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TELEVISION

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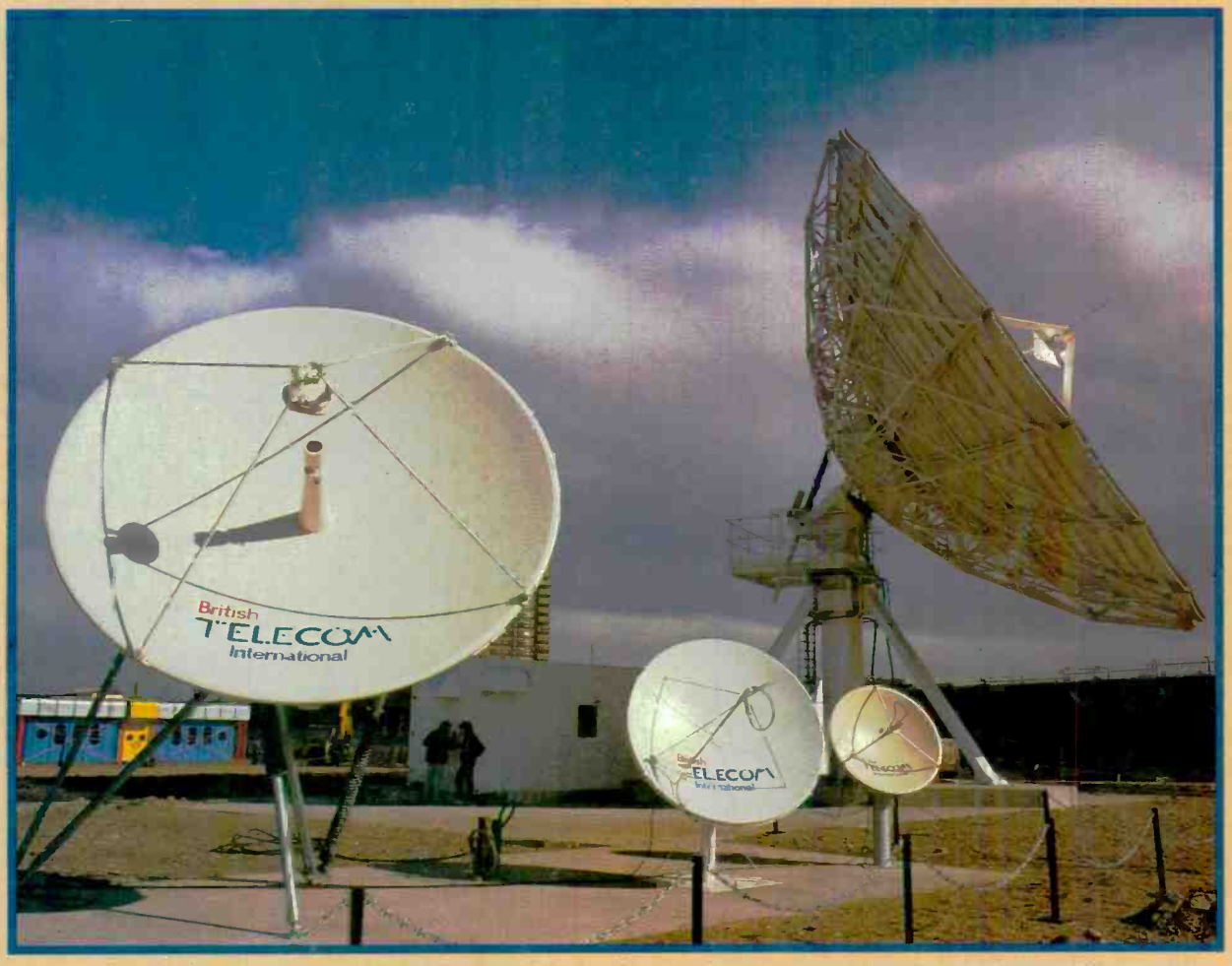

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- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
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- ★ Also available with VHF Modulator.

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SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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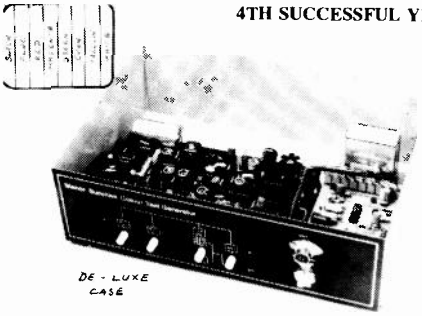
PAL COLOUR BAR GENERATOR (Mk4)

4TH SUCCESSFUL YEAR



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
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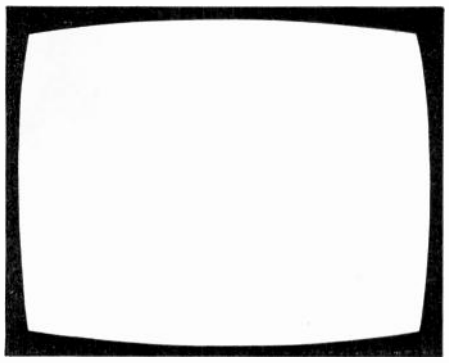

TELEVISION

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

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Sm. Neon Screwdriver	40
Lg. Neon Screwdriver	65
Min. Screwdrivers	15
Antistatic Foam (12" sheet)	95
I.C. Inserters	1.18

DATA BOOKS (Zero VAT)

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2M Fly Lead	70
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Figure 8 Mains Lead	62
Computer to TV	97
7 pin din to 5 pin din	98
5 pin din to 5 pin din	98

IC equivalent booklet £2.25 and transistor equivalent booklet £2.25

SPECIFIC COMPONENTS

Philips G8 knobs sm/lg	50
90° transductor	2.60
Thorn 1591 speakers sm	6.20
lg	6.20
Thorn 1500 controls	59
390K frame 470K line contrast 1k5	each
Focus control Thorn/GEC	1.83
Thorn 9000 focus unit	5.95
Thorn 8500 focus unit	4.75
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G8 rear conv. panel	23.00

PLUGS

Phono Plugs	12
DIN Plugs 3 pin	22
4 pin	22p
180° 5 pin	20p
stnd 5 pin	20
Car Aerial Plug	18
2.5mm Jack Plug	14
3.5mm Jack Plug	14
Stand Jack Plug	20
Stereo Jack Plug	36
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	ten 1.80
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Reducers for PL259	16
Line Connectors	16
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CASSETTE DRIVE BELTS

35m	35	46mm	37	57m	37
66m	39	71m	43	76m	43
90m	43	110m	59		

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VTC 5300/5000
VTC 5350
VTC 5500
VTC 9350

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Grundig Telepilot 160 Series Infra Red	£25.10
Grundig Telepilot 300 Infra Red	£18.87
Philips KT3/K30 Infra Red Non Teletext	£18.87
Philips G11 Ultra Sonic Non Teletext	£22.00
Philips G11 8 Way Infra Red Teletext	£23.80
Philips G11 Ultra Sonic 31 buttons	£27.00
Philips G11 Ultra Sonic 2 function	£21.00
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4015B	76	4044B	71	4078B	22	4520B	76	4561B	74
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				4510B	76	4538B	1.04		

VOLTAGE REG.

7805	78
7806	78
7808	78
7812	78
7815	78
7818	78
7824	78
78L05	68
78L08	68
78L12	68
78L24	68
7905	98
7906	98
7908	98
7912	98
7915	98
7918	98
7924	98
79L05	72
79L12	72
79L15	72
79L24	72

I.C. SOCKETS

DIL to DIL	
8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	32
24 way	34
38 way	45
40 way	84

DIL to QUIL	
14 way	32
16 way	34
18 way	37

QUIL to QUIL	
14 way	32
16 way	36

MAINS DROPPERS

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DECCA 27R/47R	1.40
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R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 713/15 3R5/15/45R	1.80
PYE 725/31 3RO/56R/27R	1.84
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PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	95
THORN 1400	1.20
THORN 1500	1.38
THORN 1600	1.77
THORN 3500	94
THORN 8000	1.24
THORN 8500	1.36
THORN 9800	1.30
DECCA 3R9 Modulohm	60

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ECC84	80	EY500A	1.50	PCH200	1.45	UCH81	2.25
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VA1104	75
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VA1039	35
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100K	55
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DECCA, RANK	55

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L.E.D's

5mm Red, Green, Yellow	14
T1 ¾ Amber	22
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THORN 1691	9.68
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PYE 713 Doubler 5 Lead	8.79
PYE 731/725	7.60
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ITT KB CVC20/25/30 (Mullard)	6.65
RRI T20	6.80

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TV13	93	TV20	1.23

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DECCA 80 (400/350V)	3.97
DECCA 100 (800/250V)	
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.30
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.70
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.66
RBM A823 (600/300V)	2.83
RBM Z146 (300/300/350V)	3.55
RR1 T20A (220/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.98
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.20
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.78
THORN 3500 (1000/63V)	86
THORN 3500 (1000/70V)	86
THORN 8000/8500 (2500/2500/63V)	3.38
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.28
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25
THORN 4700 P/C 25V	1.20
THORN 1591/1691 4700/25V	1.20

CAPACITORS AXIAL

Volts	Mfd	Price		Mfd	Price
6V3	33	9		2.2	12
10V	22	10		4.7	12
	47	10		10	11
	100	10		15	12
	220	15		22	13
	470	20		47	19
16V	33	11		100	23
	68	11		220	37
	220	16		470	49
	1000	27		1000	58
	3300	53		2200	94
25V	10	11	*100V*	10	13
	22	13		22	15
	47	15		47	20
	100	15		100	36
	220	29		220	70
	470	30	*450*	1	33
	1000	55		4.7	30
	2200	51		10	30
	4700	98		22	65
40V	10	10		33	75
	22	10	*500*	10	32
	400	48	*600*	0.1	41

MIXED DIELECTRIC CAPS

Volts D.C.			
250V 0.91mF	1.15	*1250V* 0.1mF	59
400V 0.22mF	29	*1500V* 0.0047mF	32
600V 0.1mF	38	0.022mF	30
1000V 0.01mF	24	0.033mF	62
0.047mF	46	0.005mF	65
0.033mF	33	*2000V* 0.0052mF	1.20
0.1mF	35	*2500V* 0.0022mF	50
0.22mF	66		
0.47mF	98		

DISC CERAMIC CAPS

8kV (12kV)
39pF, 200pF, 150pF, 220pF, 180pF, 250pF — 40p

63V/100V
A range of pref. values 22pF-4700pF — 12p

POLYESTER CAPS

250V 0.01mF	12p
0.1mF	
0.22mF	
400V 0.01mF	12p
0.1mF	
0.22mF	

TANTALUM CAPACITORS

6.3V	47mF	42
	100mF	90
16V	10mF	22
	22mF	28
	47mF	1.03
25V	22mF	46
35V	0.1mF	13
	0.22mF	13
	0.47mF	13
	1mF	13
	2.2mF	17
	4.7mF	26
	10mF	57

CONVERGENCE POTS

3W/5R-6R8-10R-15R-20R
50R-100R-200R-500R — 60

METRIC CONVERGENCE POTS

PHILIPS G8
5R-10R-15R-20R-50R — 60

FUSES

	Per type	Pack of 10
1¼" QUICK BLOW		
100ma		73
250ma-500ma-750ma-1A		60
1.5A-2A-2.5A-3A-5A		60
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A, 1.5A, 2A		1.70
2.5A, 3A, 5A		2.70
20mm ANTISURGE		
80ma		4.80
100ma		2.50
160ma, 200ma		2.20
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A		1.30
2.5A, 3.15A, 4A, 400ma, 5A		1.90
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A		60
1" MAINS		
2A, 3A, 5A, 10A, 13A		1.00

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18" A47/343X	59.00
19" A49/120X	53.00
20" A51/110X	53.00
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25" A63/200X	55.00
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26" A67/120X	65.00
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A56 510	67.00
A66 510	92.00

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A56/610	95.00

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ALL AVAILABLE EX-STOCK ON GLASS FOR GLASS EXCHANGE FROM TRADE COUNTER. SOME TYPES AVAILABLE WITHOUT EXCHANGE FOR SMALL GLASS CHARGE

17" A44/271X	32.00
18" A47/342X (Low Focus)	32.00
18" A47/343X (Stnd Focus)	32.00
20" A51/110X	30.00
19" A49/120X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
25" A63/200X	34.00
26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (410X) 110°	36.00
26" A66/140X (410X) 110°	36.00
20" A51/161X	60.00
22" A56/510X	50.00
A56 540X	89.00
A66 540X	75.00
A66 500X	64.00

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SLIDER POTENT

Lin or Log
470R-1K-2K2-4K7
10K-47K-470K — 65

SKELETON PRE-SET POTS

Standard or miniature
Horizontal or Vertical
100R-2M2 — 16p

MIDGET CONTROLS

Insulated Spindle Length 44mm
Log or Lin Without Switch
5K-10K-25K-50K-100K-250K-500K-1M — 54p
With D.P.S.T. Switch
Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M — 97p
Dual gang Controls — 1.25
16mm Rotary Controls 10K, 22K, 100K, 1M, 10K — 39p

THICK FILM RESISTOR NETWORK

THORN 3500 (5 pin connection)	1.98
PYE 731 (6 pin connection)	2.20
THORN 9000 (Circuit Ref. R704/7)	1.98

WIREWOUND RESISTORS*

4W 1R-10K	24p
7W 1R-22K	26p
11W 1R-22K	29p
17W 1R22K	32p
(Preferred values)*	

EVER READY BATTERIES

HP2	26	PP6	82
HP7	12	PP7	82
HP11	24	PP9	84
HP16	13	R6PP	17
PP3	42	R14PP	26
PP3-C	53	1289	45

CARBON RESISTORS*

¼W 3R3-8M2	20
½W 3R3-8M2	20
1W 10R-10M	36
2W 10R-10M	62

Sold in packs of 10 per type i.e. per value

RECHARGEABLES

EVER READY

RX6 (HP7)	1.10
RX14 (HP11)	1.95
RX20 (HP2)	2.15
RX22 (PP3)	3.75
Universal Charger	7.50

STOP PRESS

Special Prices
5¼" Floppy Disc

	1-10	10-40	50-90	100+
SS/SD	1.61	1.17	1.12	1.05
SS/DD	1.70	1.23	1.17	1.10
DS/DD	2.00	1.44	1.37	1.29

SERVICE MANUALS (Zero VAT)

THORN 1590/1	4.00	VIDEO 3V00	24.00	110	3.90
1615	2.95	3V22	24.00	PHILIPS G8	8.50
1640/1	5.00	3V29/30	33.00	G9	4.20
9000	8.20	DECCA 30	4.75	G11	3.90
9800	6.80	80	5.35	K30	3.90
Tx9	16.50	70/90	3.90	KT3	3.90
Tx10	19.20	100	4.80		

P. V. TUBES

PLEASE NOTE OUR NEW ADDRESS – COME AND SEE US
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Tel: 0254 36521/32611 Telex: 635562 Griffin G (For P.V.)

HOW TO ORDER

ADD 75p per order P+P (U.K.). Heavier parcels e.g. cable, service aids, degaus. coils please allow £1.30 P+P (U.K.). Export orders charged at cost. First Class Mail is used whenever possible. Add 15% VAT to total except where it states zero rate.

Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible. We try our best to give a speedy, fair and efficient service. V.A.T. invoice on request. Give us a ring – we'll give you service. Please ask if what you need is not listed – we will try to help. Prices are subject to change without notice.

SEMICONDUCTORS

AC107	35	BC558	9	BF355	56	OT121	1.91	AN214Q	3.91	SN76110N	1.15
AC126	30	BCY72	13	BF362	68	R2008B	1.90	AN240	3.84	SN76115N	2.27
AC127	32	BD115	45	BF363	72	R2010B	1.92	AN318	3.98	SN76131N	2.00
AC128	32	BD116A	65	BF371	30	R2285	1.50	AN262	2.45	SN76226DN	2.00
AC128K	40	BD124P	79	BF392	35	R2322	62	AN301	5.15	SN76227N	1.18
AC141K	39	BD131	50	BF422	34	R2323	67	AN715Q	3.97	SN76533N	1.70
AC142K	38	BD132	49	BF423	46	R2461	1.50	AN6340	7.85	SN76033N	2.49
AC176	35	BD133	60	BF435	35	R2540	2.80	AN6341N	5.10	SN76544N	2.35
AC176K	35	BD135	38	BF457	35	RC4558	2.20	AN6344	7.85	SN76650N	1.05
AC186	41	BD136	38	BF458	43	RCA16334	90	BA521	2.80	SN76660N	80
AC187	38	BD137	38	BF459	43	RCA16029	99	BA536	3.00	SN76666N	80
AC187K	38	BD138	35	BF460 = BF462	86	RCA16039	99	CA555	46	SN76530A	1.47
AC188	35	BD139	35	BF469	46	RCA16092	99	CA556	84	STK015	6.25
AC188K	39	BD140	44	BF470	66	RCA16040	96	CA741	25	STK032	=
AD143	82	BD144	1.70	BF597	10	RCA16041	84	CA748	45	STK078	13.25
AD161	54	BD150	60	BF757	54	RCA16334	90	CA3065	1.80	STK043	11.05
AD162	54	BD159	65	BF758	54	RCA16335	90	HA1151	3.89	STK433	5.65
AD161/62 MP	1.15	BD166	52	BF839	27	RCA16957	2.88	HA1322	2.65	STK435	9.06
AF106	49	BD179	70	BFR40	30	TIC45	90	HA1342	2.49	STK436	5.50
AF114	89	BD182	1.20	BFR79	85	TIC46	60	HA1306N	2.60	STK437	7.85
AF118	1.20	BD183	75	BFR90	1.74	TIL32	65	HA1366WR	2.80	STK439	6.62
AF121	75	BD201	85	BFT42	39	TIL78	48	HA1392	3.95	STK459	8.20
AF124	48	BD202	91	BFT43	39	TIP29C	43	HA11219	2.49	STK441	8.10
AF125	46	BD203	80	BFW10	60	TIP30A	47	HA11244	1.98	STK461=465	9.60
AF126	46	BD204	99	BFX29	40	TIP30C	43	LA4031P	3.21	STK463	14.30
AF127	38	BD222	46	BFX84	42	TIP31C	55	LA4032P	2.90	SW153	2.74
AF139	58	BD223	56	BFX85	30	TIP32C	42	LA4102	3.37	TA7050P	95
AF178	1.54	BD225	47	BFX86	30	TIP33B	75	LA4400	3.05	TA7051P	95
AF239	60	BD232	68	BFX88	46	TIP34B	1.06	LA4422	3.28	TA7063P	2.20
AL102	2.00	BD233	60	BFY50	30	TIP41C	47	LC7130	5.93	TA7074P	1.00
AU106	2.50	BD234	63	BFY51	30	TIP42C	50	LC7120	5.87	TA7108P	3.43
AU113	2.00	BD235	60	BFY52	24	TIP47	70	LC7137	5.50	TA7120P	2.43
BC107	20	BD236	65	BFY90	95	TIP120	65	LM1011	3.25	TA7129AP	3.76
BC108	20	BD237	57	BR100	34	TIP2955	90	LM1340T	75	TA7130P	1.93
BC109	20	BD238	65	BR101	45	TIP3055	63	LM1303N	2.63	TA7146P	4.67
BC114	12	BD243	85	BR103	83	TIS91	21	MB3712	1.95	TA7193P	5.67
BC115	17	BD244	85	BR303	1.46	TU106/02	1.80	MC1307	1.99	TA7171P	1.85
BC116A	16	BD410	79	BRC4443	94	2N696	21	MC1310P	1.60	TA7172P	1.85
BC117	30	BD434	74	BRC4444	98	2N918	82	MC1327	1.70	TA7173P	1.85
BC118	24	BD437	86	BRY39	56	2N2904	51	MC1351P	2.93	TA7176P	2.50
BC119	36	BD438	94	BRY55	45	2N2905	28	MC1349	1.99	TA7202P	4.27
BC139	28	BD507	52	BRY56	57	2N3054	60	MC1350	1.50	TA7204P	3.77
BC140	32	BD508	55	BSR59	1.80	2N3055	60	MC1352	1.75	TA7205AP	3.72
BC141	26	BD509	56	BSV57B	89	2N3702	11	MC1358P	1.50	TA7208P	3.40
BC142	30	BD510	60	BT100	1.65	2N3703	10	MC1495L	3.00	TA7210P	6.60
BC143	31	BD278A	81	BT101	1.20	2N3705	10	MC13002	3.90	TA7222	2.42
BC147	13	BD517	60	BT102/500	1.20	2N3706	10	MC14011BCP	66	TA7223P	3.74
BC148	9	BD520	75	BT106	1.60	2N3708	17	MC14049UB	43	TA7227P	5.98
BC149	12	BD535	82	BT108	1.69	2N5294	48	MC7742	1.35	TA7228P	5.98
BC157	16	BD536	91	BT109	99	2N5296	48	MC7812	1.35	TA7310P	2.78
BC158	16	BD696A	1.49	BT116	1.21	2N5298	69	ML231	2.20	TA7609P	4.39
BC159	15	BD697	1.24	BT119	3.66	2SB337	1.86	ETTR6016		TA7611AP	2.92
BC160	52	BD695	1.39	BT120	3.66	2N5496	53	ML232	2.20	TAA300	58
BC161	28	BD698	1.50	BT151/800	1.20	2N6107	75	ML236	5.35	TAA310	2.83
BC170B	15	BD707	95	BU104	2.00	2N6109	81	ML237	2.50	TAA320	2.00
BC171	15	BDX32	2.10	BU105	1.58	2SA715	1.98	ML238	6.00	TAA550	55
BC172	15	BF115	38	BU108	1.80	2SC495	1.10	ML239	2.50	TAA630	3.90
BC173	12	BF117	36	BU124	1.90	2SC496	1.31	ML920	4.12	TAA840DS1	1.96
BC174	10	BF125	26	BU126	1.75	2SC643A	1.50	ML922	3.29	TAA661B	1.20
BC177	27	BF127	47	BU204	1.50	2SC1096	1.72	ML928	2.18	TBA120A (A),(S),(AS),(SA).	80
BC178	26	BF154	23	BU205	1.42	2SC1172Y	2.20	MM5387ANN	4.15	TBA120B	1.30
BC182L	9	BF158	18	BU206	1.80	2SC1173Y	1.69	MRF475	2.50	TBA120SB	1.37
BC183L	12	BF160	27	BU208	1.60	2SC1306	2.73	MRF477	10.00	TBA120T	95
BC184L	14	BF167	24	BU208A	1.65	2SC1307	3.00	MSN5807	7.87	TBA120U	1.10
BC186	30	BF173	22	BU208D	2.20	2SC1449	1.67	MS1513L	2.80	TBA395	1.20
BC187	25	BF177	52	=BU800		2SC1520	68	MS1515L	3.28	TBA396	80
BC204	10	BF178	46	BU208/02	2.10	2SC1678	2.67	SAA1025	4.40	TBA440N (TBA1441)	2.75
BC208	13	BF179	28	BU326A	1.75	2SC1909	2.90	SAA1124	2.50	TBA440P	2.50
BC209	10	BF180	39	BU407	1.70	2SC1953	1.44	SAA1250	3.94	TBA480Q	1.50
BC212	9	BF181	39	BU426	3.07	2SC2028	1.82	SAA1251	4.90	TBA510	3.00
BC212L	13	BF182	36	BU500	2.30	2SC2029	2.60	SAA5000	4.39	TBA520(Q)	1.68
BC213	13	BF183	29	BU526	2.46	2SC2078	2.90	SAA5010	6.30	TBA530(Q)	1.38
BC214	10	BF184	36	BU508	3.20	2SC2091	1.34	SAA5012	6.50	TBA540	1.68
BC237	14	BF185	36	BU806	1.40	2SC2166	2.73	SAA5020	5.90	TBA550(Q)	1.58
BC238	14	BF194/394	16	BU807	2.94	DEC1	2.20	SAA5030	8.25	TBA560Q	1.59
BC251A	18	BF195	16	BUW84	1.45	DEC2	2.20	SAA5050	8.50	TBA570	1.79
BC252	12	BF196	16	BUW91A	3.84	THY15/80	2.20	SAA3210	2.93	TBA690	1.50
BC261	18	BF197	16	BUX84	1.50	THY15/85	2.20	SAS560S	1.89	TBA641BX1	3.50
BC262	18	BF198	18	E1222	40	BUW81A	3.84	SAS570S	1.89	TBA673	2.45
BC300	50	BF199	21	MCR101	45	T6006V	1.50	SAS660	3.25	TBA700	2.12
BC301	53	BF200	35	MCR220	1.50	T6021V	90	SAS670	3.25	TBA720	2.64
BC303	33	BF224	25	ME0411	20	T6022V	1.80	SAS580	2.90	TBA750	2.98
BC307	20	BF225	20	MJE340	68	T6026V	90	SAS590	2.90	TBA800	1.62
BC308	25	BF241	25	MJE520	50	T6027V	63	SL901B	5.50	TBA810AS	1.10
BC323	99	BF256	55	MJ3000	1.98	T6028V	66	SL917B	6.50	TBA820	1.70
BC327	18	BF257	28	MPSA92	35	T6029V	2.50	SL1310	1.80	TBA820M	1.25
BC328	18	BF258	25	MR814	45	T6034V	81	SL1327Q	1.20	TBA890	3.94
BC337	18	BF259	35	MR854	55	T6036V	90	SL1430	1.25	TBA920(Q)	3.00
BC338	18	BF262	84	MR475	2.46	T9002V	1.12	SL1432	3.36	TBA950(2X)	3.05
BC461	30	BF263	75	MR479	2.60	T9003V	60	SL76544	2.05	TBA970	4.09
BC547	13	BF271	24	ON447	99	Transistor mounting kit TO66, TO3, TO220AB	30	SN76003N =SN76013N	2.49	TBA990	1.90
BC548	13	BF273	24	ON448	99			SN76023N	2.00	TBA14406	2.44
BCX32 = BC637	39	BF274	24	OT112	1.91					TCA160	2.50
BC549	8	BF336	36							TCA760	2.30
BC550	7	BF337	41								
BC557	8	BF338	41								

INTEGRATED CIRCUITS

TCA270SQ	2.50	UPC1180C	1.84	AA119	9
TCA800	3.10	UPC1181H	1.62	BA102	17
TCA830	2.44	UPC1182H	2.95	BA115	13
TCA830S	1.75	UPC1183H	1.38	BA145	17
TCA900	2.20	UPC1185H	3.66	BA148	17
TCA910	2.20	UPC1188H	2.20	BA154	6
TCA940	1.95	UPC1190G	1.20	BA155	14
TDA440	2.20	UPC1197C	1.06	BA156	15
TDA1002	1.95	UPC1198C	84	BA317	26
TDA1003A	5.50	UPC1200V	1.18	BAX13	4
TDA1004A	3.35	UPC1211V	2.70	BAX16	8
TDA1006A	2.50	UPC1212V	1.34	BB105B	30
TDA1005	3.60	UPC1215V	1.66	BB105G	30
TDA1010	1.54	UPC1216V	1.20	BY126	12
TDA1035	4.70	UPC1217G	1.13	BY127	11
TDA1037	2.95	UPC1218H	1.80	BY133	15
TDA1044	4.37	UPC1223C	2.20	BY164	45
TDA1060A	4.44	UPC1225H	2.00	BY176	85
TDA1062	1.56	UPC1226C	1.50	BY179	63
TDA1083	1.68	UPC1227V	1.20	BY182	87
TDA1170S	3.00	UPC1228H	54	BY184	55
TDA1190	3.50	UPC1230H	3.95	BY199	28
TDA1180	2.91	UPC1238V	1.16	BY206	14
TDA1200	2.95	UPC1245V	1.35	BY210/600	28
TDA1220A	2.12	UPC1350C	4.15	BY210/800	33
TDA1270	3.95	UPC1353C	1.92	BY223	90
TDA1327	1.70	UPC1365C	6.38	BY227	28
TDA1352B	1.60	UPC1356C2	2.08	BY298	22
TDA1412	1.20	UPC1367	2.08	BY299	22
TDA1415	1.40	UPC1378H	2.70	BYX10	20
TDA1470	4.67	UPC1358H	1.88	BYX36/10	30
TDA1770	5.60	UPC1360C	2.20	BYX55/600	30
TDA2002	2.80	UPC1363C	2.16	BYX71/600	90
TDA2003	1.20	UPC1366C	1.84	DY224	2.00
TDA2004	2.52	UPC1368H2	2.15	OA47	9
TDA2006	1.78	UPC1370C2	2.58	OA90	10
TDA2010	2.00	UPC1382C	1.08	OA91	10
TDA2140	5.95	UPC1384	3.78	OA95	6
TDA2150	2.22	UPC1447H	58	OA202	11
TDA2020	4.66	UPC41C	2.80	IN914	4
TDA2030	2.80	UPC5743	38	IN4001	4
TDA2521	4.17	UPC577H	2.46	IN4002	4
TDA2522	2.40	UPC585C	1.28	IN4003	4
TDA2523	3.40	TDA 1011	4.00	IN4004	5
TDA2524	2.25	11A 4112	75	IN4005	5
TDA2525	4.00	TAA570	3.98	IN4006	10
TDA2530	2.70	while stocks last		IN4007	10
TDA2532	2.56			IN4148	2
TDA2540	3.84			IN4448	10
TDA2541	3.84			IN5401	12
TDA2560	3.50			IN5402	14
TDA2571	2.56			IN5403	12
TDA2576	3.75			IN5404	12
TDA2576A	3.75			IN5405	13
TDA2577	3.25			IN5406	16
TDA2581	3.30			IN5407	16
TDA2582	2.60			IN5408	20
TDA2590	3.25			ITT2002 = BAX16	
TDA2591	2.95			Y969 – Disc.	
TDA2593	2.95			REP BZX85 30V	
TDA2600	5.30				
TDA2610	3.20				
TDA2611A	1.95				
TDA2640	2.92				
TDA2652	7.31				
TDA2653	5.90				
TDA2680	3.40				
TDA2690	1.35				
TDA3190	2.00				
TDA3500	6.90				
TDA3560	6.00				
TDA3561	6.50				
TDA3571	3.75				
TDA3651A	4.50				
TDA3950	3.50				
TDA4420	4.22				
TDA4600	2.95				
TDA9503	2.50				
TEA1002	3.50				
TEA1009	1.37				
UPC554	1.34				
UPC566H	2.95				
UPC575C2	3.40				
UPC576H	1.90				
UPC587C2	1.60				
UPC1025H	2.95				
UPC1028H	2.52				
UPC1032H	64				
UPC1042C	1.56				
UPC1156H	4.26				
UPC1158H	78				
UPC1163H	98				
UPC1167C2	94				
UPC1168C	1.28				
UPC1176C	1.46				
UPC1177H	1.56				
UPC1178C	1.28				

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BZX79 Range (400mV)	10
BZY88 Range (400mV)	10
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AN7110	1.93
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AN7115	2.37
AN7116	2.35
AN7120	2.43
AN7140	2.10
AN7145	3.25
AN7150	2.89
AN7151	2.89
HA1137	2.30
HA1144	2.39
HA1151	1.97
HA1156	1.97
HA1166	2.65
HA1197	2.30
HA1199	2.30
HA1202	1.75
HA1211	1.87
HA1306	2.97
HA1319	2.99
HA1322	2.10
HA1325	2.30
HA1338	2.78
HA1339	2.80
HA1342A	2.33
HA1366 W/WR	2.30
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HA1371	2.97
HA1374	2.56
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HA1388	4.20
HA1397	4.15
HA11211	2.43
KIA7217	2.75
HA11221	2.77
LA1201	1.88
LA1230	2.30
LA1365	2.25
LA2200	2.25
LA3122	2.10
LA3301	1.97
LA3350	1.93
LA4031	1.66
LA4031P	2.45
LA4032	2.34
LA4051	2.79
LA4101	1.88
LA4102	1.97
LA4112	2.97
LA4201	2.95
LA4400	2.80
LA4420	1.94
LA4422	2.75
LA4430	1.93
LA4460	2.95
LA4461	2.95
MB3712	2.30
MB3713	2.25
MB8719	5.20
MC1327A	1.00
MC1358P	1.60
MC1330P	.90
ML231B	1.95
ML232B	1.70
ML237	2.50
ML238	4.22
SAA1024	2.55
SAA1125	4.70
SAA1250	3.85
SAA1251	5.20
SAA5010	5.10
SAA5012	5.70
SAS560S	1.83
SAS570S	1.90
SAS580	2.40
SAS590	2.40
SL901B	5.65
SL917B	6.95
SN76003N	2.30
SN76013N	2.30
SN76023N	2.30
SN76110N	.90
SN76226DN	1.45
SN76227N	1.00
SN76660N	.65
STK0039	6.45
STK0040	5.95
STK0050	7.50
STK011	7.35
STK014	7.65
STK015	7.15
STK016	7.45
STK020	9.05
STK032	11.32
STK035	12.67
STK036	12.67
STK043	11.33
STK050	20.75
STK070	21.95
STK077	8.56
STK078	8.45
STK082	9.75
STK086	12.89
STK415	9.66
STK433	7.25
STK435	7.75
STK437	7.77
STK439	7.86
STK441	9.52
STK443	11.33
STK459	9.55
STK461	9.95
STK463	10.88
STK501	8.98
TA7072P	2.75
TA7108P	2.10
TA7120P	2.05
TA7129	3.00
TA7130P	1.20
TA7139P	2.80
TA7157P	3.00
TA7171P	3.40
TA7172P	3.40
TA7176AP	2.90
TA7193P	4.20
TA7202P	3.00
TA7203P	3.00
TA7204P	1.80
TA7205AP	1.60
TA7208P	2.20
TA7210P	5.60
TA7222P	1.70
TA7223P	3.15
TA7227	4.65
TA7310P	1.70
TA7313P	2.10
TAA550	.28
TBA120AS	.70
TBA120SB	.90
TBA120U	1.00
TBA395	1.25
TBA396	.85
TBA520	1.30
TBA530	1.00
TBA540	1.27
TBA550	1.40
TBA560Q	1.60
TBA750Q	2.45
TBA800	.80
TBA810AS	1.15
TBA820	1.40
TBA890	2.95
TBA920Q	1.50
TBA950/2X	2.65
TBA990	1.55
TCA270S	1.30
TCA800	5.10
TCA940	1.55
TDA1003A	2.80
TDA1004A	2.70
TDA1035	3.20
TDA1044	3.10
TDA1170	1.80
TDA1412	.90
TDA2004A	4.35
TDA2020	2.95
TDA2522	1.80
TDA2523	2.25
TDA2530	2.10
TDA2532	2.20
TDA2540	1.95
TDA2560	1.80
TDA2581	1.70
TDA2590	2.25
TDA2591	2.70
TDA2593	2.30
TDA2600	5.50
TDA2611A	1.50
TDA2640	2.30
TDA3560	5.10
TDA3561	5.35
TDA3562	5.50
UPC41C	2.95
UPC554C	1.30
UPC555H	.70
UPC566H3	2.10
UPC577H	3.00
UPC585C	1.40
UPC1018C	1.15
UPC1025H	3.30
UPC1026C	1.45
UPC1028H	2.15
UPC1031H	2.85
UPC1032H	.85
UPC1035C	2.50
UPC1042C	2.40
UPC1043C	2.45
UPC1156H	2.45
UPC1168C	2.70
UPC1170C	1.55
UPC1176C	2.15
UPC1177H	2.30
UPC1178C	2.20
UPC1180C	3.05
UPC1181H	2.20
UPC1182H	2.35
UPC1183H	2.35
UPC1185H2	3.30
UPC1188H	3.30
UPC1190C	2.10
UPC1198H	1.30
UPC1200V	1.90
UPC1208C	1.85
UPC1211C	4.05
UPC1215V	2.50
UPC1216V	2.00
UPC1217G	3.35
UPC1218H	2.75
UPC1222	2.05
UPC1223	3.40
UPC1225	3.10
UPC1226	2.55
UPC1227	2.10
UPC1230H	4.45
UPC1245	1.99
UPC1250	2.45
UPC1350C	4.50
UPC1353C	2.60
UPC1356C2	3.05
UPC1358H	3.05
UPC1363C	3.20
UPC1365C	5.05
UPC1366C	2.85
UPC1367C	2.85
UPC1368C	3.76
UPC1370C2	3.80
UPC1373H	1.20
UPC1377C	4.60
UPC1378H	3.80
UPC1384C	5.50
UPC2002H	2.20

TRANSISTORS

TYPE	PRICE
AC127	.22
AC128	.22
AC128K	.30
AC187K	.30
AC188K	.33
AD149	.70
AD161	.42
AD162	.42
AF127	.36
AU110	3.10
AU113	4.60
BC107	.14
BC108	.14
BC109	.14
BC141	.26
BC142	.23
BC143	.25
BC147	.09
BC148	.09
BC157	.10
BC158	.11
BC159	.11
BC160	.22
BC172	.10
BC177	.22
BC1B2	.10
BC1B2L	.11
BC183L	.11
BC184L	.11
BC208	.12
BC212L	.10
BC213L	.10
BC214L	.10
BC237B	.11
BC337	.11
BC338	.10
BC547	.10
BC548	.10
BC557	.10
BC558	.10
BD124P	.70
BD131	.33
BD132	.33
BD201	.80
BD202	.70
BD203	.70
BD204	.83
BD222	.50
BD232	.50
BD233	.37
BD234	.40
BD235	.32
BD236	.43
BD237	.40
BD238	.39
BD410	.50
BD434	.50
BD437	.70
BD438	.78
BD707	1.05
BDX32	1.65
BF194	.12
BF195	.13
BF196	.11
BF197	.11
BF198	.14
BF241	.15
BF256LC	.25
BF258	.25
BF259	.26
BF337	.28
BF338	.30
BF458	.30
BF459	.36
BFR90	1.60
BFY51	.22
BR100	.18
BR101	.48
BR103	.55
BT106	1.15
BT116	1.30
BU126	1.78
BU205	1.42
BU208A	1.40
BU208/02	1.70
BU326A	1.48
BU407	1.12
BU426A	1.75
BU500	1.80
BU526	2.00
BU826	3.20
BUX84	.90
R2010B	1.45
R2540	2.35
TIP31C	.46
TIP32C	.47
TIP33B	.80
TIP41C	.48
TIP42C	.48
TIP2955	.70
TIP3055	.55
TV106/02.	1.60
2N3054	.55
2N3055	.50
2SC867A.	3.55
2SC1034 .	4.55

NEW

Sony SG613/6533 SAE 8.70

LINE O/P TR.

RBM T20/22A	7.85
RBM Z718 18/20/22	22.95
PHILIPS G8	8.20
PHILIPS G9	7.45
PHILIPS G11	13.50
THORN 1590/1	8.68
THORN 1690/1	9.68
THORN 1615	9.75
THORN TX10	12.50
PYE 731/713 (110)	10.20
PYE 725 (90)	10.20
ITT CVC 1-9	9.60
DECCA 2230	8.30
DECCA 80	8.58
DECCA 100	8.58
ITT CVC 20	7.75
ITT CVC 25/30/32	8.00

ANTI-SURGE FUSES

A/S20MM 80MA	2.75
100, 160, 200MA	1.70
315, 400, 500, 630, 800MA, 1A, 1.25, 1.6, 2A	1.20
2, 3.15, 4, 5A	1.35

NEW VALVES

PCF802	.93
PCL82	.87
PCL805	1.03
PCL86	.91
PL504	1.50
PL508	2.90
PL509/519	5.65
PY88	.80
PY500A	1.95
PY81/800	.86

E.H.T. TRAYS

RBM T20/22A	7.35
RBM A823	7.85
PHILIPS G8-550	7.90
PHILIPS G9	6.45
PHILIPS KT3	10.00
THORN1500-3S	5.05
THORN1500-5S	5.40
THORN3500	8.25
THORN8000	5.20
THORN8500/8800	7.60
THORN9000	8.70
PYE 731	7.30
DECCA 2230	7.20
DECCA 80	7.20
DECCA 100	7.35
ITT CVC 20/30	6.85
ITT CVC 45	8.95
Universal	5.90

DIODES

TYPE	PRICE
BY127	.10
BY133	.15
BY164	.40
BY179	.60
BY210/800	.30
BY223	.86
BY227M	.23
BYX10	.20
BYX55/600	.26
OA90	.07
1N4001-7	.07
1N5401-8	.12
BZX61-range	.18
BZY88-range	.11

MOTORS

6-9-12-13.2V Motors 5.00

SUNDRIES

PYE IF GAIN MOD	7.85
E/W COIL G11	1.65
VA1104	.70
G8 TRANSDUCTOR	2.25
G8 ON/OFF SW.	1.40
TX10 FOCUS UNIT	8.95

TV ELECTROLYTICS

DECCA 30(400/400)350V	2.95
DECCA 80-80/100(400)350V (800)250V	3.30
PHILIPS G8(600)300V	2.00
PHILIPS G9(2200)63V	1.15
PHILIPS G11(470)250V	1.95
PYE 691/7(200-300)350V	2.10
RBMA823(2500/2500)30V	1.10
THORN3500(175/100/100/400)350V	2.25
THORN3500(1000)70V	.85
THORN9000(400)400V	2.75

PUSH BUTTONS/TUNERS

DECCA/ITT 4W	6.45
DECCA/ITT 6W	7.95
PYE-G11 P/B	7.95
PHILIPS G8S/L	14.90
PHILIPS G8S/Q	12.00
HITACHI 4W	8.95
ITT CVC5 7W	10.40
ITT CVC8/9	12.80
PHILIPS G11 (TIP SW.)	26.90
1043/05TFK	8.70
U321	8.70
U322	7.85

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Telegen-1

PRICE £17.20 (Inc. VAT)

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

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

Telegen-2

PRICE £34.45 (Inc. VAT)

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

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

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A47 342/343X – 470 BCB22/CTB22/BGB22	£39
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A51-161X/162/163/168	£49
510-JKB22/JEB22/JDB22/JGB22/ALB22/GLB22	£49
510-VLB22/DTB22/001/RFB22/RCB22/SFB22	£49
A51-570X/580/001/210/241	£49
A56-120X/123/140/410	£39
560-DZB22/HB22/AKB22/TB22/AWB22	£49
560-ETB22/DTB22/CSB22/DMB22/DNB22	£49
A56-611X/615X – A66-611X/615X	49
A66-120X/A67-120X/140/150/200/410	£39
20AX – A56-500X/510X – A66-500X/510X	£49
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VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.95
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.95
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.25
EL84	0.69
EL509	5.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.95
PCF801	1.45
PCF802	1.00
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	1.15
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.90
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.30
AC128	0.30
AC128K	0.34
AC132	0.55
AC141	0.26
AC141K	0.40
AC142	0.26
AC142K	0.48
AC151	0.45
AC152	0.45
AC176	0.28
AC176K	0.46
AC187	0.42
AC187K	0.48
AC188	0.44
AC188K	0.50
ACY40	0.88
AD142	1.10
AD143	1.10
AD149	0.96
AD161	0.42
AD162	0.42
AD161/AD162	0.98
AF106	0.48
AF114	2.10
AF115	2.10
AF116	2.10
AF117	2.10
AF118	0.85
AF121	0.62
AF124	0.48
AF125	0.48
AF126	0.48
AF127	0.48
AF139	0.68
AF178	0.68
AF239	0.68
AF279S	0.75
AL100	2.50
AL102	5.90
AL113	2.20
ASY80	1.75
AU110	1.40
AY102	4.32
BA102	0.34
BA110	0.67
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12

Type	Price (£)
BC108	0.10
A,B or C	0.12
BC113	0.14
BC114	0.12
BC115	0.12
BC116	0.15
BC117	0.22
BC118	0.17
BC119	0.30
BC125	0.12
BC140	0.28
BC141	0.42
BC142	0.30
BC143	0.30
BC147	0.08
A or B	0.10
BC148	0.08
A or B	0.10
BC149	0.09
BC157	0.10
BC158	0.10
BC159	0.10
BC160	0.30
BC161	0.30
BC168B	0.12
BC169C	0.10
BC170	0.14
BC170B	0.12
BC171	0.10
BC171	0.10
A or B	0.08
BC172	0.08
A or B	0.12
BC177	0.20
BC178A	0.22
BC182	0.09
A,B or C	0.09
BC182L	0.09
A,B or C	0.09
BC183	0.09
A,B or C	0.10
BC183L	0.08
A,B or C	0.12
BC184L	0.10
A,B or C	0.10
BC207	0.15
BC208	0.16
BC212	0.09
A,B or C	0.10
BC212L	0.08
A,B or C	0.10
BC213	0.09
A or B	0.10
BC213L	0.10
A or B	0.10
BC237	0.11
BC238	0.12
BC239C	0.14
BC251	0.12
A,B or C	0.14
BC301	0.30

Type	Price (£)
BC302	0.32
BC303	0.32
BC307	0.10
BC308A	0.10
BC323	0.99
BC327	0.14
BC328	0.14
BC337	0.12
BC338	0.12
BC350	0.14
BC440	0.30
BC441	0.32
BC461	0.32
BC547	0.12
BC548	0.12
BC549	0.12
BC550	0.18
BC550C	0.18
BC557	0.12
BC558	0.12
BCX34	0.27
BCY70	0.15
BCY71	0.17
BCY72	0.18
BCZ10	1.68
BCZ11	1.45
BD124P	0.80
BC130Y	0.68
BD131	0.34
BD132	0.34
BD131/BD132	0.95
BD135	0.32
BD136	0.36
BD137	0.36
BD138	0.38
BD139	0.38
BD140	0.38
BD144	1.60
BD145	1.82
BD150A	0.51
BD159	0.65
BD160	1.65
BD165	0.45
BD175	0.60
BD182	1.00
BD183	1.10
BD184	1.20
BD201	0.72
BD202	0.87
BD204	0.80
BD222	0.80
BD225	0.86
BD232	0.45
BD233	0.60
BD234	0.62
BD235	0.63
BD236	0.63
BD237	0.65
BD238	0.56
BD241	0.60
BD243A	0.80

Type	Price (£)
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.54
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.10
BF115	0.32
BF117	0.54
BF119	0.82
BF120	0.38
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BF160	0.23
BF167	0.30
BF173	0.25
BF177	0.42
BF178	0.30
BF179	0.32
BF180	0.35
BF181	0.35
BF182	0.32
BF183	0.32
BF184	0.32
BF185	0.32
BF194	0.08
BF195	0.10
BF196	0.10
BF197	0.10
BF198	0.14
BF199	0.16
BF200	0.26
BF222	0.48
BF224	0.20
BF224J	0.16
BF240	0.20
BF241	0.20
BF244	0.26
BF244A	0.28
BF244C	0.24
BF245A	0.28
BF254	0.15
BF256	0.40
BF257	0.32

Type	Price (£)
BF258	0.30
BF259	0.32
BF262	0.30
BF263	0.30
BF270	0.30
BF271	0.26
BF273	0.18
BF274	0.32
BF323	0.92
BF336	0.26
BF337	0.26
BF338	0.26
BF355	0.42
BF363	0.82
BF367	0.24
BF371	0.27
BF422	0.38
BF450	0.38
BF457	0.33
BF458	0.36
BF459	0.44
BFR39	0.22
BFR40	0.22
BFR41	0.22
BFR51	0.30
BFR61	0.32
BFR62	0.28
BFR88	0.34
BFR90	1.72
BFT41	0.38
BFT43	0.38
BFW10	0.79
BFW44	0.76
BFX29	0.28
BFX30	0.30
BFX80	3.56
BFX84	0.24
BFX85	0.26
BFX86	0.26
BFX87	0.26
BFX89	0.65
BFY50	0.21
BFY51	0.21
BFY52	0.21
BFY57	0.40
BFY90	0.90
BFY90S	1.34
BR100	0.20
BR101	0.44
BR103	0.58
BRC4443	1.76
BRY39	0.38
BRY56	0.42
BRY61	0.86
BSS17	0.56
BSS27	0.92
BSX19	0.34
BSX20	0.34
BSX59	0.62
BSX76	0.29
BT100A/02	0.94

Type	Price (£)
BT101/300	1.15
BT101/500	1.25
BT102/300	1.35
BT102/500	1.65
BT106	1.50
BT108	1.30
BT109	1.18
BT116	1.25
BT119	3.62
BT120	3.60
BT121	3.02
BT138/600	1.30
BT151/560R	0.90
BT151/300R	1.15
BTY79/400R	2.80
BU100A	2.30
BU104	2.00
BU105	1.20
BU105/02	1.56
BU108	1.80
BU124	1.75
BU126	1.25
BU133	1.80
BU204	1.35
BU205	1.30
BU206	1.70
BU208	1.55
BU208A	1.63
BU208/02	2.05
BU326S	1.75
BU407	1.65
BU407D	1.80
BUX80	3.70
BUY20	1.75
BUY69A	2.60
BUY69B	1.98
BY101	0.48
BY118	1.10
BY122	0.68
BY126	0.12
BY127	0.10
BY133	0.16
BY135	0.25
BY164	0.44
BY179	0.66
BY182	0.87
BY184	0.40
BY187	0.72
BY189	4.75
BY198	0.44
BY199	0.47
BY206	0.24
BY207	0.24
BY210/400	0.25
BY210/600	0.26
BY210/800	0.30
BY223	1.20
BY227	0.26
BY229	0.30
BY238	0.68
BYX10	0.24

Type	Price (£)
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ITT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.48
MJE2955	0.99
MJE3055	0.70
MPSL01	0.28
MRF475	2.50
MRF479	5.20
MRP477	10.00
OA47	0.10
OA90	0.08
OA91	0.09
OA95	0.18
OA200	0.06
OA202	0.15
OC25	2.10
OC26	1.70
OC28	1.50
OC29	2.47
OC35	1.75
OC36	1.75
OC42	0.72
OC42K	1.40
OC44	0.72
OC45	0.58
OC71	0.50
OC72	0.52
OC81	0.68
OC200	2.46
OC202	2.20
ORP12	0.85
R2008B	1.50
R2010B	1.52
SHG1.5	0.40
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70

Type	Price (£)
TIC106A	0.70
TIP30A	0.46
TIP31C	0.54
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72
TIP41C	0.46
TIP42A	0.52
TIP47	0.60
TIP110	0.88
TIP2955	0.60
TIP3055	0.60
TIS43	0.32
TIS88	0.40
TIS90	0.25
TIS91	0.28
ZTX108	0.12
ZTX109	0.12
ZTX212	0.28
IN4001	0.05
IN4003	0.05
IN4004	0.06
IN4006	0.07
IN4007	0.07
IN4148	0.05
IN5400	0.12
IN5402	0.15
IN5405	0.16
IN5406	0.18
IN5408	0.20
IS920	0.08
2N697	0.55
2N706A	0.33
2N2904	0.28
2N2906	0.24
2N2926G	0.10
2N3053	0.40
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.16
2N3906	0.16
2N5294	0.48
2N6107	0.71
2N6126	0.68
2SB337	1.60
2SC495	0.65
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
2SC1226	0.84
2SC1279	0.50
2SC1306	0.92
2SC1307	1.40
2SC1413A	2.70
2SC1444	1.45

Type	Price (£)
2AC1449	0.63
2SC1507	0.63
2SC1678	1.06
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74
2SC1957	0.76
2SC1969	2.88
2SC2028	0.73
2SC2029	2.10
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
2SC2166	1.20
2SC2314	0.80
2SC2335	1.50
2SC2371	0.90
2SC2749	2.70
2SC2752	0.60
2SD234	0.64
2SD348	3.30
2SD986	0.62
2SJ50	5.20
2SK134	3.80
2SK135	4.60
3N126	1.90
3N211	2.52
3SK45	0.76
3SK88	0.66
3SK135	5.20

I.C. SOCKETS

Dil to Dil

8 pin	0.08	0.70/10
14 pin	0.10	0.95/10
16 pin	0.11	1.00/10
22 pin	0.21	1.95/10
28 pin	0.30	2.75/10
40 pin	0.34	3.10/10

CAPACITORS

Metallised Paper

2n2F 600V AC	24p
10nF 1000V DC	22p
10nF 500V AC	80p
15nF 300V AC	30p
22nF 300V AC	32p
100nF 1000V DC	46p
470nF 1000V DC	60p

HV Disc Ceramic (†)

1kV 1.5nF	18p
8kV 10, 47, 56, 82, 100, 120, 150, 180, 200, 220pF	30p
270, 300pF	39p

ZENER DIODES

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20W Stud 7.5–75V **£1.35 each**

INTEGRATED CIRCUITS (£) EACH

Type	£
AN240P	3.42
AN214Q	3.88
AN715Q	2.90
CA3065	1.75
CA4031P	2.88
CA4102	3.30
CA4250	3.50
CA4400	2.98
CA4422	3.07
LC7120	5.33
LC7130	5.26
LC7137	5.16
LM380N	1.65
LM1303N	2.52
HA1151P	3.12
MC1307P	1.85
MC1310P	1.85
MC1312P	2.25
MC1327P	1.25
MC1330P	0.83
MC1349P	1.85
MC1350P	1.20
MC1351P	2.50
MC1352P	1.50
MC1357P	2.88
MC1358P	1.30
MC1496L	1.15
ML231B	2.10
ML232B	2.10
ML237B	2.30
MRF475	2.50
MRF479	5.20
MRP477	10.00
NE555	0.50
C-mos 555	0.88
NE556	0.80
SAA1024	5.35
SAA1025	8.40
SAS560A	2.50
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.82
SC9503P	1.10
SL432A	4.00
SL901B	5.20
SL917B	7.25
SL1327Q	1.10
SN76003N	2.44
SN76013N	1.90
SN76023ND	2.90
SN76033N	2.45
SN76110N	1.12
SN76115N	2.00
SN76131N	1.65

Type	£
SN76226DN	1.80
SN76227N	1.10
SN76530P	1.40
SN76533N	1.60
SN76650N	1.05
SN76660N	0.75
SN76666N	0.80
STK015	6.50
TA7108P	3.20
TA7120P	2.20
TA7129AP	3.65
TA7130P	1.65
TA7172	1.80
TA7193	5.50
TA7172P	1.80
TA7176	2.50
TA7202P	4.18
TA7204P	1.86
TA7205AP	1.50
TA7208P	3.27
TA7210P	6.50
TA7222P	2.12
TA7223P	3.68
TA7227P	5.60
TA7310P	1.80
TA7609P	4.28
TA7611AP	2.88
TAA263	2.46
TAA310A	2.68
TAA550	0.50
TAA570	1.99
TAA611A12	3.50
TAA630S	3.90
TAA661B	1.70
TAA700	2.80
TAA840	3.38
TAD100	2.80
FM FILTER	1.20
TBA120 AS,	
S,SA,SB	1.30
Q,T,U,UQ	1.32
TBA120B	1.30
TBA231	1.45
TBA281	2.65
TBA395	1.20
TBA480Q	1.50
TBA400	2.30
TBA510	2.60
TBA510Q	2.60
TBA520/Q	1.60
TBA530/Q	1.30
TBA540/Q	1.40
TBA550/Q	1.52
TBA560C	1.70
TBA560CQ	1.60

Type	£
TBA570	1.50
TBA641BX1	4.50
TBA673	2.40
TBA700	2.85
TBA750	2.80
TBA800	1.60
TBA810P	1.10
TBA810S	1.20
TBA820	1.60
TBA890	3.88
TBA920/Q	3.00
TBA950/2A	3.05
TBA970	4.05
TBA990	1.88
TCA160C	3.90
TCA270S	4.00
TCA270SA	4.02
TCA800	3.10
TCA940	1.90
TDA440	3.80
TDA1002	1.90
TDA1003A	5.50
TDA1006A	2.40
TDA1035S	4.50
TDA1044	4.30
TDA1170S	3.00
TDA1190	3.50
TDA1200	2.98
TDA1270Q	3.70
TDA1327A	1.66
TDA1352A/B	1.56
TDA1412	1.20
TDA2002	2.80
TDA2020	4.60
TDA2030	2.78
TDA2140	5.90
TDA2521	4.10
TDA2523	3.50
TDA2530	2.70
TDA2540	3.80
TDA2541	3.80
TDA2560	3.50
TDA2571A	2.50
TDA2581	3.20
TDA2590	3.20
TDA2591	2.98
TDA2593	2.98
TDA2610	3.20
TDA2611A	1.94
TDA2640	2.90
TDA2680	3.40
TDA2690	3.50
TDA3950A/B	2.60
UPC554C	1.32
UPC557H	0.90
UPC566H	2.95
UPC575C2	3.20
UPC1018C	1.10
UPC1025H	2.90
UPC1032H	0.90
UPC1156H	4.20
UPC1158H	0.76
UPC1163H	0.98

Type	£
UPC1181H	1.60
UPC1185H2	3.75
UPC1212C	1.30
UPC1228H	0.54
UPC1230H	3.90
UPC1350C	4.25
UPC1367C	3.40
UPC1378H	4.40
UPC2002H	2.80

D CONNECTORS

	9 way	15 way	25 way
Male			
Solder	.75	1.00	1.50
Angle	1.40	2.00	2.40
Female			
Solder	1.00	1.45	1.85
Angle	1.50	2.00	2.40
Covers	.80	.80	.80

PLUGS & SOCKETS

Metal Co-ax Plug	0.18
Plastic Co-ax Plug	0.14
Metal Line Socket	0.50
Single Junc Socket	0.80
Plastic Phono	0.10
F.M. Plugs	0.20
PL259 Plugs	0.38
Reducer	0.15
Low loss splitter 1 in, 2 out	1.00

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	49.95
XS25 Watt Iron complete with steel and plug attached	7.20
CS 18W, as above	7.00
Antex 15W iron	5.00
Antex 18W iron	5.00
Antex 25W iron	5.20
Antex elements	2.00
Antex bits	0.95
Antex stands	1.90
Soldersucker	4.50
Nozzles	0.65

TERMINAL BLOCKS

2 amp 12 way	0.19
5 amp 12 way	0.20
10 amp 12 way	0.40
15 amp 12 way	0.46
32 amp 12 way	0.90

SONY TV & VIDEO SPARES

Rewind Kits	SLC5-SLC7	A-670-634-8A	4.50
	SLC6	A-670-639-1A	3.50
Video Heads	SLC6-SLC7	A-676-203-8A	48.25
	SLC5	A-676-204-4A	45.60
Motor Kit		X-354-931-41	13.45
Idler Assembly		X-365-331-50	0.95
Cap.Film 0.18mf/1.5Kv		1-129-952-11	1.35
Relay		1-515-323-00	5.10
Switch Power		1-516-390-11	2.30
Switch Push Button		1-552-503-11	3.25
Thyristor	SG264A	8-726-420-00	4.00
	SG6533	8-765-330-00	13.45
Service Manuel			

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20mm Chassis Mounting	0.06
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Carline 1¼" holder	0.10

FUSES Prices per 10

1¼" Quick Blow. 100, 150, 250mA **£1.30.** 1, 1.25, 1.5, 2, 2.5, 3, 10, 15A **55p.** **1¼" Time Delay.** 100mA **£3.50.** 150mA **£2.25.** 250, 300, 500, 600, 750, 850mA **£1.84.** 1, 1.25, 1.5, 1.6, 2A **£1.84.** 2.5A, 3.15, 3, 5A **£2.82.** **20mm Quick Blow.** 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. **40p.** **20mm Time Delay.** 100, 125, 160, 200mA **£1.80.** 250, 315, 400, 500, 630, 800mA. **£1.00.** 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A **85p.** **1" Mains.** 2, 3, 5, 7, 10, 13A **85p.**

Manufacturers please note — Very attractive quantity prices available upon request.

REPLACEMENT TV MAINS DROPPERS

GEC2010	8R + 15R + 17R + 70R + 63R + 188R	0.95
GEC 2018	10R + 15R + 19R + 70R + 188R	1.15
Philips G8	2.2R + 68 R	0.80
Philips 70	6R + 124R + 84R	0.68
Philips 300	118R + 148R (with link)	0.85
Philips 300	30R + 125R + 2.85K	1.08
RRI A640	250R + 14R + 156R 50W	1.05
RRI A816	302R + 70R + 6.2R	0.78
Thorn 1500	350R + 20R + 148R + 1.5K + 317R	1.34
Thorn 3000/3500	6R + 1R + 100R Fused	0.93
Thorn 8000	56R + 1K + 47R + 12R	0.95
Thorn 8500	1K5 + 40R + 50R	1.28

MULTISECTION ELECTROLYTICS

THORN	850	100+300+100+16/300V	1.80
	1400	150+100+100+100+150/320V.	2.70
	1500	150+150+100/300V	1.50
	3000	1000/63V	0.56
	3500	175/400V+100+100/350V	1.70
	8000	400/350V	2.10
	8000/8500	2500+2500/63V	1.35
	8000	700/250V	2.10
		1000/70V	0.58
	9000	400/400V	2.25
Timer Amp		4700/25V	0.70
DECCA 10/30		400+400/350V	2.45
	1700	200+200+400/350V	3.52
GEC	2047	2048 2083 2084 2104	
		200+200+150+50/300V	2.32
		600/250V	1.50
ITT/KB		200+200+75+25/350V	2.15
		220/100V	1.95
PHILIPS	G8	600/300V	1.70
	G8 G9	600/300V	1.50
	G11	470/250V	1.50
	G9	2200/63V	1.26
EKCO	T148	125+200+100+32/275V	2.65
	691 Series	200+300/350V	2.15
		600/300V	1.80
RANK		300+300/300V	2.05
	A823	2500+2500/30V	0.98
		220/400V	1.75
		600/300V	1.78

VDRs, etc.

E295ZZ 01/	0.28
02/	0.28
E298CD /A258	0.25
E298ED /A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E299DD/P116-P354	all 0.23
E299DH /P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/ 39/ 40/53	all 0.20
VA1055s/56s/66s/ 67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/ 98	all 0.20
VA1103	0.32
VA1104	0.72
VA1108/09/10/ 11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59

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SERVICE AIDS

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Switch Cleaner	0.98	Excel Polish	0.92
Circuit Freezer	1.14	Fire Extinguisher 640g	2.80
Foam Cleanser	0.96	Video Head Cleaner	0.86
Aero Klene	0.90	Solda Mop (Std)	0.74
Silicone Grease (Tube)	1.64	Solda Mop (L/Gauge)	0.74
Antistatic Spray	0.98	Heat Sink Comp	1.08
Plastic Seal	1.08	Additional P&P on above 30p	

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)	**7p each. 65p/10. 6.00/100**
2W 10R to 2M2 (E6 Range)	**8p each. 70p/10. 6.00/100**

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	5.00
¼W pack 5 each value E12 – 10R to 1M 305 pieces	3.00
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	6.00
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	3.50
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.00

RESISTORS – WIREWOUND. Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.20
4W – 1R0 to 10K – Available in preferred values	0.21
7W – 0.47R to 22K – Available in preferred values	0.25
11W – 1R0 to 22K – Available in preferred values	0.29
17W – 1R0 to 22K – Available in preferred values	0.37

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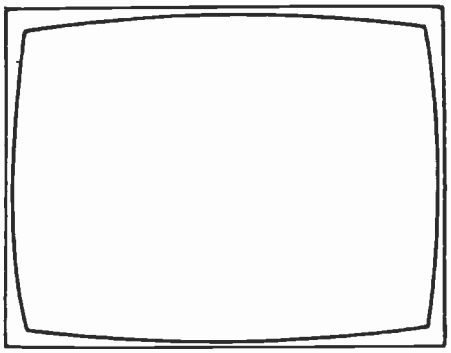

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Please note that the telephone numbers above are for contact with the advertisement departments only. Editorial enquiries should be sent to the editor at the address given on page 297.

SPEECH ICs

The General Instruments' speech synthesis i.c. set mentioned in our March issue (Electronic Speech for TVs and VCRs) is no longer listed in the Tandy catalogue. Many Tandy branches still hold stocks however.

MATSUSHITA

The profits made by Matsushita Electric for the year to November 20th 1984 showed a 30 per cent increase over the previous year on turnover up 18 per cent. Our apologies for the incorrect figures quoted in Teletopics last month. VCR sales increased by 24 per cent in value.

COVER PHOTO

Our cover photo this month was taken at British Telecom International's London Teleport. The 3·7m, 1·8m and 1·2m dishes shown are being used to test satellite TV reception conditions in conjunction with Intelsat transponders operating at both half and full power. The aim is to compare actual picture quality obtained using small TVRO terminals with predicted performance based on British Telecom's theoretical calculations. Our thanks to British Telecom International for permission to reproduce the photograph.

DBS: Getting Nowhere Fast

The BBC was given the go-ahead to start a two-channel UK DBS service early in 1982. It was hoped that the service would start during 1986. By 1983 the BBC had signed a provisional agreement with United Satellites Ltd. (Unisat) who were to provide the satellites for the service – three of them, two in orbit (one as a spare) plus another spare ready for launch if need be. It had also been decided that the IBA developed C-MAC transmission standard would be used, and shortly afterwards the IBA was authorised to supervise a commercial DBS service. Then things started to go sour: someone had to find the money to pay for it all.

It's one thing to authorise something (the government made it clear from the start that it didn't wish to get involved financially) and to put forward technically feasible proposals, another to get the hardware into orbit and working. It's costly, horrendously so as it turns out, and a great deal has to be spent before any revenue comes in. This raises the question of how much revenue and when it's likely to be seen, something that in the nature of things is hard to assess. What one can say is that people are reasonably happy with the service they receive at present from the terrestrial network, and that they are not too happy when it's suggested to them that a bit more choice could be provided if they were prepared to pay a fair whack extra. The fact is that TV of the quality we get comes cheap in the UK, and that any extra that comes via satellite certainly won't be as cheap.

By the middle of last year it had become clear that the BBC, strapped as ever for funds, would not be able to start a DBS service on its own. It seemed unlikely that the IBA or anyone else would get very far either. So in true British fashion a compromise was arranged. Everyone should pull together in the hope that this would result in UK space TV. Not only the BBC and the ITV companies: five outside (non-broadcasting) companies were brought into the consortium that was set up to get DBS started. Unfortunately even this hasn't worked so far. As we approach mid-1985, the argument continues – how to pay for it.

The members of the consortium called for a business plan to see how they could proceed. This came to the conclusion that if satellite TV was ever to be a paying proposition the cost of providing the satellites would have to be brought down – considerably. There, at present, the matter rests. Various costings have been aired in the pages of the *Financial Times* in recent weeks. It appears that initially Unisat offered to reduce the cost of providing the satellites from £640 million to £580 million covering an eight year period. The consortium's business plan had proposed a cost of around £350 million with a view to achieving a return on investment of 14 per cent. The consortium was advised by a merchant bank that it would be possible to lease a satellite system for around £400-£450, well below the Unisat figure though still well above the consortium's costings for profitability. More recently Britsat, a UK company offering to operate a US satellite system using RCA birds, has put forward a suggestion for a two-satellite system at £38·5 million a year (that works out at £310 million over an eight year period, though the satellites would have an estimated twelve year life), reduced to £30 million if the launch of the second satellite is delayed for three years. This would appear to make satellite TV a business proposition in terms of the consortium's calculations.

The problem now appears to be a political one. The Unisat consortium (British Aerospace, British Telecom and GEC-Marconi) was put together by the government. To start with, a DBS service would be largely a prestige matter. After all no country yet has DBS TV. So the aim would be to show how well the UK could do it – and hopefully win future orders. Not much prestige however if you have to use satellites leased from abroad.

An alternative suggestion that has apparently been considered is a single orbiting satellite from Unisat with a second back-up satellite ready for launch if need be. Neither the banks who would provide the finance nor the electronics industry who would be trying to sell receiving equipment to the public seem to be very happy with this idea however. The problem is the service interruption that would occur, lasting for a good few months, in the event of failure of the orbiting satellite.

The government remains committed to Unisat. But there's something a bit odd about this. Surely the reason for satellite TV is to provide a broadcasting service rather than a demonstration of satellite technology? The viewer isn't going to care very much whose bird is up there: it's the quality of the picture and the programmes on offer that will matter. What also matters from the electronic industry's point of view is the opportunity to get ahead with the design, manufacture and sale of satellite receiving equipment. A lot of development work is going on in Japan and North America: UK consumer electronics firms could well fall behind while the start of the service remains in such doubt. In this respect it seems that the interests of the satellite communications industry are being put before those of the domestic electronics industry.

The reason for the public bandying about of satellite TV cost figures appears to be to put pressure on the authorities and Unisat. No one suggests that the problem is an easy one. US concerns are not exactly jumping at the opportunity to start DBS services at present, and a great deal of haggling, financial and political, is going on in Europe. Doubtless we'll get our service before long. The interesting thing then will be the public's response.

The Lid off Microcomputers

Part 1

Mike Phelan

For most of you it may not have happened yet, but sooner or later you'll probably be asked to service a home microcomputer. More so now that they are appearing at all sorts of outlets in addition to specialist computer shops – and with large numbers now starting to go ex-guarantee. Many TV engineers are no doubt already accomplished computer users. Many actually understand how a computer works. This series of articles, which will endeavour to explain the workings of a home computer rather than how to use it, is intended for the rest of you. Thus armed you'll be more than ready to deal with any faults that arise. We'll try to avoid lengthy treatises on binary and hexadecimal arithmatic, though some explanation will be given in order to make an understanding of microcomputers simpler.

Those readers who've serviced very much video equipment will already have a nodding acquaintance with microcomputer i.c.s. They were mentioned in my previous VCR servicing series, though we tended to treat them simply as black boxes that did certain things when presented with the appropriate inputs. It's probably best to forget these devices for now as the type of microprocessor used in a home computer is not the same – the differences will be dealt with in due course.

Members of the public commonly regard the microprocessor as a large, magic piece of silicon that can do almost anything. This is not true: it can do only about fifty or sixty different things, all these consisting of data manipulation. What's more, it can do them only if someone or something has told it to. Hence a microprocessor on its own is not much use. The advantages however are that it can carry out thousands of operations per second and that it never gets bored!

Typical Microcomputer Arrangement

Let's examine a typical home microcomputer. Fig. 1 shows a basic block diagram. Unlike larger machines, all the circuitry is in the same box as the keyboard – usually everything is on one PCB, there not being that many components. Most can now generate sound, so there's either a small a.f. amplifier i.c. followed by a speaker or the sound signal goes to the TV set used for the display, in which case a modulator with this facility is needed. Among the i.c.s there is of course the CPU itself (the microprocessor/central processing unit), which is often a Z80 or a 6502 or one of their derivatives. Then there's usually a large chip to connect the CPU with the outside world so that instructions can be fed in and information fed out. This is called a PIA or VIA. We'll come back to this. There will be a RAM (random access memory) and a ROM (read only memory). The ROM is usually a single i.c. while the RAM is likely to consist of four or eight i.c.s. To go into this a bit further, the ROM is where the language used by the computer resides, and can only be read from. The RAM is where the computer can store things, and can be written into or read from.

In those home microcomputers with extensive sound capabilities there's a PSG (programmable sound generator chip), typically the AY-3-8912. Then we must have a CRTC (c.r.t. controller) to sort out the information to be displayed on the screen of the display TV set/monitor, generate and insert sync pulses, etc.

This leaves a host of odd jobs most of which are taken care of the a large i.c. called a ULA. This stands for "uncommitted logic array": it means that the i.c. consists of a collection of logic gates with no interconnections – until the computer manufacturer gets his hands on it and tailors it to suit his own needs – it's then very much committed! In fact at this stage an "uncommitted logic array" is an example of those phrases we love to use but actually mean the opposite of what they say – "industrial action" is another example. We shall henceforth refer to the ULA as a "gate array".

Some, if not most, home computers have facilities for providing an output in either RGB + sync or composite video form. If the signal comes out at u.h.f. for feeding to the aerial socket of a TV set we don't get the best results, though we can (family permitting) use the domestic TV set. As much of the display will consist of text or fine graphics, the limitations imposed by restricted chroma bandwidth and the noise generated in the mixer, i.f. strip and PAL decoder can be appreciated. With a display of 80 characters per line, text can be illegible. A composite video output gives better results as the modulator in the computer and the TV set's tuner and i.f. strip are bypassed. But we still have the chroma bandwidth of only 1·5MHz and the noise produced by the PAL decoder and chroma amplifiers. RGB + sync is the ideal solution since the definition is limited by only the video circuits (and the tube) and is typically 15MHz. Unfortunately RGB signals are not present as such in some home microcomputers. When RGB outputs are provided they are usually at TTL levels, i.e. 0-5V. A little thought will show that this gives us a total of six colours plus white (RGB all at 5V) and black (RGB at 0V). Some home microcomputers give a much greater choice of colours. We'll return to ways of doing this later.

How it Works

The foregoing has provided a general introduction to the subject. Next, how does the beast work?

We'll start by taking a look at the microprocessor chip. What is it and what does it do? The answer to the second question could well be not very much, on its own. Refer to Fig. 1 again. This doesn't represent any particular microcomputer incidentally. Note how few interconnections there are. The microprocessor requires a clock to act as a timing reference: it can be a separate i.c. or built into the microprocessor. The reset pulse generator you'll have met in microcomputer based VCRs.

Forget everything except the microprocessor and the RAM. The CPU is capable only of transferring data, adding or subtracting it, or carrying out logical and shifting operations on the data. When we talk of data we mean collections of numbers which within the computer are in the form of bytes (a byte is eight binary digits – bits – i.e. eight ones and zeros). Each byte can have a value between zero and 255. If 255 seems a strange choice, blame our decimal system of numbering which came before the computer. In binary form 255 is 11111111 – in

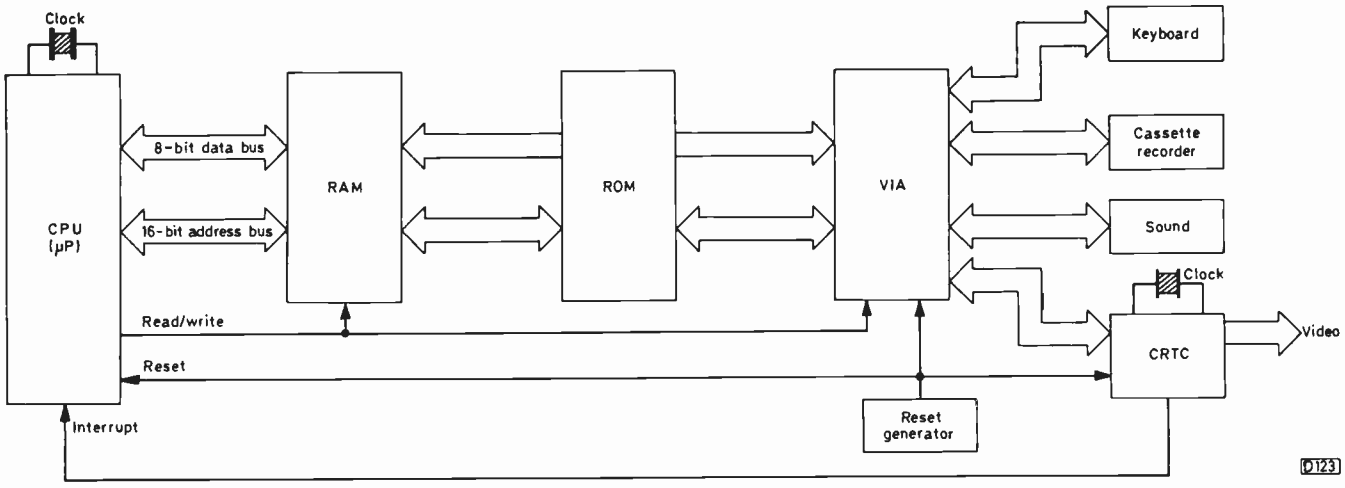

Fig. 1: Basic microcomputer block diagram.

logic parlance, all eight bits are said to be "set". Storing 255 at an address in a memory actually means setting eight memory cells at logic 1. A memory address is a section of memory that can store one byte. A microcomputer's RAM typically has a storage capacity of 64Kbytes – this is not 64,000 but 64 × 1024 = 65,536.

As the binary system doesn't lend itself to counting in tens, we use the hexadecimal system (hex) to relieve us of having to look at interminable strings of 0s and 1s. In the hex system the digits from 0 to 9 are the same as in decimal. Decimal 10 is A, then it's up to F for 15 and 16 becomes 10. You may think that this is a waste of time and effort, but 11111111 binary is hexFF (#FF) and 65,536 is #10,000 – 65,535 is #FFFF. Memory is conveniently split into "pages" of 256 (#100) bytes, so it's much easier to think in hex and to convert from binary if necessary.

There are two buses between the CPU and the RAM, one labelled "data bus" and the other "address bus". These consist of 8 and 16 parallel lines respectively, each line carrying one bit of the data or address. Each particular CPU has an "instruction set" of the operations it can carry out. These are in binary form and are stored in sequence in the RAM. Each instruction is one byte long and is followed by possibly one or two bytes which represent either data or an address to find or put the data (the "operand"). The instruction itself is called an "op code". Clearly we can have up to 255 different instructions.

Inside the CPU there's a register called a program counter. This tells the CPU where in the RAM to find the next instruction – this counter is incremented by 1 each time a byte is fetched from the RAM. The register must be able to hold numbers up to 64K (#FFFF), so must have a capacity of two bytes (16 bits).

To summarise, the CPU sends out an address along the address bus, the read/write line goes to read, data is fetched from the specified address and travels along the data bus to the CPU which then examines it to see if the data represents a valid instruction, increments the program counter, decodes the instruction and fetches one or two operands from the next addresses in the RAM if the instruction requires this.

When all the required data has arrived – 0, 1 or 2 bytes – the CPU acts on the instruction. If the latter requires sending data out the read/write line goes to write, the address goes out on the address bus to open the correct location in the RAM and the data goes there via the data bus. The CPU is then ready for the next instruction, the address for this being held in the program counter which will have been incremented by either 1, 2 or 3.

You may have wondered about instructions that don't have any operands. These are things that increment, decrement or perform logical shifts on data at an address.

One thing we've not mentioned so far is the line marked interrupt. We've met this before – regular readers will recall the mechacon i.c. in the Ferguson 3V23 VCR. Briefly, an interrupt signal tells the CPU to finish the operation it's carrying out then go to a fixed routine, complete this and return to where it left off. Fast as it is the CPU can do only one thing at a time, and one job that it must do fairly often is to examine the keyboard to see whether any keys have been pressed since the last time it looked. This is conveniently done by scanning the keyboard during the field flyback, using the CRTC field sync pulse to generate an interrupt pulse.

So that's basically what a CPU does. We'll go into it in a little more detail next month. CPU operation is not that difficult to grasp.

You'll notice that all sorts of things are connected to the VIA. How does the CPU know which one to send data to or receive data from? Most of these devices are "memory mapped": briefly, this means that to the CPU the printer appears as a group of addresses, as do the cassette, CRTC, etc. Thus if we send a data byte to one of the screen addresses, a character or something will appear on the screen.

The arrows shown in Fig. 1 indicate the direction of data travel. Some are two-way. To and from the printer for example. Why should the printer send data to the CPU? Well, being a mechanical device it cannot operate nearly as fast as the computer. So it needs a way of asking the computer to slow down. The printer sends back a "busy" signal to the computer, stopping the latter while the printer deals with the data in hand. This implies that the printer is capable of storing data, which is so – a printer has a "buffer" that can store anything from one byte to several K. Incidentally a buffer in computer parlance doesn't mean the same as it does to a TV technician. It's a term employed for any portion of memory that can be used to store temporarily data that will be transferred as a block. So the computer sends data to the print buffer: when the latter is full the printer sends back a "busy" signal to halt the computer. When the information in the buffer has been printed the busy signal ends and the computer restarts.

The keyboard is also shown as having a two-way data flow. This is because the keyboard operates in the same way as many remote control handsets and VCRs. If there are say 64 keys, we send out eight addresses and the data comes back along any one of eight lines when a key is pressed.

The cassette port is included so that a cassette recorder can be used to record data and programs and, on playback, transfer them to the RAM.

Next month we'll look at the operation of the CPU in detail. This will also be helpful in connection with the microcomputer i.c.s used in VCRs etc. It's always much easier to repair something when you understand how it works.

Tiny Tim's New Shoes

Les Lawry-Johns

Tiny Tim eventually got the new pair of shoes he needed so much – from Tinker Bell, for Christmas. So on Boxing Day he put on his new pair of shoes and kept them on. That evening he had a few drinks (quite a few) and as the hour grew late he indulged in dancing with a young lady (a member of the family you understand). Whilst demonstrating his amazing dip and reverse he somehow stumbled and fell, bashing his chest on the bar. So Tinker Bell took him home and he managed this feat without falling down. When he got upstairs he did fall down, across the table, hitting his chest in the same place. So Tinker Bell guided him to the bedroom and as he was undressing he sort of stumbled and fell on to the arm of the vicar's chair, again on the same rib.

In the morning he couldn't cough or blow his nose but he did sneeze once and that very nearly killed him. He was very cross and vowed not to wear new shoes any more. It still hurts.

The Puzzle

Despite Tim's injuries he managed to carry on almost without complaint. It was business as usual and he made a muck up of only one or two jobs. Until this fellow came in carrying a 14in. Philips portable that is. Tim thought he recognised it as a KT3 and felt confident he could stick in a new 4·7Ω resistor without too much trouble. So he tried to show off.

"Hang on a moment sir, won't take a second."

His doubts grew as he turned the set around. Why was there a three wire mains lead (no plug)? He removed the rear cover and noted a couple of tracks blown open on the right side lower print, then released the top catches and lowered the panel to get at the lower right side of the power board. On removing this he was stunned to see that it was severely blackened and had several tracks blown open. He looked at the control board next to it and noted that this had also taken a pounding. He looked at the man who'd brought it in and confessed that it wouldn't be a quick job and could well turn out to be expensive.

The man showed no surprise. "That's what I thought you'd say. I don't want to spend much on it. If you like you can keep it for spares."

So Tim was left with this bundle of mystery and resolved to solve it when time permitted.

When he returned to it later he started by repairing the power board, replacing two of the diodes in the mains bridge rectifier, the 4·7Ω surge limiter resistor and the 12V zener diode that had gone short-circuit. He then cleaned off and remade the tracks. The control board needed quite a bit of attention – two transistors, a diode and track repairs. The main board also presented a problem, with tracks blown and two diodes at the top short-circuit. There were lots of other faults to clear up, all apparently due to the original big bang.

Tiny Tim looked at the green earth lead suspiciously and checked that it did indeed go direct to chassis. Also that the brown and blue leads went direct to the power board, i.e. there was no on/off switch. Rightly or wrongly he concluded that the set had been removed from an entertainment centre which must have featured a central bank of switches and a mains isolating transformer. So Tim removed the green lead altogether before testing the set, which now worked perfectly. He put it on one side, intending to show Tinker Bell how clever he'd been when she returned from a visit to the daughters.

Zacharius

When she did return all thought of the set left his mind. This was because she came in with a large puppy Alsatian on the end of a choke chain. She'd apparently had quite a time trying to control him.

"This is Zack" she explained. "When he grows up he'll guard us and we'll be able to sleep at nights. The trouble is that he's a bit unruly and I sound soppy saying Zack back or back Zack. We'd better change his name."

The outcome was that he came to be known as Zeb. He's quite a handful, being only four months old, with boundless energy and a fear of being left on his own for a second or two. Tim's ribs have taken a battering – the cat doesn't like him either.

Sans Switch

When Tim finally showed Tinker Bell how clever he'd been with the Philips portable he was a bit disappointed with her reaction.

"Why can't you switch it off?"

Tim was annoyed with this lack of appreciation.

"The set incorporates this latest safety factor, so far present only in this one set. There's no flimsy on-off switch. When sets are not in use they should be disconnected from the mains supply completely to ensure that they are safe."

Tinker Bell was not impressed. But the more Tiny Tim thought about it the more convinced he became that he was right. He resolved to write a letter to the editor of *Television* magazine suggesting that no sets made in future should be fitted with an on/off switch. . . .

Thorn 1600/1615 Chassis

Tim is also getting angry with the daft 24kΩ resistor (R5) used in these 20 and 24in. monochrome sets to feed the tuning voltage supply regulator. Surely a resistor connected between a 185V h.t. line and a 30V line should be rated at 2W or more for long-term reliability?

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AD142	1.18	BC213L	12	BD144	1.70	BF197	15	BFY52	34	R2305	80
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AD162	32	BC250A	15	BD203	78	BF224	19	BU126	1.10	RCA16599	1.25
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SN74154N	1.40	TBA395	1.00	TDA11705	1.50	ULN2165	1.30
SN76001N	1.40	TBA480Q	1.40	TDA1200	2.42	ULN2216A	1.25
SN76110N	1.14	TBA510	1.90	TDA1270	2.76	UPC1365C	5.75
				TDA1327	2.53	SC9488P	1.40
						SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested

PSU	2.80
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn 3/3K5 ex equip panels untested

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75
Autovox Decoder FG/01 boxed	new 5.00
Thorn 4000 Convergence panel ex-factory	3.75

Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1.75
Thorn 3K5 PSU bottom board PC206 new	2.75
Thorn 3K5 IF panel new	3.00
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

UHF TV Aerial for portable Indoor Aerial Parabolic Type Reflector to Help Combat Ghosting Problems	50p
Line Connectors	2.50
	38p

Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Rush Mounting TV/FM Diplexer	1.00
Switched Rush Fitting Aerial Outlet	1.00

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+ 116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 350+20+148+ 1K5+317	1.40
Thorn 6+1+100	92p

Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	3.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

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

CAN TYPES

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

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC8 On/Off Switch	65p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2.5A Push to make on/off switch	15p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BR303	46p	IN5254B	8p
BT106	1.50	IN5349	14p
BT116	1.00	IN5400	12p
BT119	2.56	IN5401	12p
BT120	2.82	IN5402	14p
BT151 650	1.00	IN5404	12p
BY127	12p	IN5406	16p
BY188	16p	IN5408	16p
BY204	26p	IS025	8p
BY206	16p	IS131	8p
BY207	16p	IS1658	8p
BY208/800	38p	MR854	35p
BYZ23	95p	SKE1/02	20p
BYZ25	1.20	MCR106/1	1.00
BYZ27	28p	MCR406	35p
BYZ98	22p	2N4444	1.50
BYX22/400	30p	Y827	80p
BYX55/600	30p	Y969	75p
BYX71/350	80p	ZX150	12p
BZV15 C12R	1.16	OA91	5p
BZV15 C24R	1.16	MCR106/7	1.00
IN60	8p	MCR106/8	1.50
IN2070	8p	TD3F800H	2.80
IN4001	4p	TD3F800R	3.00
IN4002	4p	BYZ55	30p

TV Fault Finding

Reports from Hugh Allison, David Rainey, John Coombes, Tony Thompson, Mick Dutton, Keith Hamer, Garry Smith and Malcolm Burrell

Grundig 2200GB

Whilst waiting it's turn to be repaired this set caught the eye of several engineers. Though old it was in such excellent external condition it looked as though it had just come out of the box. When it was opened up there was really a surprise – not a speck of dust to be seen. After three hours the engineer gave up and called in the expert – me! The complaint was that the set would run for ages then pack up for a while. If left on it would suddenly start up again and work perfectly as though nothing had happened. The set hadn't packed up on the workbench, but the engineer had noticed that white specks appeared on the screen if the cabinet was gently tapped. Remembering an old dodge I pulled the curtains, switched off the lights and tapped the cabinet. A faint but clearly visible spark could be seen between one leg of the line output transformer and the relevant PCB solder land. With the lights on again the joint looked perfect, but reflowing it with the iron cured the specks and the intermittent close down. **H.A.**

Philips G11 Chassis

Field collapse on several of these sets has been traced to pin 16 (output) of the TDA2600 i.c.'s holder becoming open-circuit between the print and the top side of the holder. This can usually be seen since the holder will be discoloured. **D.R.**

Hitachi CPT1471/CPT1473

In the event of ragged verticals, usually accompanied by a loud whistle from the line output transformer, replace the LA7801 sync/timebase oscillator i.c. (IC701). For no sound or raster with the safety resistor R772 (10Ω) open-circuit replace the STA441C field output i.c. (IC681). **J.C.**

Hitachi NP9A Chassis

In the event of no sound or raster with a loud whistle coming from the set you'll probably find that the 2SC2027 line output transistor Q702 is short-circuit. For lack of width/no EW correction check whether one of the EW modulator diodes D715 (GH3F) or D716 (GU3B) is open-circuit. If not R756 (30Ω, 1W), which is in series with the EW drive, is probably open-circuit. **J.C.**

Philips KT3 Chassis

For a bright raster/cutting out, if the decoder and RGB output panels are o.k. check whether there's an output pulse at pin 13 of the TDA2571Q sync/line generator i.c. If not, replace the i.c. For intermittent loss of sound check the TDA2611AQ audio i.c. (IC5181) by replacement. **J.C.**

Thorn 9000 Chassis

After replacing the tripler (a regular offender on this chassis) we were presented with a narrow picture, the width and keystone controls having no effect. Suspecting the EW modulator driver transistor VT702 we checked it and found that there was 20V on all three pins – in addition the 2·2Ω resistor R726 in its collector circuit was open-circuit. Great we thought, replace these two items and switch on. When we'd done this there was a strong burning smell followed by a click, then no raster or sound – but the e.h.t. was present. A nasty burn to the index finger proved that the replacement VT702 was distictly unhappy. It was short-circuit emitter-to-collector as its predecessor had been. The two components were changed once again (hang the expense!) but some further checks had to be made before switching on. As is usual with this type of circuit, the driver transistor's supply is provided by the diode modulator circuit. The relevant diode, W711 (MR814), disintegrated when touched. Much to our relief replacing this restored normal results. **T.T.**

Rank A823A Chassis

Poor field linearity was traced to the bootstrap capacitor 5C35 (250μF) in the field output stage. The effect was more of a nuisance than anything else: setting the appropriate controls produced reasonable linearity but after the set had been on for a time the linearity would start to drift. **T.T.**

Decca 120/130/140 Series Chassis

The problem was no signals. The supplies to the tuner were correct, including the tuning voltage which varied over the appropriate range, so we came to the conclusion that the tuner was defective and changed it. Wrong, the fault was still present. The BF959 i.f. preamplifier transistor turned out to be open circuit. **M.D.**

Amstrad CTV2200

The complaint with this set was field collapse. Voltage checks on the TDA3562 field timebase i.c. (IC801) showed that the supply was present at pin 9 but there was nothing at pin 6, due to D809 (DFA05G) being open-circuit. When this was replaced we still had field collapse – it was necessary to replace the chip as well. **M.D.**

Philips K30-II with Teletext

The fault was no red and judging by the soldering on the decoder panel it was obviously a bouncer. The TDA3560 decoder i.c. had been changed and we subsequently discovered that the fault had been intermittent, usually putting in an appearance five minutes after the set had been returned to the customer despite working perfectly on soak test for several days. We didn't have the exact circuit with us so we used the basic K30 manual – the circuitry around the TDA3560 is similar. A check on the voltages at the RGB output pins revealed that the voltage at pin 12 (red) was lower than at the corresponding green and blue output pins. Each output is clamped, the clamp reservoir capacitors being connected to pins 18-20. The voltage at the red clamp pin 20 was about 3-4V compared to the 10V present at pins 18 and 19. We devilishly tried shorting pin 20 to pin

19 and, hey presto!, the red came back. The clamp capacitor turned out to be open-circuit – it's C3046 on the standard chassis, C2171 on the teletext version.

K.H.-G.S.

Rank T20 Chassis

Sometimes something that looks straightforward turns out to be otherwise. This set came in with the report "dead". At switch on there was a flashing between the pins of 5Z2, which links the h.t. supply to the line output panel, then the whole set became dormant. The h.t. line was found to be correct but the intensity of the flashover suggested a breakdown in the tripler, which was thus the first thing to be replaced. Set still dead, because the flashover had destroyed the TBA950 line oscillator chip. Replacing this got the set working after a fashion – with partial field collapse amongst other things. 4VT8 and 4VT10 in the field timebase were found to be defective. With full field scan we could proceed to the remaining faults – no colour or sound, with the top half of the picture shaded!

The shading suggested a fault in the flyback blanking circuit, which is on the decoder panel. 3D1 (BA317) turned out to be short-circuit, and when this was replaced we had a good picture with colour. The loss of sound was due to the TBA120SB intercarrier sound chip. **M.B.**

Philips TC2 Chassis

This is the Pye "Cube" TV/radio/cassette combination. The raster was overbright with the picture visible at the top and shading at the bottom. Clearly a field frequency waveform was being superimposed on the video waveform. A look at the circuit revealed that field flyback pulses are applied to the base of the BF422 video output transistor (TS250) via diode D257 (BAW62). D257 turned out to be short-circuit. **M.B.**

Vintage TV

Vivian Capel

The Marconiphone Models VT59DA and VC59DA were released exactly 33 years ago this month, in 1952. They were very popular, no doubt due to the brand name which had a good reputation stemming from pre-war radio receivers and radiograms. Both were fitted with a 12in. triode Emiscope tube, type 3/31, and employed the same chassis – the VT was a table model and the VC a console. There were two versions of the chassis, the later one being identified by the prefix H17 before the serial number – the main difference between the two versions lay in the sound channel.

Circuitry

The receiver side employed a superhet curcuit. Three marconi Z152 valves were arranged as r.f. amplifier, self-oscillating mixer and common i.f. amplifier, followed by a further Z152 vision i.f. amplifier and either one or two Z152 sound i.f. amplifier stages. In the earlier version of the chassis the contrast control varied the common i.f. valve's cathode bias but in the later version the range was extended by including the r.f. amplifier valve in the variable cathode bias circuit. At the aerial input end there was a built-in r.f. attenuator. I think it was little used except possibly within sight of a transmitting mast as these sets were not over endowed with gain. The Marconi Z152 was an equivalent to the better known EF80.

The low sound i.f. gain in the earlier version of the chassis with a single Z152 i.f. amplifier was made up for by using a ZD152 double diode pentode to provide sound detection and a.f. amplification. A separate miniature metal rectifier was used for sound detection in the later version, and sound a.g.c. was added. In both versions a metal rectifier was used for sound interference limiting. A D152 double diode valve was used in the vision channel for detection and interference limiting. Both the audio and video output stages used a Z152 valve, which certainly meant economy in valve types.

There was further economy in valve types in the timebase section, where two Marconi LN152 triode-pentode valves were used – an equivalent to the ECL80. One of these valves acted as field blocking oscillator and output valve. This was a straightforward circuit with height, hold and linearity controls. In the oscillator circuit a single capacitor provided both the charging and timing functions, the height control setting the h.t. applied to the circuit. A similar arrangement was used in the line oscillator circuit, as we shall see.

The other LN152 acted as sync separator (pentode section) and line blocking oscillator (triode section). A miniature metal rectifier was present in the field sync pulse feed, arranged so that the negative-going pulses developed at the anode of the field oscillator triode didn't interfere with the action of the line oscillator. Without this precaution there would be a tendency for the line synchronisation to become unstable during the field flyback period.

The reason for the previous comment will be clear from Fig. 1, which shows the complete line timebase circuit, since the negative-going pulses developed at the anode of the sync separator are fed via integrating/differentiating networks respectively to the anodes of the field and line blocking oscillator triodes. The pulses are transformer coupled to the grids, with inversion, so that the oscillators are switched on at the correct times to initiate the field and line flybacks.

C46 in the line oscillator circuit provides both the timing and sawtooth generating functions, the time-constant being set by the line hold control network. The complication here is the line drive control which sets the h.t. applied to the stage. C47 couples the sawtooth drive to the N152 (PL81) line output pentode which is unusual in being operated with a cathode bias of some 10V. It operates in the conventional switching mode, with the U152 (PY80) efficiency diode producing a boost voltage of 300V at its cathode. The U151 (EY51) provides a flyback derived e.h.t. voltage of 8·5kV.

The two ganged coils L25 and L26 provide width adjustment. Note that one coil is in shunt while the other is in series with a section of the line output transformer's secondary winding. The idea of the arrangement is to maintain the total inductance present so that the e.h.t. doesn't vary with adjustment of the width control. The line scan coupling capacitor C52 is included to provide a d.c. block. C41 is present to prevent scan coil ringing.

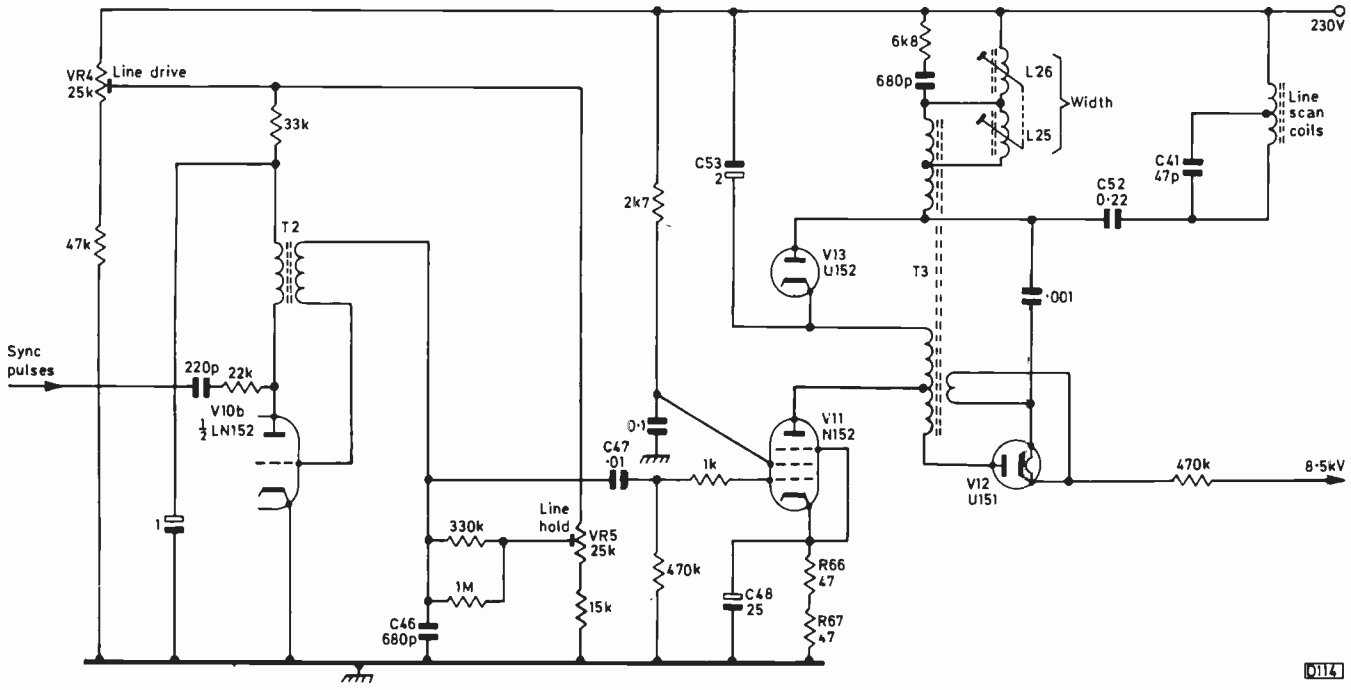

Fig. 1: Line timebase circuit used in the Marconiphone Models VT59DA and VC59DA.

Component reference numbers apply to the earlier version of the chassis.

Adjustments

The line drive control was a rather misleading feature. It consisted of a slider potentiometer that was mounted on the same subchassis as the field linearity control. As it altered the linearity of the line scan, it could be used as a line linearity control and was often mistakenly so used. This misuse would lead to premature failure of the line output valve or transformer due to inadequate drive. The correct procedure for setting it up was to raise the slider until a white line appeared down the centre of the raster, then to lower it until the line just disappeared along with all traces of centre cramping, this being the optimum position. There was no line linearity control as such.

There was another peculiarity in the operation of the line timebase. The line hold control would achieve a locked picture over a fairly wide range, but a locked picture didn't mean that the control was correctly set. Over part of the control's lock-in range the e.h.t. regulation would be poor. So this had to be checked by swinging the brightness control up and down while resetting the line hold control to find the position that gave minimum picture expansion!

As was frequently the practice with sets of this vintage, focusing was achieved by means of a coil that was included as part of the tube yoke, with the h.t. current passing through the coil and a shunt resistor to act as the focus control.

Power Supply

Most receivers that used a series heater chain had the c.r.t. heater at the chassis end of the chain. This was mainly for safety, so that the tube would be unaffected by a heater-cathode short in any of the valves. Any heater placed above a heater-cathode leak would of course be overrun, the leak becoming the effective end of the chain. In these models there were three heaters below the c.r.t., the two sound amplifier (not output) valves and the vision detector diode. The desire to avoid hum in the vision circuit with its possible effect on field sync is understandable, but the inclusion of the sound valves below the c.r.t. is more obscure.

H.T. rectification was performed by a large metal rectifier mounted in a cut-out on the main chassis. This provided good ventilation for cooling. In the earlier version of the chassis the rectifier was a half-wave type while in the later version a full-wave type was used. Choke-capacitor smoothing was employed, these components being mounted at the front of the chassis. Table models used an energised speaker, with the field coil providing some of the h.t. smoothing, while the console models had a permanent magnet speaker. As a result the h.t. smoothing choke in the table models had a lower d.c. resistance to compensate for the inclusion of speaker's field coil.

The Chassis

The chassis itself was somewhat unusual in that the rear corners were flattened. The mains voltage adjustment was on one corner while most of the preset controls were mounted on the other. At the lowest level there was a long transparent knob with a black plunger inside. The knob was calibrated with five black lines along its length, rotation of the knob bringing the edge of the plunger into line with each of the calibration marks in turn. The local oscillator was thus tuned to each of the five channels in use. Alongside this there was a hole through which the r.f. coil could be tuned. The contrast and vision interference limiter controls were mounted above this, then came a bracket with the rotary focus and timebase controls. This corner positioning of the controls made adjustment easier while watching the screen in the absence of a mirror. The only front controls were for brightness and volume.

As you'd expect, there were equivalents in the HMV range: Models 1814 and 1816 respectively.

Teletopics

RECORD JAPANESE VCR PRODUCTION

Production of VCRs in Japan broke all records in 1984, rising by almost 50 per cent to 27·12 million units. While exports to Europe fell by 19·2 per cent, exports to the USA more than doubled. The Japanese home market took 5·05 million machines (penetration now estimated at 30 per cent), the USA took 11·91 million machines while shipments to the rest of the world totalled 10·16 million.

MORE SATELLITE TV

Though the UK's DBS TV service gets no nearer there's plenty going on in the satellite field. The first Eutelsat (European Telecommunications Satellite Organisation) satellite came into operation just seventeen months ago. Eutelsat has now decided to double the in-orbit capacity available on its satellites for TV distribution to European cable networks via leased transponders by launching a third satellite, ECS-3 (Eutelsat I-F3). The launch date is this August, via Ariane flight V15. To date a total of 22 transponders have been leased, including two used exclusively by the EBU for Eurovision, making Eutelsat one of the world's leading distributors of satellite TV programmes. Eutelsat has also announced plans for a new generation of satellites, with the first launch scheduled for mid-1989 – there will again be three satellites. Technological improvements with the new generation of satellites will include improved transponder characteristics, greater operational flexibility and enhanced service zone coverage by means of shaped-beam aerials. The satellites will have a nominal orbital lifetime of seven years with a total of sixteen transponders operating in the 11/14 and 12GHz bands.

The first Arabsat satellite, which includes TV facilities, is now in orbit at 19°E over Zaire – the UK is just within the predicted fringe area (20dBW) of the footprint. The Arabsat organisation is funded by the Arab League. A second satellite is due for launch later this year. The Arabsat satellites operate in the 2·6 and 4GHz bands.

Marconi Defence Systems Ltd. recently demonstrated a working pre-flight 12/17GHz TV transponder developed for use with the Unisat spacecraft. The C-MAC transmission system was used and the equipment featured state-of-the-art microwave integrated circuits.

Following the Australian government's decision to use the B-MAC system for the Aussat DBS satellite, Scientific-Atlanta has licenced Plessey's Australian subsidiary to manufacture the Scientific-Atlanta B-MAC baseband processor, a decoder/receiver for home satellite TV terminals. The satellite is due to be launched towards the end of the year.

Europe's first DBS satellite is expected to be the French TDF-1 which is due to be launched in July 1986. The economic and financial aspects of TDF-1 are still under consideration.

British Telecom International has reached an agreement to allow direct reception of the US cable TV channel Cable News Network in the UK. The channel is produced by Turner Broadcasting Systems in Atlanta and will be available to UK broadcasting companies from this September. It features a variety of news and current affairs programmes. The Network will be transmitted to the UK via an Intelsat V satellite – the same satellite as that currently used to distribute TV channels to cable networks across the UK. The UK will be the first country outside N. America able to receive Cable News Network on a full-time, commercial basis.

FERGUSON'S FST SETS

Ferguson's first two TV models fitted with the new flatter, squarer type of tube have now been released. The sets are in production at Enfield and use the TX100 chassis. A fresh approach to styling has been adopted for these two 51cm screen sets which incorporate frequency synthesis tuning, a second memory for user control settings, a remote control system that also operates Ferguson VCRs (from the 3V31 on) and other up to the minute features.

FLAT TUBES

Flat TV display devices have been talked about and worked on for many years. It's still anyone's guess as to what technology will eventually be used. Matsushita pulled the wraps off a very interesting device at Tsukaba Expo '85 however. It's a flat colour tube with a ten inch screen and a depth of 3·9in., and was demonstrated working in a prototype TV set. The technology is conventional in so far as a striped phosphor screen with electron beam activation is used, but the internal arrangements are something quite new. To start with there are fifteen filament-cathodes that extend across the full width of the rear of the panel, spaced one above the other. Between these and the screen, which has vertical phosphor stripes, there are a grid plate, a series of vertical deflection plates, a matrix-addressed beam control electrode, and a series of horizontal deflection plates. The use of fifteen cathodes substantially reduces the amount of matrixing required (compared to a full X-Y matrix) while the narrow-angle electrostatic deflection system minimises the power requirements. The beam is the same width as the stripes and the combined deflection/focus system is said to give good resolution over the entire screen area. The set used digital techniques for signal processing and tube drive.

A totally different approach has been taken by the W. German firm Siemens which, with government backing, has developed a plasma type colour TV display panel. The device has a 12in. screen and is only 2·5in. deep. The screen is of the conventional phosphor type with plasma activation: since the latter requires full matrix control the drive circuitry is relatively complex.

CABLE NEWS

The Information Technology Advisory Panel (ITAP), which advises the Prime Minister on all aspects of information technology and produced the famed 1982 report advocating the "recabling" of Britain, has been taking a look at what went wrong. It has decided that its 1982 report was correct in foreseeing a £1 billion a year industry that could be funded by the private sector of the economy. Well it would, wouldn't it? The question as to when all this might happen remains tantalizingly vague however. Recommendations to get things going include ways of helping cable operators with their initial cashflow problems, a simplified licensing system and a firmer government commitment to cable TV.

While the ITAP considers that the main purpose of cable should be the development of two-way communications systems, a report from the media research

consultancy CIT, entitled "Cable – The Way Forward", urges a simple approach with the emphasis placed on low-cost systems using existing techniques. It predicts a doubling of cable penetration to eleven per cent of homes by 1995, feels that overhead cabling would help by greatly reducing start-up costs, and is sceptical about the IT aspects of cable.

Both CIT and the ITAP think that cable TV has a rosy future: their views of what this future might be don't seem to have much in common however.

Last month we mentioned that the Cable Television Authority had approached forty companies with a view to assessing their interest in applying for the next batch of cable franchises. Some thirty replies were received, most expressing long-term rather than immediate interest. The Authority's director general Mr. Jon Davey sees this as a "heartening" response in view of the present financial outlook for cable TV, but it doesn't look as if the next batch of franchises on offer will meet with much enthusiasm. Five franchises are currently being advertised – applications are due by April 30th.

Swindon Cable, the only wideband service to have started up so far, now has some 2,500 connections: the French-language TV5 channel has recently been added to the programmes available – it comes via the ECS-1/ Eutelsat I-F1 satellite.

SONY'S BRIDGEND INVESTMENT

Sony is to invest £6 million over the next three years on modernising its TV receiver/tube manufacturing plant at Bridgend in S. Wales. The plant at present produces 180,000 colour sets and 240,000 tubes a year (the tubes also go to a setmaking plant in W. Germany).

COMPUTER TV RENTAL PACKAGE

Phoebe Software Ltd., Chambers House, Ellison Street, Castlebar, Co. Mayo, Ireland have introduced a computer software package designed for use by TV rental dealers. The TVR system can handle up to 31,000 accounts, with records on a weekly, monthly, quarterly, annual or once-off basis. A price of £495 is suggested and a comprehensive demonstration system is available. It can also cover sales, hire purchase, service calls, aerial installations etc. and will work with many popular business microcomputers (ACT, IBM, Televideo, etc.).

MULLARD'S HIGH-VOLTAGE EPITAXIAL DIODES

Mullard have introduced two diodes, types BYR29-600 and BYR29-800 (rated at 600V and 800V respectively), that for the first time bring the advantages of epitaxial technology to high-voltage applications. The BYR29 diodes will replace devices that use conventional double-diffused technology in applications where speed is essential: recovery times of 75nsec with soft recovery and low on-state losses make the diodes ideal for use as high-voltage, fast-switching rectifiers in applications such as switch-mode power supplies and the new generation of high-frequency TV line output stages.

REVISED BS ON INTERFERENCE

British Standard 905 "Sound and television broadcast receivers and associated equipment: electromagnetic compatibility" has been revised and published in two parts. The purpose of the revision is to assist the domestic radio and television industry in bringing the limits of interference caused by radio and TV receivers into line with international standards. Interference limits for TV games are also specified. The new Part 2 deals with the susceptibility of radio, TV and associated equipment to interference and specifies immunity limits over the part of the h.f. band where problems have been increasing. It also specifies TV receiver immunity limits from tuned frequency interference (ghosting).

FERGUSON'S MONOCHROME MONITORS

The Ferguson monochrome monitor previewed in this column last July has now been released – it's in production at the company's Gosport plant. The specification is impressive and an examination of the circuit diagram shows that some interesting techniques are incorporated. For example a cascode video output stage is used: the video channel has a bandwidth of over 25MHz with rise and fall times of less than 20nsecs. A cascode amplifier is also used to provide the dynamic drive to the tube's focus electrode. This ensures sharp focus and spot consistency over the entire screen – both line and field waveforms are fed to the dynamic focus circuit. The elaborate sync circuit provides for a comprehensive range of inputs to allow maximum user flexibility. In addition the timebases operate to UK/European/US standards with automatic height compensation between systems, enabling the monitors to handle most hardware/software arrangements. Both linear and TTL inputs are accepted. Anyone who has to deal with the innards should note that the series regulator circuit provides a −12V output: the line output stage provides 12kV, 400V, 60V, 16V and −245V supplies. Model MN02 is fitted with a green phosphor tube while the MN06 has an amber screen tube. Both models have an anti-glare faceplate to reduce unwanted reflections. The fast line flyback (8μsec) makes it possible to display up to 100 characters per row on the screen.

PINNACLE LIQUIDATION

The well known TV components distribution company Pinnacle Electronics Ltd. has gone into voluntary liquidation with an estimated deficiency of £1·17 million. Problems started with a sharp drop in TV component demand, notably valves, in 1982. Further problems arose when the company tried to enter the video cassette distribution market.

TOSHIBA'S HDTV EQUIPMENT

Toshiba have developed a complete range of transmitting and receiving equipment, including a camera and VTR, for use with the NHK high-definition (1,125 lines) system. The receiver incorporates a 40in. tube with an aspect ratio of 5:3 – it's used in conjunction with a dynamic focusing circuit and a digital convergence circuit and employs 12mm guns (conventional tubes use 9·5mm guns) to reduce the beam diameter by half. One can't help wondering why such emphasis is being placed on wide-screen, cinerama-type displays for high-definition TV: domestic TV viewers have to sit much closer to the screen than cinema viewers, and even with normal tubes attention is focused on the centre portion of the screen for most of the time – except of course with a text display.

KLYSTRON EFFICIENCY IMPROVED

Marconi Communications Systems Ltd. and Comark Communications Inc. have achieved a klystron beam efficiency of over 77 per cent at the WTTE-TV Channel

28 TV transmitter, Columbus, Ohio, USA, the highest efficiency ever achieved for a u.h.f. klystron under actual field conditions. This places klystron energy performance on a par with v.h.f. tetrode technology. The klystron is operated in the pulsed mode (see page 218, February) with 7·1kV pulses applied to the modulator anode – beam efficiency in the non-pulsed mode is 46 per cent. Marconi claim that when installed as a retrofit package the drive/modulator and pulser system will pay for itself in less than a year on the basis of typical energy prices. The transmitter uses the new Marconi B7500 modulator, Comark S series 60kW amplifier and Amperex YK1265 klystron, with a Comark CTM20 pulser interfaced with the B7500. The Marconi B7509 pulser unit is available for use with klystrons that have a beam control electrode. Details of the tests are to be presented in a paper at the forthcoming Las Vegas National Association of Broadcasters convention.

TUBE SHORTAGE

A world-wide shortage of 14in. colour tubes has been reported, emphasizing the growing popularity of small-screen colour portables. Japanese exports of small-screen colour sets to the USA, where they are widely used as computer monitors, rose by 82 per cent last year to 1·2 million. Even more remarkable was the increase in exports to the People's Republic of China, where there was a sevenfold rise to just over a million sets, accelerating towards the end of the year with shipments in December rising above 300,000 sets.

VIDEO USE AND ABUSE

The Federation Against Copyright Theft (FACT) was involved in over 400 raids last year when some 30,000 video cassettes were seized and damages of £137,000 were received. FACT says that growing success is being achieved in the war against video piracy, with sales of pirated tapes reduced from 60 per cent two years ago to less than 20 per cent of the market last year. A new method of marking films has played a major role in this success, enabling investigators to trace the cinema from which the prints originated.

FACT estimates that the total size of the UK video cassette market last year was £113 million. According to a recent Mintel report 40 per cent of VCR users rent or buy prerecorded tapes while 70 per cent use their machine to record programmes for subsequent viewing.

NEW PUBLICATIONS

Philips Service have published a useful glossary of audio and video terms. Copies are available for £1 each inclusive of postage and packing from Philips Service, 604 Purley Way, Waddon, Croydon, Surrey CR9 4DR. On a quick spot check we didn't find a definition for breathing and were rather surprised at the definition given for AV. The latest IBA technical review, number 22, covers light and colour principles.

EXHIBITIONS

This year's Berlin Radio Show is being held on August 30th-September 8th. IVAC 85, the International Video and Communications Exhibition, will be held at the Alexandra Pavilion, London from November 3rd to 6th. The 19th Milan International Exhibition of Music, High-Fidelity, Video and Consumer Electronics (SIM-HI·FI-IVES) is being held on September 5th-9th. The Olympia, London All Electronics Show is being held on April 30th-May 2nd. The Mullard stand at the latter show will include many new products for both industrial and consumer equipment – of particular interest will be a display showing the range of household functions that can be monitored and controlled via a television set (lighting and heating control, external surveillance, etc.).

NEW BBC-1 SYMBOL

The familiar BBC-1 rotating world symbol took on a new look from February 18th. The old mechanical model with electric motor and simple camera has been replaced by a digitally generated pattern that requires minimum maintenance and alignment. Full rotation of the globe takes twelve seconds, which is equivalent to 600 TV fields. This would normally require some 250Mbytes of memory but the BBC has developed a data-saving technique (patent applied for) which stores a single field of world in only 8Kbytes.

US ADOPTS ZENITH MTS SYSTEM

US broadcasters and set manufacturers have decided to adopt the Zenith MTS (multichannel TV sound) system which, in addition to stereo TV sound, has provision for a SAP (second audio programme) and a narrow-band "professional" channel, i.e. a total of four sound channels. The stereo feature is expected to be brought into operation by over a hundred TV stations this year and by mid-1986 it's thought that ten per cent of new sets will be equipped for multichannel sound, rising to 45 per cent by mid-1988 and levelling off at this figure.

THE OMNIMAX AERIAL

Maxview Aerials Ltd., Setchey, King's Lynn, Norfolk have introduced a wideband (channels 21-68), omnidirectional set-top aerial for use by caravanners etc. The Omnimax aerial incorporates a 22dB amplifier and has a suggested price of £39·50.

NON-VISUAL GREY-SCALE ADJUSTMENT

A new item of test equipment from H.C. Taylor Electronics (45 Apsley Way, Peterborough PE3 6NY) enables grey-scale adjustments to be made without having to look at the screen. The Tel-Set is priced at £185: it produces signals for feeding into the set and incorporates an optical sensor system whose output is converted to readings on three built-in meters. The advantages claimed are faster and more consistent grey-scale adjustments.

LATEST VIDEO EQUIPMENT

JVC have introduced a "component video" system comprising the HRS10 VCR and matching TUS10 tuner/adaptor. The two slide together to give direct, cableless connection. On its own the HRS10 weighs just 2·4kg, making it one of the world's lightest and smallest portable VCRs to use standard VHS cassettes. Sharp's latest budget VCR, Model VC581H, replaces the VC482H: the suggested price is £430. Panasonic have introduced the NV870 hi-fi VHS machine to replace the NV850: the suggested price is £755. Mitsubishi's latest machine is the dual-speed Model HS307 which has a suggested price of £570. A logical development by Pioneer, introduced in the USA, is a combined LaserVision and compact digital audio disc player. The intensity of the solid-state laser adjusts automatically for either video or audio disc playback.

Twiddlers' Delight: Preset Adjustments for VHS VCRs

Derek Snelling

As anyone who's read a VCR service manual knows, it's impossible to set up or adjust a VCR without an alignment tape, an oscilloscope, a signal generator, a frequency counter and an Avometer. Or is it? Experience has shown that by carefully observing the picture and sound the following adjustments can be made on most VHS machines with no more than a blank tape and one with a known good test pattern recording:

Drum forward and reverse search speeds.
Drum free-running speed.
Drum standard speed.*
Capstan forward and reverse search speeds.
Capstan standard speed.*
Head switching points.
Record switching (record timing).
E-E video and sound.
Playback video and sound.
Video equalisation.
The tracking presets.

For long term stability the two adjustments asterisked (*) should if possible be done properly.

For all you twiddlers then, here's how it's done.

Drum Speed

First the drum speed adjustments. Playback the test pattern recording. Note that drum speed changes produce a similar effect to that of a TV set's line hold control, though for different reasons. So adjust for a locked picture, setting the potentiometer at the centre of the locked range. With some machines, e.g. the Hitachi VT8000, the tracking control will operate correctly (i.e. in both directions) only with the correct drum speed setting, so check this while making fine adjustments.

Now put the machine into forward search and, ignoring the noise bars, adjust the drum forward search speed control first for a locked picture, then (fine adjustment) for best colour registration, i.e. the colour not leading or trailing the luminance. Repeat for reverse search drum speed.

Capstan Speed

The capstan speed adjustment causes noise bars to move up or down the screen and the sound to be at the wrong speed. Adjust for no noise bars and set to the centre of the locked range. Check that the sound speed is correct.

Put the machine into forward search. The picture will have a number of noise bars – how many depends on the machine. Adjust the forward search capstan speed for stationary noise bars (note that there's no definite lock position for this adjustment, so it may not be possible to get perfectly stationary bars). Repeat for the reverse search capstan speed.

Head Switching

The head switching point adjustments (there are two, for playback) give the effect of foldover at the bottom of the picture if adjusted one way or field jump if adjusted the other way. Adjust for minimum foldover. Often the best method is to adjust till the picture jumps, then back off slightly, repeating this with the other preset.

The record switching (record timing) adjustment is a little more tricky. Turn the preset fully anticlockwise, zero the counter and set the machine to record. Watch the counter and each time it advances by 1 (or 2 or 5 if your machine counts fast) turn the preset one twelfth of a turn, i.e. 6 o'clock, 7 o'clock etc. When the preset is fully clockwise stop the tape and rewind to zero on the counter. Play the recording back. At some point during the recording the picture will have little or no foldover and will not be jumping. By checking the counter at this point the correct setting of the preset can be worked out. Set to this point and do a recording to check. Fine adjust if necessary.

Preset Tracking

Now preset tracking. Record and play back a test pattern. Set the tracking control to the preset or centre position and adjust the preset control for the best picture. If the machine has slow and fast speeds, adjust the relevant presets similarly.

E-E Video and Sound

For E-E video and sound, compare the picture and sound of a TV channel with the same channel through the VCR. Adjust the presets for the same results.

Playback Video and Sound

Record a test pattern and play it back. Adjust the playback video and sound controls so that the playback is as close as possible to the original, being careful with the video adjustment not to get overloading on peak whites (this can give a bluish tint to peak whites or a buzz on sound).

Video Equalisation

Video equalisation acts as a picture sharpness control. At one end you get a soft picture and at the other end a sharp picture with ringing. Adjust for the sharpest picture without objectionable ringing while playing back a test card recording.

Warning

While all these adjustments will work as described, if more than two or three of them have to be made, particularly if they are related, it's best to use the correct test equipment and procedures as small errors in each adjustment can add up and result in a performance below par.

Finally a warning to experimenters: don't under any circumstances adjust the following controls except as detailed in the manual: white and dark clips; f.m. record level; carrier set and deviation; any colour oscillator adjustment.

Guide to Satellite TV Reception

Part 1

Hugh Cocks

Satellite TV reception involves a number of techniques that will be new to many TV engineers and aerial riggers. Although the start of a DBS service for the UK is still some way off, the presence of the Eutelsat I-F1 and I-F2 (ECS-1 and -2) satellites in orbit, transmitting TV signals to Europe, and the prospects of a French DBS service coming into operation during the next couple of years, mean that many readers are likely to be involved in receiving satellite TV signals before long – some already are. The purpose of this and later articles is to provide practical guidance on the technology involved. Let's start off with bands and frequencies.

Satellite Bands

4GHz, 11GHz, 12GHz – what's the difference? The 4GHz band (Band C) was the first to be used for satellite TV, starting with Telstar in 1962 – at around 4·15GHz. The current Intelsat V series of satellites and the US domestic satellite system operates in the band 3·7-4·2GHz – the new Intelsat VI series, due to come into operation in 1986, will use 3·65-4·2GHz. In parallel with this there's the Russian 3·4-3·9GHz satellite band – the well known Gorizont TV transmissions are at around 3·675GHz.

The 4GHz US "domsats" aren't intended to provide a DBS service. With the power levels in use increasing and low-noise amplifier (LNA) noise figures falling however a lot of signals can be received there using a 6ft dish. The 4GHz birds provide a reasonably cheap system – compared with the launch of a dedicated 12GHz satellite – and, with the financing of US DBS services now giving cause for concern and a forecast one million 4GHz home terminals in use there by 1986, it could well be that 4GHz will end up being the US DBS band.

The 11GHz band is in fact 10·95-11·2GHz and 11·45-11·7GHz. It's used by Intelsat, Eutelsat and will be used by the Russians before long – Gorizont at present has a beacon transmitting at around 11·541GHz with quite a high output, and Russian 11GHz satellites called "Loutch" (beam) are planned. The power levels used by the Intelsat and Eutelsat satellite spot beams are about 15-17dB below the proposed levels for DBS services. Polarisation in this band is either linear or circular – the latter is used by the Russians.

The 12GHz band is the future European DBS band, covering 11·7-12·5GHz with circular polarisation. It's intended that a sub-band at 12·5-12·7GHz will be used with the DBS satellites for data transmission. An Australian DBS service, which is scheduled to come into operation by the end of this year, will use the band 12·5-12·7GHz.

In North America the 11·7-12·2GHz band is intended for business communication. There's also some TV however – the USCI subscription TV service is at present using this band. The US DBS band proper is supposed to be 12·2-12·7GHz, when it gets off the ground.

The Indian Insat service operates in Band S, at around 2·5-2·6GHz. The advantage here is that dish accuracy need not be great: the high-level, wide coverage beam allows relatively simple receiving technology to be used. The Arabsat satellite has two S-band transponders and a number of C-band transponders.

There's also the Russian Ekran (screen) semi-DBS service which operates at 714MHz from a satellite at 99°E. This again enables simple technology to be used: the beam is widespread, even putting a good signal into S. Africa behind the aerial! Due to terrestrial interference problems in the western part of the USSR, Gorizont at 4GHz is used for distribution in this area. Its spot beam spills over into Western Europe – and has done much to promote European interest in satellite TV over the past few years, however unintentionally!

Aerials

The only practical form of aerial for S, C and K Band satellite TV reception is the parabolic dish reflector. The dish intercepts the satellite beam, reflecting the signals to a focal point. The main variations in aerial design concern the arrangements used at the focal point of the dish.

The traditional microwave technique was to use a rectangular horn to pick up the signal at the focal point, followed by a section of waveguide to carry the signal to a detector probe adjacent to a preamplifier. The circular feedhorn surrounded by a series of rings called "scalar rings" (see Figs 1 and 2) has now largely taken over. This gives an extra 1dB in signal strength. It doesn't seem much in terrestrial broadcasting terms but can mean a lot if the signal is a little below the f.m. threshold (f.m. video is used for satellite TV transmissions, primarily because the transmitter power can be reduced considerably).

The scalar rings are used because the E and H (electrical and magnetic) characteristics of a circular horn are unbalanced, as a result of which the dish is not evenly "seen". The rings, usually three to five in number and a quarter wavelength deep, serve to balance the characteris-

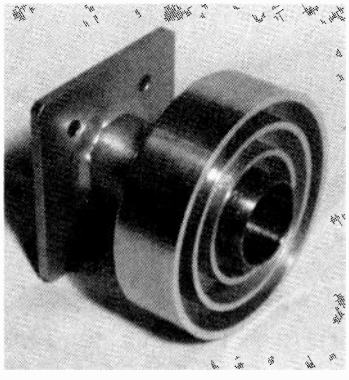

Fig. 1 (left): Typical scalar feedhorn. Note that the rings are adjustable with respect to the waveguide pipe, which is shown protruding slightly. The LNA/LNC is bolted to the rear flange.

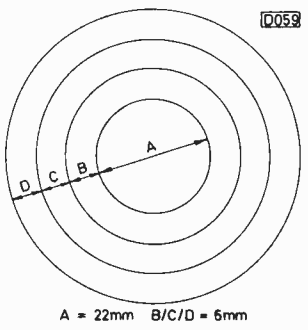

Fig. 2 (right): Scalar feedhorn rings. At 11GHz the depth of the rings is 8mm. Up to seven rings can be used. A-D figures apply at 11GHz.

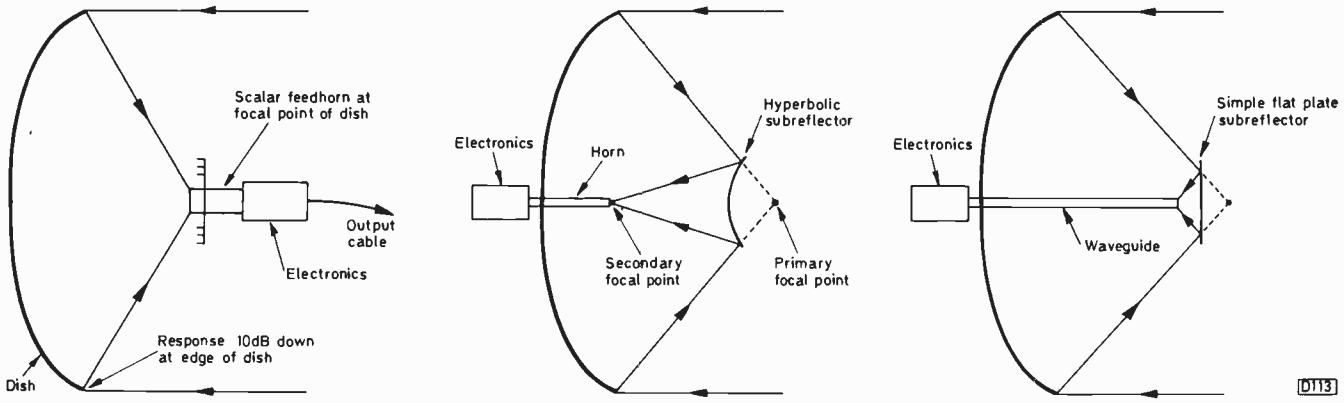

Fig. 3 (left): Parabolic dish aerial with the feedhorn and electronics mounted at the focal point (prime-focus feed).
Fig. 4 (centre): The cassegrain aerial. A hyperbolic subreflector focuses the signals at the mouth of a horn which conveys them to the electronics at the rear of the dish.
Fig. 5 (right): A simple flat plate subreflector can be used for experimental purposes.

tics. The pipe protrudes in front of the rings by an amount that varies with the "depth" of the dish (ratio of the focal depth of the dish to its diameter). If a shallow dish is used the rings should be near the mouth of the pipe: with a deep dish the rings are mounted further back. It's useful to make the rings adjustable on the pipe so that the scalar horn can be peaked for the individual dish by measuring the signal strength obtained.

The feedhorn must look at the dish but not over the edge towards the ground where noise will be picked up, degrading the system's overall noise performance. This can be difficult to achieve in practice and a degree of compromise is required. The efficiency of a dish decreases towards the perimeter. It's generally 10dB down at the rim, so ground noise will be low. The efficiency of a dish with a feedhorn mounted at the focal point (called prime-focus feed) is generally 55-60 per cent, due largely to this problem (see Fig. 3). It's interesting to read claims of 75-80 per cent effiency in American magazines: these claims must be considered highly optimistic – the lack of a trade descriptions act helps no end here!

The cassegrain subreflector technique (see Fig. 4) increases the efficiency of the aerial. In this case the preamplifier and converter are at the rear of the dish, a small hyperbolic subreflector being mounted near the focal point. As a result, the converging rays at the focus are diverted towards the rear of the dish where the feedhorn is located. The system has several advantages:

(1) The electronics are kept out of the worst of the weather. Not only bad weather – the hot sun causes the noise figure of an LNA to increase.

(2) The feedhorn can be made to see the hyperbolic subreflector efficiently and if it sees over this only the sky, which doesn't produce appreciable noise at the frequencies concerned, will be seen.

(3) The subreflector can be made to look at the edge of the dish more efficiently. Indeed professional aerials often use a technique called dual distortion, where the edge of the dish is not a true parabola and the subreflector is matched to this. Efficiencies of 75-80 per cent are obtainable using this technique.

Subreflector feed is better at 11GHz than 4GHz with a small dish, as the subreflector must be at least five wavelengths in diameter or ten per cent of the dish diameter, which inevitably causes some obstruction of the satellite's beam. As the wavelength at 11GHz is appreciably shorter than at 4GHz a smaller subreflector can be used.

A flat reflector plate can be used at the focal point of the dish (see Fig. 5). The efficiency will be about the same as with prime-focus feed but the electronics can be mounted out of the way at the back. This is useful when experimenting.

If you wish to try different hyperbolic subreflector shapes to get a long or short secondary focus at the rear, it's convenient for initial testing to have the subreflector made of wood on a lathe, then covered with aluminium foil, rather than having it spun from metal.

Noise Figures

The noise figure for a satellite receiving system is very often quoted in degrees Kelvin. An LNA noise temperature of 100°K is common at 4GHz. This translates to 1·3dB. At 11GHz 170°K is now the state-of-the-art figure, using an LNA with gallium arsenide f.e.t.s. This is 2dB. Most of the equipment used for cable TV receiving head ends has a noise temperature of around 225-290°K, i.e. 2·5-3dB. The reason for using noise temperature figures is that it's easier to work out the overall system noise.

The ground radiates around 290°K – if you have a satellite receiving system, point the feedhorn at the sky which produces little noise then at the ground and watch the signal strength meter reading rise. As with a conventional TV aerial the polar response of a dish includes small sidelobes, so a small amount of ground noise will inevitably enter the receiving system. The amount depends on the elevation of the satellite. With an 11GHz signal and a 1·2m dish, 30-40°K can normally be added at an elevation of 30°. This is nearly 0·5dB. As the elevation of the satellite decreases, so more and more ground noise will be picked up. The IBA's *Broadcast Engineers' Pocket Book* has a very good dB to Kelvin conversion chart.

What are we to do if, with a low-noise converter (LNC) that has a noise figure of 3dB and a 1·8m dish, at 11GHz, the signal is 2dB below the threshold? If the dish size can't be increased, you might initially think of using an LNC with a noise figure of 1dB. At present this is not practical. However, to work out the situation the noise figures must be converted to noise temperatures and the ratio of the temperatures then converted back to dBs. Say we could obtain an LNC with a noise figure of 2dB. Now 3dB = 290°K and 2dB = 170°K. 290/170 = 1·71 which is 2·33dB. Thus by using an LNC with a 2dB noise figure instead of 3dB we've gained 2·33dB and the signal will be a little above the threshold.

Note that a larger dish decreases the ground noise pick up, giving a further improvement in picture quality.

LNCs with 2dB noise figures should be the norm by the time a UK DBS service starts, in all probability giving clear reception of the satellite's signals on a tiny dish. Spillover reception from neighbouring European satellites will be possible with quite a small dish. If the French DBS service does start in 1986 as planned, reception with a 90cm dish should be possible throughout the UK and a 60-75cm dish might give acceptable results in the south.

Teletalk

Malcolm Burrell

"To murmur continuously like a bee" is one of the definitions of the word "hum". In other words, although it doesn't actually say "a low-frequency noise" this is what we tend to think of as hum. The word "fizz" can mean "a hiss or splutter", while "buzz" is defined as "humming of bee . . ., confused sound of talk . . ." We all know what "whistle" means don't we? The dictionary gives quite a long description but the closest it comes to defining the approximate frequency is "a sound made by forcing air through a small hole between nearly closed lips".

Misleading Reports

What's all this got to do with TV? Well these are all words you'll find customers using in connection with their sets, and to my mind they don't take too much care about selecting the most appropriate word. For example last week I visited a customer who had a dilapidated 26in. set fitted with the Thorn 3500 chassis. Gesticulating in the direction of the power supply she commented "it buzzes, usually after it's been on for a while. It gets worse as the evening goes on."

Off came the back but application of one of my large ears to the area indicated failed to detect any appreciable buzz. Deciding that the mains transformer was in all probability the cause I trekked the hundred yards or so to the nearest point where I'd been able to park and grabbed a replacement power unit (not being in the mood to change the transformer). Out came the old one and in went the replacement. Switching on I was greeted with no sound and field collapse. Much muttering and cursing ensued as I retensioned the pins in the edge connector to get the set working properly. Then "that's the noise!" exclaimed the woman.

"What noise?" I asked rather impatiently, knowing that I'd other calls to make. It transpired that the noise was a faint fizz from a pinhole in the e.h.t. tray on the other side of the set! Usually any e.h.t. brushing tends to be at its worst when the set is cold and damp. With this one it was different. Anyway another trek to the car solved the problem.

It seems strange to me that we're continually led up the garden path by incorrect or inadequate descriptions of symptoms. I've had the "whistle" on captions and "buzz" from the line output transformer. One problem is that we're working against the clock and often have to rely on the customer's description of a fault. Here's another recent example. The set was a Philips G8 and the complaint "intermittent focus". Following lots of probing I found that the focus VDR's silder was making poor contact. Whilst I was putting the whole assembly back in the set the daughter of the house walked in exclaiming "couldn't see it last night – it was all lines". So what fault should I have been looking for? Just to cap it all father walked in as I was refitting the back cover. The aerial was disconnected so there was a raster of noise. "That's it" he said, "that's how it goes."

Treating Symptoms

Many years ago I remember a KB VC3 chassis that used to consume PL36 line output valves at the rate of one every six weeks. It was my luck to be the umpteenth caller to pop a new one in and to muse for a second or so on the unscathed appearance of the previous valve. It was also my luck to be lumbered with the task of having to find out why the set was so fond of these valves.

With the set in pieces on the bench I discovered that a lot of work had been done on the tagstrip behind the line can. There'd apparently been a burn-up and all the resistors had been replaced. The VDR had been left out however because there hadn't been one in stock. When a VDR was ordered and fitted the operating conditions were restored to normal and the set lost its appetite for PL36s.

This reminds me of all those old Bush TV161s that either had defective line hold controls, a low-emission PCF80 or leaky sync diodes. Engineers would call and carefully explain to the customer how to adjust the line hold. One of the many cases where adjustment either compensates or is used instead of finding the real cause of the problem.

Misleading Symptoms

The first time I came across a G8 with the complaint "poor picture" I switched on and after a poke around confidently said "it needs a new tube". With the set on the bench I noticed that the test card looked a little large. This symptom led me to realise the mistake I'd made. The fault was low e.h.t. due to one of the series-connected line output transistors being short-circuit.

More recently I'd a G8 with apparent h.t. flutter. A little pile of components and two power boards later, the small boy in the room asked if I knew what I was doing? I'd done everything, including checking the h.t. and even the mains plug – but I'd not checked the mains voltage. Surprisingly, a check at the set's mains fuse revealed that this was varying wildly, from about 150V to 220V. This proved to be the case at the mains plug too.

"Your mains supply is faulty" I said to the boy, who promptly plugged in the nearby vacuum cleaner to prove me wrong. Behold the fault cleared – until he switched the cleaner off again! "That's it" I said. "Get your wiring fixed or plug the vacuum cleaner in every time you watch TV!"

Reception Problems

A customer phoned and gave me a long, rambling account of his trouble with a Sanyo VTC9300 VCR. So I had to pick it up. It transpired that he'd just had installed a Siemens' TV from another shop under a maintenance scheme and the engineer had said the VCR was faulty. Apparently he'd tuned the TV set to the VCR but "after

an hour or so the picture goes to black and white then disappears in lines". This seemed to me like a tuning fault so I checked to see whether the TV set was tuned to the correct sideband – it wasn't.

To keep the customer happy the VCR was checked in the workshop for several days. No fault appeared. When I returned the VCR I made sure that the TV set was tuned to the right sideband then, as a check, tuned one of the other buttons incorrectly. Within minutes of mistuning this button the fault returned, proving that in most cases it's essential to tune the set to the correct sideband of a VCR's output otherwise the a.f.c. will not be able to cope. The idea of having one button mistuned was to enable the customer to check for himself what was happening.

Here's a VCR problem that's probably quite common. The particular combination was a Ferguson 3V35 and an old Decca 26in. console set fitted with the 30 series chassis. The complaint was "lines", even on playback. At first glance it looked as if the VCR's modulator was tuned too close to a broadcast transmission. Removing the aerial plug eliminated the interference but with off-air reception, even directly by the TV set instead of via the VCR, there was a background of "noise" and the hint of a negative of another channel, i.e. crossmodulation. Another engineer had called a week before and had deduced that the modulator was "too close to BBC-2" – he'd improved matters a bit by retuning. When I tuned through the bands there were lots of spurious harmonics of the local channels: in fact the VCR's modulator was beating with one of these. The signal from the aerial was slightly too strong for the TV set while the VCR's aerial amplifier made matters really bad. The solution was to fit a 12dB attenuator.

I had a similar problem with an Hitachi VCR. The crossmodulation was less and simply caused a slight background image. A set-top aerial was in use – Crystal Palace could be seen about fifteen miles away. Since the off-air signals were more or less synchronous (though the false images were out of phase) the main disturbance was noticed on playback. This was due to the fact that the playback signal was not synchronous with the off-air transmissions, so that the off-air crossmodulation signals were superimposed on the VCR one and looked as though they were on a slightly different line standard – a sort of loss of line lock in the background. Again an attenuator cured the problem, but diagnosis required close scrutiny of the effect produced.

Here's something similar. A couple of years ago I was called to a TV fault and after putting it right made a final check that all was well. Suddenly BBC-1 appeared to go unstable. With trepidation I removed the aerial plug. The instability disappeared and with a screwdriver applied to the aerial socket the result was not BBC-1 but the clear image of a table-tennis game! Apparently the customer hadn't had any problems of this sort, but then it was a Saturday morning . . .

I prefer to have equipment on the bench so that obscure problems and possible future ones can be dealt with. Field servicing is really only first aid, but whatever the situation it's vital to pay attention to the exact symptoms if a lot of wasted time is to be avoided. Too often the symptoms are treated rather than their cause. With intermittent faults it's much harder of course. While the cause can often be found, one sometimes has to go through the motions. This is a similar business to dealing with medical problems – but I hope doctors are a little more thorough than some TV engineers!

Letters

PHILIPS TUNING SYSTEMS

It's coming to something when a whole page of the magazine has to be devoted to the operating instructions for a complex tuning system – I refer to Michael Pitt's excellent article on the Philips TRD IV system in the February issue. Unfortunately, as a colleague noticed, neither he nor I (see page 46, November issue) made it clear that there are two different systems as follows:
(1) TRD IV which does *not* have yellow line tuning but shows channel numbers instead.
(2) VST which *does* display a yellow line, no channel numbers, and is for the lower priced sets.

Both are totally incompatible and even have different handsets. Incidentally TRD IV = television remote digital four, VST = voltage synthesized tuning.

As for the use of symbols instead of words, we have a Philips wallchart that gives over sixty different symbols users could encounter plus all those in service manuals. What I want you all to do is to use as many of them as you can instead of words whenever you write to Philips, thus giving them a taste of their own dyslexia. While you're at it, order in Roman numerals. There's no need to express TRD IV thus – it's really TRD 4!
Harold Peters,
Lowestoft, Suffolk.

GRUNDIG CUC SERIES CHASSIS

Further to Steve Beeching's comments on the Grundig CUC120 etc. chassis (TV Fault Finding, February), I've also had R646 (270kΩ) cause these sets to eat BU208As. It's important to note that the replacement resistor should be a carbon composition one, not a carbon film type. It's prudent to replace the BU208A's base drive coupling capacitor C631 (100μF) as well, preferably with one rated at 63V.

Note that the BU208D line output device in these chassis contains an integrated base-emitter resistor and an efficiency diode with its cathode to the collector and its anode to the emitter. So it may be all right even though it reads short-circuit with an AVO. If you do have to replace it, a BU208D must be used.
C. J. Heard, Argo Services (B'ham),
Selly Oak, Birmingham.

COMPUTERISED FAULT INDEX

I was interested to read a recent letter advocating the use of a computer to store servicing information, having recently completed a computerised "index" to faults reported in *Television* using a Sinclair ZX81 with 16K of RAM. For anyone considering a similar project, the following may be useful.

I needed a program that would accept details of a particular set and its fault and then produce a list of those issues of *Television* that dealt with the problem. With only a limited amount of memory available some form of data compression has to be used. In my program each reference to *Television* is described by a number having three component parts: the manufacturer number, the chassis number and the fault type number. The reference will then occupy only two bytes of memory, making it possible to index about a hundred issues of the magazine. My program at present covers sixty two issues. Any program of this type should be capable of being added to and able to provide for the addition of new makes and chassis.

It's tempting to think that all servicing problems could be solved by referring to lists of faults. This is not so of course, particularly nowadays when modern TVs don't have many stock faults. Even so it's a great help when dealing with an unfamiliar chassis to be able to check on other people's experiences. Articles dealing generally with particular chassis are of especial value and should be included in the index. If any reader is interested, I could provide details of my program.
J. S. Round, 6 Rothesay Mead,
Newton Farm, Hereford HR2 7BJ.

THE TDA4600 – WARNING

Steve Beeching mentions the resistor (R646) connected to pin 4 of the chopper control i.c. in the Grundig CUC95/120/220 series chassis. It's important to note that the chopper transistor's base drive with a TDA4600 depends on the value of the resistor(s) connected to pin 4 of this device. In any chassis that uses a TDA4600, increase in the value of this resistance will result in an appetite for chopper transistors. Before pushing another sacrificial BU208 or whatever into its grave, scope between the base and emitter to make sure that there's a waveform capable of switching the transistor on and off.
Bob McClenning Services,
Tacolneston, Norfolk.

PHILIPS G9 CHASSIS

A common fault with the Philips G9 chassis is a black band at the top left-hand corner of the screen – usually only when the set is cold. The basic cause of the problem is incorrect d.c. conditions in the field output stage, as a result of which the field flyback blanking comes into operation at the wrong time. The correct waveform at the emitter of the upper field output transistor T43 is shown in Fig. 1 – the flyback blanking circuit is fed from this point. The ramp starts at 5V and climbs from this point. Also

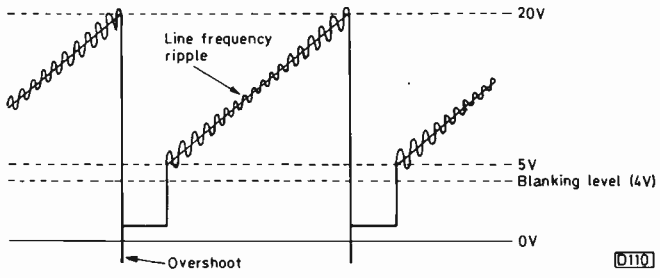

Fig. 1: Correct waveform at the emitter of T43 in the G9's field output stage.

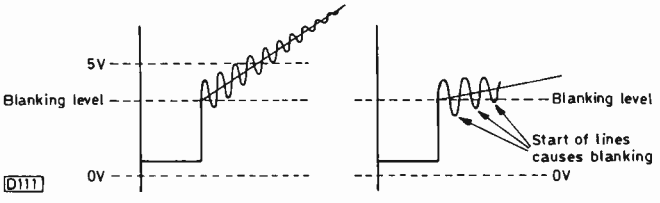

Fig. 2 (left): Incorrect waveform – d.c. conditions wrong.
Fig. 3 (right): Incorrect waveform expanded.

present on the ramp is a line frequency ripple of some 1V peak-to-peak amplitude, due to the action of the NS correction transductor L182 on the line scan panel. Field flyback blanking occurs when the instantaneous voltage at the emitter of T43 falls below 4V. Thus if the field output ramp starts from a voltage that's slightly too low, the tips of the line ripple pulses will blank out the start of the first few lines of the picture, giving the familiar black band in the top left-hand corner.

The d.c. conditions in the G9's field output stage are set mainly by the feedback loop. It should be appreciated that when a non-sinusoidal waveform is passed through an *RC* network a d.c. component depending on the wave shape and the component values is present. The main culprits are the electrolytics associated with the feedback loop – C22 10μF, C51 47μF and C55 100μF. This is not the end of the story however. If the amplitude of the line frequency ripple that sits on the field ramp is too large there will still be blanking. The ripple is filtered by L120 on the convergence board and is damped by R49 (100Ω) on the timebase panel. Check the adjustment of L120 and the condition of R49 which has been known to go open-circuit. Figs. 2 and 3 show what happens when the field scan waveform is incorrect.

One other point with this chassis. Always replace C138 and C155 on the line scan panel. They are both 2,200μF. Adding an 0·1μF capacitor in parallel with each of them will prolong the life of the replacements.

Peter Richards, Criccieth TV,
Gwynedd, N. Wales.

BROWN TANT PROBLEM

Whenever I replace a tantalum capacitor I remember Les Lawry-Johns' story "Beware the Blue Tants". Last Friday I had a call from a new customer with a 14in. Boots CTV. She'd already taken it to one shop that had returned it with a note to say "don't recognise chassis, suspect LOPT fault". I switched on and the tuner indicators lit up but nothing else happened. Upon removing the back I faced a total stranger. Nothing new you might say when one repairs TV sets. In the old days most sets could be dealt with using a neon screwdriver on the mains dropper and tapping the side of a valve or two. So I held my trusty neon near the LOPT and was pleased to see it light up. I told the customer I'd have to take the set away for a day or two.

Back on the bench I looked for the video signals. These came from an HA11401 which should have had about 12V at its supply pin 10. The reading was 0V however. I searched in vain for an open-circuit 12V regulator or a faulty zener diode and on Monday phoned Boots in Nottingham. It took some time to get through but eventually a nice lady said she's put a service manual in the post and apologised for it being only a copy. I put the set aside to wait the usual two or three weeks only to find that the bit needed has to come from Japan, but no – it arrived the following afternoon. Very many thanks Boots.

A quick look at the circuit showed that the 12V supply for all the i.c.s comes from a 15V line derived from the line output transformer. The 15V is dropped to 12V via a 10W resistor which had 15V at one side and 0V at the other. It was hot, so not open-circuit. "Oh dear" I said, or something like that. Now the set has a lot of those handy wire links, and these had been put just where I needed them. Lifting the first one gave me 15V at each side of the resistor and it was then a matter of tracing through to the next link and lifting this until the fault was found. Needless to say the cause was in the i.f. strip under a tin plate held in place by eight solder lugs. Yes, a tant, but brown instead of blue. Cost of replacement, 24p. Add labour plus VAT and the result was a happy customer – and an interesting repair!

The set was a Thomson-Brandt TVC PZ3614/Boots-Thomson T3614 P1. Symptom no results except tuner indicators alight. Fault due to the 47μF, 16V tantalum capacitor C122. The hot resistor was FR401, 100Ω fusible.

J. Hopkins, The TV Workshop,
Wisbech, Cambs.

SPECTRUM PROGRAM

In response to Oliver Bowry's request (Letters last month) here's a simple program for the Sinclair Spectrum to get colour bars.

```
 5 LET B=0
10 FOR C=0 TO 7 STEP 1
15 FOR A=0 TO 21·5 STEP 1
20 INK C
25 PRINT AT A,B;"■■■■"
30 NEXT A
35 LET B=B+4: NEXT C
```

The block (four spaces) in line 25 is put in using the graphic mode.

A. Lloyd,
Plymouth, Devon.

Editorial comment: Several readers have written to us on this subject, to which we'll return next month.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

16029	1.58	2SC1061	0.54	2SD898B	2.67	AN320	4.97	BC171	0.10	BD166	0.38	BF137	0.11	BLY49	2.00	BY203/20	0.18
16181	1.13	2SC1096	1.05	40408	0.45	AN322	4.38	BC172	0.09	BD168	0.66	BF152	0.28	BR100	0.20	BY206	0.17
16182	1.13	2SC1104	2.60	40594	1.39	AN331	2.99	BC172B	0.24	BD175	0.39	BF153	0.52	BR101	0.37	BY207	0.22
16334	0.88	2SC1106	4.12	40595	1.39	AN337	3.99	BC173	0.15	BD177	0.39	BF154	0.23	BR103	0.45	BY210-400	0.24
16335	0.72	2SC1114	5.61	40636	0.86	AN340P	1.06	BC174B	0.24	BD179	0.44	BF157	0.23	BR88B	0.58	BY210-600	0.27
16446	0.89	2SC1124	1.10	40871	1.39	AN355	3.36	BC177	0.18	BD181	0.90	BF158	0.16	BRC-M-300	1.58	BY210-800	0.30
16600	1.25	2SC1151A	4.29	40872	1.39	AN362	1.47	BC178	0.23	BD182	0.90	BF159	0.16	BRC116	0.60	BY223	0.85
16799	2.16	2SC1152	4.25	60857	1.10	AN5111	2.34	BC179	0.23	BD183	0.90	BF160	0.28	BRC1330	1.60	BY224-400	0.90
16801	0.86	2SC1157	4.12	74LS132	0.72	AN5132	3.99	BC182	0.08	BD184	1.10	BF167	0.34	BRC300	1.82	BY225-100	0.79
16802	1.03	2SC1162	0.95	74LS138	0.85	AN5250	3.33	BC182B	0.23	BD187	0.48	BF173	0.30	BRC4443	1.12	BY226	0.28
16803	4.81	2SC1172	1.92	74LS157	0.79	AN5435	2.80	BC182L	0.09	BD189	0.35	BF177	0.50	BRC4444	1.12	BY227	0.44
16905	1.35	2SC1195	2.83	74LS161AN	1.18	AN5610	6.75	BC182LB	0.12	BD190	0.59	BF178	0.36	BRC5296	0.70	BY228	0.54
17074	6.00	2SC1213	0.75	74LS196	1.25	AN5613	3.72	BC183	0.09	BD201	0.54	BF179	0.32	BRC6109	0.75	BY255	0.97
17127	3.91	2SC1226	1.32	74LS20	0.25	AN5620X	4.63	BC183L	0.09	BD202	0.54	BF180	0.32	BRC82	0.98	BY298	0.25
17376	1.43	2SC1306	0.85	74LS244	1.65	AN6320N	3.89	BC183LB	0.23	BD203	0.54	BF181	0.29	BRC83	0.98	BY299	0.25
1N4001	0.05	2SC1307	1.35	74LS30	0.29	AN6342	1.36	BC184	0.09	BD204	0.54	BF182	0.30	BRC84	0.98	BY476A	0.76
1N4002	0.05	2SC1316	3.40	74LS367	1.05	AN6344	4.68	BC184L	0.09	BD207	1.00	BF183	0.35	BRX44	0.54	BYW56	0.30
1N4003	0.05	2SC1364	0.49	74LS373	1.55	AN6363	10.20	BC184LB	0.23	BD208	1.00	BF184	0.39	BRX49	0.45	BYX10	0.26
1N4004	0.06	2SC1383	1.39	74LS47	1.05	AN6551	0.56	BC186	0.24	BD222	0.44	BF185	0.35	BRY39	0.50	BYX55-350	0.48
1N4005	0.07	2SC1398	0.51	74LS73	0.39	AN6552	0.52	BC187	0.18	BD225	0.44	BF194	0.15	BRY55	0.60	BYX55-600	0.25
1N4006	0.07	2SC1410	2.17	74LS74	0.39	AN7145	2.04	BC204	0.14	BD228	0.57	BF195	0.12	BRY56	0.38	BYX71-350	0.67
1N4007	0.07	2SC1413	3.68	74LS75	0.52	AN7150	2.22	BC207	0.12	BD229	0.63	BF196	0.15	BSR59	1.17	BYX71-600	0.85
1N4148	0.03	2SC1505	0.56	74LS86	0.49	AN7151	2.05	BC212	0.10	BD231	0.45	BF197	0.14	BSS38	0.30	BYX94	0.18
1N4448	0.12	2SC1578	6.67	74LS90	0.75	AN7156	2.05	BC212B	0.23	BD232	0.44	BF198	0.15	BSTBD1409	2.48	BYY56	1.09
1N5401	0.12	2SC1617	3.35	74LS92	0.75	AN7158	2.34	BC212L	0.09	BD234	0.38	BF199	0.15	BSTBD1405	4.37	BZV15-C12	0.72
1N5402	0.13	2SC1670	2.84	74LS93	0.75	AN7218	1.49	BC212LB	0.23	BD235	0.43	BF200	0.33	BSTC0146	2.25	BZV15-C12R	0.72
1N5403	0.14	2SC1678	1.25	74LS95B	0.85	AP58076	4.25	BC213	0.09	BD236	0.45	BF216	0.32	BSTC0233	2.25	BZV15-C24	0.72
1N5404	0.15	2SC1810	1.40	7805 TO-220	0.63	AS560S	1.43	BC213L	0.09	BD237	0.38	BF218	0.32	BSTC0246	4.51	BZV15-C24R	0.72
1N5408	0.18	2SC1815	0.41	7805 TO-3	1.05	AU106	1.96	BC213LB	0.23	BD238	0.29	BF222	0.50	BSTC1233	3.91	BZV15-C30R	0.72
1N914	0.05	2SC1829	2.01	7806	0.66	AU110	1.96	BC214	0.09	BD239	0.44	BF224	0.15	BSTC3146	0.71	BZX61 Range	0.16
1S44	0.06	2SC1875	4.77	7808	0.54	AU113	2.15	BC214L	0.12	BD240	0.36	BF237	0.59	BSTCC0143	2.79	BZX70-C11	0.54
1S5012A	0.73	2SC1891	3.35	7812 TO-3	0.54	AY102	2.62	BC214LB	0.23	BD240D	0.47	BF240	0.15	BSTC0643	3.06	BZX70-C12	0.54
1S921	0.09	2SC1929	2.25	7812 TO-220	1.05	AY105K	1.89	BC225	0.24	BD241	0.45	BF241	0.15	BSW57B	2.66	BZX70-C15	0.54
2582	1.94	2SC1942	5.70	7815	0.55	AY106	1.98	BC237	0.09	BD242	0.45	BF244	0.23	BSW68	0.38	BZX70-C30	0.54
2N1302	0.24	2SC1945	4.11	7818	0.55	BA102	0.30	BC238	0.09	BD243	0.44	BF245A	0.33	BSX19	0.30	BZX70-C47	0.54
2N1303	0.34	2SC1953	1.75	7824	0.55	BA1310 (IC)	1.72	BC238A	0.11	BD243A	0.50	BF255	0.18	BSX20	0.30	BZX79 Range	0.09
2N2218	0.38	2SC1957	0.86	AC107	0.66	BA1320 (IC)	1.22	BC239B	0.08	BD244	0.44	BF256	0.25	BSX21	0.45	BZY88 Range	0.09
2N2219A	0.29	2SC1959	0.36	AC117	0.39	BA1330 (IC)	1.82	BC251A	0.15	BD244A	0.77	BF256LC	0.38	BSY52	0.45	BZY93-C12	0.99
2N2222	0.34	2SC1962	1.75	AC123K	0.39	BA145	0.17	BC252	0.12	BD245C	0.68	BF257	0.30	BSY79	0.46	BZY93-C18	0.99
2N2646	0.75	2SC1969	2.92	AC128	0.28	BA154	0.08	BC258	0.22	BD246C	0.74	BF258	0.29	BT100A	1.46	BZY93-C24	0.99
2N2904	0.32	2SC2027	2.67	AC138	0.08	BA155-01	0.12	BC261A	0.20	BD253	0.95	BF259	0.30	BT106	1.20	BZY93-C24R	0.99
2N2905	0.39	2SC2028	1.91	AC141	0.26	BA156	0.12	BC262	0.20	BD278A	0.60	BF262	0.51	BT108	1.31	BZY93-C30	0.99
2N2906	0.34	2SC2029	1.49	AC142K	0.39	BA157	0.17	BC287	0.45	BD317	1.96	BF263	0.51	BT109	1.31	BZY93-C47	0.99
2N3053	0.24	2SC2057	1.07	AC151	0.25	BA159	0.12	BC294	0.45	BD318	2.08	BF264	0.33	BT112*	2.25	BZY93-C68	0.99
2N3054	0.90	2SC2073	1.40	AC153	0.30	BA182	0.17	BC301	0.36	BD375	0.38	BF271	0.30	BT113	2.25	BZY93-C7V5	0.99
2N3055	0.55	2SC2078	1.25	AC153K	0.36	BA222 (IC)	1.26	BC302	0.30	BD377	0.23	BF273	0.18	BT116	1.52	ZTK33	0.39
2N3055H	0.77	2SC2091	0.59	AC176	0.17	BA284/2	0.15	BC303	0.34	BD379	0.69	BF274	0.18	BT119	1.60	ZX18	2.47
2N3442	1.05	2SC2122A	4.65	AC176K	0.40	BA301 (IC)	0.92	BC307	0.09	BD380	0.69	BF324	0.16	BT120	1.60	C106D	0.46
2N3702	0.12	2SC2141	1.69	AC179	0.25	BA302	0.90	BC307A	0.14	BD410	0.44	BF336	0.27	BT121	2.25	C1129	0.52
2N3703	0.12	2SC2166	1.35	AC183	0.65	BA311 (IC)	1.06	BC308	0.12	BD412	5.70	BF337	0.36	BT122	2.25	CA1310E	2.45
2N3704	0.12	2SC2216	0.62	AC186	0.30	BA312 (IC)	0.98	BC308A	0.09	BD418	0.76	BF338	0.36	BT123	1.80	CA3044	3.18
2N3705	0.12	2SC2233	2.20	AC186K	0.50	BA313 (IC)	1.28	BC309	0.15	BD433	0.33	BF355	0.36	BT125	2.25	CA3046	2.23
2N3706	0.12	2SC2271	3.64	AC187	0.35	BA316	0.07	BC317A	0.11	BD434	0.39	BF362	0.54	BT126	2.25	CA3060	1.50
2N3707	0.14	2SC2278	1.03	AC187-01	0.40	BA317	0.07	BC323	0.92	BD435	0.42	BF363	0.54	BT128	2.25	CA3065	1.17
2N3711	0.14	2SC2335-KIT	7.61	AC187K	0.39	BA318	0.08	BC327	0.15	BD436	0.42	BF371	0.45	BT128P	2.79	CA3089	3.35
2N3771	1.85	2SC2526	1.70	AC188	0.33	BA328 (IC)	0.80	BC328	0.10	BD437	0.41	BF391	0.36	BT129	2.25	CA3089E	1.30
2N3772	1.55	2SC2551	0.95	AC188-01	0.40	BA333 (IC)	1.24	BC337	0.08	BD438	0.44	BF393	0.90	BT151-800R	1.47	CA3090	1.25
2N3773	1.65	2SC2570	1.80	AC188K	0.39	BA401 (IC)	0.58	BC338	0.10	BD441	1.29	BF417	1.20	BT151 500R	1.25	CA3094	2.00
2N3819	0.28	2SC2570A	0.95	AC193K	0.59	BA511 (IC)	1.98	BC360	0.30	BD442	0.56	BF418	1.70	BTT6018	2.20	CA3131EN	2.83
2N3823	1.06	2SC264A	4.38	AC194K	0.59	BA521 (IC)	1.81	BC368	0.23	BD507	0.54	BF422	0.26	BTT6218	2.20	CA3132EN	2.83
2N3904	0.56	2SC2671	1.99	AD140	0.96	BA532 (IC)	1.88	BC440	0.99	BD508	0.54	BF423	0.26	BTT8024	4.02	CAH76023N	6.00
2N3908	0.56	2SC2728	0.95	AD142	0.96	BA536 (IC)	2.72	BC441	0.40	BD509	1.29	BF435	0.49	BTT8124	4.44	CBF16848N-07	1.41
2N4101	1.10	2SC372	1.27	AD143	0.96	BA6304A (IC)	2.65	BC454	0.32	BD510	0.45	BF450	0.30	BTT8214	5.44	CD4001	0.24
2N4240	3.00	2SC373	1.05	AD145	1.45	BA843 (IC)	3.60	BC455	0.32	BD518	1.36	BF451	0.26	BTT8224	2.70	CD4002	0.24
2N4443	1.35	2SC383	1.20	AD149	0.81	BAV10	0.10	BC460	0.38	BD519	1.36	BF457	0.37	BU105	1.66	CD4008	0.96
2N4444	1.12	2SC388	0.45	AD161	0.30	BAV18	0.10	BC461	0.42	BD529	0.38	BF458	0.35	BU106	2.25	CD4011	0.23
2N4914	0.65	2SC41	1.99	AD162	0.30	BAV19	0.10	BC462	0.27	BD530	0.60	BF459	0.35	BU108	1.90	CD4012	0.24
2N5064	0.64	2SC458	0.55	AD262	0.95	BAV20	0.10	BC463	0.58	BD533	0.60	BF460	0.54	BU109S	1.90	CD4013	0.37
2N5293	0.45	2SC495	0.83	AF114	2.24	BAV21	0.17	BC464	0.58	BD534	0.36	BF469	0.27	BU110	2.52	CD4016	0.37
2N5294	0.45	2SC508	3.36	AF115	0.79	BAX12	0.10	BC465	0.58	BD535	0.44	BF470	0.28	BU111Y	3.78	CD4017	0.74
2N5296	0.40	2SC515A	1.28	AF116	0.79	BAX13	0.10	BC477	0.25	BD536	0.55	BF471	0.28	BU124	1.25	CD4020	0.92
2N5297	0.45	2SC537	0.49	AF117	0.75	BAX16	0.10	BC478	0.29	BD537	0.60	BF472	0.28	BU126	1.11	CD4021	0.24
2N5298	0.55	2SC558	3.35	AF118	0.75	BB105B	0.22	BC479	0.29	BD538	0.60	BF479	0.55	BU134S	4.15	CD4023	0.25
2N5490	1.35	2SC605L	1.05	AF121	0.50	BB119	0.15	BC532	0.25	BD544B	0.75	BF480	0.54	BU204	1.29	CD4025	0.54
2N5496	0.45	2SC620	1.32	AF124	0.36	BC107	0.13	BC546	0.15	BD580	1.06	BF495	0.58	BU205	0.98	CD4028	0.76
2N6107	0.53	2SC643A	1.40	AF125	0.36	BC107B	0.14	BC547	0.09	BD590	1.06	BF506	0.39	BU206	1.20	CD4047	0.96
2N6109	1.43	2SC673	1.11	AF126	0.36	BC108	0.12	BC548	0.09	BD598	1.13	BF509	0.37	BU207	1.50	CD4049	0.52
2N6122	1.60	2SC681	4.00	AF127	0.36	BC108A	0.12	BC549	0.09	BD645	3.62	BF523	0.18	BU208	0.98	CD4050	0.50
2N6130	0.65	2SC684	1.50	AF139	0.48	BC108B	0.15	BC550	0.36	BD677	0.55	BF594	0.24	BU208/02	0.98	CD4052	0.68
2N6133	0.57	2SC685A	2.62	AF178	0.75	BC109	0.11	BC556	0.12	BD680	0.69	BF595	0.24	BU208A	0.98	CD4053	0.72
2N6178	0.66	2SC693	0.69	AF179	0.50	BC109B	0.13	BC557	0.09	BD681	1.34	BF596	0.16	BU208D	1.43	CD4069	0.23
2N6180	0.66	2SC710	0.62	AF180	0.50	BC113	0.12	BC558	0.09	BD695	2.09	BF597	0.24	BU209	1.60	CD4081	0.26
2N696	0.39	2SC717	1.92	AF181	0.48	BC114	0.17	BC559	0.09	BD696	2.24	BF617	0.95	BU226	2.08	CD4093	0.72
2N698	0.39	2SC734	1.30	AF182	0.50	BC115	0.14	BC560C	0.10	BD697	3.27	BF618	0.95	BU312	2.16	CD4511	1.00
2N707	0.39	2SC735	1.05	AF186	0.48	BC116	0.20	BC635	0.18	BD698	1.68	BF694	0.20	BU326	0.75	CD4517	1.06
2SA1027	1.15	2SC782	2.24	AF239	0.48	BC116A	0.53	BC636	0.18	BD699	3.17	BF757	0.59	BU326A	1.40	CP5521	16.20
2SA1076	1.78	2SC790	1.15	AF279	0.80	BC117	0.18	BC637	0.18	BD700	3.36	BF758	0.59	BU326S	2.25	CV-12E	2.49
2SA329	0.36	2SC806	10.26	AL100	3.66	BC118	0.18	BC638	0.18	BD702	2.94	BF759	0.30	BU406	1.35	CX034	10.75
2SA351	1.06	2SC814	1.26	AL102	1.75	BC119	0.30	BC639	0.18	BD707	0.55	BF760	0.59	BU407	0.74	CX095D	2.85
2SA489	1.06	2SC828	0.25	AL103	2.43	BC125	0.18	BC640	0.18	BD709	0.72	BF762	0.30	BU407D	1.29	CX104	8.49
2SA490	1.51	2SC867A	2.49	AL113	1.80	BC126	0.18	BC879	0.28	BD710	0.72	BF870	0.27	BU412	4.80	CX108	6.92
2SA493	0.95	2SC926A	1.29	AN208	3.22	BC132	0.12	BC880	0.28	BD807	0.60	BF871	0.84	BU426	1.95	CX109	6.92
2SA628	1.03	2SC930	0.49	AN210	2.07	BC135	0.12	BCX32	0.33	BD809	0.60	BF900	0.68	BU426A	1.67	CX121	10.75
2SA637	1.32	2SC935	3.75	AN214	2.05	BC136	0.15	BCX33	0.24	BD810	0.60	BF907	1.62	BU427	2.67	CX130	4.90
2SA673	1.11	2SC936	1.58	AN214Q	2.05	BC137	0.16	BCX34	0.36	BD879	0.64	BF959	0.38	BU500	1.61	CX131	10.75
2SA683	1.46	2SC937	3.25	AN231	5.56	BC138	0.30	BCX37	0.60	BD880	0.65	BF970	0.55	BU508A	1.33	CX134	10.75
2SA684	1.33	2SC940	4.25	AN234	5.02	BC139	0.32	BCY70	0.27	BD895	1.98	BFR39	0.36	BU526	1.65	CX136	10.75
2SA748	0.68	2SD1138	0.78	AN235	4.84	BC140	0.33	BCY71	0.19	BD899	2.25	BFR52	0.45	BU608D	1.42	CX137	10.75
2SA818	1.65	2SD198	3.51	AN236	3.02	BC141	0.28	BCY72	0.18	BD901	0.55	BFR62	0.36	BU806	1.29	CX139	10.75
2SA835	2.27	2SD234	0.42	AN238	4.98	BC142	0.30	BD115	0.29	BDV64B	1.14	BFR79	0.29	BU806D	1.35	CX157	4.40
2SA940	1.64	2SD235	0.54	AN239	3.95	BC143	0.28	BD116	0.63	BDV65B	1.14	BFR81	0.45	BU807	1.40	CX158	3.44
2SA951	1.23	2SD257	2.67	AN240P	1.88	BC147	0.10	BD124	1.19	BDX32	1.50	BFR86	0.98	BU826A	2.79	CX170	6.92
2SA966-Y	0.54	2SD291	2.67	AN241	1.55	BC147A	0.42	BD124P+KIT	0.62	BDX53	0.80	BFR89	0.39	BUV46	1.13	CX177	5.99
2SB325	3.51	2SD292	2.35	AN245	2.54	BC148	0.11	BD131	0.38	BDX53A	3.68	BFT41	0.27	BUV84	1.12	CX506	8.48
2SB337	1.65	2SD313	2.59	AN247P	2.62	BC148B	0.11	BD132	0.38	BDX54B	2.37	BFT42	0.39	BUN81A	3.15	CX507	6.92
2SB375	3.51	2SD315	2.67	AN252	2.33	BC148C	0.11	BD133	0.48	BDX62A	1.92	BFT43	0.39	BUN84	1.56	CX758	6.92
2SB400	0.36	2SD325D	1.36	AN253	2.70	BC149	0.10	BD135	0.32	BDX63A	1.95	BFT84	0.36	BUX84	1.47	D1693	2.35
2SB407	2.94	2SD350	7.03	AN262	1.58	BC149B	0.11	BD136	0.32	BDX64A	2.37	BFW10	0.79	BY126	0.11	DEC1	1.52
2SB411	3.00	2SD350A	2.08	AN272	5.36	BC153	0.12	BD137	0.32	BDX65A	2.37	BFX29	0.30	BY127	0.11	DEC2	1.52
2SB511	1.48	2SD353	3.25	AN281	5.52	BC154	0.12	BD138	0.41	BDX76	0.53	BFX30	0.59	BY133	0.11	E1222	0.36
2SB54	1.26	2SD389	2.19	AN295	5.01	BC157	0.14	BD139	0.27	BDY20	1.10	BFX84	0.33	BY164	0.50	E5024	0.25
2SB56	1.26	2SD401	1.57	AN301	3.30	BC158	0.09	BD140	0.33	BDY62/01	4.20	BFX85	0.25	BY176	1.38	E5386	0.22
2SB618A	1.40	2SD551	2.20	AN302	3.62	BC159	0.14	BD144	1.30	BDY81	1.07	BFX87	0.50	BY179	1.42	E5529	0.22
2SB681	2.44	2SD588A	1.25	AN303	3.25	BC160	0.36	BD150	1.08	BF115	0.36	BFX88	0.30	BY182	0.95	E8021	1.17
2SB695	1.70	2SD621	8.88	AN305	8.07	BC161	0.36	BD157	0.60	BF117	0.36	BFX89	0.36	BY184	0.42	E9003	0.41
2SB75	0.94	2SD657	2.54	AN313	3.10	BC167	0.32	BD159	0.48	BF118	0.60	BFY50	0.24	BY187	0.70	E9005	0.45
2SB861	0.68	2SD731	1.72	AN315	2.12	BC168	0.32	BD160	1.45	BF121	0.22	BFY51	0.24	BY189	1.20	ER1400	10.12
2SC1034	5.61	2SD811	3.86	AN316	5.58	BC169C	0.14	BD163	0.64	BF123	0.11	BFY52	0.24	BY198	2.38	ESN310BP	3.86
2SC1050	3.66	2SD869	2.40	AN318	4.75	BC170	0.14	BD165	0.56	BF127	0.11	BFY90	0.96	BY201/2	1.36	ESM432C	4.18

IF YOU DON'T SEE IT LISTED ASK FOR QUOTE. GIVE MAKE MODEL LOCATION. REMEMBER TO ADD 0.60p POST & HANDLING. ADD 15% VAT TO TOTAL

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

ESM532C	4.18	LM1303P/N	1.50	MPSU05	0.78	SAA5010	4.90	SN74190	1.81	T6029V	4.41	TBA395	1.35	TDA1230	2.93	TDA9503	2.60
ESM632C	4.18	LM1310P/N	1.25	MPSU10	0.78	SAA5012	6.50	SN7420N	0.30	T6032V	0.89	TBA395Q	1.00	TDA1235	3.52	TDA9513	2.40
ESM732C	4.18	LM3065N	0.77	MPSU55	0.90	SAA5020	5.25	SN7430	0.28	T6033V	0.73	TBA396	1.80	TDA1270	2.64	TE527	1.25
ETT6016	2.65	LM317CKC	1.30	MPSU56	0.30	SAA5030	7.50	SN7440N	0.24	T6035V	0.66	TBA400	2.17	TDA1327A	1.65	TE538	0.36
ETTR6016	2.16	LM339N	0.68	MPSU60	1.20	SAA5040A	14.75	SN7473	0.56	T6036	0.44	TBA440P	1.55	TDA1327B	1.65	TE626	1.35
FND500	5.25	LM3407	1.29	MR510	0.30	SAA5050	8.50	SN7474N	0.72	T6037	1.91	TBA480	1.42	TDA1330	1.60	TEA1002	3.15
FT3055	1.05	LM340T5	0.75	MR812	0.60	SAA661B	1.80	SN7490AN	0.93	T6041V	0.66	TBA480Q	1.67	TDA1365	6.35	TDA1009	0.96
GF758	0.82	LM340T12	0.75	MR914	0.46	SAA700	3.00	SN75110N	0.75	T6044V	0.86	TBA500PQ	1.95	TDA1412	0.95	TEA1020SP	5.34
GF759	1.02	LM340T5	0.75	MSSD7002	0.65	SAB1009B	4.53	SN76001ANQ	2.25	T6045	1.09	TBA510	1.55	TDA1420	1.48	TEA1087	0.46
GF761	0.78	LM342N	0.56	MVS240	0.52	SAB1046P	3.66	SN76003N	2.81	T6049	1.10	TBA510S	6.39	TDA1470	2.63	TIC106C	0.55
GH3F	1.65	LM384N01	1.84	MVS460	0.30	SAB3011	7.34	SN76013N	3.63	T6052V	0.76	TBA520	1.67	TDA1512	2.20	TIC106M	0.55
HA11211	2.30	LM567CN	1.30	MVS460-02	0.55	SAB3012	5.34	SN76013ND	2.25	T6058	0.46	TBA520Q	1.35	TDA1670	3.65	TIC116D	0.80
HA11215	4.60	LM748	1.65	ME545B	2.95	SAB3013	3.28	SN76013NDG	8.07	T6059	1.05	TBA530	0.86	TDA1770	5.56	TIC44	0.65
HA11225	3.90	LM8360	2.78	ME545B	3.80	SAB3021	7.18	SN76023N	2.35	T8001V	1.09	TBA530Q	0.85	TDA1905	1.25	TIC45	0.70
HA11226	7.56	LM8361	2.78	ME5534N	1.48	SAB3022B	12.34	SN76023ND	1.04	T9003V	0.86	TBA540	0.98	TDA1908	2.95	TIC47	0.70
HA11229	2.51	M1024	2.55	ME555	0.34	SAB3023B	11.18	SN76033N	2.33	T9005V	2.16	TBA540Q	1.15	TDA1910	2.38	TIP120	0.96
HA11235	3.60	M1025	4.70	ME556	0.75	SAB3024	4.77	SN76105N	2.36	T9010V	0.87	TBA550	1.95	TDA1940	2.54	TIP110	0.48
HA1124	4.70	M1124	2.54	ME5560N	3.16	SAB3209	4.75	SN76110N	1.13	T9011V	1.27	TBA550Q	2.25	TDA1950	2.54	TIP112	0.80
HA11244	4.32	M1130	4.86	ME565N	1.20	SAB3210	2.93	SN76115AN	1.46	T9013V	5.81	TBA560C	0.86	TDA2002	1.20	TIP117	0.86
HA1125	3.90	M191	5.74	ME645BN	3.80	SAB4209	12.75	SN76131	1.74	T9014V	1.52	TBA560CQ	1.15	TDA2003	1.05	TIP120	0.73
HA11251	3.38	M193	18.55	ME646N	3.80	SAF1031	2.30	SN76226DN	1.20	T9016	0.92	TBA570	1.55	TDA2004	2.52	TIP121	1.08
HA1137W	2.57	M51102L	4.02	ME650N	3.94	SAF1032	5.60	SN76227N	0.68	T9022N	0.39	TBA570A	1.55	TDA2006	1.25	TIP126	0.96
HA1138	3.56	M5115P	4.34	ME645BN	3.80	SAF1039	11.66	SN76228N	2.97	T9034V	1.25	TBA570Q	1.35	TDA2010	2.79	TIP127	1.30
HA11414	2.50	M51231P	2.79	MP1106	4.80	SAS5010	7.62	SN76231	2.31	T9035V	1.26	TBA625A	1.97	TDA2020	2.75	TIP2955	0.78
HA1144	6.38	M5124P	4.38	OA200	0.10	SAS560	1.68	SN76242	4.75	T9038V	6.15	TBA625B	1.97	TDA2030	1.65	TIP29A	0.41
HA1156	1.23	M5134-9341	3.75	OA202	0.10	SAS560S	2.97	SN76243	4.75	T9051	2.55	TBA625C	1.97	TDA2140	1.44	TIP29B	0.57
HA11580	7.80	M51394P	6.25	OA47	0.10	SAS560T	2.85	SN76322	2.51	T9053V	1.03	TBA641A12	3.75	TDA2150	5.63	TIP29C	0.40
HA1160	3.45	M5142P	4.38	OA90	0.07	SAS570	1.61	SN76360	1.97	T9054V	0.92	TBA641BX1	2.07	TDA2151	1.75	TIP3055	0.65
HA1166	3.08	M5143P	6.66	OA91	0.08	SAS570S	0.00	SN76390	2.80	T9057V	0.63	TBA651	1.60	TDA2160	3.64	TIP30A	0.41
HA1167	5.13	M5144P	3.42	OA95	0.08	SAS570T	2.50	SN76396	2.63	T9063V	2.94	TBA673	2.35	TDA2161	1.68	TIP30B	0.63
HA11711	16.13	M51513L	2.06	OC28	0.96	SAS580	4.41	SN76510N	0.95	TA5814	1.35	TBA700Q	2.19	TDA2190	3.11	TIP31B	0.35
HA11713	6.70	M51515BL	3.10	OC29	1.95	SAS5800	2.62	SN76530P	1.90	TA7020P	4.36	TBA720	2.85	TDA2510	1.82	TIP31C	0.63
HA11714	7.05	M51516L	3.40	OC35	0.96	SAS590	4.55	SN76532N	1.80	TA7027	4.36	TBA730	1.75	TDA2520	2.15	TIP32B	0.35
HA11715	7.05	M51517L	2.90	OC36	1.16	SAS5900	2.32	SN76533N	1.56	TA7050	1.58	TBA750Q	1.46	TDA2521	2.15	TIP32C	0.66
HA11718	6.79	M5152L	1.00	OC44	0.40	SAS660	2.50	SN76540N	1.80	TA7051	1.58	TBA760	1.55	TDA2522	2.81	TIP33C	1.25
HA11724	15.60	M51522	4.90	OC45	0.40	SAS6600	1.20	SN76544	1.60	TA7060AP	0.60	TBA780	3.00	TDA2523	2.75	TIP34	1.07
HA11725	16.60	M5191P	4.49	OC75	0.40	SAS660S	1.20	SN76545	4.55	TA7061AP	0.78	TBA800	0.00	TDA2524	4.50	TIP41A	0.39
HA1180	4.68	M5192	2.00	ON188	1.70	SAS6610	1.20	SN76546	3.15	TA7069	2.84	TBA810AS	1.46	TDA2525	2.96	TIP41B	0.28
HA1203	1.56	M53273P	0.92	ON236	2.90	SAS670	2.50	SN76546N	3.15	TA7070P	1.52	TBA810S	1.46	TDA2530	2.19	TIP41C	0.44
HA1306	1.74	M53274P	1.20	OT112	0.98	SAS6700	1.20	SN76549	2.35	TA7071	3.35	TBA810T	1.46	TDA2532	2.51	TIP42A	0.39
HA1322	1.74	MA06	0.97	OT121	0.70	SAS670S	1.20	SN76550	0.30	TA7072P	1.35	TBA820	0.83	TDA2533	2.09	TIP42B	0.71
HA1339	1.76	MA8001	0.74	PD144	2.03	SAS6710	1.20	SN76551	1.35	TA7073P	4.05	TBA820M	1.65	TDA2540	1.95	TIP42C	0.44
HA1342	1.80	MB3705	1.62	PT1017	2.43	SAS6800	2.30	SN76570	2.80	TA7074P	1.95	TBA890	1.85	TDA2541	1.95	TIP47	0.65
HA1350	2.97	MB3712	2.65	PT2014	2.76	SAS6810	1.30	SN76600	1.10	TA7076P	4.95	TBA900	2.25	TDA2545Q	3.16	TIP48	0.83
HA1365	3.65	MB3713	1.30	PT6042	1.82	SBA550B	1.95	SN76611	2.35	TA7089N	1.41	TBA920	1.50	TDA2560	1.97	TIP49	3.28
HA1366WR	1.62	MB3730	2.94	R1038	1.99	SBA750	1.46	SN76620	2.35	TA7089P	1.36	TBA920Q	2.10	TDA2571A	2.81	TIS43	1.21
HA1367	3.20	MC13002	4.66	R1039	1.99	SC9488P	1.90	SN76622	1.50	TA7092P	3.85	TBA940	1.70	TDA2575A	2.95	TIS90	0.22
HA1368	1.69	MC1303P	1.96	R2008B	1.20	SC9503	1.50	SN76623	0.62	TA7093P	1.64	TBA950	1.55	TDA2576A	2.58	TIS91	0.26
HA1368R	1.66	MC1307P	1.90	R2009	1.20	SC9504P	1.46	SN76630	2.31	TA7102P	5.34	TBA970	2.08	TDA2577	5.31	TL071CP	2.02
HA1370	2.97	MC1310P	1.25	R2001B	1.20	SC9511P	1.90	SN76640	3.85	TA7108P	1.40	TBA970Q	2.98	TDA2581	1.95	TMS1000NL	10.78
HA1377	2.68	MC1327P	1.20	R2029	1.20	SCR957	1.20	SN76650N	1.24	TA7109	3.37	TBA990	1.65	TDA2582	1.98	TMS3748NS	11.66
HA1389	1.62	MC1330P	1.23	R2030	1.20	SG264A	4.38	SN76651	1.35	TA7120P	0.58	TBA990Q	1.95	TDA2590	2.80	TMS4116	1.87
HA1389R	1.74	MC1349P	1.20	R2257	2.16	SG613	7.88	SN76660N	2.25	TA7122B/P	0.54	TBA231	2.33	TDA2591	2.80	TV106	1.20
HA1392	2.68	MC1350P	1.10	R2265	1.95	SG629	6.82	SN76665N	1.35	TA7124P	2.00	TC4001	1.29	TDA2591Q	2.80	TY6010B	2.70
HA1397	2.97	MC1351P	0.75	R2305	1.07	SG6533	9.37	SN76666N	0.98	TA7130P	1.15	TC4053BP	3.94	TDA2593	2.24	U05G	1.03
HA1398	2.68	MC1352P	1.01	R2306	1.23	SI-1020N	4.76	SN76705	3.38	TA7136AP	1.15	TCA150	1.62	TDA2594	2.80	U143M	2.80
HA1406	1.80	MC1357P	1.95	R2322	1.26	SI-1125HD	10.70	SN76705N	3.99	TA7137P	0.85	TCA160B	1.62	TDA2600	5.00	U3700	0.55
HA17723	5.40	MC1358P	1.55	R2323	1.23	SI-1130N	6.30	SN76707N	3.99	TA7141AP	3.51	TCA270Q	1.55	TDA2610	2.53	U37003	0.44
HBF4030AF	2.25	MC14001	7.15	R2348	1.82	SKB2/08	0.70	SN76709	4.65	TA7146P	8.04	TCA270S	1.95	TDA2611A	1.25	UA723CA	5.02
HD4480	15.60	MC14011	0.23	R2354A	1.82	SKE2F 1/04	1.25	SN76709N	4.95	TA7148P	1.51	TCA270SQ	1.65	TDA2611AQ	2.55	UA758PC	3.06
HD44801A05	15.90	MC14013	0.37	R2354B	1.82	SKE2G 2/04	0.95	SN76730	4.23	TA7149P	2.10	TCA290A	2.05	TDA2612Q	4.25	UA783P3C	1.07
HM6231	8.50	MC14016CP	0.37	R2441	1.23	SKE2G 3/04	0.95	SN76810N	0.62	TA7153P	4.53	TCA420A	1.90	TDA2620	1.96	UAA170	2.14
HM6232	7.71	MC14025	0.54	R2443	0.80	SKE4F 1/02	1.25	SN76920N	2.63	TA7161P	5.66	TCA440	1.65	TDA2630	2.34	UAA180	2.14
HM9102	2.92	MC14049UBC	0.52	R2461	2.10	SKE4F 1/06	0.66	SN94041	3.45	TA7162P	4.25	TCA4500A	1.95	TDA2631	2.48	ULN2165	1.35
HM9104	2.94	MC1438R	0.95	R2477	0.92	SKE4F 2/06	2.10	SN94042	3.95	TA7169	4.80	TCA530	1.80	TDA2640	2.25	ULN2204	7.00
HT4207	15.60	MC14493P	2.56	R2501	1.16	SKE4F 2/08	0.60	SP8385	0.50	TA7171P	2.53	TCA640	2.63	TDA2643	6.93	ULN2216F	1.95
IS689	1.87	MC14510BAL	3.15	R2540	1.80	SKE4G 2/02	0.87	STA441C	2.27	TA7172P	1.28	TCA650	1.85	TDA2651	2.95	UPC1001H	2.50
IS751	1.87	MC14556BCP	3.15	R2540X	3.00	SKE5F 3/10	1.45	STK0029	3.42	TA7176P	2.25	TCA660B	2.63	TDA2652	7.05	UPC1009C	5.74
ITT2003	0.20	MC1712	3.52	R2615	0.60	SL1310	2.85	STK0039	4.00	TA7193P	4.44	TCA730	3.84	TDA2653	2.95	UPC1020H	2.12
K174YP	2.95	MC7724CP	3.17	RC4195NB	1.96	SL1327E	1.20	STK0050	4.96	TA7201P	3.25	TCA740	2.25	TDA2654	2.91	UPC1025H	2.49
KA2101	2.65	MC7818C	1.98	RCA16029	1.82	SL1430	1.26	STK0059	6.48	TA7202P	2.24	TCA750	1.75	TDA2655B	3.15	UPC1026C	1.24
KC581C	5.47	MC7824CP	4.25	RCA16083	4.81	SL1430T	2.10	STK0080	8.32	TA7203P	1.95	TCA760B	2.79	TDA2660	2.24	UPC1028H	0.90
KC582C	3.45	MC78M12	0.75	RCA16334	0.92	SL1432	2.25	STK011	3.86	TA7204P	1.95	TCA800	1.65	TDA2661	2.24	UPC1030H	2.06
KC583C	4.80	MC78M24	0.85	RCA16335	1.23	SL414	3.35	STK013	7.04	TA7205	1.25	TCA800Q	2.25	TDA2670	2.50	UPC1031H	8.05
L129V	1.78	MCR101	0.60	RCA16600	1.25	SL432A	3.12	STK014	7.14	TA7208P	1.95	TCA830S	1.94	TDA2670A	1.76	UPC1031H2	6.00
L200CV	1.68	MCR106/5	1.17	RCA16799	2.16	SL437	6.00	STK015	5.12	TA7210P	3.25	TCA900	1.85	TDA2680	2.30	UPC1032H	0.94
LA1111AP	0.80	MCR220/7	1.34	RCA16801	0.86	SL439	2.25	STK016	4.82	TA7214P	2.90	TCA910	1.50	TDA2690A	2.40	UPC1154H	1.75
LA1201	0.90	ME0402	0.27	RCA16802	0.98	SL480	5.00	STK022	4.77	TA7215P	2.09	TCA940E	1.68	TDA2780AQ	2.18	UPC1156H	1.45
LA1210	1.38	ME0404	0.23	RCA17028	2.25	SL490	1.78	STK025	7.20	TA7217AP	1.36	TCE330	3.53	TDA2790Q	5.92	UPC1181H	1.25
LA1320	1.46	ME0404/2	0.42	RCA17074	6.00	SL901B	6.08	STK040	7.09	TA7222	1.95	TCE527	1.37	TDA2791	2.50	UPC1182H	1.82
LA1352	1.40	ME0411	0.45	RCA17376	1.43	SL917B	7.95	STK043	7.09	TA7227P	1.69	TCE82	0.98	TDA2795	2.95	UPC1185H	2.94
LA1357N	5.90	ME0412	0.21	RCA60857	4.50	SL918A	5.63	STK054	6.48	TA7229P	4.10	TCE83	0.98	TDA2800	6.12	UPC1186H	0.95
LA1364	2.74	ME4102	0.45	RGP10	0.45	SN6848	8.82	STK070	20.28	TA7310P	1.95	TCE84	0.98	TDA3000T	2.31	UPC1212C	0.95
LA1365J	2.79	ME545B	9.10	RT402	1.40	SN16861N-07	1.59	STK077	7.00	TA7313AP	1.36	TCEP100	4.80	TDA3030A	10.44	UPC1213C	0.95
LA1385	1.70	ME6002	0.23	RT905A	2.00	SN16862N-07	1.68	STK078	5.52	TA7314	5.10	TCEP100Q	9.31	TDA3190	1.75	UPC1217C	2.24
LA1387	4.57	ME6102	0.45	S0280	1.94	SN16880N	3.30	STK082	7.54	TA7609	3.00	TD190	0.54	TDA3300B	7.75	UPC1350C	1.75
LA3155	0.90	ME8001	0.26	S0281	1.94	SN16965	8.13	STK086	9.90	TA7611AP	3.54	TD3F700H	6.00	TDA3500	5.95	UPC1351C	1.64
LA3300	1.40	MJ2501	4.95	S041P	1.26	SN16966N	5.49	STK2101	5.74	TA7676P	3.05	TD3F800H	2.25	TDA3501	10.99	UPC1353	6.75
LA3301	1.28	MJ2955	1.34	S042P	1.46	SN29715N	5.49	STK2110	6.66	TAA300	2.99	TD3F800R	3.21	TDA3506	10.12	UPC1360C	4.10
LA3350	1.30	MJ3000	2.15	S1299	4.30	SN29716N	3.32	STK2230	6.66	TAA310A	0.27	TD3F900H	3.78	TDA3510	5.95	UPC1362	7.95
LA3361	1.30	MJ3001	1.30	S175	18.95	SN29717N	6.53	STK415	6.04	TAA320A	1.15	TD3F900R36	3.78	TDA3520	8.82	UPC1365	5.79
LA4030P	2.37	MJ3028	2.40	S2062D	1.88	SN29722	10.65	STK433	9.35	TAA350A	1.62	TDA1001A	2.10	TDA3521	12.17	UPC1366	4.23
LA4031P	3.00	MJ481	1.39	S2800	5.25	SN29723AN	6.95	STK435	5.44	TAA435	1.65	TDA1003A	2.15	TDA3560	6.87	UPC1458	7.87
LA4032P	1.48	MJ802	4.95	S2800D	2.55	SN29744N	2.08	STK436	5.70	TAA550	0.33	TDA1004A	2.15	TDA3561	7.50	UPC2002	1.48
LA4050P	1.42	MJE2955	1.71	S2802	3.15	SN29764AN	3.38	STK437	8.10	TAA570	1.58	TDA1005A	2.15	TDA3571Q	2.25	UPC30C	2.22
LA4051P	1.62	MJE3055	0.78	S3702S	4.73	SN29767	3.61	STK439	6.26	TAA611B12	1.50	TDA1006A	2.15	TDA3571A	5.67	UPC32C	4.49
LA4100	1.62	MJE340	0.44	S3703F	4.73	SN29770AN	2.04	STK441	8.96	TAA621AX1	2.00	TDA1010	2.43	TDA3576	4.76	UPC41C	3.72
LA4101	1.18	MJE520	0.44	S3707	3.92	SN29771BN	4.23	STK443	9.35	TAA630S	3.31	TDA1011	2.60	TDA3950	2.81	UPC554C	1.68
LA4102	2.55	ML231	2.28	S40W	7.99	SN29772BN	4.21	STK459	6.56	TAA640	3.85	TDA1028	2.22	TDA3950B	1.40	UPC558C	3.67
LA4112	4.35	ML232B	3.30	S551	4.12	SN29773	2.28	STK460	5.78	TAA661B	1.59	TDA1029	4.44	TDA4050A	3.15	UPC566H	2.78
LA4125	2.46	ML237B	2.28	S552	4.12	SN29791	1.51	STK461	7.14	TAA700	2.35	TDA1034B	2.20	TDA4180P	1.74	UPC572	3.51
LA4138	2.00	ML238	4.02	S6080B	2.75	SN29798N	3.89	STK463	8.06	TAA840	2.27	TDA1035T	1.83	TDA4260	1.40	UPC575C2	3.72
LA4140	0.80	ML741CS	0.36	S6087AR	4.45	SN29845	2.14	STK465	7.32	TAA930	4.42	TDA1037	1.45	TDA4280	6.45	UPC576H	2.60
LA4192	2.88	ML923	2.18	SAA1020	4.32	SN29848	1.65	STK466	10.70	TAA970	2.57	TDA1041	1.96	TDA4290	4.06	UPC577H	0.64
LA4220	1.34	ML0926	3.25	SAA1021	4.32	SN29861	2.08	STK501	5.74	TAD100	1.91	TDA1044	1.61	TDA440	1.95	UPC587C2	2.34
LA4400	2.04	MM5314N	3.72	SAA1024	2.55	SN29862	2.08	STK502	5.74	TAG232-600	0.66	TDA1047	2.14	TDA4400	2.06	UPC592H	1.02
LA4420	1.56	MM5316N	3.72	SAA1025	4.70	SN72709	0.40	STR441	6.34	TAG626-600	0.84	TDA1054M	1.10	TDA4420	4.25	UPD1514C	7.56
LA4422	1.56	MM5318N	2.82	SAA1050	3.78	SN7400N	0.24	STR453	6.75	TBA120	0.95	TDA1059B	0.98	TDA4422	5.63	UPD851	14.39
LA4430	1.48	MM5369N	1.82	SAA1051	5.30	SN7401N	0.24	STR6020	7.20	TBA120A	0.95	TDA1060	2.01	TDA4430	4.34	UPX27C	1.98
LA4460	1.92	MM5387AA/N	11.50	SAA1061	3.28	SN7402N	0.59	T6007V	0.69	TBA120AS	0.95	TDA1082	2.65	TDA4431	2.06	X0022CE	3.67
LA4461	2.00	MM5841N	5.90	SAA1075	4.41	SN7404N	0.21	T6007N	0.62	TBA120S	0.95	TDA1104	5.95	TDA4432	2.06	X0035TA	4.35
LA5112N	1.62	MP8112	1.35	SAA1082	8.04	SN7408N	0.24	T6016	0.36	TBA120SB	0.95	TDA1151	0.65	TDA4440	2.52	X0056CE	3.90
LA7020	6.66	MP8113	1.35	SAA1121	4.32	SN7410N	0.24	T6017	0.65	TBA120T	0.95	TDA1170	2.15	TDA4600	2.58	X0062CE	4.95
LA7025	7.31	MP8512	1.23	SAA1124	2.55	SN74121	1.20	T6018V	0.65	TBA120U	0.95	TDA1170S	1.85	TDA4610	2.42	X0065CE	3.48
LA7800	2.12	MPF256C	0.54	SAA1130	4.86	SN74122	0.95	T6021	0.36	TBA120UB	3.47	TDA1180	2.25	TDA4620	4.50	X0109CE	6.10
LA7801	3.60	MPS6570	0.43	SAA1174	5.75	SN7413N	0.33	T6022V	3.56	TBA1440	2.08	TDA1190	1.91	TDA5500	2.48	X1074AF	6.36
LD3120	1.20	MPSA42	0.59	SAA1250	3.78	SN74141	1.41	T6026	0.89	TBA1440G	3.40	TDA1190Z	2.25	TDA5600	2.68	XC949P	1.20
LM1011N	2.95	MPSA56	0.24	SAA1251	5.30	SN74151AN	1.51	T6027	0.73	TBA1441	1.59	TDA1200A	1.30	TDA5700	2.10	Y730	0.24
LM1017N	1.96	MPSA92	1.11	SAA5000	3.65	SN74154N	1.15	T6028V	0.35	TBA240A	3.42	TDA1220	2.25	TDA9403	2.90	Y969	0.60

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All goods should be delivered within 4 working days.

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Derek Snelling and Steve Beeching, T. Eng.

Mitsubishi HS306

Once again we've had several of these machines in the workshop for repair during the course of the month. Three of them produced an intermittently "negative" picture, similar to video overload when the E-E level is set excessively high. The cause however was dry-joints in the r.f. booster-converter. One case of intermittent no video was traced to a dry-joint in the far right-hand corner of the main board. Then a lot of machines started to come in with intermittent sound recording. Mitsubishi were contacted and said that the cause of the trouble was incorrect alignment of the audio-control head. Realignment does appear to have cured the problem. Once again however I wonder how such machines manage to leave the factory. Finally on this model a colleague traced a case of no colour on record to a faulty i.c. (IC6A0, type M51452).

D.S.

Ferguson 3V22

The initial problem with a 3V22 was intermittent audio erasure. Nothing too serious. Clean the record/playback switches, solder the joints on the erase head and that was it. Except that on test the machine suddenly refused to perform. A quick check showed that the cassette bulb had failed. This was replaced and on the following day the machine was given a final check only to find that the E-E and playback pictures were noisy. This was eventually traced to a faulty r.f. converter. I wonder whether the other faults would have occurred in the customer's house or whether, as I suspect, they were sent specially to annoy me in the workshop? **D.S.**

Pye 65VR20/Panasonic NV370

Now to some faults on the Pye 65VR20, which of course is the Panasonic NV370. We've had two with faulty r.f. converters: one produced an intermittently snowy picture, the other no luminance or test signal after a quarter of an hour. Another machine had excessive colour on playback due to a faulty colour processing i.c. (i.c. is not really a correct description – it's an i.c. and several thick-film components on a flexible PCB which is folded in half and soldered into a slot cut into the main board).

Lastly a problem that occurred on a couple of machines after they'd been out for about two months. The symptoms were a wobbling picture with perhaps slight interference on sound, noticeable during quiet passages – similar to the effect you get when a faulty audio-control head vibrates in some Hitachi machines. While the fault seemed to be caused by vibration, the audio-control head seemed to be blameless. We decided to phone Panasonic for help – Philips weren't considered as they haven't even been able to supply a service manual to date. Panasonic were very helpful: they'd obviously come across the problem before. The cause of the trouble is vibration from the impedance roller, caused by the tape rubbing on the washer. The cure is to remove the roller, clean and turn over the washer, lubricate the shaft and washer, refit the roller and carefully adjust the height so that the tape just clears the washer. See Fig. 1.

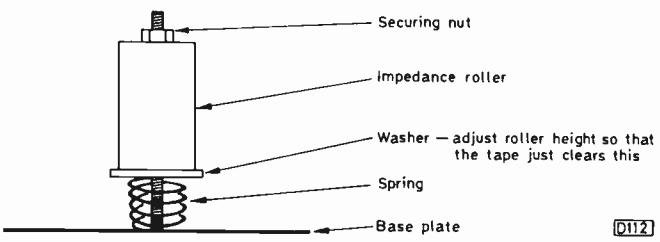


Fig. 1: Impedance roller adjustment, Panasonic NV370.

Whilst on the subject of Pye/Philips, we've recently taken delivery of some Philips VR6540 machines. These still use Panasonic mechanics but with Philips electronics and automatic tracking. No faults yet – but no service information either. **D.S.**

Deliberate Mistake

Did anyone else notice the deliberate mistake on BBC-2 at about 4 p.m. on January 17th? For about ten minutes they had the sound track for the test card at the wrong speed. Quite worried me for a moment when I played back a recording – I was checking for a sound fault at the time . . . **D.S.**

Sharp VC381

I've had a rush of dead VC381s recently, all with the 4A fuse blown. This has been due to either the 12V or 13V supply going up to 18V as a result of the relevant series regulator transistor going short-circuit. When replacing the transistor ensure that it makes good contact with the heatsink – often the original one didn't. **P.B.**

ITT VR3605/Ferguson 3V38

The ITT technical liaison officer gave me a useful tip on his last visit. If you've got a VR3605 on the bench with an electronic fault, once you've narrowed the fault down to a particular stage look for an open-circuit 33kΩ resistor! Apparently these resistors are rather unreliable. Here's a relevant fault we've had. The machine would play normally then suddenly stop dead, still threaded up, with the timer light flashing. This was due to R253 going high-resistance intermittently – it connects the power switch to the microcomputer i.c. (IC201) in the mechacon circuit. As a result of R253's behaviour IC201 was receiving an invalid 2·5V logic level.

For those who deal with other brands VR3605 = Ferguson 3V38 = JVC HRD110 and the same comments should apply to the VR3905/3V35/HRD120. **P.B.**

Mitsubishi HS306

The picture produced by a new machine looked as though its heads were dirty. Cleaning them (no mean task with this model) brought a reasonable picture back for a few minutes, but the fault then returned. A second go at cleaning failed to restore a good picture.

Back in the workshop I found that one head's f.m.

output was missing at TP2C. The head switching signal and the play 9V and record 9V lines were normal. A signal injected at the head amplifier i.c.'s input appeared at TP2C, but there was no signal here when the input was applied to the head input plug itself. The PCB track from the head was cracked – by C222. **P.B.**

Sharp VC386

When a VC386 came in with the head drum rotating much too fast I thought I'd a power supply fault. Not so – and I'd no manual. The servo i.c.s are the same as those used in some of the older models however so a VC9700 manual was used as a guide. Luckily one of the first tests I made was on the drum FG (frequency gear) signal which was being held down. One of the coupling capacitors, C710, was short-circuit. **P.B.**

Tatung VRH85001

This JVC clone would thread and start to run, then unthread again. The drum and capstan motors were running and there was no obvious reason for the machine to unload the tape and stop. A check around the system control i.c.s revealed the absence of the drum flip-flop signal. The drum pickup head was open-circuit. **S.B.**

Ferguson 3V22

No colour replay was the complaint with this machine. Checks revealed that there was no output from the a.c.c. circuit in IC202 (AN305) – the signal was missing on record as well. Replacing the AN305 restored normal operation. **S.B.**

Sanyo VTC5000

The complaint with this VCR was intermittent stopping. There was no sign of the fault when the machine was brought into the workshop, so we replaced the intermediate idler and returned it. A few weeks later the machine came back and this time we were able to see the fault. I still suspected the take-up drive – so did the microcomputer IC3001: pin 39, the take-up reel sensor input pin, had a switching waveform on it but the waveform didn't reach 0V and was only 5V peak-to-peak with a 9V supply. Pin 39 is driven by the collector of transistor Q3013 which was not being fully turned on. The reel sensor output level was 2V peak-to-peak, a bit on the low side. After removing the turntable and cleaning the optocoupler the output increased to 6V peak-to-peak. Q3013 now turned fully on and the machine worked normally. **S.B.**

JVC HR7700

The letter that accompanied this machine was very explicit – not from one of your rain coat and wellies types. There was tracking noise that wasn't affected by the tracking control, no slow motion or still frame and occasional sound pitch variation. Being all too familiar with this model I knew that the replayed control track pulse was probably missing. It was, but came back again whilst I was prodding about. It could be heard that the sound did indeed keep fluctuating: not a lot, just every so often. The cause of the trouble was IC1, the control pulse amplifier i.c. on the servo-1 panel. It was noisy, with lumps of noise that sometimes got into the capstan servo on its output. Fitting a new AN360 put matters right. **S.B.**

Hitachi VT8700

This machine lost time: it was clocked as counting 72 seconds to its own minute. Obviously switched to 60Hz, so it was switched back to 50Hz with mumbles to the effect that the customer should know better. It still lost time however. A check around the clock microcomputer i.c. didn't reveal any obvious problem though there were no pulses on the Hr/Hz pin (pin 13). So the micro was changed, which is where it got a bit funny. At switch on it still counted 72 seconds to the minute. It was switched to 60Hz. After throwing the switch to 50Hz it still counted 72 seconds. Various things were blamed – diodes and the dog and Andy . . .

The Hr/Hz pin was at −25V. A diode is connected between this pin and pin 24 which was at 0V, reverse biasing the diode. It was difficult to see how the circuit worked. The diode can be changed from pin 24 to pin 25 for 12/24hr operation. This was tried and worked and the count was now correct. Change back and it's still correct. Why? Well it seems that the micro sets 50/60Hz and 12/24hr on pin 13 *when powered up*. So what I should have done was to switch to 50Hz and unplug the machine from the mains for a short while. Oh well, you live and learn!

S.B.

JVC HRD110/Ferguson 3V38

A JVC HRD110 rental machine had a severely damaged cassette compartment – extensive dismantling was required to replace both side cheeks. The cause of the trouble was one of the two small cogs in the pairs that drive the cassette carriage having been sheared off – one at each side that is. Once the repair had been done and the cassette compartment reinstalled for final testing the initial fault showed up.

When the operate button was pushed the machine did a shuffle with the loading mechanism and went into a very rapid rewind. Andy said that the customer had complained about this before, but had cured the problem by unplugging the machine from the mains for an hour or so.

There was no motor control signal, so both microcomputer i.c.s were blamed in turn and replaced. Still the same fault, and intermittent. After a long time spent checking various things I found that if the cassette lamp was covered the rewind didn't happen – until the machine was put on its side that is (this effect was traced to the end sensor and my bench lamp however). It was obvious that the end sensors were active, so the microcomputer i.c. must think that a cassette is in – logical things, micros. Both had been eliminated however. The micro concerned was right in what it thought – C228 which decouples the housing down detect switch turned out to be intermittently short-circuit. **S.B.**

Special Offer!

I've a limited quantity of second-hand ex-JVC centre tolerance HR7350 (stereo/eight-event timer) VCRs for sale. I want £299·95 each for them, with a six month warranty. Anyone interested should write to me at the Newark Video Centre, 108 London Road, Balderton, Newark. **S.B.**

Miller's Miscellany

Chas E. Miller

"Bargain" used colour TV sets are now being sold in many parts of the country for "less than £30", i.e. £29·99. Now we all know that it's possible to acquire elderly CTVs for a few pounds, but most of us would probably think twice about renovating them and selling them to the public. A thorough overhaul just wouldn't leave sufficient profit if you offer delivery, installation and a worthwhile guarantee – to say nothing of the doubtful wisdom of placing old sets back in the market. I'm not being funny about this: it's no secret that I'm a vintage TV enthusiast, and in fact I have in everyday use a seventeen year old colour set. But I wouldn't sell such old sets to anyone who wasn't himself a vintage fan.

The trouble is that when sets are advertised at very low prices it becomes difficult to obtain the go-ahead from a customer for any repair that's likely to exceed about £20. We've all heard the reply "why should I pay that when I can get a 'new' one for only £30?". And there's no easy, convincing answer! I'd be the last person to decry selling second-hand sets, but let's stick to reasonably modern ones at realistic prices. It will be to everyone's advantage in the long run.

This and That

Test Card F is still to be seen occasionally. Thinking back, it would seem that the young lady with the blackboard and doll must now be about 20 years of age. With its usual love of anniversaries, couldn't the Beeb persuade her to appear in an updated Card when her 21st falls due? I'm sure we'd all like to see how she's changed over the years – and anyway I still think F is better than that electronic thing . . .

I heard recently of a one time radio and TV man who'd had his own business for years but had quit to become a prison officer. I've no doubt at all that he'll earn a lot more in his new job, and there's a good chance that his customers will be far more agreeable as well . . .

How Things Change

One of my correspondents not long ago asked me if I had any information on the Perdio portable TV set known as the Portarama. I found what he wanted in the 1963-64 volume of *Radio and Television Servicing*. How things have changed since then! There wasn't a single imported TV set mentioned, and only a handful of foreign radio sets were covered. I doubt whether many of the engineers of those days could have foreseen the present situation, where the truly domestic product is becoming a rarity. What will a few more years bring?

Endangered Species?

Are TV engineers becoming an endangered species? As guarantees on new sets become longer and longer, those repairs that do become necessary are likely to be undertaken almost exclusively by the shops that sold the sets in the first place. We could be edging towards the throwaway situation in which sets that have gone ex-guarantee are scrapped when they next give trouble. The inevitable result of these processes will be a steady diminution in the need for service engineers.

A Calling?

Some thinning of the ranks will take place through "natural wastage". Perhaps we shall return to the situation that existed years ago, when being a TV (or purely radio) engineer was virtually a calling. I can't see that final extinction will ever occur however, for the simple reason that the British will never accept the throwaway concept completely. There will always be the individualists who will try to keep something going for as long as possible, and even though they may be a small minority they'll guarantee a certain amount of work. But will they be prepared to pay economic repair bills? I think this is where we came in . . .

Guide to Coarse Servicing - cont.

When I popped in to see Ike Hodge the other day I found him busily removing the line output transformer can from a GEC hybrid colour set. Anxious to display my encyclopaedic knowledge of these sets I made a guess as to what might be amiss with it.

"Don't tell me" I said, "I bet you've a PY500 with an open-circuit heater."

Ike shook his head, and the pliers he was using instead of a box spanner slipped and wounded his hand. After he'd made the customary speculation as to the parentage of the set I asked him if the PY500 had gone soft. He replied negatively so I went on to enquire whether a high-voltage puffer had burnt itself to ash. Once more the answer was no.

"All right" I persisted, "the PL509 has overheated and drawn a dimple."

"No it hasn't" he snapped back, licking an incipient blood blister. "If you must know it's the silencer."

"The silencer?" I repeated blankly. I thought I knew all the slang terms, but this was a new one. "What's that?"

Ike gazed at me pityingly. "It's the thing that hangs under the van and quietens the exhaust" he said impatiently. "Don't you know anything about motor vehicles?"

"Yes but what's that got to do with a colour set?"

"The silencer in my van has a ruddy great hole in it and these line cans are just the right metal and thickness to make a good patch. Now do you see?"

"Ike!" I exclaimed, "you wouldn't pinch a customer's line can just to repair your van."

"Can you suggest a better method?" he demanded. "After all line cans are only fitted to be taken out and thrown away, aren't they?"

I was shocked and said so.

"Gertcha!" retorted Ike offensively. "Don't tell me you've never left a line can off. As for me, I've never knowingly replaced one since 1953, Coronation year. I remember fitting one in a twelve inch Regentone. The only reason I did so was because the whole transformer fell apart if you didn't. After that it was a matter of pride to leave 'em off. That's the trouble you know nowadays – not enough people got a pride in their jobs." He sighed as he started to straighten out the GEC line can with a pair of tin snips. "How are things with you?"

"So-so" I replied, "I've still got one customer owing me

fifty quid for a tube change job with little hope of ever seeing it."

Ike eyed me keenly. "You haven't fallen out with him I hope?"

"No, but I will if he doesn't cough up soon" I replied.

Ike shuddered. "That's the worst thing you could do" he said. "Never ever fall out with someone who owes you money. If you do you don't stand a cat in hell's chance of seeing it. What you do is to be polite and sociable. Don't even mention the bill. Just let nature take its course. What kind of set was it anyway?"

When I told him Ike laughed uproariously. "Only a berk like you would repair a thing like that" he spluttered. "But in this case it's all to the good. A heap like that can't possibly go for more than a month without something going wrong with it. As I said, let nature take its course. When it fails you take it straight into the workshop – even if it's only a fuse. Then you send the owner a little message to the effect that he'll get his set back if and when he pays up. Never fails."

"Are you sure?" I asked. "Tried it yourself?"

"Hundreds of times" he said extravagantly.

"Did it always work then?"

Ike frowned. "Not always, but at least I got the parts I'd put in back, 'cause I just kept the sets."

I suddenly realised why there were at least twenty of the "heaps" he'd just been so scornful about at the rear of his workshop.

"Think I'd rather have people owing me money than a workshop full of junk" I said caustically.

"That's the trouble with you" sighed Ike. "No pride in your job!"

Test Pattern Program for the Oric-1

Mike Phelan

Here's a program for the Oric 1 microcomputer to give dots, crosshatch, split-screen bars, ditto with a three-frequency multiburst, any of these with a centre circle, plus a plain raster in black, white or any of six colours. It should also work with the Oric Atmos. Lines 190-240 give the dots, 250-320 the crosshatch, 330-410 the colour bars and 430-470 the multiburst. The line 710 instruction is for no circle on a plain raster. This is because the latter is drawn in the text mode, in which the circle command won't work. The text mode is used to give a complete raster: in the hires mode the bottom three lines are reserved for messages and the colour would have to be changed separately.

Program

```
10 REM***PATTERN GENERATOR***
40 PRINT CHR$(20)
50 TEXT
60 PAPER 0:INK 7:CLS
70 FOR J=1 TO 5:PRINT:NEXT
80 PRINT"1 . . . . DOTS"
90 PRINT"2 . . . . CROSSHATCH"
100 PRINT"3 . . . . COLOUR BARS"
110 PRINT"4 . . . . MULTIBURST"
120 PRINT"5 . . . . RASTER"
130 PRINT"6 . . . . QUIT"
140 PRINT
150 INPUT"ENTER SELECTION & PRESS 'RETURN'";SEL
160 IF SEL<1 OR SEL>6 THEN 150
165 ON SEL GOSUB 190,250,330,420,480,650
170 GOSUB 660
180 PRINT CHR$(20):GOTO 10
190 HIRES
200 FOR Y=10 TO 199 STEP 10
210 FOR X=10 TO 239 STEP 10
220 CURSET X,Y,1
230 NEXT X,Y
240 RETURN
250 HIRES
260 FOR X=10 TO 239 STEP 10
270 CURSET X,1,1:DRAW 0,198,1
280 NEXT
290 FOR Y=10 TO 199 STEP 10
300 CURSET 1,Y,1:DRAW 238,0,1
310 NEXT
320 RETURN
330 PAPER 7:INK 0:HIRES:PAPER 7
340 FOR X=1 TO 239 STEP 30
350 CURSET X,0,0
360 READ V
370 FILL 180,1,V
380 NEXT
390 RESTORE
400 DATA 23,19,22,18,21,17,20,16
410 RETURN
420 GOSUB330
430 CURSET 47,50,0:FILL 99,29,16
440 CURSET 50,50,0:FILL 33,29,49
450 CURSET 50,83,0:FILL 33,29,73
460 CURSET 50,116,0:FILL 33,29,85
470 RETURN
480 TEXT:CLS:PAPER 7:INK 0
490 FOR J=1 TO 5:PRINT:NEXT
500 PRINT"1 . . . . BLACK"
510 PRINT"2 . . . . RED"
520 PRINT"3 . . . . GREEN"
530 PRINT"4 . . . . YELLOW"
540 PRINT"5 . . . . BLUE"
550 PRINT"6 . . . . MAGENTA"
560 PRINT"7 . . . . CYAN"
570 PRINT"8 . . . . WHITE"
580 PRINT
590 PRINT"SELECT NO FOR COLOUR"
600 PRINT"THEN SPACE BAR TO RETURN TO MENU"
610 GET V$:V=VAL(V$)-1
620 IF V<0 OR V>7 THEN 610
630 PAPER V:INK V:POKE#26A,10
640 RETURN
650 TEXT:CLS:END
660 PRINT
670 PRINT"PRESS SPACE BAR TO CONTINUE"
680 PRINT"OR 'C' FOR CIRCLE"
690 Z$=KEY$:IF Z$<>CHR$(32)AND Z$<>CHR$(67)THEN
    690
700 IF Z$=CHR$(32)THEN RETURN
710 IF SEL=5 THEN 740
720 CURSET 120,100,0
730 CIRCLE 80,1
740 GOTO 690
```

Note that line 690 of the program ends "THEN 690" (we were not able to print the "690" on the same line).

Workshop Hints

G. Haigh

Here are a few servicing tips and ideas that may save you time and money in the workshop.

Compass Checks

Most degaussing circuits used in colour TV sets are simple enough. The odd faults that occur are usually due to ageing thermistors or open-circuit resistors. Although some sets give an audible buzz from cold, some are very quiet. A quick check in the latter event is to place a cheap magnetic compass near the coils at switch on from cold. If the circuit is intact there'll be a sudden dip or rotation of the pointer.

The same effect occurs at switch on or off if the compass is placed close to most mains transformers, proving that current is flowing in the primary winding at any rate of an otherwise dead set without need to touch the multimeter.

Whilst on the subject of degaussing circuits, can anyone say why a coil wound over a bar attached to the shield is used in some Thorn sets instead of the usual pair of coils?

Tuner and IF Problems

The raster, no signals symptom can be an awkward fault to tackle. One gets a rough idea of the problem area by judging the amount of noise on the screen or at the loudspeaker. With a non-working tuner the i.f. strip will probably work at full gain, producing a lot of noise. Removing a suspect tuner, obtaining another, fitting it and carrying out adjustment for good results is very time consuming – and the printed tracks may lift if the original tuner has to be put back. There are many other things to check, such as open-circuit coils and capacitors, transistors and possible print faults.

For those who, like me, don't have a 50MHz scope it's very useful to have a signal tracer so that you can see what's happening between the tuner and the vision detector. Fig. 1 shows the system I use. It consists of a spare working TV set (in my case an old Rank A640 chassis) with the tuner disconnected and a probe applied to the i.f. input socket instead. The defective stage in a faulty set can be quickly located – as most i.f.s are standard there's little problem with loading or mismatching or a.g.c./a.f.c. effects. The contrast control in the tracer set can be used as a gain control.

The set-up described has scored many times. In one case the i.f. board in a Bush Ranger wasn't mating up properly. On a Sharp portable the signal reached the first i.f. stage but got no farther: the a.g.c. preset had been tampered with, biasing the signal off. In a Fidelity FTV12 portable the signal could be quite clearly traced at both sides of the SAW filter that drives the TDA440 i.f. i.c. The chip's supply was present and the scope showed no detected video output (the sound output pin was lively). It seemed therefore that the i.c. was defective. It was.

The old radio dodge of proving that a local oscillator is working can be applied to a TV tuner – see Fig. 2. Connect the aerial sockets of the set with suspect tuner and a working set. Tune the working set to midband and tune around with the other. The principle is similar to the way in which TV licence dodgers are caught. The radiation from a working local oscillator will lie in the passband of a similar set. The effect, if the oscillator is working, will be patterning or, if there's broadcast breakthrough, a sort of beating effect can occur. A slight complication might arise if the r.f. stage is open-circuit, but the test is so easy to set up that it can be used to prove immediately that the tuner's supply is present. It may be possible to use a sniffer loop for direct probing.

A mechanical tuner powered by a bench supply and connected to an aerial can be useful in proving whether a tuner is faulty – see Fig. 3. All that's necessary is to disconnect the i.f. lead from the tuner in the set and inject the signal from the external tuner.

Transformer Topics

Old autotransformers from the Thorn 950 Mk. II chassis are still giving good service as part of my equipment – as a "poor man's variac", see Fig. 4. Two of them provide an ideal "gentle" mains supply for powering up sets such as the Sony KV1340UB (78W) when expensive replacement semiconductor devices have to be fitted.

Redundant field output transformers are safe enough to use with the mains supply – the insulation is usually very good. The thick-wire secondary winding can give useful current: if the output voltage is too high, remove turns until you get the right voltage. Uses include power supplies, lamps, doorbells etc. Don't use audio transformers. Note that an incomplete transformer (if one has to be dismantled) will give an output different from that expected. The primaries of two transformers can be connected in series, the secondaries likewise, giving the option of a split supply. The arrangement shown in Fig. 5 is suitable for test equipment, e.g. to provide a supply for a capacitance leakage test. With the growth in low-voltage, solid-state equipment, high-voltage isolation transformers don't seem to be as plentiful as in the past.

Semiconductor Devices

Transistors are a not uncommon cause of failure in TV sets etc. Most are easy to identify for replacement purposes – even Japanese types aren't too difficult despite tending to drop the 2S from the start of the code. When repairing an obscure set with unknown devices on the board and you think you've located a faulty transistor it may be worth looking around the set for an identical device that can be swapped over (like in the old days with valves!). Note the connections, remove the device and identify its polarity and construction, using a multimeter – or alternatively an in-situ tester. If you possess a metered

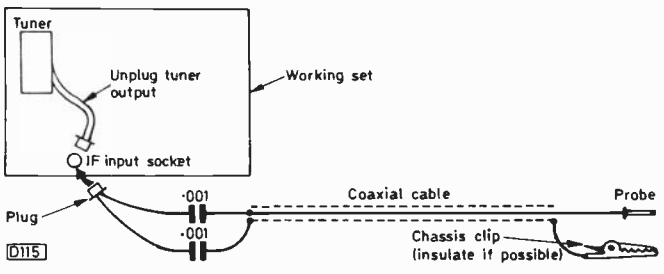


Fig. 1: Tuner/i.f. signal tracer using a working TV set with its tuner disconnected.

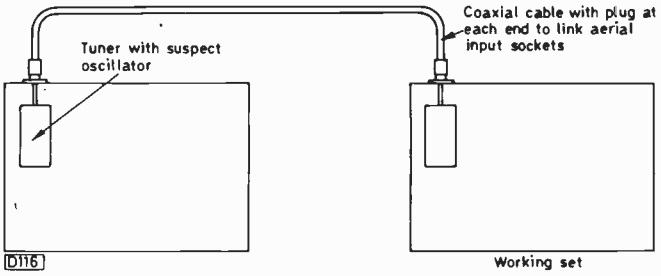


Fig. 2: Using a tuner as a u.h.f. oscillator.

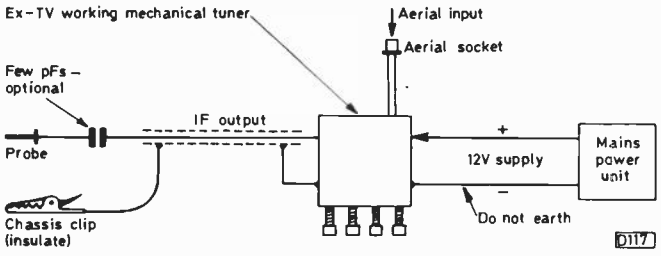


Fig. 3: Tuner substitution set-up. Connect as shown: take care as the metalwork in some chassis is at half mains potential (fit in box). No varicap tuning voltage is required with a mechanical tuner.

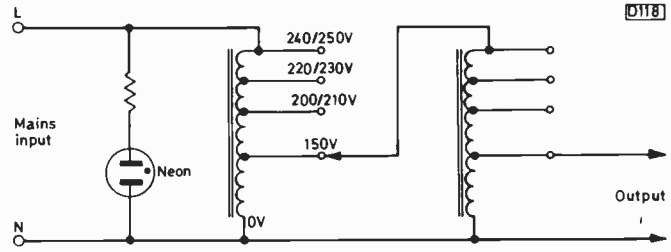


Fig. 4: Poor man's variac: use of two old Thorn autotransformers to give a supply ranging from about 88V up to full mains potential. Isolation is not provided. Output is determined by the various combinations of taps. Take care not to overload.

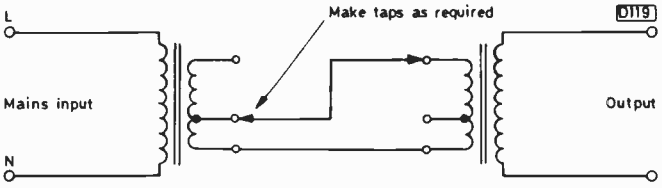


Fig. 5: Use of two transformers to give mains isolation. Small to moderate loads can be connected. Provides 1:1 or other ratios of mains voltage.

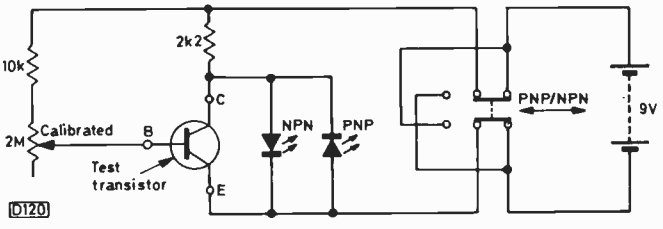


Fig. 6: Simple transistor gain checker. Adjust the potentiometer until one LED is just extinguished: read gain at this point off calibrated potentiometer.

gain checker, all the better. If not, see Fig. 6. This test enables the choice of a suitable replacement to be considered – a completely open-circuit or short-circuit device will yield very little information of course.

The arrangement shown in Fig. 7 is useful for making

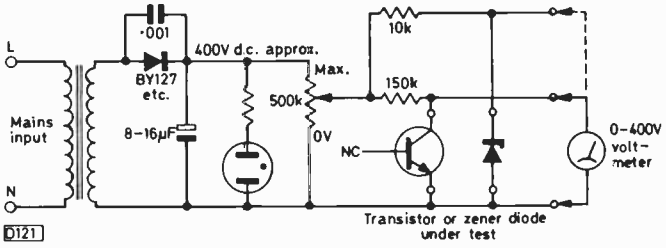


Fig. 7: Non-destructive breakdown tester for transistors and zener diodes. Turn control to zero, insert device being checked then turn up control until the meter gives a stable reading – voltage shown is the breakdown or zener voltage.

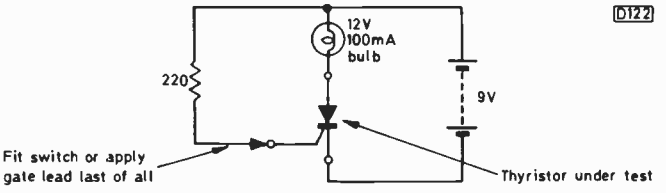


Fig. 8: Simple thyristor tester. Short the anode and cathode connections to check the bulb.

non-destructive transistor collector-emitter or base-collector voltage breakdown tests, i.e. the avalanche voltage is registered. No damage occurs because the current is very small (always use a protection resistor). As shown, zener diode checks can also be made.

A simple thyristor tester is shown in Fig. 8. It works fine in situ on G8s, A823s, Pyes etc. – discharge any capacitors first.

Reclaim Tips

Transistor sockets are worth reclaiming. I'm thinking of old Grundig or Russian radios, some Rank tuners, also i.c. sockets. When soldered to short, flexible leads the arrangement can be tacked to the foil side of a panel and likely substitutes can be plugged in to assess performance.

Defunct sets can supply many useful items. The plastic tuning rods from old Rank tuners will, with the brass rings cut off and filed at the ends, engage many ferrite cores. Even better adjusters are to be found on early GEC convergence units: when cut and filed at the end the metal makes an ideal preset adjuster – the type a small screwdriver won't fit.

Miscellaneous Tips

If you want to try adjusting a preset resistor to observe the effect but you'd prefer not do disturb the setting if possible, carefully remove the preset with a solder sucker and fit another one on the print side. Then adjust away – the original can be replaced undisturbed.

Most cheap meters don't have an a.c. range for current measurements. An approximate answer is to insert a low-value resistor in circuit, say 10Ω but not wirewound, and measure the voltage across it. Use a sensitive voltmeter on the a.c. range – let Ohm's Law do the rest.

The customer's set itself can be a useful test centre. When confronted with a stereo unit with only one channel working, why not use the good channel as an audio signal tracer for going through the defective channel? One manufacturer advocated using a TV set's own audio amplifier, connected via protection components (a capacitor and resistor in series), for detecting 50Hz field, 7·8kHz ident and 15·625kHz line signals.

Long-distance Television

Roger Bunney

As 405-line TV disappeared from Bands I and III, so it seems all the Continental signals went in sympathy. January 1985 was a really grim month, with virtually no reception of note. Band I has been very quiet – even MS reception has been lacking. It's hardly worth compiling a log, but my thanks nevertheless to Iain Menzies, Simon Harmer, Dave Shirley and Gareth Foster for sending in reports of their MS sightings.

Fortunately there was a short-lived tropospheric lift during the evening of January 30th. Strong v.h.f. and u.h.f. signals from Benelux and France were noted here at Romsey, Hants, Paris Canal Plus ch. F6 being particularly strong. Roger Pates (Nottingham) logged strong W. German (ZDF) and E. German signals. Along with several others he contacted me about the Band III System L SECAM signals present that evening. The signals were from Rouen ch. F7: the transmitter is at present carrying test patterns – a form of colour bars with a crosshatch – during the day and evening in preparation for Canal Plus. A further brief but equally intense tropospheric opening occurred on February 4th when a passing high-pressure ridge gave clearing skies and high-level signals from the east/south east, with results similar to the 30th in southern areas.

Altogether a gloomy month, with the trop events on the 30th and 4th the only glimmer of light to cheer us up.

The DTI has been active during January: at least six popular pirate radio stations including Jackie have been closed down. Thameside TV ch. 28 came on air for four nights over January 6-9th with a repeat of their Christmas show: the London City skyline tuning caption has been dropped in favour of a version of the ETP1 pattern with magenta border and the identification "Ch. 28".

There have been suggestions that the approaching sunspot minimum, due in October 1987 according to the traditional method of calculation, could well occur earlier – some say by the end of this year!

A new 50·045MHz, 20W (into a ground plane) amateur radio beacon is now in operation at Denmarkshaven, East Greenland – call sign OX3VHF.

News Briefs

Extreme snow and frost caused the collapse of the 284m high W. German WDR-1, ch. E11 transmitter mast at Teutoburgar Wald. The 100kW transmitter is currently off air, low-power standby transmitters being used with a temporary 80m mast . . . A local Danish TV station, TV Syd, is in operation at 200kW e.r.p. on ch. E7 . . . A new E. German high-power transmitter is in operation on ch. E51, thought to be a translator.

Interference

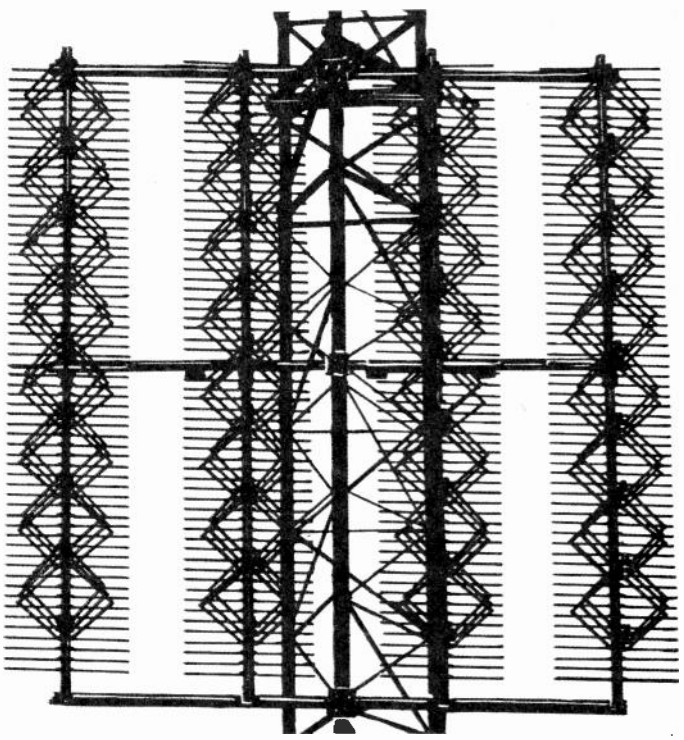
Interference at v.h.f. from the BT Ambassador type phone was mentioned last month. Similar trouble occurred here recently. A 3kHz whistling became apparent at various spots throughout the v.h.f. spectrum, being particularly loud above 100MHz with a superimposed rapid pulsing – audible on an SX200n scanner at f.m. narrow-band and on a standard 2-metre transceiver. An interesting characteristic of the interference was that two peaks of whistling were present at each noise spot monitored, the two peaks being some 13kHz apart. The received frequencies were unstable and would vary over a period of time. The source of the interference was eventually located using a portable v.h.f. radio – the airband type with coverage over the 108-170MHz range. Its cause was a couple of phone instruments that were in use in a clothes shop some 150 yards distant. Contact with the Radio Services Section of the DTI put an end to the interference.

UK Six Metre Group

A group has been formed to represent the interests of radio amateurs in a Band I allocation. The proposed band is 50-54MHz, to be used for general research by all UK amateurs. If your interests lie in this area, membership of the group costs £5 for the first year and £4 thereafter. Write (with s.a.e.) to Peter Turner, G4IIL, Flat 6, 132 Marine Parade, Brighton, Sussex.

Curtain TV Aerial

An interesting stacked loop wideband aerial is currently available in the USA for distant signal reception. The original idea of a large curtain array was devised by Chireix Mesney in 1928 for SW transmission use. The system was further refined by post-war amateur radio experimenters and is now being marketed as the "Zig-Zag" array for use in CATV systems. Its large capture area is invaluable for receiving trans-horizon scatter signals and twin or quad stacks give high gain. For example, a single-bay system for a given Band III channel has a gain of 15dBd and a front-back ratio of 25dB: for channel A13 the reflector width is 4·5ft and the height of the whole



Zig-zag curtain aerial: four-stack array mounted on a lattice mast. Produced by Lindsay, Horsham, Pa, USA.

stack is a staggering 23ft! The dipole elements consist of three loops which are isolated electrically in each bay but stack with their partners in the adjacent bay and are combined at the central termination. Such arrays are manufactured for Band III and u.h.f. use only and are intended for side mounting on lattice towers.

NOS-3 Channel Allocations

The projected main network for the NOS-3 Dutch TV service is as follows: Lopik ch. E30, Roermond ch. E34, Arnhem ch. E40, Wieringermeer ch. E42, Smilde ch. E44, Markelo ch. E51, Goes ch. E52.

Installation of equipment for stereo/two-channel sound at the main NOS-2 service transmitters is due to be completed by 1986 (Smilde is already equipped). The completion date for the NOS-1 service is in 1990.

Commercial Corner

The Mullard EF4200TV tuner is being sold by Time Step Electronics, Wickhambrook, Newmarket, Suffolk CB8 8QA at £23·95 inclusive. It covers 47-101MHz and 111-293MHz with an i.f. output at 35MHz. A version with similar coverage but output at 10·7MHz, suitable for use with an f.m. i.f. strip, is available at £27·95 inclusive.

North East Satellite Systems, Cropton, Pickering, North Yorkshire YO18 8HL have available a Mitsubishi "microwave satellite signal source" at £65 plus VAT and £1·50 post/packing. It produces an audio tone preset to a nominated channel and would be helpful for alignment etc. with projects such as Hugh Cocks' 11GHz converter (February issue) and low-noise amplifier (forthcoming issue).

From our Correspondents . . .

Jim Maden and Ian Roberts have been evaluating various tuners in S. Africa. They found that the ELC2060 is somewhat better than the ET021 for Band III use. A particularly interesting tuner they've come across is the Philips UV471 which they say is "virtually overload proof" and has gain and noise performances superior to all other tuners so far tested. Its performance is maintained down to the 435MHz ATV allocation. Have any other enthusiasts tried this tuner? Anyone know of a UK source of supply?

Paul Barton has been developing a sophisticated v.h.f./u.h.f. sound receiver which uses currently available tuners and provides wide/narrow bandwidth f.m. and a.m. reception of all TV channels (other than the French Canal Plus!). Results are excellent and an article is promised. One tuner that's been tried is the ET547, a new one from Sendz with v.h.f./u.h.f. coverage (not Band II) and excellent performance.

TV from the Air

Mention was made in the December column of various TV experiments/services with the transmitters aboard aircraft, in particular "The Voice of Blue Eagle" which broadcast both radio and TV services from aircraft flying at 20,000ft over South Vietnam during the mid/late 60s. A request for further information was included and I'm grateful to AFRTS, Los Angeles, who have sent in extensive details of the operation in Vietnam.

The AFRTS provides a news and entertainment service for US servicemen and their families on a world-wide basis via SW radio, the SATNET satellite system and packaged video material (some 92 hours weekly) that's distributed to 300 overseas bases. The satellite provides a 24-hour service.

AFRTS started with a small transmitter at Kodiak Island, Alaska in late 1941. It's come a long way since then! Official recognition was given in 1942 with the setting up of a "Morale Branch" of the War Department. When the US became involved in S. Vietnam the AFRTS established broadcasting facilities at the Rex Hotel, Saigon – on August 15th, 1962. The service expanded and by late 1964 94 per cent of US personnel were in range of a broadcast transmitter operating 24 hours daily.

The Blue Eagle Flight project, for airborne MW, SW and TV transmissions, was started by the US Navy's Oceanographic Air Survey Unit in early 1965. The first plane, Blue Eagle One, flew out to SE Asia in May 1965, equipped for MW and SW transmission – the first programmes consisted of the 1965 Baseball World Series. The experiment was so successful that the decision was taken to equip Blue Eagles Two and Three for TV transmission as well. These aircraft arrived in Vietnam in January 1966. Each carried two 200W TV transmitters, a 10kW MW transmitter, a 1kW v.h.f./f.m. transmitter and various 10kW SW/SSB units, also two videotape recorders, two 16mm telecine channels, a small live presentation studio and various items of sound equipment. The TV transmissions used system M, 525 lines, chs. A11 and A9 (the latter for a Vietnamese TV service).

The airborne TV service started on February 7th, 1966 with various speeches recorded at the Tan Son Nhut base near Saigon. Subsequently a downtown Saigon TV studio was established for videotaping the Vietnamese service –

Left: AFVN Vietnam identification slide.

American Forces Vietnam Network

the US Forces ch. A11 service consisted mainly of US mainland network programming on 16mm film.

The success of this service led to plans to construct a land-based TV network in Vietnam. In early April 1966 all three Blue Eagle craft were damaged when the Viet Cong attacked the Tan Son Nhut base. Blue Eagle Three continued to give a five-day service until May 11th when Blue Eagle Two was able to resume operations and a seven-day service was restored. Land-based facilities arrived during the Summer months and a service, with programmes produced in Saigon, commenced on October 25th. The Blue Eagle service was then reduced to one flight which provided a Vietnamese only service in the Delta area.

The land-based service was considerably expanded during 1967, with seven vans at strategic points while Saigon was operating at 240kW e.r.p. from a 380ft mast. By October 1967 TV had been brought to some 85 per cent of serving US forces, the first time that a forces' TV network had operated in a combat zone. From late 1967 the radio and TV network was known as AFVN (American Forces Vietnam Network).

Damage and expansion continued throughout 1968 and in late 1969 a microwave TV link from Saigon to the Mekong delta was inaugurated. The three US Navy NC121 Super Constellations of the Blue Eagle flight flew their last regular missions over S. Vietnam on September 30th, 1970, thus ending nearly five years of airborne TV transmissions. The task of providing the TV service had by then been taken over by a sophisticated land-based network. Two NC121s flew back to the US mainland while the third remained to provide a backup service.

During 1971 there was a gradual withdrawal of US forces and the network began to contract. The final AFVN TV transmissions were on February 22nd, 1972.

My thanks to Mrs Dorothy McAdam of the Armed Forces Radio and Television Programming Center, Los Angeles, for providing a detailed history of the operations in Vietnam, also factsheets on current AFRTS operations. I've also heard from an airman who was based at Tan Son Nhut at the time of the Blue Eagle operations.

IR Remote Transmitter Tester

J.R. Allan

During a call to service a set the customer will often say that the remote control system isn't working. It's very helpful to be able to check quickly whether the remote control transmitter (infra-red) or the set is at fault. For this purpose the device presented in this article was devised. It gives an instant check on the transmitter.

All you have to do is to point the remote control unit at the area of the pickup photodiode in the tester, then operate the tester's on switch and the transmitter. If the latter is working the tester will make a noise. You'll find that different types of remote control transmitter make different noises, and with experience you'll get to know which sound goes with which transmitter. A LED was incorporated because some of the older IR remote control handsets are not "modulated". In this case the LED will light up to show that an infra-red beam is present.

The device is useful both for field service engineers and for workshop use if you don't want the bother of getting the scope out.

The circuit is shown in Fig. 1 and is very straightforward. Photodiode D1 picks up IR radiation. Its output drives pin 3 of the operational amplifier IC1 which in turn drives the piezoelectric transducer X1 for audible indication and the red LED D3 for visible indication.

The circuit can be built on a small piece of Veroboard, 3·5 × 2·5cm. Note that the photodiode is reverse biased in operation and that the most sensitive pickup area is the largest surface farthest from the leads. The piezoelectric transducer is in the form of a flat disc and is glued to the box for greatest effect. A small ABS box was used to house the unit, with holes made for the switch, LED and photodiode. The tester's current consumption is about 1mA.

★ components list

R1, 2, 4	100kΩ	IC1	741
R3	1kΩ	X1	Maplin type QY13P piezo transducer
R5	330Ω		
All 0.25W			
C1	100µF, 10V	D1	TIL100
C2	0·01µF mylar	D2	1N4148
C3	1µF, 10V	D3	Red LED

S1 push-to-make switch. Board Vero 14354 (Maplin FL06G). Box ABS 2002 (Maplin WY03D).

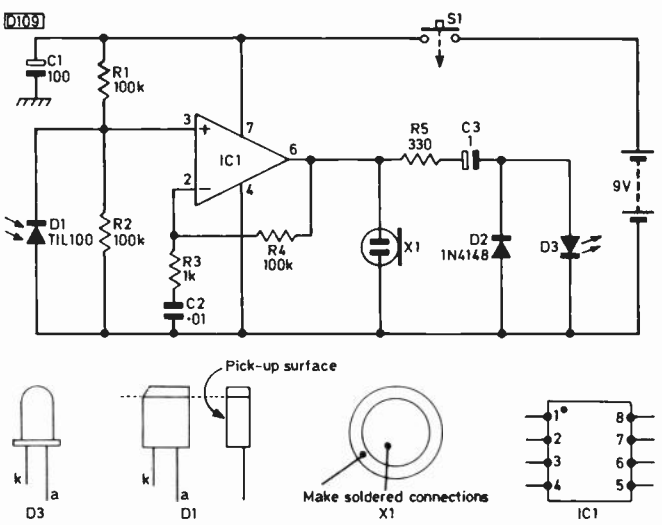


Fig. 1: Circuit diagram.

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SANYO VTC5300P

Fast forward and rewind are o.k. but when play is selected the machine switches off. With a little manual help the machine will lace up and try to operate.

The trouble is not uncommon with this machine and is due to lack of friction in the loading roller and loading belt. While a clean and degrease may work it's best to replace these parts. To replace the belt the "loading gear lever 2" has to be removed: be sure to replace its underdeck spring before operating the machine.

SONY KV1810UB

The brightness varies from the left to the right of the screen – with the brightness control set for a normal picture on the left-hand side, the brightness increases gradually until at the right-hand side it's excessive with desaturated colours.

It's almost certain that the reservoir capacitor for the h.t. supply to the RGB output transistors has dried up. This is C543 in the Mk I version, C596 in the Mk II – 4·7μF in each case.

BEOVISION 4000 CHASSIS

The problem is intermittent loss of field scan, usually for about ten minutes. In the fault condition the supply is present at the collector of the "upper" field output transistor but its emitter voltage is low. In-circuit checks have been carried out on the field timebase transistors which all appear to be o.k.

Despite the in-circuit tests we suggest replacement of the output transistors after thoroughly checking for dry-joints in the area. We've also known the driver transistor 5TR12 go base-emitter short-circuit intermittently. The other trouble spot here is the 2,000μF scan coupling capacitor 5C34 which can go open-circuit spasmodically.

PHILIPS N1700

Prerecorded programmes go haywire on occasions – similar to line slip. The tracking control works in the fault condition as a change in the sound pitch can be heard but it has no effect on the picture. The pinch roller has been cleaned and new heads were fitted recently. Also the tape stalls on rewind: only by winding forward then quickly back again can the tape be completely rewound.

The first problem appears to be due to incorrect head speed. This is usually caused by leaving insufficient clearance in the bearing when fitting new heads. There should be 1-2mm end float, adjustable by moving the pulley on the spindle. For the rewind problem, clean the idler and the driving face of the flywheel. Dismantle, clean and lubricate the reel disc assembly, noting the position of any shims. Also check the condition of the brake pads beneath the lower reel disc.

RANK T20 CHASSIS

This set blows BU208A line output transistors at the rate of about one a month. When a new transistor is fitted and the set is switched on the picture first jitters out of focus for a minute then returns to normal. The tripler and focus control have been replaced and the line output transformer shows no visible signs of damage.

First replace 5R8 (1Ω) in the BU208A's base circuit, using a suitably beefy type, and the flyback tuning capacitor 5C14. The latter should be a maker approved type. Also check for dry-joints in the line output stage and adjust 5L3 (fifth harmonic tuning) in accordance with the instructions in the manual. Make sure that the h.t. voltage is not excessive – adjust 7RV2 for 200V at 5FS1. The scan correction capacitor 5C11, EW modulator diodes 5D6/7 and line driver transformer 5T1 are less likely culprits – but possibles nevertheless.

PHILIPS TS7 CHASSIS

Loss of line lock was cured by adjusting the line oscillator coil. The slight waviness remaining at the top of the raster was then cured by replacing the flywheel sync filter capacitor C213 (10μF). There are still two problems: ballooning when the brightness control is advanced and excessive width. A new e.h.t. rectifier has failed to cure this.

The new e.h.t. rectifier should have cured the ballooning: the fact that it didn't suggests that either the output from the series regulator circuit is low or the 2SC901A line output transistor is in need of replacement.

RANK T16A CHASSIS (BUSH RANGER)

The set works all right when first switched on but after half an hour there's a gradual decrease in picture quality, as if the signal input to the set is being reduced in strength.

We assume that the visible symptom is gradually increasing snow, in which case the tuner is the most likely suspect. To eliminate the a.g.c. circuit, confirm that no marked change of voltage occurs at the tuner's a.g.c. pin 1 as the fault appears and gets worse. If it does, measure the voltage at pin 1 when the set is working normally. Wait till the fault appears, then disconnect pin 1 and apply an external voltage equivalent to that for normal operation. If this doesn't cure the snow, condemn the tuner. If it does, check the transistors, diodes and capacitors in the a.g.c. circuit.

PHILIPS G8 CHASSIS

First the picture suddenly went dark. Suspecting loss of e.h.t. I cleaned the tube and the connections from the

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tripler to the line output transformer and the focus control. Things then returned to normal. More recently there's been a convergence fault, which was traced to a dry-jointed convergence control connection, and now there's excessive width.

Excessive width is quite common with these sets – we assume that the picture is also a bit dim and defocused. One of the series-connected line output transistors or flyback tuning capacitors is probably short-circuit.

HITACHI CNP192

The picture has shifted to one side. Adjusting the line oscillator coil provides a fair amount of correction but not enough. I've replaced the line oscillator transistor and the flywheel sync discriminator diodes.

We suggest you check C707 (3·3μF) in the flywheel sync filter circuit and the feedback pulse integrating/delay resistor R709 (1·5kΩ). If necessary, go on to check the supply decoupler C711 (10μF) and the pulse feedback capacitor C736 (0·022μF).

TEST CASE

268

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

A lot of the VCR repairs carried out in our workshop concern mechanical rather than electrical problems. Clutches, idlers, belts and heads seem to be the most wear-prone parts, and the Achilles' heels of most machines are quite well known to us – sometimes to the point where a reasonably accurate diagnosis and estimate can be made on sight.

Of all the mechanical ills that befall VCRs, tape chewing is one of the most frustrating for the owner. He'll lose at least one tape, often more, and if a well-chewed tape is fed back into the machine he stands to lose more than tapes! We recall one machine with a lazy reel motor that wrote off half the local hire shop's stock of cassettes, or so the proprietor told us.

An unusual tape-chewing fault came our way recently. The machine was a JVC HR7200 – the deck mechanism is used in a number of models including the Ferguson 3V29. The mischief was done during the tape loading phase: it didn't always happen, much depending – we suspect – on temperature, tape condition and the way in which the wind was blowing. When it did occur the sequence of events was as follows. The tape loading poles would move away from the cassette, carrying a loop of tape between them. As the loop contacted the fast-spinning video head drum the tape would billow out to the right, falling into the loading-pole guide slot and sometimes piling up on the take-up spool in the cassette. As lacing continued, the tape would get mangled under the sliding take-up pole base or double-cocked between the capstan and pinch roller. We had to crucify an old tape several times in order to analyse fully what actually happened – the whole sickening business took only about one second.

Naturally enough our first step was to check the loading tension brake which operates on the feed spool during this phase. It was present and apparently worked correctly, damping the movement of the feed spool and then withdrawing at the completion of loading. Maybe it wasn't applying enough tension? A stronger spring was fitted experimentally, and at first we thought that this had cleared the trouble. On loading up for the umpteenth time however away went the tape to a greasy fate amongst the loading ring cog teeth! A more far-fetched theory was next tested. If the tension in the expanding tape loop was too great, perhaps it would bind heavily against the head drum on contact – to be picked up and whisked away. Accordingly we disengaged the loading tension brake altogether and performed more play/stop cycles. It was not long before the tape ribbon was again at large in the works. . . .

We next compared the head drum's acceleration and speed during loading with that of a similar machine. There was no discernible difference between them. The trouble was finally cured to the satisfaction of our customer who, fortunately for him, rented the machine. In retrospect our efforts under the feed spool were quite pointless – where did the trouble lie and how was it cured? See next month's issue for the answer!

ANSWER TO TEST CASE 267
– page 282 last month –

Last month's puzzle centred on the chopper power supply used in the GEC Model C1401H and ITT mini-series colour sets (CVC800 series chassis). Despite the efforts of the pulse-width modulator to increase it, the h.t. supply produced by the chopper circuit was low at only some 50V. Our tests led us to believe that something odd was going on in the chopper stage itself. The chopper consists of a BU126 switching transistor whose collector is fed with an unstabilised, mains-derived 290V supply while its emitter is loaded by the chopper transformer and the efficiency diode. The emitter waveform shown in Fig. 1 last month was strange indeed. The little wiggles at the start of the chopper's output pulse bode ill for the health of the BU126 and suggested that the chopper transformer Tr702 was ringing in some way.

And so it was! What we discovered when we turned the chassis over was that the two halves of the transformer core had come apart and were separated by about 3mm of nothing! That's why the fault had occurred during the owner's house move. Two dobs of Superglue sorted the problem out – watch out for it in any chassis that uses this form of transformer construction.

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AC127	15p	BCY42	20p	BFY52	14p	TIP122	47p	2N4037	25p	OA91	4p	ECH81	49p	4049	33p	7492	45p	**LINEAR IC'S**	
AC128	16p	BCY56	16p	BFY56	25p	TIP125	47p	2N4443	76p	OA200	7p	ECH84	52p	4050	30p	7493	35p	LM324	30p
AC128K	23p	BCY70	16p	BFY57	25p	TIP126	56p	2N4444	76p	OA202	7p	ECL80	57p	4051	57p	7495	48p	LM380	100p
AC141K	23p	BCY71	16p	BFY64	25p	TIP127	56p	2N5061	20p	IN914	2p	ECL82	59p	4052	58p	7497	80p	LM381	100p
AC142K	22p	BCY72	16p	BFY90	60p	TIP147	100p	2N5294	30p	IN4001	4p	ECL84	57p	4053	54p	74107	30p	LM709Dil	30p
AC153K	23p	BD115	26p	BR100	14p	TIP2955	34p	2N5296	30p	IN4002	4p			4054	74p	74111	52p	LM723	32p
AC176	18p	BD124P	80p	BSX20	15p	TIP3054	38p	2N6106	40p	IN4003	4p	ECL85	57p	4055	75p	74116	85p	LM741Dil	15p
AC176K	20p	BD124	110p	BT106	90p	TIP3055	34p	2N6107	40p	IN4004	4p	ECL86	49p	4056	75p	74119	85p	LM741 Met	45p
AC187	15p	BD128	35p	BT109	90p	TIS43	45p	2N6109	40p	IN4005	4p	EF80	31p	4060	60p	74122	40p	LM3900	25p
AC187K	20p	BD131	25p	BT116	80p	TIS44	40p	3N128	85p	IN4006	4p	EF85	34p	4066	38p	74123	20p	NE555	20p
AC188	17p	BD132	25p	BT119	100p	TIS61	15p	3N143	65p	IN4007	5p	EF89	43p	4068	24p	74125	40p	NE556	40p
AC188K	23p	BD135	20p	BT120	100p	TIS88A	45p			IN4148	2p	EF183	45p	4069	24p	74126	45p	AN-214P	200p
ACY18	48p	BD136	20p	BU104	100p	TIS90	15p	**JAPANESE**		IN5400	9p	EF184	53p	4070	23p	74132	42p	AN-240P	150p
ACY19	48p	BD137	20p	BU105	80p	TIS91	18p	**TRANSISTORS**		IN5401	10p	EL34	190p	4071	23p	74141	55p	AN-360	120p
AD142	60p	BDY92	100p	BU108	100p	TIS93	20p	2SA73	30p	IN5402	10p	EY86	31p	4072	23p	74145	70p	AN-7110	150p
AD149	45p			BU110	110p			2SA104	32p	IN5403	11p	EY87	31p	4073	23p	74153	45p	AN-7114	170p
AD161	22p	BD138	20p	BU111	140p	VK1010	88p	2SA198	32p	IN5404	11p	PC97	100p	4075	23p	74155	45p	AN-7115	180p
AD162	22p	BD139	20p	BU126	70p	VN10KM	60p	2SA203	32p	IN5405	12p	PCC85	42p	4076	60p	74157	45p	AN-7120	150p
AF124	25p	BD140	20p	BU204	75p	VN46AF	85p	2SB54	25p	IN5406	13p	PCF80	58p	4077	24p	74160	50p	AY3-1270	680p
AF125	25p	BD144	90p	BU205	70p	VN66AF	100p	2SB77	32p	IN5407	13p	PCF200	135p	4078	24p	74164	60p	AY3-1350	300p
AF127	25p	BD150	30p	BU208	75p	VN88AF	115p	2SB337	120p	IN5408	13p	PCF801	110p	4081	24p	74167	35p	AY3-8910	360p
AF139	22p	BD157	38p	BU208A	80p	VN89AF	110p	2SB405	22p			PCF802	57p	4082	24p	74173	80p	AY3-8912	400p
AF239	22p	BD158	38p	BU208D	120p			2SC460	21p	**LOW PROFILE SOCKETS**		PCF806	115p	4093	32p	74174	75p	AY5-3600	570p
AL112	70p	BD166	30p	BU326	85p	ZTX107	11p	2SC495	80p	8pin	6p	PCH200	100p	4094	68p	74175	65p	CA270	40p
AL113	80p	BD175	30p	BU406	85p	ZTX108	11p	2SC733	130p	14pin	8p	PCL81	54p	4096	70p	74176	45p	CA3046	60p
ASZ15	100p	BD177	30p	BU407	75p	ZTX109	12p	2SC1161	110p	16pin	9p	PCL82	63p	4098	70p	74180	50p	CA3048	190p
ASZ17	100p	BD179	32p	BU408	100p	ZTX212	27p	2SC1172Y	150p	18pin	12p	PCL84	50p	4501	34p	74182	45p	CA3060	280p
AU110	110p	BD181	45p	BU500	110p	ZTX300	13p	2SC1279	24p	20pin	14p	PCL85	55p	4502	50p	74192	40p	CA3080E	70p
AY102	180p	BD182	60p	BU526	80p	ZTX301	16p	2SC1306	100p	22pin	16p	PCL86	55p	4503	38p	74196	40p	CA3086	25p
AY106	180p	BD183	80p	C106D	23p	ZTX302	16p	2SC1307	100p	24pin	18p	PCL805	55p	4504	72p	74197	45p	CA3089E	150p
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BA148	10p	BD203	42p	MJ2955	65p	ZTX320	29p	2SC2029	120p			PL504	95p	4508	110p	74LS00	24p	CA3130S	100p
BA154	8p	BD204	42p	MJ3000	115p	ZTX326	29p	2SC2078	120p	**ZENERS**		PL508	190p	4510	52p	74LS04	24p	CA3140E	45p
BA157	12p	BD222	31p	MJ3001	115p	ZTX500	13p	2SC2122A	200p	400MV		PL519	450p	4511	45p	74LS08	20p	CA3189E	280p
BB101	13p	BD225	31p	MJE29A	30p	ZTX501	13p	2SC2952	27p	BYZ88 Range		PY81	70p	4512	52p	74LS09	18p	CA3240E	90p
BB103	16p	BD232	31p	MJE30A	30p	ZTX502	18p	2SD234	37p	2V7 to 39V	6p	PY88	48p	4513	120p	74LS10	25p	HA-1156W	160p
BB105B	18p	BD234	32p	MJE340	25p	ZTX503	18p	2SK135	400p	1.3W Zeners		PY500A	160p	4514	100p	74S11	18p	HA-1197	180p
BB205B	24p	BD237	21p	MJE350	80p	ZTX504	25p	MB3712	150p	BZX61 Range				4516	53p	74S14	40p	HA-1306W	220p
BC107	7p	BD238	24p	MJE520	30p	ZTX550	24p	TA7205	90p	2V7 to 39V	12p	**CMOS**		4518	45p	74LS20	24p	HA-1319	250p
BC108	7p	BD433	28p	MJE2955K	90p			UPC575	100p			4000	20p	4520	57p	74LS30	24p	HA-1339	220p
BC109	7p	BD437	28p			2N1131	28p			**VOLTAGE REGULATORS**		4001	20p	4522	50p	74LS32	24p	HA-1342	200p
BC115	10p	BD535	38p	OC28	100p	2N1132	28p	**DIODES**				4002	20p	4526	57p	74LS38	24p	HA-1366WR	200p
BC118	11p	BD536	38p	OC29	60p	2N1613	24p	AA119	9p	7805	35p	4006	85p	4527	57p	74LS73	28p		
BC140	19p	BD537	40p	OC35	100p	2N1711	24p	BY100	40p	7812	35p	4007	23p	4528	57p	74LS74	33p		
BC141	19p	BD538	40p	OC36	120p	2N2218A	24p	BY103	32p	7815	35p	4008	52p			74LS75	38p		
BC142	19p	BDX32	100p	OC45	50p	2N2219	24p	BY126	6p	7818	35p	4009	40p	**74 SERIES**		74LS78	28p		
BC143	19p	BDX65	80p	OC71	30p	2N2221	23p	BY127	8p	7824	35p	4010	50p	7400	22p	74LS86	32p		
BC147	6p	BF180	16p	OC72	50p	2N2222	23p	BY133	8p	7905	35p	4011	20p	7401	16p	74LS112	40p		
BC148	6p	BF181	18p	OC200	180p	2N2369	15p	BY164	22p	7912	40p	4012	23p	7402	18p	74LS113	32p		
BC149	6p	BF183	20p			2N2484	20p	BY176	85p	7915	40p	4013	30p	7403	22p	74LS125	38p		
BC157	6p	BF184	20p	R2008B	80p	2N2646	38p	BY179	35p	7918	40p	4014	50p	7404	18p	74LS133	47p		
BC159	6p	BF185	20p	R2010B	80p			BY182	32p	7924	40p	4015	42p	7405	10p	74LS139	45p		
BC182	6p	BF194	5p			2N2904	20p	BY184	32p	78L05	28p	4016	30p	7406	40p	74LS151	45p		
BC182L	6p	BF195	5p	TAG06-60	42p	2N2905	20p	BY187	32p	78L12	28p	4017	43p	7407	40p	74LS153	60p		
BC183	6p	BF196	6p	TAG521-200	72p	2N2906	18p	BY196	20p	78L15	28p	4018	48p	7408	25p	74LS157	35p		
BC183L	6p	BF199	6p	TAG4443	76p	2N2907	18p	BY206	11p	78L18	28p	4019	50p	7409	20p	74LS161	58p		
BC184	6p	BF200	16p	TAG4444	76p	2N2926	8p	BY207	11p	78L24	28p	4020	72p	7413	35p	74LS163	60p		
BC184L	6p	BF240	16p	TIP29	15p	2N3019	28p	BY208	18p	79L05	40p	4021	52p	7414	45p	74LS164	68p		
BC212	6p	BF241	10p	TIP29A	22p	2N3053	18p	BY210	22p	79L12	45p	4022	52p	7417	32p	74LS174	68p		
BC212L	6p	BF255	12p	TIP29C	25p	2N3054	35p	BY223	72p	79L15	48p	4023	24p	7420	22p	74LS192	50p		
BC213	6p	BF256	18p	TIP30	16p	2N3055	32p	BY225	120p	LM309K	100p	4024	38p	7421	25p	74LS197	52p		
BC213L	6p	BF257	18p	TIP31A	24p	2N3055H	38p	BY226	18p	LM317K	220p	4025	22p	7425	15p	74LS221	75p		
BC214	6p	BF258	18p	TIP32	24p	2N3440	58p	BY227	19p	LM317T	180p	4026	75p	7430	25p	74LS240	80p		
BC214L	6p	BF259	18p	TIP32A	24p	2N3442	85p	BY228	32p	LM323K	420p	4027	35p	7437	28p	74LS241	72p		
BC237	7p	BF336	20p	TIP33	50p	2N3702	9p	BY296	20p	LM723	32p	4028	40p	7442	45p	74LS244	80p		
BC238	7p	BF337	20p	TIP34	50p	2N3703	9p	BY298	26p	78HGKC	570p	4029	55p	7447	60p	74LS245	90p		
BC300	18p	BF338	20p	TIP41A	22p	2N3704	9p	BY299	28p	78HO5KC	520p	4030	30p	7450	22p	74LS247	50p		
BC301	18p	BF362	30p	TIP41C	25p	2N3705	9p	BY476	90p	78GU1C	190p	4032	64p	7451	10p	74LS248	80p		
BC302	18p	BF422	21p	TIP42A	22p	2N3706	9p	BYX10	15p	79GU1C	215p	4034	140p	7454	25p	74LS251	30p		
BC303	18p	BF458	19p	TIP42C	25p	2N3707	9p	BYX55/350	30p	79HGKC	670p	4035	60p	7470	30p	74LS257	55p		
BC327	6p	BF459	19p	TIP47	40p	2N3708	9p	BYX55/600	30p			4038	66p	7473	30p	74LS266	25p		
BC328	6p	BFX29	20p	TIP48	40p	2N3771	85p	BYX55/800	32p	**VALVES**		4040	52p	7475	25p	74LS280	30p		
BC337	6p	BFX84	20p	TIP110	47p	2N3772	90p	BYX70/300	29p	DY87	53p	4041	40p	7481	90p	74LS293	30p		

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LA-4102SK	140p	TDA2522	90p																
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	120p	2716	300p																
TA-7310P	100p	2516	200p																
TAA550	16p	2532	400p																
TBA120S	45p	2732	400p																
TBA395	60p	2764	400p																
TBA396	60p	4116	75p																
TBA520	100p	4164	300p																
TBA530	100p	6116	400p																
TBA540	100p	6802	220p																
TBA560	100p	6809	600p																
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GEC S/State	from £35
Thorn 17" 8000	£30
Decca 30	18/20/22/26 £30
Japanese	from £30

Many other makes available from £25

Discount on quantity

Some Examples of UNTESTED TVs available

Thorn	10 for £125
Philips	6 for £90
Bush	6 for £80
GEC	6 for £60
Decca	6 for £60
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All sizes	£4.95

All Prices subject to V.A.T.

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Over 2,000 TVs in stock

Ring for quote. Callers welcome.

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Cassette lamp (Ferg/JVC)	£1.80	Video head (Ferg) (state model)	£37.50
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Belt kit (Sanyo 9300)	£6.50	Loading Belt (Sanyo 9300)	£1.50
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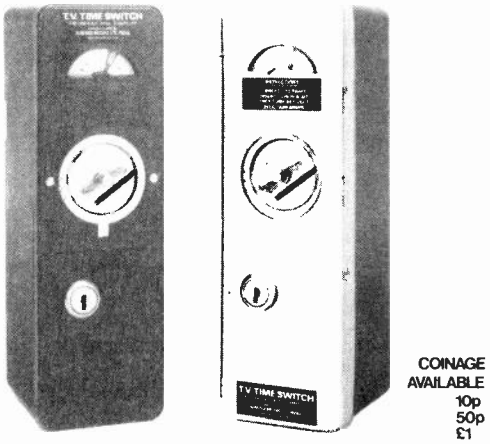

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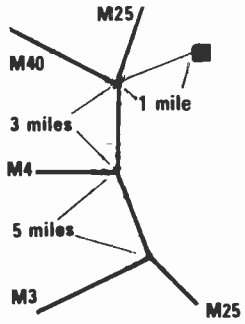

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VIDEO N1700, Rank Beta, VR2020, best offers secure. Phone Sheffield 366536/580714.

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MONO TYPES **P.O.A.**

ALL PRICES EXCLUSIVE OF VAT.

All Tubes Guaranteed for 2 YEARS and Reprocessed to Original Manufacturers Specifications.

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Genuine RBM Units.

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UHF Aerials P & C Wideband 4 Bay Bowtie (12.5 dB)	**£20.00**
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No need to spend £5 returning old delta tube.
PROFESSIONAL STICK

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INCLUSIVE
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All sizes from £66 INCLUSIVE 1 year Guarantee

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Panels from **£10.00,** Breaking for spares, Push button units, Tube bases for sale or exchange etc. All good working order.

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All working and polished. These are not from major companies. A lot are from hotels and have had very little use.
Excellent reliable sets for rental.

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Phone 021-471 3023
Telex 335540-G
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Delta types from **£28.00 to £33.00**
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Large stock of most types. All tubes pumped at 385°C

SONY tubes **£55.00** (fitting service + £12.50)

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PRICES FOR REP. EXC. AS FOLLOWS

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Bush T20	X	12	16	15	12
Bush T26	X	16	18	15	X
Bush 718	X	12	18	X	12

All panels are repaired and aligned according to rank std.
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All panels guaranteed for 3 months.
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GEC 2010	was £25	NOW **£20**
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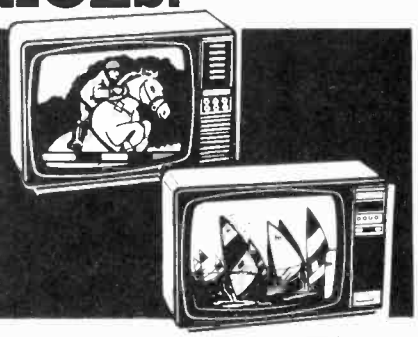

Hybrids £5 all makes! Many more inc Pye KT30, Ferguson TX etc.

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No cheques.

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3000/3500	2.00	4.00	8.00	8.00	5.00	5.00	6.00
G8	5.00 WITH SOUND PANEL	7.00	14.00	8.00	5.00	—	5.00
GEC 2110	10.00	5.00	12.00	6.00	5.00	5.00	5.00
BUSH 718	8.00	15.00	25.00	3.00	5.00	—	15.00
BUSH T20	8.00	15.00	20.00	20.00	5.00	—	15.00
THORN 9000	—	12.00	25.00	—	—	—	10.00
PYE 222	15.00	10.00	15.00	10.00	4.00	—	6.00

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GUARANTEED 90% WORKING
100's of GEC 2110/2111 stripped to spares

Decoder	Line Output	Power	Convergance	Tram-Time Base	Tripler
13.00 single combined	£4.00	£2.50	£2.50	£3.00	£2.50

Other types e.g. Bush, G8, Thorn 8500, Pye, GEC Hybrid
all non-working/complete.

	Decoder	Line	Power	Conver-gence	Frame	IF	Tripler
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G8	£3.00	£5.00	£4.00	—	£3.00	£5.00	£2.50
3500 Thorn	£3.00	£4.00	£4.00	£3.00	£2.00	£2.00	£2.50
GEC	£3.00	£5.00	£4.00	£2.00	£2.00	£2.00	£2.50
Pye	£3.00	£5.00	£5.00	£2.00	£2.00	£2.00	£2.50

SABACO, Elastic Yarns Building, Derby Road, Sandiacre, Notts. Tel: (0602) 397555

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B45H/G-UHF TV next to the set fitting, gain about 20dbs, PP3 battery or 8V to 14V/working. **Price £8.70. P&P 30p.**
UHF TV BOOSTER MODULE. PCB ready made up to cover the complete UHF TV band. Gain 10dbs, noise 1.9dbs. 8V to 14V/W. **Price £2.50. P&P 30p.**
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SONY KV 1330 UB or KV1310 UB worker or non worker. Will collect. Ring Brock 40114 (Lancashire) after 6pm.

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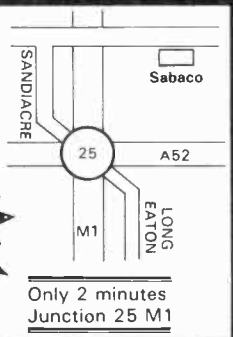

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3500 A1 Diode	20p
Export 3500 IF panel	£2
IC board with set of SN74LS	£1
4000 Tube base	£4
3500 A1 pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V/ 7.5/9V/300mA	£3.50
Rank/Toshiba preh unit 0354	£9.50
2 banks of 3 PB unit. Pye 731	£2
4 Push button unit preh	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button Unit fits GEC & Decca etc.	£6.00
6 Push button unit for GEC 2040 and ELC 1043/05	£6.00
Hearing aid unit	£3
6 Push button unit PYE 713	£7.00
7 Button Unit GEC with Lamps	£7

Mains Droppers

G8 2R2+68R	£1.25
G8 47R 15 watt	75p
Pye 731 3+56+27R	50p
Pye 3R5/15R/45R	50p
Thorn 50/17/1K5	£1.00
120/20/20/48/117	£1.00
270/10/6 for Thorn 4000	50p
18/320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ae Socket & Lead GEC, ITT, Philips, Pye	25p
7×3¾ Thorn	£1
Rank Toshiba Tube Bases	30p

Speakers

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

KT3-K30

OE-550	I.W.	10p
OE-513	correction	10p
OE-557		50p

Diodes

BY 127	10p
BY 133	10p
BY 134	10p
BY 164	50p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600: 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 228	20p
BY 229/400	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 602	10p
F 247	10p
XK 3102	50p
International Rectifier EHT Diodes G770/11V34 6KV	3 for 8p
6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p

XK 3123	50p
Hitachi 2A/1500V metal case wire end	20p

20.AX

GEC Degausing Panel 809 with PT37	£1.00

Line Transformers

Hitachi Split Diode and GEC 1981 to 1984	£13
2 J/Pots 3,500 1 off each type	£3.00
G8 Symmetry Coil	£2.00
G8 Trans. Philips	£7.00
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B/W AD5308F + Stik + Lead	£1.50
1690 Thorn EHT over-wind with diode lead & anode cap	£2.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono T704A	£3.50
Split Diode Trans	£7.00
GEC 20 AX Rank Z522	£3
Rank L.O.P.T. Z970	£3
CVC 5-8-9	£3.00
CVC20 ITT	£3.50
AT2080/15	£5.00
CVC30 ITT	£5.00
CVC32 Line Tran	£4.75
CVC800 Line Trans	£6.00
CVC40 Slip/Diode	£12.00
CVC 45	£5.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
EHT Split Diode Leads ITT	£1.00
EHT Cable/Metre	20p
Ex panel "14" Fidelity portable	£5
3500 L.O.P.T. & HT Trans	each £2
LOPT Rank Z763	£5

Triplers

Rank T25LE Tripler	£2.00
Rank 11TCP A823	£3.50
TU 25 30K Rank	£3.00
8500 Triplers	£6.50
11 TFZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.00
9000 Thorn	£5
9500 Thorn	£4.50
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
TVK 76/9	£3.00
G8	£4.00
CVC 825 ITT CVC 20/25/30/32	£3.50
Decca 80 100	£4.50
Grundig TVK 52	£2.50
11TBQ Pye 731	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
KT3 BG200/43	£3.50
T/text ultrasonic rec'r panel	£14.00
Video cassette lamps on lead. 12-14V.	50p or 3 for £1.00
20 for £5.00	200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots	£4.00
G11 E.W. Transformer	50p
G11 E.W. coils	£1.00
G11 Transient Suppressors 245V	10 for £1.00
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3/K30 infra-red receiver head	£1
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AE Sockets	50p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Pye, K30, GEC, etc. Pre-mains stand-by switch	£1
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O.P. Trans.	pair 25p
5 button touch tuner BBC1/2 ITV1/2	
video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P.B.U.	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans. & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg.	30p
20 GEC Black Spark Gaps	£1.00
G11 Line Driver Transformer	35p
KT3 Front Panel Control Assy.	£2.50
BTW 30/50	50p

TELETEXT DECODER

I.C. SAA 5051	K30	
I C SAA 5042		
I.C. SAA 5030		
I.C SAA 5020 etc.		£8.00
BTW 92/800R		£3
25A473 PNP C/P		10p

Pye 731 Power Panel	£13
6 Diode Universal Triplers	£3.25
NEW PYE 725 line O/P panel with L.O.P.T. & Tripler	£10.00
Thorn Mains Isolator unit for 70-80W. Ex-speaker	£2
NEW GEC 20AX Power Supply Switch Mode	£12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U./ v.cap/LOPT1	£10
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPT1	£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 607/205 Line panel with transformer	£10.00
Pye CDA/205 panel	£6.00
GEC portable chassis + LOPT1 2114 New	£4.00
Thorn 1613/1713 chassis	9.75
Hills 520 multimeter + case. 20,000W/volt, fuse diode protected + logic test facility. 10meg/1200 volt	£19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230)	£15.00
Panel 6101	£15.00
Panel 6330	£15.00
G8 Tuner Unit + Panel	£6.00
G8 Convergence Panel (late type)	£12.00
G8 Power Supply	£6.00
G8 6 Sloping PBU	£8.00
G8 IF & Chroma	£12.00
G8 Chroma	£6.00
G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz I.C. SL437F	£3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q	£2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+ SC9503P	£1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead	£5.00
Pye 6 button switch portable	£1.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£6.00
2110 GEC Power Panel	£8.00
GEC Power Supply (Export)	£10.00
G11 dynamic correction panel	£6
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots	£14
CVC9 slider pots panel	50p
CVC 5 Mains on/off + 5 pots	£2
Universal Focus. Fits Pye, Thorn and Decca Units	
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
TX10 Focus Units	£6.00
CVC 32 Focus Unit	75p
3500 Thorn Focus Unit	£1.00
ITT Small for use with Split Diode	50p
TV11	50p
Remo TV12SP	50p
TV13	50p
TV14	50p
TV18	60p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p

G7000 Philips Video Games Packs 11 types **£8.00 each**

G11 drawer ASS 3 pots Mains switch and lead	£2.00
Line O/P panel GEC 2217/2218/2213/ 2214/2226/2227/2228	£10
3500 thick film	£2.00
4000 thick film	£2.00

DISPLAYS

4040 Clock	£1.00
7seg Red LED	50p
2 digit LED 8.8	50p
2 digit LED +1.8 with panel + MC1451I	£1.00
4700/63	£1.50

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

250/6v4	10p
3300/70	50p
.1/100	5p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
2000/100	70p
4700/100	75p
47/160	10p
600M/300V	£1.00
800+160	50p
.1/250 Pulse	5p
G11 0.47/250	10p
2.2 250v	10p
3n3/250 A.C.	10p
.33/250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
.91/250	35p
.91/400	30p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
GEC600/250	60p
700/250	£1
300+300 MFD 350v	£1.00
600M/300	£1.00
800/250	40p
32/400	20p
4/350	5p
8/350	8p
12/300	10p
4.7M/350v	10p
16/350	25p
33/350	20p
50/350	10p
220/350	30p
300/350	40p
400/350	50p
10/375	10p
22/375	15p
220/385	75p
330/385 CVC 820 ITT	60p
0.1/400	15p
KT3 E/W .39/400	20p
.56K/400v	20p
4700pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
400/400	40p
394K/400V	20p
220/450	40p
.47/500	25p
0.1/600	15p
.047/600	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
.47/1000v	65p
.47/250V A.C.	10p
.001K/1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n0/1500	10p
2n2/1500	15p
.01/1600	15p
G11 8.200/2KV	15p
0.1/2KV	20p
10n/2KV	15p
3n9/2KV	15p
0.0015/2KV	10p
5n2/2KV	10p
6n2/2KV	15p
2n0/2KV	15p
2n2/2KV	15p
7:00pf/2KV	10p
4n7/2KV	15p
8n2/2KV	15p
0.0082/2500	15p
150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
1.70/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p

Rank Secam Decoder Panel UHF & VHF T115A	£13.00

NEW
GRUNDIG SPARE PANELS
Set No SC4127, SC4337, SC6217, SC6237
GRUNDIG MODULE TYPES
Tuner IF, AF TRX 1 OP TP preamplifier Tuning board Colour RGB, LED Board Deflection Board
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Multi-Caps

470/250 G11	10 for £15
Thorn 3500	
175/100/100/350v	£1.00
KT3/200/25/25/385v	£1.00
300+300+150+100+50MFD 350V	£2
47/220/350v	60p
150/150/100/100/100/320v	£2.00
2500/2500/63v	50p
150/200/200/300v	70p
400/400/200v	£1.70
300/100/100/16/275v	£1.50
100/200/325v	40p
150/150/100/375v	£1.50
300/300/100/32/32/300v	2.00
1500/2000/30v	50p
Jelly pot Thorn 00D44013	£3
150/150/100/100/320v	£2.00
100/350 + 300/200/100/16/275v	£2.00
300+300/300	£1.00
225+25/380 GEC	70p
200/100/100/350v	£1.50
500/500/25v	50p
150/150/100/300v	75p
200/150/150/300v	1.00

ITT Panels

CVC 40/2 Chassis, new L30, complete with intrfase panel	
CVC 820 Line O/P Panel	
CVC20 Mains Panel	£3.00
ITT 8 & 6 Push Button Unit	£1.00
CVC40/2 New Chroma Panel	£10.00
CMA 10	£2.00
CMA 11	£2.00
CMA 30	£2.00
CMA 40	£1.50
CMC 10/2	£5.00
CMC 16	£4.00
CMC 38	£8.00
CMC 45	£1.50
CMC 47	£1.00
CMC 52	£15
CMC 57	£6.00
CMC 58	£8.00
CMC 59	£8.00
CMC 67	£3.75
CMC 67/2	£4.00
CMC 68	£4.00
CMD 12	£10
CMD 32	£5.00
CMD 33	£5.00
CMD 40	£5.00
CMD 41	£5.00
CMD 800	£10.00
CMF 25	£2.00
CMF 26	£2.00
CMF 40	£2.00
CMH 10	£1.50
CMH 31	£1.00
CMK 12 (untested)	£4.00
CMK 30 (untested)	£4.00
CMN 20	£1.50
CMN 21	£1.50
CMN 40	£1.00
CMN 45	25p
CMP 10	£2.00
CMP 11	£4.00
CMP 40	£2.00
CMS 11	£2.00
CMS 40	£2.00
CMU 12	£10.00
CMU 14	£8.00
CMU 30	£7.00
CMU 45	£7.00
CMZ 30	£5.00
GMA 90	£5.00
GMC 120	£2.50
GMR 64	£5.00
IMN 2	£2.00
VCA 20	£10
VCA 21	£10.00
VMC 26	£3.00
VMC 34	£5.00
VMC 44 + 45	£4.00
VMC 51	£5.00

Hand Sets

Transducer Hand Set Insert, crystal, transducer, SAA 1124 & lead	£3.50
8 C.H. Ultrasonic GEC Full Remote C2011H/ C2219H	£15.00
New Replacement for G11 Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£24.00
Rank, Infra-red	£10.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18
Philips full remote KT3, 16C926/20C934, 7228/7324; K12 26C 797/1ST 66K 1826	£12.00
G11, Full remote top button assy	£12.00
G11, Full remote repair service (exchange unit)	£12.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
Philips Key Pad set KT3/K30	£3.00
KT3/K30 T/Text	£15.00
KT3/K30 Full remote	£15.00
KT3 Power supply	£4.00
Hitachi 8 button unit with resistor unit Last year mod	£7.00
GEC infra-red 2236-2026	£4.00
GEC push pad hand set button blobs 10p each	
Pye & Philips handset KT3-K30 chassis No RC4001-RC5150-RC5176-RC5471-RC5177. Special Price	£13.00

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V/Cap Rank VHF Z773T/Unit £5
NEW G8 Tuner V/Cap £5.50
ELC2000 on Panel £2.50
GEC 6 Push Button Unit £6
ITT 6 Push Button Unit £6
DECCA 6 Push Button Unit £6
GEC or Hitachi 6 push button unit 2110 Conversion £8
GEC 2110 V/Cap £5
ELC1043 (Ex Panel) £3.75
ELC1042 NEW £5.00
ELC2000 £4.00
ELC2004 £10.00
ELC2006 NEW £10.00
GEC Tuner V/Cap Hitachi After 1979 ET548, ET547 £10.00
U322 (UHF) .. £4.00
V314 (VHF) .. £5.00
V317 (VHF) £5
V334 (VHF) £5
U321 £6
U341 UHF £7.00
U342 (UHF) £5
U411 UHF £7.00
U.V. 411 Tuner £10.00
ELC1043/05 Thorn £5.90
ELC1043/06 Thorn £5.00
Small V/Cap Mitsumi UHF .. £4.00
VHF .. £3.00
G8 Tuner £6.00
Portable & rotary Tuners Sanyo & Mitsumi UHF £5.00
NSF-UHF/VHF Varicap (old type) £8.00
Mosfit UHF/VHF (new type) £8.00
SONY 1400KV Tuner unit £3.50
Thorn Tuner PANEL with 6×100K pots + cursors NO TUNER £1.00
HITACHI 20 Turn Pot 40p
U321 on panel £6.00
Tuner unit VHS Sylvania GTR Videon MTS 900 £2.50
Mullard Video Modulator Application, video tape recorders, TV cameras, video games, closed circuit T/V, C.C.I.R. system. Data supplied. £10.00
VT 100 Sound Tuner Kit. TV Viewsound. The latest design in low noise fitted with DNR, RF output and audio £30.00
Sylvania UHF E4720B £6.00
Sylvania VHF 900 £6.00
Decca Bradford Tuner 5 Button £4.00
Small Tuner DX 175-220MHz Auto Changeover £5.00
9000 Thorn Tuner on Panel £7.00
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each or 40 for £1.00

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

Delay Lines
DL20A 80p DL600 £1.00
G8 (Old Type) £1
DL600 £1.00
DL710 £1.00
UDL11 30p
KT 3 Luminence 75p
Luminance Delay Line (CVC 45)
10×630ma fuse 25p
10×2A fuse 50p
10×3.15 fuse 50p
10×500mA 80p
10×1 amp 80p
20 3.15 AS Fuses £1.70
Co-Ax Joint 15p
Co-Ax Belling Lee Plug 12p
Co-Ax Splitter £1.00
UHF Modulator CCIR £3.00
Infra Red Emitting Diode 20p
NE2861 Small Neon Lamps GEC & Philips 5p
Mullard 5 Watt Amps. LP1162 New 75p

T.V. Tubes

12" A31/300 Hitachi £10
15" A38/170W Hitachi £8
18" Hitachi PIL tube with scan coils 470 KCB22-TC03 £25
10" Green tube scan coils & line trans £6.00
12" 90° Tubes £12
14" 110° Tubes £12

Integrated Circuits

AC76003 £1.50
AM2SLS23PC 10p
BAV40 40p

BF694	10p
BF758	30p
BF760	30p
BFT34	15p
BFT43	10p
BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BLY49	25p
BPW41	25p
BRC116	25p
BRX43	15p
BRX48X	10p
BRY56	30p
BSS68	10p
BSY79	10p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
FT3055	30p
TCE82	30p
2N930	5p
2N2221	8p
2N2222	8p
2N2906	10p
2N3055	40p
2N3566	10p
2N3702	10p
2N3711	10p
2N3583	50p
2N3904	15p
2N4355	10p
2N4442	£1.00
2N4444	£1.00
2N5296	40p
2N5983	30p
2N6099	40p
2N6109	40p
2N6130	50p
2N6133	20p
2N6348	20p
2N6399	10p
2X 2N6099 on heat sink	50p
2SA437	20p
2SB407 Sanyo TO3	10p
2SB474	30p
2SB566	10p
2SC381	10p
2SC458	50p
2SC515	10p
2SC732	10p
2SC733	10p
2SC1030	£1.00
2SC1172A	10p
2SC1173	10p
2SC1419	20p
2SC1546	20p
2SC1725	20p
2SC2068	20p
2SC2073	8p
2SC2122A	£1.00
2SC2229	15p
2SC7350	15p

2SD180 TO3 80v/6A	15p
2SD200	£2.00
2SK30A	10p
BC107	10p
BC108	10p
BC109	5p
BC113	10p
BC114	10p
BC115	10p
BC116	10p
BC117	20p
BC119	20p
BC125	10p
BC126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC183	10p
BC184	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC 250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p

BC440	30p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
BCX31	25p
BCX32/36 Pair	75p
BCX32	25p
BD116	25p
BD124	50p
BD124 (metal)	60p
BD130Y	25p
BD131	30p
BD132/238	30p
BD135	25p
BD136	30p
BD138	30p
BD140	30p
BD176	25p
BD182	£1.00
BD183	70p
BD202	60p
BD204	60p
BD221	20p
BD222	30p
BD228	30p
BD226	20p
BD233	30p
BD235	30p
BD238	30p
BD239	15p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD332	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD439	50p
BD501	30p
BD678	30p
BF761	30p
BF858	30p
BF871	30p
BFR39	15p
BFR52	7p
BFR79	15p
BFR81	15p
BFR87	10p
BFS60	10p
BFT42	20p

MR1366	20p
BRC-M-200	40p
BRC-M-300	50p
BRC 1330	75p
BRC 3064	£1.00
BTT822	£1.00
BTT6016	£1.20
BTT6018/ML237B	£1.50
BTT6218	£1.50
BTT8124	£1.00
BTT8224	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AE	£1.00
CA1310	50p
CA3065Q	50p
CA3089Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBF16848	50p
CD4510	30p
DM7492	50p
HA1196	40p
HA1370	£2.00
HA11223	40p
HEF4001	10p
HBE4011AF	10p
HEF4053B	30p
LA3220	50p
LM1011N	£1.00
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
MC476p	£1.00
MC1307	75p
MC1312	
MC1330	75p
MC1349	50p
MC1352	£1.00
MC1358	£1.00
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14514	50p
MC1748	80p
MEM4956	£1.00
ML231	£2.50
ML236E	£1.00
ML237B	£1.00
ML238B	£4.00
ML239	£2.00
MM5387	£1.00
MM5611	£1.00
MM5840	75p
MM5290N-4	75p
MM53108N	£4
MR1366	20p
N64100	£1.00
NE545B (Dolby)	75p
NE555P	60p
NE555	60p
H-1	20p
OPT600	20p
OPT601	20p
SAA611	50p
SAA661	£1.75
SAA1020	£4.00
SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
SAA1176	£3.00
SAA1250	£3.00
SAA1251	£4.00
SAA1272	£3.00
SAA1276	£3.00
SAA3027P	£4.00
SAA5000A	£1.50
SAB3013	£2.00

Filters

5-5MHz 15p
6MHz 30p
BFU455k 5p

Thyristors

BT151/800R 80p
TD3B800 £1.50
BT106 Plastic 30p
BT106 Metal £1.20
BT119 £1.00
BT120 £1.00
BRC4443 75p
G11 Thyristor 60p
Decca 80-100 60p
2N4444 £1.00
MCR72-6 25p

Thermistors

G8 Degausing 35p
Philp type VA1104 50p
ITT P726312 15p
PH1451 AOR 15p
PT37P Fits Pye & PT34 20p
Degausing Thermistor (fits most sets) 20p
GEC Double Thermistor 25p

SAB4209	£2.00
TBO0124	£1.00
SAA5000A	£1.50
SAA5012A	£5.00
SAA5020	£3.50
SAA5030	£5.00
SAA5040	£3.50
SAA5040A	£4.40
SAA5050	£3.50
SAF1032p	£2.50
SAF1039	£2.00
SAS560	£2.00
SAS660	£1.00
SAS670	£1.00
SL901B	£4.50
SL918	£4.50
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	50p
TAA621	£2.00
TAA661	50p
TAA641	£1.50
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7607AP	40p
TA7609P	50p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1441	£1.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA550Q	£1.75
TBA560CQ	£2.00
TBA570	£1.50
TBA625	50p
TBA641	£2.00
TBA651	£2.00
TBA673	£1.00
TBA720A	£1.50
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA890	£1.00
TBA900	£1.50
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2216	75p
UPD8049HC	£2
SN29848	50p
SN29770BN	£1.00
SN29771BN	£1.00
SN29772BN	£1.00
SN7402N	£1
SN7472N	£1
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76013ND	£1.50
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50

BLY49	50p
I.C. Heat Sink	20 for £1
20×TO5 Heat Sink	£1.00
CVC 9-power supply board	£1.50
CVC 20/2 mains panel	£2.00
ITT Mains Filter .1/250v/	
CVC 20 to 45 chassis	50p
Pots 10 k with Switch	25p
Pots 47 k with Switch	25p
Mullard Surface Wave Filter RW 153P Colour TV Filter	40p
Mullard Surface Wave Filter RW 154 Colour TV Filter	40p
G11 Line Scan P.C.B.	£1.00
G11 Power Supply P.C.B.	£2.00

SN76033	£1.50
SN76110N	£1
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00p
SN76228N	£1.00
SN76270	£1.00
SN76532N	50p
SN76544N	£2.00
SN76545	£3.50
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76650	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£1
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA640	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£4.00
TCA830	£1.00
TCEP100	£2.25
TCE120CQ	£1.00
TDA440Q	£1.00
TDA1003A	£1.00
TDA1010	£1.00
TDA1060A	£1.50
TDA1035T	£3.50
TDA1072	£1
TDA1151	30p
TDA1170	£1.00
TDA1190	£1.00
TDA1200	75p
TDA1327A	£1.00
TDA1365	£3.00
TDA1412	50p
TDA2003	80p
TDA2004	£2
TDA2010	£1.00
TDA2140	£3.50
TDA2030	£2.00
TDA2525	£1.00
TDA2640	£2.00
TDA2522	£1.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2571AQ	£2.50
TDA2575A	£1.00
TDA2581	£2.50
TDA2590	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£5.00
TDA2611A	£1.00
TDA2611AQ	£1.00
TDA2653	£4.00
TDA2002	£1.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3560	£4.00
TDA3571Q	£1.50
TDA9403	£3.00
TDA3651AQ	£3
UPC1365	£3.00
TDA3300B	£6
SN74LS 125AN	30p
SN74LS 248	50p
SI14516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
RGP30G	10p
MPSA14	10p
MPSA43	10p
MJL3005	30p
MJE5IT	25p
MJE340	28p
MJE660	25p
MJE661	25p

TV Crystals

4MHz
4.433-619
6MHz
8.867238
Large or small GEC Power Panel 50p each
TV106 Thermistor
PT34 New £1.00

NEC 4730312 £3.00
Line Tran Tripler in Case

MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	30p
Sanikron Diode SKE2G204	30p

Philips Cartridges

GP422 (4CH) £6.00
GP412 £6.00
GP412/11 £6.00
GP406 £6.00

Transistors

A1222	15p
A1223	15p
AC106	15p
AC121	15p
AC124	15p
AC128	15p
AC137	15p
AC151	15p
AC131	15p
AC138	15p
AC152	15p
AC153K	15p
AC142K	15p
AC169	15p
AC176	15p
AC176K	15p
AC178K	15p
AC179	15p
AC186	15p
AC187K	15p
AC188	15p
AC188K	15p
ACY21	25p
AD143	50p
AD149	50p
AD161/162	pair 40p
AF17A	25p
AF139	25p
AF181	£1.00
AF239	25p
AF367	25p
AL102	£1.75
BC161	30p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p
BD646	50p
BD676A	30p
BD678	50p
BD681	25p
BD807	20p
BD826	50p
BD948	30p
BDX75	20p
BDX32	£1.25
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF256	10p
BF257	20p
BF258	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF422	15p
BF423	15p
BF448	30p
BF450	20p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	20p
BF480	50p
BF594	10p
BF597	10p

I.C. Holders

DIL – DIL'		DIL – QIL	
40 Pin × 4	£1.00	16 Pin × 10	£1.00
42 Pin × 5	£1.00	18 Pin × 10	£1.00
28 Pin × 5	80p	28 Pin × 4	£1.00
16 Pin × 10	70p	8 Pin × 10	50p
24 Pin × 5	75p	16 Pin G11	each 10p
14 Pin × 10	70p	AB Mains Switch u/v	30p
18 Pin × 10	80p		