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TELEVISION

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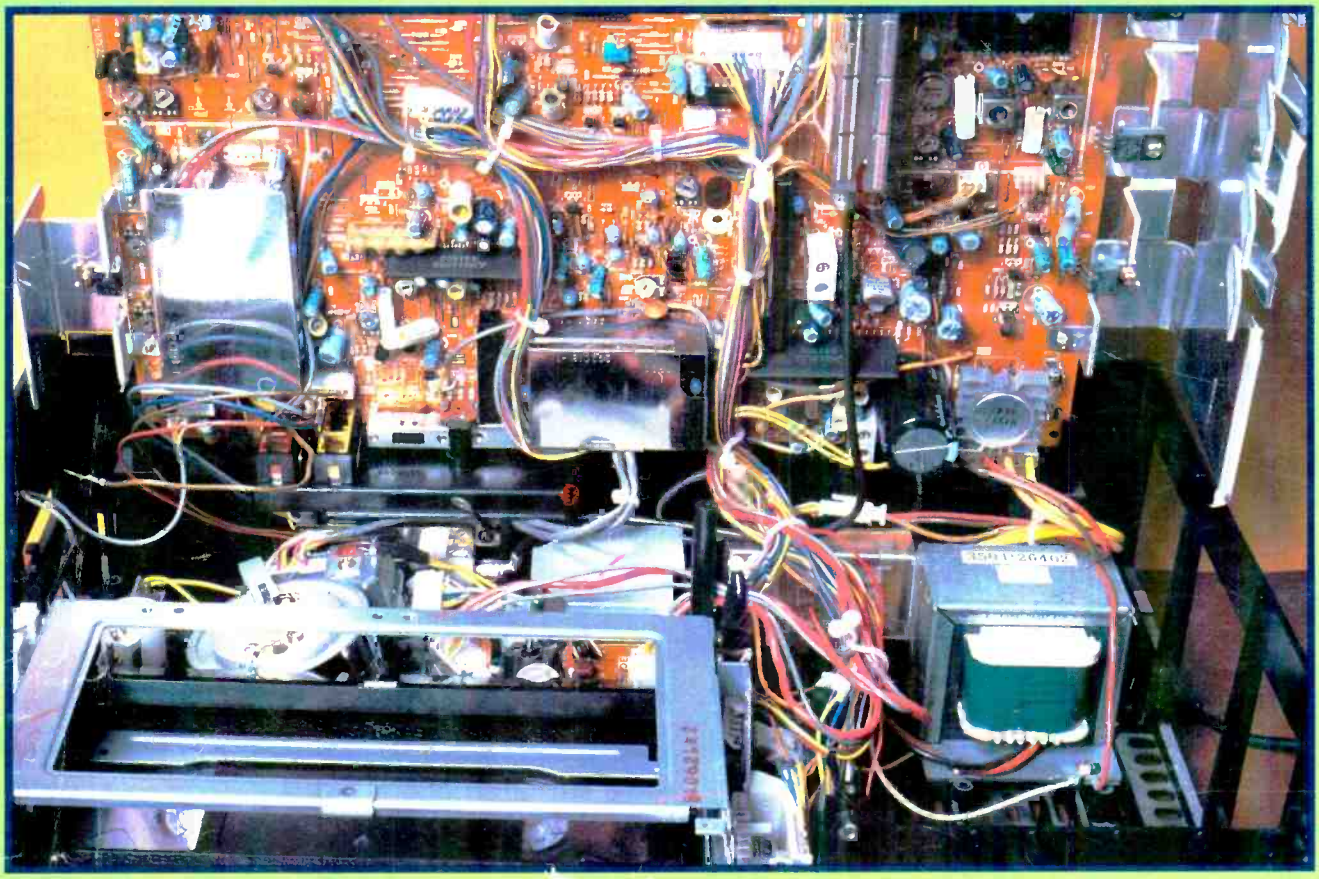
FREE inside
TV/VCR Spares Guide



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Detecting Licence Dodgers
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- ★ Chequerboard.
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- ★ 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.

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Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£108.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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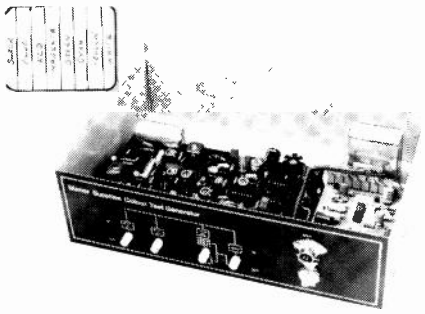
PAL COLOUR BAR GENERATOR (Mk4)



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

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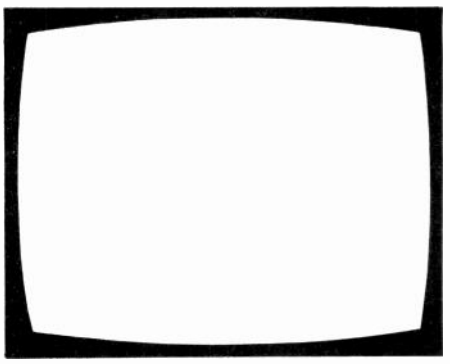

TELEVISION

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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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TDA2530	2.70
TDA2532	2.90
TDA2540	95
TDA2541	3.84
TDA2560	1.15
TDA2576A	7.84
TDA2577	4.73
TDA2578A	5.12
TDA2581	3.95
TDA2582	2.60
TDA2593	2.95
TDA2600	6.90
TDA2610	3.20
TDA2611A	2.35
TDA2640	2.90
TDA2652	7.31
TDA2653A	5.90
TDA2680	3.40
TDA2690	2.72
TDA2800	1.60
TDA3190	2.00
TDA3330	2.21
TDA3500	6.90
TDA3540	2.35
TDA3541	2.24
TDA3560	6.00
TDA3561A	6.66
TDA3562	8.60
TDA3571	3.75
TDA3650	3.85
TDA3651A	4.50
TDA3652	6.00
TDA3810	3.86
TDA3950	4.37
TDA4420	5.55
TDA4500	5.84
TDA4503	5.68
TDA4505	6.03
TDA4600	2.95
TDA4600-2D	2.95
TDA8180	4.00
TDA8190	4.94
TDA9503	4.21
TEA1009	1.86
TL494CN	6.57
UPC554	2.63
UPC566H	75
UPC575C2	89
UPC576H	1.90
UPC585	3.06
UPC587C2	2.34
UPC1025H	2.15
UPC1026H	90
UPC1028H	90
UPC1032H	58
UPC1042C	1.56
UPC1156H	2.45
UPC1158H	3.50
UPC1163H	2.48
UPC1167C2	2.70
UPC1168C	3.20
UPC1176C	2.63
UPC1177H	3.15
UPC1178C	4.21
UPC1180C	1.84
UPC1181H	1.00
UPC1182H	1.00
UPC1183H	2.48
UPC1185H	3.45
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
UPC1230H	4.39
UPC1238	2.50
UPC1245V	1.35
UPC1277	4.81
UPC1350C	4.15
UPC1353C	4.76
UPC1365C	6.38
UPC1356C2	2.08
UPC1367	2.00
UPC1358H	1.88
UPC1360C	2.20
UPC1363C	2.16
UPC1368H2	2.15
UPC1370C2	2.58
UPC1382C	1.08
UPC1384	3.78
UPC1394C	3.07
UPC1447H	58
UPC41C	2.80
UPC577H	2.46
UPC585C	1.28
UPC1167C2	2.70
UPD553C164	20.76
UPD7519G	17.13
UPD7538C020	11.06
UPD546C107	22.28
UPD547C049	11.18
UO5G	1.27
V11N	1.27
10E2	43
10VT05	8.74

VALVES

30FL2	1.70
DY802	98
DY86/7	66
ECC81	1.50
ECC82	98
ECC83	1.07
ECC84	80
ECC85	98
ECC88	1.35
ECF80	1.30
ECF82	88
ECH81	1.60
ECH84	1.66
ECL80	84
ECL82	1.30
ECL86	1.99
EF80	95
EF86	2.20
EF183	99
EF184	1.09
EL90	1.75
EL34	3.50
EL84	1.05
EY86/7	68
EY500A	2.25
EZ80/81	56
GY501	1.45
GZ34	3.50
KT66	9.75
KT77	8.50
KT88 (alt type)	12.00
PC92	4.50
PC97	1.65
PCC85	85
PCC805	1.40
PCF80	1.00
PCF200	1.35
PCF800	1.38
PCF801	1.13
PCF802	1.12
PCF805	1.80
PCF808	1.63
PCH200	1.45
PCL82	1.20
PCL84	1.20
PCL805	1.09
PCL86	92
PFL200	1.86
PL36	1.87
PL81	94
PL95	2.25
6L6GT	2.30
12HG7	3.20
PL504	1.65
PL508	2.90
PL509/19	5.30
PY88	81
PY500A	2.30
PY800/1	69
UCH81	2.25
UCL83	1.82
UY85	1.35
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21LU8	3.00
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BC328	0.06
BD124P	0.50
BD131	0.27
BU208A	0.70
BU326A	0.85
TIP 31C	0.24
TIP 32C	0.27
TIP 41C	0.25
TIP 112H	0.40

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INTEGRATED CIRCUITS

AMS4002B	13.45
AM5612 (526)	4.37
AM5620X(542)	4.87
AN6320N	2.88
BS326	7.10
CX134	6.00
CX135	4.37
HA1377W/BO8203	3.65
HD74LS136N	1.25
HSF310/3170	11.82
LA6358	3.75
LA7800402	3.75
NC1377P	1.25
NN1512FUC	10.50
MN14847FCD	14.43
MSO120P	2.97
OEC1001	8.87
OEC0005	13.10
OEC1001A	7.50
OEC3002	4.06
SN74HC240N	2.06
TC74HC00	1.68
TC74HC04	1.68
TDA2030	2.80
TDA3652	8.60
TMM41257P-15	13.50
UPC1378H	2.50
UPC5743	3.75
UPC1394C	3.75
UPD8048	0.93
Z8080PU/Z8400AP	1.70
2N7400E	10.00
7293-1951	11.92
40007-4/40008	11.25
74HCUD4P	1.87
74LA00	2.75
74LS27N	0.35
74LS32	0.90
74LS74	0.65
74LS132	3.12
OEC300IA	7.50
HA1137	8.20

TRANSISTORS

BC212	0.07
BC237	0.07
BC239/C	0.93
BC337	0.18
BC547	0.08
KD471CV	0.62
KSC945C-0	0.62
KTA1015Y-BF195	0.93
KTC380	0.93
KTC732	0.93
KTC1015Y	0.93
KTC2120Y	0.93
KTC2229Y	0.93
KTC2230	0.93
TCP850	2.00
ZTX312L	0.93
2N5496	0.53
2SC838C	0.62
2SC950Y	0.93
2SC1317R	0.62
2SC1417H	0.93
2SC1573NC	1.27
2SC1815Y	0.93
2SC2621	1.25
2SC2634S	0.62
2SC3156A	2.46
2SD980	1.56
2SD1159	1.25
2SD1397	2.87
2SD1398	2.46
50033	0.93

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SAME DAY DESPATCH
FAST – FAIR – EFFICIENT SERVICE

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1422187	CTV2200		15.00
151910	TV/VIDEO		15.00
1409221	CTV1409		15.00
151175	VCR5200		17.00
150583	VCR7000		10.00
150878	VCR9000		10.00

DECCA

80/100	NON TXT	US	16.50
80/10	NON TXT	US8511	19.50
101	NON TXT	US8513	23.50

SONY

C5	RH75T	29.04
C6	RH72	22.62
C7	RHT200	45.00
C9	RHT213	45.00

ITT

305	IR8649	29.04
306	IR8650	22.65
CVC45 RG5	VS8262	25.00
CVC32 RG15	VS8573	25.00

PLEASE NOTE THAT SOME HANDSETS ARE MANUFACTURERS ORIGINALS BUT SOME MAY BE AN ALTERNATIVE TYPE.

FIDELITY

FD09193	Txt.	32 butt.	15.90
FD09820	IS500	12 butt	13.81
FD09156	F14R	12 butt	13.81
FD09111	AVS	14 butt	13.75
FD09141	CTV14S	4 butt.	13.75
	20R/22R/140R		

THORN/FERGUSON

T723	TX9/10	NON TXT IR	16.50
T725	TX9	NON TXT IR	16.50
T731	TX9/10/100	TXT/STEREO IR	16.50
T732	TX10	TXT IR	16.50
T736	TX9/10/100	TXT IR	16.50
T739	TX100		16.50

JVC

TP843	TXT	IR	13.50

GEC

GEC/HITACHI	9300/V4001	9.93
GC56520831	C1404H-C1656H	30.00
GCA512220	C1653	22.00
GCA512230	C2086H, C2087H	28.50
GCA510710	C2067H	28.50
GCA514620	C2089H, C2090H C2889H, C2290H	21.00
GCA510870	C2069, C2269H	27.50

GRUNDIG

RTP20/VRC112	TP16-21-21VHR	IR	13.50
RTP05/VRC138	TP8-120-120E	IR	13.50
RTP06/IR107N	TP160-160E	IR	13.50
RTP07/IR380N	TP200-300-390	IR	13.50
RTP400/IR401	TP400VT-500VT	IR	13.50
VRC204	TP12	US	13.50

PHILIPS

G11 IR170/843 TXT IR		13.50
G11 (KONIG) TXT IR8435		22.20
G11 (KONIG) TXT 2 FUNCTION VS8518		18.75
G11 (KONIG) NON TXT VS8263		21.50
G11 31 BUTTON 691-17181 (PHILIPS) US		27.00
KT3/30 (KONIG) NON TXT IR8331		15.85
KT3/30 (KONIG) TEXT IR8420		17.90
KT3/30/35/40 RC5		16.95

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KT3/K30 WITHOUT TEXT	8.95
KT3/K30 WITH TEXT	8.95

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E180	2.45
E240	3.45

SCOTCH

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E120	2.89
E180	3.50
L750	3.65
VCC360	6.59
VCC480	7.50

VIDEO SPARES

WE HAVE A LARGER RANGE LISTED UNDER SPECIFIC MANUFACTURERS IN CATALOGUE FOR THORN, SONY, HITACHI, FIDELITY, NATIONAL PANASONIC, PHILIPS.

REFURBISHED HEADS (Exchange)
Equivalents Chart in Catalogue

THORN NEW LIFE (Most VHS types)	22.95
THORN NEW LIFE (National Panasonic)	24.95

REPLACEMENT VIDEO HEADS

AKAI

VS1	3HSSV	21.95
VS2	3HSSV	21.95
VS3	3HSSV	21.95
VS5	3HSSV	21.95
VS10	3HSSV	21.95
VS77	3HSSV	21.95
VS88	3HSSV	21.95
VS7100	3HSSV	21.95
VS7200	3HSSV	21.95
VS9300	3HSSV	21.95
VS9500	3HSSV	21.95
VS9700	3HSSV	21.95
VS9800	3HSSV	21.95

FERGUSON

3V00	3HSSV	21.95
3V01	3HSSV	21.95
3V06	3HSSV	21.95
3V16	3HSSV	21.95
3V22	3HSSV	21.95
3V23	3HSSV	21.95
3V24	3HSSV	21.95
3V29	3HSSV	21.95
3V30	3HSSV	21.95
3V31	3HSSV	21.95
3V35	3HSSV	21.95
3V36	3HSSV	21.95
8903	3HSSV	21.95

HITACHI

VT6500	3HSSHA	25.50
VT7000	3HSSHA	25.50
VT8000	3HSSHA	25.50
VT8040	3HSSHA	25.50
VT8100	3HSSHA	25.50
VT8500	3HSSHA	25.50
VT8700	3HSSHA	25.50
VT9000E	3HSSHA	25.50
VT9300	3HSSHA	25.50
VT9500S	3HSSHA	25.50
VT9700	3HSSHA	25.50
VT9900	3HSSHA	25.50
VT4000	3HSSH	25.50
VT4200	3HSSH	25.50
VT5000	3HSSH	25.50
VT5500	3HSSH	25.50

ORION

VH1	3HSSN	21.95
VH2	3HSSN	21.95

JVC

HRD110	3HSSV	21.95
HRD111	3HSSV	21.95
HRD120	3HSSV	21.95
HRD121	3HSSV	21.95
HRD220	3HSSV	21.95
HRD225	3HSSV	21.95
HR2200	3HSSV	21.95
HR3300	3HSSV	21.95
HR3320	3HSSV	21.95
HR3330	3HSSV	21.95
HR3350	3HSSV	21.95
HR3360	3HSSV	21.95
HR3660	3HSSV	21.95
HR3860	3HSSV	21.95
HR4000	3HSSV	21.95
HR4100	3HSSV	21.95
HR7200	3HSSV	21.95
HR7600	3HSSV	21.95
HR7610	3HSSV	21.95
HR7650	3HSSV	21.95
HR7700	3HSSV	21.95

NEC

PV760	PS3BS	23.95
PV764	PS3BS	23.95
PV774	PS3BS	23.95
N830	3HSSV	21.95
N831	3HSSV	21.95
N832	3HSSV	21.95
N833	3HSSV	21.95
PV2300	PS3BS	23.95
PV2400	PS3BS	23.95

SONY

SLF1	PS4B2S	29.95
SLC5	PS3BS	23.95
SLC6	PS3BS	23.95
SLC7	PS3BS	23.95
SLC8	PS5B3S	39.95
SLC9	PS5B3S	39.95
SLC20	PS4B2S	29.95
SLC24	PS4B2S	29.95
SLC30	PS4B2S	29.95
SLC33	PS4B2S	29.95
SLC40	PS4B2S	29.95
SLT50	PS5B3S	39.95
SLF60	PS5B3S	39.95
SLK95	PS5B3S	39.95
SL200	PS5B3S	39.95
SL3000	PS3BS2	25.00
SL8000	PS3BS2	25.00
SL8080	PS3BS2	25.00

NATIONAL PANASONIC

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NV250	3HSSU2N	36.97
NV270	3HSSU2N	36.97
NV280	3HSSU2N	36.97
NV300	3HSSN	21.95
NV322	3HSSN	21.95
NV330	3HSS3N	35.99
NV333	3HSSN	21.95
NV340	3HSSN	21.95
NV370	3HSSU1N	25.99
NV380	3HSSU1N	25.99
NV390	3HSSN	21.95
NV450	3HSSU2N	36.97
NV470	3HSSU2N	36.97
NV480	3HSSU2N	36.97
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NV777	3HSS3N	35.99
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NV3000	3HSSN	21.95
NV7000	3HSSN	21.95
NV7200	3HSSN	21.95
NV7500	3HSSN	21.95
NV7800	3HSSN	21.95
NV7850	3HSSN	21.96
NV8170	3HSSN	21.95
NV8200	3HSSN	21.95
NV8400	3HSSN	21.95
NV8600	3HSSN	21.95
NV8620	3HSSN	21.95

SHARP

110	3HSSSP	26.95
381	3HSSSP	26.95
383	3HSSSP	26.95
384	3HSSSP	26.95
385	3HSSSP	26.95
386	3HSSSP	26.95
387	3HSSSP	26.95
388	3HSSSP	26.95
481	3HSSSP	26.95
482	3HSSSP	26.95
2000	3HSSSP	26.95
3300	3HSSSP	26.95
9100	3HSSSP	26.95
9300	3HSSSP	26.95
9400	3HSSSP	26.95
9500	3HSSSP	26.95
9600	3HSSSP	26.95
9700	3HSSSP	26.95

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TOSHIBA

V31	PS3BT	30.00
V33	PS3BT	30.00
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V57	3HSSV	21.95
V5470	PS3BS2	25.00
V9600	PS3BT	30.00

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6520	3HSSU1N	25.99

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SONY SLC5, 6, 7	49.39
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HITACHI VT33E/GEC 4004	35.62
HITACHI VT11/GEC 4100	35.62
SANYO 9300/9435/9500	53.00
SANYO 5000/4700/5300	53.00
PHILIPS V2000/V2023	64.00
PHILIPS 1700	71.00

VIDEO IDLER TYRES

	O.Dia	I.Dia	Width	
SONY	23 7	17 4	4 9	50p
SONY	24 2	18	5 1	50p
HITACHI	31 8	25	4.9	50p
PANASONIC	37	29	3 9	52p
AKAI	26	20	3 9	50p
JVC	39 3	32 8	3 9	56p
JVC	33	23 9	4	56p
NATPAN	31 2	25	3 1	56p

VIDEO PINCH ROLLERS

PANASONIC	NV7000	3.75
SANYO	VTC9300/VBS7000	3.75
SONY	C7/J7/SL17	3.75
JVC	TCE3V00/01/06/16/23/24	3.75
JVC	HR2200/3320/3330-3660/1100/7700	3.75
AKAI	VS9700	3.75
HITACHI	VT5000	3.75
SHARP	VC6300/6500	3.75
SONY	TC6 GEN	3.75

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	JVC	HR3300/3320/3360	
	TCE	8903/3V00/16/22	
VKIT 2	PANASONIC	NV7000/7200	1.45
VKIT 3	SONY	SLC5-7	2.25
VKIT 4	SONY	SL8000/8500/8600	3.60
VKIT 5	SONY	SL3000UB	2.10
VKIT 6	PANASONIC	NV3000B	1.99
VKIT 7	SANYO	9300P	2.75
VKIT 8	PANASONIC	NV2000B	1.45
VKIT 9	PANASONIC	NV8600/8610/V011	1.50
VKIT 10	TOSHIBA	V8600	1.45
VKIT 11	SHARP	VC7300	1.50
VKIT 12	SHARP	VC6300/6600	1.80
VKIT 13	SANYO	VTC5000	0.95
VKIT 14	SANYO	VTC5300	1.85
VKIT 15	JVC	HR7650-3V31	2.08
VKIT 16	HITACHI	5000	1.90
VKIT 17	SHARP	8300	1.76
VKIT 18	SHARP	9300	1.47
VKIT 19	HITACHI	VT8000	1.05
VKIT 20	HITACHI	VT11 33	1.50
VKIT 21	HITACHI	9500	1.12
VKIT 22	SONY	SLC6	1.90
VKIT 23	SANYO	5500	1.05
VKIT 24	PANASONIC	NV300/333	1.55
VKIT 25	TOSHIBA	V7540	1.90
VKIT 26	JVC	HR7000	0.96
VKIT 27	THORN	3V29/HR7200	1.75
VKIT 28	AMSTRAD	7000	1.45
VKIT 29	PANASONIC	NV777	1.80
VKIT 30	SONY	T9	2.20
VKIT 31	TOSHIBA	9600	1.20

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SHARP TAKE UP IDLER 0005/GEZZ 0006/GEZZ	2.20
SANYO REEL DRIVE PULLEY	5.10
HITACHI F/F IDLER VT11E/33E	2.98

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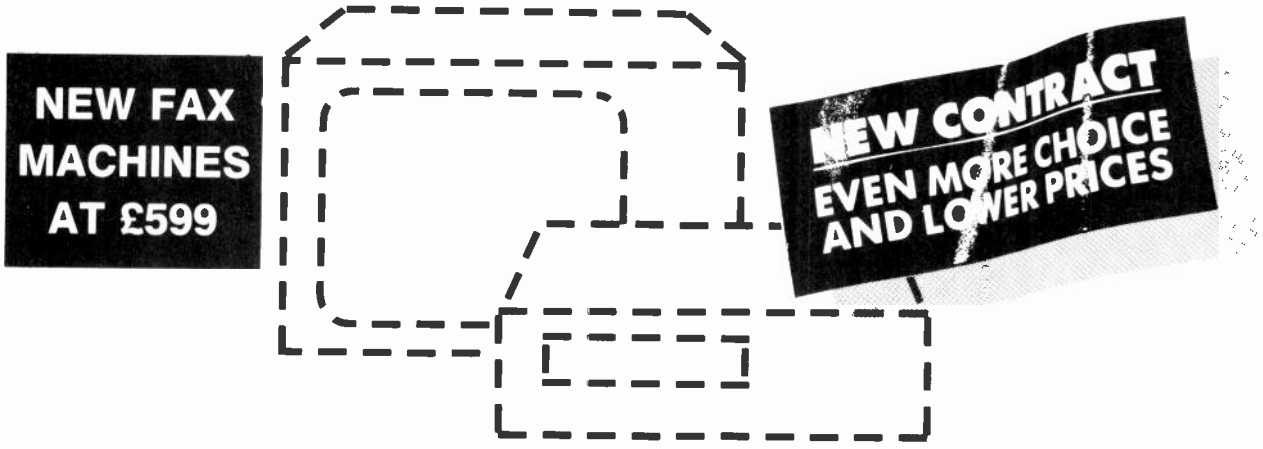

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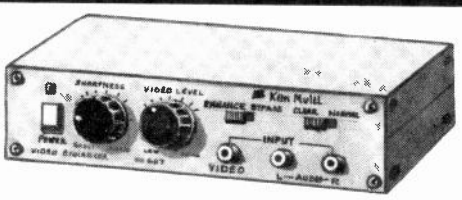

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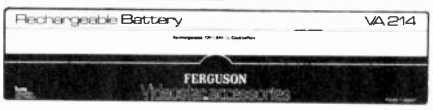

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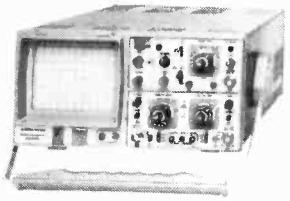

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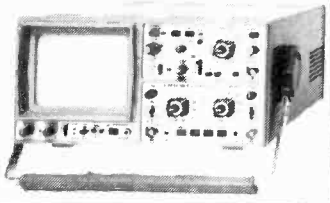

SPECIFICATION
- Bandwidth DC-20MHz
- Sens. Ch1, Ch2. 1mV/cm
- Delay Line
- Time Base 1·25s/cm – 10ns/cm
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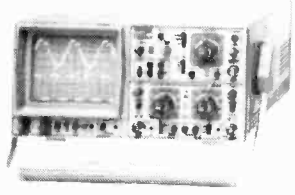

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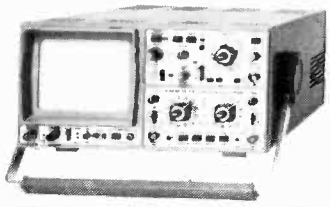

SPECIFICATION
- Bandwidth DC-60MHz
- Sens. Ch1, Ch2. 1mV/cm
- Delay Line
- Delayed Sweep 100ns – 0·1s
- Trigger DC-80MHz AC, DC, HF, LF, (TV Frame)
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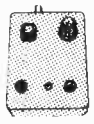

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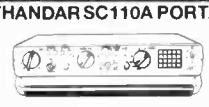

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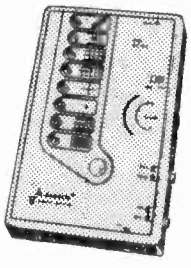

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VP274	12	SCR's (Thyristors) 1A 100-400v, TO-39	£1.00
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VP276	5	SCR's standard type, 5-16Amp to 400v	£1.00
VP277	4	Triacs 2Amp 400v TO-39	£1.00
VP278	4	6Amp 1000v plastic Silicon Rectifiers	£1.00
VP283	5	Diac BR100, triac trigger	£1.00
		TRANSISTORS	
VP38	100	Sil. Transistors, NPN plastic, coded, with data	£3.00
VP39	100	Sil. Transistors, PNP plastic, coded, with data	£3.00
VP47	10	Sil. Power Transistors, similar 2N3055, uncoded	£1.00
VP48	5	Pairs NPN/PNP plastic Power Transistors, 4A, data	£1.00
VP50	60	NPN Sil. Switching Transistors, TO-18 and TO-92	£1.00
VP51	60	PNP Sil. Switching Transistors, TO-18 and TO-92	£1.00
VP60	100	All sorts Transistors, NPN/PNP	£1.00
VP150	20	BC183B Sil. Transistors, NPN 30v 200mA Hfe240+ TO92	£1.00
VP151	25	BC171B Sil. Transistors, NPN 45v 100mA Hfe240+ TO92	£1.00
VP152	15	TIS90 Sil. Transistors, NPN 40v 400mA Hfe100+ TO92	£1.00
VP153	15	TIS91 Sil. Transistors, PNP 40v 400mA Hfe100+ TO92	£1.00
VP154	15	MPSA56 Sil. Transistors, PNP 80v 800mA Hfe50+ TO92	£1.00
VP155	20	BF595 Sil. Transistors, NPN eqvt BF184 H.F. TO92	£1.00
VP156	20	BF495 Sil. Transistors, NPN eqvt BF173 H.F. TO92	£1.00
VP157	15	ZTX500 series Sil. Transistors, PNP plastic	£1.00
VP158	15	ZTX107 Sil. Transistors, NPN eqvt BC107 plastic	£1.00
VP159	15	ZTX108 Sil. Transistors, NPN eqvt BC108 plastic	£1.00
VP161	25	BC183L Sil. Transistors, NPN 30v 200mA TO92	£1.00
VP162	5	SJE5451 Sil. Power Transistors, NPN 80v 4A Hfe20+	£1.00
VP163	2	NPN/PNP pairs, Sil. Power Transistors, like SJE5451	£1.00
VP164	4	2N6289 Sil. Power Transistors, NPN 40v 40w 7A Hfe30+	£1.00
VP165	6	BFT33 NPN Sil. Transistors, 80v 5A Hfe50-200 TO39	£1.00
VP166	5	BFT34 NPN Sil. Transistors, 100v 5A Hfe50-200 TO39	£1.00
VP167	1	BUY69C NPN Transistors, TO3 VCB 500, 10A, 100w, Hfe15+	£1.00
VP168	10	BC478 eqvt BCY71 PNP Sil. Transistors. TO18	£1.00
VP169	10	BXS21 eqvt BC394 NPN Sil. Transistors, 80v 50mA TO18	£1.00
VP170	10	Assorted Power Transistors, NPN/PNP coded and data	£1.00
VP171	10	BF355 NPN TO-39 Sil. Transistors, eqvt BF258 225v 100mA	£1.00

Pak No	Qty	I.C.S. Description	Price
VP7492	4	7492 Divide by 12 Counter	£1.00
VP7493	4	7493 4-bit Binary Counter	£1.00
VP7494	4	7494 4-bit Shift Register	£1.00
VP7495	4	7495 4-bit Shift Register	£1.00
VP74111	4	74111 Dual J-K Master Slave, Flip-Flop	£1.00
VP74141	4	74141 BCD-Decimal Decoder/Driver	£1.00
VP74151	4	74151 1 of 8 Data Selectors/Multiplexers	£1.00
VP74153	4	74153 Dual 4 line to 1 line Data Selectors/Multiplexers	£1.00
VP74164	4	74164 8-bit Parallel Output Serial Shift Registers	£1.00
VP74167	4	74167 Synchronous Decade Rate Multipliers	£1.00
VP74174	4	74174 Hex D type Flip-Flops	£1.00
VP74181	4	74181 Arithmetic Logic Units/Function Generators	£1.00
VP74193	4	74193 Synchronous Up/Down Dual Clock Counters. Binary clear	£1.00
VP74279	4	74279 Quad S-R Latches	£1.00
BPX6	1	TTL Data Book 74 series, including "LS". Complete with Pin out diagrams. 7400-74670. TTl interchangeability guide. Function selection guide and explanation of function tables. "NO VAT"	£1.00
BPX5	1	IC555 PROJECTS BOOK (TIMER). 167 pages. Over 50 project circuits to build and other information on IC555 Timers. Plus FREE with our compliments, 3 x IC 555 Timer, worth 80p. **Special offer price just £2.95. "NO VAT"**	
BPX4	1	INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE. Babani Publishing's latest edition BP85, plus FREE with our compliments, 10 popular Silicon Transistors, worth £1.00. **Special offer price just £3.50. "NO VAT"**	
		MISC.	
VP17	50	Metres PVC single strand Wire, mixed colours	£1.00
VP18	30	Metres PVC multi strand Wire, mixed colours	£1.00
VP19	40	Metres PVC single/Multi strand Wire, mixed colours	£1.00
VP22	200	Sq. Inches total Copper Clad Board	£1.00
VP23	10	40mm Track Slider Pots. 100K Lin	£1.00
VP42	10	Black Heatsinks, fit TO3 and TO220, drilled	£1.00
VP43	4	Power-fin Heatsinks, 2 x TO3, 2 x TO66	£1.00
VP44	15	Assorted Heatsinks, TO1/3/5/18/220	£1.00
VP56	100	Semiconductors from around the world, mixed	£4.00
VP82	1	Electronic Buzzer, 3v, 25MA	£0.95
VP83	1	Electronic Buzzer, 6v, 25MA	£0.95
VP84	1	Electronic Buzzer, 9v, 25MA	£0.95
VP85	1	Electronic Buzzer, 12v, 25MA	£0.95
VP86	1	TECASBOTY Components Pack, semiconductors, caps, wire, etc	£8.00
VP87	1	Telephone Pick-up Coil with 3.5mm jack plug	£1.25
VP88	1	Pillow Speaker with 3.5mm jack plug	£1.45
VP107	1	Piezo Buzzer, miniature, 12v	£1.25
VP108	1	Piezo Buzzer, miniature, 240v	£1.25
VP113	1	Coax Antenna Switch, 2 way	£4.50
VP114	1	Coax Antenna Switch, 3 way	£4.75
VP115	1	High Pass Filter/Suppressor, CB/TV	£0.50
VP116	1	Low Pass Filter, VHS/TV bsnd	£3.00
VP122	1	Precision Morse Key, fully adjustable	£1.85
VP144	4	100K Lin multi turn Pots, ideal vari. cap. tuning	£1.00
VP145	10	Assorted Pots, inc dual and switched types	£1.00
VP148	30	Presets, horizontal and vertical, mixed values	£1.00
VP174	5	DIL Switches, 1 and 2 way slide, 6 way SPST, assorted	£1.00
VP176	30	Fuses, 20mm and 1¼" glass, assorted values	£1.00

Pak No	Qty	TOOLS. Description	Price
VP410	1	18 Pc Hex Wrench Keys. AF sizes in wallet	£1.50
VP411	1	16 Pc Hex Key Wrench Set. SAE and Metric	£2.00
VP412	1	Crimping Pliers, Wire Strippers & Bolt Cutters	£1.00
VP413	2	IC Extraction Tools, jaw width 18 and 29mm	£2.00
VP414	1	End Action Stripping Pliers. Adjustable jaws	£1.00
VP415	1	5" Grip Locking Pliers	£3.00
VP416	1	6" Long Nose Grip Locking Pliers	£3.00
VP417	1	6" Adjustable Wrench. Forged alloy steel	£2.50
VP418	1	8" Tin Snips. Hardened steel, spring joint	£2.00
VP419	2	"Chubby" Screwdrivers. Crosspoint No 1 and 2	£1.50
VP420	2	"Chubby" Screwdrivers. Flat blade 4.5 and 6mm	£1.50
VP421	1	Screwdriver 400mm long, 6mm flat blade	£3.00
VP422	1	Screwdriver 400mm long, No 2 crosspoint	£3.00
VP423	1	Vernier Caliper-Crosshorns. Depth gauge. Vernier Cap. 4½"/110mm reading 1/128", 1/10mm	£2.50
VP424	1	Helping Hand with Magnifier	£4.50
VP425	1	7 Pc high quality Screwdriver Set	£8.50
VP426	1	7 Pc high quality Screwdriver Set 1000v	£12.50
VP427	1	6 Pc Cushion Grip Screwdriver Set	£4.00
		LEADS.	
VP300	1	10m Speaker Lead 2 pin DIN Plug to 2 pin DIN Skt	£1.00
VP301	1	2m Video Lead Coaxial Skt to Coaxial Skt + 2 adaptors	£1.20
VP302	1	3m 4 core cable indv. screned 5 pin DIN Plug-5 pin DIN Plug	£1.80
VP303	1	TV Ext. Lead. Coax plug to Coax Plug. White	£1.00
VP304	1	1.5m 4 core indv. screen. 5 pin DIN Plug-tinned open end	£1.00
VP305	1	1.5m cable 5 pin DIN Plug-3.5mm Jack Plug. Pin 1 & 4 connect	£1.00
VP306	1	2m Typewriter/Calculator Lead. 3 pin Plug, angled European IEC configuration. 6A 250vAC	£2.00
VP307	1	60cm Patch Lead. PL259 Plug to PL259 Plug	£1.00
VP308	1	1.2m Patch Lead. PL259 Plug to PL259 Plug	£1.50
VP309	1	1.2m Lead 4 Phono Plugs to 4 Phono Plugs	£1.50
VP310	1	20cm Lead 2 x 2 pin DIN Plug to Stereo Inline Jack Skt	£1.00
VP311	1	2m Lead Scart Plug to 5 pin DIN Plug & 2 BNC Plugs	£6.00
VP312	1	1.2m Video Lead. BNC Plug to Phono Plug	£1.50
VP313	1	3m Headphone Lead. 3.5mm Jack Plug to 3.5mm Jack Skt	£1.00
VP314	1	2m Coax Lead BNC Plug to BNC Plug. 75 ohms	£3.00
VP315	1	2m Coax Lead BNC Plug to UHF Plug. 75 ohms	£3.00
		TELEPHONE ACCESSORIES.	
VP316	1	5m Telephone Ext. Lead. Plug to Socket	£4.50
VP317	1	10m Telephone Ext. Lead. Plug to Socket	£6.00
VP318	1	3m Line Jack Cord. BT 4 way Plug to 4 Spade Terminals	£1.75
VP319	1	Double Adaptor. One IDC plug, 2 socket	£3.50
VP320	1	IDC Telephone Plug 4 way	£0.50
VP321	1	Telephone Master Socket Surface Box. Screw terminals	£3.50
VP322	1	Telephone Slave Socket Surface Box. Screw terminals	£2.25

MINIATURE CARBON FILM RESISTORS ¼ & ½ WATT 5%.
Resistance values from 1 ohm-10meg ohms. Available in lots of 100 pieces per value. To order state R100 ¼ watt or R200 ½ watt, plus resistance required, eg. R100 1K = ¼ watt 1K.
BI-PACK price per 100 pieces R100 £1.00 per pk. R200 £1.30 per pk.

VOLTAGE REGULATORS.

Pos. 1 Amp 7805-12-15-18-24	35p each
Neg. 1 Amp 7905-12-15-18-24	40p each
Pos. 100mA 78L05-12-15-18-24	28p each
Neg. 100mA 79L05-12-15-18-24	30p each

VPS30 REGULATED VARIABLE STABILISED POWER SUPPLY MODULE.
This versatile regulated variable stabilised power supply with short circuit protection and current limiting is a must for all electronics enthusiasts. It incorporates adjustable voltage from 2v-30v with a current limiting range of 0-2A. AC input max. 25v. Dimensions 110 x 75 x 25mm. **Price each £9.50**

BI-PAK

Send your orders to: BI-PAK DEPT TV, PO BOX 33 ROYSTON, HERTS.
TERMS: CASH WITH ORDER, PERSONAL CHEQUE, ACCESS AND BARCLAYCARD, GIRO 388 7006. SAME DAY DESPATCH.
TEL. 0763-48851. ADD £1.50 P&P PER ORDER AND 15% VAT.

BARCLAYCARD VISA

REMEMBER YOU MUST ADD £1.50 P&P AND 15% VAT TO TOTAL ORDER.

POPULAR BAKERS DOZEN PACKS (Still available)

All packs are £1 each, if you order 12 then you are entitled to another free. Please state which one you want. Note the figure on the extreme left if the pack ref number and the next figure is the quantity of items in the pack, finally a short description.

BD1 5 13A junction boxes for adding extra points to your ring main circuit
BD2 5 13A spurs provide a fused outlet to a ring main where device such as a clock must not be switched off
BD7 4 in flex switches with neon on/off lights, saves leaving things switched on
BD9 2 6v. 1A mains transformers upright mounting with fixed clamps
BD11 1 6½" speaker cabinet ideal for extensions, takes your speaker. Ref BD137
BD13 12 30 watt reed switches, it's surprising what you can make with these — burglar alarms, secret switches, relay etc etc.
BD22 2 25 watt loud speaker two unti cross-overs
BD29 1 B.D.A.C. stereo unit is wonderful value
BD30 2 nicad constant current chargers adapt to charge almost any nicad battery
BD32 2 humidity switches, as the air becomes damper the membrane stretches and operates a microswitch
BD34 48 2 meter length of connecting wire all colour coded
BD42 5 13A rocker switch three tag so on/off, or change over with centre off
BD45 1 24hr time switch, ex-Electricity Board, automatically adjust for lengthening and shortening day. Original cost £40 each
BD49 10 neon valves, with series resistors, these make good night lights
BD56 1 mini uniselector, one use is for an electric jigsaw puzzle, we give circuit diagram for this. One pulse into motor, moves switch through one pole
BD59 2 flat solenoids – you could make your multi-tester read AC amps with this
BD67 1 suck or blow operated pressure switch, or it can be operated by any low pressure variation such as water level in water tanks
BD91 2 mains operated motors with gearbox. Final speed 16rpm. 2 watt rated
BD103A 1 6 750MA power supply, nicely cased with input and output leads
BD120 2 stripper boards each contains a 400v 2A bridge rectifier and 14 other diodes and rectifiers as well as dozens of condensers etc
BD122 10m twin screened flex with white pvc cover
BD128 10 very fine drills for p.c.b. boards etc. Normal cost about 80p each
BD132 2 plastic boxes approx. 3" cube with square hole through top so ideal for interrupted beam switch
BD134 10 motors for model aeroplanes, spin to start so needs no switch
BD139 6 microphone inserts – magnetic 400 ohm also act as speakers
BD148 4 reed relay kits you get 16 reed switches and 4 coil sets with notes on making c/o relays and other gadgets
BD149 6 safety cover for 13A sockets – prevent those inquisitive little fingers getting nasty shocks
BD180 6 neon indicators in panel mounting holders with lens
BD193 6 5 amp 3 pin flush mounting sockets make a low cost disco panel
BD196 1 in flex simmerstat – keeps your soldering iron etc always at the ready
BD199 1 mains solenoid very powerful has 1" pull or could push if modified
BD210 8 keyboard switches – made for computers but have many other applications
BD210 4 transistors type 2N3055 probably the most useful power transistor
BD211 1 electric clock mains operated put this in a box and you need never be late
BD221 5 12v alarms make a noise about as loud as a car horn. Slightly soiled but OK
BD242 2 6" × 4" speakers 4 ohm made from Radiomobile so very good quality
BD246 2 tacho generators, generates one volt per 100revs
BD252 1 panostat, controls output of boiling ring from simmer up boil
BD259 50 leads with push on ¼" tags – a must for hook ups – mains connections etc
BD263 2 oblong push switches for bell or chimes, these can mains up to 5 amps so could be foot switch if fitted into pattress
BD268 1 mini 1 watt amp for record player. Will also change speed of record player motor
BD275 1 Guitar mic – clip on type suits most amps
BD283 3 mild steel boxes approx. 3" × 3" × 1" deep – standard electrical
BD293 50 mixed silicon diodes
BD296 3 car plugs with lead, fits into lighter socket
BD305 1 tubular dynamic mic with optional table rest

Most other packs still available and you can choose any as your free one.

5A BATTERY CHARGER KIT – all parts including case only £5 add £1 postage.

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's dozen range and you become entitled to a free gift with each dozen 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.

THIS MONTH'S SNIP

3½ floppy Disk Drive, made by the Chinon Company of Japan. Beautifully made and probably the most compact device of its kind as it weighs only 600g and measures only 104mm wide, 162mm deep and has a height of only 32mm, other features are high precision head positioning – single push loading and eject – direct drive brushless motor – Shugart compatible interface – standard connections – interchangeable with most other 3½ and 5¼ drives. Brand new with copy of makers manual. Offered this month at **£28.50** post and VAT included.

CASE – adaptable for 3" or 3½" FDD, has room for power supply components price only £4 includes circuit of PSU. Our Ref 4P8.

POWER SUPPLY FOR FDD – 5V and 12V voltage regulated outputs, complete kit of parts will fit into case 4P8 pice £8 or with case **£11**.

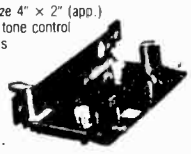
MULLARD UNILEX AMPLIFIERS

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, case and all parts with data case **£17.50** post £2.

MINI MONO AMP on p.c.b. size 4" × 2" (app.)



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 **£1.15 each or £13 for 12.**

LIGHT BOX

This when completed measures approximately 15" × 14". The light source is the Philips fluorescent "W" tube. Above the light a sheet of fibreglass and through this should be sufficient light to enable you to follow the circuit on fibreglass PCBs. Price for the complete kit, that is the box, choke, starter, tube and switch and fibreglass is £5 plus £3 post, order ref 5P89.

TANGENTIAL HEATERS

We again have very good stocks of these quiet running instant heat units. They require only a simple 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

5" **£5** + £1.25 post. 6" **£6** + £1.50 post.
4" x 4" Muffin equipment cooling fan 115V **£2.00**
4" x 4" Muffin equipment cooling fan 230/240V **£5.00**
9" Extractor or blower 115V supplied with 230 to 115V adaptor **£9.50** + £2.00 post.
All above are ex computers but guaranteed 12 months.
10" x 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.

9" MONITOR

Ideal to work with computer or video camera uses Philips black and white tube ref M24/306W. Which tube is implosion and X-Ray radiation protected. VDU is brand new and has a time base and EHT circuitry. Requires only a 16V dc supply to set it going. It's made up in a lacquered metal framework but has open sides so should be cased. The VDU comes complete with circuit diagram and has been line tested and has our six months guarantee. Offered at a lot less than some firms are asking for the tube alone, only **£16** plus £5 post.

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.**

TELEPHONE LEAD

3 mtrs long terminating one end with new BT, flat plug and the other end with 4 correctly coloured coded wires to fit to phone or appliance. Replaces the lead on old phone making it suitable for new BT socket. Price **£1** ref BD552 or 3 for **£2** ref 2P164.

COMPACT FLOPPY DISC DRIVE EME-101

The EME-101 drives a 3" disc of the new standard which despite its small size provides a capacity of 500k per disc, which is equivalent to the 3½" and 5¼" discs. We supply the Operators Manual and other information showing how to use this with popular computers: BBC, Spectrum, Amstrad etc. All at a special snip price of **£27.50** including post and VAT. Data available separately **£2**, refundable if you purchase the drive.

POWERFUL IONISER

Generates approx. 10 times more IONS than the ETI and similar circuits. Will refresh your home, office, shop, workroom etc. Makes you feel better and work harder – a complete mains operated kit, case included **£11.50** + £3 P&P.

J & N BULL ELECTRICAL

Dept. T.V., 250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT.

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Access & Bcard orders accepted Brighton (0273) 734648 or 203500.

NEW ITEMS

Some of the many described in our current list which you will receive with your parcel.

FIRST TIME OFFERS

Items not yet advertised so you get first choice.

13A PLUGS – Good British make complete with fuse, parcel of 5 for £2, order Ref. 2P186.
13A ADAPTERS – Takes 2 13A plugs, good British make, packet of 3 for £2. order Ref. 2P187.
SHAVER ADAPTERS – enables a 5 amp two pin plug to connect to 13A socket 2 for £1. Ref. BD61.
20v – 0 – 20v – Mains transformers 2½ amp (100 watt) loading, tapped primary. 200-245 upright mountings £4. order Ref. 4P24.
DIAMONDS HALF-PRICE – Your record player stylus may be almost impossible to obtain so why not buy a spare now – we have over 50 types in stock, list on request.
BENCH ISOLATION TRANSFORMERS 250 watt – again available 230v in and out with plenty of tappings to give exact bolts. £5 + £2 order Ref. 5P5.
PANEL MOUNTING FUSES – Normal type you unscrew the top to replace the fuse. New, but ex equipment complete with fuses, packet of 4 for £1. Ref. BD618.
COMPOSITE VIDEO INPUT UNIT – for our 9" monitor with notes on suppression of fly back lines and improving "hold" makes our monitor ideal for use with any computer or camera kit contains p.c.b. and all components price £4. order Ref. 4P23.
SMOKE DETECTOR – The heart of this is the sensor – we have these Jap made and will supply with the circuit diagram price £2 order Ref. 2P188.
POWERFUL 12v MOTOR – was intended for the Sinclair electric car. Rated approx. 1/3hp. £15. Ref 15P8.
BURGLAR ALARM BELL – 6" gong – OK to fix outside in the rain and shelter – mains operation £3. Ref. 8p6.
AGAIN AVAILABLE – 12" mini fluorescent tubes – Price £1 each. Ref. BD314.
POWER PACK OR AMPLIFIER CASE – Size approx 10" x 8¼" x 4¾" plated steel – with ample perforations to cooling. Front panel has on/off switch and E.E.C. mains inlet plug with built in RF filter – undoubtedly a very fine case which would cost at least £50 from regular sources, our price is £5 each and £3 post. Ref. 5P111.
MINIATURE BCD THUMB WHEEL SWITCH – Matt black edge switch engraved white on black – gold plated, make before break contacts – size approx 25mm high 8mm wide 20mm deep – made by the famous Cherry Company and designed for easy stacking – Price £1 each. Ref. DB601.
EDGE METER – miniature, whole size approx 37mm x 13mm 100ua fsd – centre zero scaled 0 to – 10 and 0 to +10. Price £1 each. Ref. DB602.
24hr TIME SWITCH – 16A c/o contacts – up to 6 on/off per day – cased intended for wall mounting. Price £8. Ref. 8P6.
CAPACITOR BARGAIN – axial ended – 4700uf 6v 25v Jap made. Normally 50p each, but you will get 4 for £1. Ref. 613.
CLEANING FLUID – Extra good quality – intended for video and tape heads – regular price £1.50 per spray can – our Price – 2 cans for £1. Ref. BD604.
DON'T FREEZE UP! – We have had the strongest winds for over 200 years and who knows may be in for coldest winter, so if you have not already protected your water pipes you should do so now – our heating wire wound around the pipes will do this and will cost only about 50p per week to run – 15 metres (minimum length to connect to 220-240v mains). Price £5. Our Ref. 5P109.
PIEZO ELECTRIC FAN an unusual fan, more like the one used by Madame Butterfly, than the conventional type, it does not rotate. The air movements is caused by two vibrating arms. It is American made, mains operated, very economical and causes no interference. So it is ideal for computer and instrument cooling. Price is only £1 each. Ref. BD605.
SPRING LOADED TEST PROBS – heavy duty, made by the famous Bulgin company. Very good quality. Price four for £1. Ref. BD599.
CURLY LEAD – four core, standard replacement for telephone handset, extends to nearly two metres. Price £1 each. Ref. BD599.
TELEPHONE BELLS – these will work off our standard mains through a transformer, but to sound exactly like a telephone, they then must be fed with 25hz 50v. So with these bells we give a circuit for a suitable power supply. Price 2 bells for £1. Ref. BD600.
ULTRA SENSITIVE POCKET MULTIMETER – 4k ohms per volt – 11 ranges – carry one of these and so be always ready to test ac/dc volts to 1000, DC milligrams and have an ohms range for circuit testing – will earn its cost in no time. Price only £7. Ref. 7P2.
BLOW YOUR ROOF OFF 140 watt speaker systems – new type you must not hide! They have golden cones and golden surrounds and look really "Bootiful" 12" Woofer, Midrange and Tweeter and comes with a crossover at a special introductory price of £49, carriage paid. Two sets for £95 carriage paid. 140w Woofer only £35 carriage paid
ASTEC PSU. Mains operated switch mode so very compact (6½" × 4" × 2" approx.) Outputs +5 Volts 3.5 amp +12 Volts 1.5 amp. −5 Volt 1.5 amp. Brand new. Normal price £30+. Our price only £10. Ref. 10P34.
APPLIANCE THERMOSTATS – spindle adjust type suitable for convector heaters or similar. Price 2 for £1. Ref. BD582.
3 CORE FLEX BARGAIN No.1 – Core size 5mm so ideal for long extension leads carrying up to 5 amps or short leads up to 10 amps. 15mm for £2. order Ref. 2P189.
3 CORE FLEX BARGAIN No.2 – Core size 1.25mm so suitable for long extension leads carrying up to 13 amps – or short leads up to 25A. 10m for £2. order Ref. 2P190.
NOTE – as with most of our other wires and cables, longer lengths can generally be supplied but please in multiples ie; 3 × 2P189.
ORP12 LIGHT DESCENDENT RESISTOR – Resistance decreases rapidly from 2K to 150 when light falls on its face – will work a relay with only one transistor as amplifier price £1. order Ref. BD619 request circuit diagram if you want it.

COMPUTERS

Big consignment of computers expected, various makes and numbers, write or phone for details.

METAL PROJECT BOX – Ideal size for battery charger, power supply etc. sprayed grey, size 8" × 4¼" × 4" high, ends are louvered for ventilation other sides are flat and undrilled order Ref. 2P191 price £2.
50v 20a TRANSFORMER – 'C' Core constuction so quite modern – tapped mains input, only £25, but very heavy so please add £5, if not collecting. order Ref. 25P4.
POWER SUPPLY BOARD OR STRIPPER – has 8 very useful components 470 UF 63v cap, 47UF 63v cap, 3 400v 2a rects, 100, 180, & 220 ohm 2 watt resistors all mounted on 3½" × 2" p.c.b. and wired as a full wave rectified circuit to give d.c. from a centre tapped transformer, circuit supplied. 2 for £1. order Ref. BD620.
TWIN TWISTED BELL WIRE – p.v.c. covered 4mm copper – ideal also for burglar alarm circuits etc. 250m for only £2. order Ref. 2P192.
BENCH DISTRIBUTION UNIT – up to four items and mains neatly and safely complete with four plugs only £4. order Ref. 4P25.
DOWNLIGHTER – adjustable recessed zone lighting unit. Takes Edison Screw spot lamp only £2. order Ref. 2P193.
NOVEL NIGHT LIGHT – plugs into a 13A socket. Gives out a surprising amount of light, certainly enough to navigate along passages at night or to keep a nervous child happy. Very low consumption, probably not enough to move the meter. Price £1. Ref. BD563.
CASE WITH 13A PRONGS – to go into 13A socket, nice size and suitable for plenty of projects such as car battery trickle charger, speed controller, time switch, night light, noise suppressor, dimmers etc. Price – 2 for £1. Ref. BD565.
SPEAKER EXTENSION CABLE – twin 0.7mm conductors so you can have long runs with minimum sound loss and for telephone extensions or burglar alarms, bells, intercoms, etc. 250m coil only £3 plus £1 post. Ref. 3P28.
ALPHA-NUMERIC KEYBOARD – this keyboard has 73 keys with contactless capacitance switches giving long trouble free life and no contact bounce. The keys are arranged in two groups, the main area field is a QWERTY array and on the right is a 15 key number pad, board size is approx 13" x 4" – brand new but offered at only a fraction of its cost namely £3, plus £1 post. Ref. 3P27.
TELEPHONE EXTENSIONS – it is now legal for you to undertake the wiring of telephone extensions. For this we can supply 4 core telephone cable, 100m coil £8.50. Extension BT sockets £2.95. Packet of 500 plastic headed staples £2. Dual adaptor for taking two appliances from one socket £3.95. Leads with BT plug for changing old phones 3 for £2.
MODULAR SWITCH – Panel mounting highest quality and ideal where extra special front panel appearances is required, can be illuminated if required d.p.d.t. and latching. Price – 2 for £1. Ref. BD607.
WIRE BARGAIN – 500 metres 0.7mm solid copper tinned and p.v.c. covered. Only £3 + £1 post. Ref. 3P31 – that's well under 1p per metre, and this wire is ideal for push on connections.
INTERRUPTED BEAM KIT – this kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components – relay photo transistor, resistors and caps etc. Circuit diagram but no case. Price £2. Ref. 2P15.
3-30V VARIABLE VOLTAGE POWER SUPPLY UNIT – with 1 amp DC output. Intended for use on the bench for experimenters, students, inventors, service engineers etc. This is probably the most important piece of equipment you can own. (After a multi range test meter). It gives a variable output from 3-30 volts and has an automatic short circuit and overload protection, which operates at 1 1 amp approximately. Other features are very low ripple output, a typical ripple is 3mV pk-pk, 1mV rms. Mounted in a metal fronted plastic case, this has a voltmeter on the front panel in addition to the output control knob and the output terminals. Price for complete kit with full instructions is £15. Ref. 15P7.
TRANSMITTER SURVEILLANCE (BUG) – tiny, easily hidden, but which will enable conversation to be picked up with FM radio. Can be housed in a matchbox. All electronic parts and circuit. Price £2. Ref. 2P52.

EAST CORNWALL COMPONENTS

BARCLAYCARD VISA — Access

CATALOGUE available – range of components greatly increased – over 136 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Credit Tickets (3), Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now.

APRIL SPECIAL OFFER

21 piece precision tool set in moulded plastic case with clear sliding lid. Set consists of 6 flat bladed screwdrivers (0.9 to 3.5mm) 2 cross headed sc/drivers (No. 0 to No. 1), 3 hex key wrenches (1.5, 2 & 2.5mm), 5 nut drivers (3, 3.5, 4, 4.5 & 5mm), 5 spanners (4, 4.5, 5, 5.5 & 6mm) and a tommy bar.

SPECIAL OFFER DRASTICALLY REDUCED PRICE – 13A TEST PLUG

This device is extremely useful for testing your 13A sockets and telling you what, if anything is the fault.
Simply plug the test plug into the socket and observe the amber lights. **PRICE 99p EACH 10 OFF 90p EACH**

BT APPROVED EQUIPMENT

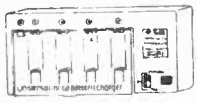
Master Socket (Flush)	£2.90	Wiring Tool	50p
Master Socket (Surface)	£2.75	Plug — 431A	25p
Secondary Socket (Flush)	£1.90	Slimtel Phone	£17.35
Secondary Socket (Surface)	£1.85	Viscount Phone	£26.04
B.T. Cable (per metre)	15p	Conversion Kit &	
Line Jack Cord with Plug	£1.25	Wiring Diag.	£6.90
Extension Lead 5 Mtr	£3.90		

PANEL METERS

A comprehensive range of good quality, cost effective, moving coil panel meters. Cut-out required is 38mm. All plastic, black and white finish with four nuts and bolts. **Features:** All the meters have a mirrored scale i.e. reading can be taken from any angle. Illuminated face, by two built-in lamps. These require a 6V supply.

0-50µA	4K3	PANEL/M1	£4.90	0-1A	3R	PANEL/M6	£4.90
0-100µA	3K75	PANEL/M2	£4.90	0-2A	3R	PANEL/M7	£4.90
0-500µA	430R	PANEL/M3	£4.90	0-25V DC	196R	PANEL/M8	£4.90
100-0-100µA	1K1	PANEL/M4	£4.90	0-30V DC	196R	PANEL/M9	£4.90
0-1mA	196R	PANEL/M5	£4.90	VU Meter	196R	PANEL/M10	£4.90

BATTERY CHARGER (Universal Nickel Cadmium)
An attractive nickel cadmium battery charger ideal for charging the rechargeable batteries detailed below. The charger will charge all the sizes listed: AAA, AA, C, D and PP3 and up to four AAA, AA, C and D types and one PP3 can be charged at the same time. The charger has a hinged plastic dust cover for easy viewing. The five battery positions have L.E.D. 'charge' indicators. The unit also has a switch allowing batteries to be checked for current state of charge.
Power: 240V A.C.
Dimensions: 210 × 100 × 50mm
ORDER CODE
BAT CHARGE
1+ **£4.50**
10+ **£4.25**
100+ **£3.75**



Ni-CAD BATTERIES

AAA	£1.25	£1.20 ea/10	
AA	90	85 ea/10	
C	2.10	1.90 ea/10	
D	2.50	2.20 ea/10	
PP3	4.10	3.90 ea/10	

SAFEBLOC
FOR QUICKLY AND SAFELY TESTING EQUIPMENT ON MAINS VOLTAGE, SIMPLY CONNECT WIRE TO CLIPS AND CLOSE LID. £6.75

ORVX PORTASOL GAS SOLDERING IRON

L171 (cap fitted) 160 (when soldering). Dia. 20

A miniature, pocket-size gas soldering iron, compact and convenient for use in many areas of soldering where mains power is inaccessible and trailing leads are a hindrance. The strong nylon casing well hold sufficient liquid butane gas* for 60 minutes' continuous use before refilling. A fuel regulator can control the gas output to give top temperatures up to 400°C (equivalent to 60W). Four nickel-plated brass soldering bits are offered separately in varying sizes, each with an integral catalyst. The iron is supplied with the 2.4mm bit fitted. Bits have a simple screw fitting into the iron and run with a flameless gas flow. The iron comes complete with a protective cap, pocket clip and flint igniter (cigarette lighter style). Instructions for use are included.
*Supplied discharged of gas. Suitable butane refill canisters are readily available from many retail outlets.

PRICE £16.00 EACH
SPARE TIPS £4.00 EACH

SOLDER: 60% TIN 40% ALLOY

22g. Non-corrosive Multi-core Solder.
500gm Reel £4.99 each — 10 Reels £3.75 each

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	72.50	CS 18W, as above	10.90
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20	Antex 15W iron	5.60
CS17 Iron Kit	7.99	Antex 18W iron	5.80
C15 Iron Kit	8.30	Antex 25W iron	5.80
XS25 W Iron kit/complete with steel & plug attached	11.00	Antex elements	3.20
		Antex bits	1.15
		Antex stands	2.20
		Soldersucker	4.50
		Spare nozzles for Soldersucker	0.65

SERVICE AIDS

Goldklene Degreasing Solvent	1.78	Aero Duster	1.55
Switch Cleaner Lubri	1.18	Super 40	1.94
Supa Freeze-it	1.46	Rapid Fire Extinguisher	3.45
Foam Cleanser	1.26	Silicone Grease Tube	1.82
Video/Tape Head Cleaner	1.14	Silicone Grease Spray	1.48
Plastic-Seal	1.40	Heat Sink Compound	1.20
Aero-Klene	1.16	**Solda-Mop**	
Anti-Static Spray ellist	1.28	Light guage 0.08mm	0.80
Excel Polish	1.24	Standatd gauge1.2mm	0.78
		Industrial reel 1.2mm	2.96

RESISTORS – CARBON FILM 5%

¼W 1R0 to 10M (E12 Range) — 2p each. 15p/10. 75p/100
½W 2R2 to 10M (E24 Range) — 2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range) — 5p each. 40p/10. 3.00/100
2W 10R to 2M2 (E6 Range) — 8p each. 60p/10. 5.00/100

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	4.50
¼W pack 5 each value E12 – 10R to 1M 305 pieces	2.95
¼W pack Popular – 10R to 10M 1000 pieces	6.50
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.75
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.70
½W pack Popular – 2R2 to 10M 1000 pieces	9.50
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	13.75
2W pack 5 each value E6 – 10R to 2M2 317 pieces	21.75

ADDITIONAL KITS

DISC CERAMIC 50V	125 pieces	£3.50
ZENER DIODES 5ea	55 pieces	£3.50
ELECTROLYTICS R.	100 pieces	£7.25
FUSES O/BLOW 20mm	80 pieces	£3.75
FUSES T/DELAY 20mm	80 pieces	£7.50
PRE-SET POTS-H	120 pieces	£6.75
PRE-SET POTS-V	120 pieces	£6.74

T.V. AERIAL ACCESSORIES

	1+	10+
Co-Ax Cable 75 Ohm 100 Metre Reel	£11.00	
Co-Ax Metal Plug	20p,	18p
Co-Ax Line Socket	25p,	22p
Co-Ax Line Connector	12p,	10p
Co-Ax In-Line Splitter	80p	
TV/Video/Computer Combiner	£3.09	
TV Indoor Amplifier		
Improves signal 3 times	£13.66	
Second Set Amplifier		
Improves signal to 2 sets 50%	£12.72	
CB interference Suppressor		
Minimises CB interference on TV	£4.45	
TV/FM Diplexer		
Separates UHF TV signals from FM radio signals	£3.78	

MAINS SWITCHES

Single 1 Way (1 Gang 1 Way)	0.85
Single 2 Way (1 Gang 2 Way)	1.20
Twin (2 Gang 2 Way)	2.00
Triple (3 Gang 2 Way)	2.85

MAINS SOCKETS

13A Single Unswitched	1.50
13A Single Switched	2.18
13A Twin Unswitched	2.50
13A Twin Switched	3.98

EXTENSION MULTI SOCKETS

ALL 13A, FUSED WITH NEON INDICATOR

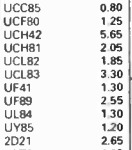
2-WAY	£2.75 each £2.50ea/5
3-WAY	£3.80 each £3.50ea/5
4-WAY	£3.99 each £3.75ea/5
4-WAY with lead & plug	£5.75 each £5.25ea/10+
PLUGS 13A 3-pin fused	£0.46 each £0.42ea/10

VALVES

Enquiries are welcomed for any other valve not listed here.

Type	Price (£)
AZ31	4.55
AZ41	2.05
DAF96	1.05
DF96	0.80
DK96	2.70
DM71	3.00
DY86/87	0.70
DY802	1.00
CV850	2.55
CV4015	2.85
E180F	6.55
EABC80	1.05
EAF42	1.55
EB91	1.35
EBC41	3.50
EBF80	0.80
ECC81	1.05
ECC82	0.95
ECC83	1.20
ECC84	0.85
ECC85	1.00
ECC88	1.45
ECC189	0.90
ECF80	1.25
ECF82	0.90
ECF83	1.95
ECH35	3.80
ECH81	1.45
ECH84	1.55
ECL85	0.80
ECL86	1.80
EF80	0.80
EF86	1.85
EF91	2.05
EF95	1.70
EF183	0.95
EF184	1.05
EH90	1.00
EL34	3.45
EL36	2.30
EL81	7.00
EL84	2.40
EL85	5.00
EL86	6.95
EL509	7.90
EL519	8.00
EM80	0.90
EM84	1.80
EM87	2.60
EY51	0.95
EY86/87	0.70
EY88	0.80
EY500A	2.55
EZ41	2.85
EZ81	0.85
GY501	1.45
GZ32	1.25
KT66(G.E.C.)	18.00
KT77	11.50
KT88(G.E.C.)	19.00
PC88	1.45
PC92	3.05
PC900	1.45
PCC88	0.85
PCC89	0.80
PCC189	0.90
PCF80	1.00
PCF82	1.00
PCF84	0.80
PCF86	1.30
PCF87	0.60
PCF200	2.00
PCF201	2.00
PCF800	1.25
PCF801	1.10
PCF802	1.10
PCF805	2.05
PCF806	1.25
PCF808	1.65
PCL82	1.05
PCL83	2.55
PCL84	1.05
PCL86	0.95
PCL88	2.55
PCL805	1.10
PD500	2.95
PFL200	1.90
PL33	1.55
PL36	1.80
PL82	0.80
PL95	2.05
PL504	1.55
PL508	2.75
PL519/509	5.30
PL802	5.55
PY81/800	1.15
PY82	1.80
PY88	0.85
PY500A	2.25
PY801	0.75
UABC80	0.90
UAF42	1.30
UBC41	4.35
UBC81	1.75
UCC85	0.80
UCF80	1.25
UCH42	5.65
UCH81	2.05
UCL82	1.85
UCL83	3.30
UF41	1.30
UF89	2.55
UL84	1.30
UY85	1.20
2D21	2.65
6AT6	1.30
6AU6	1.05
6C4	1.05
6GH8A	1.25
6J5GT	2.55
6K7G	2.05
6K8G	2.80
6KD6	6.55
6X4	1.55
30FL2	1.75
30FL12	1.65

MAINS ADAPTOR



Unstabilised D.C. output may be switched between 3, 4.5, 6, 7.5, 9 and 12V at up to 300 mA. Replaces batteries for many portable instruments. Reversible polarity output lead fitted with a four-way spider connector and PP3 battery connector.
Complies with Electrical Safety Requirements of B.S.415 Class 11B.

PRICE — 1+ £3.80 — 10+ £3.40

INTEGRATED CIRCUITS (£) EACH

741	0.16
CA810OM	1.20
CA3020	2.10
CA3065	1.60
HA1366WR	1.50
LA4422	3.20
LC7131	4.90
LM324N	0.40
LM380N8-P	0.80
LM380N14-P	1.80
LM1011N	3.20
LM1458N	1.35
LM3900N	0.50
M51513L	2.30
M51515L	3.15
MC1307P	1.99
MC1327P	1.50
ML237B	2.30
NE555	0.20
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.85
SN76226DN	1.30
SN76227N	1.10
SN76533N	1.75
STK015	6.20
TA7203P	2.50
TA7204P	2.50
TA7205AP	1.80
TAA550	0.50
TAA611A12	3.50
TAA621AX1	3.50
TA120B	1.30
SAS50	1.30
TBA520	1.50
TBA530	1.20
TBA540	1.64
TBA560C	1.50
TBA810S	1.20
TBA950/2A	3.05
TCA2705Q	4.07
TDA1006A	2.45
TDA1035S	4.50
TDA1170S	1.99
TDA1352A	1.80
TDA2030	1.80
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
UPC575C2	1.45
UPC1350C	4.05
UPC1182H	2.75
UPC1208C	1.25
UPC1356C2	3.00

TEST PRODS (FUSED)

Manufactured by Bulgin. High strength plastic inc. 1A 1¼" fuse. Length of prods — red & black — 144mm. **99p Pair**

DESOLDERING PUMP

£2.99

SPARE NOZZLE FOR ABOVE – 60p

HELPING HANDS WITH MAGNIFIER **£3.99**

20mm FUSES

QUICK BLOW – 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3.15, 4, 5, 6.3 — **45p/10**
TIME DELAY – 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 10 — **90p/10**

1 DOMESTIC MAINS FUSES

ALL 13A, FUSED WITH NEON INDICATOR
2A, 3A, 5A, 13A **£1.00/10**

1¼" QUICK BLOW FUSES

500mA, 1A 1 25A, 2A, 12A **50p/10**

PCB ETCH RESIST MARKER PEN

NYLON TIPPED **95p ea.**

FERRIC CHLORIDE CRYSTALS

250 gms **£1.65 ea.**

SOLDERLESS BREADBOARD VEROBLOCK

Incl. Bracket **£8.67**

TRANSISTORS & DIODES

Type	Price (£)	Type	Price (£)
AC128	0.30	BC171/A/B	0.10
AC128K	0.38	BC172/B/C	0.12
AC141	0.58	BC177/B/C	0.24
AC141K	0.38	BC182/A/B/C	0.10
AC142	0.40	BC182L	0.10
AC142K	0.38	LA LB LC	0.12
AC152	0.48	BC183/A/B/C	0.10
AC153K	0.46	BC183L	0.10
AC176K	0.32	LA LB LC	0.12
AC187	0.40	BC184	0.08
AC187K	0.42	A B CL LC LB	0.10
AC188	0.24	BC212/A/B/C	0.10
AC188K	0.38	BC212L	0.10
ACY22	1.50	LA LB	0.10
AD142	0.88	BC213/A/B/C	0.10
AD149	0.95	BC213L	0.10
AD161/162	1.20	LA LB LC	0.10
AF114	0.88	BC237	0.12
AF115	2.10	BC238	0.12
AF116	2.10	BC251/A/B	0.14
AF121	0.66	BC262	0.26
AF124	0.70	A B	0.29
AF125	0.50	BC301	0.36
AF126	0.50	BC302	0.38
AF127	0.50	BC303	0.36
AF139	0.56	BC307A	0.15
AF178	1.50	BC317B	0.15
AF239	0.65	BC323	0.90
AF279S	1.40	BC327	0.10
ASY80	5.20	BC328	0.10
ASZ17	2.00	BC337	0.08
AU110	2.90	BC338	0.10
AY102	4.32	BC350A	0.24
B40C200	1.03	BC351	0.16
BA115	0.12	BC516	0.35
BA121	0.40	BC547	0.08
BA148	0.16	BC440	0.36
BA155	0.12	BC548	0.08
BA157	0.20	A B or C	0.10
BB105B	0.32	BC549	0.08
BB105G	0.30	BC550	0.10
BB110B	0.42	A or B	0.10
BC108	0.10	BC557A	0.10
A,B or C	0.14	BC558A	0.10
BC109	0.10	BCY70	0.36
A,B or C	0.14	BCZ10	3.21
BC115	0.15	BCZ11	2.60
BC117	0.28	BD124P	1.20
BC118	0.20	BD129	0.90
BC119	0.43	BD130Y	0.68
BC125	0.14	BD131	0.46
BC140	0.48	BD132	0.50
BC141	0.36	BD135	0.26
BC142	0.26	BD136	0.26
BC143	0.36	BD137	0.28
BC147B	0.16	BD138	0.30
BC148	0.10	BD139	0.30
BC148B	0.12	BD140	0.29
BC149	0.12	BD142	1.60
BC149C	0.14	BD145	1.82
BC159	0.14	BD150B	0.50
B/C	0.16	BD160	1.58
BC160	0.38		
BC161	0.30		
BC168B	0.25		
BC170/A/B/C	0.12		

Type	Price (£)	Type	Price (£)
BD165	0.45	BFY52	0.32
BD183	0.70	BFY90	0.80
BD201	0.52	BFY90S	1.34
BD202	0.57	BR100	0.20
BD222	0.80	BR101	0.76
BD225	0.40	BR103	0.60
BD232	0.52	BR303	2.75
BD234	0.30	BRY39	0.80
BD235	0.30	BRY56	0.42
BD236	0.36	BSX20	0.20
BD237	0.38	BSY52	0.35
BD410	0.76	BSY95A	0.25
BD438	0.64	BT100A/02	0.90
BD439	0.85	BT101/300	2.75
BD441	0.85	BT101/500	3.25
BD507	1.05	BT102/300	3.60
BD520	1.20	BT106	1.15
BD587	0.88	BT116	1.20
BD707	0.80	BT119	3.30
BDX18	1.00	BT138/600	0.98
BDX32	1.75	BT151/560R	0.90
BF115	0.32	BTY79/400R	2.80
BF117	0.50	BU104	1.80
BF119	0.82	BU105	1.40
BF125	0.42	BU108	1.90
BF127	0.44	BU126	1.60
BF154	0.14	BU133	1.90
BF157	0.46	BU204	1.60
BF160	0.23	BU205	1.40
BF167	0.32	BU208A	1.50
BF177	0.42	BU326S	1.75
BF178	0.36	BU407	1.40
BF180	0.27	BUX80	2.90
BF181	0.27	BUY20	2.75
BF182	0.32	BUY69A	2.90
BF183	0.32	BUY69B	1.98
BF184	0.47	BY100	0.80
BF185	0.28	BY103	0.50
BF194A	0.15	BY122	0.60
BF195	0.12	BY126	0.10
BF224J	0.20	BY127	0.08
BF240	0.15	BY133	0.10
BF241	0.18	BY135	0.35
BF257	0.22	BY164	0.45
BF258	0.26	BY179	0.60
BF259	0.30	BY182	0.80
BF262	0.34	BY184	0.38
BF263	0.38	BY187	0.65
BF270	0.30	BY189	6.75
BF271	0.28	BY198	0.64
BF273	0.22	BY199	0.72
BF274	0.34	BY206	0.14
BF294	0.46	BY207	0.16
BF336	0.46	BY210/400	0.21
BF337	0.38	BY210/800	0.22
BF338	0.28	BY227	0.28
BF355	0.42	BY228	0.50
BF371	0.27	BY238	0.65
BF450	0.30	BYX10	0.28
BF457	0.36	BYX36/150	0.40
BFR51	0.38	BYX36/600	0.48
BFR61	0.32	BYX48/300	0.70
BFR90	0.86	BYX55/600	0.38
BFT41	0.68	BYX71/600	1.50
BFT43	0.38	E1222	0.30
BFY50	0.32	E5024	0.30
BFY51	0.32	MCR106/5	1.20
		ME0413	0.70
		ME6002	0.26
		MEU21	0.62
		MJ400	1.45
		MJ2955	1.10
		MJ3000	1.80
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		MPSA05	0.30
		MPSA12	0.30
		MPSL01	0.34
		MPSU05	1.05
		MPSU06	1.20
		MR502	0.40
		MR854	0.86
		OA91	0.14
		ORP12	0.95
		R2008B	1.40
		R2010B	1.20
		R2540	2.71
		TIP30A	0.35
		TIP31C	0.30
		TIP32	0.36
		TIP33A	0.75
		TIP34A	0.90
		TIP41C	0.36
		TIP42	0.38
		TIP47	0.60
		TIP121	0.63
		TIP2955	0.68
		TIP3055	0.85
		TIS88	0.50
		TIS90	0.27
		Y723	0.92
		Y969	2.80
		IN4001	0.04
		IN4003	0.05
		IN4004	0.05
		IN4006/7	0.07
		IN4148	0.04
		IN5400	0.08
		IN5402	0.12
		IN5405	0.12
		IN5406	0.14
		IN5408	0.18
		2N2122A	0.34
		2N2222	0.30
		2N2904A	0.48
		2N2926G	0.14
		2N3053	0.30
		2N3054	0.80
		2N3055	0.60
		2N3703	0.14
		2N3773	1.90
		2SB337	1.90
		2SC1098	0.94
		2SC1172Y	1.70
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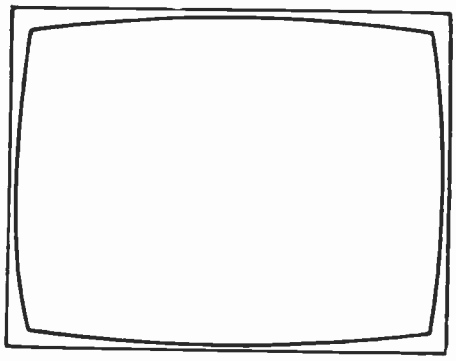

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COVER PHOTO
This month's cover photo shows an internal view of the Mitsubishi HS306B VCR – see article on page 422.

CAPACITANCE BRIDGE
Three points relating to last month's article: (1) The terminal board is a Tandy 274-621. (2) VR4, which is used only when checking the larger electrolytics, should be of the type that has zero resistance when fully anticlockwise. A small wire-wound is best. (3) The magic eye target anode (Fig. 5) should have been shown connected direct to the 150V line.

Broadcasting in Turmoil

The world of TV broadcasting will never be the same again. In the past we've been used to the comfy BBC/IBA duopoly. Technical devolpments, in particular satellite TV broadcasting, are about to introduce an increasing element of competition. But the political dimension could be even more significant: the government has made it plain that it intends to shake up the world of broadcasting to provide greater opportunities and increased consumer choice.

Mrs. Thatcher has said there are two types of people in this world, those who see difficulties and become weighed down by them and those who see new opportunities. Forgive us if, for the moment, we join the former camp. In the not too distant future there will certainly be plenty of choice, in terms of the number of channels: the BBC and ITV/Ch. 4 channels, about twelve channels aimed at UK viewers via the Astra satellite, the three BSB DBS channels and, almost certainly, a fifth terrestrial channel – not to mention the cable TV offerings. Plenty of opportunity then for the fledgling programme maker and broadcaster. But to support this lot a considerable income will be required. Where is it to come from? The number of UK viewers will remain substantially the same, which means that the audience will be spread more thinly. You can, of course, try to get people to pay more. But it's uncertain how much subscription TV there will be and, if we are to judge by the experience of the cable companies to date, it seems that people are hardly falling over each other to pay more for their TV viewing. No: it's pretty clear that advertising revenue will be called upon to provide the main source of income to support these new channels. The advertising revenue of the existing ITV companies has certainly been buoyant over the past few years. But then again there's a finite limit to the amount of potential advertising revenue available. The TV medium is such that it's best suited to mass market products – cars, detergents, videos, baked beans and such like. For anything more specialist it's not worth spending your money on TV advertising. So the prospect is of a finite viewing audience and a finite revenue being spread over a doubling or trebling of the number of TV channels. Perhaps we could tackle the problem from another angle, by reducing the cost of broadcasting. This is certainly something that the government sees as part of the solution. There's little doubt that the incentive to maintain a tight budget in the world of ITV has often been lacking. But there's obviously a limit to the amount that can be saved by cutting a few pounds here and there.

Somehow, it doesn't seem to add up. This could mean that some of those involved are going to burn their fingers. If you think that this is perhaps alarmist, there's a case in point to be seen across the channel. The fifth French network, La Cinq, was being hotly fought over only a year or so back. It's now in serious financial trouble, with losses in the current year already some £80 million. Well of course Canal Plus made a loss to start with – so did ITV for that matter. But it could just be that La Cinq has come at the point where the demand for more channels is no longer there.

This all begs the question of what sort of channels. If they are all much of a muchness the system is bound to find itself in financial difficulties. To introduce more specialist channels so that viewing choice is genuinely increased and more specialised advertising opportunities are created, as was the intention with cable TV, could provide a solution, but here again there are constraints. Doubtless a porno channel could be hugely profitable. But would it be allowed?!

The government would perhaps argue that greater opportunity inevitably involves an element of risk, and that risk taking is what the new world of opportunity is all about. True enough, but isn't broadcasting perhaps just a bit different from most other types of commercial activity? For one thing it's a major element of our popular culture. For another it takes a long time and a lot of investment to build up the programming for a channel and establish standards that are acceptable to viewers. This isn't something you can do overnight in a spare studio under a railway arch somewhere.

Perhaps we are being too alarmist, looking too much at the difficulties. But let's just run through one or two aspects of the scene that's emerging. What are the prospects for cable, of which so much was once expected? Though the number of UK subscribers has now passed 250,000 (of whom only 40,000 are connected to a modern multi-channel system), this hardly seems an adequate basis to sustain a viable industry. On top of this, the cable channels are about to become available via the Astra satellite. Do you buy a dish and decoder or link up with the cable (if it's there)? The provision of dishes is going to be a lot easier than laying cable. There are certainly problems for the cable operators. What about the prospects for DBS? BSB would be justified in feeling let down if it found itself with an expensive flop on its hands. Competition from Astra and from a fifth terrestrial channel was not part of the prospectus it was originally offered. It's not likely to have an easy time of it, at least initially.

There are certainly greater opportunities in TV broadcasting than ever before. And greater risks for all. This includes the sixteen ITV companies who, the government has decided, will have to bid for renewal of their franchises when the time comes in 1992. Whether making TV a more adventurous business will lead to better television is something else again. It seems that too little thought has been given to this aspect of the matter.

TV Fault Finding

Reports from Alan Shaw, Colin Boggis, Hugh MacMullen, Roger Burchett, Nick Beer and Mick Dutton

Hinari MT2

It's difficult to purchase a large-screen monochrome TV receiver nowadays. Ferguson no longer make them and Philips import only small quantities. Yet for various reasons many older people still won't take out a colour licence. One company, Hinari, has imported a 24in. receiver, Model MT2, from Yugoslavia. The cabinet is rather bulky, in fact larger than the average colour set, but the construction is very robust. A large, vertically mounted PCB drops down in a similar manner to older ITT and Indesit designs.

For a change the circuit shouldn't present any headaches. Everything is conventional, using standard i.c.s such as the TDA1170 for the field timebase and a TBA120S/TBA800 combination in the sound chanel. The power supply has a series regulator and a large mains isolating transformer, a nice change from switch-mode power supplies.

The set has been available for about two years now. During this time very few faults have shown up. Those that have are as follows. (1) The e.h.t. stick rectifier, which is encased in the line output transformer, occasionally goes short-circuit. (2) The common earth tag on the push-button channel selector tends to go open-circuit, with the result that the tuning voltage can't be varied. Fortunately there's another tag at the other end to which to transfer the wire. (3) Line tearing for several minutes when the set is first switched on is not the line output transformer breaking down, as one might suspect, but a faulty line driver transistor. This is T502, type 2N1893. Fitting a BF355 cures the problem. **A.S.**

Toshiba C2020

Patterning with this set was not caused by an unstable tuner: the h.t. reservoir capacitor C807 (120μF) was responsible. **A.S.**

ITT 3493 Stereo CTV

The remote control system was inoperative, there was no sound and no colour. The SAA1251 remote control decoder chip was faulty. **A.S.**

Sanyo CTP6144

If the power supply is pulsing, check whether the l.t. transformer T391 (part no. PT0144) has a high-resistance or open-circuit winding. **A.S.**

Ferguson TX10

The mains on/off switch had been replaced and now the channel selection was behaving most unusually – buttons 1, 2 or 3 selected channel 1 only, button 4 was o.k., buttons 5, 6 or 7 selected channel 5 and button 8 (VCR position) was also o.k.

Whilst examining board PC1548 we noticed that when the mains switch had broken it had fallen against the panel and flashed across to the ML923 i.c. This chip was replaced, but the fault persisted. We eventually thought really hard about the symptoms. It was then soon obvious that two of the input lines from the touch selector panel were permanently grounded. Replacing C930 and C931 provided a complete cure. When these capacitors were checked out of circuit they both produced a reading of about 3kΩ. **C.B.**

Ferguson 3787

When servicing one of these portables we had difficulty setting up the e.h.t. control RZ13 for the correct level of 55V across CA18 – the set would trip out before the correct setting was reached. The cause of the trouble was eventually traced to transistors TZ07/8 on the control module. At some time they had been incorrectly replaced using BC548A devices instead of the higher gain B version. **C.B.**

Philips KT3 Chassis, Edition II

There was no chrominance after about an hour. We had to resort to freezer to find the cause. It turned out that C56 (0.1μF) which is connected between pin 23 of the TDA3560 colour decoder chip and chassis went completely open-circuit when warm.

We've had several cases of intermittent chrominance with these sets due to the internal leads in the delay line touching one another. In one set the cause was dust inside the delay line case. **M.MacM.**

NordMende 3543A

There were pairs of lines from top to bottom in three areas of the picture. The cause was eventually traced to odd functioning within the TDA4610 EW correction circuit. The voltages were all o.k. but changing the chip cured the fault. **H.MacM.**

Philips CTX-S Chassis

Every now and then this set would either not start or would go off intermittently. We eventually found that the slider of the set-h.t. potentiometer R3325 was dirty. **H.MacM.**

Decca 135 Chassis

This set drifted off tune after about an hour and was o.k. again when cold. R68 (33kΩ) was going very high in value when hot: the tuning voltage then dropped to about 10V maximum. **H.MacM.**

Philips 2A Chassis

What looked like a simple case of noise but no tuner oscillator operation was eventually traced to a hairline crack in the print between pin 4 of the tuner and pin 7 of socket M1. As a result, the tuner was deprived of its tuning voltage. **H.MacM.**

Philips CP90 Chassis

This set was brought in with no picture and just traces of sound. The voltages in the SOPS power supply were all o.k. and after a great deal of time had been spent we found that there was a tiny hairline print crack between

pin 7 of the line output transformer and the junction of R3495/C2594. As a result there was no 15V at the earthy end of the e.h.t. circuit, with obvious effects in the beam limiter circuit. **H.MacM.**

Philips K40 Chassis

No remote control operation on one of these sets with teletext turned out to be sloppy manufacture — the red wire to socket M83 was plastic instead of wire pinched. This is the socket on the front panel, linking the control module and the operating panel. No field scan with this chassis is often caused by the connection to pin 18 of the line output transformer being either dry-jointed or open-circuit. **H.MacM.**

Philips G11 Chassis

This one was a bit of a silly. There was no remote control operation. A well-known service organisation had soldered the third pair of contacts on the on/off switch. Oh dear! **H.MacM.**

Ferguson 3787

I took this set on with some trepidation, not having looked at one before — it belonged to a business associate's sister. The complaint was that on loud music passages the set seemed to go off tune. For several weeks the owner had been using a monochrome portable for sound. No, it wasn't the tuning line: the LM341 12V regulator IL01 was faulty. **R.B.**

Philips KT3 Chassis

Tripler failures are getting to be common with this chassis. On this one the TDA3560 colour decoder chip had been damaged as well. **R.B.**

Sony KV1820/KV2000 Mk II

The line output transformer tuning capacitor C813 (0.016μF, 1.5kV) seems to be a very common failing in these sets. It goes short-circuit, as a result of which the chopper transistor Q607 dies. R628 and R639 usually go open-circuit as well. **R.B.**

Panasonic U4 Chassis

These sets suffer from intermittent memory loss. We've received various modification kits in the past but none of them have really solved the problem, though I have found that resoldering the crystals associated with the MAB8440 and SAB3035 chips on the print side of the PCB has provided a cure – the legs are much smaller than the holes, and the joints become dry. More recently Panasonic have released a kit that modifies the appropriate M board to the U5 design. This seems to cure the problems, but unfortunately one of the first I received and fitted didn't work at all as the MAB8441 chip was faulty. **N.B.**

Decca 70/90 Series Chassis

No results with the 1A fuse F601 in the power supply open-circuit means that the BUW81A Darlington chopper transistor has gone short-circuit. Replace it with a BU426A. Then leave the 1A fuse out and check for a squarewave drive signal at the base of the transistor. I've had several cases where the squarewave has been missing – switching on would have blown the lot up again. The following items have been known to cause loss of drive – sometimes they've all failed: Tr604 (BSR59), Tr603 (BC157), D608 and D610 (1N4007), Tr601 (BD410), IC601 (TDA2581), Tr602 (BC147), C627 (10μF), D604 (ZPY11) and D603 (1N4148).

For tripping check the tripler (of course), C633 (fit a 1,000pF replacement instead of 680pF), and for dry-joints on the chopper transformer. **N.B.**

ITT CVC9 Chassis

Some time ago there was a query about the VDR R409. I use a VA8650, which is readily available from Willow Vale, and have had no comebacks. Failure of R409, giving loss of sound, is a very common fault. **N.B.**

Philips G11 Chassis

The problem with this set was no luminance. After changing the i.f. and decoder panels to no avail I traced the cause of the fault to the 4·7V zener diode in the beam limiting circuit on the power supply panel. **N.B.**

Decca 70 Chassis

There was no picture though the e.h.t. was present. The yellow lead soldered to the back of the mother board in the area of the decoder had broken. **N.B.**

ITT VC301 Chassis

There was no sync on this ageing monochrome portable. The volume control was very noisy and the e.h.t. arced, but the tube still looked very lively. The supply at pin 2 of the SN76532N sync separator/line oscillator chip was correct at about 9·3V but the voltage at the video input, pin 9, was slightly negative. The bias resistor R100 (1MΩ) had gone open-circuit. **N.B.**

Sony KV1412

This set wouldn't start. The fuse was intact and there was 115V at IC601 (μPC1394C). While checking voltages the set started, then went off. After resoldering a couple of suspect joints on IC601 the set worked for a couple of days, then on a particularly cold morning it refused to start. Heating IC601 got it going once more and after fitting a replacement we had a lasting cure. **N.B.**

Ferguson TX90 Chassis

This set came in with no picture. We advanced the first anode control and got a blank white raster. Checks were then made around the decoder chip. The −0·8V that should have been present at pins 19 and 23 was found to be missing. A check with the scope showed that pulses from the line output transformer were arriving at R171 (270kΩ) but there was nothing at the chip side. Replacing R171 cured the problem. **M.D.**

ITT CVC1110 Chassis

The problem with this set, which was actually a GEC colour portable, was a small picture with a hum bar. The h.t. rail was found to be low at 95V instead of 110V. The reference voltage in the chopper control circuit is provided

by the 10V zener diode D711, and a check revealed that the voltage across this diode was varying between 6V and 8V. Replacing D711 rewarded us with a stable 115V h.t. supply. **M.D.**

Micro Clinic

Reports from A.G. Grace, Brian Renforth and John de Rivaz, B.Sc. (Eng.)

Spectrum Plus

We've had similar Spectrum Plus faults to those described by Ken Taylor in the January Micro Clinic.

When one machine was powered up the screen showed a changing brick pattern but no Sinclair logo. The current consumption was excessive at over 1A – it should be nominally 680mA. The ROM, CPU and ULA chips were checked by fitting them in a known working machine. The ROM and CPU were o.k. but the ULA proved to be defective. Unfortunately the same fault was present when the ROM and CPU chips plus a new ULA were fitted in the defective machine. A quick prod around with the logic probe then showed that the CPU had crashed (/halt pin 18 = 1). The ROM, CPU and ULA were again removed and power applied. The logic probe was then used to check the data bus – all lines should have been high due to resistors R9-R16. Lines D1, D2, D4, D5 and D6 were found to be low however. A resistance check showed a direct short-circuit and we next found that pin 14 (data out) of IC16/17/19/20/21 was shorted to ground. Lifting pin 14 of these i.c.s removed the excessive current drain. IC25 and IC26 were at this stage removed to disable the top 32K.

A scope probe check then revealed that the /RAS control signal for the lower 16K RAM was missing at pin 4. It was present at pin 35 of the ULA. A resistance check showed a contact resistance of 14Ω between the ULA and its socket. Fitting a new socket re-established the signal – but still didn't clear the fault. Address line A6 was found to be present at one side of R20 but not the other side. A resistance check showed that R20 had infinite resistance. Replacing R20 cured the remaining faults, allowing the machine to initialise correctly – but only as a 16K machine (IC25/26 removed).

Phone calls to various distributors revealed that the TMS4532 and the MSM3732 have been obsolete for a couple of years, the replacement being the 4164 series. Which links do you use with these devices? I assume the Texas link is used and either link 3 or link 4 depending on whether the upper or lower 32K is used.

Incidentally, the EAR socket circuit is shown incorrectly in Ken Taylor's series of articles. C32 is in parallel with D13 and C35 in series with R36 (see Figs. 5 and 12). **A.G.G.**

BBC Model B

The three LED indicators for cassette motor, caps and symbol shift would light up intermittently, the rest of the computer working perfectly. On inspection we found that the print around a couple of LED pins had broken, causing intermittent contact. Apparently the symptoms put in an appearance after the keyboard panel had been removed and refitted: the LEDs had been knocked while the panel was being refitted – it's easy to do. A permanent cure was effected by bridging the print with thin wire. **B.R.**

Unwanted Customers

Some years ago when the Spectrum appeared on the scene we coincidentally received a handful of ZX81s returned shortly before the guarantee period had expired, all with the same complaint – that the keys didn't work. We were asked to exchange the machines for Spectrums, with the difference paid. Naturally we were suspicious, and on each occasion we could see that the keyboard had been deliberately dented by a screwdriver blade! We didn't miss such customers after telling them where to go for their Spectrums! **B.R.**

Patching up a QL

The Sinclair QL has no proper parallel port for a printer. Usually a serial-to-parallel converter is used. As part of a disc interface, the Sandy Superqboard has a parallel port which worked perfectly for a time with an Epson MX80FT2 printer. Eventually however the computer failed to take any notice of the printer's busy signal, with the result that gibberish was printed. An oscilloscope check revealed that the output from the printer wasn't rising above a few millivolts instead of to the 5V specified. Adding a 1kΩ resistor to the 5V line cured the fault.

It's worth noting that printers have several different ways of acknowledging data from computers, but each computer usually uses only one of them. Thus a printer may work with one computer but not another, the reason being that the acknowledgement pin used with the computer the printer doesn't like is in some way incompatible. **J.deR.**

The SPEM QL Digitiser

Suppliers of the SPEM digitiser, which allows pictures from a video source to be digitised and displayed on the QL computer's screen and to be printed out, may get complaints if the user tries to display the input TV picture on the computer's monitor. This is a feature of the equipment, provided for in the switching, and is explained in the manual.

When I tried this the picture wouldn't lock. On examination I found that no sync pulses were being supplied to the monitor. A simple circuit (see Fig. 1) was added to pick them up from within the unit and feed them to the appropriate pin on the output. **J.deR.**

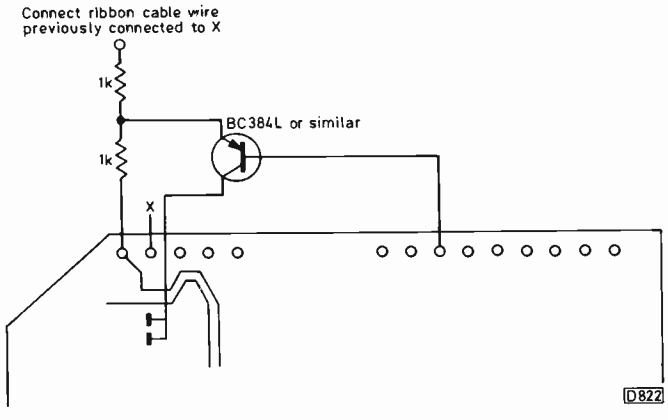

Fig. 1: Modification to the SPEM digitiser board to provide video source sync pulses to the QL's monitor.

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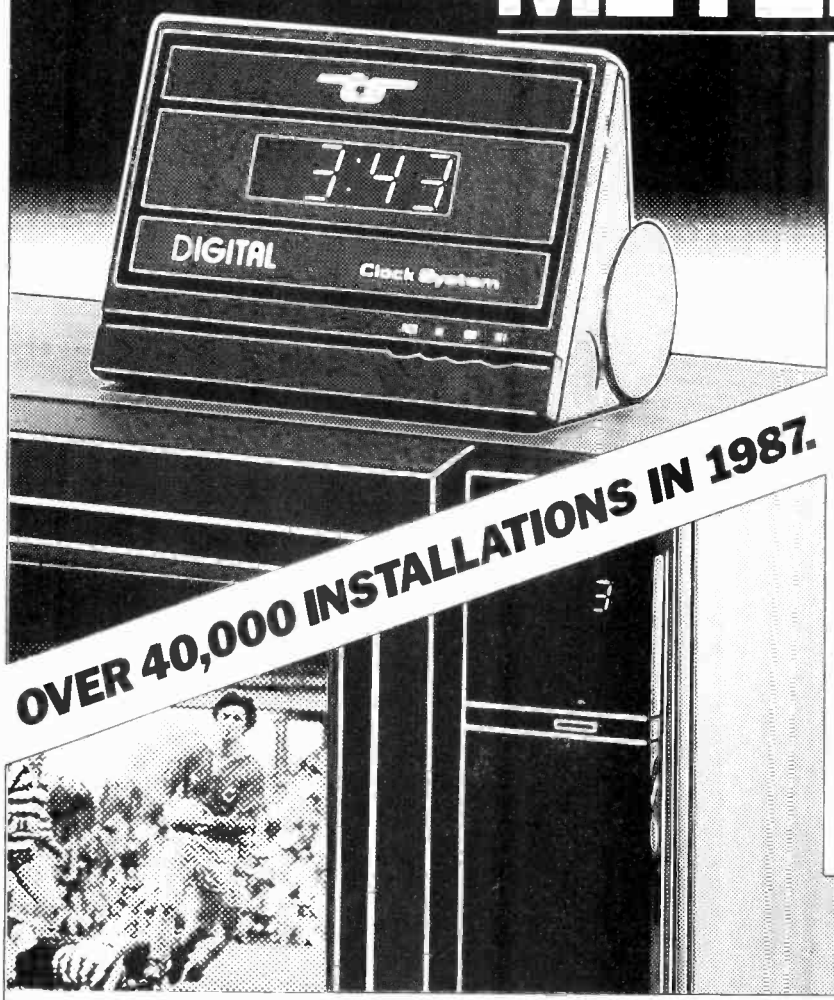

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Letters

PROBLEMS WITH SCRAMBLING

Most satellite TV enthusiasts will by now have noticed that more and more signals are appearing on Intelsat VA F11 at 27·5°W. You'll also have noticed that with this satellite various forms of scrambling are now evident, i.e. SIS/TV3 on transponder 5/6W with B-MAC, BBC-1/2 on transponder 4W and, more recently, Premiere on transponder 2W with SAVE. Some readers will have sent their hard-earned cash to Premiere and received a "brown box" to decode the scrambled signal. For the benefit of those who haven't, or who got out a soldering iron and sorted it out for themselves, the instruction sheet supplied with the decoder is a sight to behold. The formidable task of explaining how to get the decoder into operation is summarised on a single sheet in simple steps:

"1. Don't panic, be strong, tread boldly.
2. Look carefuly at your Hi-Tech TV and its surroundings. Find a place amongst the black boxes for the little Premiere decoder box.
3. Find an empty 13 amp mains socket for it within reach – not so easy huh!!
4. Slot your Premiere decoder physically into place and plug it in. The little red light should come on! . . . pretty.
5. Now switch on your entire Hi-Tech TV system, the lot including the video, food mixer etc."

And so on.

The rest of the instructions flow with the same literary skills, suggesting that Premiere's viewers have never progressed beyond the *Beano*. A diagram showing a few typical installations would have helped but was not included. Instruction 26 finally throws in the towel with:

"If after all your valiant efforts still no picture appears, I am afraid it's time to call your friendly satellite TV installer."

Most of us have come across Far Eastern products that come with poorly translated instructions. This must be an excellent example of a UK product whose instructions would benefit from being translated into Taiwanese! We know of a number of customers who reached instruction no. 26 without success. Presumably this is only the tip of the iceberg, since according to sales engineer Steve Tucker over 1,500 decoders have been delivered by manufacturer SAT-TEL.

We've also had a number of complaints about "universal sync generators" which are sold at ridiculous prices and are supplied with disclaimers such as "not intended for use as a de-encryption device". The idea is to provide a cover for a shady operation, from both a trading and a technical viewpoint.

Let's have some comments from those who feel that satellite TV deserves better than these shoddy approaches from professionals and amateurs alike.

Gordon McCrea, B.Sc. (Hons), Technical Director,
Kesh Electronics (Satellite Systems) Ltd., Kesh, N. Ireland.

TV/VCR STANDARDS CONVERSION

I read with interest Eugene Trundle's article on TV and VCR standards conversion and would like to add the following comments. Almost all the TV sets and VCRs sold in Saudi Arabia have multisystem capability. Some provide for PAL I reception and playback (usually switchable). Most models have "autovolt" (90-260V) power supplies. The domestic current is nominally 127V, 60Hz but two phases are frequently used to provide 220V. Often both are available in the same room, with interchangeable sockets – hence "autovolt".

A problem not mentioned in the original article is the fact that when a PAL I u.h.f. only machine is taken to a v.h.f. only area the mixer/booster amplifier may not provide a v.h.f. path because of the use of small-value u.h.f. coupling capacitors.

George N.M. Tolley,
Jeddah, Saudi Arabia.

TODAY'S SERVICING PROBLEMS

In reply to R. Lewis (Letters, February) I'm all too well aware of the problem of Mastercare's spares prices. Before Willow Vale started to supply Saisho reel idlers we had to get them from Mastercare, which meant cash with order and an astonishing bill for over £11. This is why I originally suggested Willow Vale as a source of supply in VCR Clinic (October 1987). Their parts enable us to undertake repairs on these machines to a certain level, with minimal outlay on manuals and labour, giving us a rare quick, profitable job. I was subsequently asked to make clear in *Television* that Mastercare supply OM replacement parts for Dixons/Currys own brand goods.

On the subject of video servicing, also discussed in recent letters columns, our experience is that until a year ago the majority of jobs were straightforward mechanical ones. We still get the same machines with the same faults but find that an increasing number of new machines are faulty when unboxed or taken out for over-night demonstration, calling for urgent service attention often without the relevant service information being available and almost certainly before you've been on a course. Couple this with the fact that there is rarely a belt in a machine these days, that new mechanical and electronic technology is present, and that there are no parallels with previous audio equipment for example and you'll appreciate that the need is for highly trained engineers specialising not just in video, TV or audio but, as Steve Beeching has pointed out, in the separate video subdivisions of camera related equipment and domestic VCRs.

Another product that the smaller dealer is finding it increasingly more difficult to service is the compact disc player. These use new, advanced electronics and, as with the latest generation of VCRs, there are the minimum number of helpful adjustments. Those adjustments that are provided require extreme precision, a good understanding of the operation of the various servos and specific manufacturers' jigs. I've spent the last few days on not much other than compact disc players, all either Technics or Pioneer and the majority under guarantee. One of each make required replacement of the optical pick-up unit, again under guarantee. Actually fitting the unit takes about an hour, and a further one and a half hours at least are then required to set up the machine. In the case of the Technics machines this would be impossible without at least two of their excellent jigs – the servo gain adjuster and laser extension PCB. The former has to be used in conjunction with a dual-trace scope and an l.f. generator. All this takes money to purchase, and a dealer who sells say twenty machines is not going to be able to justify spending very much on jigs. Disc players need setting up fairly regularly, so dealers must have the facilities to get this done. The obvious answer is to employ a service subcontractor who deals with players from many sources.

This brings me to my final point – labour reimbursement scales. This has always been a contentious point and I've no doubt it always will be. Take the aforementioned Pioneer compact disc player. You spend two and a half hours at least on it and get £15. One of your correspondents seems to use manufacturers' service departments rather often. This shouldn't be necessary, as most companies now have specialist service dealers (e.g. Sony ASDs, Panasonic Service Centres, Hitachi/Ambassador dealers etc.) to whom smaller dealers should send any problematic units. This emphasises the advantage of specialist service companies. But isn't it a fact that if manufacturers and retailers raised prices to a more realistic level we could be paid a decent wage and service standards would go up? The current trends of further price cutting and higher scale integration of mechanics, necessitating replacement of larger assemblies, are very worrying, especially to us poor sods who get the narked customers with their "only eighteen months old" units requiring attention.

Nick Beer,
Bideford, N. Devon.

WHAT IS AN HONEST PROFIT?

There have been quite a few letters recently on the subject of repair charges. While following these with considerable interest a question that keeps flashing through my mind is what is an "honest profit"? Let me explain. Recently I needed a certain component for the audio amplifier section of a colour receiver. So off I went to the wholesaler, only to find that it was out of stock and wouldn't be available for at least a fortnight. I'd promised the customer that his TV set would be ready for collection that evening, so I had no alternative but to go to a retail shop for the item required. I bought two, not taking much notice of the price, and returned to the ranch. On reckoning up the customer's bill the cost of this item was brought home to me. Allowing for VAT, transport, and administration costs to the shop they'd made 125 per cent profit on each item. Is that fair? This is why I ask "what is an honest profit"?

M.K. Hayter,
Moseley, Birmingham.

IR REMOTE CONTROL HANDSET TESTER

The circuit of a very simple but quick infra-red remote control unit tester is shown in Fig. 1(a). It was devised because, having had several remote control handsets that had been through the automatic washer, I needed a quick go/no go test set. I've found the arrangement to be ideal, since it uses the Avo and can be thrown into the toolbox without much fear of anything happening to it. If you want to use a separate meter and battery, use the circuit shown in Fig. 1(b). Note that if a Gould digital meter is used the red and black connections will have to be reversed as red is positive on the ohms ranges.

Use the 200kΩ range. H23A1 phototransistors are available in pairs from Farnell Electronics of Leeds.

Jim Littler,
Wigan, Lancs.

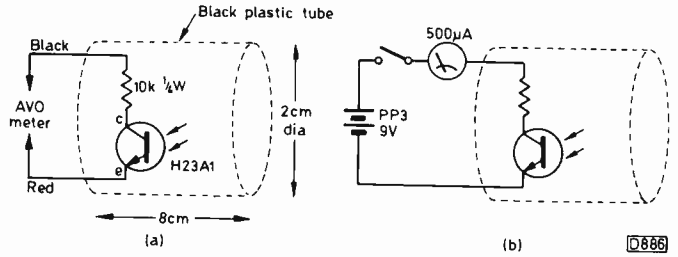


Fig. 1: Jim Littler's infra-red remote control unit tester. (a) For use with an Avo. (b) With own meter and battery.

GRUNDIG VCRs WITH ELECTRONIC LOCKING

With reference to the letter headed "a deterrent to theft" in the February issue I would point out that Grundig VCRs have since 1984 featured a method of electronically locking the recorder to prevent unauthorised use or theft. The system is programmed by the customer who keys in four digits on the keypad, after which the recorder is "locked up" for several years unless it's unlocked by keying in the same four digits. A local Grundig dealer would be happy to give a demonstration. The first VCR to incorporate this feature, Model VS200, was released in June 1984. The latest, Model VS540, was released last December. Other models to date have been the VS310, VS340, VS380 and VS400.

A.M. Kolodynski, Technical Advisor – Video,
Grundig International Ltd.,
Rugby, Warwickshire.

PHILIPS 2023 MODIFICATION

The modification R.W. Silver asks for (Letters, March), to override the three-four minute auto shutdown with the Philips 2023 VCR, is simple. All that's required is a track cut on the power supply board. There are two SG3524 control chips on this board. Pin 10 of IC7052, the one nearest the bottom of the board, must be disconnected. Cut the track near to the device. This will prevent the remote control shutdown working.

B.B. Lock Eng. Tech.,
Verwood, Dorset.

BEST PRICES

As spares stockists/suppliers we feel it necessary to make our position clear to dealers who apparently don't know what is currently available. Two items have been mentioned in your columns recently. Saisho VR1000 idlers have been available under Willow Vale order code 17-411 at £2·90 plus VAT since 1986. The reel motor for Triumph/Amstrad machines has again been available since 1986, under order code 17-412, at our trade price of £11·50 plus VAT. Willow Vale stock in depth, not just the popular items but a fair proportion of the hard to obtain spares – and not at rip-off prices! It may pay Service Managers and buyers to find out who can supply what, then maybe suppliers such as ourselves will be able to look forward to a few pats on the back instead of being knocked in the press.

Bryan Tuckfield, National Sales Manager,
Willow Vale Electronics Ltd., Reading, Berks.

THE LIGHTER SIDE

After all the letters in recent issues about service charges and cowboy operators I'd like to add a touch of humour with the following true story. Someone asked a friend of mine to have a look at an old ITT CVC5, the complaint being that a funny smell came from the back and the picture was breaking up. When he called at the house he

removed the back and noticed the obvious thing on this chassis – the earthing point on the right-hand side of the set was dry and needed resoldering. Commenting that it was "only a dry-joint on the panel – I can fix it in a few minutes and put you a good earth on it", he went out to the van to get his soldering iron. On returning he found that the customer had replaced the back and now said he'd changed his mind and didn't want the set repaired. No money was offered for the call, and my friend left complaining bitterly.

A few days later he was asked to return, the customer promising that this time he would have the set fixed. "I'm not coming out, but if you bring the set in we'll repair it" replied my friend. Some time later the customer arrived with the TV set and his wife. She was holding a large bucket filled with soil. A lead went from this to the back of the set. When he asked what the bucket and wire were for he received the following reply: "Well, I've a friend who can repair anything. You said the set had a bad earth so he suggested I made an earth of my own. The bucket was the only thing we could think of to hold it." God help us! I won't even begin to tell you what my mate said. . .

E. Hunt,
Great Sutton, South Wirral.

TAPE LOOPING PROBLEM

David Hall mentions the problem of tape looping with the Philips VR6462 in the February Letters pages. Philips themselves have referred to this problem in *Service Link*. Their suggestions can be summarised as follows.

If tape looping with Models VR6462/6463/6660/6860 and Pye Models DV464/662 is experienced during forward or reverse search, possibly aggravated by low temperature conditions, first suspect a slipping idler wheel. Clean the motor pulley, idler wheel and reel discs with Freon TMS. If slipping still occurs, change the idler wheel. The wheel is available under part no. 528 70484 as a kit comprising the wheel (item 264), spring (item 266) and two pieces of plastic sleeving. Fit all these items — they are of improved type. The pieces of sleeving fit on the pillars over the ends of the spring to hold it in the correct position.

If tape looping is still a problem the following electrical modification can be carried out. Connect a 27kΩ, ⅛W resistor and BC548 transistor in series across R3111 — the 27kΩ resistor is connected to the collector of the transistor whose emitter is connected to the chassis side of R3111. Connect the transistor's base via a 100kΩ, ⅛W resistor to pin 19 of IC7915.

This may be of help to other readers experiencing this problem.

Steven Belcher,
Wigan, Lancs.

BUSH TV22 – HELP WANTED

I've recently realised an ambition and acquired a Bakelite Bush TV22, circa 1951. The set is in excellent condition and the renovation required appears to be minimal. Unfortunately the PL38 line output valve is missing, as is the valve next to it — I don't know the number (it's a PZ30 — Editor). A vague service note on paper very browned with age informed someone long ago that the set had "low e.h.t., suspect poor PL38". I'd have liked the earlier TV12 with EF50s, but. . .

Can anyone supply the missing valves and a service sheet? And does anyone have an oil-filled magnifying screen to complete the set which has had holes drilled for one? Needless to say any costs would be met along with payment for parts.

I paid (secrets out time) ninety pounds for the set in bits, and the antique dealer wouldn't drop the price.

David C. J. Tilley,
55 Jenner Road, Stoke Newington, London N16 7RB.
Telephone 01-806 0287.

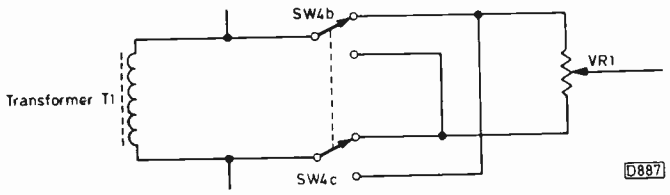


Fig. 2: Use of a three-pole changeover switch to reverse the connections to VR1 in the capacitance bridge.

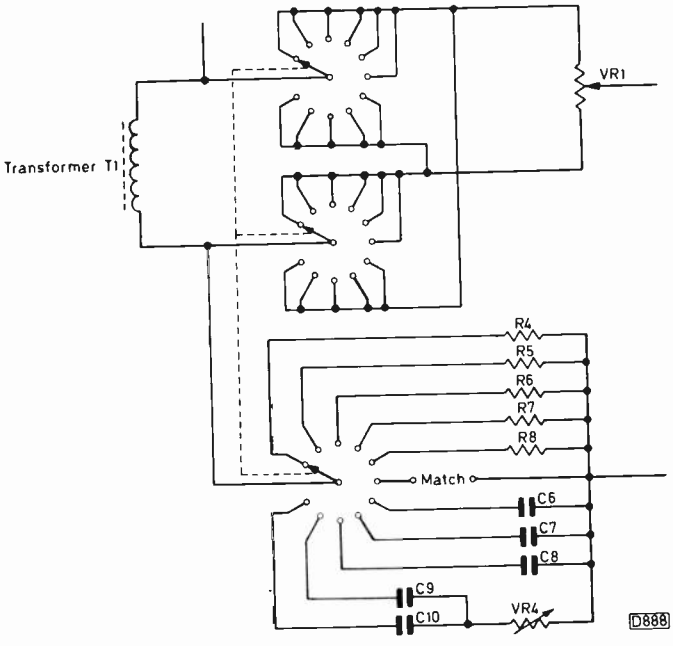


Fig. 3: Use of a three-pole, eleven-way switch for range selection and reversing the connections to VR1.

CAPACITANCE BRIDGE MODIFICATION

I read with interest David Botto's article on building a wide-range capacitance bridge. On the grounds that most of us are more handy with a soldering iron than with a drawing pen, a small design modification, which I have included in my own version, avoids the need to have a separate scale for resistance measurement. This modification reverses the connections to VR1 when it's used for resistance measurement, and can be achieved quite simply by making SW4 a three-pole changeover switch, using two of the poles to reverse the connections as shown in Fig. 2.

A more elegant solution is to use a three-pole, eleven-way switch for range selection and reverse the connections to VR1 automatically as the scales are changed from capacitance to resistance measurement — see Fig. 3.

My own bridge has been in use for around forty years and is as accurate now as the day it was built! It's easy to detect a leaky capacitor because the null/minimum sound position of VR1 will be fuzzy, while with a good capacitor it's quite sharp.

Congratulations to David Botto on updating a very useful piece of test equipment.

R. A. Jackson,
Basildon, Essex.

Servicing Mitsubishi VCRs

Derek Snelling

In this article I'll be covering the HS303/320, the HS304/330, the HS306/307, the HS700 and also mention briefly the more recent HS318/319.

Model HS303

We'll start with the HS303/320. The HS303 is the basic model. Most of the electronics are on the main panel underneath. Access is by removing the top (two screws at the rear) and bottom (six screws). After undoing the three securing screws the panel can be hinged upwards. Take care when working on the machine upside down as the tuning panel on top is not secured and can short out to the metal mounting bracket.

This machine has five motors – capstan, loading, drum and two for the reels. It's on the whole a fairly reliable machine but the picture quality, particularly by current standards, is poor – this is not so noticeable if the machine is used with an old TV set.

Common Faults

Failure of one of the reel motors is common, giving poor or no rewind or intermittent play. The motors are easy to check – when taken out it should be possible to spin them quite freely by hand. Any stiffness means that replacement is required.

Motorboating on sound or failure to record sound usually means that the audio relay K3F0 has dirty contacts. Cleaning may help but replacement is usually best. Failure to record while leaving the previous sound intact is caused by the plugs and sockets in the erase circuit, one on the main board and one on the head itself. Remove the plugs and sockets and solder the wires direct.

Video head wear usually shows up after about three years, giving streaks on the picture highlights. You'll often find that the head has taken on a dull appearance because the chrome has worn off. To change the head drum on this and most Mitsubishi machines you must first remove the motor coils from the top of the assembly (two screws), next remove the ring magnet (three screws) noting which way it goes on, then the drum itself (two screws). Mitsubishi head drums can be a tight fit. Heating with a hairdryer can help but whatever happens don't be tempted to try to lever the drum off with a screwdriver – all you'll succeed in doing is to damage the lower drum assembly.

Another common fault, which you get with all the Mitsubishi VCRs covered in this article, is failure to record and/or playback in colour. The problem is usually intermittent. In nearly all cases it can be cured by using a frequency counter to set up the various 4·43MHz oscillators to within 50Hz of the specified value. Just occasionally one of the crystals may have to be replaced. Before making the adjustments it's a good idea to give the trimmer capacitors a few turns to clear away any flux drawn up into the leaves during manufacture.

A final common fault with the HS303 and also some later models is failure to track prerecorded tapes or even earlier recordings made by the machine. The cause is loose tape guides. You'll find that they can be easily turned by hand. After resetting, tighten the locking screw – this is mounted vertically next to the guide rather than on the shaft as you would expect. When correctly tightened you should be able to turn the guide by hand. Seal the locking screw with paint.

Model HS320

The HS320 was an upmarket machine sold at the same time as the HS303. In many respects however it was very different. As we sold only a few I can't say much about it, but here are a few points to watch out for.

The supply photosensor is mounted on the left side panel. So if you have this board out when working on the machine the tape won't stop at the end. It's essential to refit the board in the correct position to ensure that the sensor lines up with the lamp. A panel lock switch is fitted: if this is "on", operation of most of the front panel is prevented.

Common faults are the guides, oscillator adjustments, reel motors, incorrect speed due to crystal X6A0, and failure to load correctly because the loading switches are incorrectly positioned. These switches are located by the head drum at the end of travel of the loading arms and can be adjusted from above by loosening the mounting screw. The problem can occur with the other models dealt with in this article but seems to be more common with the HS320.

Models HS304 and HS330

The HS303 was replaced by the HS304. The mechanics are similar but the HS304 has a front-loading mechanism. The electronics are on two boards at the right of the machine. The top board, mounted with the components down, contains the signals circuits while the bottom board, mounted with the components up, contains most of the servo and power supply circuits. Access is by removing the top – two screws at either side. All lower board adjustments are along the right-hand edge and are easy to adjust from this side. Access to this board for service is difficult however as most of the solder side is obstructed by plastic reinforcing bars for the chassis. It's usually necessary first to remove the top board then unscrew and lift the lower board as far as the wires permit.

The HS330 is the upmarket version of the HS304 and is very similar. The main difference is the addition of an extra board above the video heads. This board caters for the dual-speed functions.

Common faults on these two machines are as follows: the guides, reel motors, oscillator adjustments and intermittent sound erase. In addition the HS304 can suffer from intermittent playback luminance, record picture, speed variation or record colour. These problems are all caused by dry-joints on IC2A0. Scrape all the varnish from the pins before resoldering. Intermittent sound recording is caused by misalignment of the audio/control head assembly. The HS304 has wired remote control: the socket is mounted on a corner of the tuner preset panel and can break off if the plug is inserted using undue force. The replacement panel is quite cheap however.

Less common faults I've had with the HS304 are: patterning/instability on certain channels due to a faulty tuner; no capstan operation due to IC4A2; failure to switch

off due to R908/910; taking a long time to come out of visual search due to a faulty capstan motor; and intermittent sound due to misalignment of the audio/control head assembly.

Models HS306 and HS307

The HS304 and HS330 were replaced by the HS306 and HS307 respectively. They are completely different from the earlier models – the mechanics were redesigned so that only one motor is used for loading, fast forward, rewind and play (capstan) while the electronics are mounted on one main board with the clock/timer on a smaller board that's permanently fixed to the front of the main board. The two machines are identical apart from the fact that the HS307 has extra components fitted on the main board.

Access is by removing the top – two screws at either side and the front; three clips along the top, one either side and three along the bottom. For access to the head for cleaning, undo the six screws that hold the main board and the four that hold the timer board, then swing the whole assembly into the vertical position after which the head cover can be removed and the heads cleaned.

Common faults on these models are as follows: wired remote control failure (replace the plug and wire); failure of the remote control socket; mains fuse failure (upgrade to 630mA); an intermittently negative picture due to dry-joints in the booster/converter; squeaking due to lack of grease and poor centring of the head drum earthing spring; intermittent sound recording due to poor alignment of the audio/control head assembly; failure of the capstan to go in one direction due to the capstan drive chip which is mounted on the metal strip at the front of the main board; low gain due to a faulty booster/converter; intermittent or no colour due to IC6A0; and failure to front load correctly due to the nylon cassette housing guides jumping out of the grooves. Head wear is also beginning to show on these machines a bit earlier than one might expect.

Models HS318 and HS319

The HS306/307 were replaced by the HS318/319. Again, this involved complete redesign. Access is as awkward as with the previous models. Head cleaning involves unclipping three small subpanels connected to the main board as well as the main board itself. Note that when removing the front there's a screw behind the front flap.

There are not many common faults with these machines, but failure of the front loading or loading switches is one, and this usually results in damage to one or more of the cogs. This can also happen with the HS306, but is less common with this machine. No playback or E-E sound can be due to cracks in the print at the rear left of the main board, while low gain can be caused by the 9V stabiliser that supplies the booster/converter.

Model HS700

Most of the electronics in the portable Model HS700 are on the rear boards, with the mechacon section on the board mounted on the left-hand side. Access is by removing the back (six large and two small screws), the cassette lid (two screws) and the front (up to six small screws and clips plus one screw and the tracking knob behind the front panel). In addition, to clean the head drum properly the control panel and head cover must be removed. Undoing the three screws along the top edge of the rear panels enables them to be hinged down as one board.

The mechanics are very similar to those of the HS303/304. A point here is that the machine is designed to operate in the upright position: when used on its back the cassette housing is not strong enough to eject the tape.

Common faults with this machine are as follows: intermittent colour due to poor oscillator adjustment; poor tracking due to loose guides; reel motor failure; failure of the aerial socket; incorrect positioning of the take-up reel cog – it has a tendency to move up or down the shaft, giving intermittent play or high rewind speed, often resulting in damaged tape; stopping after a few seconds due to a broken still frame adjustment potentiometer (adjustable through the rear cover of the machine); intermittent sound recording and failure to erase the previous sound (see Model HS303). For vertical lines on dark scenes fit a 100μH choke across R6G3 on the chrominance/luminance board. A few tips with this model. Be careful how you refit the shield over the front controls – it can short R858 to deck, causing F902 to fail; remember to refit the counter belt if you have the cassette housing out; if you have to replace the camera socket order one for the HS710 – it's metal and available separately. The fuses are located on a small panel mounted end-on under the control panel.

Slow Rewind

The subject of slow rewind with earlier models – the HS303, HS320 and HS700 – was deal with in some detail in the March 1985 issue (see page 279). The first thing to check is the reel motors. If these are o.k., the values of the resistors in the feedback paths to the reel revolution detector transistor can be increased. With the HS303 and HS700 the resistors are R5K6 and R5K5, with the HS320 they are R5B4 and R5M4. To determine the value, temporarily fit a 10kΩ preset in series with a 1kΩ fixed resistor, then adjust the speed for whatever is best in the particular case.

In General

Finally, a few words in general about these machines. In the case of dirty heads, particularly with the more recent models, it's not unusual to have to clean them two or three times to get the picture back. Some of these machines are now appearing on the secondhand market. Since they were not as widely sold as many other makes they can be bought at very reasonable prices. Provided the heads are good I'd recommend all models except the HS303/320/330 as good buys. Heads can be a problem: as they are not as widely available as other makes they tend to be rather more expensive.

Bn Red or Y Grn. (Mode switch)

Teletopics

SATELLITE TV LATEST

The sixteen-channel, medium-power Astra TV satellite, which is now due to be launched this October, will use two transmission standards, D-MAC and D2-MAC. PAL has been ruled out. The ten English-language channels, which will include Premiere, Sky, MTV, SuperChannel, Screensport, Children's Channel, CNN and Lifestyle, will use D-MAC while channels directed primarily at Continental viewers will use D2-MAC.

The IBA has announced the award of two further contracts for equipment to be installed at its satellite broadcasting up-link station, which will feed signals to the BSB DBS satellite due to be launched late next year. The contract for the high-power up-link transmission equipment had been awarded to Thorn EMI Electronics Ltd. of Wells, Somerset. The equipment will take each of the three modulated D-MAC/Packet channels, upconvert the signals to frequencies at around 17GHz, amplify them to approximately 1·5kW and combine them for feeding to the aerial system. The contract for the latter has been awarded to ERA Technology Ltd. of Leatherhead. The system will consist of a pair of eight metre diameter dish aerials with tracking.

A two-day conference on direct broadcasting by satellite, organised by the Society of Electronic and Radio Technicians (SERT), is to be held at the IBA, Brompton Road, London SW3 1EY on June 5-6th. For further details apply to SERT at 57-61 Newington Causeway, London SE1 6BL (01-403 2351).

Tatung (UK) Ltd. have introduced a satellite TV receiver system called Early Bird. It consists of an easy-to-mount 80cm offset parabolic dish aerial and a state-of-the-art indoor unit which is programmed to receive the sixteen Astra channels and forty future DBS channels. Although no price has been announced the system is aimed at the mass consumer market, via High Street outlets.

Satellite Technology Systems Ltd. (Satellite House, Blackswarth Road, Bristol BS5 8AU) has put into production, aimed primarily at OEM customers, a new high-precision, low-cost dish system which will be available in a range of pastel colours. The initial production capacity is 500,000 units a year. Precision has been achieved through computer profiling, and the tooling has been manufactured under direct computer control in clean-room conditions. The dish is made of aluminium which, unlike plastics, is not affected by extremes of temperature or by ultra-violet light: a chemical finish is applied to give long-term protection against corrosion and enable the dishes to be supplied in a range of pastel colours. Computer-aided design has also been used for the fittings, which enable the dish to be rapidly installed on a wall or chimney using the unique STS fixing kit. Each dish is packaged separately for maximum protection then cased in outers of fifty or a hundred.

INDUSTRIAL SCENE

Matsushita (National Panasonic) is investing £7m in a third South Wales plant, at Baglan Bay. It will be used to produce colour TV sets, VCRs and microwave ovens. Employment is expected to rise to 120 within two years.

J2T, owned by Thomson and JVC, is to cease production of VCRs at the Newhaven plant. Worldwide over capacity is blamed for the move. The local management hopes to buy the plant from J2T and use it for the assembly of PCBs for J2T and other European VCR manufacturers.

The European Commission is to investigate complaints that South Korean manufacturers of small-screen colour TV receivers have been selling them at prices as much as 38 per cent below those charged by Community producers. It's estimated that in 1987 S. Korean manufacturers took about 16 per cent of the European small-screen CTV market.

DIXONS ACQUIRES WIGFALLS

Dixons is to pay around £16m for the Sheffield-based Wigfalls chain of electrical retail outlets. Wigfalls has 106 shops in the north and midlands and has been running at a loss in recent years. Most of the shops will be converted to Dixons or Currys outlets.

VIDEO EQUIPMENT

JVC and Ferguson have both stated that they expect to introduce S-VHS equipment – VCRs and camcorders – in the UK this autumn. Doubtless other firms will be aiming for a launch at much the same time. S-VHS equipment is expected to sell at around 20-30 per cent more than standard VHS equipment while cassettes could be twice as much.

Sony's latest 8mm camcorder, Model CCD-V200, which supersedes the CCD-V100, has a very high specification for its suggested selling price of around £1,800. For a start it has stereo sound pick-up, using PCM digital processing, and a new 440,000 pixel image sensor. The electronic shutter operates at up to 1/4,000th of a second and the variable zoom lens can give up to eight times magnification. The V200 can be used in lighting conditions as low as five lux – half the light produced by a single camera. Features include a character generator, fader and wiper, interval record for animation type videos, and the user can add the time and date over the recorded image. A microphone is provided to add narration and, since the camcorder is for enthusiasts, automatic and preset functions such as infra-red focus, linear auto-white balance and iris control have manual override. Action and character displays can be monitored via the electronic viewfinder and an LC display is used to show the operating mode selected. An external stereo microphone, and stereo headphones for sound review, can be used with the camera.

Cameron Communications Ltd. (Communicate House, 50 Suttons Park Avenue, Reading RG6 1AZ – 0734 664 611) have introduced in the UK the Photophone, a cost-effective means of transmitting video pictures over a single ordinary telephone line. Since the Photophone uses a high-resolution camera, you can take a picture of literally anything. Operation is easy – there's nothing to install and neither a computer language nor software to learn. You just point the camera, focus it and transmit. Fifteen seconds later the same high-quality picture can be available anywhere in the world.

HOW MANY CHANNELS?

The DTI Civil Land Mobile Radio Committee, concerned that frequencies required for the expansion of mobile communications services might be reallocated to TV, has produced a report suggesting that up to twelve national TV channels could be squeezed into the spectrum occupied by the present four. The channels would have a bandwidth of 4MHz and digital techniques would be used to provide

signal interleaving. The technology is said to be five-ten years away. It seems doubtful whether it would be in any way compatible with current standards.

The BBC and the IBA have both stated that they would be prepared to provide the transmission facilities for the proposed fifth UK TV network and any other services that may be given government approval.

CHANGES AT ITT

The Nokia Corporation, having taken over ITT's European consumer electronic goods interests, has changed the name of the UK operation to SL Consumer Electronics (UK). SL will continue to market ITT brand TV and video equipment in the UK. Servicing and the supply of spares has been taken over by Hoopwell Ltd. whose address and telephone number will be found under ITT in the TV/VCR spares guide issued with this month's *Television*.

SONY CTV BOOK

Sony (UK) Ltd. has published a Colour Television Circuit Book, in two volumes, which provides model specifications, circuit diagrams, PCB layouts, exploded views and spare parts information for every Sony colour TV receiver, teletext board and remote control unit from the earliest sets sold in the UK and Ireland up to the present day. Copies of this publication can be obtained through the Sony Spare Parts Department (for address see the TV/VCR Spares Guide), S.E.S. Ltd. or Sony Regional Service Centres by quoting the following part numbers: Volume 1 up to and including 20in. models, part no. S-796-003-10; Volume 2 21in. and over models, teletext boards and remote commanders, part no. S-796-004-10. The price of each volume is £14·95. If both books are ordered together however, quoting part no. S-796-006-10, the total price for the two is £24·95. We will be publishing a short review of this obviously useful work in a future issue.

HEDS DATE CHANGED

The 1988 Home Entertainment Dealer Show at the Birmingham National Exhibition Centre will be held on August 16-18th instead of the May dates previously announced.

TV RECEIVERS

Ferguson has announced that colour TV models fitted with the new Super Planar tube will be released in the Autumn. The new tube is produced by a Thomson subsidiary in Italy, and the sets will incorporate a Thomson-designed chassis. The tube has a flatter screen that offers a wider viewing angle than a standard FS tube – the extra flatness has been made possible by computer optimisation of a special aspherical shape. It has an anti-reflection coating, black matrixing, a specially prepared shadowmask that gives stable colour purity over a wide picture brightness range, and the new DB/XL gun with improved focus performance.

Goodmans have introduced a new monochrome portable, the Quadro 901, with a 5in. tube and m.w./v.h.f. radio. The suggested retail price is £79·90.

Mullard has introduced two new transistors, types BU603 and BU903, for use in CTV and monitor switch-mode power supplies. The BU603 is in a TO220 package and is rated at 5A, 1·35kV. The BU903 is in the slightly larger SOT93 package and is rated at 6A, 1·35kV.

A Guide to Microwave Techniques

Part 1: Waveguide Theory

Andrew J. Heron

The advent of satellite TV has brought the subject of microwave communications to the attention of those concerned with domestic electronics. The purpose of this new series is to provide an insight into basic microwave technology – where precision engineering takes precedence over "state of the art" electronics.

Transmission Lines

At relatively low frequencies signals are conveyed between sections of a system by cables. Open-wire transmission lines are commonly used at up to about 200MHz, but above this frequency the attenuation (power loss) becomes prohibitive. At up to about 10GHz coaxial cables are quite efficient.

Transmission line losses are generally described in terms of power losses – the resistance of the conductors converts the signals to heat (this is also referred to as ohmic losses). Above a few GHz however the following factors become increasingly significant. (1) Radiation loss due to the fact that the conductors radiate a proportion of the signal, i.e. the conductor acts as an aerial. (2) Dielectric loss. Changes in the potential between the two conductors induce surface charges on the dielectric (the insulating material with a coaxial cable, the air between the conductors with an open-wire transmission line). (3) Skin effect: as frequency rises the current density becomes greatest around the outer surface of a conductor. This effect can be minimised at microwave frequencies by coating the outer surface of a conductor with a low-resistance material such as gold.

Until recent times the most effective method of transmission at microwave frequencies – it remains so for high power levels – has been the use of a waveguide, which is basically a hollow tube of rectangular, square or circular cross-section.

Nature of a Radio Wave

Before going into waveguide propagation we must understand exactly what a radio wave is. It's an electromagnetic wave, which means that it consists of an electric (E) field and a magnetic (H) field.

If an electromagnetic wave is radiated from a point source in space, the radiation will be uniform about the source, forming a spherical wavefront – see Fig. 1. If this spherical wavefront is observed at a great distance only a small section of the sphere will be visible. It will appear as a plane transverse wave, i.e. with no E or H field component in the direction of propagation and with the E and H fields at right-angles to each other. Such a wave is usually referred to as a transverse electromagnetic or TEM wave.

Three fundamental conditions must be met for a TEM wave to be propagated along a transmission line. These are commonly referred to as the boundary conditions, as defined by Maxwell's Laws (see Fig. 2). (1) The E field must be at right-angles to any conducting boundary or be zero at the boundary. (2) The H field must be parallel to all conducting boundaries and form closed current loops. (3) Both the E and H fields must be at right angles to each other and normal to the direction of propagation.

When a TEM is travelling along an open-wire transmission line the conditions are as shown in Fig. 3(a). The E and H fields are at right-angles to each other and both are at right-angles to the direction of propagation. The boundary conditions mentioned above are met and the TEM wave will be propagated.

If the two conductors are replaced by two parallel plates as shown in Fig. 3(b) the boundary conditions are again fulfilled and the wave is propagated. These plates represent the side walls of a waveguide. If a pair of plates is added across the top and bottom as shown in Fig. 4 a waveguide of square cross-section is formed.

Waveguide Propagation

The top and bottom plates appear as a short-circuit across the parallel side plates and effectively become part of the conducting boundary. The following conditions are now present. (1) The E field lies parallel to the conducting boundaries. (2) The H field does not form closed current loops. These oppose the previously mentioned boundary conditions. So how can a TEM wave be propagated in a waveguide?

As we've seen a TEM wave will radiate equally in all directions and form a plane wavefront. If a reflecting surface, i.e. a boundary, is placed at some point in the path of the wavefront the latter will be reflected, with phase reversal at the boundary. The angle at which a wave is reflected from such a surface is equal to the angle at which it strikes the surface (see Fig. 5). Thus a TEM wave striking a reflective boundary is similar to a beam of light that strikes a reflective surface. It will follow a fundamental rule of optical physics: that the angle of reflection of a light ray from a reflective surface is equal to the angle of incidence at the surface.

Consider a TEM wave directed towards a perfect reflecting surface or boundary – see Fig. 6. This diagram shows the incident and reflected waves, with their associated E field maxima. At point P the electric field must be zero since phase reversal occurs at the boundary. The incident and reflected components thus cancel each other and the first criterion of the boundary conditions is fulfilled.

Between points Q and Q' the electric field resulting from the combination of the incident and reflected components varies from a maximum in the positive sense to a maximum in the negative sense. The distance between two positive (or negative) maxima must therefore be one wavelength, as indicated by R-R'. Similarly Q-Q' is one half wavelength.

The distance S-S' represents one wavelength of the incident wave and is referred to as the free-space wavelength (λa). The wavelength R-R' is longer and is referred to as the waveguide (or guide) wavelength – we'll return to this later.

In the plane T-T' the resultant electric field is again zero, because the 180° out-of-phase E field components cancel. A second reflective boundary can therefore be placed in this plane and again the first criterion for boundary conditions will be met. The wavefront will then be continually reflected between the two boundaries and will be propagated along the centre of the waveguide.

If the waveguide is completed by the addition of two further boundaries in the plane of the paper the E field will

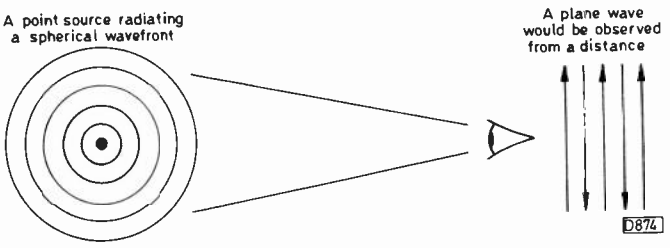


Fig. 1: An electromagnetic wave radiated from a point source in space will appear as a transverse plane wave when seen from a great distance.

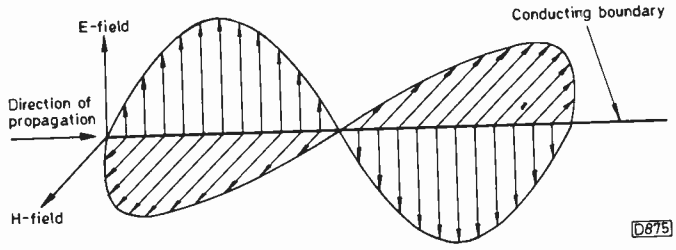


Fig. 2: Propagation of a TEM wave.

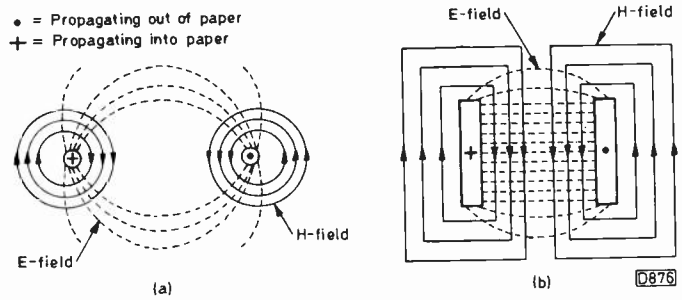


Fig. 3: A TEM wave applied to an open-wire transmission line (a) and two parallel plates (b).

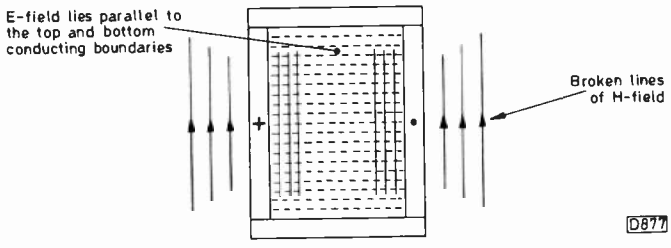


Fig. 4: Forming a waveguide of square cross-section – sorry, but we've not got the proportions quite right . . .

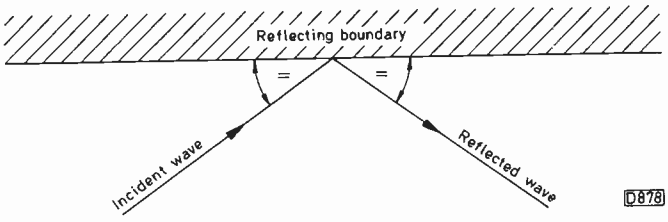


Fig. 5: Incident and reflected waves.

be at right-angles to these boundaries and the boundary conditions will be fully satisfied for the E field.

To meet the boundary conditions for the H (magnetic) field, the latter must lie parallel to or be tangential to all the conducting boundaries and form closed current loops. The H field must also be normal (at right-angles) to the direction of propagation.

Fig. 7(b) represents a section of an incident plane wave travelling in the direction indicated. The wave is polarised with the magnetic component lying in the plane of the paper and the E field at right-angles to the plane of the

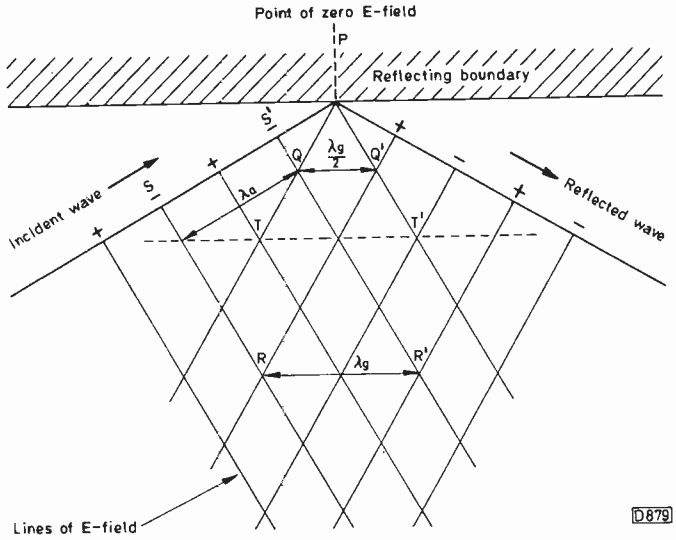


Fig. 6: A TEM wave directed towards a reflective surface.

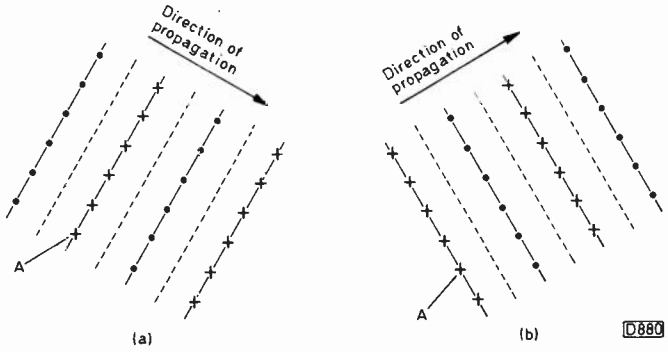


Fig. 7: Sections of incident plane waves travelling in the directions indicated.

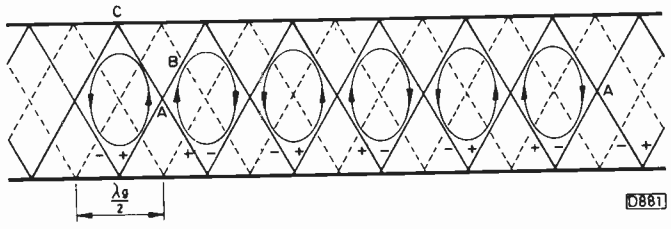


Fig. 8: Incident and reflected waves in a waveguide.

paper, in phase with the H field. Fig. 7(a) is identical to Fig. 7(b) except for the direction of propagation. It represents a reflected wave. In both cases the solid lines indicate H field maxima in alternate directions (positive and negative) while the dotted lines indicate positions midway between the maxima, where the H field is at zero.

Within a waveguide the incident and reflected waves are superimposed, as shown in Fig. 8, where the conditions shown in Fig. 7 have been superimposed with points A coinciding. Because this field is a combination of two magnetic components the magnitude and direction at any point where the lines cross will be determined by the resultant of the two fields. At points such as B one component is zero, so that the resultant field magnitude and direction is represented by the solid line. At points such as A and C the resultant will lie on one or other of the bisectors of the two lines, its magnitude and direction being between the positive direction of the two lines. At points of intersection of two dotted lines the resultant H field will be zero.

It will be apparent from Fig. 8 that the resultant lines of force will form closed current loops and lie parallel (or

tangential) to the conducting boundaries. The boundary conditions for the H field have been met and the wave will be propagated along the centre of the waveguide.

Waveguide Dimensions and Modes

Waveguide dimensions are determined by frequency. Table 1 lists a few standard waveguide sizes and dimensions. The two dimensions are referred to as "a" and "b", "a" being the broad dimension (width) and "b" the narrow dimension (height). This is the generally accepted representation, but in certain instances the "b" dimension may be referred to as the broad one.

The cut-off frequency is defined as the lowest frequency that will propagate along a waveguide of given dimensions. This situation occurs because, as the frequency decreases, the angle at which the wavefront reaches the reflective boundary from its source approaches the vertical, i.e. 90°. At the cut-off frequency a wave is simply reflected between the boundaries, at right-angles to them.

A waveguide's mode of propagation is given by the number of "diamonds" formed between its reflective boundaries by the wave's zig-zag path. If the electric or magnetic fields across each dimension are observed the mode of propagation can be described as follows: (1) transverse electric (TE) field or (2) transverse magnetic (TM) field. In each case the convention is to complete the description by adding two numbers, so that it takes the form TEmn or TMmn, where m is the number of E field (or H field for the TM mode) maxima across the "a" dimension and n is the number of E field (or H field) maxima across the "b" dimension.

Fig. 9 shows a rectangular guide with TE10 mode propagation. It can be seen that there is one E field maximum across the "a" dimension and none across the "b" dimension (the E field is at zero at this boundary). The TE10 mode is referred to as the dominant mode for a rectangular waveguide. It can be considered as the mode that provides the least complex E field pattern.

The TE10 mode produces vertical polarisation – polarisation is defined by the plane of the E field. If the E field shown in Fig. 9 is rotated through 90° the mode becomes TE01 and the polarisation horizontal.

We've already defined the critical (cut-off) frequency. The critical wavelength (λc) is the longest free-space wavelength that will propagate along a given waveguide. For a given waveguide and mode of propagation it can be found using the following formula:

$$\lambda c = 2/\sqrt{[(m/a)^2 + (n/b)^2]}$$

where m and n describe the mode of propagation and "a"

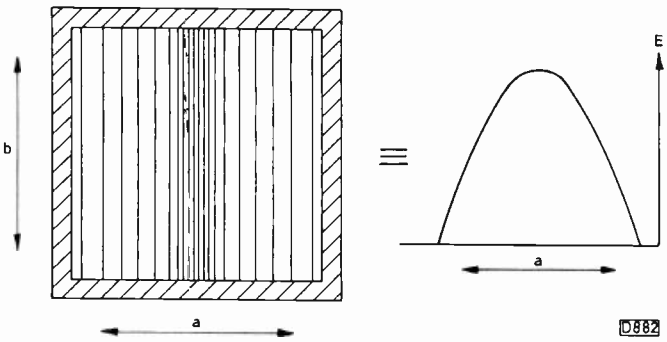


Fig. 9: The TE10 waveguide mode.

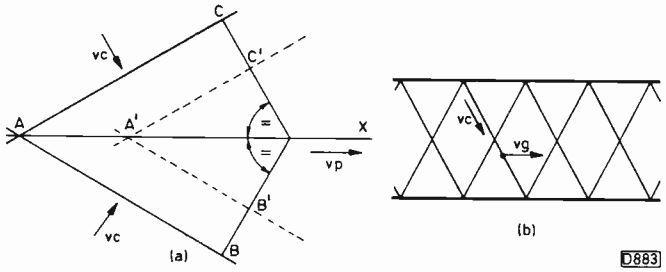


Fig. 10: Illustrating guide wavelength.

and "b" are the broad and narrow dimensions of the waveguide respectively. The critical (or cut-off) frequency Fc is given by Fc = 1/λc.

Since the TE10 mode is the dominant one for rectangular waveguide the "a" and "b" dimensions are selected to support this mode and suppress higher modes (TE20, TE30, etc.).

Fig. 9 showed that the "a" dimension contains half a free-space wavelength of E field. So for the TE mode λa < λc, λc = 2a and λa < 2a.

For the TE20 mode λc = a. To suppress the TE20 mode the following conditions must exist: λa > a and λa < 2a. This ensures that the E field is not zero at either boundary. The boundary conditions are thus violated and the wave will not propagate.

The "b" dimension is not critical in allowing propagation but determines the waveguide's power handling capacity. It should be such that the waveguide has sufficient power handling capacity but not be too large (compared with the "a" dimension) as the TE01 mode could then be propagated.

Guide Wavelength

We've already seen that at a given frequency the wavelength when transmitted in waveguide is greater than the free-space wavelength λa – it's referred to as the guide

Table 1: Details of standard waveguides

Waveguide type	*Internal dimensions (in.)*		*Frequency range for dominant mode (GHz)*	*Breakdown power level (mW)*
	a	*b*		
WG6	6·5	3·25	1·12-1·7	40·2-58
WG8	4·3	2·15	1·7-2·6	17·5-25·2
WG10	2·84	1·34	2·6-3·95	7·3-10·4
WG12	1·872	0·872	3·95-5·85	3·2-4·5
WG14	1·372	0·622	5·85-8·2	1·9-2·5
WG16	0·9	0·4	8·2-12·4	0·73-1·1
WG18	0·622	0·311	12·4-18	0·44-0·6
WG20	0·42	0·17	18-26·5	0·16-0·24
WG22	0·28	0·14	26·5-40	0·095-0·145

wavelength (λg). When a TEM wave is transmitted along a waveguide the wavelength is increased but the frequency remains constant, where wavelength is given by λa = vc/f (f is the frequency and vc the velocity of light – 3×10^8 m/sec).

To illustrate this relationship, Fig. 10(a) shows two wavefronts in a waveguide, one reflected from the top boundary and the other from the bottom. The two wavefronts have been reflected and are travelling in the directions shown, at the velocity of light, such that B and C are moving towards X. Thus the two wavefronts travel forwards parallel to themselves, intersection A moving to A'. You'll see that A-A' is greater than B-B' (or C-C').

The motion of the two wavefronts causes a resultant velocity in the direction vp. This velocity is greater than that of either of the components (AB and AC) that produced it, since the time taken for A to move to A' is equal to the time taken for B to move to B'. This suggests that the velocity in the direction of vp is greater than the velocity of light, but the laws of relativity state that any form of energy cannot be propagated at a velocity greater than that of light. The answer to this conundrum is that the waves are actually travelling along zig-zag paths at velocity vc, since they are reflected between two boundaries. Thus in a given period the waves have travelled a greater distance in their zig-zag motion than the resultant along the axis of the waveguide. The velocity in the direction vp is therefore less than the velocity of light.

The advance in the direction vp is the transfer of energy in the waveguide, as shown in Fig. 10(b). This is referred to as the group velocity vg, and is defined as follows:

$$vg = vc \times (\lambda a/\lambda g).$$

Given this relationship, and by applying basic trigonometry to Fig. 6, an expression relating the free space, guide and critical wavelengths can be derived. This is as follows:

$$1/\lambda g^2 = (1/\lambda a^2) - (1/\lambda c^2)$$

where λa is the free-space wavelength, λc is the critical wavelength and λg is the guide wavelength.

Coming Next Month

In Part 2 next month we'll deal with various waveguide components.

The Room at the Back

J. LeJeune

The weather was in a capricious mood. One warm and sunny day would be followed by another of thick fog or drenching drizzle. High winds would rattle many a rooftop aerial then die away to give a cold, clear day. Shirtsleeve order at lunchtime could be followed by double anoraks and moon boots a half past five.

Sid stood in the middle of the workshop and surveyed the area with displeasure. Gareth's bench resembled a Silicon Valley explosion. Integrated circuits in various attitudes of death lay around a disembowelled micro-computer. This Grapefruit Turbo-Q machine was always wrecking large quantities of i.c.s. The power unit was to blame. Andy had been wrestling with a 3V23 that needed new cassette loading rollers. He'd dropped his watchmaker's screwdriver into it with the power switched on. Something had gone pop and restoring normal service was becoming the saga of the week. Sid's own bench was occupied for once. A brand new G8 stood upon it awaiting his pleasure. He'd get to it later. How the G8 came to be brand new was a sad tale of stock-room organisation. The incident had reflected badly on the shop manager's competence – he'd since left to join the Civil Service.

A Newsound portable cassette recorder came in from the shop. Cynthia handed it to Sid, adding that "the lady says there isn't much wrong with it and she'll call back for it later, after lunch."

"Another fine mess you've got me into" grumbled Sid as he prised the bottom off the machine and peered at the belts. "She didn't get this rubbish here, I hope."

"Said she'd bought it in Petticoat Lane on a day trip to London" said Cynthia.

The belt had gone slack. Sid wondered where in the world he could get one by lunchtime. He dug into his selection, but it was no good. Then he remembered. He went into the outhouse kitchen and put on the kettle.

The Topcut van lurched back into the rear yard, with Andy and Gareth. Sid was on the phone as they came in. The rattling kettle and steam in the outhouse indicated that a brew was on the way, so Gareth threw some teabags into the pot and poured in the boiling water. A nice hot brew was what was wanted on a day like this. But Andy's first sip produced a grimace. "Ugh, it tastes of rubber. What have you done to it?"

Sid chortled as he put the phone down. "Take a look inside the kettle and you'll see the reason why!"

Gareth disappeared and returned with the belt from the Newsound.

"You've been boiling belts again" declared Andy.

Sid explained the problem, and they all agreed that it was the only thing to do. The kettle would taste of rubber for a few days, but making the tea stronger would deal with that. They'd have to tell Mrs. Know-all that it was a temporary repair, and perhaps not charge her too much. She'd either be grateful for their honesty and return to Topcut's to buy a new machine when the belt gave out again, as it was bound to do soon, or she'd take the wretched thing elsewhere.

Andy and Gareth had been out to deal with a teletext problem. It turned out to be signal trouble and had been tricky. The problem had arisen after the erection of a crane at a nearby construction site. Even after very careful alignment of the aerial, crane movement badly upset the teletext. A very disgruntled businessman on enforced rest with a bad heart was well on the way to his next attack when Andy and Gareth had arrived. Diplomacy had placated him, two freezing hours on the roof had virtually eliminated the problem, and the crane driver had agreed to leave his tower crane in a certain position when it was not in use at night. "Servicing isn't all soldering irons and spanners" Andy had told Gareth as they drove back to the store. "It's handling people as well."

"And getting pneumonia on someone's roof" added Gareth.

The afternoon brought more enlightenment in the form of a compact disc player. It was a "no fault found" item that had bounced.

"Still won't skip forwards or backwards" complained the owner, "I tried my disc in it only an hour ago."

"Odd" muttered Andy to Sid, "it worked fine on our YEDS-1 disc yesterday."

Sid told the caller he'd send his best engineer to the house to take another look, and shortly afterwards despatched Andy with the YEDS-1 disc.

Gareth was inside a stereo teletext receiver and looked set for the afternoon, so Sid settled down to a Ferguson 22G3. The customer had complained of no operation and a chattering noise from inside the set. He plugged in and switched on. The customer was right. "These blasted relays" he commented, and soon had the contacts shorted across. He switched the set on again. There was a squealing noise from within, but no life other than that.

Andy returned with a broad smile on his face.

"Well" asked Sid, "what was it?"

"Nothing wrong with anything" replied Andy, "YEDS-1 plays perfectly, with all functions normal. She's only got one disc, 'The Phantom of the Opera' selection, and you can't skip tracks on it. It's only got track 1 – that's the whole of the disc!"

"Come and sort out this 22G3" snorted Sid, "I've got some paperwork to do."

The TX100 was still emitting a squeal and little else from its power supply. Andy remembered that Grundigs did similar things and began to look round with the Avo. The h.t. rail was short-circuit, or rather the line output transistor was. With a new transistor fitted the set worked normally and Andy removed Sid's modification to the relay, which didn't chatter now that the h.t. line was o.k. He switched the set off and turned to look at the G8. The picture was fluttering madly. "What's up with this museum piece then?" Andy called out to Sid.

"That's no more a museum piece than I am" retorted Sid, "it's straight out of stock."

Norman appeared at the door. "New thyristor wanted there" he commented. "Stock fault: bung in a new BT106."

Andy looked as though he'd recalled some half-forgotten truths and walked over to the components drawers.

"Do we have any left?" asked Norman.

"We're getting low – there are only thirty left" grinned Andy.

Norman crossed to the 22G3 and, pressing in the power switch, said "must catch the hourly news". The set spluttered and the relay resumed its clattering. He disconnected the remote standby connector plug 18 and the clattering stopped. "An h.t. short" he mused, probably the line output transistor. It had gone again. This time a new silicone thermopad and spring clip were fitted with the replacement BU508A. "Best to change the pad and clip, just as we do with mica washers" he commented.

Gareth came over to look on. He was about to try the receiver again when Norman stopped him.

"We've got to change C75 in the line generator circuit from 1μF to 22μF first" he said, "it's often the cause of line output transistor failure".

With the small electrolytic replaced and PL18 reconnected the TX100 sprang to life.

Silence fell briefly on the workshop. Then Ralph Topcut strode through the door. He called to Sid who went out with him. Ten minutes later he returned, his face ashen and his normally assured manner badly dented.

"What's up?" asked Norman.

"Microwave ovens, that's what's up" replied Sid. "The DA boys won't do them without training and more pay, so we've got them."

"Anyone feel like retiring?" asked Gareth.

"Me for a start" replied Sid.

Teletext Decoder Output Circuits

Peter Marlow, B.Sc., C.Eng.

Following the low-cost teletext decoder project which appeared in the December 1986 and January 1987 issues I received a number of requests for alternative output circuits. The main requests were for output stages to drive an RGB monitor with TTL inputs, and for an output stage that provided a composite 1V peak-peak PAL colour signal at 75Ω for distribution purposes. Figs. 1 and 2 show circuits that fulfil these requirements.

In neither case is the layout critical, though the input leads should be kept as short as possible. Both circuits can of course be used in other situations. The RGB output circuit can be driven directly from TTL logic – in this case the base bias resistors R1-3 should be omitted.

Components for the low-cost teletext decoder project – programmed 8748 microcontroller chips, TEA2000 PAL encoder chips, DL270 delay lines etc. – are still available from VIP Ltd., Charlton House, 32 Charlton Lane, Cheltenham, Gloucestershire GL53 9DX.

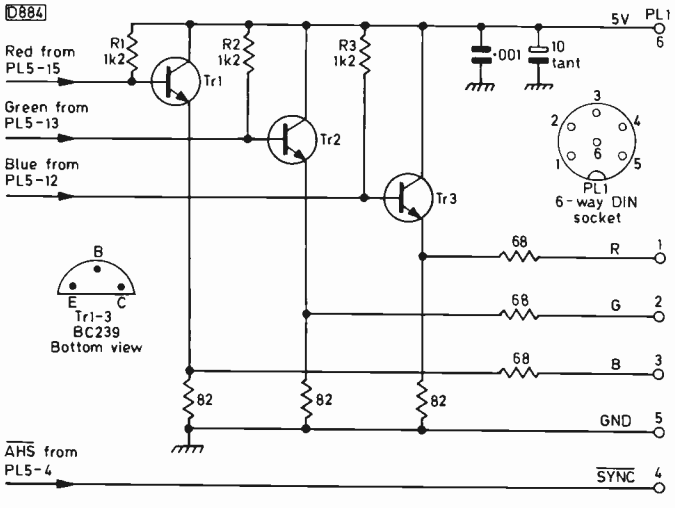


Fig. 1: Teletext RGB drive circuit.

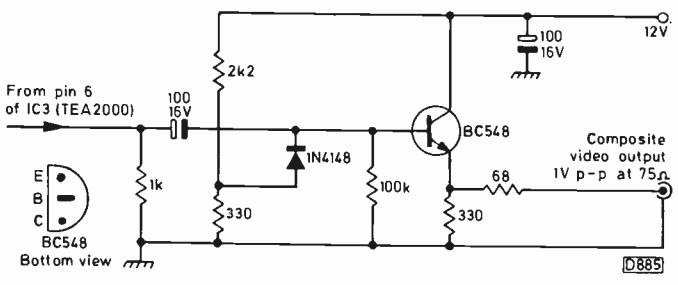


Fig. 2: Teletext composite video output circuit. Note that R16, R17, C19 and MOD1 in the original circuit can be left in place.

Servicing Notes on the Mitsubishi HS303

John Coombes

Our experiences with this machine have been as follows.

Noise bars with vertical jumping or rolling: Check the f.m. envelope. If misshapen, the guide rollers are probably out of adjustment. As a check they can be moved by hand to restore the waveform. To set the guide rollers correctly, loosen the set screw then adjust with an Allen key for best waveform.

Unstable picture with poor sound: The guide rollers could be responsible (see above) but we have had the trouble due to a sticking back-tension lever. You may have to remove the whole deck, dismantle the back-tension lever, clean, grease the shaft very lightly and reassemble. Make sure the lever is of correct shape.

Picture breaking up at top: Check the back tension which should be 30g-cm. Excessive tension can ruin the video heads.

Poor rewind: Check the supply and take-up motors by replacement.

No rewind or reverse fast search: Could be due to a defective supply reel motor, which can be intermittently faulty. The usual cause however is the tape start sensor phototransistor Q578 (PN202S-R) – check by substitution.

Tape looping with no cue or review, poor rewind or possibly a noise bar on the screen: All these symptoms can be caused by a faulty reel motor. Check by substitution.

Plays for a short time then cuts out: Check the take-up reel motor by replacement. Make sure that the take-up pinion is set on the shaft correctly.

Tape breaks on rewind, noisy on play and reverse or forward search: Check whether the pinion on the take-up motor shaft has slid down or broken in two. It's best to order the part for Model HS330 as this is a complete pinion with grub screw to ensure tight fitting on the shaft, not just a tight plastic fit. The tape breaks on rewind because a loose pinion prevents the auto-slow circuit operating.

Tape catching on eject: Check that the loading motor is operating correctly. If the motor is in order check the brake pads on the right- and left-hand reels – adjust and set the take-up and supply brakes. Ensure that the contact surfaces are clean.

No loading: If loading fails to occur when the play button is pressed check the loading motor or, if there's slipping, check the loading belt by replacement.

No sound or intermittent sound, record picture all right: If the original sound track is still present after making a recording, remove the plugs and sockets connecting the erase head to the main board and wire direct.

Hum on sound. The hum may be intermittent or may become a howl. The usual cause is high-resistance contacts on the audio head switching relay K3F0. A replacement relay is best.

Distorted or low-volume recorded sound: If prerecorded tapes are all right, check the audio/control head assembly by replacement. If the distortion occurs a few seconds after the tape starts, check the 4066B analogue switch chip IC3F1 by replacement.

Sound wow: If this is more noticeable with recorded music, usually at the beginning of an E240 tape, check the pinch roller bearing. If this is the cause of the trouble replace the pinch roller. Make sure that the capstan shaft is clean. It's possible that the capstan motor is faulty – check by replacement.

Wow and flutter with noise bands on the screen: If cleaning the pinch roller and capstan shaft fails to cure, check the capstan motor by replacement.

Slow forward and rewind speed: An E180 tape should rewind in four minutes ten seconds. If not, check whether R5K7 (3·3kΩ) has a 6·8kΩ resistor in parallel. Remove the parallel resistor – on board MC.

Capstan speed too fast, no switch off: If there's no waveform at pin 7 of IC4A1 (AN6341N), check this chip by replacement. If the waveform is present and correct check the 2SC2603 capstan drive transistor Q4A3 by replacement.

Drum speed incorrect or capstan speed varies: The symptoms are loss of line lock or sound variation respectively. Check IC4A0 (AN6350) by replacement.

Playback picture has displaced colour, cogging, intermittently snowy: Check for a squarewave signal at pin 25 of IC4A0 (AN6350). If missing, check back to pins 9 and 10 of IC4A6 (TC4066BP), then back to pin 7 of plug/socket VH and if necessary back to the junction of diodes D601/2 on the Y/C board.

Use a frequency counter to check that the 4·433MHz signal is present at pin 3 of IC603 (AN6342N). If crystal X601 is all right suspect trimmer VC601 (45pF). Rotate the trimmer to clean the plates (note position first). If this doesn't do the trick replace the trimmer.

Intermittent loss of playback colour: Check for line sync pulses at test point TP6S. If these are present check at pin 6 of IC6A0 (HA11741). Loss of line pulses here can be caused by C6E3 (150pF) going open-circuit intermittently. Check by substitution.

No recording, playback all right: Check the f.m. modulator circuitry or IC2B0 (AN6310) by replacement. If necessary check the carrier set trimmer VC2B0 (50pF) which can go high-impedance. Note its setting and rotate to clean the plates. Replacement of IC2B0 can involve the need to carry out carrier deviation adjustments.

Intermittent clock operation: C8F2 (0·47μF) connected to pin 9 of IC8F0 can develop a variable leak.

No machine functions, clock all right, all front panel LEDs alight: Check IC500 (MC14174BCP) by replacement.

Tuning drift: Drift with loss of the record control pulses can be caused by misoperation of the a.f.t. circuit. Check the a.f.t. defeat transistor Q102 (2SA1115E/F). If drift is affected by picture content add a shorting link across L109 and remove C132 from the circuit.

405-MAC: A New Approach to Compatible HD-TV

Jeffrey D. Borin, B.Sc. (Eng.), ACGI, AMIEE

Exciting new developments in a leading British TV laboratory can for the first time be revealed to readers of *Television*. Although only limited details have been released to date, the implications could be very interesting. For reasons of commercial security the company concerned does not wish to be named in this article.

There are two main protagonists in the HD-TV field. The Japanese have a 1,125-line, 60Hz system. This basic specification would call for a huge bandwidth, so a system called MUSE (multiple subnyquist sample encoding) is used to shoehorn the signal into a satellite TV channel. As a result, the picture quality suffers. In addition, this approach is completely non-compatible with any existing TV system.

The "50Hz countries", including all of Europe, are naturally not happy with this. 60Hz working would be difficult due to flicker caused by 50Hz lighting, while conversion to existing standards would be difficult. With memories of the 405-625 change still fresh, a number of European countries have got together to develop a *compatible* system. Euromoney has gone into the Eureka consortium, which aims to have a 625-line, 50Hz system ready for 1990 when the CCIR has to make the final decisions.

The joker in the pack is 405-MAC. Based on sound historical principles, the aim is to transmit a very high quality picture in a relatively narrow channel. It's well known that if you transmit fewer lines you need less bandwidth for the same horizontal resolution. The old 405-line system with its 3MHz bandwidth is as good on horizontal resolution as 625 lines with a bandwidth of 5MHz.

The sceptics will say "but it's only 405, with all the lines showing and a horrible loud whistle". Things have changed a bit since the original 405-line system was invented however. To understand why 405-MAC works you need to look at the Eureka 625 proposals.

First, colour. For DBS use all major European broadcasters intend to use one or other of the MAC (multiplexed analogue components) variants. The MAC system, developed by IBA engineers, has been described before in *Television*, so I'll give only a very brief account of what's involved. Each line of luminance is compressed in time to about two-thirds of its original length and occupies the last 40μsec of the transmitted line. The two colour-difference signals are compressed by a ratio of about 3:1 and are transmitted during the initial part of the line – on alternate lines. This completely avoids cross-colour effects (the lurid patterning that occurs with stripped jackets etc.) since the luminance and colour signal components are never mixed.

The really important point however is that we no longer need to use the same line standard in the camera, for transmission and display. Even now we can improve existing PAL pictures by digitally converting to 1,250 lines for the display. At the same time we can remove the interlacing. This gives a very peaceful picture, free of 25Hz flicker effects. The use of large-scale integrated circuits makes this economic in a TV receiver.

These ideas, along with many other detail improvements, are leading the Eureka team to a *compatible family* of high-quality systems based on 625-MAC. A typical arrangement might start with a programme originated in 1,250-line format, then processed to squeeze it into a 625-line channel and finally converted back to 1,250 lines at the receiver. The result is designed to be fitted into a standard satellite TV channel but not existing terrestrial channels.

The 405-line system was invented by EMI in the early 1930s. The crude cameras and receivers of the period meant that its full quality couldn't at the time be exploited, but brilliant members of the team that developed the system, like Alan Blumlein, were thinking of ways of making the system better. Spot wobble could be used to conceal the line structure – just after the war synchronous spot wobble held out the promise of 819-line quality via 405-line channels. It was hoped that this would justify the British decision to stay with 405 lines while the rest of Europe (except France) was proposing to adopt 625 lines. France, being French and thus different, chose 819 lines and created the world's first really high-definition system.

The UK stayed with 405 lines and the rest is history. Or is it? The 405-line service closed over two years ago but is not forgotten. Apart from a band of vintage TV enthusiasts, one leading British laboratory retained an interest in it. After all, if EMI had the ideas over forty years ago why have they now largely been forgotten? How many times have you congratulated yourself on developing some new circuit only to hear someone say "but Blumlein invented that in 1932!".

The 405-line NTSC experiments in the 1950s never really came to anything. But the new idea is to take MAC and other modern trickery and apply it to 405 lines. Brilliant! If you do the tedious sums you discover that a 405-MAC picture fits into an ordinary 8MHz terrestrial TV channel. It has better horizontal resolution than current 625-line systems because this comes more easily with fewer lines. To make the lines disappear we use large-scale chips to double the line count to 810 (suspiciously close to the French 819) or even triple it to 1,215 for a really super display. Even basic 405 lines don't look bad on a good set with accurate interlacing. Bad interlacing used to plague older sets and that gave 405-lines a bad name. Raising the line number also conveniently avoids the line whistle. The RSPCA can worry about all this annoying the dogs. With these improvements we can produce a good picture even on the large, flat screens of the future.

This may sound like a confidence trick. You can't get 1,215 lines worth of picture from 405 lines. Strictly speaking that's correct. But it ignores the very bad value for money we get from our lines these days. The Kell factor, named after Ray Kell, a leading American researcher of the 1930s, is about 0·6 for the present system. This means that our 625 lines give us only 400 lines of real resolution. We can improve the Kell factor at the receiver by deinterlacing the picture and increasing the number of lines. But the big improvements are at the studio end.

Imagine an 810-line (or even 1,215-line) camera without interlacing. This has a really good Kell factor. All recording and processing are done at 810 or 1,215 lines to preserve quality. One day when wider channels may become available we may be able to transmit this full signal. For

now we have to convert it down to fit a 405-line channel – a little quality is lost, especially with moving objects. The down-converter is at the transmitter and can thus be quite complex and expensive so that a good job is done. It also produces a DATV (digitally assisted TV) signal. This latter contribution was invented by BBC engineers, and is transmitted during spare parts of the TV waveform. The DATV signal tells the receiver how to convert the signal back to 810 lines in the best possible way. The receiver is told which bits of the picture are moving, and in what direction. This allows fairly simple circuits at the receiver to perform a really first class conversion from 405 to 810 lines.

It's not quite as good as 810 lines all the way from the studio to the domestic TV receiver, but demonstrations I've seen show that very little is lost.

The big question has to be answered by the CCIR in 1990. Will 405-MAC make it as the system of the future? Despite its obvious advantages, its chances are not good. Not many 405-line sets remain to take advantage of the compatibility. Powerful political and economic interests are backing the two main HD-TV contenders. It will probably end up as another great British invention consigned to the scrapheap. If we'd stuck to 405 lines, the French to 819, and we'd persuaded the rest of Europe to accept our lead, perhaps the UK would have been left with more than just a pale shadow of its TV industry.

Practical Computer Programming

Part 4

Mike Phelan

Last month we discussed various computer languages and the features, such as control structures, they have in common. We'll now look at their suitability for the various tasks likely to be required by readers of *Television*.

In a small business a computer will probably be used for more than one purpose. These jobs are termed applications. Most of them fall into the categories of data base, word processing or spreadsheets.

Data Base Applications

A data base application can be thought of as a job that does the same as keeping a card index manually. The subject has been covered in some depth by Chas E. Miller in recent issues. Briefly, a data base is a two-dimensional file, with "records" as one dimension, corresponding with the cards, and "fields" in the other, corresponding with the lines on the cards. For example, you could have a data base of customers' names and addresses: each record would be a customer while the fields would be their names and addresses. A third dimension could be added by having several data bases linked in some way. We will elaborate on this in a future article, as it comes into the realms of system design.

The obvious choice for a data base management system is one of the dBase series from Ashton-Tate – we are up to dBase III plus at the moment, and dBase IV is rumoured. These packages are rather expensive and will only run on a machine with 128K or so of RAM and an operating system such as CP/M or MS/PC-DOS. There's nothing to stop anyone from using a general purpose computer language to write a data base program – Basic, C and Pascal are all suitable. There are several budget-priced packages on the market for the smaller business however.

Word Processing

It's hardly worth writing your own software for word processing – there are many excellent packages on the market. WordStar by MicroPro is virtually the industry standard, and there are things like Tasword in the lower-price range. The latter is an excellent product. Most word processors have add-ons such as spelling checkers and mailmerge facilities.

Mailmerge works as follows. You set up a file of names, addresses and any other data that's different for each letter. It's then necessary to type the letter in only once, with some sort of instructions to the program on where the variables should be printed – these vary with different word processors. When the program is run the variables are inserted in each letter, the letters being printed out until the supply of data is exhausted.

Spelling checkers vary in their degree of sophistication but most allow the user to add words to the dictionary or to use different dictionaries. When the program encounters a word that's not in the dictionary the user can do various things, typically ignore the fact, correct the word as suggested, add it to the dictionary, correct globally, show multiple suggestions, etc.

Spreadsheets

Spreadsheets are probably not used as much as the other types of software. They are primarily used for financial jobs such as producing budgets and accounts, and consist of an on-screen matrix of "cells" into which can be entered numbers, letters or formulae, which can be quite complex. The whole thing can recalculate after any value is changed, so that you can do things like seeing what would happen to your profits if you charged ten per cent more on all VCR service calls requiring collection, to give a simple example.

The same factors apply to spreadsheets as to word processors. It's hardly worthwhile writing your own unless you really want to. Packages come in a wide range of prices, with products like Lotus 123 at the top end. Even more expensive are financial modelling packages that enable you to write an application which can be used by anyone. They are like a spreadsheet backed by a powerful high-level programming language, and can move data between files, consolidate it, etc. For a medium-sized business one of the best of these is MasterModeller, which is produced in this country by Planning Sciences Ltd.

If these are all way beyond your needs you can fairly easily write a simple spreadsheet in Basic, using its array handling facilities. C would be even better and faster, but a basic compiler is a worthwhile investment if much programming in Basic is undertaken.

Esoteric Languages

More esoteric languages such as Forth are for the enthusiast and, as such, worth learning. Forth is compact and fast. It relies on a "dictionary" of commands which execute machine code routines. New works are defined in terms of existing ones, as we've mentioned before.

Next month we'll talk about planning a typical data base application and how to approach the problem of system design in a typical case.

A Low-cost TVRO Installation

Part 2

Roger Bunney

Last month we described an inexpensive method of providing a 90cm patio mounted dish system with azimuth adjustment. I'd intended to continue this month with a description of the arrangement devised to provide hand-operated elevation adjustment – using a handle! Unfortunately the handle suppliers took their time in coming up with one, so this aspect of the installation will have to wait until next month. Meanwhile a simple way of improving weak signal reception has been adopted.

IF Bandpass Characteristics

The receiver selected for the installation is one of the cheapest and most basic. It thus has the minimum number of controls, incorporating only the essential features. Fortunately access to the i.f. strip is readily achieved via a convenient i.f. break-out loop at the rear of the receiver – a feature that's common to the majority of imported satellite TV receivers. The 70MHz i.f. in/out F-type sockets are intended for use with a descrambler, but provide a handy point for inserting a bandpass filter to reduce the original very wide bandpass characteristic of the i.f. strip.

The receiver's non-adjustable i.f. bandwidth, of the order of 36MHz, is intended for full transponder operation. As experienced DX-TVers will know however trading bandwidth against the noise present with a weak signal pays dividends. We can in this way obtain improved visual clarity with reduced noise (sparklies).

Some transponder downlinks, in particular those used for TV link operations, EBU news links, etc., use only a half transponder bandwidth. If such a signal is received with a full i.f. bandpass characteristic the level of noise will be very high.

The best way of improving reception under such conditions is to incorporate a means of switching between the receiver's basic wide i.f. bandwidth and a narrow bandwidth of say 16-18MHz. This will still leave a wideband demodulator sitting at the end of the i.f. strip, but nevertheless a relatively simple switched filter will enable us to achieve a considerable enhancement of picture quality and resolution.

John Standen of North East Satellite Systems kindly sent me a photocopy of a circuit that originally appeared some years ago in the Tay Howard *Howard Terminal Manual*. The circuit later appeared in Steve Birkill's *STTI's International Satellite Television Reception Guidebook*. It's a basic but effective series of tuned circuits comprising both bandpass and band-stop filters. Figs. 1 and 2 show the circuit and a simple means of switching the circuit in or out of operation, the latter via a simple bypass. The component values have been revised to suit v.h.f. coils available in the UK.

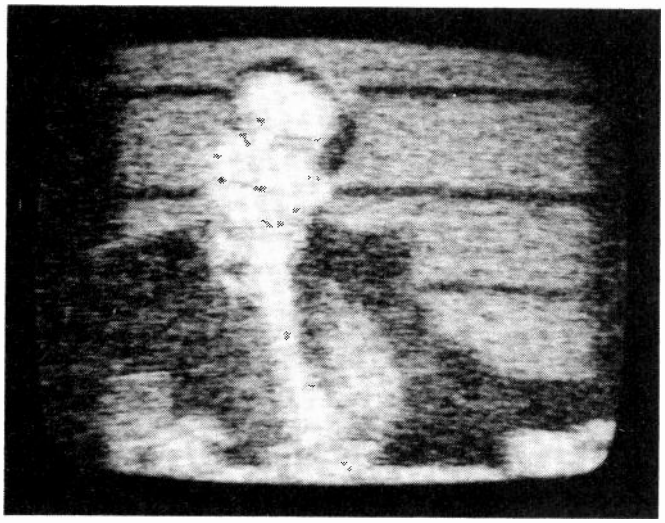
Construction

Construction is simple. For ease of connection I decided to etch a crude PCB, soldering the coils, standing on their own leadout wires, directly to the copper areas on the laminate. All the components can be obtained by mail order from Maplin. Similar Toko coils are available from Cirkit. If ordering from Cirkit, note that these coils are ferrite, not aluminium, cored.

Table 1 suggests frequencies to which to tune each coil. These differ slightly from the original design recommendations since I decided to tune the notch frequencies 2·5MHz closer to the 70MHz bandwidth centre frequency. This was found to work well, giving a useful improvement with current downlinks with no loss of audio.

Alignment and Setting up

I don't have any advanced alignment equipment – a wobbulator or anything like that. Alignment was carried out using an ancient Advance Components Ltd. valved signal generator and a TES field strength meter that covers Band I through to above Band II. The procedure was simply to inject the suggested frequencies and tune for maximum (pass) or minimum (notch) as indicated by the meter. Perhaps not the correct City and Guilds way, but it worked satisfactorily.



TVE-1 received from the ECS-4 satellite at 10°E, with incorrect polarisation to give the effect of a very weak signal. Full i.f. bandwidth used.

The same signal, again received with incorrect feedhorn polarisation, but this time with the narrow bandwidth i.f. filter in circuit. Note greatly improved resolution.

Table 1: Alignment frequencies

Bandpass coils		*Notch coils*	
L1	76MHz	L3	85·5MHz
L2	70MHz	L5	54·5MHz
L4	64MHz		

Note: L3 can be tuned down to 82MHz, L5 up to 58MHz.

I intend to devise a filter system giving selection of two reduced bandwidths. Details will be given in a later issue.

The filter is fitted across the 70MHz i.f. in/out access sockets. The use of US domestic F-type plugs is unfortunate: other than a BNC-to-F plug adaptor, F-type accessories seem to be available only from satellite dealers who charge rather high prices. I've opted to use the BNC-to-F adaptor with BNC connectors. If you've friends in the USA you could ask them to obtain F plugs from the Radio Shack group – F plugs are standard in the USA. The back-to-back male F adaptor costs anything up to £5·95 in the UK but the US Radio Shack retail price is $1·39!

After fitting the filter across the F access points at the rear of the receiver, switch to the bypass position and tune in a weak signal. Switching the filter in should then result in a dramatic improvement. If it doesn't, there's a fault! The accompanying photographs show the results obtained with a TVE (Spain) signal via the ECS satellite at 10°E with the feedhorn assembly horizontal (the TVE signal is vertically polarised). The weak signal obtained with incorrect polarisation lifts out of the noise well – it's not unlike using a larger dish.

If you tune off signal to noise you'll find that there's a decrease in the noise when the filter is in circuit compared to the bypass position. The filter introduces a 3dB insertion loss and, with the bandpass limitation, so the noise decreases. With a stronger signal such as CNN etc. you'll find that when the sparklies come up on a wet day switching the filter in will clean up the picture. For those longer-haul signals via the satellites at 27°W and 60°E the filter should be very useful.

For the record, the prototype had a measured insertion loss of 3dB and produced a flat response ±6MHz of 70MHz. The h.f. roll-off was as follows: 80MHz −12dB, 82MHz −27dB, 84MHz −38dB, 86MHz −38dB, 90MHz −37dB. A similar characteristic was found to the l.f. side of 70MHz.

Components

The following can be obtained from Maplin:

C1, 4, 7, 8	22pF
C2	18pF
C3, 5, 6	33pF

The above are 100V working metallised ceramic plate capacitors, WX series.

L1	Blue, 6·5 turns, type UF67X
L2, 4, 5	White, 8·5 turns, type UF69A
L3	Green, 5·5 turns, type UF66W

The above are Toko moulded r.f. coils, UF series. Filter switch: 2-pole 2-way sub-miniature/miniature slide type. See page 443 of the Maplin 1988 catalogue for a suitable switch.

The original Tay Howard component values are as follows:

C1, 4, 7, 8	22pF	L1	6·5 turns
C2	10pF	L2	12·5 turns
C3	33pF	L3	5·5 turns
C5	18pF	L4	9·5 turns
C6	27pF	L5	9·5 turns

Coils are quarter inch diameter close-wound with core.

Cost

The total cost of all new components will give you change from £3 if you have your own board and connectors.

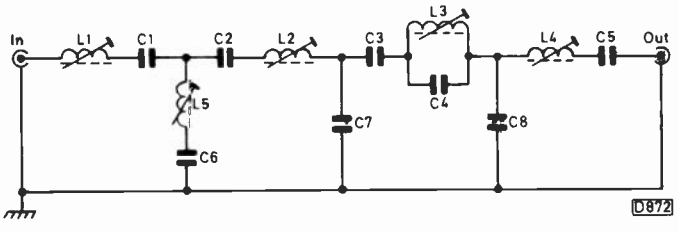


Fig. 1: The Tay Howard filter circuit.

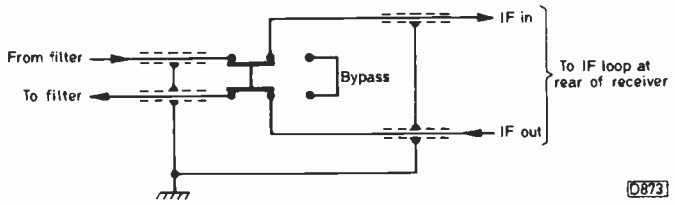


Fig. 2: Filter in/out switching arrangement adopted.

Detecting Licence Dodgers

Vivian Capel

Most TV receiver users pay their annual licence fee conscientiously if not eagerly. BBC programmes are paid for entirely out of licence revenue and the profits made by selling programmes and video tapes, so it's essential that the licence income is maintained. Some may not care for the material offered to them, but the viewing figures seem to indicate that the majority find it acceptable.

Some viewers baulk when licence renewal time comes around and simply don't renew. They may consider the programme standards to be a valid excuse, or be honest and say they are just short of cash. So renewal is put off. Others are more blatant, perhaps acquiring a cheap set second-hand and feeling it to be an imposition to have to pay more for a licence than the set cost. The set owner may feel that because he never watches BBC it's not fair to have to pay for a licence. But the fact is that if you operate a "TV receiving station" you are legally obliged to have a valid licence.

The number of those who fail to obtain or renew a licence is large enough to cause a sizeable loss of revenue. If this could be avoided perhaps programmes could be improved – or the fee for the rest of us reduced.

To reduce the loss detector vans are employed to locate non-licence TV receiver users and scare others into coughing up promptly. It appears that the cost of operating these vans is more than recouped by the fees recovered. How do they work, and what are their limitations?

How Detection Works

Older readers will recall the effect that the line timebase whistle from a 405-line receiver had on a nearby a.m. radio tuned to the long-wave band. This is probably the cause of the common misconception that detector vans operate by picking up line timebase radiation. They don't: they detect the radiation from the tuner's local oscillator.

Setmakers try to keep this radiation to a minimum to avoid interference with other receivers and equipment, and indeed the oscillator appears to be effectively screened within the tuner's case. In addition, some sets have foil-lined cabinets. So direct radiation would appear to be negligible, any that does get out being radiated via the aerial. Again this is not so – the detector vans can determine not only which house has a working TV receiver, but the room in which the set is being used. Direct radiation from a set is the source on which detection is based.

The range of the detectors is fifty yards with a narrow polar response, twelve yards with a broader one. The range can be switched in order to determine distance from source. This is of value when, for example, investigating back-to-back terrace houses: the longer range may pick up a receiver in the house behind the one being investigated, so the shorter range is then used, despite the fact that its broader beamwidth makes it less precise.

The van operator selects oscillator frequencies manually, a digital readout showing the frequency to which the detector is tuned. Another circuit constantly scans the spectrum: if it detects radiation, it overrides the manual setting and displays the result. So unlicenced viewers cannot escape detection by tuning to a fringe station not normally received in the locality – or by realigning their oscillator and i.f.s to a non-standard frequency!

Display within the van is by means of an oscilloscope screen on which the radiation is shown as a narrow, flat-topped peak rising from a floor of noise. This can be stored for later display, along with marker blips to identify the precise location.

The equipment cannot detect whether a set is licensed – such a facility would no doubt be most welcome!

A Detection Run

A detection run starts with a list, from the licensing centre, of all the houses in a given area with no record of holding a current licence. Choosing a peak viewing time, the van then coasts down the street at about ten miles per hour. The detector aerials on its roof are aligned sideways so that they scan each house as it's passed. The premises are also visually scanned. A key is pressed, putting a marker blip on the stored trace, as each window, door and end-of-house boundary is passed. Thus trace examination after the van has reached the end of the road will show the locations of all detected radiation. Should radiation be located at an address which does not appear to be licensed a call is made. We'll draw a veil over subsequent events.

Flats

Where there may be separate flats the detector aerials can be angled to scan the first floor, though not all vans are equipped to do this. High-rise flats cannot be dealt with by means of radiation detection. If the records show that more than five per cent of the residents of a block don't have current licences they are called on, though there's no means of catching anyone red-handed in these circumstances.

One might have thought that portable, low-range equipment operated outside the front door of each suspected flat would have been a viable possibility. But detection measures have to result in a net cash gain: the equipment plus the extra man hours required for on-foot flat scans would probably make this approach unprofitable. A block with less than five per cent of unlicenced residents is ignored.

VCRs

Video recorders must be licensed unless the owner already has a current licence for his TV receiver. The reason for this is that the most common use for VCRs is to record programmes off-air for subsequent viewing. The position is less clear when a VCR is used solely with a video camera: if it doesn't have a tuner it can't radiate so it couldn't be detected anyway.

A VCR that's capable of playback only doesn't need a licence as it would be used only with prerecorded tapes. In this case the set used for display purposes must be a monitor type without r.f. circuits, otherwise it would be licensable. For selective and infrequent viewers this seems to be a reasonable option – quite a number of cassettes could be hired for the cost of the licence.

So, if you object to or cannot afford to pay for a TV licence your options are: (a) buy a playback only VCR and hire tapes; (b) live in a house that's more than fifty yards from the road; (c) live in a high-rise block where almost everyone else has a licence; (d) construct a t.r.f. receiver (at u.h.f.!); (e) give up viewing!

A Different Life

Les Lawry-Johns

I made this astounding discovery the other night. H.B. often claims to see things that I don't, and has often said that an old chap prowls around in the cellar where the living quarters were years ago. I dismissed this as imagination until our next door neighbour Irene told me that an old chap kept coming into their downstairs living quarters. She described him exactly as H.B. had done and told me she'd asked her husband Vic to put up a wooden screen to stop him coming through the wall that separates our shops. If a wall won't stop him, why should a fence? . . . H.B. also says she often sees an old girl in our lounge, constantly rocking to and fro in a rocking chair. I've not seen her either.

Last Sunday evening we were sitting looking at TV with the electric fire on. Tessa was sitting in front of it. She suddenly leapt to her feet and started to bark at the fire.

"She's daft" I said.

"No, she's barking at Trog" said H.B.

You may remember our black female cat Trog who was run over ten years ago – we now have Spock, who pokes her nose into everything.

"Trog's been dead for ten years" I pointed out.

"Yes but she was sitting by the fire until Tessa frightened her away."

I must say that I don't get this. Women and female dogs see things that we don't. Zeb didn't see anything either. I'm not stupid: it's just that females are different I suppose. I thought maybe it's my empty head, which has been funny for some time but is now improving thanks to the vitamin E Mr. Hurran recommended. It takes time though, and I'm still not working properly.

The Philips K35

Take for example the 26in. Philips K35 that came in yesterday. For a while it nearly turned me barmy – when you tuned it in it would go slightly off tune and spoil the picture. When you tune it in you have to open the front flap, which disconnects the a.f.c., so I discounted a.f.c. trouble. I eventually found that the switch was faulty and realigned the a.f.c. coil cores (U157 and U158). The picture then tuned in correctly. Alignment isn't easy as the tuner is too near the a.f.c. coils.

At last we had all channels right and I was satisfied. Terry came to collect it and his wife phoned today to say that although TV reception was o.k. they couldn't get the set to accept the video channel. Oh dear, what a tangled web we weave.

A Ferguson TX9

I was also driven up the wall by a TX9 – one of the ones with a thyristor power supply (PC1040 main panel). It had a good picture except for two well-spaced horizontal lines that revolved slowly. I bridged the electrolytics in the field timebase chip's supply then fitted a new TDA1170 chip. The result of this was a constantly revolving picture, so I looked for the field hold preset. There isn't one. Of course, it should be a TDA1170S which works with close-tolerance components in the field oscillator department. With the correct chip fitted we were back to a good picture with slowly rotating horizontal white lines.

I then turned to the power supply and checked the electrolytics in this section of the set. They all proclaimed their innocence. At this point the test electrolytic came adrift and shorted to a point lower down. There was a flash and the 1·6AT mains fuse failed. I stuck in another which blew straight away at switch on. After much testing I found that the crowbar trip thyristor CSR2 was short-circuit. So I left this out while I continued to make tests.

The fuse now held and the picture, with the lines, returned as before. I found that the only way I could get rid of the lines was to shunt the power supply efficiency diode D77 with a 470μF, 250V electrolytic. This left slight dotted lines that were difficult to see. I was aware that I'd missed something, but for the life of me I couldn't find the real cause of the fault.

I fitted a new crowbar thyristor and wrapped the job up with the extra 470μF electrolytic securely fitted inside the cabinet. This made me feel guilty, but there haven't been any complaints.

Another TX9

I'd just got rid of the TX9 when another one arrived, this time with a cracked panel that needed many leads fitted to restore normal working. This was done quite quickly. The owner collected it and was grateful to see the really good picture it displayed. It came back in a matter of hours with a very grainy picture.

"I'm not paying out any more on the thing" grunted the owner.

So I checked it over and came to the conclusion that the tuner was at fault. As the owner didn't want to pay for a new one I pulled off the side screen and the picture came up as good as new. It remained like this for some considerable time, then the owner came and carted the set away again.

It's a fact that removal of one side or the other will often restore normal reception and save replacement of the tuner – except in areas of high signal strength of course.

This left me a bit fed up with early TX9s. The TX10 seems to be a lot better – except for the focus control of course. Mind you they can be naughty at times, and I'll probably be eating these words within a week or two.

The ITT CVC1120

Phil tells me that I must mention the ITT CVC1120 that came in last Saturday. My memory of this is very hazy and in fact I left it to Phil to tackle. The trouble was that the 1A fuse in the power supply kept blowing. Because the owner was an attractive young lady with large, er . . . eyes, Phil was eager to please her. To cut a long story short, he traced the trouble to the 10μF filter capacitor C701 which was short-circuit. Well done Phil. I won't tell Sara about the young lady with the . . . eyes.

That's all for now. See you next month.

All About Bar Codes

Harold Peters

Nowadays we tend to specialise. So when you've a competent wife whose "pre-calculator" years in an Accounts Department enable her to approach the supermarket checkout tendering the exact amount for the goods in her trolley you leave the shopping to her. In consequence the use of bar code scanners at some checkouts (no doubt to counteract such ladies who can add better than the till/operator . . .) has up to now gone unnoticed by yours truly. Until now.

With the introduction of a range of Panasonic VCRs that use bar code scanning it's time to sit up and take an active interest. The general principle is blindingly simple: the code is scanned by a light pen with a built-in photosensor, the pulses produced by the latter being processed to provide the desired instruction, description or whatever. It's only when you look at the decimal translation of the bars, which you can see on most packaged foods etc., that you get to wonder how such a long number can be read off so few bars.

Codes

There are many different codes. Pass a bag of sugar through the out terminal at the library and the reader will go sick on you. The converse also applies. Supermarket produce uses the EAN (European article numbering) code, which can have eight decimal digits but is more commonly in thirteen digit form. These are normally printed conventionally beneath the bar code – those intended for UK use begin with "50". EAN is too complicated a system for us to go into here, but its application means that few people need to know how it works as opposed to how it's used. The code used at the library is generally more straightforward. It needs to be, since membership cards may be produced locally. It's very similar to Telepen, the code some of you may already use with your microcomputer.

Code used by Panasonic

Fortunately the easiest code to understand is also the one that interests us most. It's called "interleaved two of five", and is used by many current Panasonic VCRs. The code embodies all the basic principles of the more complex systems and its title tells you all. Each "message" consists of two interleaved sets of five bits. The black parts represent one set of bits, the white parts the other set. The two are handled simultaneously and are sandwiched between a start code and an end code. Intrigued? Let's go into detail.

Have a look at Fig. 1, the code for channel one with timer on. It consists of ten black bars with nine white ones in between. At either side of the bars there are areas of plain white paper: these are the start and stop margins respectively. To the left of the start margin there's a box at which the scanner is pointed before you start scanning: it ensures that the scanner gets up to a steady speed by the time it reaches the code. Things will become clearer if, to appreciate the theory, we take the scanner through the code slowly to see what it detects.

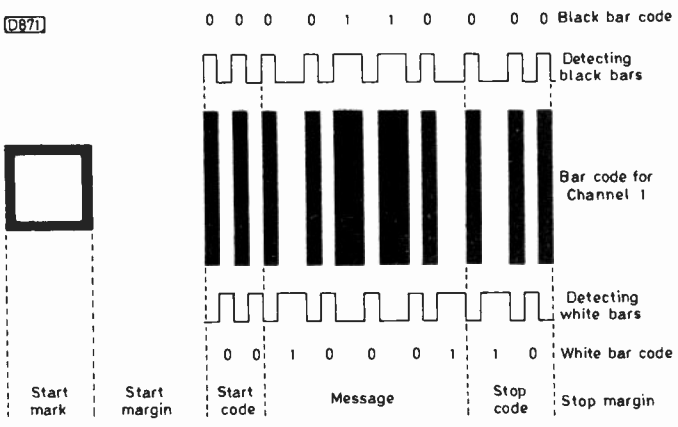


Fig. 1: The bar code used by Panasonic.

How it's Decoded

Taking the black bars first, the narrow ones produce a binary zero and the wide ones a binary one. The gaps in between are of no consequence until we come to detection of the white bars. The principle with the latter is the same, but the message will be entirely different. Laid out in easy to see form it looks like this:

Black:	0	0	0	0	1	1	0	0	0	0		
White:		0	0	1	0	0	0	1		1	0	
		Start				Message				Stop		

The start code, a succession of two black and two white zeros, is the same at the start of every message and serves a similar purpose to the teletext clock run-in. The five bit message section of the code represents any number from 00 to 99. The black bits represent tens and the white bits ones, and these have to be decoded – Table 1 gives the conversion. Thus the black bits in the above message, 00110, represent zero while the white bits, 10001, represent one. So when converted the message tells us one. One what? The stop code is used to indicate the nature of the message, i.e. channel, date, on time, off time, and is read sequentially. In the above case the stop code reads 01000 which means channel – and timer on. So much for the bar code itself, now let's look at the hardware.

Hardware

The scanner comes with a programming card that's coded with all channels, dates, on and off times. Scanning the card in the correct sequence produces short recognition bleeps per item from the scanner and a succession of bleeps when a complete booking (channel required, date, on and off times) has been scanned. The times are given to the nearest half hour, with an extra column of discrete minutes for in-between times. Once the scanner has recorded a complete booking this can be transferred to the VCR by

Fig. 2: A complete booking. See text.

Table 1: Decoding the interleaved two of five bar code message.

Message	*Means*
00110	0
10001	1
01001	2
11000	3
00101	4
10100	5
01100	6
00011	7
10010	8
01010	9

pointing the blunt end of the scanner at the machine and pressing the transmit button.

Programming the VCR

To accept a booking the machine must be in either the timer mode (clock logo lit) or "on" but not running. Its display should be showing the actual time. On transfer the VCR displays the channel, date, on and off times of the booking for eight seconds (timer mode) or twenty seconds (on but not running). It bleeps cheerfully in recognition of a correct transfer but gives a woeful slow bleep if for some reason the transfer is not accepted. At the end the machine goes to the timer mode, with the cell number(s) of the booking held also displayed.

Bookings can be checked by scanning the "check" bar code and transmitting this to the VCR. You can cancel by scanning "check", displaying the unwanted booking, scanning "cancel" and transmitting that. You get only eight seconds in which to do this, but the writer managed it with three seconds in hand – and he's left-handed! "Cancel" should also be used to erase any bookings retained in the scanner.

In case you forget to turn the scanner off, it mutes itself after twenty seconds of idleness. Bookings can also be made from the normal remote control handset by conventional means. These start with low cell numbers as opposed to the scanner which starts at cell seven and works backwards. The four separate codes can be lumped together into one message with a single start code.

The aim is to have the appropriate codes published in the official programme magazines, alongside the programmes concerned, so that the user can quickly scan and book what he wants to record during the coming week. This will have to wait until agreement between the various parties concerned has been reached. Until then, if you have a

Fig. 3: An EAN code. The first two decimal digits (50) indicate a UK item. The final decimal digit (1) is the check sum derived from the other twelve.

scanner, you can try the programme shown in Fig. 2. It should give you channel 12, day 25, on 19·30, off 21·00. If you do try it out, cancel it afterwards to avoid being surprised at the end of the month!

The Scanner

The scanner itself contains an infra-red transmitter, a large microcomputer chip, a quad operational amplifier chip, four RO3 batteries and a combined send/receive optosensor. Sensors are graded for gain and set at an average figure by selecting the value of RO9, the feedback resistor used in one of the operational amplifier chip's sections. Poor sensitivity in use is usually due to fluff at the business end of the scanner – if it hasn't been mislaid, use the little cleaning brush that comes with the instrument.

A Puzzle

If you like puzzles and are keen to try, you might like to attempt to crack the code on the cornflake packet, working back from the printed decimal answer. Personally, I wouldn't know where to begin. Look at a thirteen number EAN code (see Fig. 3 for example). The start code appears not only at each end but in the middle too. The left-hand message "field" can comprise either of two code patterns and the right-hand field yet a third. The thirteenth decimal figure is the check sum of the others, and is produced by adding all six even digits, multiplying by three and adding the result to the sum of the first six odd digits. That answer is taken from ten and the remainder is the check sum – digit thirteen.

Telepen

The Telepen home computer system isn't much better. Each frame is a reversed binary number which is turned around, the parity bit removed, and is then given a hexadecimal value. From this is derived a decimal code which translates to an ASCII letter.

So now you know why I still leave the shopping with absolute confidence to my wife, who in turn still patronises checkouts as yet unaffected by such inhumanities.

ECONOMIC DEVICES & QUICK SAVE T.V. SPARES

15/80H	3.30	2SA940	1.32	2SC535	0.79	AF180	0.55	BA656	1.00	BC560C	0.14	BDX63A	1.96	BFY52	0.27	BYX71-350	0.72
15/85R	3.30	2SA940-2	2.14	2SC536	0.45	AF181	0.53	BA7100	11.35	BC635	0.36	BDY20	1.21	BFY79	0.49	BYX94	0.16
16039	0.79	2SA950	0.72	2SC537	0.54	AF186	0.53	BA841A	28.98	BC636	0.28	BDY81	1.05	BFY90	0.61	BYY56	1.20
16181	1.04	2SA951	1.75	2SC605L	1.16	AF239	0.43	BA843	3.96	BC637	0.24	BF115	0.40	BLY49	2.20	BZY93C30	1.86
16182	1.04	2SA966-Y	1.16	2SC620	0.95	AF279	0.88	BA854	5.76	BC639	0.20	BF117	0.66	BR100	0.29	BZY88 RANGE	0.10
16334	0.98	2SA999	1.36	2SC643A	1.54	AL113	1.36	BAV18	0.21	BC640	0.24	BF118	0.67	BR101	0.65	BZX61 RANGE	0.18
16335	0.94	2SB774	1.15	2SC668	0.67	AN115	3.98	BAV19	0.11	BC879	0.49	BF121	0.25	BR103	0.55	BZX79 RANGE	0.10
16446	0.98	2SB185	1.13	2SC681	4.40	AN155	1.89	BAV20	0.35	BC880	0.31	BF123	0.21	BR303	1.15	C106D	0.46
16600	1.38	2SB375	3.87	2SC682	1.88	AN206	2.58	BAV21	0.12	BCX34	0.18	BF127	0.13	BRC116	0.67	C106M	0.76
16802	1.27	2SB400	0.40	2SC684	1.65	AN208	3.55	BAW62	0.11	BCY70	0.30	BF137	0.29	BRC300	2.01	C1129	0.58
17052	5.61	2SB405	1.03	2SC693	0.63	AN210	2.28	BAX12	0.48	BCY71	0.21	BF153	0.58	BRC5296	0.77	CA3046	1.55
17053	5.61	2SB449B	6.98	2SC710	0.69	AN211	3.25	BAX13	0.11	BCY72	0.20	BF154	0.26	BRC6109	0.83	CA3089	0.83
17074	9.30	2SB511	2.50	2SC711A	0.50	AN214Q	2.40	BAX16	0.11	BD115	0.34	BF157	0.33	BRC82	1.08	CA3090AQ	3.25
17089	3.45	2SB54	1.39	2SC717	1.28	AN234	5.92	BC107	0.13	BD116	0.70	BF158	0.18	BRC83	2.19	CA3094	2.20
17127	2.50	2SB546	0.56	2SC734	1.43	AN236	3.78	BC107A	0.11	BD124	1.31	BF159	0.18	BRC84	2.08	CA3131EM	2.95
17376	1.58	2SB56	2.80	2SC761-Y	0.95	AN239	4.68	BC107B	0.18	BD124P+KIT	0.69	BF160	0.31	BRX44	0.60	CBF16848N-071	1.56
1N4001	0.04	2SB618A	2.22	2SC783	3.98	AN240P	1.25	BC108	0.08	BD131	0.57	BF167	0.38	BRX49	0.67	CD4001	0.34
1N4002	0.06	2SB631	1.45	2SC790Y	1.85	AN241	1.71	BC108B	0.15	BD132	0.20	BF173	0.34	BRY39	0.69	CD4002	0.27
1N4003	0.06	2SB643	0.80	2SC828	0.28	AN245	4.49	BC109	0.12	BD133	0.53	BF177	0.35	BSS38	0.87	CD4008	1.35
1N4004	0.05	2SB669	3.67	2SC867A	3.84	AN253	1.80	BC109B	0.15	BD135	0.36	BF178	0.40	BSTB0140G	5.25	CD4011	0.29
1N4005	0.05	2SB681	3.96	2SC876	0.96	AN260	3.85	BC109C	0.12	BD136	0.26	BF179	0.36	BSTC0246	6.99	CD4012	0.24
1N4006	0.08	2SB695	1.98	2SC930	0.54	AN262	1.20	BC113	0.14	BD137	0.26	BF180	0.36	BSTC0233	7.25	CD4013	0.33
1N4007	0.07	2SB75	1.04	2SC935	4.13	AN272	8.25	BC119	0.36	BD138	0.33	BF181	0.32	BSTCC0143	3.07	CD4016	0.46
1N4148	0.03	2SB774	0.65	2SC936	8.66	AN295	5.52	BC126	0.23	BD139	0.28	BF182	0.34	BSTD1043	2.85	CD4017	0.82
1N4448	0.05	2SB819	1.13	2SC940	4.68	AN301	2.45	BC132	0.14	BD140	0.29	BF183	0.39	BSV57B	3.49	CD4020	1.23
1N5401	0.14	2SC1034	6.75	2SD1128	2.90	AN302	3.99	BC135	0.14	BD144	1.70	BF184	0.43	BSW68	0.60	CD4021	0.39
1N5402	0.15	2SC1050	5.06	2SD1138	0.94	AN303	4.39	BC137	0.18	BD150	1.25	BF185	0.39	BSX19	1.29	CD4023	0.28
1N5403	0.16	2SC1096	1.16	2SD1273	1.56	AN305	8.95	BC138	0.34	BD157	0.67	BF194	0.14	BSX20	0.30	CD4025	0.64
1N5404	0.15	2SC1104	3.98	2SD1453	1.40	AN315	2.46	BC139	0.28	BD160	1.60	BF195	0.14	BSY52	0.50	CD4028	0.84
1N5408	0.35	2SC1106	4.54	2SD152K	2.64	AN316	5.53	BC140	0.45	BD163	0.71	BF196	0.17	BSY79	0.51	CD4040B	0.85
1N914	0.04	2SC1114	3.25	2SD198	4.20	AN318	5.25	BC141	0.34	BD165	0.62	BF197	0.18	BT100A	1.61	CD4047	1.06
IR3403	5.00	2SC1116	4.95	2SD234	0.49	AN320	5.47	BC142	0.23	BD166	0.42	BF198	0.17	BT108	1.45	CD4049	0.24
1S1555	0.31	2SC1124	1.28	2SD235	0.60	AN321	2.25	BC143	0.19	BD168	0.73	BF199	0.17	BT119	1.76	CD4052	0.75
1S44	0.10	2SC1129	1.65	2SD24	2.29	AN322	5.85	BC147	0.08	BD175	0.20	BF200	0.37	BT120	2.17	CD4066	0.20
1S5012A	0.81	2SC1131	0.64	2SD257	1.98	AN331	5.11	BC148A	0.11	BD179	0.45	BF218	0.36	BT121	2.48	CD4069	0.29
1S921	0.10	2SC1158	3.33	2SD292	2.59	AN337	5.37	BC148B	0.13	BD181	0.99	BF224	0.17	BT123	1.98	CD4070	0.66
2N1303	0.38	2SC1162	0.55	2SD313	2.59	AN340P	1.17	BC148C	0.11	BD182	0.99	BF237	0.65	BT151-800R	0.89	CD4081	0.35
2N2219A	0.33	2SC1172	2.22	2SD325D	2.26	AN355	5.98	BC149	0.11	BD183	0.99	BF240	0.17	BTT6018	2.42	CD4093	0.72
2N2222	0.38	2SC1195	3.26	2SD348	16.13	AN362	1.50	BC149B	0.13	BD184	1.21	BF241	0.15	BTT8124	4.89	CD4511	1.10
2N2646	0.80	2SC1212A	1.97	2SD350	5.20	AN370	3.95	BC153	0.14	BD187	0.53	BF245	0.50	BU106	2.48	CD4528	2.04
2N2904	0.36	2SC1213	0.89	2SD353	7.50	AN5010	5.70	BC154	0.14	BD189	0.69	BF245A	0.52	BU108	1.50	CD4556	1.47
2N2905	0.59	2SC1226	1.46	2SD389	2.41	AN5111	2.92	BC159	0.36	BD190	0.72	BF245B	0.49	BU109	2.65	CR02AM-8	1.70
2N2906	0.38	2SC1293	0.90	2SD401	1.40	AN5120N	4.50	BC160	0.40	BD201	0.65	BF246A	2.52	BU110	5.69	CV12E	4.09
2N2926	0.15	2SC1306	1.98	2SD414	1.98	AN5132	5.39	BC161	0.28	BD202	0.60	BF255	0.20	BU111Y	4.16	CX095D	3.14
2N3053	0.35	2SC1316	10.25	2SD471	2.13	AN5250	3.98	BC168	0.36	BD203	0.50	BF256	0.38	BU125	2.48	CX104	9.64
2N3054	0.99	2SC1317	0.50	2SD560	2.95	AN5435	2.25	BC169C	0.16	BD204	0.41	BF256LB	0.42	BU126	1.45	CX108	12.48
2N3055	0.61	2SC1364	0.49	2SD588A	2.36	AN5610	5.50	BC170	0.16	BD207	1.79	BF256LC	0.82	BU137	6.53	CX109	7.86
2N3442	1.56	2SC1383	1.20	2SD600	2.98	AN5612	4.68	BC171	0.11	BD208	0.34	BF257	0.34	BU205	1.35	CX130	8.76
2N3702	0.14	2SC1391	2.45	2SD601R	0.65	AN5613	4.63	BC172	0.13	BD222	0.50	BF258	0.36	BU206	1.27	CX134	12.32
2N3703	0.18	2SC1398	0.79	2SD613	1.03	AN5630	3.95	BC172B	0.27	BD225	0.49	BF259	0.34	BU207	1.65	CX136	11.49
2N3705	0.16	2SC1413A	3.05	2SD621	12.85	AN5701N	1.66	BC173	0.17	BD228	0.53	BF262	0.28	BU208	1.20	CX139	11.83
2N3706	0.14	2SC1446	1.25	2SD636	0.55	AN6250	2.95	BC174B	0.27	BD229	1.05	BF263	0.57	BU208/02	1.97	CX157	5.52
2N3707	0.16	2SC1447	2.07	2SD639-R	0.72	AN6300	4.40	BC177	0.35	BD232	0.50	BF271	0.34	BU208A	1.12	CX158	5.52
2N3711	0.13	2SC1475	0.60	2SD655	0.98	AN6310	8.74	BC178	0.26	BD234	0.42	BF273	0.20	BU208D	1.95	CX177	6.46
2N3771	0.70	2SC1505	1.00	2SD657	3.50	AN6320N	4.28	BC179	0.26	BD237	0.47	BF274	0.20	BU209	1.50	CX187	6.84
2N3772	1.71	2SC1514	1.69	2SD661A	0.80	AN6340	10.14	BC182	0.05	BD238	0.39	BF324	0.35	BU226	2.45	CX755	12.95
2N3773	1.65	2SC1573Q	1.25	2SD731	1.05	AN6341	2.98	BC182L	0.10	BD239	0.45	BF336	0.33	BU326	2.00	CX885A	6.85
2N3819	0.54	2SC1578	8.74	2SD773	0.60	AN6342	2.77	BC182LB	0.07	BD240	0.57	BF337	0.45	BU326A	2.20	DEC1	2.20
2N3823	1.17	2SC1583	0.50	2SD811	3.30	AN6363	16.00	BC183L	0.11	BD241	0.39	BF338	0.33	BU326S	2.20	DEC2	2.20
2N3904	0.62	2SC1617	3.89	2SD823	1.98	AN6371	9.24	BC183LB	0.26	BD242	0.39	BF355	0.49	BU406	1.49	DS3486N	4.33
2N3908	0.62	2SC675	1.41	2SD837	1.56	AN6387	10.65	BC184	0.13	BD243A	0.35	BF362	0.62	BU406D	1.79	DS3487N	4.95
2N4101	1.73	2SC1678	1.98	2SD841	2.60	AN6531	1.95	BC184L	0.14	BD243C	0.29	BF363	0.50	BU407	0.82	E1222	0.40
2N4240	3.30	2SC1741	1.25	2SD856	1.00	AN6551	1.35	BC184LB	0.26	BD244	0.45	BF371	0.50	BU407D	0.99	E5024	0.28
2N4444	0.99	2SC1810	1.70	2SD857Q	1.84	AN6552	0.68	BC186	0.27	BD244C	0.79	BF391	0.25	BU412	5.29	E5386	0.25
2N5293	0.50	2SC1815	0.45	2SD882	1.15	AN6610	2.40	BC187	0.28	BD245C	0.99	BF417	0.84	BU426A	1.13	E9003	0.46
2N5294	0.50	2SC1826	0.67	2SD894	1.75	AN6677	10.45	BC204	0.16	BD246C	0.77	BF418	1.87	BUV84	1.39	E9005	0.50
2N5296	0.49	2SC1829	2.22	2SD898	1.85	AN7111	1.25	BC207	0.14	BD253	1.05	BF422	0.29	BUX84	1.00	FND500	5.78
2N5297	0.50	2SC1875	4.50	2SK105H	2.15	AN7114E	8.54	BC212	0.11	BD278A	0.68	BF423	0.52	BUX85	1.10	GC374	1.65
2N5298	0.61	2SC1881K	2.98	2SK152	3.59	AN7115	3.38	BC212B	0.26	BD317	2.69	BF450	0.35	BUY69A	2.04	GD243	4.34
2N5771	1.18	2SC1893	3.02	2SK34	0.76	AN7120	4.65	BC213L	0.10	BD318	2.00	BF451	0.29	BUY126	0.13	GF758	0.84
2N6109	1.58	2SC1906	0.98	2SK41	1.07	AN7145	2.80	BC213LB	0.15	BD375	0.42	BF457	0.41	BUY127	0.08	GH3F	1.82
2N6130	0.80	2SC1921	1.37	2SK79	2.98	AN7146	4.35	BC214	0.10	BD380	0.70	BF458	0.33	BUY133	0.12	HA11215	1.75
2N6133	1.25	2SC1923	0.30	40408	0.50	AN7151	2.26	BC214LB	0.26	BD410	0.55	BF459	0.52	BUY164	0.44	HA11211	2.53
2N6180	0.95	2SC1929	2.25	40594	1.53	AN7156	2.85	BC225	0.40	BD433	0.47	BF460	1.45	BUY176	0.52	HA11225	1.50
2N6292	1.65	2SC1942	1.65	40636	1.43	AN7158	2.32	BC237	0.10	BD434	0.49	BF469	0.22	BUY179	1.08	HA11226	10.44
2N696	0.43	2SC1945	7.99	4EX581	0.80	AN7218	1.64	BC237BJ	0.12	BD435	0.45	BF470	0.55	BUY182	0.95	HA11229	1.96
2N698	0.43	2SC1953	1.93	741	0.30	AN7223	4.25	BC238	0.10	BD436	0.60	BF471	0.33	BUY184	0.37	HA11235	1.75
2SA1006	1.50	2SC1959	0.26	7805-T022	0.63	AU107	3.50	BC238A	0.13	BD437	0.49	BF472	0.33	BUY187	0.77	HA11124	5.25
2SA1011	1.65	2SC1962	1.93	7806	0.73	AU110	2.25	BC238B	0.08	BD438	0.40	BF479	0.35	BUY189	1.79	HA11244	4.02
2SA1015	0.49	2SC1969	2.04	7808	0.85	AU113	5.25	BC239	0.12	BD441	1.42	BF480	1.38	BUY198	1.62	HA11251	4.47
2SA1012	1.25	2SC1983	1.51	7812-T022	0.35	AY105K	2.08	BC239B	0.25	BD442	1.41	BF491	1.98	BUY201/2	1.50	HA1125	4.29
2SA1020Y	0.89	2SC1985	1.55	7815	0.64	AY106	1.09	BC251A	0.31	BD509	1.65	BF495	0.64	BUY203/20	0.59	HA1137W	4.87
2SA1027R	0.45	2SC2009	0.34	7818	0.45	BA524	8.21	BC294	0.50	BD510	0.62	BF506	0.43	BUY207	0.22	HA1138	5.83
2SA473	0.75	2SC2028	2.11	7824	0.64	B250	2.25	BC300	0.35	BD519	0.98	BF509	0.41	BUY208	0.46	HA11414	5.65
2SA766S	4.95	2SC2063	0.99	7905	0.80	B40	1.55	BC301	0.45	BD529	0.80	BF523	0.24	BUY210-400	0.19	HA1144	7.87
2SC1173Y	1.25	2SC2078	3.11	9368	10.70	BA130	0.14	BC302	0.53	BD530	1.18	BF532	0.45	BUY210-600	0.27	HA1156	1.16
2SC1474	1.25	2SC2073	2.25	AA133	0.12	BA1310	1.98	BC303	1.04	BD533	0.67	BF596	0.18	BUY210-800	0.30	HA1160	4.78
2SC1509	1.35	2SC2085-Q	1.65	AC133	0.12	BA1320	1.38	BC307	0.18	BD534	0.53	BF597	0.27	BUY218	1.64	HA1166	1.90
2SD1391RL	3.95	2SC2091	1.30	AC123K	0.43	BA1322	3.95	BC307A	0.08	BD535	0.79	BF694	0.22	BUY223	1.23	HA1166X	6.43
2SA1095	3.00	2SC2141	2.44	AC127	0.27	BA1330	2.75	BC308	0.18	BD536	0.61	BF757	0.59	BUY224-600	1.88	HA1167	5.36
2SA1103	6.55	2SC2166	1.98	AC128	0.34	BA145	0.19	BC308A	0.11	BD537	0.80	BF759	0.47	BUY225-100	1.13	HA11706	3.61
2SA329	0.40	2SC2216	0.69	AC138	0.24	BA148	0.25	BC309	0.17	BD538	0.80	BF761	1.05	BUY226	0.25	HA11705	8.00
2SA489	1.17	2SC2233	1.80	AC141	0.29	BA154	0.40	BC317A	0.13	BD544B	0.83	BF762	0.50	BUY227	0.20	HA11703	4.22
2SA490	2.25	2SC2236	1.65	AC142K	0.35	BA155	0.12	BC327	0.15	BD598	1.25	BF869	0.47	BUY228	0.60	HA11701	4.56
2SA493	2.25	2SC2278	1.69	AC151	0.28	BA156	0.05	BC328	0.10	BD677	0.69	BF870	0.30	BUY229-1000	1.12	HA11710	9.50
2SA562	0.57	2SC2314	2.17	AC176	0.30	BA159	0.08	BC337	0.09	BD679	0.57	BF959	0.42	BUY229-600	0.92	HA11713	9.75
2SA564	0.75	2SC2335+KIT	13.44	AC179	0.28	BA182	0.24	BC338	0.10	BD680	0.76	BF960	0.49	BUY255	0.66	HA11711	20.16
2SA614	4.88	2SC2551	1.26	AC183	0.72	BA222	1.66	BC368	0.24	BD681	1.48	BF970	0.50	BUY295-600	1.03	HA11715	3.25
2SA628	1.14	2SC2565	3.92	AC187	0.39	BA302	1.24	BC440	0.69	BD696	2.47	BFR39	0.44	BUY298	0.36	HA11714	9.75
2SA639S	1.75	2SC2570	2.88	AC187K	0.43	BA311	1.32	BC441	0.44	BD699	3.49	BFR61	0.92	BUY299	0.45	HA11716	13.10
2SA659	0.49	2SC2577	1.60	AC188	0.37	BA312	1.45	BC454	0.36	BD700	3.70	BFR62	0.50	BUY407	0.90	HA11725	18.26
2SA673	1.50	2SC2578	6.75	AC188-01	0.44	BA313	0.76	BC460	0.42	BD707	0.98	BFR79	0.29	BUY448	1.35	HA11725MP	16.80
2SA684	1.61	2SC2671	1.99	AC188K	0.43	BA317	0.08	BC461	0.35	BD709	1.05	BFR81	1.65	BY113	0.65	HA117555P	6.23
2SA697	1.05	2SC2826	2.07	AC193K	0.65	BA318	0.02	BC462	1.15	BD710	0.80	BFR86	1.08	BY127	0.08	HA11781	19.90
2SA699	1.75	2SC288A	1.85	AC194K	0.65	BA328	1.65	BC463	0.64	BD809	0.80	BFR89	1.63	BY133	0.12	HA1180	5.15
2SA715	0.95	2SC3153	6.84	AD140	1.06	BA333	1.37	BC477	0.37	BD810	0.69	BFR90A	0.70	BY164	0.44	HA1196	7.43
2SA747	10.74	2SC372	1.40	AD143	1.93	BA335	6.27	BC478	0.22	BD879	0.74	BFT42	0.43	BY176	0.52	HA13001	1.73
2SA748	1.36	2SC373	1.16	AD145	1.60	BA5102A	2.86	BC479	0.41	BD880	0.78	BFT43	0.43	BY179	1.08	HA1306	2.26
2SA817	0.65	2SC383	1.33	AD161	0.30	BA511	1.95	BC532	0.28	BD895	2.31	BFT84	0.40	BY182	0.95	HA1338	7.50
2SA835	2.50	2SC388	0.50	AD162	0.30	BA514	2.20	BC546	0.08	BD899	2.48	BFW10	0.60	BY184	0.37	HA1339	3.40
2SA836	0.89	2SC394V	0.81	AD162	1.25	BA521	2.52	BC547	0.10	BD901	0.79	BFX29	0.34	BY187	0.77	HA13402	7.87
2SA844	0.65	2SC403C	0.60	AF114	2.47	BA524	8.94	BC548	0.10	BD902	0.84	BFX84	0.37	BY189	1.79	HA13342	2.65
2SA872	0.80	2SC41	2.19	AF115	0.79	BA526	7.98	BC549	0.10	BDW83C	1.45	BFX85	0.41	BY198	1.62	HA13365	4.02
2SA884	2.15	2SC458	0.15	AF118	1.20	BA527	2.98	BC550	0.10	BDW84C	1.56	BFX86	0.36	BY200	0.47	HA1366WR	1.50
2SA937R	0.97	2SC495	0.92	AF127	0.79	BA532	1.50	BC556	0.10	BDX32	1.75	BFX87	0.55	BY200/1	0.47	HA1367	2.75
		2SC515A	2.85	AF139	0.40	BA536	2.05	BC557	0.10	BDX53A	1.25	BFX88	0.34	BY206	0.47	HA1368R	2.45
				AF178	1.45	BA6209	4.55	BC558	0.10	BDX53B	1.85	BFX89	0.44	BY207	0.22	HA1368	2.07
				AF179	0.55			BC559	0.10	BDX54B	2.16	BFY50	0.32	BY208	0.46	HA1370	3.30
								BC559B	0.11	BDX62A	2.15	BFY51	0.25	BYW19/1000	0.69	BYW56	0.16
														BYX10	0.29	BYX55-600	0.23
														BYX71-600	0.85		

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HA1374	4.80	LR3419	9.37	NE565N	1.33	SKE4F2/08	0.80	STK3042	4.95	TA7312P	2.45	TD62105P	2.50
HA1377	1.75	LR3471	9.37	NE645BN	3.35	SKE4F2/06	0.44	STK3044	5.75	TA7313AP	1.36	TD62104P	2.50
HA1389R	2.05	LU1141	7.27	NP1106	7.25	SKE4F2/10	1.24	STK4019	4.50	TA7314	5.94	TD62106P	4.50
HA1389	2.39	LU52012	5.95	OA202	0.11	SKE4G2/02	0.36	STK430	10.95	TA7323P	3.15	TDA1001B	2.31
HA1392	2.40	LU52011	14.95	OA47	0.16	SKE5F3/10	1.60	STK433	6.25	TA7325P	1.15	TDA1003A	2.25
HA1394	2.95	LU03112	12.37	OA91	0.08	SKS1/10	2.15	STK4332	8.25	TA7339P	1.85	TDA1005A	2.38
HA1397	3.76	M193	6.83	OA95	0.13	SL1310	3.14	STK435	5.94	TA7340P	5.95	TDA1006A	2.11
HA1398	2.95	M21C	1.13	OC28	2.95	SL1430T	0.89	STK4352	1.95	TA7607AP	3.10	TDA1010AF	4.25
HA1406	1.30	M23C	1.98	OC29	2.15	SL414	3.69	STK436	4.70	TA7609	3.91	TDA1011	0.95
HA1452	0.85	M293	6.95	OC36	1.28	SL432A	3.44	STK437	9.65	TA7611AP	2.32	TDA1010	1.28
HBF4030AF	2.48	M51102L	4.95	OC44	0.35	SL439	2.48	STK4372	11.15	TA7616P	5.25	TDA1011A	1.03
HD14538	2.07	M5115P	5.24	OC45	0.18	SL471	2.50	STK439	7.25	TA7622AP	8.94	TDA1028	2.45
HD38702-A2	7.95	M51203L	3.15	OC72	0.44	SL480	3.98	STK441	8.75	TA7628P	2.50	TDA1034B	2.42
HD38750A53	10.44	M51231P	0.95	OC75	0.44	SL490	1.25	STK443	10.29	TA7629P	7.50	TDA1035S	2.95
HD38750A-7	7.25	M5134-9341	4.13	ONZ36	1.06	SL901B	6.95	STK457	13.45	TA7630P	0.95	TDA1035T	1.85
HD38800A50	14.09	M51353P	5.25	ONZ782	1.98	SL918A	9.07	STK460	7.02	TA7640AP	2.29	TDA1037	1.95
HD44801A05	19.98	M51381P	5.45	OT121	1.45	SN16861AN0	1.65	STK461	9.68	TA7672P	2.95	TDA1037D	2.05
HEF4001BP	0.67	M51393AP	9.35	PT6042	2.45	SN16862AN	2.98	STK463	11.53	TA7676P	2.81	TDA1044	1.95
HISH1010	8.59	M51394P	14.05	PT8504	4.98	SN16966N	10.25	STK466	11.77	TA7726P	12.50	TDA1047	3.25
HISH1004	6.00	M5142P	6.85	R1038	2.19	SN29717N	7.19	STK4833	10.95	TAA320A	1.27	TDA10596	9.98
HISH1002	9.50	M5144P	2.97	R1039	2.19	SN29716N	3.66	STK501	6.32	TAA350A	6.45	TDA1054M	1.35
HM6231	9.81	M51513L	2.06	R2008B	1.33	SN29715N	6.04	STK502	7.25	TAA570	1.85	TDA1060	2.60
HM6232	10.65	M51515BL	2.75	R2009	1.98	SN29722	11.95	STK5314	12.32	TAA621AX1	4.85	TDA1082	2.95
HM6251	6.51	M51517L	2.90	R2010B	1.33	SN29723AN	8.77	STK5730	2.98	TAA621A12	2.14	TDA1151	1.22
HM7103	4.85	M5192	2.20	R2029	1.33	SN29764AN	1.65	STK7216	14.50	TAA661B	2.62	TDA1170S	1.85
HM9032	9.98	M5194AP	5.74	R2030	1.33	SN29767	4.90	STK772	6.95	TAA691	8.58	TDA1190	2.11
HM9012	3.22	M5231L	1.95	R2257	3.71	SN29770BN	1.95	STR1096	5.45	TAA700	2.37	TDA1190Z	3.96
HM9015	3.24	M53274P	1.33	R2265	1.49	SN29772BN	4.91	STR4090	10.55	TAA930	4.87	TDA1200	1.51
HT4207	17.16	M54532P	1.71	R2305	1.18	SN29771BN	1.65	STR440	4.78	TAA970	2.83	TDA1235	3.88
HT4208	20.65	M54544L	3.45	R2322	0.59	SN29798N	5.56	STR441	5.95	TAA110	2.52	TDA1236	4.39
IN5401	0.11	M58478P	8.77	R2323	0.76	SN2709	0.44	STR451	5.36	TAG232-600	0.79	TDA1270	3.55
IR2403	1.45	M58485P	14.25	R2354A	2.01	SN7400N	0.34	STR453	8.16	TAG626-600	1.20	TDA1327A	1.33
IR2C05	4.25	MA06	1.07	R2354B	2.01	SN7401N	0.36	STR454	4.95	TBA120AS	0.69	TDA1412	1.05
IR3P06	2.25	MA8001	0.82	R2443	0.88	SN7402N	0.65	STR6020	4.95	TBA120SB	1.05	TDA1420	2.56
IR3P08	4.95	MA8003	1.16	R2461	1.50	SN7404N	0.52	T6029V	5.75	TBA120T	0.97	TDA1440	3.45
IR94558	6.25	MB3705	1.98	R2540	1.91	SN7408N	0.27	T6035V	0.73	TBA120U	0.62	TDA1470	2.80
IS751	2.85	MB3712	1.85	R2540X	3.30	SN7410N	0.27	T6036	0.67	TBA120A	1.05	TDA1470P	4.25
ITT425	0.18	MB3713	1.69	R2615	0.67	SN74121	1.60	T6037	2.11	TBA1440	1.76	TDA1505	7.85
IZ0003GE	5.37	MB3730	2.94	RCA16029	2.01	SN7413N	0.74	T6044V	0.97	TBA1441	1.62	TDA1510	4.60
IZ0020GE	5.93	MC13002	3.59	RCA16600	1.38	SN74141N	2.65	T6045	1.20	TBA240A	2.65	TDA1512	3.89
K174YP	3.46	MC1310P	2.25	RCA16802	1.08	SN74151AN	1.51	T6049	1.45	TBA395	1.10	TDA1515	2.80
KA2101	2.92	MC1327P	1.33	RCA17074	6.60	SN74154N	1.27	T6052V	0.87	TBA395Q	1.19	TDA1559	3.15
KC581C	6.32	MC1330P	1.45	RCA17376	1.58	SN74190	1.35	T6058	3.88	TBA396	1.20	TDA1670	4.48
KC582C	3.97	MC1350P	1.61	RCA17524	0.83	SN7420N	0.55	T6059	2.77	TBA400	2.38	TDA1770	6.85
KC583C	6.63	MC1351P	3.96	RCA17523	0.83	SN7430	0.49	T9003V	1.25	TBA440C	2.34	TDA1905	1.27
L200CV	1.69	MC1352P	2.50	RCA2060	2.00	SN7440N	0.27	T9005V	2.38	TBA480Q	1.30	TDA1908	2.98
LA1201	1.02	MC1358P	1.35	RGP01-15	1.65	SN7472	1.54	T9011V	1.40	TBA510	2.11	TDA1940	1.95
LA1210	1.56	MC14001	2.40	RGP10	0.30	SN7474N	0.44	T9013V	4.95	TBA520	1.15	TDA1950	2.85
LA1230	2.20	MC14013	0.41	RGP30M	0.28	SN7490AN	0.93	T9014V	2.42	TBA520Q	1.68	TDA2605	1.45
LA1320	2.87	MC14493P	5.95	RT402	1.58	SN74LS26N	1.45	T9016	1.02	TBA530	1.30	TDA2006	1.95
LA1352	1.65	MC14494P	2.15	RT905A	2.38	SN76001N	1.65	T9019W	1.98	TBA530	1.30	TDA2604	1.48
LA1357N	11.07	MC14497	3.15	S1299	5.34	SN76013ND	3.50	T9034V	1.45	TBA540	1.15	TDA2002	0.98
LA1363	1.05	MC14510BAL	3.75	S175	31.48	SN76023N	2.75	T9035V	1.95	TBA540Q	1.15	TDA2003	1.75
LA1364	3.02	MC14511BCP	1.10	S2062D	0.95	SN76023ND	3.96	T9051	6.95	TBA560C	1.48	TDA2010	1.68
LA1365J	0.95	MC14528BCP	2.15	S2800D	5.54	SN76033N	3.65	T9054V	0.77	TBA560CQ	1.69	TDA2020	1.95
LA1385	1.53	MC1712	3.88	S2802	3.47	SN76110N	1.13	T9057V	0.70	TBA570Q	1.35	TDA2030	1.45
LA1387	5.95	MC5192	19.50	S2818	0.85	SN76115AN	1.61	T9062V	0.49	TBA570A	1.71	TDA2140	1.68
LA3155	1.25	MC7724CP	3.49	S3702S	6.15	SN76131	1.92	T9064	3.64	TBA641A12	4.13	TDA2150	6.20
LA3301	1.41	MC7818C	2.18	S40W	18.64	SN76227N	0.85	TA6002	4.35	TBA641B72	3.03	TDA2151	2.07
LA3350	1.43	MCR100/7	1.00	S6080B	8.80	SN76226DN	2.50	TA7027	4.80	TBA651	0.87	TDA2160	4.81
LA3361	1.60	MCR106-5/6	0.95	SA8063	5.17	SN76228N	3.27	TA7050	1.74	TBA673	2.60	TDA2161	1.85
LA3365	3.98	MCR220/7	2.28	SAA1006	1.85	SN76242	8.95	TA7051	1.74	TBA700	1.85	TDA2170	2.88
LA3390	5.52	ME0402	0.17	SAA1020	4.76	SN76243	8.50	TA7054	2.55	TBA720	3.50	TDA2270	2.25
LA4030P	3.16	ME0404/2	0.47	SAA1025	4.40	SN76396	2.90	TA7060AP	0.71	TBA730	3.55	TDA2520	2.37
LA4031P	3.20	ME0411	0.28	SAA1024	2.81	SN76533N	2.47	TA7061AP	1.27	TBA750Q	2.90	TDA2522	3.46
LA4032P	2.35	ME6002	0.26	SAA1075	6.25	SN76532N	0.95	TA7069	3.13	TBA760	1.71	TDA2524	4.50
LA4100	1.25	ME6102	0.28	SAA1121	7.44	SN76545	1.95	TA7070P	1.83	TBA800	0.92	TDA2521	3.71
LA4101	1.30	ME8001	0.34	SAA1124	3.38	SN76546N	3.47	TA7072P	2.57	TBA810S	1.61	TDA2525	3.80
LA4102	0.75	ME0411	0.75	SAA1130	4.99	SN76549	2.59	TA7073P	5.86	TBA810T	1.50	TDA2532	2.50
LA4112	0.56	MJ2501	3.30	SAA1174	7.77	SN76570	3.08	TA7074P	1.98	TBA810AS	1.08	TDA2530	2.55
LA4125	2.25	MJ3001	1.76	SAA1250	4.15	SN76611	2.59	TA7076P	7.80	TBA820	1.52	TDA2541	1.88
LA4138	4.55	MJ481	1.53	SAA1251	3.20	SN76620	2.59	TA7089P	3.10	TBA820M	9.82	TDA2540	2.15
LA4140	0.70	MJ802	4.90	SAA1351	8.11	SN76660N	2.48	TA7092P	8.85	TBA890	2.50	TDA2545Q	5.94
LA4192	3.48	MJE2955	1.89	SAA3027P	2.55	SN76666N	1.20	TA7093P	3.99	TBA920	1.53	TDA2566	0.75
LA4220	1.25	MJE3055	1.05	SAA5000	2.50	SN76708	4.86	TA7102P	5.88	TBA920Q	2.31	TDA2575A	0.50
LA4250	4.95	MJE340	0.49	SAA5010	3.65	SN76709N	3.30	TA7108P	1.61	TBA940	1.87	TDA2576A	2.85
LA4400	3.92	MJE520	0.49	SAA5012	5.28	SN76707N	5.11	TA7109	3.71	TBA950	1.84	TDA2571A	3.66
LA4420	1.72	ML231	3.33	SAA5020	5.78	SN76705N	6.60	TA7122B/P	0.92	TBA970	3.56	TDA2578A	2.57
LA4422	1.72	ML232B	3.01	SAA5030	8.25	SN76730	6.60	TA7124P	2.34	TBA990	1.98	TDA2576A+KIT	12.35
LA4430	1.56	ML237B	2.51	SAA5050	7.74	SN76810N	0.60	TA7129P	1.50	TBA990Q	1.68	TDA2581	1.79
LA4440	2.95	ML238	5.77	SAB1009B	5.98	SN76832N	1.35	TA7130P	1.27	TC4001BP	3.25	TDA2582	1.94
LA4445	3.95	ML923	3.00	SAB3011	7.34	SN94041	5.54	TA7136AP	1.89	TC4011BP	3.50	TDA2591	2.50
LA4460	1.75	ML926	3.98	SAB3013	3.76	SN94042	5.54	TA7137P	0.98	TC4013BP	3.75	TDA2594	3.26
LA4461	2.95	MM5314N	8.99	SAB3021	7.90	SP8385	0.55	TA7141AP	3.87	TC4016BP	3.15	TDA2593	2.47
LA4505	5.85	MM5316N	9.16	SAB3024	6.36	SPS5384	1.98	TA7146	2.50	TC4053BP	4.34	TDA2595	1.89
LA5112N	1.68	MM5318N	3.11	SAB3209	5.82	ST1702L	0.99	TA7146P	4.23	TC4069	2.25	TDA2600	6.60
LA7020	13.86	MM5369N	2.01	SAB3210	3.10	STA401	6.76	TA7148P	1.67	TC4071BP	2.76	TDA2611AQ	2.98
LA7025	11.97	MM5387AA/N	6.20	SAF1032P	3.58	STA441C	3.00	TA7149P	3.26	TC4081BP	3.25	TDA2612Q	4.80
LA7027	10.92	MM5841N	6.64	SAF1039	2.95	STA471C	7.95	TA7152P	2.72	TC40H000	1.98	TDA2611A	1.85
LA7040	9.20	MN1400VL	13.65	SAS010	8.39	STK0029	5.54	TA7161P	3.45	TC4514BP	5.44	TDA2610	3.08
LA7042	3.90	MN1405	12.50	SAS560S	1.86	STK0039	5.11	TA7162P	3.61	TC9002BP	11.34	TDA2620	2.15
LA7800	1.00	MN1435VX	11.86	SAS560T	5.42	STK0040	12.78	TA7169	7.88	TCA270Q	1.86	TDA2630	1.95
LA7801	1.30	MN6016A	20.56	SAS570T	5.42	STK0050	7.72	TA7172P	1.41	TCA270S	0.95	TDA2631	2.73
LB1274	3.61	MP1192	5.07	SAS570S	2.61	STK0080	9.16	TA7176P	2.48	TCA270SQ	1.05	TDA2640	2.95
LC7800	9.20	MP2794	4.00	SAS580	2.25	STK011	5.08	TA7193P	5.88	TCA290A	2.39	TDA2652	13.45
LD3120	1.13	MP2812	5.07	SAS8600	1.33	STK013	9.25	TA7201P	2.71	TCA420A	2.16	TDA2653	2.95
LD3150	2.75	MP8512	1.57	SAS660	2.97	STK014	9.80	TA7203P	2.18	TCA440	2.25	TDA2654	6.18
LM1017N	1.75	MPC596	2.13	SAS6700	1.33	STK015	7.75	TA7204P	2.16	TCA530	2.24	TDA2670	2.54
LM1877	13.43	MPF256C	0.60	SAS670	3.96	STK016	8.45	TA7205P	9.98	TCA640	2.25	TDA2680	3.28
LM224	1.75	MPS6570	0.48	SAS6710	2.21	STK022	5.25	TA7206P	12.49	TCA650	3.05	TDA2690A	2.65
LM2808	6.25	MPSA42	0.65	SBA750	1.61	STK025	8.66	TA7207P	3.34	TCA660B	2.60	TDA2740	6.00
LM2877	5.25	MPSA56	0.27	SC84203	19.35	STK031	12.95	TA7208P	2.15	TCA730	3.81	TDA2780AQ	5.14
LM317CKC	1.08	MPSA92	0.72	SC9504P	1.46	STK040	13.34	TA7210P	1.45	TCA750	2.25	TDA2795	2.78
LM324N	0.98	MPSU05	0.86	SDA2006	17.95	STK043	12.95	TA7214P	3.63	TCA800Q	6.95	TDA2791	2.5
LM339N	0.35	MPSU10	1.45	SDA2112/2	12.85	STK054	7.13	TA7215P	2.58	TCA830S	2.38	TDA2910	13.25
LM340K	11.85	MPSU56	0.78	SG264A	6.45	STK058	27.50	TA7217AP	1.45	TCA890	5.44	TDA3000T	2.88
LM348N	2.15	MPSU60	1.98	SG613	10.75	STK077	7.67	TA7222	1.95	TCA900	2.04	TDA3300B	6.98
LM380N	2.80	MR818	0.33	SG629	8.27	STK078	8.48	TA7226	3.57	TCA910	2.04	TDA3330	2.95
LM384N01	3.25	MR854	0.72	SG6533	11.96	STK080	16.50	TA7227P	2.25	TCA940	2.47	TDA3506	7.98
LM567CN	1.71	MR914	1.20	SI-1125HD	17.63	STK082	11.86	TA7229P	4.45	TCA940E	2.93	TDA3501	7.25
LM6402/011	10.23	MSM5816RS	17.35	SI1125H	7.50	STK086	13.59	TA7230P	1.30	TCE330	3.88	TDA3500	4.25
LM6402A093	10.15	MSM5840H	15.15	SI1225HD	18.35	STK1039	5.75	TA7232P	6.80	TCEP100Q	10.25	TDA3510	5.95
LM748	0.69	MVS460-02	0.61	SI1630HD	20.50	STK2110	7.33	TA7233P	3.15	TCEP100	9.61	TDA3520	9.71
LM8360	3.87	NE542	2.65	SI6900	12.00	STK2145	16.95	TA7240AP	3.55	TD3406AP	3.98	TDA3540	6.99
LM8361	3.57	NE545B	2.99	SKE1/02	1.85	STK2230	7.70	TA7245P	5.92	TD3F800R	3.66	TDA3541	2.22
LR2612	11.95	NE555	0.25	SKE2F1/04	1.39	STK2240	15.65	TA7270	3.50	TD3F900H	4.16		
		NE556	0.65	SKE2G3/04	0.85	STK2250	18.95	TA7310P	2.15				
				SKE4F1/06	0.35								

TDA3560	5.25	TUA2000	8.98
TDA3571Q	2.88	TV106	2.37
TDA3576	7.48	TV6010B	2.97
TDA3590	5.79	U05G	1.14
TDA3591	6.45	ULN2204	8.50
TDA3650	6.85	UPA53C	4.94
TDA3652	2.80	UPC1003	5.95
TDA3651AQ	6.95	UPC1009C	8.95
TDA3651	5.35	UPC1025H	3.00
TDA3651A	1.75	UPC1026C	1.24
TDA3950	3.80	UPC1028H	2.00
TDA4050B	3.95	UPC1020H	2.77
TDA4280	5.95	UPC1032H	0.62
TDA4290	4.47	UPC1042C	8.95
TDA4400	2.27	UPC1156H	1.45
TDA4420	2.95	UPC1158	5.84
TDA4422	3.65	UPC1161C	4.98
TDA4427S	9.80	UPC1182H	1.22
TDA4431	2.27	UPC1186H	1.05
TDA4440	3.26	UPC1181H	1.35
TDA4442	4.15	UPC1185H	1.60
TDA4500	4.75	UPC1188	7.40
TDA4600-2	2.10	UPC1212C	1.72
TDA4610	1.79	UPC1225H	3.25
TDA4620	4.70	UPC1230	1.78
TDA5500	6.20	UPC1238	2.00
TDA5700	2.75	UPC1263	4.09
TDA7270S	2.25	UPC1277H	4.95
TDA8190	2.47	UPC1278H	2.15
TDA9403	1.99	UPC1351C	1.81
TDA9503	1.95	UPC1350C	1.48
TDA9513	3.15	UPC1353	7.85
TDB1033	2.68	UPC1355C	2.13
TDE1081	7.05	UPC1363	4.20
TE626	1.49	UPC1362	2.64
TEA1002	2.30	UPC1365C	6.98
TEA1009	1.50	UPC1366	3.25
TEA1014	2.98	UPC1360C	4.51
TEA1020SP	8.21	UPC1378H	1.25
TIC106C	0.61	UPC141C	4.95
TIC106M	0.77	UPC1458	3.34
TIC116Y100	2.07	UPC151C	2.95
TIC44	0.72	UPC2002	1.48
TIC45	0.58	UPC30C	2.51
TIC47	0.35	UPC324C	4.17
TIP120	1.06	UPC32C	5.25
TIP110	0.45	UPC339C	4.35
TIP112	0.54	UPC41C	4.10
TIP117	0.50	UPC4558C	2.15
TIP121	0.75	UPC474	5.11
TIP126	0.73	UPC564C	1.85
TIP132	0.99	UPC568H	2.95
TIP137	1.50	UPC574	4.09
TIP29	0.84	UPC575C2	2.40
TIP29B	0.95	UPC576H	2.58
TIP29A	0.46	UPC577H	1.25
TIP29B	0.63	UPC578C	8.70
TIP29C	0.40	UPC580C	4.13
TIP29D	0.75	UPC587C2	1.34
TIP3055	0.75	UPC592H	2.15
TIP30A	0.41	UPC595	2.95
TIP30C	0.16	UPC596	1.98
TIP31A	0.34	UPD1514C	4.76
TIP31B	0.38	UPD2619C	4.98
TIP31C	0.39	UPD4013B	4.00
TIP32A	0.35	UPD4066B	4.95
TIP32B	0.69	UPD553-164	19.52
TIP32C	0.40	UPD8049C-1	11.50
TIP33	0.85	X0007TA	4.68
TIP33A	1.05	X0022CE	5.75
TIP33C	0.88	X0029CE	7.09
TIP34	0.50	X0031CE	4.95
TIP41A	0.48	X0035TA	5.98
TIP41B	0.65	X0040TA	4.50
TIP41C	0.25	X0042CE	4.35
TIP42A	0.48	X0043CE	2.75
TIP42B	0.53	X0056CE	6.25
TIP42C	0.25	X0057GE	6.00
TIP47	0.37	X0062CE	8.35
TIP48	0.92	X0065CE	4.60
TIP49	3.61	X0074GE	10.00
TIP55A	3.65	X0077GE	15.96
TIS43	1.43	X0079CE	4.95
TIS90	0.28	X00092CE	4.95
TL011CP	0.95	X0096CE	5.95
TL072	1.45	X0109CE	11.25
TL494CN	8.95	X0113CE	2.07
TLD72CP	2.55	X0195CE	7.50
TMP4320	15.00	X0204CE	8.74
TMS1024NLL	13.75	X0261CE	8.75
TMS1025N	16.95	X1222AF	3.63
TMS3720ANS	12.50	IX8111CE	2.95
TMS3748NS	14.95	Y969	0.82
TMS3755	13.85	TDA3310	2.15
TMS3894NL	19.25	ZPY120	3.25
TMS5102NLL	6.25	ZTK33	0.43

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VCR Clinic

Reports from Joseph Cieszynski, D.H. Davies, Steve Beeching, T. Eng., Alfred Damp, Eugene Trundle and Mick Dutton

Sharp VC8300

The playback picture showed all the symptoms of both a capstan and a drum servo fault and I initially began checking the circuits that are common to these two loops, i.e. the supply lines, IC701, IC702, IC703 etc. The scope showed that all the relevant ramps, sample pulses and sample/hold d.c. outputs were present, though they were varying wildly as the loops were unlocked. This is usually an indication that the i.c.s are in fact working, but as time went by I was driven to replace IC701 and IC702, only to find that the fault was still present.

At this point I decided to try a different line of approach. If I could prove that a drum fault was causing the capstan to unlock, or vice versa, I would have narrowed down the possibilities by fifty per cent. This was my biggest mistake – a further two hours were wasted. How did I go about it? By disconnecting the servo loops one at a time and using a variable d.c. supply instead. All this did was to prove that there was indeed a common cause, but what? Then I saw it. The f.e.t. Q703 in the drum sample/hold circuit is biased from the same point as Q707 in the capstan sample/hold circuit. A check on the d.c. conditions revealed that the gate potentials were both low. Further checks led me to the 10μF tantalum capacitor C731 which read 10kΩ when measured out of circuit. Needless to say the celebrations went on for some time.

Perhaps I'd have found this one sooner if the circuit had been drawn larger, as the common supply via R769 is not at all clear. That's my excuse, anyway. **J.C.**

Grundig VS180

Both spools were running fast and there were no other functions. After threading up manually the machine would unthread and eject the cassette, with both spools continuing to run fast and not switching off. This would tend to suggest something wrong with the cassette eject switch, but the threading motor stopped after eject so the microcomputer chip did that all right, indicating that this chip was not faulty. After a word with Grundig Pete we decided that the most likely culprit was the M722 series-to-parallel interfacing chip, which indeed it was. We came to the conclusion that erroneous data was being sent to the microcomputer chip. The faulty chip can cause other symptoms depending on which data bit is corrupted. **S.B.**

Grundig VS180

This machine had suffered transport damage while being brought back from abroad. While sorting this out we found that the machine would sometimes initialise by winding forwards and backwards very slowly. The cause was eventually discovered to be the on/off switch. It switched off the 33V supply but not the 5V supply, leaving the clock on and the machine partially operating **S.B.**

Panasonic NV333

This machine actually wore Blaupunkt livery. There was no playback colour and unfortunately it was wanted in a hurry. Although there was no proper colour there were signs of unlocked colour flickering about occasionally.

The VCO and reference oscillator frequencies were both correct so to save time I decided to change the AN6371 and AN6363 colour signal processing chips. This didn't cure the fault, and with four or five camcorders and some cameras wanted urgently life didn't look too good. With this model it's possible to check the a.f.c. by comparing the line sync pulses at pin 3 of IC8002 with those at TP8006. I found that there was no lock in playback though the a.f.c. system was locked solid in record. There was a difference in the level of the sync pulses at pin 3 of IC8002 between playback and record, but this is normal. The only other discrepancy I discovered was that pin 9 of the chip was at 2V instead of 5·55V in playback. This led back via a switch (Q3011) to the preamplifier and drop-out detector chip IC3002. The voltage at pin 15 was low at about 2V instead of 4·8V with drop-out pulses – something to do with advancing the a.f.c. loop in the event of a drop-out. Anyway, I found that if pin 9 of IC8002 was linked to the 5V rail the machine played back in colour without need to replace the preamplifier chip. Very naughty, but the machine was old, the video heads in poor condition and the customer didn't want any more expense. After all, the customer is always right (if he pays for it). **S.B.**

Grundig VS310

This machine intermittently damaged tape. Grundig Pete spotted it by chance while we were discussing other things. He put a tape in (mine) and it scrunched up! The small, flat copper-coloured guide spring fitted to the top of the audio head had broken off. **S.B.**

Ferguson 3V43/JVC HRD725

The complaint with this machine was intermittent failure to make a timed recording. We confidently changed the loading belt and sent the machine on its way. It was very soon back on our bench with a note to say "same as before". This time we checked the loading process more thoroughly, and found that there was a stiff point in the mechanism at about the half-travel point in the progress of the loading arm. It turned out that loading gear 2 (under the deck) was very stiff on its shaft. It was removed, cleaned and lubricated, and after that the customer didn't report any further timer trouble. Why it never gave trouble on manual record and playback remains something of a mystery. **E.T.**

Mitsubishi HS303

The job card said "picture broken up". It was, too. The head drum was rotating excessively fast, giving loss of line lock on the monitor's screen. Listening to the sound track of a prerecorded test tape suggested that all was not well with the capstan servo either. We found that adjustment of the preset drum speed control VR4A0 would restore correct drum speed, but with the potentiometer's wiper far from the factory setting and with no head drum phase look.

A search for a common cause of this and the capstan speed error led us to check the common reference pulse feed (REF 50) at servo board connector HS7. It was missing here and at its source, pin 5 of the oscillator/divider chip IC603 on the Y/C board. The voltages around this chip were reasonably within tolerance except for that at pin 5,

which was at 5·5V instead of 3·5V. In fact the 4·43MHz crystal X601 had failed: replacing this and resetting VC601 restored normal operation. Although it's a PAL decoder type crystal its output is used exclusively for servo operation – despite the presence of the other faults the colour was normal, once the head speed had been artificially restored to normal.

Our pride at doing this repair was blunted by the fact that the customer's cheque bounced. We're still trying to get paid, but that's another story . . . **E.T.**

Ferguson 3V23/JVC HR7700

In my experience it's unusual for this machine to suffer from tape looping at stop. However this one would sometimes leave a loop of tape hanging from the flap of an ejected cassette. We found that the take-up spool brake was coming on after the supply spool brake because the take-up turntable tyre surface was worn to a smaller diameter than that of the supply turntable. Replacing the take-up turntable and the coil-spring that holds the brakes on cured the problem for good. **E.T.**

Panasonic NV366

The drum motor appeared to have a dead spot. We found that the cable connector on the motor was partially off owing to a tight run of cables. Rerouting the cables and fitting properly cured the trouble. **D.H.D.**

Hitachi VT9500

No sound or vision in the E-E mode was traced to a faulty TA4349 chip (IC909). **D.H.D.**

Ferguson 3V29/30

On playback there were noise bars on the screen, with spaghetti, low sound and the sound led captions as spoken. Resetting the tape guides put matters right.

No capstan drive was traced to a blown Wickman fuse (CPR-D – looks like a transistor). **D.H.D.**

Ferguson 3V29/JVC HR7200

There were two separate faults with this machine. First, when a cassette was inserted the machine would immediately go into slow rewind for a few seconds then stop. Pressing any button would then produce the alarm mode, with all the button lights flashing. The cause of this problem was a worn loading motor. It resulted in the last part of the unloading cycle being missed, so that both the after load and the unload switches were on.

The second problem was very confusing: the machine wouldn't switch off when the tape came to an end in either direction. Operating the machine without a cassette in, with the end sensors blanked and then exposed to light, proved that they were working. After much headscratching we found the cause of the problem. The cassette lamp had slipped down its holder. It still shone brightly, but was too low for the light to operate the sensors. **M.D.**

Philips VR6462

The problem was very low playback and E-E luminance. We checked the CVBS signal output from signals panel P302 and found that the luminance was missing. When we checked back to the TDA3740 chip IC7251 we found that there was no signal input. We moved back to the BC548 emitter-follower transistor T7301 and found that there was a signal at its base but not at its emitter. A check on the emitter voltage showed that it was high and unstable.

Changing the transistor made no difference but when we checked the resistance from its emitter to chassis we found that the reading indicated an open-circuit instead of around 400Ω (via L5201/2/3/4 and R3202/3). L5202 turned out to be open-circuit and when replaced we had normal luminance. **M.D.**

Toshiba V9600

This machine was continuously trying to load. The trouble was caused by QL82 in the loading motor drive circuit being short-circuit. **M.D.**

Amstrad 4600

This machine was brought to us brand new in a box. Its owner had travelled 350 miles from London where he'd bought it at a very discounted price. It was too much trouble for him to take it back under guarantee, so we got the job. The problem was that when play was selected the machine would go straight into forward search. All other functions worked correctly. A circuit was obtained – eventually. We then had to find a magnifying glass to sort out the very small print layout and wiring diagram. This was on the outside back page and was already tatty when we received it.

We noticed that there are capstan forward, reverse and fast commands from the microcomputer chip. These appeared to be correct when the relevant keys were pressed. When play was selected the voltage at pin 7 of the BA718 operational amplifier IC302 was lower than when search was selected. The output at pin 8 didn't alter however, so we suspected the i.c. This was duly ordered and after several weeks arrived. Fitting it cured the fault, and the customer was given a bill which meant that his trip to London turned out to be expensive.

This was the first time we've seen the inside of one of these machines. We were stuck by how well they are laid out and manufactured. Picture reproduction is also excellent. **M.D.**

Hitachi VT64

This machine would load the tape, play for about five seconds then unload. We found that the drum flip-flop signal from the servo i.c. was of reduced amplitude. Checks were made around the servo and syscon microcomputer chips but nothing we did restored the flip-flop signal to its correct amplitude. The flip-flop signal is also fed to the Y/C panel, and although the circuit diagram gave no clues as to what could be wrong here all became clear when the panel was removed – a liquid had been spilt into the machine at some time and was loading the flip-flop signal. The odd thing is that no other traces of liquid spillage could be found. **A.D.**

Grundig VS180

There was no clock/counter display. Checks around the clock chip revealed that the 256Hz clock pulses were missing. They come into the keyboard panel from the control panel on two matrix lines designated K4 and K8, and are generated by IC245 and the associated 32kHz crystal. We found that the 32kHz oscillator had stopped due to shorting vanes in an associated trimming capacitor. **A.D.**

Long-distance Television

Roger Bunney

January was a very poor month with little DX reception of any note. Since writing the last column however reports from several enthusiasts mention some quite startling Meteor Shower reception during the Quadrantids shower on January 4th. Peak activity seems to have been from around 1430 to 1600, during which time there was reasonable reception in Band I and, for the more vigilant, Band III signal pings were noted. Sweden ch. E8 was received by Simon Hamer (Powys) for example while Ryn Muntjewerff in the Netherlands logged several Scandinavian transmitters including YLE (Finland) chs. E5, 8 and 9!

There was above average auroral activity during January. Quite strong reception as far south as the Midlands was noted on the 6th, with the usual USSR/Norwegian TV. A longer period occurred over the 13-16th, the 14th being particularly active – the first phase started at around 1500 and, after a gap, the second phase ended after midnight.

There was just a little Sporadic E reception during the month, as follows:

8/1/88 TVE (Spain) chs. E2, 3.
11/1/88 TVE E3.
15/1/88 TVE E2, 3, 4.
16/1/88 West Germany ch. E4.
17/1/88 TVE E2, 3, 4.
19/1/88 NRK (Norway) E2, 3; TVP (Poland) R2.
20/1/88 TSS (USSR) R1; RAI (Italy) IA.
26/1/88 CST (Czechoslovakia) R1; DR (Denmark) E3; TVE E2, 3.
29/1/88 TVE E2.
31/1/88 TVE E2, 3.

My thanks to Simon Hamer (Powys), Roger Fussell (Torpoint), Iain Menzies (Aberdeen), David Oliver (Birmingham) and Ryn Muntjewerff (Holland) for sending in reception reports.

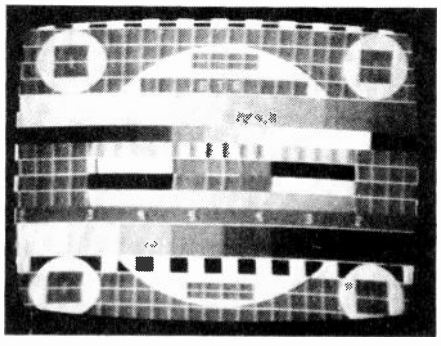
It seems that the Sporadic E season down under has been far from a good one. Robert Copeman (Victoria) and Todd Emslie (NSW) comment on the indifferent conditions in comparison with a "normal" season. On the 13-14th however Todd had the bonus of Band II f.m. radio reception from stations at Auckland and Manavatu in New Zealand, a distance of some 1,400 miles. Four stations were received in all, via tropospheric propagation – an excellent result. Strange that no NZ TV was seen at the time. On the west coast Anthony Mann (Perth) reports reception of Malaysian TV ch. E2, Philippines ch. A2 plus weak USSR ch. R1 and China ch. C1 on December 16th. The following day gave him NZ TV for some ten hours. The best day seems to have been the 12th, with Malaysia chs. E2, 3 and 4. Otherwise Anthony reports that the SpE season has been a "non-event".

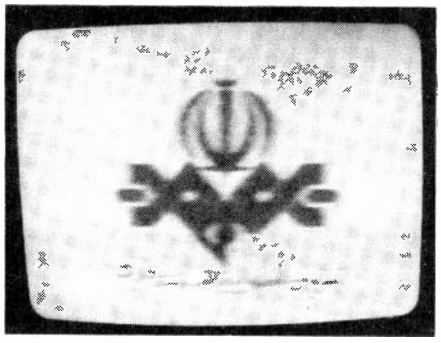
There is little else to report this month. The January IBA Engineering Bulletin contains useful data on aerial stacking for interference reduction and information on DBS/D-MAC – worth reading. There has been mutual jamming of the Iranian and Iraqi TV services in the Gulf: all transmission levels are being increased!

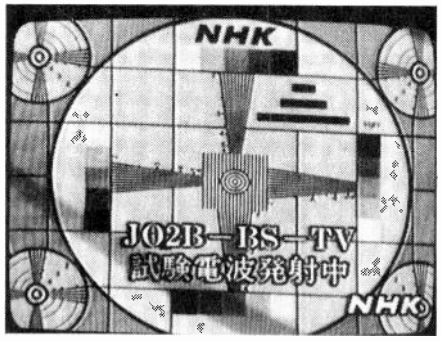
News Items

UK: The Home Office has registered with the ITU its intention to use chs. 35-38 for broadcasting purposes. This seems to confirm the government's aim of providing a fifth TV service quickly.

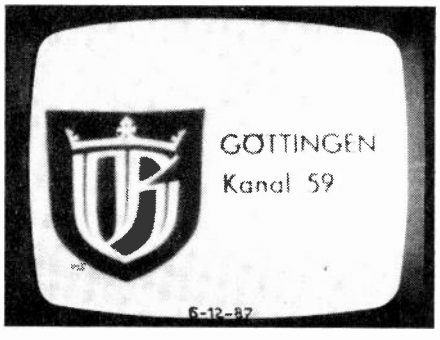
Ireland: There have been further discussions on the

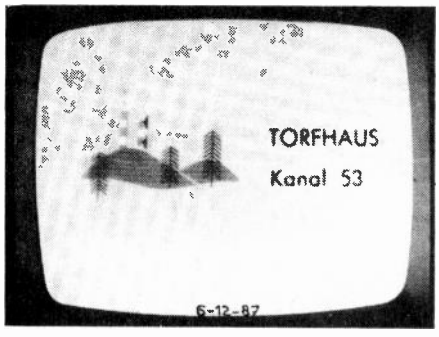






Left: The USSR (TSS-1) UEIT test pattern with MTR or MTP identification, received by Garry Smith (Derby) during an SpE opening. Centre: IRIB (Iranian TV) received in Lincoln by Ian Walker from the Intelsat V F5 satellite at 63°E. Right: A Japanese local station test card photographed by Fred Robins during a visit to Japan.





Left and centre: W. German u.h.f. transmitter identification slides photographed by Ryn Muntjewerff (Holland). Right: French Antiope text message for travellers, transmitted via the TF1 service.

provision of a third national Irish TV service covering both urban and country areas. RTE-1 and -2 will not loose any channels to make way for the projected new service, which government sources hint might make use of "new technologies" such as microwave distribution and cable – many areas of the republic are extensively cabled.

West Germany: The recently opened ch. E46 transmitter at Hamburg is now running at 1·7kW. The power will be increased to 15kW in July. From April 1st the transmitter will carry RTL+, time sharing with Tele-5. The ch. E48 Hamburg transmitter is to increase power during the summer (currently 0·6kW) and will carry SAT-1. WDR-3 is now called "West 3", with the logos similarly modified: transmitter identifications used are "WDR 3" and "DBP WDR 3".

Poland: A new main transmitter for TVP-2 has come into operation at Klodzko near the Czechoslovakian border. It carries the TVP Wrocklaw regional programme on ch. R38, with 300kW e.r.p. TVP-1 transmissions from the same site are on ch. R52.

Denmark: The Vendeyssel transmitter has moved from ch. E51 to ch. E57, at 22kW e.r.p.

Satellite news: The American PAN-AM satellite is expected to be launched into orbit at 45°W this May. It will have three downlink transponders covering Europe, at 11·5, 11·58 and 11·66GHz with horizontal polarisation, plus 4GHz capability directed at South America. The uplink will be from Miami, Florida.

Pakistan is expected to launch a satellite, Badar A, this summer. It will carry telemetry and telecommunications and remain in operation for two years. This summer will also see the launch of the third Indian satellite, "Insat C". Insat B is at present in great demand but there are no back-up transponders.

The Spanish "channel 10" is being carried by Intelsat VA F11 at 27·5°W. It was noted on January 23rd with video tests and two-channel sound, switching between 525/625 lines.

The third Aussat craft went into orbit last September. Interesting to note that for nationwide TV distribution a modified standard called "E-PAL" is used. It has inverted sync information and high-quality digital audio. The audio system uses adaptive delta modulation with the subcarriers at 6·6, 7·38 and 7·56MHz.

Band I

An increasing number of European countries are allowing amateur radio use of the 50MHz band. In France class A licence holders are to be permitted 50MHz operation under the following conditions: no operation within 150km of a ch. L2 transmitter, 3W maximum output within 150-200km and 30W maximum beyond 200km.

The use of baby alarms in the 49MHz low-power device band has been permitted since November 1986, provided the output does not exceed 10mW. A DTI consultative paper suggesting the establishment of a 12·5kHz segment within the 47MHz band for high-power car alarms (up to 100mW output) is at present going the rounds.

From our Correspondents . . .

David Oliver (Birmingham) reports that from time to time he receives Children's Channel and CNN on ch. E21. The signals are relatively weak and a narrow i.f. bandwidth is required to resolve and identify them. The source seems to be one of the illegal videosenders that can be fed with audio and video from a satellite receiver or VCR and up-convert the signals to u.h.f. for, theoretically, distribution within the home. In view of the fact that high-level signals can be present at 100 or more yards from the source we recommend that the local DTI is told about any transmissions of this type.

Dutch radio amateurs have "jumped the gun" and are producing severe interference in many areas at 50MHz – the main Rotterdam cable system uses ch. E2 to distribute WDR-1 for example. Gosta van der Linden reports that Nederland 3 is now on test with teletext and dual-channel sound. The PM5544 test pattern is used, with identification "PTT NED.3": Radio 5 is carried on sound channel 1 (left) and Radio 1 on sound channel 2 (right).

Ian Walker (Lincoln) has sent us a photograph of IRIB (Iranian TV) reception from Intelsat VF5 at 63°E. Ian used a 1·2m dish at only 5° elevation to receive the 11·155GHz signal. It's possible to receive this satellite over most of the UK provided a clear take-off to the south east is available.

Des Walsh (Co. Cork) has spent a holiday travelling around East Germany. He reports that Band I no longer seems to be in use there though the band remains popular for the reception of signals from West Germany, Poland, etc. Two Soviet TV channels are available over most of the GDR, though with poor quality sound and hum in some areas. Elaborate u.h.f. arrays with upwards of 40 elements are widely used, some consisting of a combination of Yagi and log-periodic principles. For Band III reception the traditional long-Yagi is widely used, variations including a full-wave dipole/reflector system. Nine channels, including two GDR, two Soviet, three West German, UK Forces (SSVC) and a French language forces service were available at a hotel he stayed at in East Berlin. In Leipzig he found that Czech TV is available on the town cable. The only imported TV equipment seems to consist of PAL/

SECAM Sharp receivers that sell at the equivalent of around £2,100 and small radio cassette/mono TV receivers selling for around £700. SW radios are available but no scanners and no video equipment was seen.

Insuring Satellite TV Equipment

Having invested in some TVRO equipment I was naturally concerned about the possibility of theft. The dish support frame is chained to a nearby tree by means of very thick steel chain (through the actual metalwork) and heavy padlocks. Thus to remove the system would involve cutting the chain, cutting or dismantling the frame – or cutting down the tree! However it could be done, especially at night, while a knowledgeable person might remove the head electronics. Mindful of a friend in Maidstone who returned home to find that his 6ft spun dish, feed, electronics, motor etc. had been stolen I decided to check on the possibility of insurance. Since my house contents are covered by an Eage Star "home all-in" policy I first rang them. It seemed that the only insurance they could offer was against lightning strike! Amateur Radio Insurance Services Ltd. (Quarry Street, Guildford) insure my receiving equipment, so they were approached next. They could offer insurance provided the equipment was used for amateur radio activities. When I pointed out that the equipment is used for amateur and entertainment purposes and for technical experimentation they regretted being unable to help.

I next asked a local broker whether he knew of a company that would insure domestic satellite TV receiving equipment without charging a very high premium. He was unable to suggest a particular company but felt that the current house contents insurance company would be prepared to take it on as a service to an existing customer and change a small premium. Back to Eagle Star. After putting the matter to them in writing I received a reply indicating that they were prepared to extend the policy to cover theft of the dish, cables etc. for an additional premium of £5 provided the system is padlocked as described. A subsequent letter of confirmation stated: "A satellite receiving dish and cabling is insured while in the open within the boundaries of the land belonging to the home against loss or damage caused by events in paragraphs 1 to 11 of this section for a sum insured as shown in the table of cover. Any loss, damage or amount shown as not insured under paragraphs 1 to 11 of this section is not insured." The various paragraphs referred to cover such events as fire, lightning, earthquake, storm, flood, subsidence, theft or attempted theft, riot, vandalism, water/oil escape, collisions, damage from trees/branches, etc. It seems to me that insurance cover for the low premium involved is well worthwhile.

I have discussed this matter with others who have confirmed that precautions are required before cover is granted. It's possible to devise a basic alarm consisting of a loop of cable within the main cable run (where the cables have polarotor/dish motor wires) so that a relay falls out and bells ring should the main cable harness be unplugged or cut.

I apologise for going into this matter at such length but do feel that it's important – many uninsured satellite TV systems are sitting in gardens inviting unwanted attention. I'd like to hear from others on their insurance experiences, and from anyone who knows of a company that welcomes such equipment.

Tussles with TVs

Ged Whitney

A little while ago, during an absence from my usual employment, I called in at the local car spares shop to see how large my account (slate) had got. Now the chap who looks after the place is a very decent type, and I often spend more time than is necessary simply chatting about this and that. Anyway, the conversation got around to the Pye Model 160 (169 chassis) I'd flogged him a year ago – actually a swap for a set of brake shoes. The thing had expired and could I . . . Well, of course . . .

A quick inspection without tools revealed an obvious burn mark in the heater section of the dropper resistor, so I headed off home for my instant heat gun etc. On my return Joe had the kettle boiling nicely and I set to. I'd a vast selection of dropper sections to replace the 147Ω one – 130Ω, 150Ω, 200Ω or nothing. I chose the 150Ω, 10W job. With this lashed in position the valves, other than the DY802 e.h.t. rectifier, lit up. There was plenty of voltage at the DY802's anode, but no picture. The DY802 seemed to be innocent so I dug out its base and tested the length of resistance wire that passes as a heater ballast resistor in these sets. Nope, not that! I next tentatively scraped the oxide off the valve pins. This time success! Failure of the heater to light had clearly been due to the dirty pins.

In these old bangers the line hold is set using the core of the line oscillator coil. This one was rock solid of course – even an application of 3-in-1 oil wouldn't budge it. In my meagre collection of capacitors there sat a 220pF mica one. Connecting this across the coil locked the line exactly! Just to be sure I stuck the only ceramic trimmer I had with me (60pF) in as well to obtain optimum adjustment.

As I made to leave, Joe offered to pay me. Naturally I refused! So he said "tell you what" – and tore up my slate . . .

A Sanyo CTP3101

The customer told Dave that his Sanyo CTP3101 "just blacked out during a horror film". I can imagine the shock being too much for the mild-mannered Japanese electronics. After a lot of faffing about with the scope, and replacement of D202 and Q203 with no results, replacement of the mixed blanking amplifier Q432 cured the problem. A BC107 can be used in the Q203 and Q432 positions.

The Hitachi NP6C

Which brings me to the saga of the Hitachi NP6C. This little number wouldn't start at switch on, so I bridged the start-up capacitor C910 with a 10kΩ, 2W resistor. This should have made the multivibrator Q901/2 oscillate. The scope said that it did, but this didn't start the set (this is all that Q901/2 do). A shufty around with the meter revealed that there was no 12V supply – it's obtained from the line output transformer. The rectifier diode CR705 was o.k. but the surge limiter resistor R733 – at the other end of the winding – was open-circuit. A new diode went in anyway (1N4001 in place of the V09C) and the set then went on soak for two days. After that it went home, only to come back a week later.

Once again it wouldn't start, but this time 12V was available at R733, so things like the 12V supply reservoir/smoothing capacitors C735/6 being leaky could be ruled out. Line drive appeared momentarily as the set tried to come on and for want of a better idea I replaced C910 – with instant success. But the set was back a week later.

This time I went through the whole set systematically. The scope proved its worth in revealing lack of line drive at switch on. Ah-ha, so the resistor supplying the line driver transformer was open-circuit. No, it just had a bad joint. Anyway we didn't see the set again after putting this right and have lived almost happily ever since.

Ex-Granada Tandbergs

A while back Granada released a number of Tandberg series 2-2 sets. My mate John got a few in and pointed me at one of them. These are the ones with the switch-mode power supply in a tin box at the bottom of the large vertical chassis. This power supply is of the original discrete component self-oscillating Siemens type, and is subject to the same set of nastys one gets with the Rank/Bush T20 etc. The mains fuses and other bits like the mains bridge rectifier and filter capacitor are on a little panel at the back of the main chassis, screwed to the cabinet base.

No-action sillys like the surge limiter resistor R981 (4·7Ω) or the chopper current sensing resistor R982 (1Ω) being open-circuit are commonplace. Slightly less amusing is when D991 (1N4148) goes open-circuit with the result that the crowbar thyristor Q981 (2N4442) either operates or goes short-circuit. The biggest silly is removal of rectifier board R and its replacement minus the mounting screw. This will lead you a merry chase, as it did us, since the set will trip as soon as it's turned on.

Failure of D802 (1N4148) in the field oscillator circuit is a common cause of field collapse. In this event applying a screwdriver to the base of Q803 will result in a short scan due to hum pick up. When D802 is tested it will tell you it's o.k. But it's a liar, as replacement will usually cure the fault.

The EW modulator diodes D750/1 can set light to the line output panel (not seriously though) as they self-destruct. Use BYX55-600s.

A blank white screen is probably due to Q5 (BC158) and the associated diode D3 (1N4148) in the a.g.c. circuit being short-circuit. Voltages in the i.f. strip (panel F) are as follows:

Transistor	*Emitter*	*Base*	*Collector*
Q1 BF195	—	2·5V	9V
Q2 BF196	2·3V	3V*	7·5V
Q3 BF196	3·5V*	4·5V	9V
Q4 BF197	1·5V	2·2V	9V
Q5 BC158	4·8V	2·8V	1·5V

*Average

The symptoms when Q3 or Q4 is leaky are loss of sync and no colour.

Failure of the TBA990 chroma demodulator chip U450 causes uncontrollable brilliance with flyback lines. Failure of the TBA530 matrixing chip U300 can cause no vision at all.

C700 (0·1μF) on the c.r.t. base panel is another possible cause of no vision. It goes short-circuit, removing the c.r.t.'s grid bias.

These sets often bear the name Viking. The Granada model numbers are C22NV2 and C26NV2.

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GRUNDIG CUC220 CHASSIS

The original fault was a defective sound i.c. When this was replaced the set became intermittently dead. Various components in the chopper circuit were changed, on the suggestion of Grundig, but the intermittently dead fault remained. After changing the TDA4600 chopper control chip the set worked all right for two days then the fault returned.

A very common cause of this problem is the 270kΩ resistor R646 in the power supply. Replace it, because it can fail in an intermittent way. The only other common causes of this have, in our experience, been dry-joints on the chopper transformer TR651 and a faulty BU208A chopper transistor.

SONY KV2000 Mk II

The original problem was a dead line output GCS. A check using a separate 18V supply showed that the line oscillator was working, and no other fault could be found. So a new SG613 was fitted and the set was fired up using a variac. It was then put on soak test for twelve hours at 240V. The SG613 died instantly at switch on next day. The Keith Cummins line output transistor modification (March 1985) was carried out, but despite fitting the suggested line driver transformer heatsink neither this nor the heatsink for the BU208A can be held for more than a few seconds. A further fault has also appeared – erratic PAL switching about four minutes after switch on. Decoder adjustments have no effect on this.

The ident circuit is driven from pin 6 of the line output transformer, so the colour reversal problem is almost certainly part and parcel of the line output stage fault that's causing overheating of the line output transistor and killed the original GCS. It's likely that there are one or more shorted turns in either the line output transformer T801 or the flyback transformer T851. Whichever transformer is faulty will probably run warmer than the other – our experience suggests that T851 is the most likely culprit. We've also had short-circuit turns in the feed choke L807, which is cheaper than the transformers!

HITACHI VT9500

On play or record the tape laces, the field and line stabilise to a blank screen then the machine stops. If on timed programme the above happens but the r.f. side stays on, i.e. the picture can be viewed on a monitor. The machine works perfectly in all other respects. To start with the fault occurred a couple of times a week, then got worse. Now you have to wait five-ten minutes for the machine to work normally. No information is given on lubrication – is any necessary?

The lace-unlace symptom usually indicates that the load-end switch is not being closed. In this model the cause is almost invariably a slipping loading belt, at the extreme rear of the deck. There is little or no need for lubrication with this machine: the guide slots and any shafts that squeak in operation need occasional lubrication.

REDIFFUSION Mk 4 CHASSIS

Every two-three months the line output transistor goes short-circuit and 4R2 springs open. Replacing the transistor and resoldering the resistor restores normal operation – for two or three months. Any suggestions?

This fault has cropped up several times and is generally caused by a dry-joint at corner pin A of the chopper transformer 4T1. The solder defect will not necessarily be visible. Retin and resolder the pin, also the others around 4T1.

SANYO VTC5300

When a cassette is inserted there's a whirring sound but the tape doesn't lace up. Pressing stop has no effect and the tape will not eject. None of the operating keys will function but the light comes on when fast forward is pressed even though the tape doesn't move. Eject works with the machine empty.

The loading ring is driven by the reel drive motor via the loading roller then a belt and gears. If the motor is turning it's likely that the loading roller or belt is worn and thus slipping. If the motor doesn't turn, check the cassette down switch before suspecting the motor itself.

AYR TELETEXT ADAPTOR

The display has gradually started to judder when the adaptor and TV set are first switched on. After the set has warmed up the display has a shimmering effect from side to side. The set produces a normal picture when not used with the adaptor.

Our advice, based on experience of this unit as it ages, is that you check all the electrolytic capacitors, starting with those in the power supply. Replace any that are suspect. They tend to dry-up with age, giving rise to various symptoms including those described.

JVC HR3320

On record and playback the whole picture has a very bad side-to-side wobble. The pinch roller has been replaced without improving matters.

Lateral picture wobble is generally caused by head drum speed variations. In view of the age of the machine it's likely that the drum motor is worn, in which case replacement is the only sure cure. Before condemning the motor, check the settings of the drum discriminator and sample position potentiometers on the audio/servo board – set them up as specified in the manual.

PHILIPS G11 WITH TELETEXT

The sound is normal but there's a bright blank raster with flyback lines. When checking around I found that the 2A fuse on the small regulator panel that supplies 5V to the teletext decoder had blown.

Remove the RGB lead from the teletext decoder. This is the thick black lead with red, green and black inners going from the side of the teletext decoder to the interface panel mounted at right-angles to the colour decoder panel. If this action restores the picture the trouble is in the teletext part, if not it's in the TV section – usually dry-joints on the line output panel. Trouble on the small regulator panel is

usually due to the smoothing electrolytic going short-circuit and blowing the regulator. First isolate the feed to the teletext decoder in case there's a short on this board.

TEST CASE

304

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.

Field judder is not a fault one often encounters in a modern TV set. In days of yore it could usually be cured by replacing a valve, but this set didn't have any – in fact it was a Ferguson model fitted with the TX10 chassis, main panel PC1550.

To some degree the problem was intermittent, though the image was seldom perfectly stationary. Most of the time the entire picture would bounce and judder vertically, the peak-to-peak movement being perhaps 5mm. The first move made by Techno-Supersleuth was to try adjustment of the field hold control RV771. This had no effect on the judder, but would roll the picture in either direction at the extremes of its travel. TS, who'd been around in the valve days, knew that faulty electrolytic capacitors could cause this sort of thing. Accordingly he replaced C773, which decouples the 12V supply to the hold control network and the TDA1044 field timebase chip IC771. This had no effect whatsoever on the fault. Still persuing the jittery capacitor theory, C774, C778 and C781 around the chip were checked in quick succession, by substitution. Still the picture juddered vertically, and Sleuth's ashtray was filling up rapidly. He also started to insult his colleagues at nearby benches, a sure sign that he'd got a difficult one on his hands.

Lunch time brought welcome relief. Returning from the King's Head afterwards, the better for two pints of ale (so he thought), Sleuth settled down behind the Ferguson with a determined air. He cleaned and twiddled the linearity control, and squirted everything to do with field deflection with freezer. Seeing little or no change, he next cruelly played a hairdryer over the same area until the board and the bits were hot enough to fry an egg on. Under this onslaught the picture jittered a little more, then a little less, but still jittered.

Sleuth fitted another TDA1044 chip, and after one look at the screen put the old one back in the stores. Seeing that the field sync pulses come from the TDA2576A sync processor chip he changed that too. The picture continued to jitter. Still the fault hadn't been cured, so advice was sought from others around the workshop.

The most credible suggestions he received, from three different quarters, were first that the flyback generator transistor was faulty (not a good one!), secondly that the a.g.c. circuit was in trouble, corrupting the field sync pulses, and thirdly to get another TX10 chassis and compare readings. Sleuth tried another ZTX450K flyback generator transistor, replaced the a.g.c. smoothing capacitors C35, C36 and C38, and called the set names which cannot be recorded here. Finally he got another TX10 chassis, hooking one to the raw mains supply and the other to an isolating transformer so that the chassis could be connected together. The errant set was then fed with field sync pulses, at pin 8 of its TDA1044 chip, from the known good chassis. The same screen showed the same juddering picture.

The cause of the problem was in due course found and cured, and probably would have been more quickly had Sleuth pursued his original policy more thoroughly or someone had asked the fundamental question – what is supposed to move the picture vertically? For the answer, see next month.

ANSWER TO TEST CASE 303
– page 371 last month –

Last month's test case was quite a brain teaser. The Hitachi VT8500 VCR in question was knocking a hole out of the carrier signal it recorded on tape at the beginning of only one head's sweep. Considering the fact that the effect was found to disappear a few seconds before the end of each recording, it seemed that the problem was somehow related to the tape's linear motion.

Now it takes a few seconds for a point on the tape to travel the distance between the head drum and the audio head assembly. Part of the latter is the control track head, which records one pulse for every two video tracks – the control track is laid down along the bottom of the tape.

In this machine the audio/control head assembly had been set slightly too high, so that each control pulse clipped (erased) a bit from the bottom of alternate video tracks. In fact the video recording process carried out by the rotating heads was fine, and the section of tape in transit at any time between a video head and the audio/control head assembly carried a perfect video recording. Hence the fact that the last few seconds of each recording played back properly.

How did the audio/control head assembly come to be out of alignment? You'll recall that the machine had received attention elsewhere. They'd plainly replaced or adjusted the audio/control head assembly and left it just high enough to reach the vision tracks, but not so high that the recording of audio and control track signals was impaired.

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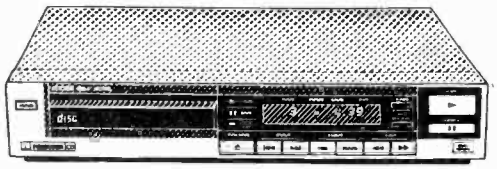

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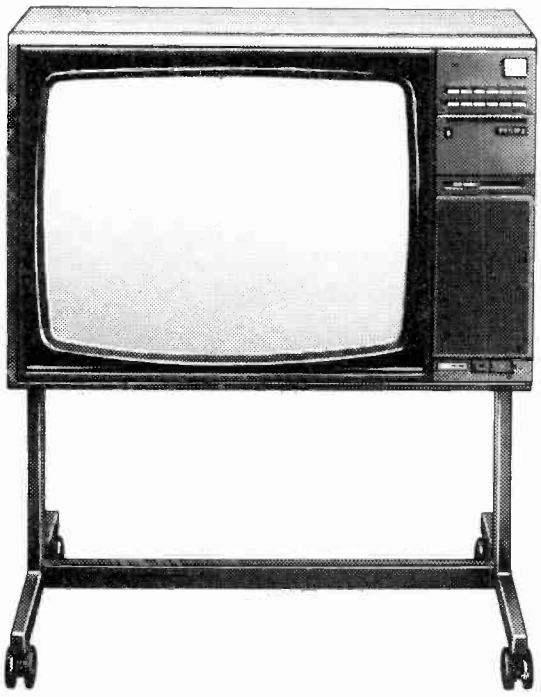

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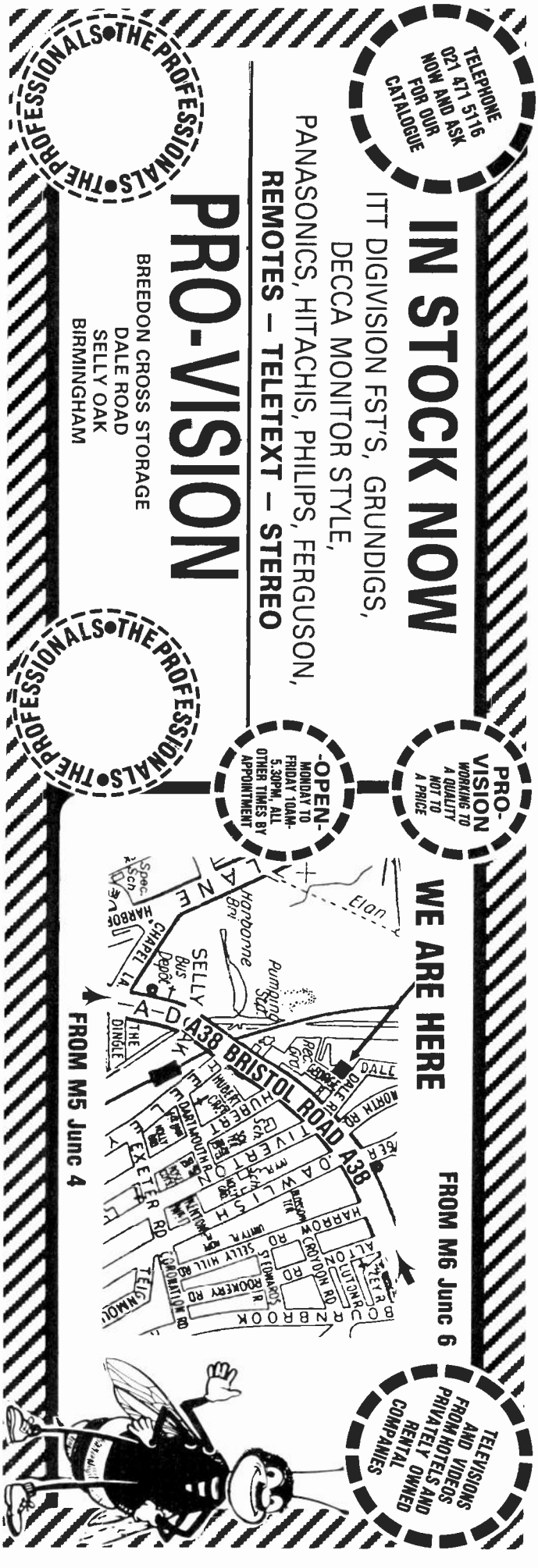

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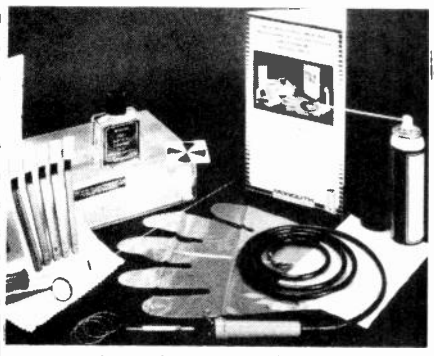

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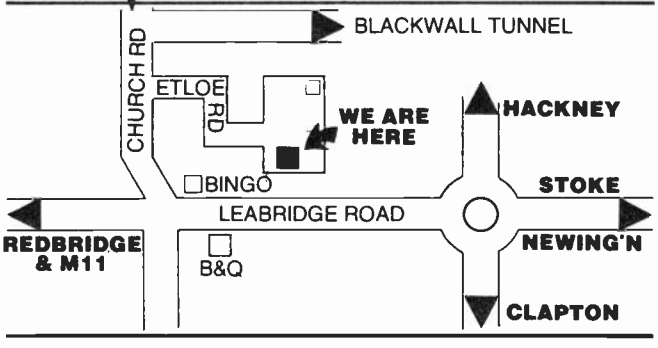

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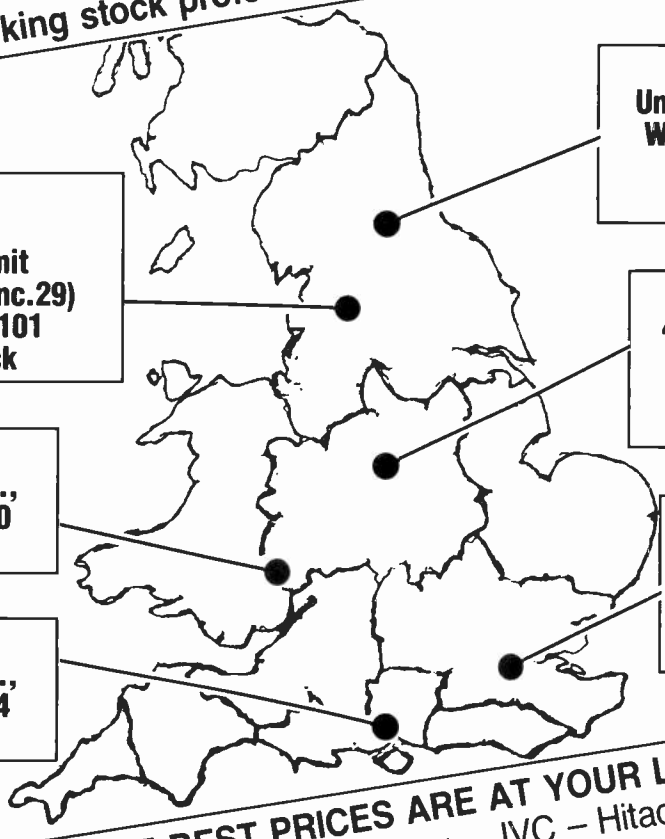

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2SA-921	£0.10	2SC-380	£0.12	2SC-1514	£0.75	2SD-313	£0.30	AN-5111	£3.50	BA-5404	£1.20	TIP-33A	£0.50	VBS-7000	£2.40
2SA-940	£0.45	2SC-458	£0.15	2SC-1584	£5.50	2SD-315	£0.75	AN-5410	£2.80	BA-6109	£1.40	TIP-41	£0.22	VBS-9000	£0.80
2SA-950	£0.25	2SC-460	£0.06	2SC-1586	£5.50	2SD-325	£0.45	AN-5431	£2.20	HA-1124	£1.25	TIP-41B,C	£0.23		
2SA-958	£0.75	2SC-495	£0.60	2SC-1627	£0.20	2SD-352	£0.50	AN-5435	£1.80	HA-1125	£1.25	TIP-42	£0.25	*HITACHI*	
2SA-968	£0.75	2SC-496	£0.75	2SC-1667	£1.40	2SD-357	£0.35	AN-5440	£2.15	HA-1137W	£1.35	TIP-42A,B	£0.22	VT-5000E	£1.55
2SA-985	£0.60	2SC-497	£1.50	2SC-1669	£0.75	2SD-358	£0.35	AN-5510	£2.50	HA-1151	£1.25	TIP-42C	£0.24		
2SA-992	£0.30	2SC-536	£0.06	2SC-1670	£0.75	2SD-381	£0.90	AN-5612	£2.80	HA-1156	£1.30	TIP-48	£0.37	*JVC*	
2SA-1048	£0.10	2SC-644	£0.25	2SC-1675	£0.10	2SD-386	£0.75	AN-5700	£0.60	HA-1196	£1.30	TIP-102	£0.50	HR-3330	£2.00
2SA-1060	£1.50	2SC-681	£1.95	2SC-1722	£0.50	2SD-388	£1.80	AN-5720	£1.25	HA-1197	£1.20	TIP-105	£0.48	HR-7200	£0.75
2SA-1062	£1.20	2SC-693	£0.25	2SC-1756	£0.45	2SD-389	£0.95	AN-5722	£1.35	HA-1319	£1.45	TIP-121	£0.40	HR-3360	£1.95
2SA-1094	£1.90	2SC-710	£0.20	2SC-1760	£0.75	2SD-400	£0.15	AN-5730	£1.35	HA-1366W	£1.75	TIP-125	£0.40	HR-4100	£1.95
2SA-1102	£1.90	2SC-717	£0.25	2SC-1775	£0.15	2SD-401	£0.45	AN-5732	£1.25	HA-1366WR	£1.75	TIP-126	£0.40	HR-6500	£2.25
2SA-1104	£2.05	2SC-733	£0.25	2SC-1815	£0.15	2SD-426	£1.50	AN-5738	£1.00	HA-1367	£3.60	HCF4001BE	£0.18	HR-3300	£2.55
2SA-1106	£1.50	2SC-738	£0.25	2SC-1819	£0.71	2SD-428	£1.50	AN-5900	£1.50	HA-1374	£1.99	HCF4008BE	£0.50	HR-7700	£0.77
2SA-1110	£0.45	2SC-741	£1.95	2SC-1845	£0.15	2SD-438	£0.30	AN-6248	£1.20	HA-1377	£2.00	HCF4017BE	£0.52	HR-7650	£0.77
2SA-1142	£2.90	2SC-783	£1.10	2SC-1875	£2.40	2SD-468	£0.25	AN-6249	£1.20	HA-11225	£1.70	HCF4025BE	£0.25		
2SA-1145	£0.20	2SC-789	£0.35	2SC-1890	£0.20	2SD-476	£0.45	AN-6250	£0.40	HA-11227	£1.00	HCF4028BE	£0.48	*NATIONAL*	
2SA-1147	£1.90	2SC-790	£0.90	2SC-1906	£0.25	2SD-478	£0.90	AN-6320	£2.00	HA-11235	£1.70	HCF4050BE	£0.32	NV-333	£1.35
2SA-1156	£0.60	2SC-828	£0.15	2SC-1913	£0.90	2SD-525	£0.75	AN-6338	£5.00	HA-11244	£1.65	HCF40103BE	£0.99	NV-8600	£1.65
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2SA-1232	£1.80	2SC-929	£0.15	2SC-1941	£0.40	2SD-612	£0.40	AN-6360	£2.80	HA-12002	£1.70			NV-7000	£0.95
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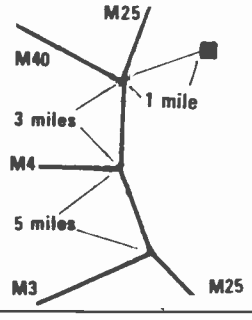

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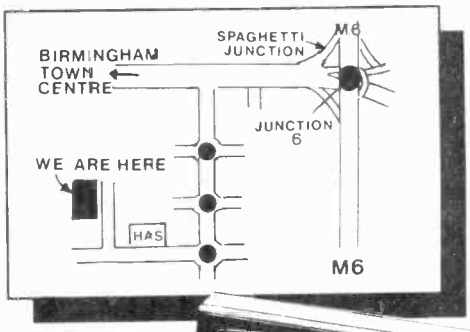

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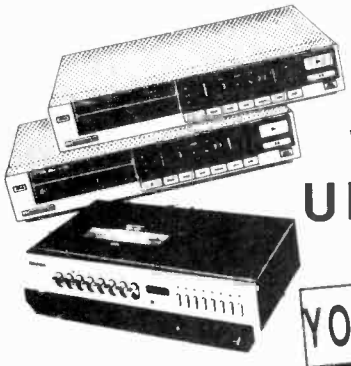

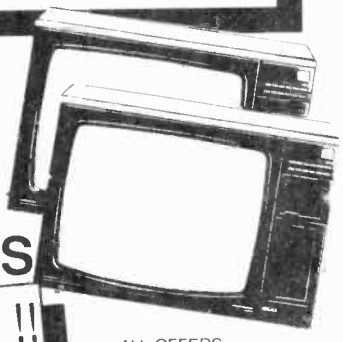

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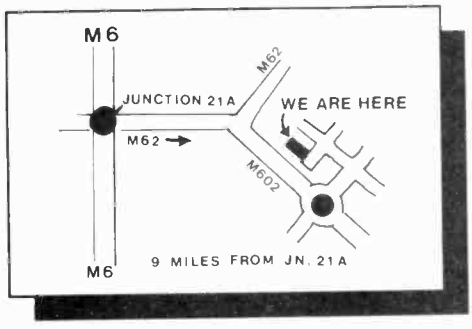

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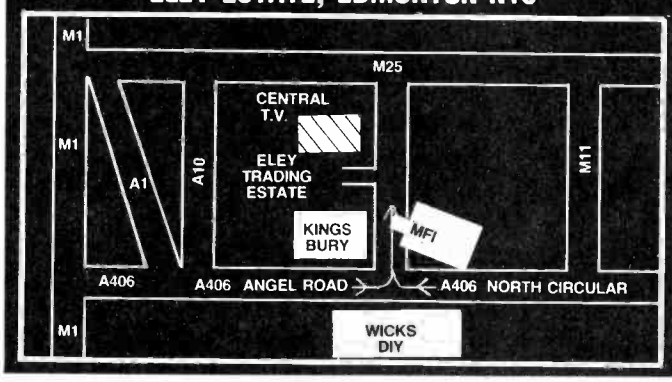

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	A51-570X	510VSB22	560EGB22	370KXB22	470FWB22
	A51-580X	A56-510X	A66-510X	420FTB22	520KB22
	A51-590X	A56-540X	A66-540X	470NUB22	520NB22
	A51-701X	A56-701X	A67-701X	510YXB22	520SB22
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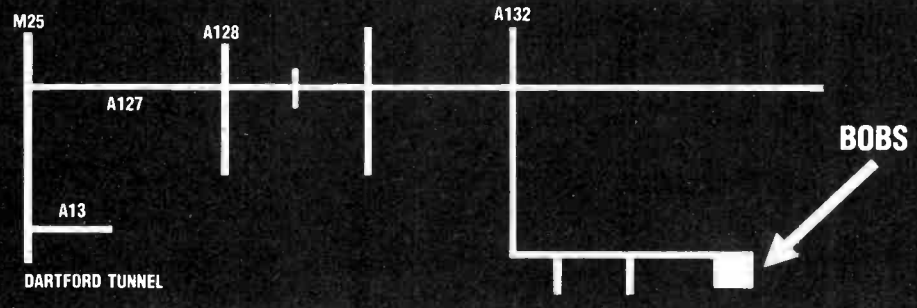

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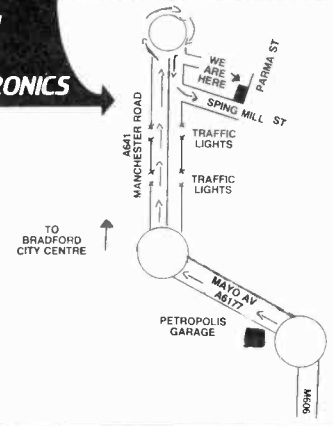

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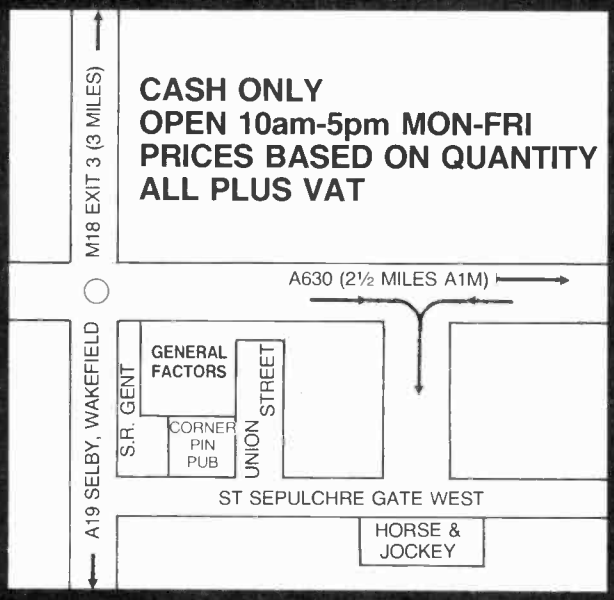

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The above equivalent video heads are new. For reprocessed heads send old head. Sharp and Mitsubishi models @ £37.50 and most 4 head VHS types @ £45.00.

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Ferguson/JVC (Mechanical models)	£21.45
Sharp VC9300, VC9500 etc.	£26.60

Reel Motors

Sanyo VTC5000, 5150, 5300, 5400	£7.90
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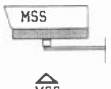

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PHILLIPS VR 6400, 6420-£29.

SABA All models except VR 6028, 6038.

SAISHO VR 100, 605, 705, 805, 905.

SANSUI SVR 5030, 7010, 7020.

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SHARP (VC 581, 582, 583, 651, 682-£36. (VC9 110, 200, 220, 300, 381, 384, 385, 386, 387, 477, 481, 482, 970, 9100, 9300, 9400, 9500, 9600, 9800, 3300-£35). (8300 send old head for rebuilding-£36).

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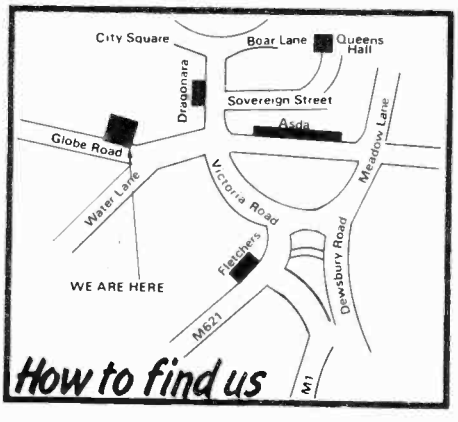

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KT 3	"	£55
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Hill Deluxe Universal Ni-Cad Charger **£6**

Nickel Cadmium Battery Charger AA-C-D-PP9 **£4.50**

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

6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit **£8**

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

PHILIPS' MIN. HEAD PHONES **£1.50**

Electronic Buzzer **60p**

15V, 015V, 1A Print Type Trans **£1**

Philips' Video Cleaning Cassette SBC461 **£6**

Philips' Headphones Compact Disc Stereo Type **£10**

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 **£20**

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 **£1**

RGP30K **10p**
RGP30G **8p**
RGP10B **5p**
RGP15G **6p**
T6024WGI **10p**
GP15Q **10p**

THORN RGP80G **30p**

Multi Core **£4.50**
60–40 Soldar 500G 20 SWG **£5.00**
15 Watt Stereo Amp Sanyo Module with Data **50p**
PHILIPS
25 Watt Solder Iron **£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**
Weller solder iron 15 watt/25 watt **£5.00**
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V **60p**
100 Coax Plugs **£12.00**
De-solder pump + 2 nozzels Philips **£4.00**
Flat Red LED and Green **5p**
500gm 60/40 solder reel **£6**
Solder 1 kilo reel **£5.50**
Dual v/u meter -20 – +10db **£1**
K30 thermistor 232266298009 **75p**
De-solder Pump **£2.50**
Portasol Flameless Gas Soldering Iron **£16.00**
Green & Red, LED pack mixed **100 for £1.00**

HILLS

Miniature Linesman Pliers **£2.20**
Miniature Pliers **£2.20**
Miniature Side Cutters **£2.20**
Miniature End Cutters **£2.20**

KT3 PANELS

Sound Output RGB Output Chroma Panel, I.F. Panel and Line OSC **£7.00 each**

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

GEC Decoder Panel PC772A3 PC446A5 **£6**

Tube Base 20AX GEC PC852B3 **£1**

Thorn Aerial Socket TX10 **£1**

12 Volt Mains Trans 500M/A **£1.00**

Double 1.5 Digital Display. High brightness **20p**

Quantity Reductions

BY204/4 **25 for £1.00**
BY206 **25 for £1.00**
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**
BF458 **10 for £1.00**
BF224 **20 for £1.40**
OA90 **40 for £1.00**
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 Philips **40p**
GEC-Hitachi Thick Film Frame **£5**

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

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**

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**
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**

Red & Green LED on Panel **1p each**

Mixed 100 Transistor B.F. and B.C. and PET **£1.50** 1000 for **£10.00**

12 Volt 4 Amp Video Battery Pack 10 of Type D Cells **£8.50**

40 glass reed switch **£1**
10 press to make switch **70p**
40 Pots **£1.50**
With Focus Pin, 10 Tube Bases, mixed **£2.00**
1,000 Diodes, Condensers, Resistors on Bandolier **£1.00**
20mm Fuse Holders
Chassis Mount **20 for £1**
EHT Diodes, small **20 for £1**

300 Mixed Diodes **£2**

100 500M/A 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

Matsushita PY34220 Tuner £7

C. Cam Decoder with FDA3591 £5
Toshiba VHF/UHF EG522F £6

Mitsumi MECI-F51 £5

Thorn Spares

New 9000 Decoder £8.50
9000 Frame panel £8
9000 Cyclops panel £1.50
8800 convergence panel £6
8500 convergence panel £6
4000 Power supply £3
1600 Mains lead, switch
T605 IvNPN TO66 80c/6A 10p
9000 Sound output panel £1
3500 Focus unit £1.50
3500 Mains Trans £4
3500 cut outs 10 for £4
3500 IF panel £2
3500 Frame panel £3
3500 Line panel £3
3500 A1 Diode 20p
Export 3500 IF panel £2
IC board with set of SN74LS £1
4000 Tube base £4
3500 A1 pots 50p
Beam limiter panel £1.50
3500 Power panel with Y969 £1
3 Way regulated adaptor 240V 6V/
7.5/9V/300mA £3.50
Rank/Toshiba preh unit 0354 £9.50
4 Push button unit preh £1.00
6 Push button VHF/UHF for
v/cap. GEC-Decca type £7.00
7 Push button for CVC5 ITT £8.00
KT3 12 Push button unit £2.00
KT3 (Export) 12 P.B.u £2
6 Push button Unit Thorn £1.00
6 Push button 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

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
7×3¾ 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
6×4 speaker	16 ohm	
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 Philp	15 ohm	75p
K30 15 watt		£1

KT3-K30

OE-425
OE-550 L.W 10p
OE-513 correction 10p
OE-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
Flat BY 229 black	15p
BY 299 Red	20p
BY 229/400	30p
BY 299/600p 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
GRP80G (TX10)	60p
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 £8.00
K35 Sound OP £4.00
K35 Split Diode 3122-138-38930 £10.00
Thick Film Daughter KT3 3122-127-43891 £3
12 C.H. K30 Tex Rec Front Panel with I.C £5
K35 IF £5.00

Plug In

K4 Focus Pot £1.00

Fidelity Tube Base with transistor & focus pot £1.50

Bush Tube Base on panel £1.00

TX10 Tube Base on Panel £3.00

Line Transformers

Line O.P. Trans. Mono T.X. 12"-14" Philips
27482 £10
4822 £10
10273 £10
Thorn 1690 LOPT £7.50
2.2kPots 3 500 Lolt each type £3.00
G8 Trans. Philips £7.00
G11 Split Diode £12.00
CVC820 Split Diode ITT £10.00
Thorn B/W ADS308I + Stik + Lead £1.50
GEC 2040 £3.00
GEC 2110 £7.00
Mullard AT 2036 £1.50
Pye 169 Line Trans £3.00
Pye mono £3.00
Rank mono T704A £3.50
Split Diode Trans £7.00
GEC 20 AX Rank Z522 £3.00
Rank LOPT Z970 £3.00
CVC32 £6.00
AT2080/15 £5.00
CVC 30 ITT £5.00
CVC32 Line Tran £7.00
CVC800 Line Trans £6.00
CVC40 Slip Diode £12.00
CVC 45 £5.00
GEC Portable G1OT2041 £3.00
GEC Portable G1OT2046 £3.00
ITT Split Diode Leads ITT £1.00
3500 L.O.P.T. & HT Trans each £2.00
LOPT Rank Z763 £5.00
K35 Split Diode 3122 138 35930 £10.00

Universal Tripler

with small focus pot. Green type £7.00

Black Triplers

K13 Triplers	£6.00
S.T.C. Universal Tripler	£6.00
11 ITT	£2.50
11 IGA	£2.00
ITT CVC 5-8-9	£3.50
Rank 125LL Tripler	£2.00
Rank 11TCP A823	£3.50
TU 25 30K Rank	£3.00
11 TE/Z Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
8800 Thorn	£4.00
9000 Thorn	£7.00
9500 Thorn	£4.50
9600 Thorn	£4.00
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
G8 Tripler	£5.00
CVC20-32	£5.00
Decca 80 100	£4.50
Grundig TVK 52	£2.50
11 TBQ Pye 731	£3.00
11 TTY	£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 loaes PO7	
BG2087	£5
T/text ultrasome 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 F.W. Transformer	50p
G11 F.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 AT Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye, K30, GEC, etc Pre-mains stand-by switch	£1
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O.P. Trans pair	25p
5 button touch tuner BBC1/2 ITV1 2 video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P.B.U.	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans. & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40 45 IF panel	£5
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg	30p
20 GEC Black Spark Gaps	£1.00
KT3 Front Panel Control Assy	£2.50
BTW 30/50	50p
BTW 92/800R	£3
25A473 PNP C/P	10p

Rank T20 Z136 Panel £6.00
NEW GEC 20AX Power Supply Switch Mode £12.00
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 £10.00

25% OFF ALL PANELS

G8 Tuner Unit + Panel £4.00
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 I.T.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 button units £9.00
CVC9 slider pots panel 50p
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 £8.50
CVC 32 Focus Unit 75p
Fidelity 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 LHT Rec and Lead 50p
TV13 50p
TV14 50p
TV18 60p
TV20 £1.00
TV45 50p
Thorn 14/1500 ree stick 5p

TX10 8 Button Unit £10.00

TX10/TX100 16 Button £10.00

G11 drawer ASS 3 pots Mains switch and lead £2.00

K30 Drawer Ass with pots cable forme £1.00

TX10 Drawer with 8 way pots. ass. £2.50

TX10 Ex pott with band switch (drawer) £2.50

Line O/P panel GEC 2217/2218.2213/ 2214/2226-2227/2228 £10

PHILIPS BATTERIES (Small Types) HAND SETS

SR41	40p
SR43	40p
SR44	40p
SR54	40p
LR43	40p
LR44	40p
LR54	40p
CR2032	40p
10 500PF 2KV	20p
22/1000	20p
1/250AC	20p
1/100	5p
1MFD-250AC	25p

1/100 × 10 30p
22/100 10p
4·7M/100 5p
470/100 20p
4700/100 75p
4·7/160 10p
300-300/300V 80p
800/160 50p
1/250 Pulse 5p
2·2 250v 10p
7N5 1500V 15p
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
GEC9600/250 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
300/350 50p
22/375 15p
220/385 (TT3 75p
330/385 CVC 820 ITT 60p
0·1/400 15p
KT3 E/W 39/400 15p
56K/400v 20p
4700pf/400 10p
22/400 10p
8/300 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 15p
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
6n2/2KV 10p
7n1/1500V 10p
8n2/1500V 10p
9n1/2000V 10p
8n2/2KV 15p
0·0082/2500 10p
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
Tube Thermpath 167 £1.00
Rank Secam Decoder Panel UHF & VHF T115A £13.00
10 off 91 CAP G11 £2.00
Philips K4 CAP 150M/385V 50p

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 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
G8 Mains Switch 75p
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
2000 Chassis Fidelity Mains Switch (4 TAG) 60p
250V/4A White Lorlin Mains Switch 60p
KT3-K30-K35 Full Remote Mains Switch (6 TAG) £1
Teletext Adaptor Kit TY-500 Panasonic £12

Multi-Caps

220 MED Sprague 385V 50p
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
KT3-K30 220+30+40 75p
300+200+75+25M 325V £1.00
300+300+150+100+50MFD
350V £2.00
G11 CAP 470/250 £2.50
47/220/350v 60p
150/150/100/100/100/320v £2.00
2500/2500/63v 50p
150/200/200/300v 70p
300/100/100/16/275v £1.50
100/200/325v 40p
150/150/100/375v £1.50
200/200/75/25M 375V £1.00
Thorn TX9 Caps 500+500M 175V £1.00
300/300/100/32/32/300v 2.00
1500/2000/30v 50p
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

CMC 301 front panel £8.00
CMC 303 front panel £8.00

CMC 302 Panel with I.C mains switch etc £8.00

CMD 800 Decoder £8.00

UPC 574 30p
BSS 38 30p

G11 I.C. Receiver Panel £1.50

3 I.C. Power Supply G11 Full Remote Receiver Panel £3.00

FET Power VN88AF 50p

PHILIPS SBC 469 Stereo Microphone £23.00
Meters Hills 520 £17.00
Meters Hills 420 £15.00
Hills HDS5000 Digital Meter 1000V DC
750AC 10 Amp 20 MRG Rangers £28

HTP100 Multimeter £6.75
HTP300 Multimeter £7.75
HTP500 Multimeter £9.00
HD1000 Digital £20.00
HD3000 Digital £25.00
HD5000 Digital £25.00
HD36000 Digital £32.00
HD8000 Digital £37.00
HD9500 Digital with capacity Temp Trans Volts Ohms and Amps ranges £60

Infra Red Hanset Fester

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

Handset Tester with LED £4.50

Repaired Handsets

Philips K4-K35, RC5350-RC5300
RC5370, RC5375, repaired same day £10.00

RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £15.00

GEC Full Remote Infra-red, 1983 models £15.00

Timers, 60 mins, small £1.00

TOSHIBA HAND SETS

24 Button CT938 Fulremote £5.00
32 Button CT983 Videotext £6.00

THORN

VCR Front Display Panel £7.00

Large type ITT TV and VCR Handset £15.00

GEC Ultrasonic 8CH Full Remote £15.00

G11 Full Remote Ultrasonic £32.00
G11 Ultrasonic Teletext Handset £20.00
8 CH. Ultrasonic GEC Full Remote CT2014H/C2219H £15.00
New Replacement for G11 Ultrasonic Full Remote £12.00
Thorn 4000 insert with 7 buttons £5.00
Decca RC 11 £14.00
Decca RC 12 £14.00
G11 Infra-red full teletext £24.00
Dynatron-Full remote CTV 62, 63, 64 £19.00
Hitachi infra red handset £18.00
Philips full remote KT3, 16C928/20C934, 7228/7324, K12 26C 797/15F 66K 1826 £12.00
G11, Full remote top button assy £12.00
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GEC infra red full remote 8 channel (UCSAA1250) £14.00
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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
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GEC 8 button full remote £14.00
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Pye & Philips handset KT3-K30 chassis No RC5150-RC5176-RC5171-RC5177
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UNIVERSAL HAND SET £15.00
KT3 – K45

We have all parts for Philips Handsets

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TEX-TYPE

Replace Hand Set for
Philips KT3-K30 K4 etc £12.30