/600	90
BY224	2.00
OA47	20
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
BY225	37
General Purpose Triac	95
SKE4F	£1.19
SKE5F	£1.19

ZENER DIODES

BZV15 C12/C24	1.24
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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COMMODORE ICs

6510 CPU	5.66
6526 CIA Keyboard Int.	5.11
6569 Col. Vid. Cont.	20.77
6581 Sound Gen.	7.79
901225 Char. ROM	3.37
901226 Basic ROM	6.45
901227 Kernel ROM	3.52
906114 PLA	4.51
4164 RAM	1.60
Timer	84
8701 Clock Chip	5.46

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Commodore PSU	19.95
Commodore Modulator	21.00

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Pair of A-Z/2N2S TV180	8.80
LIN IC Books (data only not Equiv.) LINI	5.95
IC equivalent booklet £3.25 and transistor equivalent booket £3.25	
TDV1 Trans. Data Dictionary	7.50

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2SC 867A		3.07
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2SC 1061= 2SC1986		3.07
2SC 1114		6.57
2SC 1124		1.27
2SC 1316		8.05
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2SC 1364		43
2SC 1413A		9.23
2SC 1475		43
2SC 1962		1.84
2SC 2009		32
2SC 2278		1.24
2SC 2335 Kit		11.18
2SC 2369		4.14
2SC 2551		1.27
2SC 2785		43
2SC 3153		5.12
2SD 257		3.04
2SD 725		11.18
2SD 773		32
2SD 774		1.24
2SD 1164		1.27
2SD 1497-02		5.12
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UHF Tuner BT-871	KV1810UB	48.36
Booster Antenna	SLC7UB	40.79
RF Modulator	SLC6UB	68.30

SONY REMOTE CONTROLS

SLC5UB RM751 (Wired)	29.04
SLC6UB RM-72 (Wired)	22.62
SLC7UB RMT200 (IR)	42.60

SONY SPARES VIDEO/AUDIO HEADS

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Ace Assembly	SLC6UB SYA-676-104-6A rep	49.39
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Video Head DSR-36R	SLC5/C6/7UB	49.39
Video Head DSR-43A	SL8000UB	49.39
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Main Drum Assy	SLC7UB	192.52
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Forward Assy	SLC6UB	4.14
Gear Kit	SLC9UB	8.94
Guide Pin Kit	SLF1/C9UB	6.57
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Pinch Roller	TC204SD	1.84
Pinch Roller	HMK44/44B	1.24
Pinch Roller	TCK55	1.24
Cass Holder Assy	TCK44	1.84
Lever Fwd. Assy	WM2	1.24
F.Wheel Assy	WM2	4.13
Limiter Assy	SLC7UB	3.07
Idler Assy	SLC7UB/C5/3000	1.27
Brake Assy	SLC7UB	1.82
Pulley Load Assy	SLC6UB	1.27
Thrust Bear. Assy	SLC6UB	4.13
Screw Cass. Lid	WM2	32
Coil Spring	WM2	32
Battery Lid	WM2	1.27
Lid Timer	SLC7UB	1.27
Threading Gear	SLT6ME	1.27
C5 C7 Capstan Motor		44.20
C7 Drive Motor		42.89
Pinch Roller	SLC7UB	0.96

SONY SPARES BELTS

Belt	WMR2	1.27
Rubber Belt	TC-GEN	1.27
Take Up	TC-GEN	1.27
Drive	TC-GEN	1.27
Midway Pull	TC-GEN	1.27
Capstan	TC92	1.27
Capstan	TC135/136SD	1.27
Flat New	TC186SD	1.27
Capstan	TC-GEN	1.27
Capstan	HST300	1.27
Take Up	HMK3000UK	1.27
Capstan	HMK3000UK etc	1.27
Fast Fwd-Rwnd	V02850P	3.07
Forward	V02850P	1.82
Motor	V02850P	3.07
Capstan	VP2000	5.61
Forward	SLC7UB/SLC5UB	43
Capstan	SL8000UB	1.27
Extension	SL8000UB	3.07
Drum	SL8000UB	1.82
Fast Fwd Idler	SLC7UB	1.27
Threading	SLC7UB	43
Capstan	SLC7UB/CS	1.27
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Counter	SLC7UB	43
Fast Forward	SLT7ME	1.27
Forward	SL8000UB	1.27
Belt	SLC6UB	1.27
Fast Forward	SLC6UB	1.27
Counter	SLC6UB	1.27
Threading	SLC6UB	1.27
Relay	SLC6UB	1.27
Capstan	SLC6UB	1.82
Belt	PS-5520 etc	3.18

SONY SPARES SWITCHES

Sw.(Sfce wave) Filter	KV2022UB	1.27
PB Switch Channel	1820/2 & 1340	18.86
PB Power	KV-GEN	3.87
PB Switch	SL8000UB	1.27
PB Power	KV14/2060UB	4.14
Sw. Power	KV2022UB	5.12
Sw. Slide Record	SL8000UB	1.27
Sw. Slide Rec/pback	SL8000UB	1.82
Sw. On/Off	KV1612UB	5.12
Sw. Power	KV-GEN	5.12
Button Stop/Eject	WM4	1.27
Control Knob	SLC7UB	1.27

SONY SPARES MANUALS (Zero VAT)

Instruction Manuals	
SLC9UB	4.14
SLC6UB Mk 2	2.47
SLC7UB	4.14
SLC5UB	6.84
SL6UB	1.72
KV2212UB/E2	1.72
KV2705UB	1.72
Service Manuals	
HMK3000	8.25
KV1400UB	8.25
SLC7UB	9.23
SLC5UB	9.23
SLC6UB	9.23
SLC9UB	9.23
SLC6UB Mk 2	9.23

PHILIPS – CTX

CTX EHT Leads	7.36

THORN SPARES

SEMI-CONDUCTORS

GL4850	TX10	74
TIC45	TX9	1.18
T9022W	TX9	43
T9053/4	TX9	1.10
AN6360	3V29	6.81
HA11741	3V32	23.22
M293	TX90	7.10
M50790SP	3V35	6.98
M54544L	3V32	3.80
MC13002		4.98
MC14493	TX9/TX10	2.74
MN1219	3V36	11.43
TDA1236	TX10	3.44
TDA3652	TX18	6.00
TDA4500	TX90	5.84
SL490	TX9/TX10/TX100	
DTC144WF	3V35	30
R2540	9000	3.20
TIP112H	TX9#	69
T5051V	TX9	3.43
T6069V	TX9	38
T6071	TX100	1.46
T9063V	TX9	3.64
19064V	TX90	1.14
UPD553C 164	3V29	20.76
UPD7519G 031 036	3V36	17.13
UPD7538C 020	3V38	11.06
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Service Manual	3V23	30.62
Service Manual	3V24	28.42
Service Manual	3V29	29.00
Instruction Manual	3V29	3.28
Service Manual	3V90	17.50
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Instruction Manual	3V30	2.65
Service Manual	3V31	25.84
Instruction Manual	3V35	1.63
Service Manual	3V35/3V36	27.20
Supplement to	3V35 3V38	1.24
Supplement to	3V35/8 3V39	90
Service Manual	3V42	23.94
Service Manual	3V43	30.72

THORN BELTS/LAMPS

Counter Belt 1	3292/3V00/3V16/3V22	60
Counter Belt 2	3292/3V00/3V16/3V22	60
Reel Drive Belt	3292/3V00/3V16/3V22	1.00
Relay Belt	3V00	2.79
Capstan Belt	3292/3V00/3V01/3V16/3V22	3.28
Unloading Belt	3292/3V00/3V16/3V22	60
Drum Motor Belt	3292/3V00/3V16/3V22	2.79
Cassette Drive Belt	3V23	60
Capstan Belt	3V29/3V30	1.62
Loading Belt	3V23	60
Loading Belt	3V29/3V30	60
Loading Belt	3V35/3V36/3V38	60
Tape Spool Drive	3V35/3V36/3V38	60
Take Up Clutch	3V29/3V30/3V35/3V36/3V38	60
Capstan Belt	3V35/3V36/3V38	1.21

THORN LAMPS

Tuning Indic Lamp	TX9	62
Cassette Lamp	3292/3V00	3.66
Cassette Lamp	3V16	1.53
Lamp Holder	3V16	60
Cassette Lamp	3V23	1.95
Lamp Holder	3V29/3V30/3V31/3V32	60
Cassette Lamp	3V29/3V30	1.41
Cassette Lamp	3V31/3V32	1.60

THORN VIDEO HEADS

Upper Drum Assy	3292/3V00	35.94
Upper Drum Assy	3V22	35.94
Upper Drum Assy	3V16/3V23/24/31/35/36/38/39	35.94
Upper Drum Assy	3V29/30	35.94

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470K Line Control	59

V.C.R. MOTORS

Capstan Motor	3292/3V00/3V01/3V16	51.45
Drum Motor	3292/3V00/3V01/3V16/3V22	43.49
SMP Reel Motor	3V23	32.79
Cassette Housing Motor Assembly	3V23	10.32
Capstan Motord	3V23	52.81
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Capstan Motor	3V29/3V30	27.32
Reel Motor	3V29/3V30	32.79
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T725 Non Text/ TX9	20A2/2282/3781/37081/ 37101/3714/37351/37361/ 37371	19.40
T731 Text/ TX9	20A4/22B4/37063/37093/	
Stereo 10	37463/37371	20.01
T736 Text 100	20A3/2203/3795/3796/ 37003/37103/37353/37363/ 37373/37953/37963	31.60

THORN SWITCHES

On/Off Switch	TX9	2.98
On/Off Switch	TX10	2.74
Focus Unit	TX10	10.20
8 Way Tuner Unit (Not Drawer)	37141 TX90	12.88
8 Way Tuner Unit (Not Drawer)	37360 TX9	13.50
8 Way Tuner Unit (Not Drawer)	37340/37370 TX9	20.44
Volume Control	38030 1790	1.74
6 Way PB Assy	3722/4722/ 6722/8000 Thorn 9000	20.70

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FHT Transformer	TX10	33.80
LOPT	TX10	15.00
LOPT	TX9	23.85
LOPT	38030	6.18
RFI Choke	TX9	3.45
DC Input Choke	TX9	15.36
Mains Transformer	TX90	15.03
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RFI Input Choke	TX9	60

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Take Up Rubber Tyre	3V92/3V00	60
Rewind Tyre	3V92/3V00	60
Timing Gear Assembly	3V00	3.97
Audio Control Head Sub Assembly	3V92/3V00/3V01/3V16/ 3V22	42.38
Fast Forward Idler	3292/3V00/3V16	1.63
Fast Forward Tyre	3V00/3V16	60
Pinch Roller	3V92/3V00/3V01/3V16/ 3V22/3V23	7.30
Stop Solenoid	3V16	10.42
Pause Solenoid	3V16	16.60
Take Up Idler Assmb	3V00 up to Serial No. 19006 3V16 up to Serial No. 16509 3V22 up to Serial No. 27700	7.54
Take Up Idler Assmb	3V00 19007 onwds 3V16 16510 onwds 3V22 27701 onwds	5.28
Rewind Idler	3V16	8.52
Take Up Tension Brkt	3V23	80
Roller Assembly	3V23	4.08
Take Up Spool Idler Assmb	3V29/3V30	2.12
Pinch Roller	3V29/3V30	8.66
Idler Counter Pulley	3V29/3V30	60
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Spool Carrier Idler Assmb	3V35/3V36/3V38	2.73
Cass. Housing Assy	3V35/3V36	36.74
Lower Door Spring	3V35	60
IF Panels	TX10	23.52
Cassette Cover	3V29/3V30	4.34
TX90 Battery Inverter	TA127	£37.81

TUNERS/MIXERS

Mix Booster	3292	30.62
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RF Convertor	3V29	59.32
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116 40025 Dual Posistor	1.80
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101 20519 Focus Control	3.68
140 10161 LOPT	10.06
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276 80198 Select Unit 933	16.67
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212 20796 Sound Panel	10.20

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276 17083 On/Off Sw.	2.60
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310 27455 Prog. Select	13.10
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All Gun Switches	70
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DECCA – Manuals

Decca 80	5.35

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Thorn 8500	6.50
GEC 7 B/P c neons	10.50

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Thorn 9/10	2.Tx 98
GEC 2040 on/off	98
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GEC 2110 tuner neons	35
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DPST Switched log. 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M 1.26

Dual Gang Controls 1.25
16mm Rotary Controls 10K, 22K, 100K, 1M 1.25

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Metric/Philips Type 60
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Skeleton Presets 16
Stand. or miniature. Horiz. or Vert. 100R-2M2

Slider Potentiometers Lin. or Log. 75
470R, 1K, 2K2, 10K, 47K, 470K, 100K, 4K7 Log.

Multiturn Pots 65
GEC/TCE 100K, Philips G8, Decca/Rank

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9. 2 – mains transformers with 6V 1A secondaries
10. 2 – mains transformers with 12V ½A secondaries
11. 1 – extension speaker cabinet for 6½" speaker
13. 12 – glass reed switches
17. 2 – ultrasonic transmitters and 2 receivers with circuit
19. 2 – light dependent resistors
25. 4 – wafer switches – 6p 2 way, 4p 3 way, 2p 6 way, 2p 5 way, 1p 12 way small one hold fixing and good length ¼ spindle your choice
28. 1 – 6 digit counter mains voltage
30. 2 – Nicad battery chargers
31. 1 – key switch with key
33. 2 – aerosol cans of ICI Dry Lubricant
34. 48 – 2 metre lengths colour-coded connecting wire
39. 1 – long and medium wave tuner kit
41. 8 – rocker switch 10 amp mains SPST
45. 1 – 24 hour time switch mains operated
49. 10 – neon valves – make good night lights
50. 2 – 12V DC or 24V AC, 3 CO relays
51. 1 – 12V 2 CO miniature relay very sensitive
52. 1 – 12V 4 CO miniature relay
54. 10 – rows of 32 gold plated IC sockets (total 320 sockets)
55. 1 – locking mechanism with 2 keys
56. 1 – miniature uniselector with circuit for electric jigsaw puzzle
60. 5 – ferrite rods 4" × 5/16" diameter aerials
61. 1 – Mullard thyristor trigger module
66. 1 – magnetic brake – stops rotation instantly
67. 1 – low pressure 3 level switch can be mouth operated
69. 2 – 25 watt pots 8 ohm
70. 2 – 25 watt pots 1000 ohm
71. 4 – wire wound pots – 18, 33, 50 and 100 ohm your choice
77. 1 – time reminder adjustable 1-60 mins clockwork
85. 1 – mains shaped pole motor ¾" stack – ¼ shaft
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
96. 1 – thermostat for fridge
98. 1 – motorised stud switch (s.h.)
101. 1 – 2½ hours delay switch
102. mains PSU 9V
103. 1 – mains power supply unit – 6V DC
104. 1 – mains power supply unit – 4½V DC
107. 1 – 5" speaker size radio cabinet with handle
111. 2 – musical boxes (less keys)
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118. 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
121. 4 – push push switches for table lamps etc.
122. 10 – mtrs twin screened flex white p.v.c. outer
124. 25 – clear plastic lenses 1¾ diameter
127. 4 – pilot bulb lamp metal clip on type
128. 10 – very fine drills for pcbs etc.
129. 4 – extra thin screw drivers for instruments
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
134. 10 – model aircraft motor – require no on/off switch, just spin to start
142. 10 – 4BA spanners 1 end open, other end closed
145. 2 – 4 reed relay kits 3V coil normally open or c/o if magnets added
146. 20 – pilot bulbs 6.5V 3A Philips
154. 1 – 12V drip proof relay – ideal for car jobs
155. 3 – varicap push button tuners with knobs
169. 4 – short wave air spaced trimmers 2-30f
172. 10 – 12V 6W bulbs Philips m.e.s.
178. 3 – oblong amber indicators with liliputs 12V
180. 6 – round amber indicators with neons 240V
181. 100 – p.v.c. grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
184. 1 – three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45mm
193. 6 – 5 amp 3 pin flush sockets brown
195. 5 – B.C. lampholders brown bakelite threaded entry
196. 1 – in flex simmerstat for electric blanket soldering iron etc.
197. 2 – thermostats, spindle setting – adjustable range for ovens etc.
199. 1 – mains operated solenoid with plunger 1" travel
200. 1 – 10 digit switch pad for telephones etc.
201. 8 – computer keyboard switches with knobs, pcb or vero mounting
211. 1 – electric clock mains driven, always right time – not cased
216. 1 – stereo pre-amp Mullard EP9001
232. 2 – 12V solenoids, small with plunger
236. 1 – mains transformer 9V 1 amp secondary C core construction
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
241. 2 – speakers 6" × 4" 4 ohm 5 watt made for Radiomobile
243. 2 – speakers 6" × 4" 16 ohm 5 watt made for Radiomobile
244. 1 – mains motor with gear-box very small, toothed output 1 rpm
245. 4 – standard size pots, ½ meg with dp switch
249. 1 – 13A switched socket on double plate with fused spur for water heater etc.
266. 2 – mains transformers 9V ½A secondary split primary so ok also for 115V
267. 1 – mains transformers 15V 1A secondary p.c.b. mounting
291. 1 – ten turns 3 watt pot ¼ spindle 100 ohm
296. 3 – car cigar lighter socket plugs
298. 2 – 15 amp round pin plugs brown bakelite
300. 1 – mains solenoid with plunger compact type
301. 10 – ceramic magnets Mullard 1" × 3/8 × 5/16
303. 1 – 12 pole 3 way ceramic wave charge switch
304. 1 – stereo amp 2W per channel
305. 1 – tubular dynamic microphone with desk rest
308. 1 – T.V. turret tune (black & white T.V.)
310. 2 – oven thermostats
313. 5 – sub miniature micro switches
316. 1 – round pin kettle plug with moulded on lead

MULLARD UNILEX AMPLIFIERS

We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules – i.e. Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for **£6.00** plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

CAR STARTER/CHARGER KIT

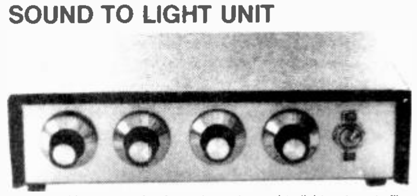
Flat Battery! Don't worry you will start your car in a few minutes with this unit – 250 watt transformer 20 amp rectifiers, all parts with data **£15** case £4 p&p £2.

Ex-Electricity Board. Guaranteed 12 months.

VENNER TIME SWITCH

Mains operated with 20 amp switch. One on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95** without case, metal case – **£2.95**, adaptor kit to convert this into a normal 24hr time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is **£2.30.**

SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is **£14.95** in kit form.

12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle –
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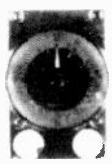
1/8 hp **£5.75.** 1/6 hp **£7.50**

25A ELECTRICAL PROGRAMMER



Learn in your sleep. Have radio playing and kettle boiling as you wake – switch on lights to ward off intruders – have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/off switch. A beautiful unit at **£2.50**

THIS MONTH'S SNIP

400 Watt Mains Isolation Transformer 230 volts in 230 volts out. Supplementary 10 volt winding for voltage adjustments. Torroidal construction makes it most compact. Regular price £40. Our price **only £10.00** + £2 post.

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TUBE HOLDERS Canopy type spring loaded, 4 pairs for **£1**, 100 pairs **£20**, 1,000 pairs **£150**, post paid.

TANGENTIAL HEATERS

We again have very good stocks of these quiet running instant heat units. They require only a simply case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw, 2kw, 2.5kw, and 3kw. Prices are **£5** each for the first 3, and **£6.95** for the 3k. Add post £1.50 per heater if not collecting.
CONTROL SWITCH enabling full heat, half heat or cold blow, with connection diagram, 50p for 2kw, 75p for 3kw.

FANS & BLOWERS

Woods extractors
5" **£5** + £1.25 post. 6" **£6** + £1.50 post
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4" × 4" Muffin equipment cooling fan 230/240V **£5**
5" Plannair extractor **£5.50**
9" Extractor or blower 115V supplied with 230 to 115V adaptor **£9.50** + £2 post.
All above are ex computers but guaranteed 12 months.
10" × 3" Tangential Blower. New. Very quiet – supplied with 230 to 115V adaptor on use two in series to give long blow **£2.00** + £1.50 post or **£4.00** + £2.00 post for two.

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Refresh your home, office, shop, work room etc. with a negative ION generator. Makes you feel better and work harder – a complete mains operated kit, case included. **£11.95** plus £2 00 post.

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Master sockets (has surge arrestor – ringing condenser etc) and takes B.T. plug **£3.95**
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Dual adaptors (2 from one socket) **£3.95**
Cord terminating with B.T. plug 3 metres **£2.95**
Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets **£11.50**

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Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of **£1.50 each, or 13 for £12.00**

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There is a total of over 400 packs in our Baker's dozen range and you become entitled to a large free gift with each dozen pounds you spend on these packs. A classified list of these packs and our latest "News Letter" will be enclosed with your goods, and you will automatically receive our next news letter.

£2 POUNDERS*

2P2 – Wall mounting thermostat, high precision with mercury switch and thermometer
2P3 – Variable and reversible 8-12V psu for model control
2P4 – 24 volt psu with separate channels for stereo made for Mullard UNILEX
2P6 – 100W mains to 115V auto-transformer with voltage tappings
2P8 – Mains motor with gear box and variable speed selector. Series wound so suitable for further speed control
2P9 – Time and set switch. Boxed, glass fronted and with knobs. Controls up to 15 amps. Ideal to program electric heaters
2P10 – 12 volt 5 amp mains transformer – low volt winding on separate bobbin and easy to remove to convert to lower voltages for higher currents
2P12 – Disc or Tape precision motor – has balanced rotor and is reversible 230V mains operator 1500 rpm
2P14 – Mug Stop kit – when thrown emits piercing swawk
2P15 – Interrupted Beam kit for burglar alarms, counters, etc.
2P17 – 2 rev pr minute mains driven motor with gear box, ideal to operate mirror ball
2P18 – Liquid/gas shut off valve mains solenoid operated
2P19 – Disco switch-motor drives 6 or more 10 amp change over micro switches supplied ready for mains operation
2P20 – 20 metres extension lead, 2 core – ideal most Black and Decker garden tools etc.
2P21 – 10 watt amplifier, Mullard module reference 1173
2P22 – Motor driven switch 20 secs on or off after push
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2P26 – Counter resettable mains operated 3 digit
2P27 – Goodmans Speaker 6 inch round 8 ohm 12 watt
2P28 – Drill Pump – always useful couples to any make portable drill
2P31 – 4 metres 98 way interconnecting wire easy to strip
2P32 – Hot Wire amp meter – 4½ round surface mounting 0-10A – old but working and definitely a bit of history
2P34 – Solenoid Air Valve mains operated
2P38 – 200 R.P.M. Geared Mains Motor 1" stack quite powerful, definitely large enough to drive a rotating aerial or a tumbler for polishing stones etc.
2P43 – Small type blower or extractor fan, motor inset so very compact, 230V
2P46 – Our famous drill control kit complete and with prepared case
2P47 – Telephone ringing unit reduces mains to 50 volts and changes frequency from 50 hz to 25 hz to give right ringing tone
2P49 – Fire Alarm break glass switch in heavy cast case
2P51 – Stereo Headphone amplifier, with pre-amp
2P55 – Mains motor, extra powerful has 1½" stack and good length of spindle
2P62 – 1 pair Goodmans 15 ohm speakers for Unilox
2P64 – 1 five bladed fan 6½" with mains motor
2P66 – 1 2kw tangential heater 115v easily convertible for 230V
2P67 – 1 12v-0-12v 2 amp mains transformer
2P68 – 1 15v-0-15v 2 amp mains transformer
2P69 – 1 250v-0-250v 60 mA & 6.3v 5A mains transformer + £1 post
2P70 – 1 E.M.I. tape motor two speed and reversible
2P72 – 1 115v Muffin fan 4" × 4" approx. ex computer
2P75 – 1 2 hour timer, plugs into 13A socket
2P82 – 9v-0-9v 2 amp mains transformer
2P84 – Modem board with press keys for telephone redialler
2P85 – 20v-0-20v ½A Mains transformer
2P88 – Sangamo 24 hr time switch 20 amp S.H.
2P89 – 120 min. time switch with knob
2P90 – 90 min. time switch with edgewise engraved controller
2P95 – 13A socket on satin chrome plate very superior G E.C.
2P97 – mains transformer 24v 2A upright mounting
2P98 – 20m 4 core telephone cable, white outer
2P99 – 500 hardened pin type staples for telephone cable
2P101 – mains transformer 15v 4A upright mounting
2P105 – capillary type thermostat adjustable for air temperatures with 10A c/o switch
2P107 – membrane keyboard, telephone type superior plug in type
2P108 – mains motor with gear box giving 110rpm
2P109 – 5" wide black adhesive pvc tape 33m, add £1 post if not collecting
2P111 – ITT line output unit
2P112 – 6 volt 200MA Voltage regulated PSU for 13 amp socket
2P113 – 9 volt 200MA Voltage regulated PSU for 13 amp socket
2P114 – 12 volt 200MA Voltage regulated PSU for 13 amp socket
2P116 – FM front end with tuning capacitor and F.M. circuitry
2P118 – 30rpm mains motor with gearbox
2P119 – Under carpet switch mat for burglar alarm etc

LIGHT CHASER KIT

Motor driven switch bank with connection diagram, used in connection with 4 sets of X-mas lights makes a very eye catching display for home, shop or disco, **only £5** ref 5P56

£5 POUNDERS*

5P1 12 volt submersible pump complete with a tap which when brought over the basin switches on the pump and when pushed back switches off, an ideal caravan unit.
5P2 Sound to light kit complete in case suitable for up to 750 watts.
5P3 Silent sentinel ultra sonic transmitter and receive kit, complete
5P5 250 watt isolating transformer to make your service bench safe, has voltage adj. taps, also as it has a 115v tapping it can be used to safely operate American or other 115v equipment which is often only insulated to 115V. Please add £3 postage if you can't collect as this is a heavy item.
5P6 12V alarm bell with heavy 6" gong, suitable for outside if protected from direct rainfall. Ex GPO but in perfect order and guaranteed.
5P15 Uniselector 5 pole 25 way 50 volt coil
5P18 motor driven water pump as fitted to many washing machines
5P20 2 kits, matchbox size, surveillance transmitter and FM receiver
5P23 miniature (appr. 2½" wide) tangential blow heater, 1.2kw
5P24 ¼hp motor, ex computer, 230v, mains operation 1450rpm. If not collect add £3 post
5P25 special effects lighting switch. Up to 6 channels of lamps can be on or off for varying time periods
5P27 cartridge player 12v, has high quality stereo amplifier
5P28 gear pump, mains motor driven with inlet and outlet pipe connectors
5P32 large mains operated push or pull solenoid. Heavy so add £1.50 post
5P34 24v 5A toroidal mains transformer
5P35 modem board from telephone auto dialler, complete with keypad and all ICs
5P37 24 hour time switch, 2 on/offs and clockwork reserve, ex. Elec Board loading up to 50A. Add £1 post
5P41 5" extractor fan, very quiet runner sh, gntd 12 mths.
5P45 pack of 6 cooker clock switches
5P48 telephone extension bell in black case, ex-GPO
5P50 box of 20 infra red quartz glass enclosed 360w heating elements
5P51 200w auto transformer 230v to 115v toroidal
5P52 mains transformer 26v 10A upright mounting, add £2 post
5P54 mains motor with gear box, final speed 5rpm
5P58 Amstrad stereo tuner FM and LM and S. AM
5P60 DC Muffin type fan 18w to 27v, only 3w
5P61 drill pump mounted on frame, coupled to mains motor
5P62 2½kw tangential blow heater, add £1 50 post if not collecting
FP69 Fluorescent light box for viewing PCB's or can be used for shop window sign

TELEVISION

EDITOR
John A. Reddihough

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PRICE INCREASE
The price of *Television* will be £1·30 from the next issue dated February. We regret the need to make this price adjustment to cover the increased costs we and our distributors have to meet. We aim to offer good value: larger issues have been published regularly in recent months and the present issue is the largest ever.

COVER PHOTO
This month's cover photo shows a Sony KV1800 with the rear cover removed. See servicing article on page 158.

CAN YOU HELP?
Does anyone know of a source of information/circuit diagrams/spares for the Viptronic 22in. CTV (no model number or country of origin indicated in the set) and a 12in. "Continental" portable, Model GA-X-31, made in Korea? Our enquirer states that these sets have been distributed in Ireland.

CORRECTION
Fig. 4, page 113 last month (low-cost teletext decoder interface panel circuit diagram) had two R8s: the resistor in series with the LED should have been shown as R18. In addition REGs's earth connection was omitted.

Financing and Controlling TV

The Home Secretary Douglas Hurd has called for public discussion on the subject of financing the broadcasting services. So far as TV is concerned the first question must be whether any change is needed or is desirable. The government seems to think so. It set up the Peacock Committee with a view to getting proposals for change and, despite having received from the Committee a rather curious report, seems to be determined that the matter should not be allowed to rest. Addressing the Royal Television Society recently Mr. Hurd commented on "the increasingly curious system under which the public pays for TV through the licence fee" and said, on the subject of "cycles in broadcasting history", that "I believe we have now once again reached the point in this cycle when the pressures are building up for a change".

One is inclined simply to say bosh! Except that the matter is rather serious, with profound implications for the control of broadcasting. Cycles in broadcasting history? This is of course a pure flight of fancy. Broadcasting is still too young to have experienced anything that can meaningfully be described as a "cycle". There have been significant changes from time to time, but to talk of cycles is to show very little grasp of the development of broadcasting so far. Mr. Hurd is nearer the truth when he talks of pressures for change building up, but even here one has to discount a large imaginary element. It seems probable that the government is being carried away by the pressures it has itself generated through its committees, reports and so on. As to the licence fee system, being increasingly curious one has to ask why? I can see nothing remotely curious about it. Inconvenient in some respects perhaps, but not curious – unless that's how you want to get people to see it. In fact of course the licence system goes back the earliest days of broadcasting, when it was necessary to provide funds for a new service and, by great good fortune, a means of doing so while guaranteeing the service's independence was adopted. The licence fee system has proved to be a remarkably effective way of providing finance for broadcasting and seems as appropriate today as at any time.

But the government seems to hanker after what it likes to think of as radical solutions to problems, whether these are real or largely imaginary. The danger here is that of politicians – and others – who feel it appropriate to be associated with change whether or not this is required. But as Keith Cummins comments on another page, after successively sampling the offerings of US and Russian TV, "we've a lot to be thankful for". In fact we've a first class broadcasting system that deserves support and encouragement rather than being messed about with. It's true that we suffer from excessive repeats, which is a symptom of inadequate funding, but let's not fool ourselves that there's a simple way of unlocking vast new funds for broadcasting.

One problem seems to be that the government thinks the changes that technological development have made feasible imply some need to alter the ways in which the broadcasting services are operated. We've had a bellyful of nonsense about cable in recent years, a subject that the government clearly didn't understand – and wasn't helped to do so by its advisers. Satellite TV has more recently added to the confusion. It will be interesting to see who gains the franchise for this and what they make of it. But the whole way in which the subject of satellite TV has been handled to date is questionable. Exactly why are the three proposed channels to be handed over to a single operator? If the aim is that the new services should provide maximum viewer choice surely at least two franchisees should have been given the opportunity to show us what they could provide? After all several well backed groups have been competing for the franchise. What it seems to come down to, especially after the débâcle of earlier attempts to get DBS started, is a feeling that the whole thing is a bit of a gamble and that the best way of getting a service with minimum public involvement is to hand it over to a single operator.

It's perhaps surprising that five consortia have considered it worthwhile putting so much effort into getting a franchise which, as Raymond Snoddy writes in the *Financial Times*, could be "a licence to lose money on an unprecedented scale". Running the service is going to mean spending several hundred million pounds with no guarantee of a commercial return. Many figures have been suggested. For example, Patrick Whitten, managing director of CIT Research and a realist when it comes to broadcasting opportunities, has suggested that for DBS to be viable in the longer term it will need to attract ten per cent of viewers within five years, going into two million homes, rising to 15-20 per cent over ten years. But he considers that the number of homes going for DBS will be a fraction of this requirement and that accumulated losses could top £1bn within ten years. All pure guesswork of course.

What could induce anyone to invest in such an enterprise? The danger is that the whole thing could end up in a great big shambles – and that this could coincide with the supposed need for change in broadcasting. We could in fact find the whole of broadcasting thrown into the melting-pot. If this scenario is valid, it seems important to ensure that our present broadcasting services do not suffer, though they are bound to do so to some extent. In the past, new services have been tacked on to the existing framework with such associated changes and safeguards as have been considered appropriate. The evolutionary approach has served us well. The danger of the radical approach is that we could all too easily end up with far worse services than we already have.

Servicing the Sony KV1800UB

David Botto

Though this was one of the first Sony colour sets to be released in the UK large numbers were sold and many are still in use, giving good results. A 90° Trinitron tube is used and there's an unusual "non-PAL" colour decoder. There are a number of circuit features to confuse those not familiar with Sony practice of the time. For example the pincushion correction circuit modulates the supply to the line output transformer and there's a separate flyback transformer which is driven by the "converter" transistor Q802. The latter has a regulator arrangement in its emitter circuit. A conventional series regulator circuit produces a stabilised 110V h.t. line.

Access

Access for service is easy. Start by pulling off the brightness and field hold knobs at the top of the cabinet back. Next remove four screws from the back and two on the underside. Lay the set on its face on your rubber bench mat and lift the entire cabinet away.

Panel Arrangement

The circuit boards are identified by letters in the usual Sony fashion and are connected together by wiring that goes to various numbered circuit points. We'll use these board identification letters in this article and identify some of the circuit points. The board mounted upright on the left-hand side when you look into the receiver from the rear is board C. This contains the decoder circuitry, the luminance channel and the RGB output stages, also the sync separator. Next to this is board S, which contains the signal circuitry – the i.f. strip, the a.g.c. and a.f.c. circuits and the intercarrier sound channel. Boards D and P are mounted horizontally at the bottom of the chassis. Board D contains the field timebase and the line timebase up to and including the line driver stage (which drives the converter transistor, the two parallel-connected line output transistors Q801A/B being driven by a winding on the flyback transformer). Board P contains the mains bridge rectifier, the series regulator control circuit, the pincushion correction circuit, the line output transformer and various rectifier diodes fed from the flyback transformer. At the right-hand side, mounted upright, is the small horizontal regulator board HR – this circuit is connected in series with the converter transistor.

Major Circuits

As with most TV sets the majority of faults occur in the power supply and/or the line timebase, so for fast fault location it's important to understand the arrangements used. Fig. 1 shows the mains input and rectifier circuits and the series regulator that produces the 110V h.t. line. The block diagram in Fig. 2 indicates how the converter, line output and associated circuits are arranged while Fig. 3 provides a simplified circuit diagram of the system outlined in Fig. 2. At first sight it looks a bit complicated, but the whole thing breaks down into a number of relatively simple circuits.

The mains input (see Fig. 1) is fed via fuse F901 (2AT) and the double-pole on/off switch (incorporated with the volume control) to the mains autotransformer T903. This feeds the heater transformer T902 and the mains bridge rectifier D601-4 which produces 130V across C902A. The 2A circuit breaker CB901 is connected in one side of the feed to the mains bridge rectifier – it seems to do a good job of protecting the circuitry. The unregulated 130V supply is fed to the collector of the series regulator transistor Q902 which is mounted at the top right of the receiver (viewed from the rear). It's control circuit (Q601, Q602 etc.) is conventional and is mounted on board P which receives the regulated 110V output from Q902 at point 17. VR601 is used to set up the 110V line. If the series resistor R631 (2·7kΩ, 0·25W) has to be replaced use an 0·5W type at least. Notice that Q602 receives its collector supply via R902/3 (both 0·5W types) which can and do fail or change value.

The 110V line should be set up before any other adjustments are made. Do this with a digital multimeter connected between point 17 on panel P and chassis: disconnect the aerial and adjust VR601 carefully for exactly 110V. Check the reading again after the set has been running for half an hour.

The three presets VR602/3/4 (all 250kΩ) on board P provide low-level white balance adjustment. You set them up by turning the first anode preset VR605 (also on board P) to give a barely visible picture, preferably using a crosshatch input signal.

There are two presets in the pincushion correction circuit on panel P. VR608 (5kΩ) sets the width while VR606 (10kΩ) provides pincushion adjustment. The waveform shown in Fig. 4(a) should be present at the emitter of Q604 when a set is correctly adjusted – the d.c. voltage present at this point should be about 100V.

Dealing with a Dead Set

What to do when a set won't start up? Since the panels are all wired together it's not easy to isolate them for fault finding. Fortunately however if the set is dead or tries to start up but can't quite make it tracing the faulty section is not too difficult.

Start by examining fuse F901 (with the mains disconnected of course). If it's open-circuit with no signs of blackening it may well have failed of old age – especially if it's the original one. Replace it – after checking that the cutout (CB901) is pushed in – and try the receiver on the mains. If the set works run it for at least three hours before returning it to the customer.

If F901 is in order but the receiver just won't start up examine C531 on board D. This capacitor forms part of the line oscillator start-up circuit (see Fig. 5). It can dry up, falling in value and leaking. It may well fall apart in your hands when you touch it. If it's the original one change it anyway – this will save you an almost certain callback later. In the event of a fault in the line timebase Sony suggest connecting a 3·9kΩ, 5W resistor between the cathode of D510 and the 110V end of R555 in order to get the line oscillator going. We prefer to use a separate d.c. supply, variable between 11-18V. You'll then be able to check the line oscillator circuit with the mains supply

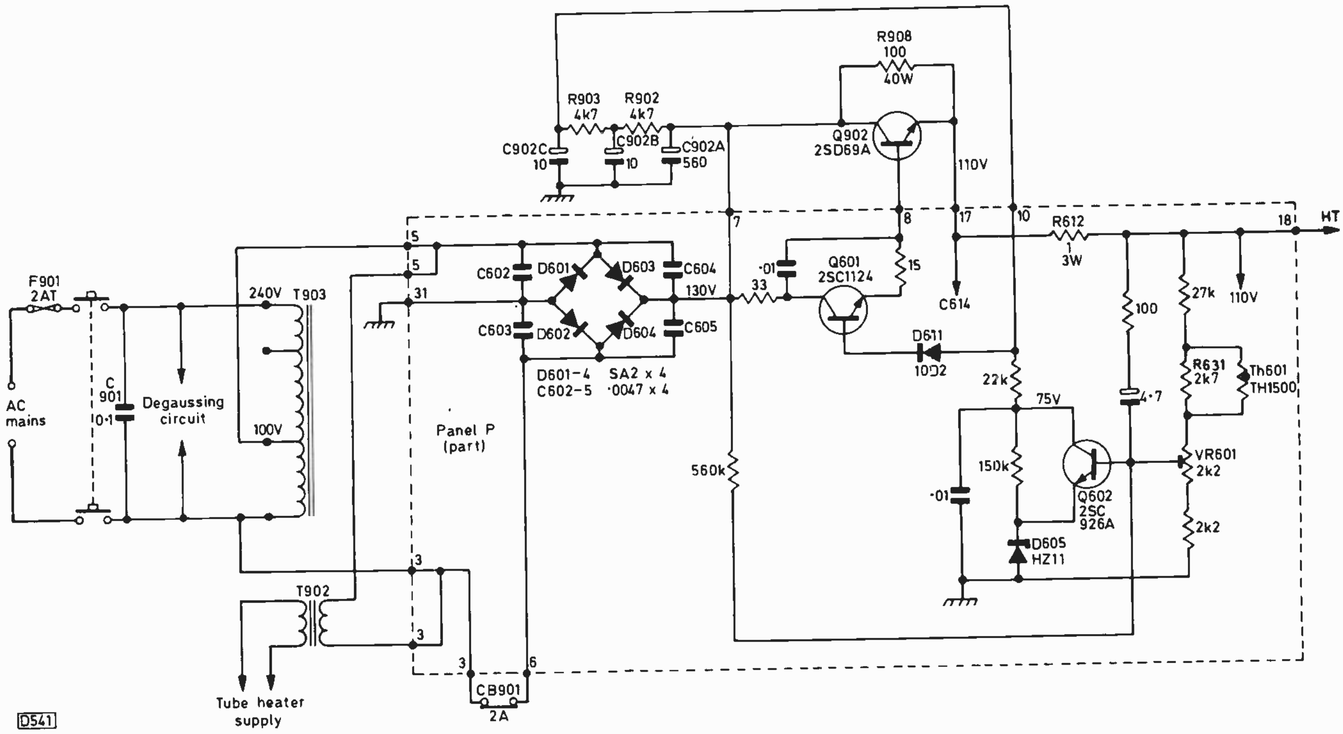


Fig. 1: The mains input, rectifier and series regulator circuits. D601-4 are type SA2 or U05E.

disconnected.

A variac or tapped mains input transformer is essential when working on this model: a component tester (see *Television*, June 1984) saves hours of time since all components on the board you're testing can be speedily checked. When a variac/tapped transformer is used the set must be switched on and the mains input increased gradually. Even if the set is in perfect order it won't start when the mains input is slowly increased from zero because the line oscillator start pulse provided by C531 will not be present. You'll need the external 18V supply.

Now a brief warning. Always keep the mains switch in the "on" position whilst the set is connected to your variac. Don't switch it on and off. If you do there'll be a sudden surge of a.c. input that may well blow out transistors all over the receiver. Please don't ask me how we found this out . . .

If fuse F901 is o.k. and capacitor C531 is in order, make sure that the receiver is disconnected from the a.c. mains supply then check the line output transistors Q801A/B, the series regulator transistor Q902, the converter transistor Q802 and the two transistors Q851/2 on the HR panel. If any are faulty replace them – but don't connect the mains supply to the receiver yet. If all appears to be in order, connect the positive side of your external d.c. supply, adjusted to 11V, to the cathode of diode D510, negative to chassis, to power the line oscillator. Connect your oscilloscope (10:1 isolation probe) to the collector of transistor Q510 in the line oscillator circuit (it's a multivibrator, using Q509 and Q510, both types 2SC1364). A waveform similar to that shown in Fig. 4(b) should be seen. Since the line oscillator is running free you may observe some variations in this waveform. The important thing is that it is present.

If the waveform is present, disconnect the d.c. supply and instead connect it between the junction of R536/R534 and chassis. Increase the supply to 18V. The waveform should continue to be present.

If the line oscillator doesn't produce an output waveform check the two transistors Q509 and Q510. While you're about it, check the flywheel line sync phase splitter transistor Q507 (another 2SC1364) and the line driver transistor Q511 (2SC867). If any of the transistors on board D show signs of corrosion on their leads replace them even if they test all right. Diode D510 (10D2), the flywheel line sync discriminator diodes D505/6 (type 1T22A) and diodes D508/9 (type 1T40) in the line driver stage should also be tested. The KV1800UB has now seen a few years service, so remember that the small tubular electrolytics tend to dry out. Check, in the following order, C525 (4·7μF, 25V), C539 and C522 (both 1μF, 50V), then C521(47μF, 25V). C531 we've already mentioned. If the line oscillator works with an 11V supply but not with an 18V supply at the junction of R534/6 and both C521 and D510 are in order check C615 (470μF, 35V) on board P. Check C614 and C619 at the same time. Although they are not connected to the line oscillator circuit this will save time in the long run.

If you don't have a variable d.c. supply handy, use a single PP9 battery in place of the 11V d.c. supply and two PP9s to provide 18V.

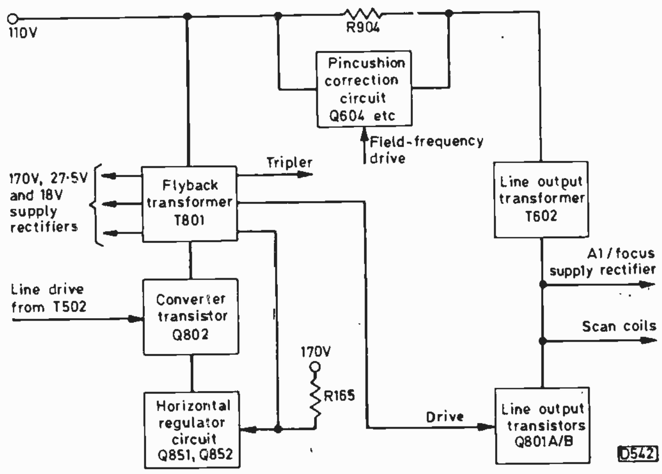


Fig. 2: Block diagram showing the converter and line output stage arrangements.

Make sure that the track of the line hold control VR505 is intact. It's a good idea to apply a little Castrol DWF to the slider.

Power the line oscillator from the external 18V supply, connect your scope to the collector of the line oscillator transistor Q510 and switch the receiver on. Connect your digital voltmeter across the output from the mains bridge rectifier, i.e. between the junction of D603/4 and chassis, then slowly turn up the variac or tapped transformer until you obtain a reading of about 50-60V d.c. Reduce the mains input to zero and transfer the voltmeter to point 17 on board P, i.e. Q902's emitter. If you have two meters available they can be simultaneously connected to these points. Advance the input cautiously until the reading obtained at point 17 is 110V d.c.

Transfer the scope probe to the collector of line driver transistor Q511 then to the collector of converter transistor Q802. The waveforms should be as shown in Fig. 4 (c) and (d).

If a voltage appears at the junction of D603/4 but the 110V line is missing the fastest way to deal with the fault is to check Q601/2 and the associated diodes on board P with your component tester. Replace any that show signs of corrosion even if they test "good". Next examine all the small tubular electrolytics on the board for signs of drying out, starting with C616 (33μF, 160V). Also check the board for dry soldered joints.

We've not had a faulty flyback or line output transformer to date in one of these sets, but bear in mind that they are getting older. (We recently had our first ever line output transformer failure in a Sony KV2000UB.)

Once the receiver is functioning, turn the variac input voltage completely to zero before disconnecting the mains supply. Remove the external 18V d.c. supply and, provided you're sure that C531 and R555 are in order, connect the receiver directly to the mains supply. Switch on and you should obtain picture and sound.

Despite its age the tripler, housed in block DC801 which also contains the 1MΩ static horizontal convergence control VR801, seldom fails. If you suspect it, disconnect its input from the flyback transformer and see if the receiver starts up without it, i.e. the d.c. supplies and waveforms are correct. Don't be in a hurry to remove the tube's final anode cap as this contains an extra connector for the static horizontal convergence voltage – refitting it is not easy. If these two connectors short together the picture will be strange indeed!

The Field Timebase

The field timebase circuitry on board D seldom causes problems. The line-up is as follows: Q501 (2SA677) field blocking oscillator; Q502 (2SC1364) field amplifier; Q503 (2SA677) field driver; Q504 (2SA677) phase inverter; Q505 and Q506 (both 2SD291) field output transistors. Reduced field scan is usually caused by the field scan coupling capacitor C511 (470μF, 25V) going open-circuit or leaky. If reservoir capacitor C619 on board P dries out and C515 (470μF, 35V) on board D does the same (the two are in parallel) all sorts of weird fluctuations in the field scan may occur. If the field output transistor(s) Q505 and/or Q506 fail, check Q503/4/2 and the bias diodes D503/4 (type 1T40) before you replace them.

To make sure that the field oscillator is working check the waveforms at the collector of Q501 and the base of Q502 – see Fig. 4 (e) and (f) respectively. The coupling capacitor between these two stages, C508 (100μF, 16V), can loose capacitance, cutting off or reducing the drive to Q502. As with every board in the KV1800UB, inspect all the small electrolytics for signs of corrosion.

Signals Circuits

The tuner seldom fails. If it does the wisest course is replacement. If you've a dusty or weak picture, before condemning the tuner remove the lead from point 10 on board S (the tuner a.g.c. connection) and bias the tuner from an external source. If this results in a good picture suspect transistors Q209 (2SA677) and Q210 (2SC633A) on board S. If these are o.k. check C239 (33μF, 16V).

Board S seems to be relatively trouble free, though occasional faults do occur. 18V is supplied to this board at point 15 and is fed via choke L214 (680μH) to the various circuits on the board. If this choke goes open-circuit or suffers from dry-joints nothing will work. There are two i.c.s on the board, the intercarrier sound chip IC201 (AN241) and the a.f.c. chip IC202 (CX089D). Perhaps we've been fortunate, but so far we've found these i.c.s to be entirely reliable. The sound output transistor Q901 (2SC867) is mounted off the board, near the loudspeaker. If you get weak or distorted sound, check Q901 then, in the following order, C252/3 (both 1μF, 50V) and C251 (100μF, 16V). These electrolytics tend to lose capacitance, giving rise to weak, distorted or no sound. Note that Q901 receives its collector voltage via point 21 and R603 (68Ω, 0·125W) on board P. If R603 fails you'll wonder where the sound went . . .

To check the video output from board S, connect your oscilloscope (10:1 probe) to point 7 on board C. You should see the complete video signal – use a colour bar input. The video output from board S is fed to board C via the slider of VR903 (1kΩ) on the front panel. Sony call this the picture control.

The i.f. output from the tuner goes first to the UIF board. This is tucked away below the tuner and causes few problems. You can however get a noisy or speckled picture if the transistors on this board (Q751/2, both type 2SC1128) get corroded or if the supply smoothing capacitor C752 (33μF, 25V) loses capacitance.

The Decoder Panel

Board C contains the luminance and chroma circuitry and, with the front-panel mounted hue control, tends to remind the TV engineer of NTSC receivers. The "non-PAL" circuitry does however produce a surprisingly good colour picture – provided the hue control is correctly set to compensate for phase errors in the received signal. There are forty three transistors on the board and no i.c.s. We should perhaps mention that the circuitry was devised to avoid infringing the PAL patents. The circuitry decodes the PAL signal, but does so in a non-PAL manner that doesn't take advantage of the PAL phase error cancellation feature. There are nonetheless a chroma delay line and a bistable to carry out signal switching.

Although the chroma circuitry looks complex it's not difficult to locate the faulty section using an oscilloscope (10:1 probe) and a colour bar input to the receiver. Start at circuit point 1, where the composite video signal is fed to C301 (39pF). Then transfer the scope probe to the junction of C341 (39pF) and the secondary winding on T305 (CAT-2) where you should see the familiar cotton-reel waveform. Next move the probe to the secondary of T306 (BAT-1) to check the burst waveform, then check

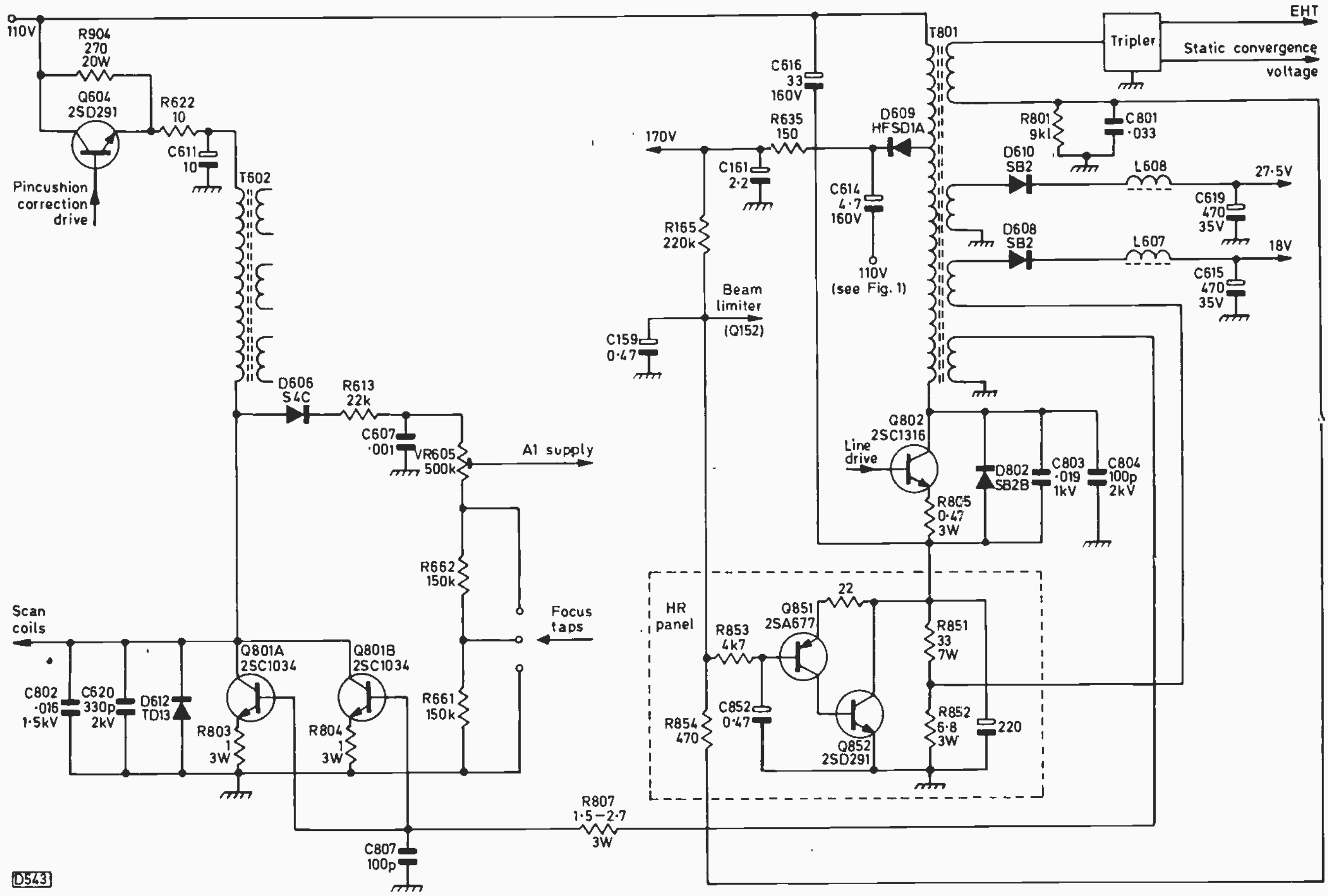


Fig. 3: Simplified circuit showing the converter, line output and associated stages. D608 and D610 are type SB2 or V09C. Component reference numbers indicate location, i.e. R165 is on board C, Q604 on board P, etc.

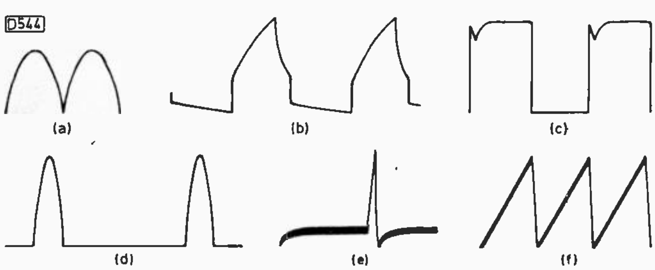


Fig. 4: Key waveforms for testing. Peak-peak voltages: (a) 10V; (b) 4V; (c) 230V; (d) 450V; (e) 6V; (f) 1V.

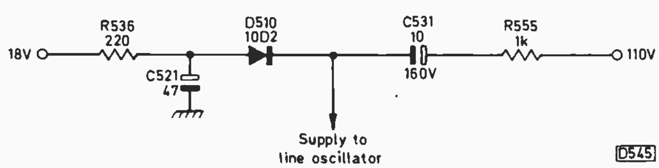


Fig. 5: The line oscillator start-up circuit.

for a 4·43MHz signal at the junction of C362 (27pF) and the secondary of T307 (COT-1). This checks out the B − Y burst/reference oscillator channel. There's a separate burst/reference oscillator channel concerned with the R − Y signal. In this case check for the burst signal at the secondary of T308 (BAT-2) and for a 4·43MHz signal at the secondary of T309 (COT-2). The R, G and B outputs should be present at points 18, 16 and 15 respectively on the board. Make sure that there's a nice squarewave at the collector of Q162 (2SC633A) in the bistable circuit.

The 18V input to the panel enters at point 4 and is fed via L156 (680μH) to the various circuits. If this choke corrodes or is dry-jointed you'll lose the 18V supply. This sounds simple – but it's easy to get caught. Fluctuating or intermittent colour is often caused by the clock pulse amplifier transistor Q324 (2SC633A) leaking. The sync separator transistor Q154 (2SA677) is mounted on this board: when it plays up it can cause colour and sync problems.

Before making a lot of voltage and scope checks on panel C it pays, as with the other panels, to examine the transistor leads for corrosion and the small capacitors for drying out. Replace any that fail this test. You'll then usually find that the circuitry works correctly! Unless someone has fiddled with the preset adjustments they are best left alone – they don't seem to drift.

Tidying Up

When all repairs have been completed spray any panels you've soldered with a thin coat of circuit varnish and make sure that all the connecting leads between the panels are in their correct positions. Run the set for a few hours before returning it to the customer.

Modifications

The main modifications of concern to the service engineer are as follows:

(1) R623 changed to 220Ω, 3W metal oxide.
(2) R910/R920 changed to 2·2MΩ (0·5W) with a 470pF (250V a.c. rating) added in parallel.
(3) C803 changed from 0·02μF to 0·019μF (1kV).
(4) After serial number 25,301 a modified flyback transformer (T801) was fitted. Part no. for the earlier type is 8-983-662-15 and for the later type 1-439-132-11. These

transformers are not interchangeable.
(5) Also after serial no. 25,301 R445 was changed to 390Ω and R807 (originally between 0·68-1·8Ω) was changed to 1·5-2·7Ω. Examine the original before replacing. R807 can fail if the line output transistors go short-circuit. The precise value depends on the gain rating of the transistors fitted. This is indicated at the right beneath the transistor type number. If the rating is 3, use a 1·5Ω resistor; if the rating is 4 use a 1·8Ω resistor; if the rating is 5 use a 2·7Ω resistor.
(6) The voltage rating of C233 on board S was changed from 16V to 10V – but always fit a 25V working type when a replacement is necessary.
(7) A "squelch" circuit board was fitted in the audio circuit after serial number 33,301. If the board seems to have little effect measure the voltage between the base of Q052 (2SC633A) and chassis. The reading should be 0V with no signal rising to approximately 4-5V d.c. or more with a good signal. If it doesn't, replace capacitor C054 (3·3μF, 25V).

Letters

TELETEXT DECODER

Peter Marlow's article was of considerable interest to me since I have already constructed a teletext decoder on similar lines, albeit using a 6502 microcomputer control board and providing RGB outputs for use with a colour monitor. The decoder will also provide a printer dump of the displayed page on any Epson lookalike printer.

Like Peter Marlow I used the /AHS sync signal from the VM6101 decoder but found that the field sync was intermittently lost about thirty seconds after switch on when an incoming video signal was present. Removing the signal cured the problem – but of course removed the ability to receive teletext! I found that a better solution was to use the off-air sync from the decoder board – this is automatically switched to /AHS in the absence of a video input signal, thereby allowing after-hours display.

I also implemented a "next page" and "previous page" increment/decrement facility but found that the decoder randomly forgot one of the digits in a transmitted page number. This doesn't appear to be a timing or a decoder board fault. Any comments?
R.G. Nevell,
Warrington.

GRUNDIG GSC100 CHASSIS

The article on the Grundig GSC100 chassis (September 1984 issue) covered most faults experienced with these sets. A chroma fault I had recently was traced to C863 (0·1μF) which decouples pin 8 of the TDA2521 chip in the colour module. The voltage at this pin read approximately 6V instead of 9V because C863 was leaky (350Ω). Failure of this capacitor also caused flashing grey lines when there was no colour. C861 (0·1μF) which decouples pin 9 of the chip could presumably cause similar problems.
D. Parsons,
London W12.

VCR UPDATING

After my two Philips N1500s, converted to half-speed operation, had notched up over fifty thousand hours' use each I decided that the time had come to upgrade to newer, VHS machines – the rising price of N1700 heads was a major factor in this decision.

After making enquiries I decided on Panasonic, whose machines have a reputation for reliability, and bought two NV7200Bs from a dealer in Truro (he offered me a "quantity" discount!). To get best results I modified the receivers to work as PAL input monitors and found that the overall quality obtained using the combination of ancient Rank A823 chassis with modified line timebases and the NV7200Bs was very good.

One of the machines developed a fault after a few weeks but we could find no reference to the fault in back copies of *Television*. The machine left a loop of tape after threading out, so that it was necessary to press rewind briefly before playing or ejecting. This went on for some time until I noticed that rewind got sluggish when the machine had been in use for some time, and eventually it wouldn't play for more than about half an hour before cutting out. Fearing the worst I monitored the tape motor voltage by connecting an AVO via flying leads soldered to the motor plug, but nothing seemed to be amiss. The fault was eventually cured by removing the two turntables and applying a very small amount of Three-in-One oil to the shafts, taking care not to splash the belts or rubber wheels.

For the benefit of others using NV7000 series machines here's a list of faults etc. noted in back issues:

July 1981, page 465.	Loading failure.
October 1981, page 632.	Cassette lamp failure.
January 1982, page 153.	Unthreading: Hall sensor fault.
March 1982, page 241.	Unthreads after threading.
October 1982, page 647.	Aerial amplifiers.
May 1984, pages 386/8.	Tuning drift and timer faults.
August 1985, page 566.	Capstan fault: oiling.
September 1985, page 635.	Jammed supply spool.
March 1986, page 308.	Programme switch replacement.
June 1986, page 511.	Sound fault.
July 1987, page 590.	Servicing article.

John de Rivaz, B.Sc. (Eng.), A.M.I.E.E.,
Truro, Cornwall.

S. AFRICAN SATELLITE TV RECEPTION

I understand that signals can be received here in South Africa from the Russian Ekran satellite at 99°E with 714MHz transmissions. Could any S. African reader interested get in touch with a view to exchanging information on the technology involved?
Dez Boldizsar, 14 Goudsnip Road, Atlasville, Boksburg 1459, Transvaal, S. Africa.

FOR DISPOSAL

We have a Saba Ultra CSL Model 6745 fitted with the H Telecommander chassis for disposal. It's clean and was owned by a non-smoker but has a low tube and unknown faults. We just can't bring ourselves to throw this beautiful abomination on the skip! It's free of charge to anyone who likes to collect it.
R.S. Daynes, Radio and TV Service, Deepdale House, Dibdale Road, Dudley, W. Midlands (telephone 0384 56 355).

TV Behind the Curtain

Keith Cummins

Last summer I took my holiday in Eastern Europe, passing through East Germany, Poland and the USSR before emerging via Finland and crossing the Baltic to Scandinavia. I was particularly interested in observing the TV scene in the USSR – we see only edited snippets on our news. There were three things to consider: the quality of the transmissions (using the SECAM colour system), the TV sets and the programmes available.

Communication in the USSR is rather difficult for the Western visitor. Not only is the language a problem but unless you know the Cyrillic alphabet it's almost impossible to read anything. A similar problem occurs in Greece of course. As a result it was much more difficult for me to get at the facts than it had been on my earlier visit (see *Television* January 1986) to Canada and the USA, where all you have to do is ask. In the USSR I had to depend almost entirely on observation, and although I had technical questions there was no one I could easily ask and most of them had to remain unanswered.

Having outlined the constraints I'll try to give you a picture of TV behind the curtain. First, a visit behind the Iron Curtain is not as rigidly controlled an affair as it once was. We were able to walk about freely and look at things: we weren't allowed to take photos of touchy subjects like border posts, military installations and airports, but we were otherwise not too restricted in our movements.

Receivers

The Russian TV sets I saw, in hotels and elsewhere, were generally very substantial – constructed like the proverbial brick-built outhouse. All were of hybrid design, with plenty of valves and pictures of varying quality. Some were very good, others dreadful, but this is true the world over and is not peculiar to the USSR. Most of the sets could receive two channels. All TV broadcasting in the USSR is at v.h.f. I read that the Moscow transmitter has a service area of 200km radius and is "of sufficient power that no relay stations are needed". The area is quite flat and v.h.f. will go a long way, but even so the power must be formidable. I was told that three channels are available in Moscow.

Transmission Standards

Transmission standards appeared to be consistently good. As the USSR covers such a vast area microwave links are used for TV and other communications. I saw some that had the dishes mounted horizontally near the ground, firing upwards towards a reflector plate mounted on a tower. The plate reflected the signal horizontally in the right direction.

Receiving Aerials

A weird and wonderful variety of TV aerials were to be seen. Many had a definite DIY look about them, particularly out in the country. It was unusual to see them mounted on a house – most were mounted alongside on a pole with stays, the pole often consisting of a long sapling stripped of its branches. Band I and Band III aerials were in evidence near centres of population: in the country Band I only was usual. I saw many "Double Diamond" aerials (see Fig. 1) west of Leningrad. These were definitely home built, probably from a bought-in kit. Judging by the varieties seen the constructor had to supply his own timber. This is a particularly unusual type of aerial – I've seen nothing like it elsewhere in my travels. Fig. 2 shows some other aerials seen.

Economic Conditions

Progress seems to be slow in the USSR: there isn't the commercial competition we see in the West, with different

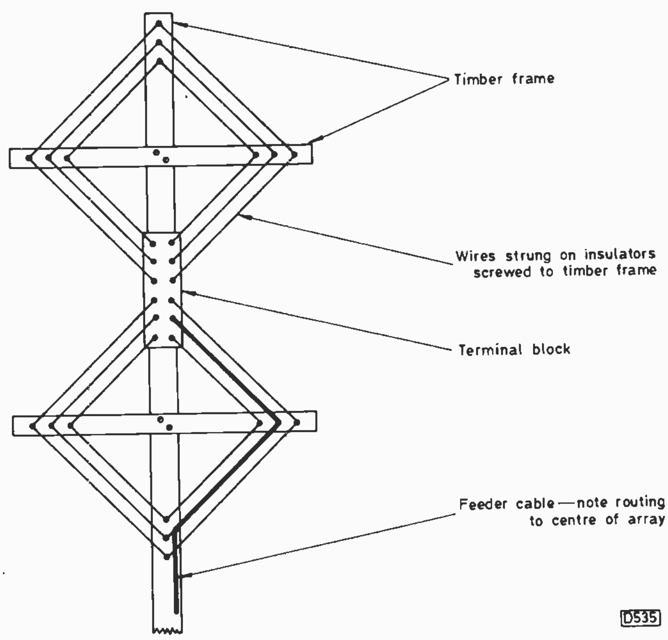


Fig. 1: Double-diamond type aerial.

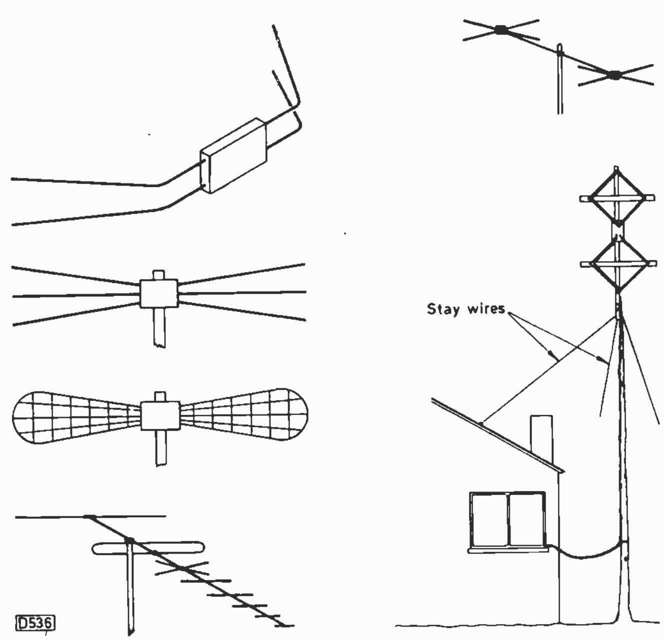


Fig. 2: Some other types of aerial seen and an example of a double-diamond aerial mounted on a stripped tree.

companies leap-frogging each other in an attempt to be first with the latest technology. The Russian philosophy seems to be that if something works all right stick with it and don't try to get too fancy (you can certainly see that this is true of their cars, the popular ones being mostly based on obsolete Fiat designs). In addition, economic priorities are assigned by government control, and when you see people queueing in some places for milk and bread it's obvious that there's not much cash available for luxuries. A black-and-white set costs approximately £200 and a colour set around £500. Wages are low (typically £200 a month) but since accommodation is cheap (some £20 a month inclusive) the economic conditions are not as harsh as they might at first appear. Nevertheless the purchase of a colour set represents a much bigger chunk of a Russian's income than it does for us and a typical shop had just two sets in stock.

The Programmes

I wasn't very impressed by the programmes, though having no understanding of the language didn't help. Their shots seemed to last too long, particularly with "talking heads" and stage productions. Production techniques are nothing like as slick as ours (no Quantel) and in some ways it's like going back twenty or thirty years. Presumably the viewers don't miss what they've never seen. If Mr. Gorbachev is saying something important on the news you get the whole lot, without editing. One night he was on for half an hour solid during an hour-long news programme. Somehow there doesn't seem to be much fun in Russian TV. The complete reverse is of course the ghastly American games show, all flashing lights, screaming contestants, "big bucks" and "whammies"!

Postscript

I still believe that in the UK we have the best TV in the world, in all respects. There will always be criticisms of course, and nothing's perfect, but believe me when, after successive visits to the USA and the USSR, I say that we've a lot to be thankful for.

The Operation of Electric Motors

Part 5: Brushless DC Motors

Mike Phelan

In this final part of the present series we'll take a look at what is now becoming the most popular type of motor for video applications. This is the brushless motor which uses semiconductor devices instead of the conventional commutator and brushes to carry out pole switching.

In the commutator motors described in Parts 3 and 4 the commutator and brushes provide a means of supplying current to the rotating armature windings in turn as the motor rotates. There are several disadvantages to this arrangement. A few of these are as follows. Switching is abrupt, the self-inductance of the windings causing interference – a "ringing" component is superimposed on the armature current. In addition a large number of poles are required to give sufficient smoothness of rotation. In most cases this is not enough: the motor must run at a fairly high speed under load, with considerable gearing down to the driven component – drum or capstan – and even more inertia added in the form of a flywheel in order to allow smooth servo speed control.

Development of the Brushless DC Motor

If we make the current flowing through the windings as nearly sinusoidal as possible, with two or more poles receiving currents with phase displacements equal to 360° divided by the number of poles, then we have a fairly good polyphase a.c. motor. With a stationary set of windings and rotating magnets the resemblance to a synchronous motor can be clearly seen.

To provide sinusoidal a.c. with two or more phases it's necessary to have some sort of frequency source. Now in a VCR we are already closely controlling the speed and phase of the drum and capstan motors, so it's no use having a fixed frequency source – it has to be varied to control the speed. The motor itself can therefore be employed to provide the switching, by using some sort of pick-ups spaced equidistantly around the motor. There are several ways of doing this – magnetic, mechanical or optical to name a few. As the rotor is a magnet (see Fig. 1) this is the obvious choice. The sensing devices could be coils, but Hall effect sensors are normally used in practice. These are four-terminal semiconductor devices whose resistance varies when subjected to a magnetic field: d.c. is supplied to two of the terminals, the current flowing via the remaining two terminals being amplified by an i.c. or transistors to carry out pole switching.

This type of motor can be looked upon as a polyphase synchronous motor (it must be synchronous as the supply frequency is locked to the speed of rotation!) which behaves as a normal d.c. motor, i.e. the speed can be controlled by varying the supply voltage.

The performance is vastly superior to the commutator type in all respects. Low-speed running is smooth as the mechanical inertia is high, due mainly to the heavy magnet. In addition the current through the Hall-effect sensors can be made to approach a sinusoid by suitable design of the magnet. This also eliminates the interference problem. Mechanical design of the tape transport system is much simpler, belts, pulleys and flywheels being eliminated. There may be belt drive for ancillary functions such as reel drive and loading, but we're concerned here with drum and capstan drive. Finally the only parts that wear are the bearings, so the motor lasts longer.

Drive Electronics

The electronics required consist simply of a means to amplify the Hall current. Early systems used discrete components but more modern machines tend to use chips designed for the purpose. A stable d.c. supply is essential. Fig. 2 shows a simplified circuit. Most motors have either two or three sets of poles, with two coils per pole.

Construction

Fig. 3 shows the construction of a typical motor – the head drum motor used in the JVC HR7700, which has a discrete component drive circuit. The rotor magnet

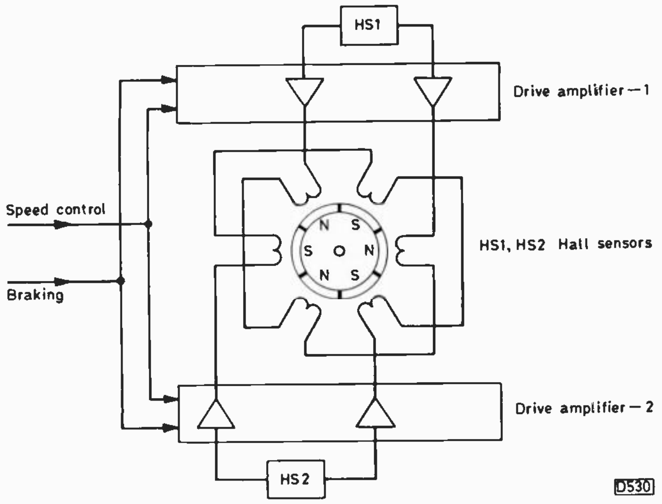


Fig. 1: General arrangement of a brushless d.c. motor and its drive amplifier system.

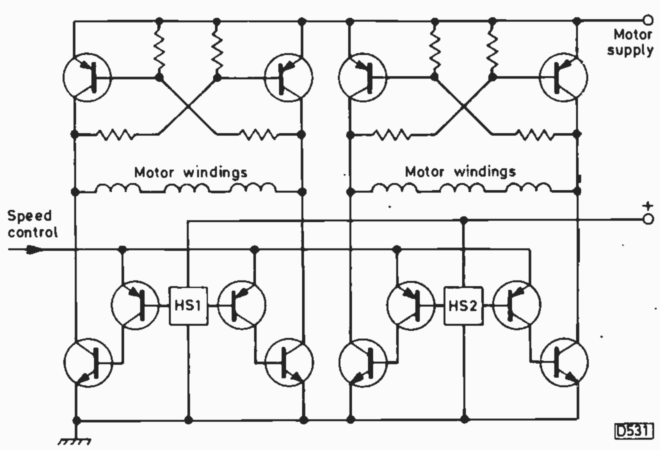


Fig. 2: Basic motor drive amplifier circuit, simplified.

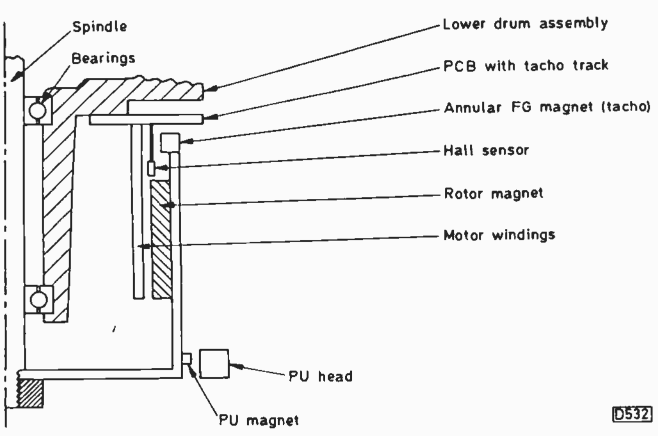


Fig. 3: Motor construction – cylindrical type.

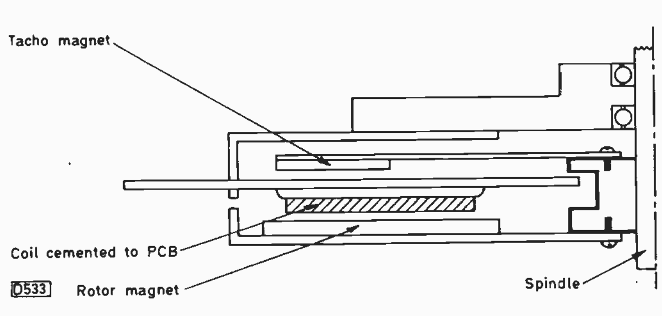


Fig. 4: Motor construction – disc type.

operates the Hall sensors, and there's a multipolar magnetic ring to provide a frequency input for the servo's speed control loop – this corrects for wide speed variations before phase correction is applied. The small external magnet on the rotor triggers the drum flip-flop: this signal is used in many parts of the machine.

Fig. 4 shows an alternative form of construction. This is used in Hitachi machines and results in a very flat motor. The rotor magnet is in disc form, some four inches in diameter and no more than an eighth of an inch thick. The windings are mounted with adhesive on a PCB which also carries the Hall sensors and the drive i.c. The plastic-ferrite ring that provides the capstan servo tacho signal, in conjunction with a printed sinewave track, is cemented to part of the rotor.

Faults

This tends to be a trouble spot: the cement occasionally gives way, the magnet becoming detached. The result is a rumbling noise, and if this is unheeded the magnet wears through the tacho track. The capstan then runs very fast. A rather curious effect can occur when this happens: touching the live side of the tacho circuit with a finger or screwdriver reduces the speed of the capstan motor to almost the correct value. This is obviously because we are injecting mains hum into the tacho line. Whilst maybe not the correct waveform, it's better than nothing! The unwary might think they've stumbled upon a dry-joint or something similar.

This fault can sometimes be cleared by removing the flywheel and PCB carefully, then cementing the magnet back on. If the capstan speed is out the PCB is of course open-circuit and it's too late to effect a repair except by bridging the track – this is rarely possible. Careful reassembly is necessary as the clearances in this type of motor are very small.

Other brushless motors suffer from different faults. The JVC type is occasionally noisy because particles have flaked off the magnet, possibly due to rough handling. In some motors the bearings are "preloaded" and the manufacturers do not recommend any dismantling. Preloading means that where we have two bearings on a spindle pressure is applied during assembly so that the bearings are forced together. When the motor is warm the spindle expands, giving the bearings the correct clearance. If one of these motors is assembled without preloading it may be noisy in use. The ball races in this type of motor are usually sealed and cannot be lubricated. Any solvent will get past the seals however, washing out the lubricant and rendering the bearing useless.

Short-circuit turns in one winding are not too unusual. The symptoms can range from fuse blowing to a sideways displacement of part of the picture (if the offender is the drum motor). This looks like a hum-bar but doesn't move. The symptom can also occur if one pole of the motor is not being supplied with current for any reason. Shorted turns will result in overheating of the driver device(s) and their eventual failure.

In Conclusion

This concludes our discussion of the electric motor. We hope that it has given readers an insight into the operation of this important component and that it will in some cases enable repairs which may not have been attempted previously to be carried out.

Band C Satellite TV Reception

John Standen (North East Satellite Systems)

We've been involved with satellite TV since the days when the only signals that were available were those in Band C (3·4-4·2GHz). This band remains a source of considerable interest to us. In the early days it was all that we could offer, and in terms of a sensible dish size it had to be the Russian Gorizont transmissions. Although our company operates in the commercial sphere we still find that a real enthusiast from time to time appears. He may be a radio amateur who has 11GHz equipment but finds that reception in this band is just too easy and wants something a bit more difficult. C band reception provides the answer. This article is intended for those who want something that approaches DX-TV, with the struggle for reception and the prize of receiving unexpected transmissions from the far corners of the world.

Just four years ago you'd have had to be rather well-heeled to consider reception of the very low-power transponders used in Band C. In those days Megasat advertised a lm dish at £1,000: it would just about give you a picture from the Gorizont satellite, which is almost a power generator in the sky. It all came down to dish size and efficiency. A 30ft dish could give you some noisy but interesting results. Prices can now be reduced however, and with the latest technology it's possible to resolve pictures from low-power transponders that would have been considered impossible as signal sources four years ago. A few months back I decided to try out such a system. This enabled me to compare the results and costs of modern equipment with those of 1982.

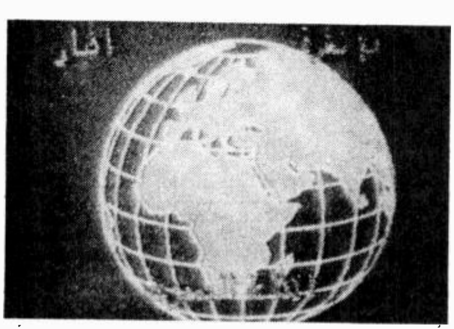
The heart of any system is of course the dish. A poor large dish equals a very good small dish. We opted for a spun parabolic reflector. Being a single unit the efficiency is inevitably higher than that of a segment dish – and much higher than that of a mesh dish. To get a decent buying price we made a quantity purchase from the USA, but we were not happy with the US mount. So we produced our own, which we've tested and found to be stable in winds of over 50 m.p.h. The only problem is that the structure weighs about half a ton, so it's not cheap to transport.

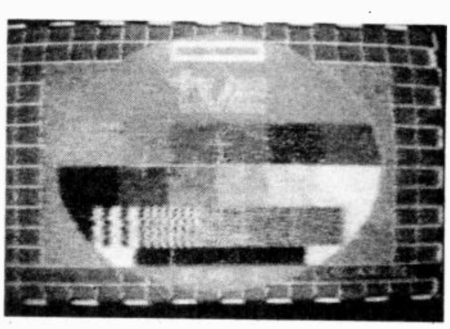
With good dish gain the next requirement was to transfer the signal to the LNA via a scalar horn. Too many 4GHz horns today are of the polarotor type. This is fine if you want to receive linear, left or right circular polarity signals with some loss, but the C-band signals are so weak that such laziness will result in unacceptable signal loss. The feedhorn required is of the basic throughfeed type, with a PTFE block to give reception of left and right polarity signals – for a linear signal, remove the block (there are no linearly polarised Band C signals available in Europe at present). Without the PTFE block, you'll lose 3dB of your left/right polarity signal.

As we were using a spun aluminium dish as opposed to mesh dish it was considered to be easier and more accurate to set up the dish using Ku-band (11GHz) signals. A Ku band LNB was fitted at the focal point and the polar mount was set to track from the Intelstat satellite at 27·5°W to the Intelstat satellite at 60°E. Horns and feeds were then exchanged and the polar arc was scanned at 4GHz, using a standard Ku-band receiver. The result was nothing, apart from the old favourite Gorizont which we could have picked up using a fire element reflector. So the system was working but producing nothing from the weak transponders.

Remember that these transmissions are intended for an Intelstat A station with a 33m dish. So what could we do with our little 2·7m terminal? Answer: reduce the bandwidth. All good quality Ku-band receivers that cover more than the required input bandwidth of the C-band transmissions incorporate a 70MHz outside loop. Into the loop we placed a 70MHz bandpass filter which was variable from 10-32MHz. With the filter in circuit the stations started to appear. Quite good reception was obtained from most 4GHz transponders, but in search of the best we changed the 85° LNA for a 55° LNA. And that's where the system rests today.

The dish tracks from 60°E to 60°W and although I have equipment to look at all the Ku-band transponders I spend far more time plucking very weak C-band signals from space. We receive Libya, Nigeria, Argentina, Saudi Arabia, France, Spain, AFRTS, Brightstar, CBS, ABC, CNN, international news feeds and Soviet transmissions from the 14°W and 57°W satellites. There's always something interesting at any time of the day or night. Nothing really superb, except for France and Gorizont. There's lots of noise but the signals are quite watchable and there's plenty of work left for the enthusiast to do by way of improving the reception using some of the many threshold extension techniques. Band C is an experimenter's paradise, where the unexpected becomes normal. It's the closest thing to DX-TV but with a greater surety of success.





Examples of Band C satellite TV reception at Cropton, North Yorkshire using the equipment described in the article above. Left, Saudi Arabia; centre, Libya; right, Spain (TVE).

4GHz equipment is not readily available in the UK today. To cater for enthusiasts wishing to experiment we are stocking a range of systems (the range is greater than that we stocked in the old 4GHz only days) based on the 2·6 or 2·7m dish. The selling price is £1,335 plus VAT (terms available), the major problem being delivery as the dish/mount assembly weighs over half a ton. Being massive a large lorry is required to move it. There are fifteen systems and the ordering delay is up to two weeks. Refinements to the feed system give reception of the 11GHz and DBS bands.

Various transmissions are available in the 12·2-12·75GHz band. The Telecom-1 satellite provides many different French feeds, including lately Monte Carlo, also PAL feeds from France to the UK. There are also the French TV5 and TV6 network signals, some of which are scrambled (using the discret system). Most of the signals are clear however.

Tests on the French system here in Yorkshire have provided huge signals on a 1·25m dish. Further tests are to be carried out using a 90cm dish: from previous results we feel that this dish size will be acceptable. For those interested a small number of LNBs have been imported and are available at £198 plus VAT.

All the systems mentioned in this article are currently in operation at our Yorkshire base. Anyone who wants to see the full range of satellite TV from 3·4-12·75GHz in a polar arc is welcome to phone for an appointment – we can be open any evening and all weekend and enthusiasts are always welcome. For further details apply to North East Satellite Systems, Cropton, Pickering, North Yorkshire YO18 8HL (telephone 075 15 598).

Micro Clinic

Reports on microcomputer servicing problems from Roger Burchett and Nick Beer

Sinclair Spectrum

Although this machine seemed to be working normally, when an Opus disc drive was purchased the computer ignored it. The cause was traced to pin 27 of the CPU chip being stuck low. Replacing the chip provided a cure – pin 27 is the /M1 line and was telling the disc drive that something else was being loaded.

As the edge connectors appeared to have had plenty of use I was left wondering what had happened to cause the fault. As luck would have it another of these machines came along – with a blown ULA chip because the customer had pushed the computer into the disc drive and then switched on without bolting the two together. Now the slot in the Spectrum's edge connector can become slightly enlarged, and the Opus's key is rather thin. It's possible for the connectors to short together if the two are left free. After changing the ULA I checked for any other damage – and found that the CPU's pin 27 was stuck low. Problem solved! **R.B.**

Dragon 32

We've been doing a few rapairs on these machines recently. The most common fault is failure of IC15 (74LS783), causing rubbish to be printed on the screen. These chips are unfortunately rather expensive. **R.B.**

Sinclair Spectrum

The following tales show how careful you have to be when working on micros. The computer had a faulty ROM and after removing it and fitting a holder for the replacement I found I had a dead keyboard. After checking the ULA chip I started to look for solder splashes, using an eyeglass. Not being able to find one, out came the trusty scope. After much running around the circuit it finally dawned on me that the /INT line was not going low enough for the CPU to scan the keyboard. There was a minute solder splash under the CPU's holder: it was removed by sliding a piece of paper under the holder. The /INT line was going down to about 2V. A lot of wasted time and slapped wrists!

The next machine had been "got at" in some way by a small boy, but we didn't know the exact details. Transistor Tr4, the ROM and the CPU were all faulty, but the machine still wouldn't initialise when these had been replaced. Again out with the scope: data line 5 was found to be shorted to chassis. This once more meant an eyeglass search for something conductive. The cause was found under the ULA's holder: it looked like silver paper. Presumably this had got in during the said small boy's investigation, i.e. he took it apart while eating something wrapped in silver paper! Perhaps something easy now? **R.B.**

Sinclair Interface 1/Microdrive

The ULA in the interface can suffer if the interface moves about or is suddenly disconnected. The usual result is a "microdrive not present" message when a microdrive cartridge is loaded, and sometimes the Spectrum won't initialise due to a grounded data line. Just occasionally a ULA chip will overheat spectacularly, causing a crater in the case just above it. As the ULAs are expensive it pays to bolt the two machines together.

It's surprising how many odd faults will go away if the main board edge connectors and the microdrive/interface connectors are given a good clean. I cannot stress this point enough. In the long run it pays to examine each machine carefully after repair. **R.B.**

Sinclair Spectrum

Several of these machines have been brought in with a permanent black raster and white border. The cause is a faulty ULA chip. **N.B.**

Sinclair Spectrum Plus

A common problem with these machines is no colour due to a faulty encoder chip. We find that it usually happens when the "SN" equivalent of the LM1889 is fitted. **N.B.**

Acorn Electron

The customer had opened up this machine and diagnosed a faulty regulator as the 5V and −5V lines were missing (they're marked on the PCB you see). What he didn't do, and what I always do to give myself enough room to work, was to disconnect the keyboard. The voltage lines then returned. There's an $0{\cdot}47\mu F$ tantalum capacitor on the keyboard panel – it was leaking heavily. **R.B.**

Sinclair QL

The customer brought in her Microvitec monitor, saying that it wouldn't work with her Sinclair QL. She didn't think to bring the computer in! We connected a BBC computer to the monitor, using the nearest lead to hand, but what we didn't know was that this computer had an intermittent fault somewhere in the RGB output section (it's normally used with a u.h.f. input only TV set). Alarm and panic (this is where I was brought in). The monitor was o.k., so the QL was sent for. After much head-banging we were able to duplicate the fault – the reset button was sticking in! This all involved a lot of running around, because the customer had humped along a 14in. monitor but not the little computer . . . **R.B.**

Teletopics

BOOM TIME

The first six months of 1986 was certainly a boom period for the UK radio and TV trade, as the latest figures from the British Radio and Electronic Equipment Manufacturers Association show. BREMA comments that the consumer electronics industry benefited from a boom in High Street spending, with deliveries of major products registering strong growth and a marked upturn in the second quarter. Total colour TV receiver deliveries during the period amounted to 1,633,000 compared to 1,388,000 during the first six months of 1985. Of the 1986 total, 982,000 sets were UK produced and 651,000 were imported – the comparative figures for 1985 were 933,000 and 455,000 respectively. It will be noticed that along with increased UK production there has been a marked increase in imports. This is put down to increased own-brand activity by the major High Street multiples, with rising imports from all the major Far Eastern exporting countries – South Korea has now become a significant supplier. A major feature in the large-screen receiver market was a six-fold increase in deliveries of sets fitted with FS tubes: by the end of the period the majority of large-screen sets were fitted with this type of tube. VCR deliveries rose to 812,000 from 555,000 in 1985. Imports of VCRs from Japan fell by 44 per cent during the period, to 239,000. BREMA has expressed concern that overall economic trends could mean that the surge in spending will not continue into the next year.

TV BROADCASTING

A decision by the IBA on the award of the UK DBS franchise is imminent as we go to press. The period of the franchise is to be extended from twelve to fifteen years in recognition of the substantial investment required and the risks involved. The government has also decided to increase the current ITV franchise period by three years instead of two – till January 1st, 1993. Ministers of the EEC have agreed to adopt the MAC transmission standard for European DBS broadcasting.

BBC's DATACAST SERVICE

The BBC's Datacast service is now in operation. This works in a similar manner to teletext, the data being transmitted during the field blanking period, but instead of whole pages the data is transmitted in the form of addressed digital data packages which can be picked up by a receiver whose decoder has been suitably programed. This latter feature enables the service to be individually charged to users who have separate codes. Information providers send data to the transmitters over leased lines. The service is on trial by the London Stock Exchange to transmit price information, by the banking communications service Euromoney Publications of London, and by the *Financial Times*.

PICTURE-IN-PICTURE VCRs

Hitachi is now selling in Japan and the USA a VCR that features a picture-in-picture facility. This is made possible by incorporating a digital memory using nine dynamic RAMs. Users can, by remote control, superimpose a smaller picture in any corner of the main picture. The picture can be off-air or via the VCR's video input socket and the two pictures can be interchanged. Either picture can be frozen. There are also special effects. For example the user can change the picture to a mosaic-like effect – this is done by reducing the 64 tones to as few as only eight. A strobe effect operates at field rates of up to 16 images a second. In the USA the machine is also being sold by RCA and Sears.

TV DEVELOPMENTS

An interesting new TV chip from SGS, type TDA8100, incorporates the complete field timebase, with direct yolk drive from pin 17, plus the sync separator and line generator circuitry.

A couple of new Toshiba TV sets released in Japan incorporate a field store to enable the line scan rate to be doubled. While this doesn't increase the resolution it does make the line structure of the picture less visible. The sets have 21 and 28in. tubes.

DIXONS LOGIK BRAND

As mentioned in this column last October Dixons have placed a substantial order for TV sets with Thorn. The sets are now being sold in Dixons' outlets under the Logik brand name.

JVC's GCR9 CAMCORDER

The JVC GRC9 camcorder, claimed to be the world's lightest and cheapest, is to be released in Europe this spring. It's a record-only version of the GRC7.

PHILIPS SERVICE VIEWDATA LINK

Philips Service has introduced a system called MOVIES (Multi-Option Viewdata Interactive Enquiry System) which enables dealers to pass orders, enquiries and messages to the Philips Service computer via the Viewdata network. A charge of £300 a year is made for this facility, but to encourage its use various benefits have been introduced including a reduced handling charge on orders under £50. In addition to placing orders, an update on orders placed can be obtained and part numbers, prices and availability can be checked. Technical and general information is also available, including service hints, details of recent modifications and technical assistance. Philips Service has also introduced floppy disc training packages.

GOLD MEDAL WINNER

Peter Richards of Criccieth TV, North Wales has won an international engineering competition. He led a strong UK contingent to the sixth Sony International Service Contest which was held in Tokyo on October 27th. Altogether 68 contestants from 24 countries competed for gold medals in six categories – four for Sony engineers and two for dealers. Peter entered the audio competition and completed his set task in 41 minutes, 13 minutes less than his nearest rival. Our congratulations to Peter, who from time to time contributes articles to *Television*.

IVAC 87 MOVES TO BRIGHTON

IVAC '87, the International Video and Communications Exhibition, will be held at the Metropole Hotel, Brighton, from 18-21 October 1987. While previous exhibitions tended to be dominated by equipment suppliers the 1987 event will be considerably expanded to include not only hardware suppliers but also duplicator manufacturers, production companies and dealers offering specialist products and services. There will be a complementary programme of technical seminars and workshops, aimed particularly at programme makers and production engineers.

PUBLICATIONS

The latest edition of Roger Bunney's DX-TV book has now been published at £5·95 by Bernard Babani (publishing) Ltd., The Grampians, Shepherds Bush Road, London W6 7NF. The book (order no. BP176) has been retitled "A TV-DXers Handbook" and is in a new, large format. It provides a comprehensive review of propagation modes and reception techniques (with numerous practical circuits), data on international transmission standards and channel allocations, and notes on related subjects such as off-screen photography. A copy of the 1987 Babani catalogue of electronics, radio and computer books can be obtained free of charge from the address above.

Those interested in vintage equipment may care to note that Chas E. Miller, who contributes regularly to these pages, is publishing a magazine entitled *The RadioGram* which is aimed at "all valve radio enthusiasts". The technical content includes complete circuits of individual sets and descriptions of unusual circuitry (and there's certainly been some of that over the years!). The magazine is published bimonthly and is available on subscription (£6 for six issues in the UK/Eire, £8·10 to Europe and to other countries by arrangement) from The RadioGram, "Larkhill", Newport Road, Woodseaves, Stafford ST20 0NP.

Electrovalue, the components by mail specialists, are now issuing an updated and currently priced catalogue three times a year. To obtain a copy send your request to Electrovalue Ltd., Freepost, 28 St. Jude's Road, Egham, Surrey TW20 8BR – you don't even have to stick a stamp on. Alternatively phone Egham (0784) 33603.

3D-TV

Peter Marlow writes: A new system of 3D-TV was demonstrated at a well attended meeting at the Institution of Electrical Engineers on November 4th. The speaker was Dr. Reinhart Börner of the Heinrich-Hertz Institut, West Berlin, who had carried out the original research. Previous 3D-TV systems have required the use of special viewing glasses. With one system red/green filters are needed while another system uses time-sequential liquid-crystal filters. No special glasses are required with the new system however. The images are projected on to a specially designed screen from which they can be viewed directly in 3D: the method is not holography but simply that used for the 3D postcards that have been available for some years.

The basis of the new system is the "parallel lenticular" screen. This consists of many small Perspex strips of semicircular profile, placed side by side and running from the top to the bottom of the screen, with a highly reflective aluminium foil backing – the strips are not individual but are formed in a large Perspex sheet. The screen is laterally curved. A great deal of effort has gone into its design, mainly concerned with the radius, overlap and depth of the strips. The demonstration screen had been custom made in Hong Kong to a tolerance of 0·01mm.

Initial work with the system was done using 35mm slides. Six shots were taken sequentially to produce one complete 3D picture, with a camera mounted on an optical bench and each picture displaced slightly from the previous one. The six slides were then projected on to the lenticular screen, the projectors being placed in the same relative positions as the camera (exact placing is not critical). The result, called a panoramagram, provides the viewer with a 3D picture consisting of five continuously following stereo images as the viewing angle changes. Hidden objects appear as in a hologram. The use of six photographs virtually eliminates blind areas where viewers cannot see the 3D effect in certain places in front of the screen.

An improvised demonstration was given using two slide projectors and a one square metre screen. The effect was good, although the viewing position was critical due to the use of only two projectors instead of six.

A 3D television system based on the principle has been built at the Heinrich-Hertz Institut, using a five by two metre screen and six monochrome cameras/projectors. The cameras are mounted in a semicircular arc with a fixed focal point. A method is being developed to allow dynamic synchronised focusing. Development of a colour system is also in progress, but this will involve colour convergence problems.

Transmission of 3D-TV images would of course require HD-TV bandwidths, but a certain amount of pre-processing could reduce the bandwidth. Synchronised video recording should be possible, though expensive, making its application in aircraft trainers attractive now. Another use for the system is in 3D molecular analysis.

The lecture certainly demonstrated the technical feasibility of the system, despite certain practical problems. The cost of TV projectors would probably limit the use of the system, particularly in the domestic context. Development of a picture tube with a lenticular screen would seem to be the best way forward, though it would need to be large to give the 3D effect properly. I look forward to having one to set up in the workshop!

Meanwhile, back with polarised viewing glasses, 3D VHD discs have been launched in Japan by JVC. The system is to be marketed by other firms in the VHD group, including Matsushita, Sharp and Toshiba.

Tiny Tim's Testing Time

Les Lawry-Johns

Things had been slack for some months and Tim was beginning to get used to it, even to like it. Except for the bills that kept coming in.

Then, last Friday, the avalanche started. The first one came in at nine o'clock.

"I'm just off down town. Be back in half an hour. Don't want to spend more than ten quid. Ta Ta."

Before Tim could say "...off" the chap had gone, leaving neither his name nor any other information. So Tim wrote PIG on the sheet and started to lift the set on to the bench. Another car then pulled up outside and a bloke staggered in carrying a 26in. Bush set of the Z718 variety. He panted out his name and address and Tim felt sorry for him. "Call back at lunchtime" he said, after being told that the screen kept going blue before the tuner selectors failed. As the chap went out someone else came in. A music centre this time. None of the lights lit, one side was dead and the stylus was broken. Tim's eyes noted the Shure cartridge.

"Call back on Monday."

"But we want it for our party tonight."

"I'll try but can't promise."

Tim put the jobs in line and was about to start on the first when a woman came in with a white portable of the Thorn 1690 variety.

"I can't stop and talk about it. I want it for Sunday and the only time I can call to collect it is on Sunday morning at about ten o'clock. Do whatever needs doing. Bye for now."

She trotted off before Tim could say a word. His Sunday had gone for a Burton as usual. Oh well, mustn't moan.

Minutes later a large ITT FT110 was brought in. "Picture's very dull and it won't respond to the contrast."

Tim's mind said "beam limiter", but he didn't actually say anything. He didn't like the FT110, mainly because he'd not done a lot of them. And he couldn't remember how the beam limiter worked. But he knew the owner quite well. "Phone me tomorrow and I'll tell you all about it."

Left alone Tim started on Mr. Pig's set. It was a Pye CT200. He hardly had time to note the smashed tube base when another lady came in.

"Would you lift my record player out of the car for me?"

Tim went out to the blue Volvo estate and noted what appeared to be a radiogram standing in the back. It was one of the large, old HMV ones. A record player indeed, with a Garrard unit, twin speakers, etc.

Tim lifted it out while the woman chattered. "It was going all right except it wouldn't play the records right through, then it went dead. I said to my husband I don't want you mucking about with it, I'll take it to that little man down the road. They say he can do things all right and doesn't charge much. Not like some of these people do nowadays and you don't know what they get up to, do you? I think it's all wrong that people should take your things and interfere with them like they do, then charge you through the nose."

Tim put a tenner on the bill right away but he didn't say much. "Pop in tomorrow" he suggested.

"Oh dear, I'll have to do without my Mozart tonight" she moaned. Tim took her name etc. and off she went, talking away to herself nine to the dozen.

The Pye's Problems

Back to the Pye. After a bit of a struggle Tim repaired the tube base socket and refitted it. When the juice was applied the heaters lit. There was a blurred raster and Tim realised he'd left the focus lead off. With that refitted the raster could be resolved but there was no picture or sound however much he fiddled with the tuner selectors. So he went down to the rear left side where the tuner joins the i.f. gain and filter unit. He removed the latter and resoldered all the contacts, noting that the one from the tuner had a track crack. Ah ha! This done the sound boomed out and a grossly misconverged picture appeared. This was attended to and he was left with a nice teletext message wishing him a pleasant day. Hardly had he finished when the owner appeared.

"Ah Mr. Pig, your set's ready after all."

"Name's not Pig, it's Sty."

"Nearly right sir."

"Actually I was only joking about calling back for it in half an hour. I've been told it's beyond repair. Thought you might give me a chit to that effect."

Tim got a bit angry. He switched the set on and showed the Sty man.

"Good lord, as quick as that. You must be a genius."

"I am but I don't let it show" said Tim modestly. He wrote the bill out and handed it to the Styman.

"Heavens. That much for such a short time?"

"Cheap for a genius, sir."

So off he went and Tim was left wondering. The set had been knocked over or off, and seeing the broken tube base someone had assumed that the tube was cracked. Oh well.

The Big Bush

Tim next turned to the big Bush. He soon found that it was a nightmare. First he took the tuner out and renewed the plastic nuts – one of the four had cracked open and was jamming the channels, as the blue ones do.

With the tuner refitted he could get a picture and was better able to see the effect of the blue flashing. He went over the blue drive from the TCA800 chip to the driver and output transistors and found that the voltages at all points varied with respect to the red and green channels. The most marked variation was at the collector of the blue output transistor.

Removing all three c.r.t. drives should have left a blank screen. It flashed blue. Tim's diagnosis was immediate and wrong. A heater-cathode short-circuit in the blue gun he thought. So he carefully removed the heaters' chassis connection and wired a resistor between the blue cathode and the heater. No change. It then dawned on him that the short-circuit was between the grid and cathode. His muddled mind recalled the adaptor he'd invented years ago to deal with a grid-cathode short in a tetrode tube by shorting the grid to the cathode and transferring the drive to the first anode. "All right with a monochrome set but you can't do that with a colour tube with its three guns, you fool" he scolded himself. The things that go through your head when you're faced with a problem. Tiny Tim's trouble is his tiny mind. Not like you lot out there.

But he had to make up his little mind. He'd render the blue gun inoperative. He disconnected the supply to the blue gun's first anode. This left a slight blue haze in the centre. It wouldn't worry anyone but of course the picture was only a pleasant red and green, with no blue apart from the faint glow. The owner didn't complain and said he's seen enough blue to last him a lifetime . . .

Ribald Club Strikes Again

Next on to the bench was the FT110. Tim surveyed the displayed picture and again thought to himself "beam limiter" – and remembered that he'd been proposed as president of the Ribald Club (removal of beam limiters). He studied the tripler and its earth return circuit, then checked all the components here. Each one checked out perfectly so he moved over to the left-hand side and studied the transistors concerned with beam limiting – three of them, T212, T213 and T214. He checked these and the associated components – quite a few of them – and again each one checked out all right. He then removed the front panel to ensure that all the connections were good and that the controls were working. He refitted the panel and injected signals here and there from the final i.f. stage to the luminance delay line. The signals were lost somewhere between the distribution amplifier stage T211/T206 – the stage that provides separate feeds to the a.g.c., luminance and chroma circuits – and the luminance delay line. The beam limiter transistors act on the distribution amplifier stage and Tim found that the voltages in the beam limiter circuit were wrong. He got more and more confused and after an hour or so he did something very naughty, he shorted out the first transistor in the beam limiter circuit, T213, by linking its collector and emitter. The picture was immediately restored to normal. He removed the short and made further investigations but still couldn't find anything wrong. He finally lost his temper, shorted T213 again and left it shorted. Ribald indeed.

Tim's Audio Department

He now turned his attention to the record player and heaved this on to the bench. On moving the pickup arm over towards the centre he found that it stuck before it got there. This was an old one indeed (the fault, not the deck). He took the turntable off and freed the small swing arms on the toothed wheel, removed them and cleaned the centres with easing oil. They now swung happily and the turntable was reassembled. He turned the unit on its end and removed the bottom cover. A fuse had gone though it didn't look like it. First bit of luck today thought Tim. It now played records and changed properly, so it was returned to the corner.

The Fidelity music centre was the one with the Shure cartridge, a fact that worried Tim a bit. He had the stylus in stock but they're costly. In fact when he'd got the whole thing working and the lamps fitted etc. the stylus cost more than the rest of the repair (shouts of traitor!), but they wanted it for that night and they happily popped down to the bank to draw out the money (why they didn't want to write out a cheque Tim couldn't say, but they paid cash and departed happily).

The Portables

Tim finally turned to the Thorn 1690 – and some other portables that had been brought in during the day. The 1690 gave him a stiff time. There were shorted turns in the line output transformer's e.h.t. overwinding. Tim selected an overwinding from the shelf – he'd sent for some a week before. He fitted the winding with care and confidently switched on. The result was a faint, small raster with poor sound. A check on the stabilised supply line showed that it was at 8V instead of the expected 11V. So Tim checked the regulator circuit thoroughly and noticed that it was running warm. He went through everything in this area and was getting more and more angry. At last he removed the new overwinding and prepared to give up the job. Then a thought struck him. He switched on again and the sound boomed out while the tube's heater glowed brighter. He couldn't believe it. Another overwinding was quickly fitted and a perfect picture appeared.

Tim said (shouted) some naughty words and the dogs hid away in shame. The cat licked her paws, having heard it all before. Tinker Bell appeared and announced that the vacuum cleaner had failed. Tim shouted at her as well but repaired it anyway. The Electrolux had shed a connection at the suppressor (remove four screws and take the top off to gain access). The connection was soldered back on and peace was restored. Tim then returned to the other portables and waded through half of them, the other half being deemed not worthwhile after an initial inspection.

The rest of the jobs had to wait another day. Tim hoped the whisky wouldn't be too cold.

Low-cost Teletext Decoder

Part 2

Peter Marlow, B.Sc. (Hons.), C.Eng.

Part 1 last month dealt with the theoretical aspects of the project. This month we'll provide constructional details. Fig. 5 shows the interface board component layout, Fig. 6 the track pattern and Fig. 7 the hole drilling details. Board construction is straightforward: note that the microcontroller chip IC1 is socketed and that the regulators are mounted off the board, Veropins being inserted in their fixing holes. If you decide to use Veroboard construction keep the wiring around Tr1, Tr2 and IC3 as short as possible. Fig. 8 provides component pinning details while Fig. 9 shows the connection points on the VM6101 decoder panel.

Work on the Decoder Panel

Some preparation work must be done on the VM6101 board before it can be used. Details are shown in Fig. 9. Reverse the polarity of the 1μF video input capacitor. Link pins 4 and 5 of PL3. Short out the two 470Ω resistors in series with the DLIM and /DATA lines. Connect pin 2 of the SAA5050 chip to the 5V supply at pin 1 of PL5 via a 4·7kΩ resistor wired on the underside of the board. Lastly connect pin 5 of the SAA5020 chip to pin 4 of PL5, via a link on the underside of the board, to provide the / AHS feed to the interface board. PL1 and PL3 are Pressac series 300 connectors which are not easy to obtain in small quantities: it's better to remove the sockets from the board and wire direct (it's unlikely that the board will need to be removed, unless Murphy's Law prevails). Connector 5 is a line of pins and is thus ideal for making direct solder connections. These changes should all be done carefully as the VM6101 board comes ready calibrated. Don't touch the components around the SAA5030 chip or the factory prealignment will be disturbed.

Case Drilling

Drilling details for the case are shown in Fig. 10. Proceed as follows:

(1) Stick adhesive boss mounting pillars (not the ones suppied with the box) on the inside top of the box (the top has long sides) on squares 1A, 1K, 5A and 5K.

(2) Drill through pillars 1K and 5K and the top of the box with a 3·2mm drill and countersink holes for 6BA bolts.

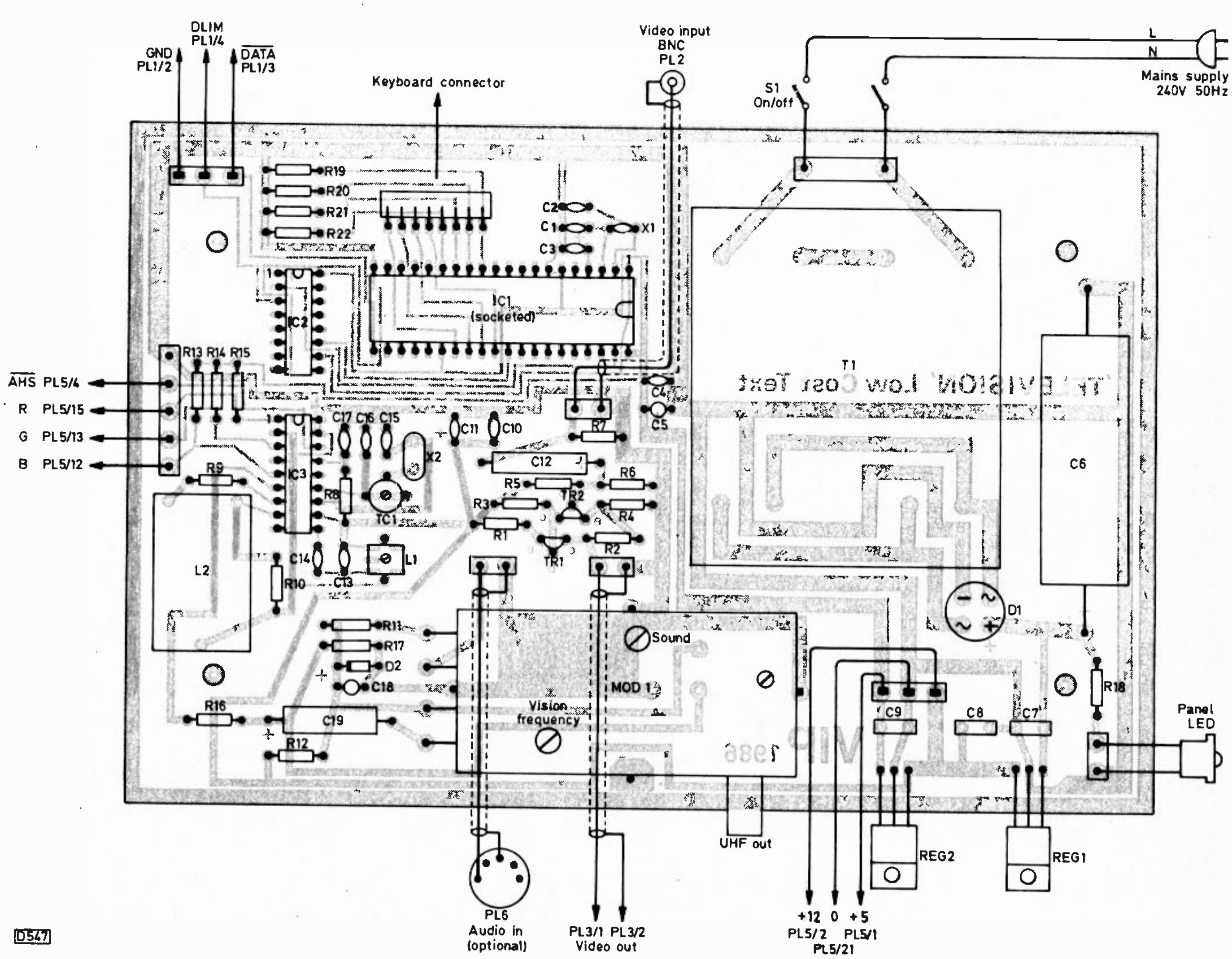


Fig. 5: Interface board – component layout and connections.

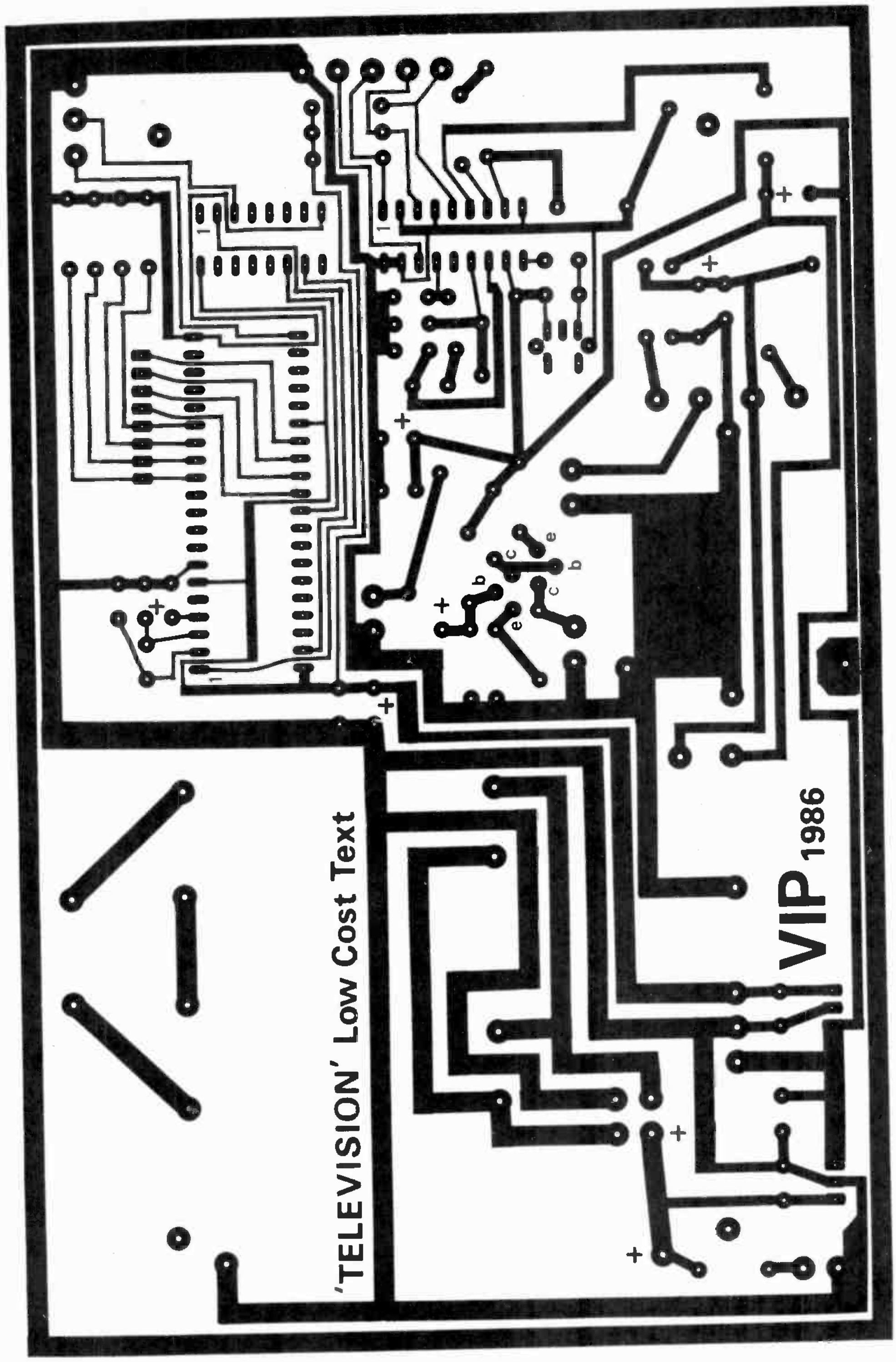


Fig. 6: Track pattern for the interface board. Scale 1:1.

(3) Make a 3mm slot for the keyboard lead at the front of the top of the box (dimensions as shown – the front of the box has a slight lip on its edge). Use either a drill and file or a soldering iron (avoid fumes).
(4) Screw the interface board to the boss mounting pillars with the 6BA screws at one end and self-tapping screws at the other.
(5) Stick the keyboard to the top of the box. Bring the connector through the slot to mate with the interface board.
(6) Drill the front (plastic) panel to take the switch and LED. As the layout is not critical details are not shown. Drill the back (aluminium) panel as shown: the only critical hole is for the u.h.f. output.
(7) Put boss pillars on the teletext board, using self-tapping screws. Stick the teletext board on the inside bottom of the box. The pillars do not take up grid positions – the board position is not critical.

Wiring

Wire up the box following the details given in Fig. 5. Use screened cable for the video and audio signals, stranded cable for the other signals and power lines.

Setting up

To set up the teletext adaptor system proceed as follows.
(1) Check the wiring, particularly the connections to the

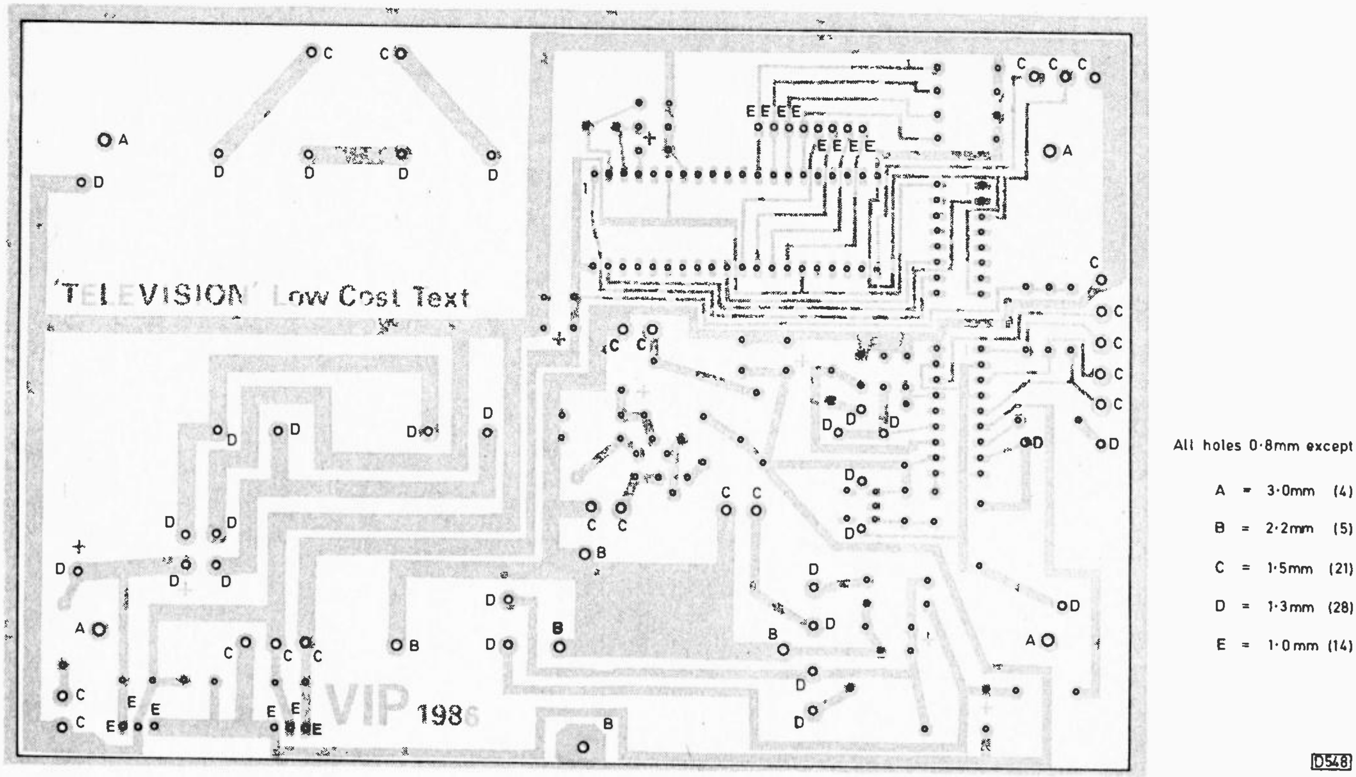


Fig. 7: Interface board hole drilling details.

voltage regulator.

(2) Apply mains to the unit and check the 12V and 5V lines. Switch off.

(3) Connect the VCR's auxiliary video output signal to the decoder unit. Set the VCR to give a BBC-1 output. Switch it on.

(4) Connect the unit's u.h.f. output to the TV set's aerial input socket, tuned to the VCR's output channel (ch. 36) – the UM1287 (or UM1233) modulator is already tuned to this channel. Switch on the TV set and the teletext

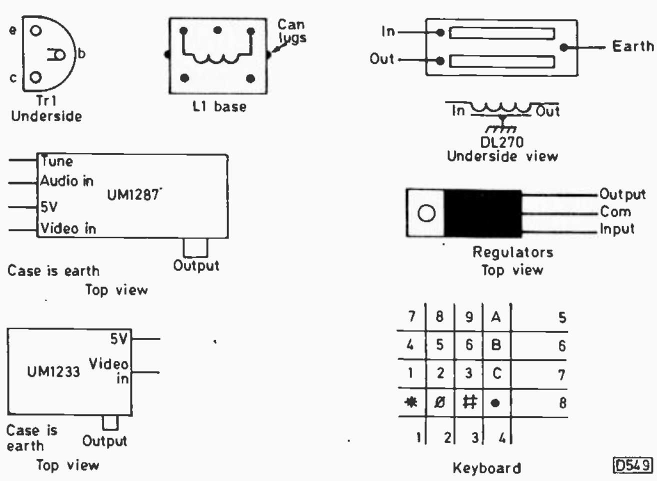


Fig. 8: Component pinning details. If the keyboard connector is viewed from the front of the keyboard pin 1 is on the left.

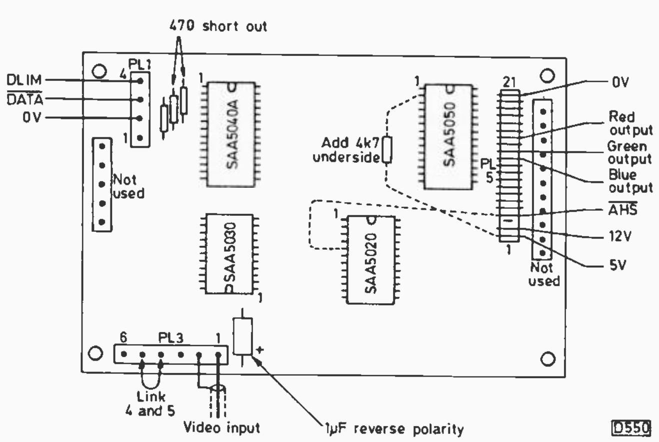


Fig. 9: Connections to the VM6101 teletext decoder panel and details of the modifications required.

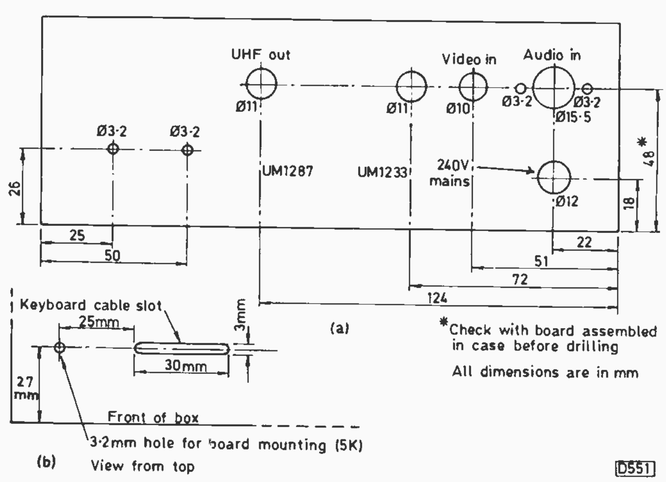


Fig. 10: (a) Back panel drilling details. (b) Drilling details for the case top.

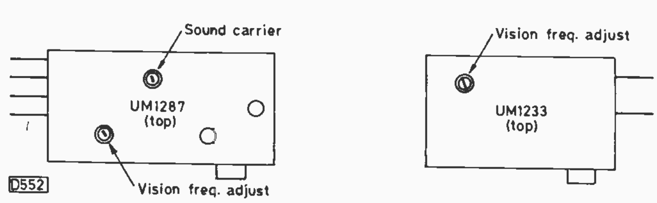


Fig. 11: Modulator tuning – core locations.

decoder unit. Wait for a picture to appear – Ceefax page 100.

(5) Adjust TC1 on the interface board to get a colour picture. If suitable measuring equipment is available, set TC1 for 8·867238MHz at pin 12 of IC3.

(6) Adjust the core of the chroma filter coil L1 for minimum interference and no smearing of letters. If a scope is available tune L1 for the maximum colour burst output amplitude at pin 6 of the TEA2000 chip (IC3). This should correspond with minimum patterning on the teletext display. If colour stability is poor, change C17 (see comments last month).

(7) Adjust the modulator's u.h.f. output by tuning the core (see Fig. 11) to a spare channel (avoid the VCR's output channel). Connect the splitter/combiner (see Fig. 3) in series with the VCR's output. The VCR's output should appear on one channel, the teletext signal on another, without interference.

(8) Inject a sound input. Adjust the modulator's sound core (UM1287 only) for the best signal.

Final Checks

Switch the VCR to different channels and observe the teletext picture. Try different page numbers and commands. As with all teletext systems the quality of the results obtained depends on the quality of the TV signal, especially on freedom from ghosting. Pages are frequently refreshed, so characters and letters missed the first time round should be corrected.

Warning

A word of warning. We have not, for obvious reasons, been able to try out the teletext adaptor unit with each and every combination of TV set and VCR – thousands of models have been sold. The TV set should present no problems, though we have found that line-frequency pickup can cause interference to the operation of the microcontroller with the adaptor on the line output transformer side of the set – moving the unit to the tuner side provides a cure. The i.f. strip in a VCR is not designed with teletext use in mind but we would not expect problems with modern machines using SAW filters. We've tried the unit with a number of VCRs and the only machine that failed to give good results was an old Sanyo model.

Other Possibilities

This decoder design is of course only one of many possibilities, low cost being the main aim. The decoder used in the Philips KT3/K30 chassis or the Mullard VM6103 (both Eurodecoders) could be used in place of the VM6101. In this case a small change is needed in the 8748's program. Superimposition and remote control could be explored and added as piggy-back circuit boards. Additional software could be written into the 8748 to provide extra decoder functions (the 8748 EPROM can be reprogrammed). A follow-up article will provide details on how to use the KT3/K30 panel which is now readily available from suppliers.

Acknowledgement

Finally I would like to acknowledge the help given by Mark Dawson in developing the prototype.

TV Fault Finding

Reports from Richard Roscoe, D. Burke, Michael Dranfield and André N. Smith

Dead Mitsubishis

Mitsubishis with model numbers ending in 23B (e.g. CT1423B, CT1623B, CT2223B etc.) are now coming up to their second birthday and we are starting to get instances of them ceasing to work. The standby light is on but the set is otherwise dead. Up to now this has always been due to dry-joints on the line driver transformer T571.

More annoyingly, later sets with model numbers ending in 27BM (CP1427BM etc.) have in a few cases given trouble only a few weeks after installation, the set going completely dead. These are remote control sets with a separate power supply to drive the standby circuits on the ETS board, a secondary board mounted on the left-hand side of the cabinet. This power supply is protected by safety resistor R7A0 (1·2Ω, 0·5W) which goes open-circuit for apparently no good reason. It's a safety component, part no. 103P39801. **R.R.**

Hitachi CTP1455 Colour Portable

Last year we sold a batch of thirty Hitachi colour portables, Model CTP1455, to a local holiday camp. Our problems began almost immediately. The mains fuse FS901 began to blow in set after set. The mains rectifier D901, type RM11C, was found to be short-circuit and usually the regulator chip (STR4211) and the R2M crowbar zener ZD953 were also damaged. We at first assumed that the problem was due to mains surges: down here the mains supply tends to be like the local scrumpy – potent but pretty rough! As the number of failures increased however we contacted Hitachi who told us that the cause actually lay with D901. They recommend replacing it with two similar diodes in series (part no. 2335981), which is what we've now done to all thirty of them. **R.R.**

Toshiba Tips

Here are a couple of common faults we've had on the newer Toshiba chassis. There have been several cases of tuning drift on the 140E4B and 140R4B colour portables due to RA05 (33kΩ). These sets employ the now usual pulse width tuning arrangement and RA05 is the integrating transistor's collector load. Other, larger screen models with "4 series" numbers use similar circuitry, but in the remote control and text versions R4B and T4B the tuning is on a separate blug-in control board.

On the earlier "3 series" sets the type 202 tuner has been responsible for several cases of video streaking and picture jumping. Once seen it's unmistakeable. In this respect the 202 tuner is definitely inferior to the later 204.

We had a similar looking fault on a brand new 222R5B but this time the cause was C833 (470μF) in the 13·5V supply. One of its solder joints had broken away from the copper track. **R.R.**

Rank T22 Chassis

A 22in. Murphy set fitted with the Rank T22 chassis had field collapse with, peculiarly, the bright horizontal line bouncing up and down an inch or so on either side of the centre of the screen. Voltage checks in the field timebase showed that all was well except in the field charging circuit, which consists of the charging capacitor 4C10, the height control 4RV4 and its feed resistors (one connected to the 12V supply, the other to the 200V supply), and the discharge transistor 4VT10 (a pnp type with its collector connected to chassis). 4VT10's emitter was at only half a volt or so instead of several volts, though its base voltage was correct at about 4V. The 200V and 12V supplies were present and correct and the feed resistors were of the correct value. 4VT10 checked out o.k. and 4C10 was not leaky. So where was the voltage disappearing to? There seemed to be no other way it could go. We then noticed that the height control has a screen which is connected to chassis. This is not shown in the circuit diagram and we had overlooked it on our first inspection of the board. Sure enough by disconnecting the screen from chassis normal voltages and field scanning were restored. **R.R.**

Hitachi NP83CQ Mk II Chassis

The problem with an Hitachi Model CPT2248 – a remote control set fitted with teletext – was very weak field sync with severe line pulling at the top of the picture. Because of the effect of the obviously degraded sync pulses on the sound muting circuit the audio level was being intermittently reduced. We knew that the fault had been getting gradually worse over a period of two or three weeks so we felt it safe to ignore the HA11423 line and field generator chip IC701 which also contains the sync separator. The bias for this part of the chip is at pin 9 and consists of R748 (82kΩ), C747 (4·7μF) and R747 (100Ω). The voltage at the pin was correct at about 6V but when we checked the bias components "cold" we discovered that R748 had risen in value to about 500kΩ. Incidentially C747 was 2·2μF instead of the 4·7μF shown in the circuit diagram but it seemed to work satisfactorily.

The following day I discovered that the same resistor had failed in another CPT2248. This time the symptoms were no sound (muted) and inability of the autotuning circuit to lock on to the received signal correctly. The sync seemed to be unaffected! **R.R.**

Philips KT3 Chassis

This set wasn't doing very much and disconnecting plug M5 exonerated the power supply. The BU205 line output transistor was next checked and found to be o.k., showing no sign of leakage. The tripler was then disconnected, found to be faulty and replaced. Sound and e.h.t. were now present but there was no luminance. Replacing the TDA3560 colour decoder chip restored the picture and after checking the h.t. (which was correct) we were about to put the back on when the set cut out again. This time the BU205 needed replacement. Changing it didn't call for much by way of muscle power since it had never been properly tightened on the heatsink. This was probably a good idea at the time of the original assembly, considering the condition of the heatsink surface – definitely not of textbook smoothness, being a mass of abrasions that extended under the insulator. Smoothing the metalwork and replacing the transistor and insulator (which didn't look at all well) restored normal operation.

Before the back could be replaced one other item required attention – the long tag from the heatsink was dry-jointed where it connects to the mother board. **D.B.**

Philips CTX-S Chassis

An impatient child had plugged this set in and switched it on just after a particularly nasty thunderstorm had rumbled by and out of earshot. The effects of lightning, especially on rural power lines, can travel a considerable distance: the result was a dead set in a short while. Unusually the surge limiter resistor was intact. But the mains fuse, rectifier, chopper transistor, excess current sensing resistors and transistors had to be replaced. This chain of failures has been reported in *Television* before. It seems that all the above mentioned items are vulnerable in thundery weather. **D.B.**

Grundig GSC100 Chassis

Tripping was the complaint with this set. Replacing the flyback thyristor provided a cure. **M.D.**

Philips KT3 Chassis

A thunderstorm can cause the mains fuse, surge limiter resistor and mains bridge rectifier(s) to fail without further damage to the set. If there's no h.t. after replacing these items check D454 and D455 (both type BAS11) which are situated near the line output transformer. They sometimes both go short-circuit along with the other items. **D.B.**

G11 Chassis – Pye Version

This one looked easy. The mains fuses had blown and the usual two rectifiers on the power supply panel had gone short-circuit. There was also a loose connection in the mains plug. Replacing the faulty items produced sound and an h.t. supply that varied. It appeared that something was amiss in the active smoothing circuit, but while checking in this area the original fault recurred. A spare power supply panel was fitted, after making sure that the h.t. fuse was of the correct value and type. This time there were no results as the line oscillator start-up resistor R2010 was dry-jointed. Resoldering this restored sound but no picture. This state of affairs didn't last long since a repeat performance was not long in coming. Two panels down, the h.t. fuse intact and a fault lurking somewhere . . .

The two power supply panels were repaired first. Both needed an identical set of components – mains bridge rectifier diodes D4091-4, beam limiter circuit components Tr4085/6 and D4090, and the trigger phase control transistor Tr4045. Not being too familiar with the Pye version of the chassis we first thought that some extra wires from the power panel were fitted and lying around somewhere to cause mischief, but this was not so. A check on the wiring from the power supply and line scan panels soon revealed the cause of all this bother. The loom that normally resides behind the metal support for the mains input panel was jammed between the metal and the panel. The wires appeared to be undamaged but there were a few small burn marks on the metalwork – VDR R1307 with its strong, untrimmed legs was probably the culprit.

Starting the set up with all items secured revealed the cause of the h.t. trouble originally encountered – the presence of D6011, the second zener diode in the beam limiter circuit, fitted on the chroma panels in some earlier sets. This was leaky and after taking care of it the set worked normally. **D.B.**

Rank T22 Chassis

This set was dead with the 1·6A fuse (7FS1) in the power supply open-circuit. No shorts could be found so a new fuse was fitted and the set was switched on. When the raster appeared it was very dull with bowed edges and a bright centre foldover. The bowed edges suggested an EW modulator fault so attention was turned to the line scan panel. It took us some time to discover that 5C15 in the line scan/EW modulator circuit was faulty. It looked o.k. but a capacitance meter check revealed that its value had fallen from 1μF to only 0.3μF. **M.D.**

ITT CVC8 Chassis

Some quickies on these sets:

(1) Touchy line sync but not total loss of line sync: change R393 and R394 (both 2·7MΩ) in the flywheel sync circuit.

(2) Weak sound: check for dry-joints on the audio coupling capacitor C75 (22nF).

(3) Intermittent loss of sound: check for dry-joints where the components in the audio output stage are earthed to chassis via the horizontal chassis support.

(4) A point to note is that faults in the line output stage can cause loss of line drive with the PL509 overheating. This is because at switch on the PCF802 line oscillator valve is powered from the h.t. line via R402 (270kΩ): when the line output stage comes into operation however its supply is taken from the boost rail, via R403 (180kΩ). Thus until the line output stage is operational the line oscillator stage is run at low power, the result being a great reduction in line drive. The symptoms look like loss of line drive. **M.D.**

ITT CVC30 Chassis

The problem with this set was crooked verticals: optimum adjustment of R905 (pincushion control) left the verticals bending inwards at the left and right side top quarter of the picture – adjustment for correct verticals at the top produced pincushion distortion. An additional symptom was slight change of picture width when the scene changed from a dark to a light one and vice versa. The latter symptom provided a clue. A picture breathing correction voltage from the e.h.t. circuit is applied to the EW modulator panel where it's smoothed by C901 (22μF) and applied to the base of the correction control transistor T901. C901 turned out to be open-circuit, replacement restoring a symmetrical picture without the width flutter on scene changes with a marked contrast difference.

On another of these sets the pincushion correction was wrong at switch on from cold, correcting itself within 30 seconds or so of warm up. R905 was found to be dry-jointed – the pins had not been properly cleaned during assembly.

Here are some other faults: Intermittent loss of colour was traced to poor contact between the pins of the TBA540 i.c. on the decoder panel and its holder. Intermittent loss of height with a bright white line across the top of the picture was traced to dry soldered joints between the mother board and chassis lugs. Trip operation followed by shut down was traced to EW modulator diode D24 (BY223) being short-circuit. **A.N.S.**

Long-distance Television

Roger Bunney

October was relatively quiet following the excellent tropospheric openings during late September and early in the month, though there was some sporadic E reception. Activity tends to fall during the winter months and for Band I reception we have to rely mainly on meteor shower activity. Sporadic E propagation often occurs during mid-December however and it's well worth keeping an eye out over the period December 10-30th. The relatively poor conditions are reflected in this month's rather bare log.

7/10/86	+PTT (Switzerland) ch. E2; RUV (Iceland) E4.
8/10/86	+PTT E2; RAI (Italy) IA, B; CST (Czechoslovakia) R1.
9/10/86	ARD (W. Germany) E2; RAI IA; JRT (Yugoslavia) E3, 4; TVE (Spain) E2, 3.
14/10/86	RAI IA; +PTT E2.
15/10/86	DFF (E. Germany) E4.
16/10/86	TSS (USSR) R1, 2; SR (Sweden) E3, 4; TVP (Poland) R2; CST R2.
17/10/86	TVP R2; SR E4; RUV E4.
19/10/86	RAI IA; +PTT E2; CST R1, 2.
21/10/86	TVE E2; TVE-2 E2; RAI IA; +PTT E2; CST R1, 2; ORF (Austria) E2a; TVP R1, 2.
28/10/86	TVE E2, 3.
30/10/86	RTP (Portugal) E3.

The above loggings cover SpE reception in the UK. Minor auroras were noted in Scotland on the 20th and 21st. Unfortunately I'm still without access to equipment due to building work – I hope to resume activities towards the end of November. My thanks to Simon Hamer (Powys), Iain Menzies (Aberdeen), Dave Shirley (Hastings), Tim Anderson (Bexhill) and Bill Cotterill (Tipton) for sending in reception reports.

Ryn Muntjewerff (Beemster, Holland) has sent in details of his reception during the excellent late September tropospheric openings. His W. German reception log resembles the EBU station list! During the period Ryn logged TVP-1 chs. R9, 12, 29, 30; TVP-2 chs. R25, 35, 38; CST chs. R9, 10, 22, 31, 33, 36, 38; many ORF, SR and American Forces transmitters, TSS (USSR) ch. R9 and some thirteen British Forces relays/transmitters. A remarkable log!

Adding Directors to Collinear Arrays

The stacked bowtie (collinear) wideband u.h.f. array, e.g. the Wolsey Colour King or Triax BB Grid system, is very popular for DX-TV reception due to its relatively flat response over the full u.h.f. bandwidth, its compact size – and its reasonable cost. The one disadvantage in comparison with the long-Yagi with X director assemblies is the lower forward gain from mid-band upwards. A long-Yagi may peak at 16-17dBd whereas the maximum gain obtained from the Colour King type array is around 12·5dBd. An attempt has been made recently in Poland to improve the performance of the standard four-bay collinear aerial by adding a boom with six director elements in front of each full-wave bowtie dipole. The director chain is cut to the top end of the aerial's bandwidth, i.e. ch. 68 for the UK but often around ch. 62 in continental Europe, giving a claimed 3dBd gain increase at the higher frequency end of the bandwidth. This would give a typical gain of 11-15·5dBd across the bandwidth. For comparison, the Fuba XC391 long-Yagi has a gain of 10·5dBd at ch. 21 rising to 16·5dBd at ch. 66.

An experimental collinear u.h.f. array of this type could be fitted with a set of director elements based on those used in a domestic UK group C/D Yagi aerial, though careful thought would need to be given to the support arrangements to ensure mechanical stability.

News Items

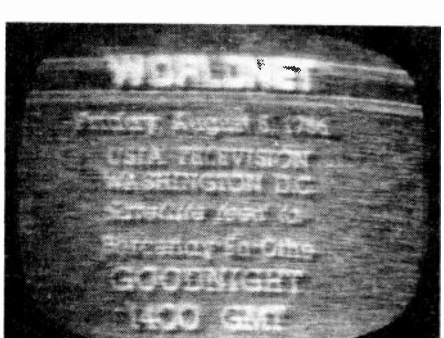
UK: There have been suggestions that a combined transmission authority will be set up and come into operation during the mid-1990s to maintain and operate the u.h.f. TV transmitter system at present run by the BBC and the IBA at common sites.

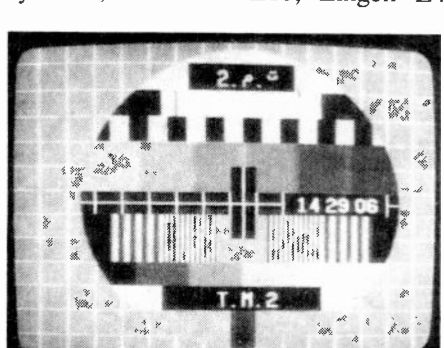
W. Germany: Changes have been made to NDR-1 regional programming. Network origination variations occur at 1800-2000 Mondays to Fridays and 1730-2000 on Saturdays (local time). Details are as follows:

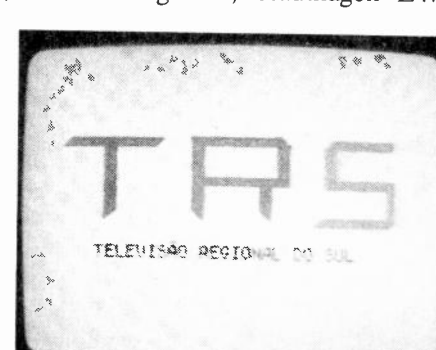
(1) NDR Hamburg transmits the "Hamburger Journal" on ch. E9. Test card indicates "NDR-1 Hamburg".

(2) NDR Schleswig-Holstein transmits the "Schleswig-Holstein Magazin" from Flensburg ch. E4, Keil E5, Lubek E7, Heide E10 (vertical), Neumunster E28, Sylt E41, Lauenburg E46, Bungsberg E50 and Molin E53. The FUBK card identification is "NDR-1 Kiel".

(3) NDR Niedersachsen transmits "Hallo Niedersachsen" from Visselhovde ch. E7 (vertical), Hanover E8, Harz E10, Lingen E41, Dannenberg E43, Stadthagen E47,







Left: Reception of the 11GHz Worldnet satellite downlink by Jaroslav Cerny in Czechoslovakia, using home-made equipment. Centre: RTM-2 Morocco ch. E27 received by Hugh Cocks in the Algarve, Portugal. The transmitter is thought to be near Tangier. Right: Portuguese Faro, ch. E28 pirate station received by Hugh Cocks.

Osnabruck E50, Cuxhaven E51, Aurich E53, Steinkimmen E55 and Hamburg E56. The former identification was "LF HS NDS" (see mystery ch. E10 signal mentioned last month). The current FUBK card identification is "NDR-1 Hanover".

Incidentally, other FUBK card identifications are "NDR 1 SH" (Schleswig-Holstein), "NDR 1 HH" (Hamburg-Hanzestadt), "NDR 1 ON" (East Niedersachsen) and "NDR 1 WN" (West Niedersachsen).

Various W. German local TV channels are being planned: a list will be included next month – indications are that high powers will be used in some areas.

Australia: Following the merger of SBS and ABC in January SBS will become "ABC One" and ABC "ABC Two". Proposals to restructure the commercial TV networks are causing controversy. The government suggested a single Queensland coverage instead of two, the NSW coverage to be reduced from three to two and the Albury region to be absorbed into the single Victoria coverage, the idea being to increase the viability of the regionals in the face of the large commercial networks by expanding their market bases. Following opposition to the plan it seems that the existing stations will be given a further monopoly for up to five years before any basic changes take place.

Transmitter Listings

Latest EBU listings of interest are as follows:

France: Carcassonne ch. L3 100kW e.r.p. vertical (this answers several queries about DX reception!), Limoges ch. L10 260kW e.r.p. horizontal. Both transmit TDF-4/ Canal Plus.

Jordan: The Suweilih ch. E3 and E6 transmitters are to remain on air.

Sweden: Hoerby SR-1 ch. E2 closed down on July 11th.

Gosta van der Linden has sent us the following list of projected French TV5/6 transmitters. The power figures given are e.r.p.

TV5 Network

Paris/Tour Eiffel	E30	12·5kW	Troyes	E29	60kW
Marseille	E32	90kW	Vannes	E58	100kW
Rouen	E59	10kW	Mont Landon	E47	50kW
Nantes	E21	50kW	Lens Bouvigny (near Lille)	E51	10kW
Toulon	E57	50kW	Beauvais (St. Just)	E49	100kW
Orleans	E52	20kW	Cherbourg	E35	20kW
Bourges	E21	100kW	Montpellier	E48	250kW
Niort	E38	500kW	Puy-de-Dome	E30	100kW
Rennes	E34	25kW	Saint Raphael	E36	80kW
Brest	E34	25kW	Metz/Luttange	E39	200kW
Reims	E53	25kW	Le Mans/Mayet	E32	150kW
Tours	E57	80kW	Mont Pilat	E59	250kW

TV6 Network

Paris/Tour Eiffel	E33	12·5kW	Toulon	E60	50kW
Marseille	E38	90kW	Lens Bouvigny	E54	10kW
Rouen	E62	10kW	Niort	E31 or L4	25kW
Nantes	E65	50kW			

Alex Gordon has sent us the following list of Saudi Arabian second network stations: Riyadh ch. E7; Shakra E25; Jeddah E12; Taif E8; Al Hada E59; Makkah E5; Jabal Shamse E45; Jabal Madafa E44; Al Baha E11; Damman E29; Hafr Al Batin E11; Al Houfouf E28; Abha E9 (vertically polarised); Al Qassim E6; Al Zulfi E7; Hail E7; Al Madinah E7; Jabal Silaa E11; Tabuk E8 (vertical); Yanbou E8; Ar Ar E8; Sharourah E8.

From our Correspondents . . .

Jean-Louis Dubler reports from Seoul, Korea that the 1988 Olympic Games will be fully reported using the NABTS teletext system (a North American version based on the French Antiope system and currently used there by CBS and NBC). Samsung showed a NABTS adaptor with infra-red remote control, costing under US$340, at the recent Seoul International Trade Fair. Interesting that Samsung have a design that uses the Korean alphabet. Dual-channel sound and teletext are to be provided on all Korean networks by 1988.

Jaroslav Cerny writes from Czechoslovakia that he has successfully received 11GHz satellite TV using a home designed and built receiver and a home constructed 1·8m dish. The receiver system uses the well-known Mitsubishi oscillator/mixer module (see *Television*, February 1985), with a 4·5V motor to provide remote tuning of the module's oscillator – it takes thirty seconds for complete rotation of the oscillator screw adjustment. All channels in the 11GHz band can be received, with noise present. Reasonable sound quality has also been achieved. A valved monochrome receiver is used as the display device.

Hugh Cocks writes from the Algarve, Portugal that he has now installed proper DXing aerials. Transequatorial skip/spread F propagation usually gives him Ghana ch. E2 from around 1600-1700 GMT, lifting to give ch. E3 video on good evenings. On some nights the signals appear at scanner level, i.e. very weak, while on other nights the signals cause overloading. Programmes start at 1800 and are preceded by a ten-minute test-card transmission – a large circle with four corner circles and the identification

"GBC" at the centre. The signals usually fade at 1900-1930. GBC local news starts at 1900.

Hugh comments that tropospheric reception from the Canary Islands is "odd". Pozo de las Nieves ch. E59/10 fluctuates between noise level and perfect colour over a one minute cycle. He can receive some eleven TV channels from the Canaries. Pirate radio and TV is active in the region. Faro ch. E28 transmits "pirated" RTP material and films taken from the Premiere downlink. A "potent" signal is received from another pirate, TV Algarve, to the west of Faro. RTM (Morocco) is well received, though the programmes are not what you might expect – the TV5 satellite downlink is transmitted on ch. E34 while ch. E37 also carries RAI-1. These transmitters are co-sited. The EBU list doesn't mention any Moroccan transmitters at present though several have been received. When the TV5 service is not available the transmitter radiates TVRO equipment noise!

John Roper (North Walsham, Norfolk) has written to us about early DX-TV. John built his first TV receiver, using a VCR97 surplus radar unit/timebase, an R1355 receiver and RF25 tuner, as soon as Alexandra Palace resumed transmissions in 1947. His aerial was an H type made from ½in. copper water pipe and electrical conduit fittings, with hosepipe for the insulation, all mounted atop a 39ft. wooden pole. Foggy nights were best for reception. Improved results were later obtained by using a 45MHz Pye i.f. strip. More consistent reception was provided when Holme Moss opened, despite John's location being some 150 miles from either transmitter. Interesting that John has two working R1355s and has just constructed a timebase/display unit using the original VCR97 circuit. In 1947 John was 14: he comments that "you can imagine the excitement when the picture locked in and we sat in a shed watching the small green screen". Happy days indeed!

405-line Corner

John Stothart has for disposal to a good home, preferably someone with a 405-line TV collection, a working Sony CV2000 ½in. video tape recorder complete with service manual – and some 405-line recorded tapes. If anyone is interested and can collect, drop us a line with s.a.e. and we'll forward the letter to John.

Help Needed

David Moller (King's Heath, Birmingham) asks to be put in touch with an enthusiast who would build a BATC project for him – a colour version of the video sync processor. Materials, information and financial reimbursement would be provided. For medical reasons David is unable to undertake constructional work. If anyone can help, please let us know.

Practical Active Deflector Systems

Roger Bunney

The November issue contained an interesting article discussing the basics and practicalities of an active deflector system to provide TV reception at an otherwise screened location. The following notes are based on experience gained during the design of a number of such systems and will, I hope, provide further guidance for anyone tackling this sort of exercise. With one exception, in all the systems I've been involved with the signals have been retransmitted on the same channels as received. Fig. 1 shows a typical system.

Aerial Systems

The use of a Yagi aerial at the deflector site was generally avoided, the Triax BB Grid/Wolsey Colour King type of array being used for both reception and transmission. The BB Grid has a particularly good reflector screen and consequently a good front-back ratio, which is essential for avoiding feedback (r.f. "howlround"). The Grid type aerial has a relatively flat response and will have a gain variation of typically 1dB across a given channel group. When used for transmission this type of aerial avoids the upper channel gain tilt typical with a Yagi array, so that a fairly level field strength on all channels should be available at the domestic receiving site. This avoids the need for channel equalisers with the insertion loss (and expense) they introduce. A typical Yagi aerial has a gain variation of at least 3dB across a channel group: it's suitable for use at the domestic receiving site where the higher h.f. gain assists in overcoming cable losses etc. that tend to rise with increased frequency.

The Grid type aerial is a wideband system covering the entire u.h.f. band. It might be thought that this could give rise to problems with adjacent channel group signals but in practice no problems have been experienced. The perfectionist might however consider the use of a Labgear CM9034 u.h.f. group pass filter. This introduces an insertion loss of typically 1dB, with out-of-group signal attenuation of some 21dB. For optimum noise performance such a filter should be incorporated after the head amplifier at the receiving site – though the presence of interfering signals could make it preferable to include it in the feed to the head amplifier. If aircraft radar interference in the ch. 35-36 region is a problem a u.h.f. notch filter (RSPK4) can be inserted in line before any amplification.

With horizontally polarised signals the −3dB beamwidth of a single Grid aerial is typically 60°, which is far too broad. For reception at the deflector site two such arrays should be used, stacked side-by-side, giving a reduction in beamwidth to 30° at the −3dB points. This will also result in a much smoother polar response than with a Yagi array, due to the phase cancellation characteristics with signals coming from the sides. Stripline filters such as the Triax 721 (or 741 if a quad stack is used) offer minimal insertion loss while allowing efficient stacking for optimum gain.

Amplifiers

The head amplifier, assuming that the received signals are weak or noisy, should be a low-noise, low-gain, high signal handling capability device: the recently introduced Labgear CM7271 with its 1·6dB noise figure (15dB gain) is ideal. A secondary amplifier such as the Triax wideband u.h.f. type with a.g.c. loop incorporated should be in-

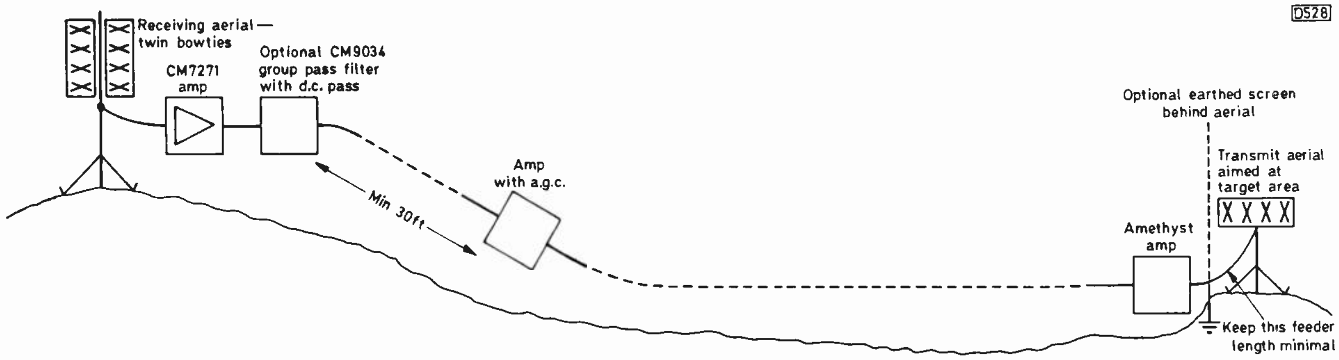


Fig. 1: Practical active deflector system. Note that the receiving aerial array is horizontally mounted, i.e. the bowties are horizontal, while the transmitter aerial array is vertically mounted.

cluded some 30ft. farther along the feeder. During high-pressure, anticyclonic weather conditions an otherwise fair to poor strength signal at the receiving site can rise to very high levels. Although, as noted, a head amplifier able to handle high signal levels should be used later stages can be pushed into severe non-linearity and saturation under such conditions. The a.g.c. loop amplifiers produced by Triax for masthead/outside use are designed to overcome this problem by reducing the gain when a signal reaches a predetermined level. This arrangement will maintain signal stability over a wide and varying signal range.

The amplifier cascade gain needs to be chosen with the feeder length between the receive and transmit sites in mind. If necessary a further low-gain repeater amplifier could be inserted.

The Wolsey Amethyst distribution amplifier used at the transmitting site provides d.c. powering at its input to supply 24V to remote amplifier(s). The 12V Labgear range can easily be modified for 24V operation. The Wolsey Countryman amplifier mentioned in the November article for use at the receiver site is undoubtedly a very high quality unit but does have a rather high noise figure: including a low-noise head amplifier prior to the Countryman will enable optimum signal/noise performance to be achieved.

Transmitting Site

The distance between the receive and transmit sites can be as little as 50m, though care must be taken to avoid feedback. If necessary, erect a close-mesh screen behind the transmit aerial – the screen should be well earthed.

We generally use a wideband Amethyst amplifier at the transmitting site, fitted close to the aerial system. A grouped version of the Amethyst is available: this provides a higher output – at a cost!

The Triax Grid type aerial was generally used at the transmitting site due to its flat response, minimum back radiation and forward beamwidth that can be tailored to suit the receiving area. Of great importance is to reverse the transmit polarisation with respect to the receiving polarisation. If a horizontally polarized signal is being received, the signal transmitted from the active deflector site should be vertically polarised. This will provide protection at the domestic receiving site where low-level signals received directly from the main station could otherwise give rise to line pairing, patterning or worse. In hilly areas there's always the possibility that signals direct from the main station will be resolved along with those from the deflector, so to avoid interference effects ensure that the polarity is reversed.

Apart from being of reversed polarity the transmitted signal needs to be as strong as possible at the domestic receiving site. A typical transmit aerial system will consist of at least two stacked bowtie grids, perhaps four. A vertically mounted four-bay Grid/bowtie array will have a beamwidth of well below 30° – nearer 20°. Two such arrays stacked side by side, i.e. eight bowties in line, will severely limit the beamwidth, which could be a problem when the home receiving sites are dispersed. Use of an Ordnance Survey map with at least 2½in. to the mile is recommended to calculate the required beamwidth at the −3dB points for the transmissions. Stacking two vertical bowtie/grid arrays one above the other will maintain the signal beamwidth, limit the vertical beamwidth and increase the gain by nearly 3dB. Results should be acceptable over a distance of about a mile. Mount the transmitting aerials a few feet above ground level and aim them at the valley/screened location to be served. It's wise to provide as high a transmitted signal level as possible to ensure that the domestic receiving aerials provide a noise-free output for the sets.

General Considerations

An 18-element Yagi aerial should provide an adequate signal at the domestic receiving sites, the high-frequency tilt overcoming the greater losses with rising frequency. Recourse to a preamplifier with a less adequate aerial is not recommended as this can result in co-channel interference being visible.

When considering an active deflector, review all locations within the intended service area – and just outside (it's possible that someone with adequate reception just outside the intended service area of the active deflector will experience interference once the deflector is in operation).

Arranging for a power supply to a remote deflector site can be difficult. If a mains supply is available, few problems will arise. I've known a remote site to be d.c. fed from the nearest dwelling via GPO twin telephone wire (on the ground) – taking into account the quite considerable voltage drop on load. At another site – in fact a second deflector in a double-hop system – a battery trickle powered by a wind-driven generator and time clock arrangement was used.

All deflector systems should have DTI approval – though I suspect that more than a few systems are in use in hilly parts of the UK without the authorities being aware of their existence. From information that comes to hand from time to time it's clear that our colleagues in the southern parts of Ireland operate many deflector systems with great enthusiasm, high powers and transmission distances of several miles.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

15/80H	3.30
15/85R	3.30
16039	0.79
16181	1.04
16182	1.04
16334	0.98
16335	0.94
16446	0.98
16600	1.38
16802	1.27
17052	5.61
17053	5.61
17074	9.30
17089	5.35
17127	3.51
17376	1.58
17523	1.32
17524	1.32
1N4001	0.06
1N4002	0.06
1N4003	0.06
1N4004	0.06
1N4005	0.08
1N4006	0.08
1N4007	0.07
1N4148	0.06
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.35
1N914	0.04
IR3403	5.00
1S1555	0.20
1S44	0.10
1S5012A	0.81
1S921	0.10
2N1303	0.38
2N2219A	0.40
2N2222	0.38
2N2646	0.80
2N2904	0.36
2N2905	0.43
2N2906	0.38
2N2926	0.15
2N3053	0.27
2N3054	0.99
2N3055	0.61
2N3442	1.56
2N3702	0.14
2N3703	0.14
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.71
2N3773	2.29
2N3819	0.42
2N3823	1.17
2N3904	0.62
2N3908	0.62
2N4101	1.73
2N4240	3.30
2N4444	1.73
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N5771	1.18
2N6109	1.58
2N6130	0.72
2N6133	1.25
2N6180	0.95
2N6292	1.65
2N696	0.43
2N698	0.43
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.86
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SD1391RL	3.95
2SA1095	4.10
2SA1103	6.55
2SA329	0.40
2SA351	1.17
2SA489	1.17
2SA490	2.25
2SA493	2.25
2SA562	0.57
2SA564	0.75
2SA614	4.88
2SA628	1.14
2SA639S	1.50
2SA659	0.49
2SA673	1.27
2SA684	1.61
2SA697	0.82
2SA699	1.75
2SA715	0.95
2SA747	8.26
2SA748	1.36
2SA817	0.65
2SA818	1.82
2SA835	2.50
2SA836	0.89
2SA844	0.35
2SA872	0.70
2SA884	2.15
2SA937R	0.97

2SA940	1.81
2SA940-2	2.14
2SA950	0.72
2SA951	1.26
2SA966-Y	1.16
2SA999	1.36
2SB774	1.15
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB407	3.24
2SB449B	6.98
2SB511	2.50
2SB54	1.39
2SB546	3.75
2SB56	2.80
2SB618A	2.22
2SB631	3.25
2SB643	0.61
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB75	1.04
2SB774	0.72
2SB819	0.89
2SC1034	6.75
2SC1050	5.06
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	6.75
2SC1116	4.95
2SC1124	1.26
2SC1129	0.34
2SC1131	0.64
2SC1158	3.33
2SC1162	1.05
2SC1172	2.22
2SC1195	3.26
2SC1212A	1.97
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1316	4.10
2SC1317	0.87
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.94
2SC1413A	3.05
2SC1446	1.25
2SC1447	2.07
2SC1475	0.37
2SC1505	1.00
2SC1514	1.41
2SC1573Q	1.25
2SC1578	8.74
2SC1583	1.17
2SC1617	3.89
2SC675	1.41
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.66
2SC1826	0.65
2SC1829	3.34
2SC1875	5.85
2SC1881K	2.98
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	1.07
2SC1929	2.25
2SC1942	4.20
2SC1945	7.99
2SC1959	0.45
2SC1957	1.09
2SC1953	1.93
2SC1962	1.93
2SC1969	3.10
2SC1983	8.35
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	0.95
2SC2073	1.54
2SC2085-Q	1.40
2SC2091	1.30
2SC2141	1.86
2SC2166	1.98
2SC2216	0.69
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2SC2236	1.65
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2SC2314	2.17
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2SC2578	6.75
2SC2671	1.99
2SC2826	2.07
2SC288A	1.85
2SC3153	5.26
2SC372	1.10
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC403C	0.39
2SC41	2.19
2SC458	0.39
2SC495	0.92
2SC515A	2.85

2SC535	0.79
2SC536	0.41
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	0.69
2SC711A	0.50
2SC717	1.28
2SC734	1.43
2SC761-Y	0.95
2SC783	3.98
2SC790Y	1.64
2SC828	0.28
2SC867A	3.05
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC936	8.66
2SC940	4.68
2SD1128	2.90
2SD1138	1.07
2SD1273	1.25
2SD1453	0.75
2SD152K	2.64
2SD198	3.87
2SD234	0.49
2SD235	0.60
2SD24	2.29
2SD257	2.94
2SD292	2.59
2SD313	2.59
2SD325D	1.95
2SD348	16.13
2SD350	5.20
2SD350A	2.80
2SD353	7.50
2SD389	2.41
2SD401	2.55
2SD414	1.98
2SD471	2.13
2SD560	2.95
2SD588A	2.36
2SD600	3.25
2SD601R	0.65
2SD613	1.03
2SD621	12.85
2SD636	0.55
2SD639-R	0.85
2SD655	0.98
2SD657	3.25
2SD661A	0.80
2SD731	2.45
2SD773	0.33
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2SK79	2.98
40408	0.50
40594	1.53
40636	1.43
4EX581	0.80
741	0.30
7805-T022	0.63
7806	0.73
7808	0.85
7812-T022	1.16
7815	0.64
7818	0.92
7824	0.64
7905	0.80
9368	10.70
AA133	0.12
AC133	0.12
AC123K	0.43
AC127	0.27
AC128	0.34
AC138	0.24
AC141	0.29
AC142K	0.44
AC151	0.28
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AD145	1.60
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AD162	0.45
AD262	1.25
AF114	2.47
AF115	1.24
AF118	1.20
AF127	0.50
AF139	0.53
AF178	1.45
AF179	0.55

AF180	0.55
AF181	0.53
AF186	0.53
AF239	0.43
AF279	0.88
AL113	1.36
AN115	3.98
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AN206	2.58
AN208	3.55
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AN211	3.25
AN214Q	2.75
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AN236	3.78
AN239	6.95
AN240P	1.52
AN241	1.71
AN245	4.49
AN253	2.97
AN260	3.85
AN262	1.98
AN272	7.92
AN281	6.65
AN295	5.52
AN301	3.60
AN302	3.99
AN303	4.39
AN305	9.47
AN315	2.46
AN316	5.53
AN318	6.27
AN320	5.47
AN321	2.25
AN322	5.85
AN331	4.59
AN337	5.37
AN340P	1.17
AN355	5.98
AN362	1.75
AN370	3.95
AN5010	5.70
AN5111	2.92
AN5120N	4.50
AN5132	4.39
AN5250	3.98
AN5435	3.08
AN5610	2.85
AN5612	4.25
AN5613	4.63
AN5630	3.95
AN5701N	1.66
AN6250	2.95
AN6300	7.00
AN6310	8.74
AN6320N	4.28
AN6340	11.00
AN6341	5.98
AN6342	1.61
AN6363	16.00
AN6371	9.24
AN6387	7.95
AN6531	1.95
AN6551	1.35
AN6552	0.68
AN6610	2.40
AN6677	8.95
AN7111	1.45
AN7114E	5.94
AN7115	2.55
AN7120	4.65
AN7145	2.80
AN7146	4.35
AN7151	2.26
AN7156	2.85
AN7158	6.75
AN7218	1.64
AN7223	4.25
AU107	3.50
AU110	2.25
AU113	5.25
AY105K	2.08
AY106	1.09
BA524	8.21
B250	2.65
B40	1.55
BA130	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.33
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.15
BA182	0.24
BA222	1.66
BA302	1.24
BA311	1.32
BA312	0.97
BA313	0.76
BA317	0.08
BA318	0.09
BA328	4.77
BA333	1.37
BA335	6.27
BA5102A	3.78
BA511	2.92
BA514	2.20
BA521	2.52
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.56
BA536	2.95
BA6209	4.75

BA656	8.99
BA7100	10.85
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.21
BAV19	0.11
BAV20	0.31
BAV21	0.34
BAW62	0.19
BAX12	0.44
BAX13	0.11
BAX16	0.11
BC107	0.13
BC107A	0.11
BC107B	0.18
BC108	0.15
BC108B	0.15
BC109	0.12
BC109B	0.15
BC109C	0.12
BC113	0.14
BC119	0.36
BC126	0.23
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC140	0.45
BC141	0.34
BC142	0.34
BC143	0.33
BC147	0.08
BC148A	0.10
BC148B	0.13
BC148C	0.11
BC149	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.36
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172	0.13
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.20
BC178	0.26
BC179	0.26
BC182	0.09
BC182L	0.10
BC182LB	0.14
BC183L	0.11
BC183LB	0.26
BC184	0.13
BC184L	0.14
BC184LB	0.26
BC186	0.27
BC187	0.28
BC204	0.16
BC207	0.14
BC212	0.11
BC212B	0.26
BC213L	0.10
BC213LB	0.15
BC214	0.10
BC214LB	0.26
BC225	0.40
BC237	0.10
BC237BJ	0.12
BC238	0.10
BC238A	0.13
BC238B	0.13
BC239	0.12
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.35
BC301	0.45
BC302	0.53
BC303	1.04
BC307	0.18
BC307A	0.14
BC308	0.18
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.11
BC337	0.09
BC338	0.34
BC368	0.24
BC440	1.09
BC441	0.44
BC454	0.36
BC460	0.42
BC461	0.47
BC462	1.15
BC463	0.64
BC477	0.37
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.17
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.10
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC559B	0.11

BC560C	0.14
BC635	0.36
BC636	0.42
BC637	0.24
BC639	0.20
BC640	0.24
BC879	0.39
BC880	0.31
BCX34	0.40
BCY70	0.30
BCY71	0.21
BCY72	0.20
BD115	0.46
BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.54
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.26
BD137	0.36
BD138	0.46
BD139	0.34
BD140	0.37
BD144	1.70
BD150	1.25
BD157	0.67
BD160	1.60
BD163	0.71
BD165	0.62
BD166	0.42
BD168	0.73
BD175	0.60
BD179	0.49
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.53
BD202	0.60
BD203	0.50
BD204	0.61
BD207	1.79
BD208	0.34
BD222	0.49
BD225	0.49
BD228	0.63
BD229	1.05
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.39
BD239	0.45
BD240	0.37
BD241	0.39
BD242	0.39
BD243A	0.37
BD243C	0.79
BD244	0.51
BD244C	0.79
BD245C	0.99
BD246C	1.25
BD253	1.05
BD278A	0.80
BD317	2.60
BD318	2.85
BD375	0.42
BD380	0.76
BD410	0.52
BD433	0.47
BD434	0.49
BD435	0.49
BD436	0.60
BD437	0.49
BD438	0.40
BD441	1.42
BD442	1.41
BD509	1.42
BD510	1.07
BD519	1.50
BD529	1.32
BD530	1.18
BD533	0.67
BD534	0.53
BD535	0.79
BD536	0.61
BD537	0.74
BD538	1.45
BD544B	0.83
BD598	1.25
BD677	0.56
BD679	0.57
BD680	0.76
BD681	1.48
BD696	2.47
BD699	3.49
BD700	3.70
BD707	1.06
BD709	1.12
BD710	0.80
BD809	0.85
BD810	0.69
BD879	0.74
BD880	0.79
BD895	2.31
BD899	2.48
BD901	0.79
BD902	0.84
BDW83C	1.56
BDW84C	1.56
BDX32	1.75
BDX53A	4.93
BDX53B	3.35
BDX54B	2.16
BDX62A	2.15

BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.40
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.21
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.18
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.17
BF241	0.17
BF245	0.50
BF245A	0.52
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.28
BF256LB	0.42
BF256LC	0.42
BF257	0.34
BF258	0.36
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.35
BF336	0.33
BF337	0.40
BF338	0.44
BF355	0.49
BF362	0.66
BF363	0.60
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.29
BF423	0.52
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.39
BF459	0.52
BF460	1.56
BF469	0.31
BF470	0.55
BF471	0.31
BF472	0.33
BF479	0.61
BF480	1.38
BF491	1.99
BF495	0.64
BF506	0.43
BF509	0.41
BF523	0.24
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.75
BF869	0.47
BF870	0.30
BF959	0.42
BF960	0.69
BF970	0.69
BFR39	0.44
BFR61	0.50
BFR62	0.50
BFR79	0.29
BFR81	1.65
BFR86	1.08
BFR89	1.63
BFR90A	1.30
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.32
BFY51	0.50

BFY52	0.27
BFY79	0.49
BFY90	0.61
BLY49	2.20
BR00	0.22
BR01	0.75
BR03	0.75
BR03	1.26
BRC116	0.67
BRC300	2.01
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.53
BRY39	0.69
BSS38	0.87
BSTB0140G	5.25
BSTC0246	7.25
BSTC0233	7.25
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.49
BSW68	0.60
BSX19	1.29
BSX20	0.34
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT106	1.55
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
TBA970	3.06
BT151-800R	1.15
BTT6018	2.42
BTT8124	4.89
BU106	2.48
BU108	1.50
BU109	2.65
BU110	5.69
BU111Y	4.16
BU125	2.48
BU126	1.55
BU137	6.53
BU205	1.08
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.93
BU226	2.95
BU326	2.00
BU326A	2.20
BU326S	2.20
BU406	1.49
BU406D	1.79
BU407	0.82
BU407D	1.09
BU412	9.15
BU426A	1.67
BU500	1.95
BU508A	1.75
BU536	5.80
BU608	2.65
BU705	4.07
BU806	1.79
BU807	0.80
BU826A	2.15
BUW84	1.39
BUX84	1.00
BUX85	1.10
BUY69A	2.04
BY126	0.13
BY127	0.13
BY133	0.11
BY164	0.47
BY176	0.52
BY179	0.62
BY182	1.05
BY184	0.47
BY187	0.77
BY189	1.79
BY198	1.62
BY201/2	1.50
BY203/20	0.59
BY207	0.22
BY208	0.46
BY210-400	0.19
BY210-600	0.27
BY210-800	0.34
BY218	1.64
BY223	1.23
BY224-600	1.88
BY225-100	1.13
BY226	0.25
BY227	0.49
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.69
BY295-600	1.03
BY298	0.20
BY299	0.45
BY407	0.90
BY409	1.49
BY448	0.69
BY713	1.10
BYW19/1000	0.69
BYW56	0.34
BYX10	0.29
BYX55-600	0.19
BYX71-600	1.25

BYX71-350	1.40
BYX94	0.16
BYY56	1.20
BZY93C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.46
C106M	0.76
C1129	0.58
CA3046	2.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	3.12
CBF16848N-071	1.56
CD4001	0.38
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.47
CD4016	0.46
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.85
CD4047	1.06
CD4049	0.46
CD4052	0.75
CD4066	0.38
CD4069	0.29
CD4070	0.66
CD4081	0.35
CD4093	0.72
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.55
CV12E	3.07
CX095D	3.14
CX104	9.64
CX108	10.50
CX109	7.86
CX130	8.76
CX134	11.04
CX136	11.49
CX139	11.83
CX157	4.84
CX158	4.10
CX177	6.75
CX187	5.26
CX755	12.95
CX885A	6.85
DEC1	2.20
DEC2	2.20
DS3486N	4.33
DS3487N	4.33
E1222	0.40
E5024	0.28
E5386	0.25
E9003	0.46
E9005	0.50
ESM310BP	4.15
FND500	5.78
GC374	1.65
GD243	4.95
GF758	0.84
GH3F	1.82
HA11215	4.50
HA11211	2.53
HA11225	4.29
HA11226	8.71
HA11229	2.88
HA11235	2.48
HA11124	5.25
HA11244	2.82
HA11251	4.47
HA1125	4.29
HA1137W	2.87
HA1138	5.03
HA11414	5.65
HA1144	7.87
HA1156	1.16
HA1160	4.78
HA1166	5.25
HA1166X	5.36
HA1167	5.36
HA11706	9.50
HA11705	8.00
HA11703	4.95
HA11701	4.56
HA11710	9.50
HA11713	8.13
HA11711	20.16
HA11715	8.13
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	8.90
HA1180	5.15
HA1196	7.43
HA13001	6.25
HA1306	2.26
HA1338	7.50
HA1339	2.33
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.86
HA1367	4.32
HA1368R	2.45
HA1368	2.07
HA1370	3.71

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Test Report: Hameg HM204-2 Scope

Eugene Trundle

In general test equipment has a long life. This is certainly true of oscilloscopes. Many scopes still in use date from the early seventies, when they were acquired to help with fault conditions experienced during the first colour receiver boom. Most of these scopes now have tired tubes and many of them lack the versatility required in today's high-tech world. Time perhaps to change to a more modern type?

The scope featured in this review was selected from the wide range produced by Hameg of East Germany, whose products seem to have come to the fore in the TV/video/audio servicing sphere. In a nutshell the HM204-2 is a mains-powered 20MHz 5mV (1mV at 5MHz) dual-trace instrument with a rectangular 8 × 10cm 2kV screen, a timebase ranging from 0·5sec to 100nsec/cm plus ×10 magnification, a variable sweep delay system plus variable hold-off time, a signal delay line to reveal the triggering edge, an X-Y display facility and a built-in component tester. It costs £365 plus VAT. An abridged specification is given in Table 1.

Evaluation

I gave my own bench oscilloscope a three-week holiday while I had this one. During this time the Hameg scope saw a great deal of TV and video work – also something of a CD player that was in for service at the time. In addition, some specific tests were set up to help evaluate the scope's performance. By the time it left I'd got to know it quite well!

The Y amplifiers worked well and were found to be able to handle a full-height display of a 20MHz sinewave signal. The slight shortcoming I noticed with a 1MHz squarewave was due to my probe rather than the scope. The signal delay line in the Y path made it possible to see the triggering pulse, typically the leading edge of a line sync pulse. I found the ×5 Y magnification facility useful with low-level signals: signals down to 500μV amplitude, e.g. a tape sound head output, could be examined with a straight-through probe – the reduced 5MHz bandwidth in this mode was no handcap. The "invert 1" and "add" facilities permit differential measurements in the Y1 and Y2 amplifiers, a useful feature though not one required every day – all common Y1/Y2 information is discarded in the display, which thus shows only the difference between the Y1 and Y2 signals. Using the "add" mode with both probes connected to the same point results in a maximum sensitivity of 500μV/cm.

The instrument's front panel bristles with green LEDs that indicate what's happening. A useful pair comprise the vertical overscan indicators: these are arrow-shaped and light up to show which way the trace disappeared off the screen – very useful in "lost-trace" situations.

A choice of test signals for calibration checking and setting h.f. compensating trimmers in probes is available at front panel sockets: 200mV and 2V doses of 1kHz and 1MHz squarewaves, the former for probe adjustment and the latter a stringent test of both probe and Y amplifier performance.

The X-Y facility provided is increasingly useful for servicing, notably for servo adjustment in CD players: at the low kHz frequencies used here the internal phase shift due to unequal X and Y bandwidths is not relevant, though it must be borne in mind when attempting to set up Lissajous or similar displays at frequencies above 50kHz.

A good trigger performance is essential with the increasingly complex waveforms encountered when servicing modern domestic electronic equipment, particularly when only a small segment of a recurring signal has to be analysed. I found that the Hameg HM204-2 is well equipped in this respect, with provision for triggering from a.c. (normal), d.c. (very low-frequency and variable duty-cycle pulses), h.f. (high-pass filtered), l.f. (low-pass filtered, e.g. field triggering from a composite video/blanking/sync signal), or line (50Hz mains) signals. All these coupling modes worked well for me, particularly the last two for field-rate TV work and observing mains-rate ripple on power supply lines respectively. Once a trigger mode has been selected the signal can be routed to the trigger circuit from an external source or the Y1 or Y2 channels. Two useful features are present in the latter case: triggering can be from the unused Y channel in the single-trace mode, and alternate triggering from the two Y channels is possible, permitting the simultaneous display of two asynchronous waveforms.

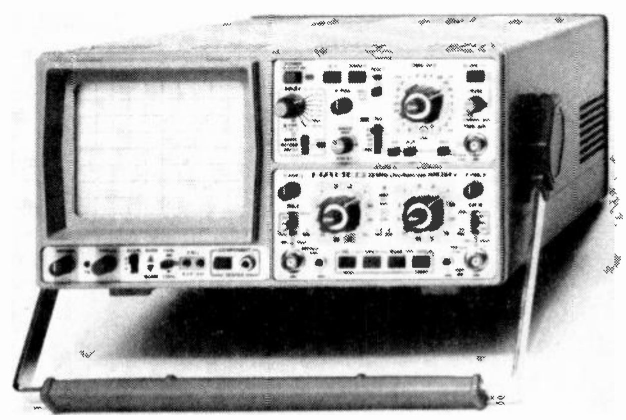
Either the positive- or negative-going slope of the trigger signal can be selected and the level at which the timebase fires is set by means of a rotary control – pushing this knob switches to automatic (peak value) triggering, avoiding the need to fiddle with the level control when displaying simple repetitive waveforms. The "hold-off" facility can be used in difficult cases (the timebase triggering is muted for a preset period during the signal cycle). I found its main advantage to be the provision of a clear display of sections of complex pulse trains like NRZ (non-return to zero) serial data pulse trains.

Whereas the short, fixed Y-signal delay permits the timebase to be fired before the trigger edge is displayed, a very wide-ranging monostable sweep delay system is fitted: there's a seven-position switch and a multi-turn potentiometer. With these, the start of the sweep can be delayed after the trigger point by any period from 100nsec to one second. This system comes into its own for segment examination, for example the full screen width display of a single teletext line or a VITS pulse, the study of a single (stationary!) picture feature at some point along a TV line, or losing a preamble signal such as a framing code in a serial data pulse train. The status of the sweep delay circuit is indicated by an LED: similar indicators show when the timebase is being triggered, when the power is on and, in the single-shot mode, when the timebase is armed. Like many other features of this scope, the single-shot facility is increasingly useful in consumer goods servicing – in this case for the analysis of transient events, though you have to pay close attention to the screen.

I found that these comprehensive triggering arrangements worked excellently. It's essential to study the Hameg operator's manual if full advantage is to be taken of the facilities available. Even so, I've become used to the simpler and more reliable method of externally triggering the scope – this makes the timebase operation independent of the amplitude, content and trace height of the displayed waveform. Virtually all the waveforms of interest in TV, video and related equipment are tied to field, line, colour subcarrier or clock rates and test points carrying these reference (trigger) signals are usually easy to find. I use a third probe (1:1) plugged into the BNC trigger input socket and get a rock-steady display – and a baseline on the screen when the signal probe falls on the floor . . .

The timebase section worked most adequately. There are 21 preset sweep speeds between 0·5sec/cm and 100nsec/cm, expandable (at the expense of brightness) to 10nsec/cm by using the ×10 magnifier. Fine control is by means of a vernier potentiometer, which brings the minimum scan speed down to 1·25sec/cm. I found that the calibration accuracy was better than 2 per cent and looked in vain for any visible retrace.

An oscilloscope is only as good as its display system, and the price of an instrument closely mirrors the goodness of the tube fitted. In the medium price range into which this model fits, a 2kV tube is par for the course. This is perfectly adequate for most purposes, giving a bright and reasonably sharp waveform display. In the "strobe" modes however, such as the segment observation and sweep-delay situations previously mentioned, the duty cycle of the scanning spot is very low, and since the eye responds only to the average brightness of the image the perceived brightness is correspondingly low. When the brightness control is advanced to compensate, the focus performance suffers. As a result a display of one test data line (duty cycle 1:625) or a single vertical line of a test pattern (duty cycle typically 1:200) will be quite dim and possibly ill-defined. The only solution to this problem is to spend a great deal more money on an oscilloscope with a very high post-deflection accelerating potential (say 10-20kV), since this will have a greater brightness reserve to cater for such situations. That said, the display on this Hameg review model had shocking astigmatism in all the display modes. Adjustment of the internal astigmatism preset produced a great improvement, but the focus performance at high brightness levels and in the strobe modes remained unspectacular.



The Hameg HM204-2 oscilloscope.

On the credit side, the internal graticule and its illumination system are very good indeed for both parallax-free observation and for photography. If I had the instrument I'd certainly buy the matching HZ65 viewing hood.

My enforced entry to carry out the astigmatism adjustment gave me an opportunity to assess both the internal construction of the scope and the recalibration/setting-up instructions (also layout and circuit diagrams) in the manual. Both were excellent. The instrument's circuit is conventional and reliable: it uses easy to obtain components like BC557 and BF458 transistors, 78 series regulators and 74 series logic chips. While I'm blowing the trumpet, I'd commend the clear and logical front panel layout, the tilt handle/stand and the dummy three-pin "socket" at the rear for stowing the mains lead. For field work however the front of the instrument is somewhat vulnerable without a hard protective cover – the HZ46 carrying case is an optional extra.

Table 1: Brief specification.

Operating modes: Channel 1, channel 2, channels 1 and 2 alternate or chopped at 500kHz. Sum/difference: channel 2 ± channel 1. X-Y mode.
Y amplifiers: Bandwidth d.c.–20MHz (–3dB). Rise time 17·5nsec. Deflection coefficients 5mV/cm to 20V/cm in 12 steps. Accuracy ± 3%. Times five magnification at d.c.–5MHz (–3dB). Delay line fitted.
Timebase: 100nsec/cm to 0·5sec/cm in 21 steps. Vernier 2·5:1. X magnification to 10. Hold-off maximum 10-1. Trigger auto/normal, ± slope from sources ch. 1, ch. 2, alternate chs. 1/2, mains, external. Coupling a.c./d.c./h.f./l.f.
Sweep delay: 100nsec to 0·1sec/cm. Variable fine control 10:1 to 1sec.
X deflection: Bandwidth d.c. –2MHz (–3dB). Input via ch. 2.
Component tester: Maximum test voltage 8·5V r.m.s. (open-circuit load). Maximum test current 24mA r.m.s. (short-circuit load).
General: 8 × 10 internal graticule with 3-step illumination. 2kV e.h.t. Z modulation TTL, two-state: + = bright. Calibrator inputs 1kHz and 1MHz switchable: rise time <5nsec at 0·2V and 2V ± 1%.
Operating voltage 110/125/220/240V a.c., 40-400Hz. Power consumption 41W.
Weight 7·7kg. Cabinet dimensions 285 (w) × 145 (h) × 380mm (d). Colour brown/grey. Lockable tilt handle/stand.

Component Tester

An unusual feature of this and other Hameg scopes is the component tester. This works by applying a sinewave voltage (50Hz) to the component under test and to the X deflection system. The current flowing in the test circuit deflects the scanning spot vertically, so that the pattern traced out shows the current/voltage characteristic of the component being checked – resistors produce diagonal lines, inductors and capacitors produce ellipses and semiconductor devices produce knees and angles. Some of the prettiest patterns I produced resulted from in-circuit tests of semiconductor devices in reactive (*LC*) circuits. The principle was described by David Botto in the June 1984 issue (page 426). It's certainly a quick and effective method of testing most components, particularly semiconductor devices. Built into the scope and ready for use at the press of a button this is certainly a very convenient feature, though it's limited in both range and accuracy with passive components like resistors and capacitors.

Verdict

Apart from my minor (and perhaps carping) criticisms of the c.r.t. and the unprotected front panel I have to report that I was very happy with this scope, which has many of the features of its more expensive 60MHz/15kV brother the MH605. It was much in demand by my colleagues (notably Tony the Audio) while it resided in the workshop. It's versatile, easy to drive and has good performance. I'm sure that it represents good value for money at £365 plus VAT and it's well backed up, during and beyond the guarantee period, by the UK service and calibration department of Hameg at Luton, Beds. There are European depots in France, Germany and Spain.

The HM605

I subsequently had the opportunity to try out the 60MHz version, Model HM605. This is of similar construction and appearance but incorporates Y amplifiers with a bandwidth of 60MHz and a faster sweep speed to match. My first test was to hook it to the i.f. output of an ordinary u.h.f. tuner, whereupon a beautiful carrier envelope pattern of the 39·5MHz modulated carrier was displayed, with gain to spare. The tube in this scope is operated at 15kV which gives a dazzlingly bright trace and an excellent display of short duty-cycle waveforms.

Judged overall the HM605 does not have as good an internal trigger performance as others, such as the "pulse-counting" scope I once reviewed or the wideband Philips type (which, incidentally, is much more expensive), but at about £567 plus VAT it offers the best price/performance ratio of any wideband scope I've come across.

Availability

Hameg scopes are available from most major trade component distributors and from several of our advertisers, e.g. BK Electronics, Stewart of Reading, etc. The review scopes were kindly lent to us by HRS Electronics Ltd., Great Barr Street, Birmingham B9 4BB (telephone 021 771 2525).

CRT Heater Voltage Checker

J. LeJeune

In virtually all present-day CTV receiver designs the c.r.t. heater voltage is provided by a winding on the chopper or line output transformer. Such a supply is preferable to the older mains transformer supply since the stabilisation is far higher. The shortening of tube life due to incorrect heater voltage becomes noticeable when the voltage varies from the rated figure by more than five per cent, which is less than the guaranteed mains supply limits. Since the c.r.t. is by far the most expensive single item in a receiver the changeover to a stabilised source of heater voltage has been a great advantage. A minority of service engineers maintain however that tube life was longer when the heaters were fed from a 50Hz source.

Theory

The sole purpose of the heater supply is to raise the temperature of the c.r.t.'s cathodes to the optimum level for electron emission. Higher or lower temperatures will result in deterioration of the cathode surface, to the detriment of the tube's life.

The heating effect of an alternating current is defined by its r.m.s. value, this being the value of direct current or voltage that produces the same heating effect. Bench multimeters are calibrated to indicate the r.m.s. value of a sinewave, and produce misleading readings when fed with alternating voltages and currents that are non-sinusoidal, such as the pulse voltages derived from a line output transformer. Furthermore the frequency at which they are intended to operate is normally 50 or 60Hz: they give erroneous indications when used with frequencies that are significantly different from those for which they were calibrated.

There are various sophisticated methods of measuring true r.m.s. values, but they are expensive and often delicate – two features that make them unsuitable for normal workshop use. The simple, inexpensive and very robust checker to be described was developed after the writer's endurance had been tested to the limit watching service engineers attempt to divine the correct heater voltage using a rectifier-voltmeter combination and guesswork.

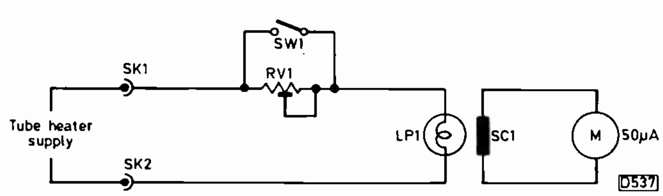


Fig. 1: Circuit diagram of the checker.

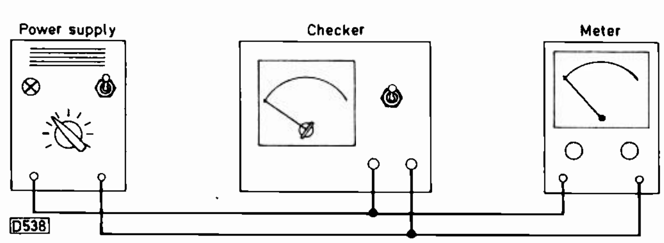


Fig. 2: Set-up for calibrating the checker.

Checker Features

The checker uses no batteries and can be forgotten about when not in use. It's fast in action and fairly immune to misuse, though inadvertent connection to a voltage higher than 12V will fuse the lamp – when this item is replaced the unit's calibration must be reset. Lamp protection was considered but all attempts to achieve this resulted in loss of sensitivity and accuracy over a wide frequency range. The meter is isolated from the supply and is well protected by the parameters of the solar cell. The few components required are inexpensive and readily available – some may be found in odd corners of the workshop. In the original prototype a tape recorder level meter, a photocell from a damaged photographic exposure meter and a plastic box that once housed 35mm transparencies were used.

Circuit Description

The checker's circuit is shown in Fig. 1. It measures the heater voltage by using the supply's heating effect to light a small lamp whose output falls on the sensitive surface of

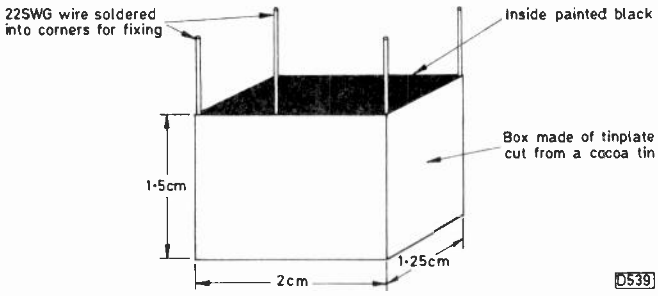


Fig. 3: Lightproof cover for the lamp and solar cell.

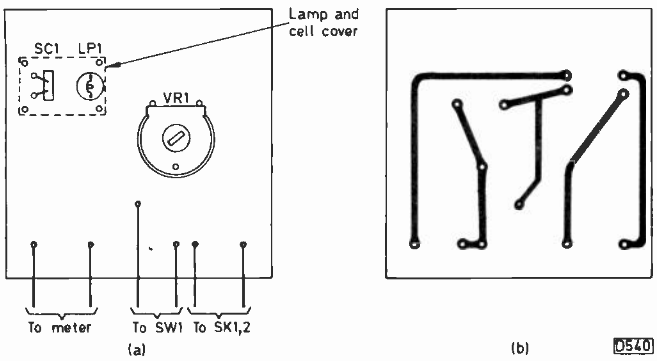


Fig. 4: PCB component layout (a) and track pattern (b).

a photovoltaic cell. This cell generates a direct current which is indicated by the meter. A resistor is switched into the circuit to allow 12V sources to be measured: this resistor drops the incoming 12V to 6V and eliminates any need for switching in the meter circuit – with the very low current involved such switching would be likely to cause trouble. The arrangement also means that the lamp's filament is rarely run at full voltage. Because of its 12V rating an attempt to test a 12V source with the checker's range switch set to 6V won't damage the lamp.

In use the checker bridges the c.r.t.'s heater supply at the tube base socket, the lamp consuming only 20mA. The effect of this on the voltage supplied to the tube's heaters via the usual ballast resistor is negligible, being of the order of 40mV with the usual 1·8-2Ω ballast resistor.

Calibration

Fig. 2 shows the best method of calibrating the checker. A variable voltage d.c. bench power supply is the easiest source of voltage to use, though a 12V battery and a 470Ω, 0·5W variable resistor can be used instead. To measure the d.c. voltage accurately an Avo 8 that's been recently recalibrated is the least that's necessary: a digital voltmeter would be ideal.

Initial setting up of the checker is simple. Uncase the checker and with the arrangement shown in Fig. 2 apply exactly 6·3V d.c. at its input sockets – the polarity doesn't matter. The lamp should light dimly and the meter will give an indication. Any incident light falling on the solar cell from room lighting, doors and windows will also produce a meter reading, so choose a dark corner to do the setting up. Adjust the distance between the lamp and the solar cell to obtain an approximately mid-scale meter deflection. Check this with the light-tight box in position over the lamp and cell. A distance of approximately 1cm will serve as a starting point: the components can be bent closer to or farther away from each other as required.

I chose exactly mid-scale for the 6·3V indication and made other marks on the meter scale at 0·1V intervals, from 5·8V to 6·8V – do this with the checker's cover in place over the lamp and cell. This completes the 6V calibration.

Set the checker's switch to the 12V position and increase the power supply output to 11·5V. RV1 sets the meter's indication for the 12V range. Adjust it until the meter pointer is at the 6·3V calibration mark. Vary the power supply output in 0·1V steps over the range 11-12V and make another set of calibration marks for this range. Don't disturb the positions of the lamp or solar cell otherwise the unit will have to be reset all over again.

Since the lamp bulb will gradually blacken over an extended period of regular use it's advisable to check the calibration from time to time. The frequency of these checks depends on the amount of use the checker gets: in a busy rental business workshop where fitting replacement c.r.t.s is a common occurrence there will be a greater need to check the calibration – it should be done after about a year of daily use. For the casual user checking the calibration is a matter of judgement.

Use

The checker should be used whenever a reprocessed c.r.t. has been fitted to a receiver. Make the last check the c.r.t. heater voltage – after all the other operating voltages have been correctly adjusted. With some imported c.r.t. gun assemblies the heater current differs slightly from that of the original gun, and because of the heater ballast resistor you will get variations outside the normal rating of the tube. Any doubt about the correct heater voltage should be taken up with the c.r.t. supplier. The checker will also show up faulty or out-of-tolerance ballast resistors.

The prototype checker has proved to be fast and reliable in use, with well over a year's service to its credit. Although its 20mA consumption means that it isn't universally applicable, some of the more exotic models reaching our shores being outside its capability, its usefulness in the diagnosis of tube-related complaints has been inestimable.

Components and Layout

There are few restrictions when it comes to the selection of components to use. Choice of solar cell is limited because few such devices are readily available. The Maplin MS4A (order no. BL23A) is one suitable type. The lamp is critical inasmuch as it should be a 12V, 30mA type. The one used in this instrument is an RS Components T1·25 (stock no. 586-380).

The checker's layout is largely a matter for the constructor's discretion, but the capacitance of the input to the lamp should be kept low as this could affect the checker's accuracy at high frequencies. While a PCB gives a neat finish to the unit it could be considered a luxury. Fig. 4 shows a layout – it may have to be altered to suit the components used.

Components

LP1	12V, 30mA lamp, type T1·25
M	50µA meter
RV1	470Ω, 0·5W skeleton preset
SC1	Silicon solar cell, e.g. Maplin MS4A
SK1, 2	Wander sockets
SW1	SPST switch

VCR Clinic

Reports from Alfred Damp, Martin Pomeroy, Christopher Holland, Les Harris, Jim Rainey, Roger Burchett and Philip Blundell, Eng. Tech.

Sharp VC3300

The fault with this portable machine was poor wind and rewind. The AUX brake wasn't releasing on wind/rewind though it did release on playback. The solenoid that operates the brake would pull in (as it should) then release again as the return coil was pulsed. Reference to the timing diagram in the manual showed that this shouldn't have been the case. After spending some time chasing round the brake drive circuit I had a look at the block diagram for inspiration. This revealed that a power failure signal is sent to the brake circuit from the power supply, and although the low-battery LED was out the signal line was floating at 3V. One half of operational amplifier IC901 was found to be open-circuit. Replacing the op-amp cured the fault but then the take-up spool didn't go round in playback! As this had been o.k. before I retraced my steps, one of which had been to swap over the reel drive and loading drive i.c.s. Although the circuit shows them as being of the same type one of them has an A suffix. Swapping them back restored normal operation (the A one should drive the reels). **P.B.**

JVC HR7200/Ferguson 3V29

The problem with this rather worn machine was intermittent loss of drum servo lock in search. The cause was a crack in the servo panel by connector 302. **P.B.**

Toshiba V31B

Severe overloading and no sound in the E-E mode, with the playback light permanently on, was due to Q663 being short-circuit. As a result the play-12V line was present all the time. **P.B.**

Philips/Finlux VR1010

An unusual problem with one of these machines was wow on sound and a rumbling noise coming from the capstan. The old screwdriver stethoscope trick proved that the noise was indeed coming from the bearing, but on these machines the races are riveted into the chassis. So I sent the machine back to Finlux who replaced the complete transport assembly. The noise was still there: red faces all round! If I'd tried replacing the tape servo board I may have traced the fault to a noisy TDA1432 DA converter chip. Sorry Gerry! **P.B.**

JVC HR7700/Ferguson 3V23

The fault on this machine served as a reminder that logical fault finding saves time and money through ordering the correct part first time: work on the assumption that all components are innocent until proved guilty. The complaint was no sound in the E-E mode, with the monitor producing an oscillation in the record mode. A hum test at pin 2 of IC1 (HA12005) produced no output while a similar test at output pin 6 produced results. We assumed that the i.c. was faulty, but were wrong. Further checks revealed that the voltage at pin 7 was low in both the record and playback modes. This pin is controlled by switching transistor X4 whose base was found to be constantly high. This took us back to X44 on the mechacon board, then to IC3 (UPD4066C) on the junction board. Replacing this item finally cured the fault. **A.D.**

Hitachi VT88

This machine would accept and play cassettes properly but was loath to give them back when requested – when the cassette was ejected it was immediately taken back into the machine. We found that the cassette housing timing gears had slipped, as a result of which the cassette-in detector switch was operating too early, before the cassette had been fully ejected. Resetting the gears will provide only a temporary repair: the complete cassette housing assembly should be replaced. **A.D.**

Hitachi VT8500/8700

Failure to record was the complaint with a Hitachi VT8500: there was neither sound nor picture in the E-E mode. The supplies to the tuner and i.f. strip were correct but there was no output from the i.f. module. Fault finding here didn't look to be easy because of the close proximity of the tuner, with both modules soldered into a mother board. Just before I was about to remove the tuner/i.f. pack a picture flashed on the screen then off again: tapping the i.f. module would make the sound and picture come and go. When the i.f. module was unsoldered and its covers removed three obvious dry-joints were seen at earthing points, about a third of the way across the module from the left-hand side. Because of the difficulty experienced in removing the module we decided to do a blanket soldering job. When the module was replaced we had nice E-E vision and sound with no more problems.

A similar machine, a VT8700 in a Granada case, had a pluggable i.f. module. The complaint was the same and on opening the module the same three dry-joints were noted. Resoldering just these three joints restored normal service. **A.D.**

Sony SLC30

Crawling beat-frequency bars on the screen during playback (also in the E-E mode, though less evident) were eventually traced to a ±1MHz oscillation on the UN12V line. This disappeared when plug CN001 was removed from the r.f. modulator – the oscillation was modulating the regulated 9V and 12V lines. After delving around in the modulator it was found that adding an 8·2Ω resistor in series with the UN12V line at plug CN001 (pin 3) solved the problem. It was easily fitted by cutting the print at the pin and mounting the resistor across the break. **M.P.**

Sanyo VTC5000

On playback there was a horizontal line three-quarters of the way down the screen – even with a prerecorded tape. Replacing the head disc didn't provide a cure so I tried swapping over the whole cylinder motor and upper cylinder from a VTC5300 (same unit!). This cleared the fault. Replacing the original upper cylinder assembly brought the fault back. On these machines the fixed head section of the transformer is mounted above the head disc in the upper cylinder: I suspect that the cause of the trouble could have been a short-circuit turn. **L.H.**

Toshiba V9600

This machine had very poor rewind – it would often stop. The problem was not due to the usual upper cylinder or rewind idler wear but to the two pillars that locate into the rear underside of the cassette. They were misaligned, causing the right-hand spool to drag. Unscrewing the pillar fixing screws and relocating the pillars correctly cured the problem. **L.H.**

Toshiba V8600

No output from the modulator due to Q661 being faulty – usually open-circuit base to emitter – has been mentioned before in these pages. I phoned Toshiba to see if any modifications were needed but it seems that the reason for this relatively common failing is not known. **R.B.**

Samsung VI510T

The problem with this machine was perfect playback of a prerecorded tape but only noise on the screen from one of its own recordings, though the sound was good. With such symptoms the first check should be on the voltages that control the video head switching transistors at the head preamplifiers. The fault is normally due to either the record voltage being incorrect or a playback voltage being present during record. What caused the problem with this repair was an apparent mistake in the manual: this suggests that during record there should be 12V on the record line, most easily checked at pin 26 on the Y/C panel. In fact there should be 12V here during playback with zero volts during record. Once this error had been confirmed by checking with a good machine it was easy to trace the fault to IC8 on the syscon panel. It's one of those one-sided green i.c.s with the internal components bulging through the casing. **C.H.**

Ferguson 3V35/3V36

In both the playback and record modes the drum speed hunted at a regular rate. The cause of the fault was traced to R446 (270kΩ) which had gone high in value. It's in the drum speed control circuit, connected between pins 14 and 15 of IC404, i.e. providing feedback in the drum speed error signal amplifier stage. **J.R.**

JVC HRD120/Ferguson 3V35. Erase Problems

Over the years various VHS machines have suffered from problems at the full erase head. When you consider that each time a tape is played the supply loading arm pushes the erase head assembly out of its way after which the assembly springs back into position it's not surprising that with a number of machines you get dry-jointed erase heads or loose plugs at the erase head panel. The resultant symptoms vary from model to model. In all cases traces of colour from a previous recording will be left on the tape, since although the f.m. record current will remove all traces of luminance information any strong areas of colour will remain. With the erase head out of circuit new audio is recorded normally though I have come across models where the previous audio remains as the erase head appears to be an active part of the h.f. circuit and, if not connected, the h.f. oscillator will not start up. In either case the accepted solution is to solder the leads directly to the pins of the erase head, removing the plug if one is used.

For some time I've been plagued by a couple of JVC HRD120s with very intermittent failure to record the audio signal, the previous track being left on the tape. Soldering up the erase head made no difference – in fact on these machines if the erase head is left open-circuit the only apparent effect is smeary colour on the new recording. The problem is due to the h.f. oscillator circuit not starting up – if it doesn't start up for a particular recording it remains inactive throughout the recording. The solution that's finally come through is the following modification. Change transistor Q8 in the oscillator circuit from type 2SD638R to type 2SD638S and alter the value of C48 by soldering a 5·6nF capacitor across it. Should the same fault be encountered in the later JVC HRD140 it's worth checking the h.f. oscillator coil T1 for dry-joints. **C.H.**

Teletext Developments

Peter Marlow, B.Sc. (Hons.), C.Eng.

The future of teletext was the subject of a very interesting lecture at the Institution of Electrical Engineers on October 20th. The speaker was Gerald Crowther, who is adviser for new applications to the Mullard board. As manager of the Mullard Applications Laboratory for several years he had been involved with the development of the first Mullard teletext chip set.

Initial Development

The talk began with a history of the teletext system since its early beginnings at the BBC's Kingswood Warren laboratories in 1972. The system was rugged, reliable and straightforward and could be put into practice economically using the technology of the time. No complicated data processing was required as the data was sent in a fixed format that corresponded directly with the screen position. Texas Instruments pioneered the first decoder chip set (Tifax), closely followed by Mullard.

The original system had the limitation that "black holes" would appear in graphics diagrams. This was corrected by the use of non-printed characters (escape codes) within the text to define the background colours. This limited the amount of printed information that could appear on a line however.

There are now ten million sets with teletext facilities in use in the UK. Fifty per cent of the large-screen sets now sold have teletext and there's a drive on to get the setmakers to fit teletext to smaller-screen models. This is an attractive proposition as the proportion of the cost of a TV set accounted for by the extra chips has dropped from 40 per cent in 1981 to ten per cent in 1985. UK manufactured chips dominate the market, which now covers most of western and some of eastern Europe. Mullard have recently introduced a second-generation two-chip decoder set which gives a better display (12 × 10 characters instead of 9 × 5) and allows for text and data manipulation by an external microcomputer. Other manufacturers are developing similar chips which have a wider application than just teletext, e.g. viewdata.

The Future

Teletext is evolving in several ways which the new second-generation chips are putting into use: multipage memory (up to eight pages at present); hardcopy facility using a printer; full channel operation – where the TV transmission is all text with no pictures; multilingual capability to allow for accented characters (Welsh has some of these) and non-latin based text; programming home terminals with telesoftware; downloaded character sets to provide enhanced graphics; and faster access time with the use of editor selected linked pages. With this last feature the decoder captures several other related pages at the same time as the one selected by the user. These pages are relevant to the subject requested, decided by the editor at the teletext studio. A menu of these pages will be displayed at the bottom of the text page, in coloured boxes: by pressing the appropriate coloured button on the remote control handset the relevant page is instantly displayed. This feature is at present being tested by the BBC and the IBA and sets should be available during the course of 1987.

It's felt that the data rate and the error detection and correction system are not in need of improvement. Users of telesoftware, which is the most demanding application in terms of accurate data, have reported that transmission by teletext is more reliable than via BT, though I suppose it depends on where you live.

Any teletext improvements have to be downwards compatible so that older decoders will receive something recognisable. The present system is called level 1: level 2 will have enhanced graphics and text, level 3 high-definition graphics, level 4 alpha-geometric graphics and level 5 full-colour still pictures.

The level 1 system uses 24 rows (or packets) of 40 characters. These are numbered 0 to 23. A five-bit binary address defines the packet, allowing up to 32 packets to be transmitted in higher level systems while retaining compatibility – 24 to be seen and the rest for colour and graphical information about the picture (formerly called "ghost rows"). These need not be limited to 40 characters. Two more packets (24/25) can be used to display status information on the screen. Packet 30 is the most interesting addition: it will contain broadcast service data which will include a network label, an accurate clock and a programme designator – the latter could be used to control a VCR.

The applications of teletext are not confined to the domestic viewer. Subscription (not closed) user groups can obtain information nationwide – Aircall Ltd. has a system in operation already. The most startling proposed teletext use is as a credit card verifier. Shops would have a teletext receiver linked to a card reader and certain teletext pages would contain the numbers of stolen or lapsed cards, allowing a cross check. In using technology to track down criminals history seems to be repeating itself – future Doctor Cripins beware!

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.

FERGUSON TX90 CHASSIS

Performance is perfect except for the following field collapse trouble. Onset of the fault is usually signalled by faint light or black lines jittering across the bottom quarter of the screen. This is followed by collapse of the bottom half of the raster to a greater or lesser extent: the collapse is sudden and takes the form of severe cramping of the lower lines, with reasonable linearity still maintained in the section above. Once the bottom half of the raster has completely collapsed the top half begins to collapse: again the lowest lines collapse into a central line, pulling the remainder of the picture down. Eventually there's just a single central line across the screen. A smart blow on the case will restore the picture to a greater or lesser extent – persistence with this technique will usually recover the whole picture which may or may not collapse again. No amount of local panel tapping or pushing has succeeded in isolating a sensitive area and application of a multimeter produces an instant and prolonged cure.

We've known this problem to be caused by hairline cracks and dry-joints in the print around the connections to the field output transistors TR104 and TR105. We have also found that these two transistors, types TIP29E and TIP112H respectively, can be responsible. Change them both after making a thorough check of the print and connections in the area. It's important that the transistors are obtained from Ferguson. Substitutes will not work satisfactorily.

PANASONIC NV8610

The problem is with the load/unload function and occurred after replacing the mains transformer. Operation of the power switch starts the drum and capstan motors but not the loading motor. The voltages on the transport/servo panels seem to be o.k. and the loading motor works when an alternative voltage source is applied to it.

The three symptoms (capstan running, head rotating, no loading action) are typical of a machine that thinks it is already loaded. The cause is almost always a stuck or faulty loading and/or load-end switch. These switches are mounted on sub-board VJB00310 on the deck.

ITT CVC20 CHASSIS

Field collapse was cured by replacing the output transistors T9/10 and diode D8 which is in series with them. Next day the set came back with the complaint that there is a band across the picture. It's a dark band about a quarter of an inch wide with bright edges, about two thirds of the way down the screen. We've replaced the driver and pre-driver transistors T8 and T7 and the resistors in T7's base circuit. All resistors are of the correct value and new output transistors have been tried. The output stage bias diode D7 has also been replaced. The linearity is good and there's plenty of height – apart from the band – but we can't get the output transistors to switch over correctly.

You've checked most of the likely culprits. We've often known D7 to be responsible for this fault and find that the correct type (BA316) is essential. Other items worth checking are C23 (1,500μF), C26 (22μF) and C27 (1,000μF) and in particular the three resistors (R62/3/5) associated with D7.

ITT VC300 CHASSIS

The problem with this monochrome portable is that the 11V supply line is low. Adjustment of the voltage control preset has no effect.

Start by disconnecting the tube's e.h.t. cap. If this restores the correct supply line voltage replace the e.h.t. rectifier stick. If not, measure the current flowing via supply fuse F2. If this is low (below 1A) the power supply is faulty – possibly the series regulator transistor T2 (R2441) is defective. If the current is high, check for leakage in the line output transistor (T14) and the diodes linked to the line output transformer (D15/16/18).

SANYO CTP5101

The problem with this set is field collapse – there's about an inch of scan. The voltages in the field oscillator stage are correct but some of the voltages in the following stages are out.

With this chassis field collapse is usually caused by defective electrolytics in the field timebase. We suggest you replace the scan coupling capacitor C436 (220μF), the boostrap capacitor C433 (10μF) and the drive coupling capacitor C431 (10μF). If necessary check the values of R444 (18Ω), R454 (68Ω), R445 (1·2kΩ) and R446 (3·3kΩ) before suspecting the field output transistors Q905/6.

THORN TX9 CHASSIS

This set (Ferguson 37003) behaves as though it's receiving signals from the remote control unit when the latter is not being used. Mostly the set changes channels, and when it does the red LED sometimes stays lit. The fault may occur several times during an evening, then not for days. Response to operation of the remote control unit is correct at all times.

Disconnect plug 32 at the rear of the IR preamplifier. If the problem disappears the cause is noise or instability in the preamplifier, which is probably easier (and cheaper) to replace than to repair. If the fault remains, check the quality (voltage and ripple) of the 11·6V line, at pin 13 of IC101 (SAA5012). If the supply is present and correct, IC101 itself is suspect.

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TELEVISION JANUARY 1987

SONY KV2706UB

The picture on this set is marred by random white spots which appear approximately ten minutes after switching on – they can be seen clearly on a dark raster. I suspected corona discharge but have been unable to locate any. There's no interference on sound.

This problem can be caused by micro-arcing at the internal connections of electrolytic capacitors, usually those in the power supply. Check C653 then if necessary the other reservoir capacitors connected to T603's secondary windings. Check also the mains switch, the safety resistor R617 and for bad joints in the power supply and especially its plug/socket connections. If necessary check the earthing of the picture tube's external conductive coating and for corrosion/discharge at the anode cavity connector and focus connection pins 2 and 3.

TEST CASE

289

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.

It often means finis when a TV set reaches the age of seven or eight years and its tube is in trouble. The economics of replacing a picture tube and the recent tightening up of the manufacturers' seven-year spares rule (have you noticed?) conspire to put the viability of such a job in great doubt. A good tube rejuvenator will often provide the answer, but not always . . .

When the set is the subject of a maintenance agreement something has to be done! We had just such a case recently. The set was a 1979 vintage ITT Model CS712, fitted with the CVC30 chassis. On its first visit to the workshop – after a chequered history of field service calls – the complaint was of a "grotty picture", an apt description. All the signs of a tired tube were present, which is perhaps not surprising after seven years. We treated the tube with our wonder tube-jacker and after a soak test and set-up the receiver was returned to its owner. After no more than a couple of months the set was back on the bench. It looked better than it did when it first came in, but not as good as when it subsequently went out! Once more the impression was of a tired tube.

A suitable replacement tube was found amongst the ex-rental pile of old, condemned TVs. An emission test proved that this was o.k., so it was fitted to the ailing ITT set. After being set up, the picture was reasonable rather than good, but a delivery order was nevertheless raised. It was a few days before delivery could be arranged: on the appointed morning the delivery man took one look at the set's picture and decided there and then that it wasn't good enough to take back. Even the workshop fraternity had to agree – the picture was somewhat defocused, the grey scale had that sickly green look, and the whites were crushed into grey at high settings of the contrast and brightness controls.

Off with the back and hook up the wonder tube-jacker again. It showed that the emission was quite reasonable. Each gun was then tickled rather than jacked, but this produced very little improvement in the picture. Resident Sage was worried. Not only had the reliability of his tube-jacker been called into question, but the set had by now been the recipient of many man-hours of attention. And here we were back at square one. He settled himself behind the set with an oscilloscope, a test meter and a stern air. Alarm bells began to ring when a scope test revealed that the R, G and B signal waveforms at the collectors of the appropriate output transistors were crushed. A check on the h.t. line suppling these stages produced a reading of a little over 200V instead of the expected 225V. Hmm. When the RGB outputs at the TCA800 demodulator/matrixing chip were scoped some flattening of the white response was evident. This led to a check on the 12V line – at pin 9 of the chip. The reading was low at about 10.2V. Attention was next turned to the 12V regulator transistor T14. The input at its emitter was a mere 13V, not really enough for it to bite on . . . It was proposed to change the reservoir capacitor at this point (C71, 470μF) and Resident Sage sent NAT (newly arrived trainee) to the stores to get one. Before he got back however RS had put two and two – or rather thirteen and two hundred – together and had arrived at a correct diagnosis. What was it, and why wasn't the width down all this time? What a wind-up! Answer next month.

ANSWER TO TEST CASE 288 – page 117 last month –

By way of a Christmas treat for our readers we described a Sharp XC30 colour camera fault last month. The last few lines of the story were a give-away! The no-picture condition was accompanied by a remarkable video preamplifier docility: its gain is normally so great that oscillation and instability result from any contact – or even approach to – the target connection lead. The other vital clue was the missing target voltage. In fact the target lead was earthed inside the cast screening cover over the front end of the vidicon tube. Connection to the target ring is made by a spring contact which is anchored to a supporting plastic moulding by a tiny self-tapping screw. As so often happens with plastic mouldings this one had rotted and crumbled away, allowing the spring contact to touch the earthed screen. Switch cleaner cannot be blamed this time!

The service manual contains no obvious part number for this little plastic treasure, but we found that the tube is centred within it by two moulded-on spacer blocks that contact the target ring on each side. We carefully bent and shaped a tiny strip of brass to make a U-shaped shoe to slip over one of these, forming a tight wedge-fit between it and the tube's target ring. After fitting a slightly longer signal-connection wire we were back in business.

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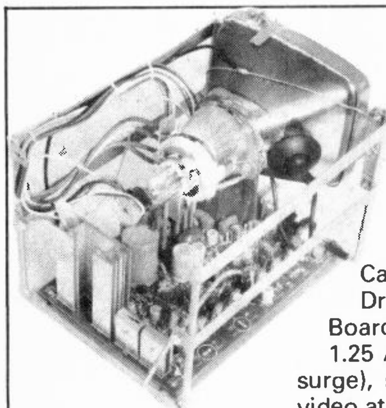

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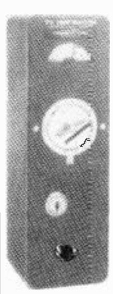

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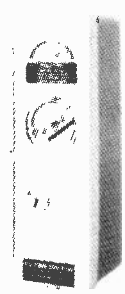

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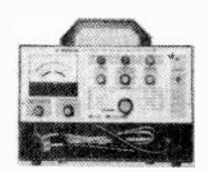

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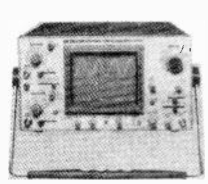

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AN303	£2.75
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AN316	£3.75
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AN6310	£6.25
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2SO 725	KV 2204/2704	10.86
2SO 773	Gen.	0.42
2SO 774	SL/HMK	1.24
2SO 870	KV 2704	7.85
2SO 1164	SLC6UB	1.24
2SO 1497-02	KV 2252/2752	4.98
2SD 1497-06	KV 2252/2752	4.98

PLEASE ASK FOR ANY PARTS NOT LISTED.
NON-STOCK ITEMS AVAILABLE ON REQUEST.

VIDEO HEADS & ACE ASSY.

SL8000/8080	DSR-43R	56.75
SLC5/6/7	DSR-36R	48.60
SLC9	DSR-21R	52.38
SLC20/30/40	OSR-35A	48.60
SL-F1	OSR-35A	48.60
SLC6	ACE	35.94
SLC7	ACE	28.26

PILOT LAMPS

STR6060F	1-518-070-00	1.24
Gen.	1-518-115-XX	1.24
360mA 11V Gen.	1-518-116-00	1.24
40mA 4.5V Gen.	1-518-169-XX	1.24
130mA 23V	1-518-263-00	1.55
13V HMK11	1-518-323-00	1.24
40mA 8V TAF-45	1-518-409-21	1.24

MANUALS (0 VAT RATED)

ALL SONY VIDEO SERVICE MANUALS	10.86
ALL SONY TV SERVICE MANUALS	6.30

VIDEO SPARES

SLC5/7	SONY PART NUMBER	
BOOSTER ANTENNA	1-463-296-00	37.50
MOOULATOR	1-464-116-00	61.51
TAPE UP SENSOR (C7)	1-543-145-00	1.80
CONTROL KNOB (C7)	3-659-547-00	1.24
LIO TIMER (C7)	3-703-075-00	1.24
CAP 2 SHAFT (C7)	3-703-075-00	0.42
CAPSTAN MOTOR	8-838-008-10	42.01
IOLER KIT	A-670-634-8B	5.40
LIMITER ASSEMBLY	X-365-331-00	2.98
IDLER ASSEMBLY	X-365-932-40	1.24
BRAKE ASSEMBLY	X-365-932-82	1.80
PINCH ROLLER	X-365-933-70	1.24
SLC6		
SOLENOIO	1-454-293-11	10.86
MODULATOR	1-464-188-00	70.91
THREADING GEAR	3-671-126-00	1.24
OC MOTOR	8-835-070-11	17.20
IOLER KIT	A-670-639-1B	4.10
REEL MOTOR (MK1)	A-673-710-1A	17.20
REEL MOTOR (MK2)	A-673-710-6A	27.85
FORWARD ASSEMBLY	A-674-007-1A	4.10
MOTOR FRONT LOAD	A-675-113-1A	8.15
PULLEY ASSY. LOAD	X-367-101-50	1.24
SL-F1/C9		
DC/DC CONVERTOR	1-464-217-00	22.53
CARRIAGE MOO KIT (C9)	A-675-121-2B	10.86
CASS. LOAD MECH. (C9)	A-675-123-6A	70.91
GUIOE PIN KIT	A-675-910-7C	6.65
UPPER CYLINDER	A-676-013-8A	27.85
5 RING ASSEMBLY (C9)	X-366-943-10	18.85
PINCH ROLLER (SLC20)	X-366-930-76	10.86

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SL8000 KIT 5 PIECES		8.82
SLC5/7 KIT 6 PIECES		5.40
SLC6 KIT 6 PIECES		8.26
TC Gen.	3-434-110-00	1.24
TAKE UP BELT TC Gen.	3-472-332-00	1.24
BELT DRIVE TC Gen.	3-498-114-00	1.24
BELT MIDWAY TC 161SD	3-531-646-00	1.24
BELT CAPSTAN TC 92	3-536-447-01	1.24
CAPSTAN TC 135/136SD	3-542-458-00	1.24
BELT FLAT TC 186SD	3-543-978-00	1.24
BELT CAPSTAN TC Gen.	3-558-706-00	1.24
BELT CAPS. HST-300	3-564-319-00	1.24
T/UP BELT HMK-3000	3-573-122-00	1.24
BELT HMK3000	3-573-153-01	1.24
HMK 70 & UNIV. T/TABLE	4-827-489-XX	3.14

SWITCHES & RELAYS

RELAY SLC7	1-515-416-00	4.98
RELAY	1-515-418-00	4.98
RELAY TC-K55	1-515-547-11	4.98
CHANNEL KV1340/1820	1-516-847-00	16.80
TIMER SW SLC5/7	1-552-438-00	1.80
SLIOE SW REC SL8000	1-552-834-00	1.24
SLIDE SW R/P SL8000	1-552-836-00	1.80
SWITCH POWER KV GEN		4.98

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RM 606	KV 2704	52.38
RM 603B	KV 2206	61.51
RM 609	KV 1612 (MK2)	43.76
RM 615	KV 2212	52.38
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RMT 213	SLC9	43.76

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REC/PLAY HEAD	8-825-710-00	22.53
R/P HEAD PP128-3602C	8-829-236-XX	17.20
R/P HEAD 181-3602D	8-829-373-40	5.10
MDTOR DNF-1001B	8-835-006-00	22.53
MOTOR ONE-4100A	8-835-049-01	17.20
VIO. TEST TAPE KR52H	8-969-995-52	36.55
CARTRIDGE XL 150	A-450-506-9A	22.53
STYLUS ND 150G	A-458-706-2A	10.86
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P. RDLLER TC 204SD	X-354-241-30	1.80
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PINCH RDLLER	X-355-862-00	1.24
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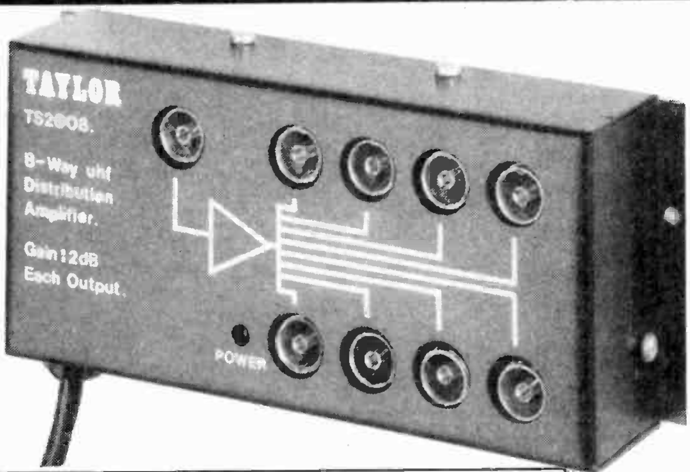

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Ferguson 3HSS Equivalent heads	£31.95
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Sharp VC7300, 7700, 8300 genuine	£58.20
Sharp VC9300 etc Equivalent	£39.90
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Sony C9, C20, C30 Equivalent	£36.50
Sony C5, C6, C7 Equivalent	£31.95
Sanyo	
VTC9300, 5000, 5150, 5300, 5400 genuine	£49.90
Toshiba	
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Toshiba V8600 genuine	£56.95
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3V23, 3V24, 3V29/30	£7.95
3V35, 36, 38, 39	£8.90
Sanyo	
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SENSOR LAMPS

All Panasonic	£1.80
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Sanyo	
VTC9300	£6.50
VTC5000	£1.99
VTC5300, 5400	£6.50
Sony	
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Hitachi	
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VT8000, 8500	£2.90
VT9300, 9300	£3.30
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BC327	£0.10
BC328	£0.10
BC337	£0.10
BC338	£0.11
BC546A	£0.10
BC547	£0.10
BC639	£0.19

SEMICONDUCTORS (Cont.)

BC640	£0.19
BD131	£0.35
BD132	£0.35
BD139	£0.30
BD140	£0.30
BD201	£0.49
BD202	£0.49
BD238	£0.45
BD675	£0.45
BD676	£0.45
BU126	£1.10
BU205	£1.15
BU208	£1.45
BU208A	£0.99
BU326	£1.20
BU406	£0.95
BU407	£0.99
BU500	£1.45
BUY69B	£1.40
BY127	£0.09
BY133	£0.10

ICs

TBA520	£1.25
TBA530	£1.25
TBA540	£1.45
TBA550	£3.95
TBA560	£1.76
TBA570	£1.79

ICs (Cont.)

TBA800	£0.99
TBA810	£1.25
TBA820	£1.25
TBA820M	£0.85
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TDA2002	£1.25
TDA2003	£1.60
TDA2030	£1.65
TA7205	£1.25
UPC575	£1.10
UPC1181	£1.25
UPC1182	£1.25
UPC1156	£1.76
UPC1185H	£2.65
UPC1230H	£3.25
HA1366W	£1.65
HA1377	£3.25
HA1388	£3.25
HA1397	£3.25
STK461	£11.50
STK463	£12.29
STR451	£5.95
LA4100	£1.25
LA4102	£1.25
LA4031P	£1.65
LA4460	£1.95
LA4461	£1.95
M51517L	£2.65
TA7227P	£2.95
TA7229P	£3.25

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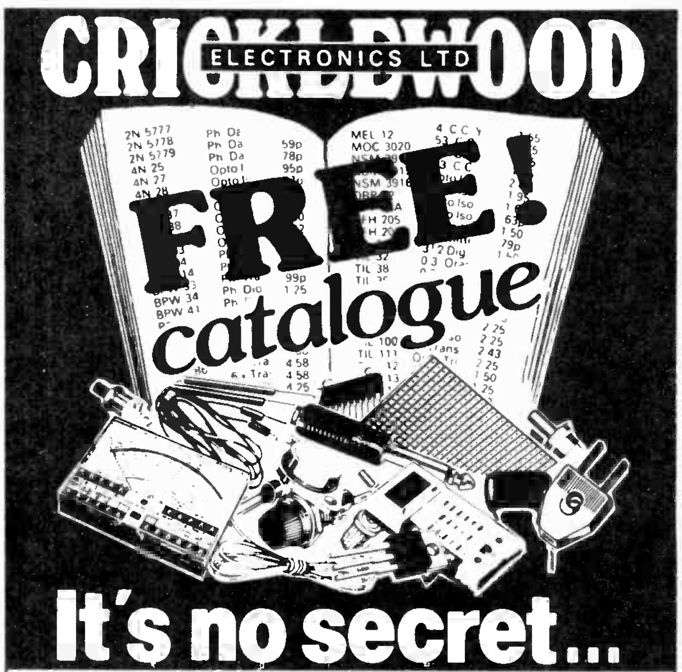
MINIMUM ORDER £5.00 PLEASE. AND WELCOME. PLEASE ADD £1.00 P&P AND 15% VAT TO THE TOTAL
ALLOW MORE POSTAGE ON HEAVIER ITEMS. PLEASE ALLOW UP TO 7 DAYS FOR DELIVERY.



that there is a *real difference* at *Cricklewood Electronics*. That's why you should never be without the *FREE* CRICKLEWOOD ELECTRONICS COMPONENTS CATALOGUE, for sheer variety, *competitive prices* and *service* from the U.K.'s number one 100% component shop. No gimmicks, no gadgets or computers, just components, millions of them, all easily available by mail order, calling or credit card telephone orders. Just pick up the phone (or a pen) to get your FREE copy now (no SAE required). You have nothing to lose.

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VISA Access

TV

TELEVISION

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The prepaid rate for semi display setting £6.78 per single column centimetre (minimum 2.5 cms). Classified advertisements 40p per word (minimum 12

SERVICE PAGES

words), box number 70p extra. All prices plus 15% VAT. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank PLC". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television Room 204B (H.H.), IPC Magazines Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5942).

THE TRADING POST

CLEARANCE SALE OF EX-RENTAL COLOUR TELEVISION SETS AND VIDEO's

Colour TV's working *from* **£20.00 + VAT**
Off the pile **£12.00 + VAT** (batches of 10)
T.V. Stands *from* **£3.00**
GOOD DISCOUNTS FOR DIRECT LOADS
Open 9am to 5pm Monday to Friday
10am to 4pm Saturday – *Sunday by appointment*
THE TRADING POST, UNIT 13, SAVILLE ROAD, WESTWOOD, PETERBOROUGH
TEL. 0733 261500

WHY NOT LET TELEVISION SELL YOUR PRODUCT RING NOW ON 01-261 5942

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	8800 R/C		G11 R/C
	9000		G11 TTX
	9000 R/C	**GEC**	S/S
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	9600 TTX	**MONO's**	20" + 24"

AND MANY MORE

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T.V. & VIDEO SPARES

We supply spares for most makes including Sony and Fidelity all at competitive prices.

We also stock a comprehensive range of rebuilt C.R.T.'s including Hitachi and Sony.

Open Monday-Saturday.

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ACL

Importers and Exporters of Electrical and Electronic Components
MAIL ORDER
Components ★ Components ★ Components
Transistors, Linear I.C.'s, Valves, Rectifiers, Diodes, Thyristors, and many more components.
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OFFERING A FRIENDLY & FIRST CLASS SERVICE TO THE TRADE

GET ON THE WAY TO SUCCESS

BUY AT COMPETITIVE PRICES TO INCREASE YOUR PROFITS

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BETA
SANYO, SONY, TOSHIBA, etc.

TELEVISION
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BUSH T20, T22, T24, T26
THORN 8.8K, 9K, 9.6K, TX
HITACHI, NAT. PAN., I.T.T., PYE, etc.

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TV & VIDEO SPARES

We stock spares for THORN, PHILIPS, PYE, RANK, GEC, SHARP, SONY, DECCA + ITT.

FIDELITY SPARES MAIN DISTRIBUTOR.

Did you know we also stock

FUSES	I.Cs
TUBES	TOOLS
AERIALS	VIDEO LEADS
AEROSOLS	AUDIO LEADS
RESISTORS	SEMICONDUCTORS
CAPACITORS	SERVICE MANUALS
VALVES	TEST EQUIPMENT
HANDSETS	TV/VIDEO TROLLEYS

AND MUCH MORE

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Tel: 061-872 5438; 061-848 0060.

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GENUINE REGULAR LARGE QUANTITIES

Philips G8 – 520	**£15**	26"
Philips G8 – 550	**£25**	20 & 22" 10

Philips G11 – Guarantees Only

WORKING

520 – 30   550 – 45

SPARES PANELS AVAILABLE

Tel. 514047 or call:
Cullum TV & Video
Unit 5, Worle Ind Estate, Queensway, Worle, Weston Super Mare, Avon
(Junct 21 M5 200yds)

COURSES

METERS

NOTICE TO READERS

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

SERVICE SHEETS

SITUATIONS VACANT

'BOBS'

TELEVISION WAREHOUSE

A NEW CONCEPT IN EX-RENTAL T.V. & VIDEO

WORKING TV & VIDEO

ENGINEERED TO THE HIGHEST SPECIFICATION READY FOR YOUR SHOWROOM

NON WORKING

GUARANTEED COMPLETE AND UNCANNIBALISED GOOD CABINETS AT LOW LOW PRICES

ELECTRONIC, REMOTE, FRONT LOADER VIDEOS

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K30, KT3, G11, TEXT, REMOTE AND BASICS

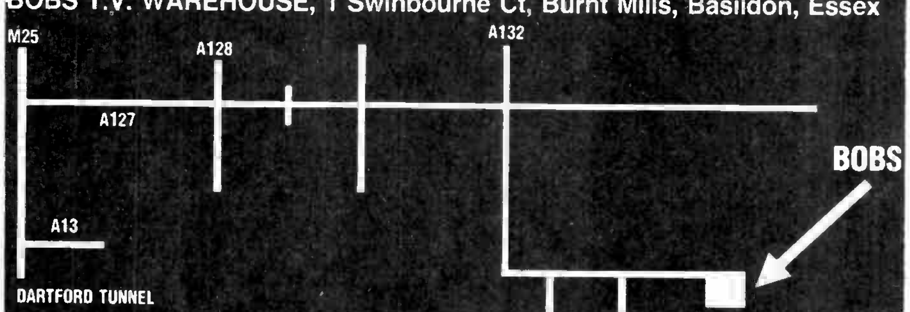
ITT, GEC, BUSH, JAPS., DECCA, ETC.

PHONE BOB BEAN ON:

0268 728966

AND DISCUSS YOUR REQUIREMENTS

BOBS T.V. WAREHOUSE, 1 Swinbourne Ct, Burnt Mills, Basildon, Essex



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TV AERIAL BOOSTERS

B45H/G UHF AMPLIFIER 20dbs gain, next to the set fitting, battery PP3 or 8V to 14V working. **SPECIAL PRICE £7.70.**

B45N/G VIDEO as a transmitter (export), or feeding into a aerial system for up to 6 TV's. On channel 36 (variable) **Price £10.50.**

P&P £1 NO VAT. ACCESS/VISA CARDS WELCOME

ELECTRONIC MAILORDER, 62 Bridge Street, Ramsbottom, Lancashire, BL0 9AG. Tel: (070 682) 3036. (24 hr).

MULTI-OUTLET/MULTI-CHANNEL Installations. Large or small distribution systems. Equipment and/or consultancy by post or on site. Catalogue (full of trade know-how and trade equipment) £1 (refundable). WRIGHTS AERIALS, 43 Greaves Sike Lane, Micklebring, Rotherham. (0709) 813419.

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RETAIL BROWN GOODS DOUBLE-FRONTED SHOP PRIME POSITION

With excellent sales hire and rental, video library premises include 2 bedroomed gas c/h flat – freehold £85,000 + S.A.V.

Reply to Box No. 229

WANTED

WANTED. WORKING AYR TELETEXT ADAPTOR. Preferably with service manual. Tel 0969 22598.

SERVICE MANUALS 1974 or later. VCR. CTV. MTV. Camera, Audio, et. anything considered. cash paid (no photo copies). 0202 892279.

CASH PAID now for your surplus TV spares, transistors, I.C.'s etc. Tel. MR. FORSHAW, 0902 29022.

GOLD PLATED SCRAP WANTED. Scrap edge connectors, circuit boards, anything considered. Contact P & F TURNER & SONS. Tel. Oxford (0865) 510293.

WANTED Video's, portables, colour TV etc. Any quantity. Immediate collection. Cash paid. Tel. Stoke on Trent 416401.

WANTED. SONY RMT-211 Remote control for TT-F1 timer/tuner. Please phone Swindon 303357.

WANTED
Ex RENTAL COLOUR TVs IN BULK
QUICK COLLECTION
Phone 0742 312832
(Sheffield)
IN STRICTEST CONFIDENCE

FOR SALE

JAPANESE TELEVISIONS FOR SALE

PRE USED 14"/22"
For details:
Phone: 0484 863489

TURN YOUR COMPUTER into a storage multimeter with my interface. Works with any 8 bit computer with hand-shake lines -Vic. C64. BBC. Program for Vic, C64 (State which) easily convertable. Circuit, program instructions £10. Program for Vic, C64 Xhatch, vert, hor. blank, colour bars. £3.50 send remittance to DELTRONICS. 10 Snell Hatch, West Green, Crawley. Sussex RH11 7JB (0923) 542823.

G8/550 EX-RENTAL GOOD TUBES. – Spare set panels with each TV £20. 5 sets £80. Buyer collects, cash only. RENTACET. 0525 403466 Bedfordshire.

2 SETS OF FULLY RECONDITIONED tube re-gunning plants for sale. Training provided. From only £3,995. Tel. 0582-410787.

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£40 each + VAT
Minimum quantity 10
Tel: (0602) 397555

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We produce a 4 channel power amplifier (10dB power gain) as an add-on to existing 1 volt amplifiers.

£150.00

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Tel. 0478 2843

DEVONICS

Quality Tube Rebuilders

2 YEAR WARRANTY

Inline Tubes	
Up to 20"	£43
22"	£45
26"	£46
Sony Tubes	+ £15
Bonded Coil	+ £5
30 AX (–540X)	+ £7
Delta tubes	from £30
Mono Portables	from £15

All plus carriage and VAT

2A BARTON HILL ROAD,
TORQUAY TQ2 8JH.
0803 33035

Sabaco

For a great deal!

TRY US YOU'LL LIKE US
TOP QUALITY TV'S & VIDEO'S AT ROCK BOTTOM PRICES

VAN LOAD DIRECT FROM SOURCES
ALL SETS & VIDEO'S OFF THE PILE
(Mostly switch-ons)
Largest selection of 4000/8800/9000/9200/9600/Ferg TX9/TX10 Stereo Teletext Colour Portables
Mainly teletext and remote with handset.
Also Pye KT30/G11/T20/T26/Hitachi/Philips 550/Grundig & many more.
BRAND NEW SETS AT LOW PRICES

VHS VIDEO'S

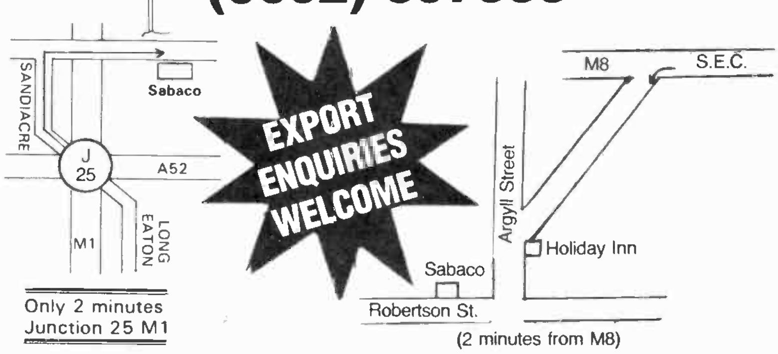
Good Working Order from 3V22, 3V23, 3V29 Portable Video's etc.
Also a selection of brand new video & E180 video tapes

OPENING HOURS:
MONDAY TO SATURDAY 9am to 5.30pm

CASH ONLY All goods subject to VAT & availability

PHONE NOW FOR UP TO DATE COMPUTERISED PRICES AND DELIVERY DAYS, BE HERE WHEN LORRY ARRIVES FOR FIRST CHOICE — PHONE US NOW ON:

(0602) 397555



Head Office:
Sabaco
Saba House,
46A Derby Road,
Sandiacre, Nottingham
(0602) 397555

Sabaco
75 Robertson Street,
Glasgow
(041) 221-2146

MISCELLANEOUS

NOW TOTAL SPARES SUPPORT FOR GRUNDIG

FROM WVE

ALL from STOCK *(Subject to availability from Grundig)*
Trade Prices subject to official order

CABINETS ★ KNOBS ★ TUNERS ★ CONTROLS ★ CRT'S ★ TRANSFORMERS
SEMI'S ★ I.C.'S ★ CAPACITORS ★ REMOTES ★ TRIMS ★ END USER PARTS

Tel: 0734 876444 — **Willow Vale Electronics Ltd** — Tel: 0734 876444
11 Arkwright Road, Reading, Berkshire RG2 0LU
SOLE UK GRUNDIG PARTS DISTRIBUTOR

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FROM WVE

ALL from STOCK *(Subject to availability from Fidelity)*
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CABINETS ★ KNOBS ★ TUNERS ★ CONTROLS ★ CRT'S ★ TRANSFORMERS
SEMI'S ★ I.C.'S ★ CAPACITORS ★ REMOTES ★ TRIMS ★ END USER PARTS

Tel: 0734 876444 — **Willow Vale Electronics Ltd** — Tel: 0734 876444
11 Arkwright Road, Reading, Berkshire RG2 0LU
GENUINE FIDELITY PARTS AT STANDARD FIDELITY TRADE PRICES

GET
SHARP *PARTS FAST*
TELEPHONE
0734 - 876444
TELEX 848953

WVE

SHARP
Main U.K. Spare Parts Distributor

Audio-TV-Video ★ Microwave ★ Photo-copier ★ Typewriter

All U.K. model spares available. Same day despatch of orders received before 1pm.
Microwave, photocopier and typewriter spares to authorised service dealers/centres only.

WILLOW VALE ELECTRONICS LTD.,
11 Arkwright Road, Reading, Berks.

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Please insert the advertisement below in the next available issue of Television for .... insertions. I enclose Cheque/P.O. for £ ....
(Cheques and Postal Orders should be crossed Lloyds Bank Ltd and made payable to Television)

NAME ....

ADDRESS ....

....

Send to: Classified Advertisement Dept.
TELEVISION
Classified Advertisement Dept., Room 2612, King's Reach Tower, Stamford Street, London SE1 9LS. Telephone 01-261 5942.
Rate: 40p per word, minimum 12 words.
Box No. 70p extra + 15% VAT.

Company registered in England. Registered No. 53626. Registered Office: King's Reach Tower, Stamford Street, London SE1 9LS. 1/87

The Theory and Practice of PAL Colour Television in three important Video Cassette Programmes

Part 1.
The Colour Signal
Part 2.
The Receiver Decoder
Part 3.
Receiver Installation

VHS★★★V2000★★★
BETAMAX★★★UMATIC

For full details telephone
0253 725499 (Day)
0253 712769 (Night)

Or send for precis details
FLINTDOWN CHANNEL 5
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LYTHAM ST ANNES FY8 1LP
(enclosing this advert)

NAME ....
ADDRESS ....
.... TEL: ....

SOLE SUPPLIERS TV/VIDEO Repair manuals/circuits, 1000s s/manuals supplied by return. S/sheets £2.50 except CTV/m.centres/stereos £3.50. LSAE with every order/query please brings free price list/magazine inc s/sheet – or phone 0698 884585 (883334 outside business hours) TIST, 76 Church Street, Larkhall, Lanarkshire.

BOOKS AND PUBLICATIONS

Ku BAND SATELLITE TV THEORY, INSTALLATION AND REPAIR

This 358 page manual is an updated version of the best seller "The Home Satellite TV Installation And Trouble Shooting Manual", by Baylin and Gale U.S.A. Covers uplinks, footprints, dish theory, site survey, installation and adjustment, de-scrambling, cable TV, even includes a computer program for finding your satellite £23.

Also available "Satellite And Cable TV, Scrambling And De-Scrambling" 256 pages £19.00

Send cheque, COD, Access Mastercard:
J. VINCENT TECHNICAL BOOKS,
24 RIVER GARDENS, PURLEY,
READING RG8 8BX
Tel: 0734 414468 (Answerphone)

★★★★★★★★★★★★★★★★
SERVICE PAGES SERVICE PAGES
PLEASE MENTION TELEVISION WHEN REPLYING TO ADVERTISEMENTS
SERVICE PAGES SERVICE PAGES
★★★★★★★★★★★★★★★★

MAIL ORDER ADVERTISING

British Code of Advertising Practice

Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfil orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch as this may be needed.

Mail Order Protection Scheme

If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt provided:

(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

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

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

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

INDEX TO ADVERTISERS

Philips small stereo headphones £4
Stereo Philips
Rank UHF 4 push button tuner £4
GRC power supply PC743B £10
Rank front panel Z950 £5
Power panel 8.500 Thorn £5
Fedility mains switch & lead and filter panel £1
Fedility mono lopt with diode FBS1245AE £3
6 TAG print mains switch PREH 1983 ITT 75p
Rank T603A tuner on panel £6
Scan control panel Z544 £3
Rank Z582 IF £3
Rank convergence Z910 £3
GEC IF tuner panel PC786B £12.50
ML 232 I.C. on panel tuch unit Fidelity £3
2SC643A £1
2SC1617 £1
2SC1942 £1
Hitachi power panel PC036A £1
Rank IF 742 £3
Rank decoder Board MTS 200/1 Tuner & IF £12.
Z733 Rank mains in put-panel £1
G11 Chroma Can 3113 108 25300 £3
20AX Line lin coil 50p
GEC switch mode trans 20AX
ITT mains CVC9 to CVC33 print type 60p
ITT 2,800 mains remote switch 50p
2110 GEC Power Panel £8.00
Line o/p frame panels GEC 20AX £10.00
GEC 20 AX Transductor £1.00
ITT CVC40 Push Button Unit & Mains Switch £8

Rank Panels
Z904 18" Line Panel £10
Z905B Decoder £10
Z736 Tuner I.F. £10
A805 Conv. 7/8 £2
Z780 Line O/P £10
Z968 £10
Z582 I.F. Panel £5

Rank Power Panel
300+300m with diodes degaussing £3
BA 301 £1
TA 4127 £1
HD 3884 2A23 £3
TA 4184 £1
TA 2125 £1
TA 4190 £1
TA 4138 £1
TA 4196 £1
TA 4174 £1
TA 4139 £1
TA 4198 £1
TA 4167 £1
TA 4199 £1
BA 546 £1
BA 328 £1
TA 4176 £1
TA 4145 £1
TA 4191 £1
HA 11710 £1
TA 4188 £1
TA 4197 £1
TA 4183 £1
TA 4197 £1
TA 4183 £1
TA 4195 £1
TA 4175 £1
TA 4177 £1
TA 4192 £1
TA 4146 £1

The Service Engineers Guide to Teletex £2
Teletex Colour Training Manual £3
Mains Trans
C. Core 240v 4v+4v 4v04v 2AMP 12v lamp £2
Mullard split diode AT2076/80 £6
4 Types Fedility front panels with i.c. & pats £2 each
Amstrad TV chassis Complete damaged print £5 + £5 post
BB 103 10p
BB 105A×12 £1
BB 105B×12 £1
BB 105G×12 £1
BB 121a 10p
47 10p each

A 823A chassis
Scan drive £5
IF £3
Scan control panel £3
NEW A31/510 tubes with s/coil £6 + £2 post
1A/1600V 10p
2 amp bridge rec. wire end 15p

CV 8617 10p
Y 716 10p
Y 729 30p
Y 730 10p
Y 827: 6A/1KV 20p
Y 860 30p
Y 933 5p
Y 969 50p
Y 997 30p
Min 12 volt Relays 75p
R 1038 40p
R 1039 40p
R 2009 80p
R 2010b £1
R 2029 50p
R 2210 60p
R 2257 60p
R 2265 50p
R 2305 50p
R 2306 30p
R 2322/2323 pair 80p
R 2323 15p
R 2396 50p
R 2461 80p
R 2030 50p
R 2443=BD124 30p
R 2540 £2
R 2737 40p
R 2738=TIP41 30p
R 2775=TIP41c 40p
R 3129=TIP47 40p
R 4050 £1.00
S 2008b 80p
2SD898B £1
2SC1942 £1

Hitachi sets etc.
STR441 £2.50
STR454 £2
S 2000AF line o.p. £1
2SC940 £1
BU 105/04 80p
BU 108 £1
BU 124 50p
BU 126 80p
BU 180a 65p
BU 204 70p
BU 205 £1
BU 206 £1
BU 207 £1
BU 208 80p
BU 208A £1.10
BU 208D 90p
BU 222 £1
BU 326 £1
BU 407 60p
BU 426V 60p
BU 500 £1.10
BU 500D £1
BU 508A £1.20
BU 526 75p
BU 807 £1
BU 824 50p
BUW 11 £1.00
BUW 84 60p
BYW 20-08-9 £1
BYW 95 10p
TIC 106a 30p
TIC 116m 40p
TIC 116n/Y 1003 35p
TIC 126N 40p
TIC 206m 30p
TIC 225S 40p
TIC 226E 40p
TIC 226m 30p
TIC 236m 30p
TICV 106D
(T092 case 2A/400V) 10p
TIP 29 20p
TIP 30 35p
TIP 30A 35p
TIP 30B 40p
TIP 30C 45p
TIP 31 30p
TIP 32 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34B 60p
TIP 34C 70p
TIP 35B 50p
TIP 35C 70p
TIP 35D 80p
TIP 36 50p
TIP 36C 70p
TIP 41B 40p
TIP 41D 70p
TIP 42/BRC 6109 30p
TIP 48 40p
TIP 49 30p
TIP 57 30p
TIP 100 30p
TIP 102 30p
TIP 115 50p
TIP 117 50p
TIP 125 35p
TIP 126 40p
TIP 127 40p
TIP 130 30p
TIP 131 25p
TIP 136 30p
TIP 140 50p
TIP 640 50p
TIP 2955 35p
T 6032 30p
T 6036 40p
T 6040 40p
T 6047 40p
T 6049 40p
T 6051 40p
T 6052 40p
T 9004 40p
T 9005 40p
ZTX 107 10p
ZTX 108c 10p
ZTX 109k 5p
ZTX 213 5p
ZTX 341 10p
ZTX 342 10p
ZTX 384 10p
ZTX 451 10p
ZTX 550 10p

MJ 2253 60p
MJE 3040 60p
MJE 2209 10p
SP 8385 50p
SAB 3205 £1.00
SAB 4209 £1.00
G11 condenser £1.75
300M + 700 320V £1.80
200 + 100 + 100 + 50 300V 50p
150 + 200 + 250M 300V 50p
Chassis complete £35
Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3
Mains ViewData Torroidals £3.75
240V/240/6V/4 amp/6v 500m/a in / out – – – – – –
Mains trans 240/12v-0-12v 2 amp £3.50

Voltage Regulators
+5V/UA78PO5SC 30p
−5V/LM79MO5CP 25p
−8V/79M08c 30p
+6V/78M06c 30p
+10v/78LA10 20p
LM 317T 35p
LM 337 30p
LM 342/18 30p
LM 340T 5.0 50p
+12V/LM 340T12 50p
+15V/78M15 15p
+18V/MC78M18 20p
+24V/78M24 30p
MC 7724cp 40p
MC 7824 40p
TIS 90 10p
TIS 91 20p
TIS 92 20p
TIS 93 20p
U 19885 40p
U 3832 15p
U 3845 15p
MR 508 10p
MR 501 10p
MR 502 10p
BCW 71R 30p
BYF 1202 10p
BYF 1204 10p
BYF 3126 40p
BYF 3214 40p
BYX 10 6p
BYX 36/600 35p
BYX 38/300 25p
BYX49/600R 75p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYX 36/600 50p
BYV 95B 10p
BVY 95C 12p
BYV 96D 10p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v G11 8p
BZU 15/24 54p
BZY 93c75 50p
BZV 15/18 30p
BZV 15/30 30p
BZW 70c6v2 10p
BZX 79.3v 10p
Bush thyristor RCA 76122 £1
Transformer 240v/20v-500Ma 75p
Chassis type Transformer 240v/12 Volts 500m/a 75p
CVC 20 tube base £2
Tube Base Rank & G11 £1.20
6v-9v-13v tape motor 75p
Infra red led LD57CA 15p
G 8 transductor £1.25
AT 4041/41 transductor £1
15K-20 turn pots 20p
Thorn panel 6×100 pot + changeover switch (Irish) 50p
Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £6
Thorn 3500 2A cut out 50p

Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit £6

SPECIAL OFFER
Decca-TTT etc.
FEO4/1/250AC/4 Mains filters (grey type) × 4 50p

BRIDGES
KBL 005 30p
KBL 02 30p
KBP 04 30p
W02 15p
W004 15p
W005 20p
AT 2076/35 £7
AT 2076/55 GEC split diode transformer £10
AT 2048/11 LOPTI Mullard £2.50
Z918 Front Panel with Mains Switch & I.C. £4
Thorn Chass U916D Compleat £10
Thorn TX9 Remote Panels with I.C.s £2.50
Thorn 9000 4 Slider Front Panel £4
Philips 12 Volt car aerial 15.00
Philips £15.00
2 off 30 watt car speakers.

Philips car radio speaker door pair £7

2× Hi-Fi Philips car tune up tweeter EN8320 £10

ITT CVC45 8 way resistor unit for v/cap £3

4700/10v × 10 50p
68/16 × 10 50p
150/16 × 10 50p
47/25 × 10 50p
220/25 × 10 50p
1/250 × 10 50p

8000/30v 50p
470/40v × 10 £1
22/100v × 10 £1
100/350v 70p
400/350v 70p
.47/500v 25p
1/600v 25p
.022/1kv 10p

Nickel Cadmium Battery Charger AA-C-D-PP9 £6

12 Volt Aerial Changer over Relays 144 Mc/s 45 watts 50p

GEC Hitachi
V/Cap tuner, after 1979 Series £8
6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £8

8 SEG LED Display with driver I.C. LM1017 50p

20AX GEC Split Diode lead £1.00

Electronic Buzzer 60p

NI.CD Charger MW398 6A.A £8
NI.CD 5 Hours Battery Charger £8

PC772A3
Philip's Headphones
Compact Disc Stereo Type £13

ITT Display Tube 58705 50p

8 Seg Display FND500 20p

Model 3000
Pocket Personal D M.M
Volts range AC, DC 200M/V to 400V. Res 2000Km £24

Export PYE731
6 Push Button unit with (UHF-VHF) band switch £4

ITT Micro Phone M5 50p with switch

1½ Volt Sub Min Relays 25p

Philips Solar Scientific SBC1730 Calculator £12

15v-0-15v 1 Amp Transformers
RGP30K 10p
RGP30G 8p
RGP10B 5p
RGP15G 6p

Multi Core
60-40 Soldar 500G 20 SWG £4.50
15 Watt Stereo Amp Sanyo Module with Data £5.00
25pcs Precision Screwdriver & Tool Set 50p
25 Watt Solder Iron £6.00 £4.00

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
T/V loop aerial 75p
Radio Telescopic Aerial £1.00
Philips Neon Lamps for TV sets 5p
Freeze Philips £1.20
Foam Cleaner Philips £1.20
Contact Cleaner Philips £1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona All at £1.40
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
Screen locking agent, large can £1.50
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
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 Philips £4.00
Plastic box for i.c.s 6"×3"×½" 50p
Flat Red LED and Green 5p
500gm 60/40 solder reel £6
Solder 1 kilo reel £5.50
Clearweld glue pack 30p
Dual v/u meter -20 – +10db £1
K30 thermistor 23226629809 75p
GEC Mains Power Supply R.E.G. £3.00
De-solder Pump £2.50

Panel Meters VM/A
Gray front and .0-300V AC/DC 2¾ × 2¼ and IM/A £2.00 each

SONY 1400KV Chroma Panel £6
SONY 1400KV Touch button unit £3.50

GEC Decoder Panel PC772A3 PC446A5 £6

Tube GEC PC852B3 £1

Thorn Aerial Socket TX10 £1

12 Volt Mains Trans 500M/A £1.00
18V or 12 Volt Mains Trans 500M/A 75p

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 £2.00
BF458 10 for £1.00
BF224 20 for £1.40
OA90 40 for £1.00
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
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
25 Panel Mount Bulbs & Neons £1.50
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
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
20 Knobs £1.00
20mm Fuse Holders
Chassis Mount 20 for £1
IN4001/6 100 mixed £2.50
EHT Diodes, small 20 for £1

200 Mixed Diodes £1

100 500M/A Fuse £1
100 1.225 Amp Fuse £1
Mixed V/Cap Pots ITT-GEC-Hitachi-Philips etc. 20 for £1
ITT Mains Switch with Remont CMC113 £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 preb 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
G8 Push Button Unit	£10.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button GRC	£6.00
6 Push button PYE 731	£6.00
Hearing aid unit	£3
Rank Z718 4 P/B/Unit MECH	£4
7 Button Unit GEC with Lamps	£7
697 Push Button Unit	£6.00
Z916B panel	£5.00
T513AP panel	£5.00

Mains Droppers

G8 2R2+68R	£1.25
G8 47R 15 watt	75p
Pye 731 3+56+27R	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
Ac Socket & Lead	
GEC, ITT, Philips, Pye	25p
7×3¼ Thorn	£1
Thorn 1600-1700	£1.50
Rank Toshiba Tube Bases	30p

Speakers

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-425		
OF-550	I. 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 228 1500v	20p
BY 299 Red	20p
BY 229/400	30p
BY 299/60p Tag	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 527	10p
BY 602	10p
F 247	10p
GP20G	5p
XK 3102	50p
BYV 28/200	20p
800v/2 75 amps	10p

International Rectifier EHT Diodes G770/HV34 6KV — 3 for 8p

6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p

K35 Decoder	£8
K35 Sound OP	£4
K35 Split Diode 3122-.38-35930	£10.00

Fidelity Tube Base with transitor & focus pot	£1.50

Bush Tube Base on panel	£1.00

Line Transformers

Thorn 1690 LOPT	£6.50
Hitachi Split Diode and GEC 1981 to 1984	£13
2 J/Pots 3,500 1 off each type	£3.00
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
CVC20 ITT	£3.50
AT2080/15	£5.00
CVC30 ITT	£5.00
CVC32 Line Tran	£6.00
CVC800 Line Trans	£6.00
CVC40 Slip/Diode	£12.00
CVC 45	£5.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
EHT Split Diode Leads ITT	£1.00
3500 L.O.P.T. & IIT Trans	each £2
LOPT Rank Z763	£5
K35 Split Diode 3122/13835930	£7

Triplers

S T C Universal Tripler	£5.00
11 TJF	£2.50
11 TGA	£2.00
ITT CVC 5-8-9	£3.50
Rank T25LE Tripler	£2.00
Rank ITTCP 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
8500 Thorn	£4.00
9000 Thorn	£6.00
9500 Thorn	£4.50
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
G8 Tripler	£5.00
Green Tripler with foacs pot	£6.00
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
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
ERO Tripler print type with foacs PO7 BG2087	£5
T/text ultrasonic rec'r panel	£14.00
12-14V. **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	20p
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 1O66 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
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
25A473 PNP C/P	10p

Rank T20 Z136 Panel	£6
NEW 1617 THORN Chassis with ICs & AU113	£5.00
30V Power Supply 500M/A 4×2¼	£2.50
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	£4.00
NEW G11 IF Panel	£7.00

G8 Tuner Unit + Panel	£4.00
G8 Power Supply	£5.00
G8 6 Sloping PBU	£8.00
G8 IF & Chroma	£6.00
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
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots 8 and 12 button units	£9.00
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

G11 drawer ASS 3 pots Mains switch and lead	£2.00

K30 Drawer Ass with pots cable forme	£1.00

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

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

.1/250AC	20p
.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
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 (ITT)	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
.22/1000	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
3n9/2KV	15p
0.0015/2KV	10p
6n2/2KV	15p
2n0/2KV	15p
2n2/2KV	15p
470pf 4KV	10p
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	60p
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

220 MFD Sprague 385V	50p
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
200+200+75+25M 325V	£1.00
300+300+150+100+50MFD 350V	£2
G11 CAP 470/250	£1.50
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
200/200/75/25M 325V	£1
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 8 and 6 Push Button	£1.00
Pye 725 LOPTs	£6.00
Pye 731 LOPTs	£6.00
Thorn 8500-8800 LOPTs	£5.00

CMD 800 Chassis. No tuner	£20.00

CMD 800 Decoder	£8.00

TAG 226/600	50p
BD 650	50p
UPC 574	30p
BSS 38	30p

G11 1 I.C. Receiver Panel	£1.50

3 I.C. Power Supply G11 Full Remote Receiver Panel	£3

FET Power VN88AF	50p

PHILIPS SBC 469 Stereo Microphone	£23.00
Meters Hills 520	£17.00
Meters Hills 420	£15.00
Infra-red Tester Handset	£12.00

Infra Red Hanset Tester

Works at 24 feet – Sound repeater.
Works off 9 volt battery £8.00
Fits in top pocket.

Repaired Handsets

Philips K4-K35. RC5350-RC5300, RC5370, RC5375, repaired same day	£10.00
RC4001 Full Remote KT3 K30 Teletext Handsets exehanged	£9.00

GEC Full Remote Infra-red, 1983 models	£15.00

Timers, 60 mins, small	£1.00

G11 Touch Unit Full Remote	£13
G11 Ultrasonic Teletext Hamdset	£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 teletex:	£24.00
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)	£18.00
G11, Full remote new ultrasonic	£32.00
GEC infra red full remote 8 channel (I.C.SAA1250)	£14.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
K35	
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 handset button blobs **each**	10p
Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177. **Special Price**	£13.00
RC4001 KT3 and Teletex	£14.00
IT CVC 32 handset repaired	£15.00

We have all parts for Philips Handsets