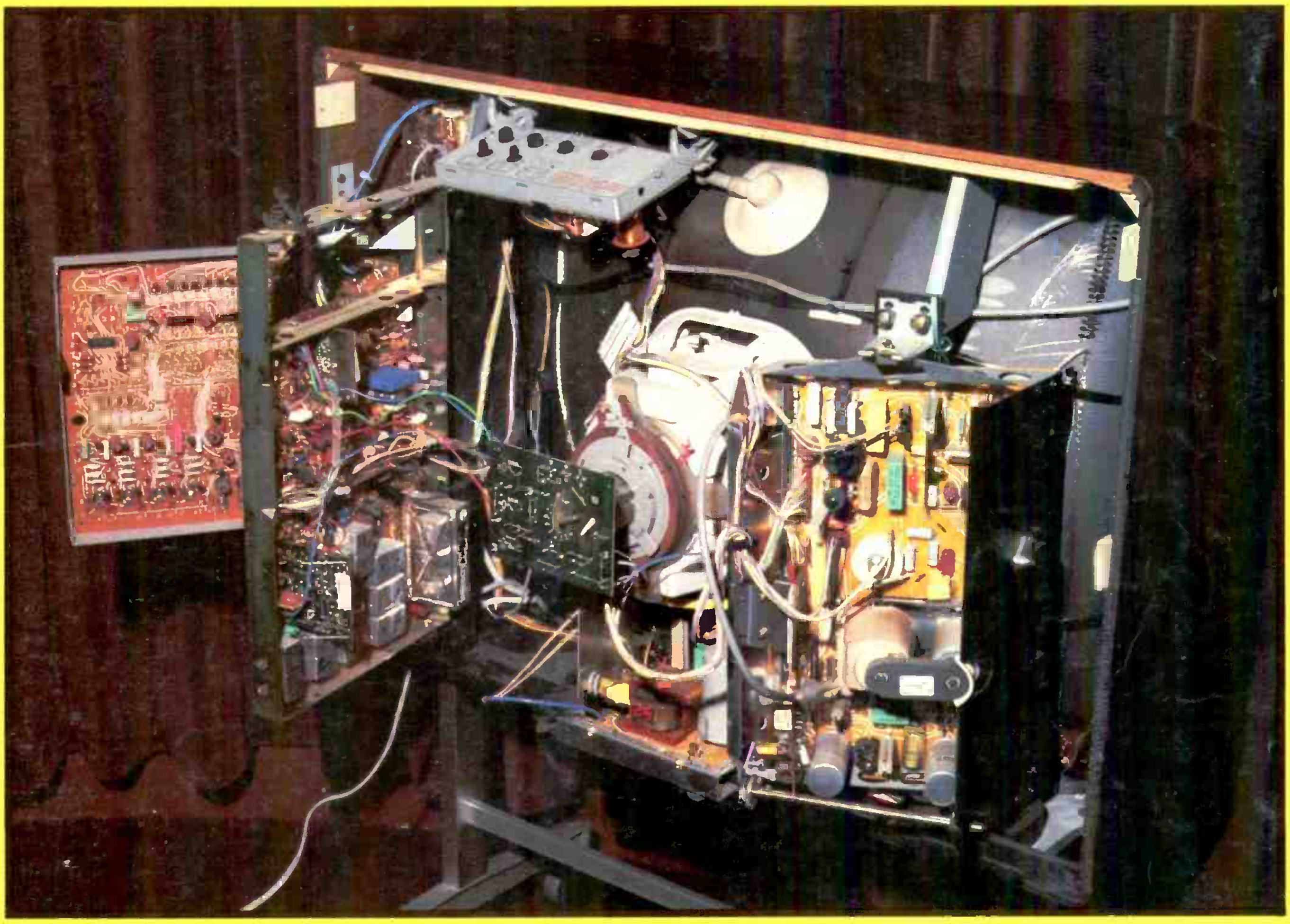
AUGUST 1985

Australia $1·80, New Zealand $2·20, Malaysia $5·50 £1·10

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Servicing the B&O 20AX Chassis
Commodore 64 Test Pattern Program
TV Fault Finding • VCR Clinic
The Strangest TV Set Ever
VCR Reconditioning • DX-TV
Tackling the ITT CVC20 Chassis

TELEVISION

August 1985

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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.

SUBSCRIPTIONS
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BINDERS AND INDEXES
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BACK NUMBERS
Some back issues are available from the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF at £1·20p inclusive of postage and packing.

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

this month

OUR NEXT ISSUE DATED SEPTEMBER WILL BE PUBLISHED ON AUGUST 21

P. V. TUBES

TEL: 0254 36521/32611

104 ABBEY STREET, ACCRINGTON

T.T.L. 74LS SERIES

74LS00	58	74LS37	35	74LS92	65	74LS160	90	74LS245	2.30
74LS02	58	74LS38	35	74LS93	60	74LS161	85	74LS251	65
74LS03	58	74LS40	35	74LS107	80	74LS162	4.04	74LS253	95
74LS04	58	74LS42	80	74LS109	58	74LS163	85	74LS257	1.20
74LS05	58	74LS47	85	74LS112	50	74LS164	85	74LS258	95
74LS08	58	74LS48	83	74LS113	44	74LS165	1.50	74LS259	1.70
74LS09	58	74LS49	33	74LS114	70	74LS173	1.32	74LS273	1.90
74LS10	58	74LS51	33	74LS123	80	74LS174	85	74LS283	1.30
74LS11	58	74LS54	43	74LS125	85	74LS175	85	74LS293	1.20
74LS13	37	74LS55	60	74LS126	60	74LS191	1.02	74LS352	1.40
74LS14	46	74LS73	60	74LS132	63	74LS192	1.30	74LS353	1.40
74LS15	33	74LS74	65	74LS138	83	74LS193	1.30	74LS365	75
74LS20	35	74LS75	65	74LS139	65	74LS194A	75	74LS366	82
74LS21	35	74LS76	65	74LS151	85	74LS197	95	74LS367	1.65
74LS22	35	74LS78	65	74LS153	85	74LS240	2.20	74LS368	65
74LS26	44	74LS83A	89	74LS155	65	74LS241	2.20	74LS373	1.40
74LS27	35	74LS86	39	74LS156	1.02	74LS242	2.20	74LS374	1.55
74LS30	35	74LS85	98	74LS157	78	74LS243	2.20	74LS393	1.20
74LS32	90	74LS90	1.22	74LS158	65	74LS244	2.20	74LS670	1.78

'4000 B' SERIES CMOS

		4027B	39	4069B	22	4511B	76	4539B	77
		4028B	64	4070B	22	4512B	72	4541B	96
		4029B	90	4071B	40	4513B	1.68	4543B	1.12
4001B	21	4032B	1.04	4072B	22	4514B	1.88	4551B	96
4002B	21	4035B	80	4073B	22	4515B	1.88	4553B	2.40
4008B	72	4038B	99	4075B	22	4516B	76	4554B	1.20
4011B	31	4040B	72	4076B	80	4518B	76	4556B	48
4012B	21	4042B	58	4077B	22	4519B	64	4560B	1.76
4013B	30	4043B	71	4078B	22	4520B	76	4561B	74
4014B	74	4044B	71	4081B	22	4521B	1.68	4566B	1.20
4015B	76	4046B	96	4093B	49	4522B	88	4580B	3.60
4016B	42	4047B	70	4094B	1.56	4526B	88	4581B	1.84
4017B	66	4049UB	32	4099B	1.20	4527B	1.20	4582B	80
4018B	72	4050B	32	4160B	72	4528B	88	4583B	1.00
4020B	76	4051B	72	4161B	72	4529B	1.04	4584B	40
4021B	70	4052B	72	4162B	72	4530B	62	4585B	88
4022B	70	4053B	72	4163B	72	4531B	72	4597B	1.84
4023B	21	4060B	96	4502B	72	4532B	1.00	4598B	2.40
4024B	50	4066B	43	4505B	1.88	4536B	2.64	4599B	2.00
4025B	21	4068B	22	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

DECCA 20	2.48
DECCA 27R/47R	1.40
DECCA 56R/6R8	1.40
R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 725/31 3RO/56R/27R	1.84
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2k85	1.75
PHILIPS 210/5051 -/118R/148R	93
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 2R5	96
DECCA 3R9 Moduiohm	60

NEW VALVES

30FL2	1.70	EF183	99	PCF200	1.35	PL504	1.65
DY802	98	EF184	1.09	PCF800	1.38	PL508	2.90
DY86/7	66	EH90	1.02	PCF801	1.13	PL509/19	5.30
ECC81	1.08	EL34	3.50	PCF802	1.12	PL802	
ECC82	98	EL84	1.05	PCF805	1.80	Glass	5.50
ECC83	1.07	EY86/7	68	PCF806	1.30	PY88	81
ECC84	80	EY500A	2.25	PCF808	1.63	PY500A	2.30
ECC85	98	EZ80/1	56	PCH200	1.45	PY800/1	69
ECC88	1.35	GY501	1.45	PCL82	1.20	UCH81	2.25
ECF80	1.30	GZ34	3.50	PCL84	1.20	UCL83	1.82
ECF82	88	KT66	8.50	PCL86	92	UY85	1.35
ECH81	1.60	KT77	8.50	PCL805	1.09	PL802T	4.00
ECH84	1.66	KT88	12.00	PD500	2.93	40KD6	5.30
ECL80	84	PC92	3.00	PFL200	1.86	21LU8	3.00
ECL82	1.30	PC97	1.65	PL36	1.87	17DW4A	1.60
ECL86	1.99	PCC85	85	PL81	94	3AT2B	5.00
EF80	95	PCC805	1.40	PL83	1.43	12BY7A	3.75
EF86	1.96	PCF80	1.00	PL84	84	12HG7	3.20

THERMISTORS

VA1104	75
VA1040	75
VA8650	55
VA1039	35
GEC Dual Posistor	1.68
GEC 2040 (CK1) Dual	1.98

THERMAL CUT OUT

THORN 3000 2A Metal	2.20
GEC 2040 Metal	2.50

L.E.D's

5mm Red, Green, Yellow	14
T1 ¾ Amber	22
T1 3mm Red, Green, Yellow	14
Flashing Red CQX21	62
CQX22	66
Panel Clips 3mm	4
5mm	4

CRYSTALS & FILTERS

6Mhz	74
5.5Mhz	74
4.3Mhz	1.30
8.8Mhz	1.30
9.94Mhz	6.00
10.692Mhz	6.00

MULTITURN POTS

100K	55
GEC TCE	55
PHILIPS G8	
DECCA, RANK	55

SERVICE WITH A SMILE

DISC CERAMIC CAPS

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

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

LINE OUTPUT TRANS.

R.B.M. T20A	13.95
R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	19.50
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 697 (Printed)	14.50
PYE 713/731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80/100	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	16.75
GEC 2040	9.50
ITT CVC 1-9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
THORN 3000 EHT	9.95
THORN 3000 SCAN	7.95
THORN 8000	11.33
THORN 8500	11.33
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN TX10	15.00
THORN 1615	9.75
PHILIPS KT3	9.70
RANK BUSHRANGER	£10.00
PYE 741	8.20
B+O (2000, 3000)	12.70
B+O (3000 EHT)	18.90
ITT CVC 45	9.50

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	5.20
THORN 1500 3 Stick	5.20
THORN 1500 5 Stick	5.29
THORN 1600	4.95
THORN 3000/3500	7.98
THORN 8000	5.28
THORN 8500/8800	7.15
THORN 9000	8.70
DECCA 1730/1830	4.48
DECCA 30	6.76
DECCA 80	6.60
DECCA 100	7.50
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	6.75
PHILIPS G8 Long Focus 550	6.75
PHILIPS G9	6.37
Pye/Philips K3 Tripler	10.65
PYE 691/3	6.58
PYE 713/4 Lead	8.79
PYE 713 Doubler 5 Lead	8.79
PYE 731/725	7.60
R.B.M. A823 (plug in) AV	7.60
KORTING (similar to Siemens TVK1)	7.32
ITT KB CVC5/9	6.90
ITT KB CVC20/25/30 (Mullard)	6.65
RRI T20	6.80
ITT CVC45	8.65

RECTIFIER STICKS

TV11	90	TV18	1.10
TV13	93	TV20	1.23

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	3.74
PHILIPS 320 (400/400/200V)	3.02
DECCA 30 (400/400/350V)	3.74
DECCA 80 (400/350V)	4.37
DECCA 100 (800/250V)	
PHILIPS G8 (600/300V)	2.53
PHILIPS G9 (600/300V)	2.44
PHILIPS G11 (470/250V)	3.19
PYE 691/7 (200/300/350V)	2.97
PYE 731 (600/300V)	2.55
RBM A823 (2500/2500/30V)	1.83
RBM A823 (600/300V)	3.12
RBM Z146 (300/300/350V)	3.91
RR1 T20A (220/400V)	2.20
ITT CVC5/9 (200/200/75/25)	3.28
ITT CVC 20 (220/400V)	2.20
GEC 2110 (600/250V)	2.14
GEC 2040 (1000/2000/35V)	1.31
GEC 2040 (300/300/150/100/50)	4.51
THORN 3500 (400/40V)	33
THORN 950 (100/300/100/16/275V)	2.02
THORN 1400 (150/100/100/100/150/320V)	3.07
THORN 1500 (150/150/100/300V)	2.42
THORN 1500 (12/300V)	35
THORN 3500 (175/100/100/400/350V)	3.06
THORN 3500 (1000/63V)	95
THORN 3500 (1000/70V)	95
THORN 8000/8500 (2500/2500/63V)	3.72
THORN 8000/8500 (700/250V)	2.55
THORN 8000/8500 (400/350V)	2.82
THORN 9000 (400/400V)	3.61
GEC (200/200/150/50)	2.91
PHILIPS 69 2200/63V	1.38
THORN 4700 P/C 25V	1.32
THORN 1591/1691 4700/25V	1.32
G11 Capacitor 7N5 1500V	1.40

CAPACITORS AXIAL

Volts	Mfd	Price	63V		
6V3	33	9		1	12
10V	22	10		2.2	12
	47	10		4.7	12
	100	10		10	11
	220	15		15	12
	470	20		22	13
16V	33	11		47	19
	68	11		100	23
	220	16		220	37
	1000	27		470	49
	3300	53		1000	85
				2200	1.10
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 0.01mF	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		

POLYESTER CAPS

250V 0.01mF, 0.1mF, 0.22mF — 12p

400V 0.01mF, 0.1mF, 0.22mF — 12p

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-6RB-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

NEW MONO TUBES

MULL. A31/510 110° 12"	18.50
MULL. A34/510 110° 14"	20.00
A50/120WR 110° 20"	18.50
A61/120WR 110° 24"	20.50
VEGA 12" 90° (Jap Types)	15.00

MULLARD COLOUREX*

18" A47/343X	59.00
19" A49/120X	53.00
20" A51/110X	53.00
22" A56/120X	46.00
25" A63/200X	55.00
26" A66/120X	65.00
26" A67/120X	65.00
22" A56/500X	60.00
A51 570X	72.00
A56 510	67.00
A66 510	92.00

WHILE STOCKS LAST

NEW TUBES

ATX 56-001	95.00
ATX 51-00X	95.00
A56/610	95.00

REBUILT COLOUR TUBES

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

P.I.L. TUBES – we can rebuild your own glass – please ring for quotes.
Carriage cost on tubes £10 + VAT

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

R20S	38	PP6	1.09
R6B	14	PP7	1.09
R14S	33	PP9	1.10
R03B	16	1289	60
PP3B	52		
PP3S	72		

STOP PRESS

Special Prices

5¼" Floppy Disc

Boxes of 10	40 Track	80 Track
SS/SD	£10.50	—
SS/DD	£11.00	£15.00
DS/DD	£13.00	£16.90

SERVICE MANUALS (Zero VAT)

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

CARBON RESISTORS*

¼W 3R3-8M2	30
½W 3R3-8M2	30
1W 10R-10M	46
2W 10R-10M	72

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

RECHARGEABLES

EVER READY

RX6 (HP7)	1.29
RX14 (HP11)	2.22
RX20 (HP2)	2.45
RX22 (PP3)	4.55
Universal Charger	7.50

EAST CORNWALL COMPONENTS

☆ ☆ ☆ 85

NEW 1985 CATALOGUE will be available July/August – range of components greatly increased – over 125 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Includes 50p Credit Note, Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now – will be despatched as soon as available.

PERSONAL STEREO CASSETTE

Current stock incl Omega & Murphy. Sorry, at this price we send what we have in stock at time. Complete with carrying strap & Headphones. £9.99 ea (plus addtl postage 50p)

SCREENED CURLY LEADS

Black 3 core (2 metres extended)
75p each 6.00/10

D.C MOTORS (Min.)

6-12V 75p £3.00/5

CLOCK RADIO – VHF/LW/MW

Mains, bedtime, digital display alarm clock radio. Full cicuit. Alarm Control/Wake to Music. Sleep Control – 10 min. Snooze. Hour/Minute Time Setting. Brightness Control. £8.50 ea. + addtl. Postage 50p

MIXED DIALECTRIC CAPS

.01mf	1000V	40p
.022mf	1000V	48p
.1mf	1000V	52p
.47ml	1000V	£1.25

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**.

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
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

ZENER DIODES

400mW Plastic	3V–75V	8p each. 10/75p.
1.3W Plastic	3V–200V	15p each. 10/£1.40
1.5W Flange	4.7–47V	£1.26 each
2.5W Plastic	7.5–75V	54p each
20W Stud	7.5–75V	£1.35 each

ZENER DIODE PACK

400mW – 5 each value – 11 values – Individually marked and packed – 55 Zener Diodes.
£3.00 per pack.

SERVICE AIDS

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

Additional P&P on above 30p each

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	0.15
F.M. Plugs	0.20
PL259 Plugs	0.38
Reducer	0.15
Low loss splitter 1 in, 2 out	1.00

TELEPHONE SPECIAL

B.T. Approved. Telephone Plug + 3m Lead **£1.25**
B.T. Approved. Master Socket. Incl. Wiring Inst. **£2.85**
B.T. Approved. Secondary Socket **£1.95**
B.T. 4-way Plug **58p**
10 for **£5.50**
B.T. Telephones now available.

NI-CAD CHARGER

Universal Ni-Cad charger, charges PP3, AA, C, D
Price **£6.00**

Rechargeable Batteries

AA (HP7)	£0.85	10/ 75p each
C (HP11)	£1.75	10/ £1.65 each
D (HP2)	£2.05	10/ £1.95 each
PP3	£3.80	10/ £3.70 each

Dry Cell Batteries – Button type for Multimeters – set of 3 **£1.50**

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			20.00

Send S.A.E. for our latest Sony Spares list. Over 140 spares now available

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

CHART RECORDER SPECIAL

Brand new 3 channel pen recorders complete with charts. Full spec. upon request. Once only price **£40 + £10 p&p + VAT.**

Fuseholders

20mm Panel Mounting	0.28
20mm Chassis Mounting	0.06
1¼" Panel Mounting	0.35
1¼" Chassis Mounting	0.12
Carline 1¼" holder	0.10

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	TI48	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

HV Disc Ceramic (†)

1kV 1.5nF **18p**
8kV 10, 47, 56, 82, 100, 120, 150, 180 **30p**

RESISTORS – CARBON FILM 5%

¼W 1RO 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

INTEGRATED CIRCUITS. (£) EACH

AN240P	3.42	SN76226DN	1.80
AN214Q	3.88	SN76227N	1.10
AN715Q	2.90	SN76530P	1.40
CA3065	1.75	SN76533N	1.60
CA4031P	2.88	SN76650N	1.05
CA4102	3.30	SN76660N	0.75
CA4400	2.98	SN76666N	0.80
CA4422	3.07	STK015	6.50
LC7120	5.33	TA7108P	3.20
LC7130	5.26	TA7120P	2.20
LC7137	5.16	TA7129AP	3.65
LM380N	1.65	TA7130P	1.65
LM1303N	2.52	TA7172	1.80
HA1151P	3.12	TA7193	5.50
MC1307P	1.85	TA7172P	1.80
MC1310P	1.85	TA7176	2.50
MC1312P	2.25	TA7202P	4.18
MC1327P	1.25	TA7204P	1.86
MC1330P	0.83	TA7205AP	1.50
MC1349P	1.85	TA7208P	3.27
MC1350P	1.20	TA7210P	6.50
MC1351P	2.50	TA7222P	2.12
MC1352P	1.50	TA7223P	3.68
MC1357P	2.88	TA7227P	5.60
MC1496L	1.15	TA7310P	1.80
ML231B	2.10	TA7611AP	2.88
ML232B	2.10	TAA263	2.46
ML237B	2.30	TAA550	0.50
MRF475	2.50	TAA570	1.99
MRF479	5.20	TAA611A12	3.50
MRP477	10.00	TAA630S	3.90
NE555	0.50	TAA661B	1.70
C-mos 555	0.88	TAA700	2.80
NE556	0.80	TAA840	3.38
SAA1024	5.35	TAD100	2.80
SAA1025	8.40	TBA120 AS,	
SAS560A	2.50	S,SA,SB	1.30
SAS560S	1.85	Q,T,U,UQ	1.32
SAS570S	1.85	TBA120B	1.30
SAS580	2.85	TBA231	1.45
SAS590	2.82	TBA281	2.65
SC9503P	1.10	TBA395	1.20
SL432A	4.00	TBA480Q	1.50
SL901B	5.20	TBA400	2.30
SL917B	7.25	TBA510	2.60
SL1327Q	1.10	TBA510Q	2.60
SN76023ND	2.90	TBA520/Q	1.60
SN76033N	2.45	TBA530/Q	1.30
SN76110N	1.12	TBA540/Q	1.40
SN76115N	2.00	TBA560C	1.70
SN76131N	1.65	TBA560CQ	1.60
		TBA570	1.50
		TBA673	2.40

TBA7002.85
TBA7502.80
TBA8001.60
TBA810P1.10
TBA810S1.20
TBA8201.60
TBA8903.88
TBA920/Q3.00
TBA950/2A3.05
TBA9704.05
TBA9901.88
TCA270S4.00
TCA270SA4.02
TCA9401.90
TDA4403.80
TDA10021.90
TDA1003A5.50
TDA1006A2.40
TDA1035S4.50
TDA10444.30
TDA1170S3.00
TDA11903.50
TDA1270Q3.70
TDA1327A1.66
TDA1352A/B1.56
TDA14121.20
TDA20022.80
TDA20204.60
TDA20302.78
TDA21405.90
TDA25214.10
TDA25233.50
TDA25302.70
TDA25403.80
TDA25413.80
TDA25603.50
TDA25813.20
TDA25903.20
TDA25912.98
TDA25932.98
TDA2611A1.94
TDA26402.90
UPC554C1.32
UPC557H0.90
UPC566H2.95
UPC575C23.20
UPC1025H2.90
UPC1032H0.90
UPC1156H4.20
UPC1158H0.76
UPC1163H0.98
UPC1222C1.88
UPC1228H0.54
UPC1350C4.25
UPC1353C2.78
UPC1356C23.40
UPC1365C8.70
UPC1367C3.40
UPC1377C4.68
UPC1382C1.88
UPC2002V2.78
CA7230.35
CA7410.35

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
470nF1000V DC	60p

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

VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.95
ECC82	0.65
ECC83	1.10
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	7.85
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	1.36
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	1.30
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	2.20
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
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
BC108	0.10

Type	Price (£)
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
BC302	0.32

Type	Price (£)
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
BD130Y	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
BD244A	0.65

Type	Price (£)
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
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
BF258	0.30
BF259	0.32
BF262	0.30
BF263	0.30
BF270	0.30

Type	Price (£)
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
BT101/300	1.15
BT101/500	1.25
BT102/300	1.35
BT102/500	1.65
BT106	1.50

Type	Price (£)
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
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29

Type	Price (£)
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
MPSLO1	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
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70
TIC106A	0.70
TIP30A	0.46
TIP31C	0.54
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72

Type	Price (£)
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
2AC1449	0.63
2SC1507	0.63
2SC1678	1.06
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74

Type	Price (£)
2SC1957	0.76
2SC1969	2.88
2SC2028	0.73
2SC2029	2.10
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
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

VDRs, etc.

E220ZZ 02/	0.28
E298CD /A2580	.25
E298ED /A2580	.22
/A2600	.22
/A2620	.22
/A2650	.22
/P2680	.22
E299DD/P116-P354	all 0.23
VA1015	0.92
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

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DBS: What Next?

No one comes particularly well out of the fiasco of the proposed UK DBS TV service's collapse. The government wanted a service since it would give the UK a go-ahead, technologically advanced look. The broadcasting authorities wanted it since they have traditionally played a part in the development of TV technology. Industry wanted it since extra channels being broadcast via a new method of transmission represents good business opportunities. Nevertheless for the time being DBS has been shelved so far as the UK is concerned. The reason for this debacle is of course money – and doubts as to whether the public really wants extra channels. Extra programmes maybe – but the broadcasters seem to have difficulty filling the present four channels.

The government has been blamed for its failure to contribute to the cost of establishing a DBS service. But the demands on government funds are already great. It's a question of priorities. Just how important is a DBS service in the order of things? Spending a lot on starting a service that few might bother to use hardly seems a wise use of public money. Yes it would be nice to be seen as a nation pioneering the way to the technology of the future. But there seem to be global doubts at present about the feasibility of high-power DBS services.

If the money was not to come wholly or in part from the government, who else might provide it? Traditionally the BBC and the IBA have been able to finance the development of new services as technological change has made them possible. But the BBC is short of money, and the government's refusal to raise the broadcasting licence fee to the figure requested by the BBC at the review earlier this year has placed severe constraints upon the Beeb. The IBA gets its money from the ITV companies, which have been going through a difficult patch with reduced advertising revenue. There has been some improvement recently in advertisement bookings, but the whole position has been thrown into confusion by the government's decision to set up the Peacock Committee to enquire into methods of financing the BBC – in particular whether it should derive some of its income from advertising. UK firms already devote a comparatively high proportion of their advertising revenue to TV – only in the USA is a greater proportion spent on TV advertising. So if the BBC was to carry advertising it's likely that the amount of advertising available would simply be spread around more thinly. It's also the case that advertising might tend to be concentrated on the main, mass-appeal channels. Either way there wouldn't be all that much to place with prospective DBS channels.

What contribution might we have expected from industry? It's silly really to ask the question. The domestic TV industry is at present going through a very difficult time. The market is saturated and sales are hard to come by. Just the time to introduce satellite TV services you might say. Well yes, but modern manufacturing tends to be a horrendously expensive business. Vast investment is needed to establish the sort of production facilities that will produce internationally competitive goods. You can't blame hard pressed manufacturers struggling in an already over provided market for coming to the conclusion that this is just not on.

Is there any hope amidst all this gloom? Well for a start questions have been raised as to whether the suggested approach to providing a DBS service was the right one. Are high-power (240W per channel) satellites dedicated to the provision of TV transmissions essential? The original specifications were drawn up at the time of the 1977 World Administrative Radio Conference. Here we are in 1985 and the technology hasn't stood still. Since we won't be getting an official DBS service for a while yet the question of how it should be provided is very much open to debate.

In the June issue of *Satellite World* Steve Birkill argued strongly in favour of using Intelsat V type satellites which appear to be capable of providing perfectly acceptable reception using an 0·9m dish and current state of the art receiver technology. In fact you could say it's all very much a question of dish size: given a large enough one, good signals will be received. The question this raises is whether the now abandoned DBS proposals involved over engineering. Obviously the public has to be offered a service that's reliable, and equally obviously one might as well use the best technological solutions available. But good engineering has been defined as doing for ten pence what others can do for a pound (or something like that!). One can't help but recall how colour TV got started in the USA – as a rather ramshackle system full of compromises. That wasn't exactly a success of course – for the first few years anyway. And perhaps the moral learnt from this has been to get things right from the start. But if the cost of a proposed system is too great you can end up, as we've now done with DBS TV, with nothing at all. It seems that a delicate engineering compromise might be called for, which is something that's not easy to achieve. If you start up with a cheap and cheerful compromise that's obsolete within a few years – think of 405 lines – you end up with public wrath. Perhaps the public could be educated to accept that a compromise start-up system that might be obsolete within a decade might be necessary? The trouble is that this would hardly be the hard-sell approach required to get the public to pay for the service. Nevertheless it's a fact that TV is by its nature evolutionary. If we'd waited for 625 lines in colour we'd never have got started.

Meanwhile low- and medium-power satellites are already in operation carrying TV signals and the government has decided that we can receive them. They open up various possibilities that may be helpful in eventually getting a full-blooded DBS service started.

BBC MICRO PROGRAM

A letter on page 571 draws attention to some printing errors that occurred in the BBC microcomputer test pattern program in last month's issue. A letter next month will provide an amendment to obtain a true circle.

SPARES

Many thanks to several readers who provided information on Sonatel monochrome portables. These have been sold by Woolworths. Spares are available from House of Carmen Ltd., Technical Services Dept., 6 Albany Parade, High Street, Brentford, Middx. TW8 0JW (01 560 5331). The sets appear to be of Hitachi design.

We receive occasional letters about Waltham sets. Some spares are available from ACR Electronics, 37-51 Greenhill Crescent, Watford Business Park, Watford, Herts. WD1 8QU (0923 24543).

FRONT COVER

This month's cover photo shows a set fitted with the B&O 20AX chassis, opened up to aid identification. See article on page 554.

VCR Renovations

Steve Beeching, T.Eng.

It was spring and as Andy's fancy turned to the young lady in the flower shop across the road my concern was to find a way to make some money. Repairs were a bit slack and I get bored when there's nothing to do. So we decided to enter the second-hand VCR market, having sold some of our own ex-rental and part-exchange machines at a greater profit than we get from new ones. We thought about it for a while and looked around for some supplies of ex-rental company flog-offs. It ended up with me driving to Birmingham to buy as many machines as I could get into the Rover. After some bargaining and mumbling I ended up with two Sony C7s and six C5s ex-Visionhire and eight VHS machines ex-Radio Rentals.

The Sonys were quite reasonable to look at, though the cases were scratched and the odd timer cover was absent. The VHS machines looked like scrap, with no clock facias and no tuner flap lids: they looked a mess in fact but the price was right. The approach adopted was to check them all out as far as possible and order the spares required to get them going, then to bring them up to specification.

Initial Checks

Most of the Sonys wouldn't operate at all, inasmuch as they would power up but wouldn't thread up. On the VHS machines odd bits were missing and it seemed that most of the video heads had been removed and duff ones just bolted in. This could turn out to be quite expensive. VHS heads can be obtained from MCES in Manchester however and are cost effective – they are reconditioned assemblies so you have to send them your old drums. They don't handle Beta heads, so new ones would have to be obtained in this case. So far I've been sceptical about what are called "general purposed" heads: this exercise would provide a good practical evaluation.

A number of the VHS machines were given a quick check: those that could be made to run had duff heads, which provided us with some drums to send off to MCES. As we carry a quantity of Sony spares I was able to get a couple of C5s running whilst the orders went off.

The Sonys

First the C5s and C7s. Only one had any working heads and they weren't much good. As C7 heads are cheaper than C5 heads we decided to fit these all round. Only one C7 had to be scrapped: it had a faulty drum motor and liquid-contaminated print. It provided some spare parts however.

The first C5 threaded up. There were no further functions though rewind could be selected. The end sensor i.c. on the syscon panel, IC8, was located and replaced. That restored play. The heads were useless and there was no rewind as the rewind idler tyre was missing. New heads were fitted and the machine was cleaned and tested.

The second C5 gave nothing at all. It powered up but wouldn't even thread. This was traced to a duff capstan motor – the motor's FG output had also been disconnected. There were no audio/sync heads either, so a set of these was fitted. We then tried for play. Still nothing. The play LED lit, indicating that the syscon was operating. The forward solenoid was . . . disconnected? Next there was no E-E picture though the sound was present. The machine was tuned with the scope connected to the demodulator's output. Three transistors, Q32/3/4, were found to be missing. Suspicious that!

At least it was now running. The output from the heads was very low, so these were replaced. We now had playback pictures and sound. Time to set it up. The audio/sync heads were aligned using a test tape. The slack sensor, back tension (the f.m. signal wandered a bit) and the video signals were then set up. Fine. Now just rewind before cleaning the case and we have – eject!!

Well, this was a new one. I won't go into the details of what we checked except to say we eventually discovered that rewind could be selected only when the counter memory switch was in the off position. If it was on, the machine selected eject when the rewind button was pressed. Fig. 1 shows the bit of syscon logic circuitry involved. Strobe outputs T0-T3 go to various switches: the return inputs to syscon chip IC7 are A0-A3. Eject is selected when T0 is connected to A1, rewind when T0 is connected to A2. With the counter memory switch closed, T0 was linked to A1 in some way. As you can see, this could be due only to failure of D11, which it was, the fault path being T0, the rewind switch, the cassette in switch, D11, the counter memory switch, A1. Note that a resistance check on D11 showed conduction one way and a high resistance the other. There was no leakage and the diode checked good when out of circuit. It took me about one and a half hours to sort that out. Then clean and test the machine.

The third C5 had no drum servo action. Another puzzler. We traced through the relevant circuitry and finally discovered that the drum assembly was loose on its mountings and was disconnected. After reassembling and guide alignment, new heads were fitted to complete the repair. During final testing the rewind function ceased: this time it was a failed start sensor i.c.

The capstan motor in the fourth C5 was disconnected and very tight. A good one had obviously been removed and a faulty one fitted in its place. So a new replacement was fitted. Some trouble with the deck mechanics was traced to a jammed sliding plate. Apart from fitting new

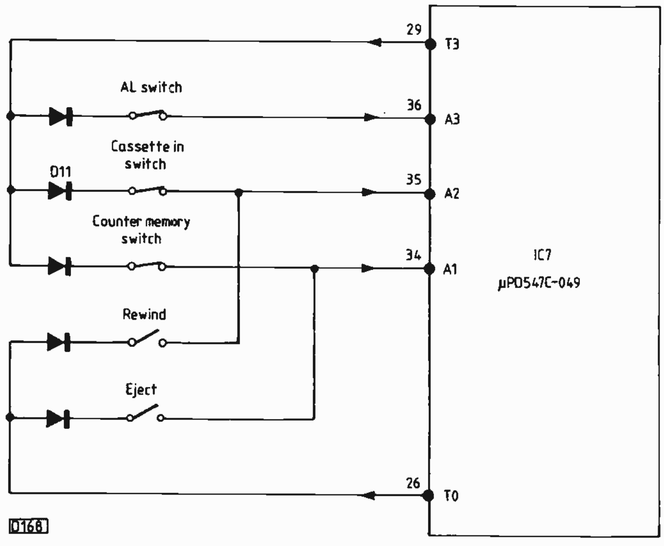

Fig. 1: Rewind/eject switching, Sony Model C5.

heads there was a problem with the video a.g.c. which overloaded and couldn't be adjusted. RV1 didn't do a great deal and only a small amount of adjustment was possible with RV8. The CX187 luminance processing chip IC1 was suspected and changed, with some difficulty due to the surrounding screening plates, but this did no good.

While tracing back to the input to video board Y6 I noticed that the video/sync ratio was wrong. The syncs were too small. They should be in the ratio 3:7 (300mV sync, 700mV video) but were at only 150mV with rounded edges at the bottom. Back on the i.f. board we found that the distortion was occurring at the video emitter-follower Q502. The sync tips at the input to Q502 were going as low as 0V and the transistor was cutting off at 600mV, hence the sync tip clipping. Base-emitter capacitance caused the rounded edges. The signal level at the base of Q502 was a massive 5V p-p instead of 2·8V p-p, as a result of which Q502 was being overdriven.

After much checking around I realised that there should be some sort of gating pulses at pin 7 of the TBA1440G i.f. chip to provide i.f. a.g.c. gating. These pulses should come from Q103 (sync separator) and Q104 (inverter) on the tuner panel. Q104 was o.k. but Q103 had given up.

The other two C5s needed just video heads, alignment and a clean up.

The first C7 operated normally in most respects. The output from the heads was very low, there was a sound warble, and no rewind. New heads and a rewind kit were fitted. The warble had been due to the old heads being off-centre: it looked as if old heads had been bunged in before the machine was disposed of.

With the second C7 the threading motor would start to run then slow down and stop, without completing the threading process. This was traced to the motor's FG output being disconnected.

There was also no E-E colour as the ACK (automatic colour killer) line was active (low). If you have a Sony service manual you'll find it best to check the block diagrams first to get an idea of the system before delving into the actual circuits. The video board block diagram shows that the ACK detector in the colour signal processing chip IC2 is driven by the summed outputs from two other detectors, one in IC2 and the other associated with transistor Q48. The input to Q48 comes via transformer T5 which turned out to be mistuned.

Next the drum servo wasn't locking due to absence of reference pulses from the video board. IC12 on this board counts the pulses down from 4·43MHz to 25Hz and was without an input. Tracing the circuit back brought us to Q58 and the crystal oscillator circuit, with X2 and T8. The transformer was corroded. At this point the machine was scrapped as there was too much corrosion in this area.

The VHS Machines

All the VHS machines were of the HR3300/3292 type, the first VHS model ever, made by JVC. There are still pundits today, some of whom write for this magazine, who agree with me that the pictures produced by this model were excellent, surpassed only by later versions of the HR7200 (3V29) and HRD110 (3V38).

All except one of these machines had to have new heads. This required PG switching point and head preamplifier alignment. No difficulties were experienced in this respect with the reconditioned heads. The machines all required cleaning, replacement belts and servo setting up. Most of them had a blown "operate" lamp.

One major problem was created by the fact that none of the VHS VCRs had tuning compartment lids, as a result of which the a.f.c. switch couldn't be operated after tuning. The lids are not available as separate parts and new tops would have cost £30 or more apiece. A get out was required, so I sprayed the tops gloss black and wired the a.f.c. permanently on. This made tuning a bit critical but not impossible.

The first machine was the only one with good heads and a timer facia. The tape guides were miles out and the servo was out of adjustment. After a good clean up it worked well.

The second machine required new heads. A sound warble was traced to the capstan motor – an old one had been put in. Set up and clean.

After fitting new heads to the third machine we found that the tape wouldn't run for more than a few seconds. The drum flip-flop signal was erratic and didn't have a 50 per cent duty cycle. As the drum pickup head was not close enough to the flywheel the pulses were too low in amplitude, 200mV peak instead of 400mV. One simply bends the head bracket closer to the flywheel.

On the fourth machine the drum motor ran fast but not the drum. There were no drum PG pulses – in fact there was no drum flywheel either. A new flywheel was fitted, along with new heads, and the servo was aligned.

On the fifth machine the E-E output was very distorted. The video signal was present but the sync pulses were very small, almost non-existent. The fault was symptomatic of a failed video signal processing i.c. (IC1) so a new AN302 was fitted. The drum motor was also replaced, along with the take-up clutch.

The next machine had an f.m. replay problem. It was not really noticeable on the screen and was in fact spotted whilst we were aligning the new video heads. A portion of the f.m. carrier at the start of the field scan was pulsating and varying in amplitude. It was some while before I decided that this was due to a beat signal. After checking around and fitting yet another video drum I discovered that the head switching signal was not present on the preamplifier panel though it was present on the luminance/chrominance panel. At some time in the past someone had connected both the signal and the screen of the connecting lead to the preamplifier to chassis. The beat signal was the simultaneous output from both heads at the overlap crossover point. A new drum motor had to be fitted.

The seventh machine required new heads and a spring was missing off the play key. In addition odd tuner pushbuttons were sticking.

The final VHS machine didn't thread. Gear wheels were missing between the capstan flywheel and the threading cam assembly. Fitted new heads and cleaned it up.

Conclusions

One obvious point about these machines was that the rental engineers had had some difficulty in setting up the servos. The drum and capstan servo discriminators both require careful setting up, as follows.

Capstan discriminator preset R76. Disconnect the mains power lead, connect a 33Ω resistor between TP14 and chassis, link TP12 to chassis and connect an analogue meter switched to the 50μA range between TP14 and TP20 – either way round. With a 1·5V battery connected between TP21 (positive side) and chassis the capstan motor will rotate. The meter may read negative. Stop the motor by hand and adjust R76 for a zero current reading, neither positive nor negative. Release the motor, stop it again and recheck the setting. Repeat until a consistent zero reading is obtained.

Drum discriminator preset R111. Disconnect the mains lead and connect a 105·6Ω resistor (100Ω + 5·6Ω in series) between TP9 and chassis. Connect the meter, again switched to the 50μA range and either way round, between TP9 and TP18. Connect the 1·5V battery between TP19 (positive side) and chassis. The drum will rotate. Stop it by hand a number of times and adjust R111 for a zero current reading each time. Repeat until a consistent reading is obtained.

Adjustments to the capstan servo and the drum servo sampling position can then be carried out as detailed in the manual, the capstan for 7·5V d.c. at TP12 and the drum for a sampling position (positive transient) half way down the ramp at TP7.

What did we learn from all this? Well, it was a profitable exercise as long as the work was carried out when nothing else required attention. If labour was costed in the exercise was not profitable. Without access to manufacturers' spares the cost would have been prohibitive. In addition, expensive test equipment is required and, with Sony machines, the expertise to install new video heads correctly. A number of obscure faults had beaten the rental technicians. I'm not surprised that they hadn't tackled syscon faults on the Sony machines – the syscon panels were the only ones that hadn't been touched at all. Finally, I'm convinced that while some machines had been robbed others had been deliberately sabotaged prior to disposal.

Oh yes, Andy says I've got to own up about boiling belts. I'm sure I don't know what he's talking about . . .

Commodore 64 Test Pattern Program

Andrew Green

An appeal was made recently in the Letters column for a test pattern program for the Commodore 64 microcomputer. The following program draws a grid and then overlays a band of colour bars on the upper part of the screen and a grey scale at the bottom. It also has the facility to switch sound in and out: not the sometimes irritating high tone but, using the 64's three voices, a harmonious chord! This is generated in the subroutine at line 3000. For those wishing to change the chord, lines 3020-3030 poke the relevant numbers into the registers. A look at pages 152/3 in the user's manual or 384/5 of the programmer's reference guide tells you the numbers to poke in for notes over a six octave range.

If a smaller spaced grid is required, change line 1000 to FOR X = Y + S TO Y + S + 160 STEP 4.

Unfortunately the display obtained with the Commodore 64 has a border in which you can't draw, so you cannot get the grid to reach the extremes of the screen. I've nevertheless found the program to be a useful one.

Program

```
5 REM TV TEST PROGRAM
8 REM BY A GREEN
10 PRINT CHR$(147): POKE 53280,11: POKE 53281,11
12 FOR X = 1 TO 10: PRINT: NEXT X: PRINT
   SPC(15)CHR$(5) "TELEVISION"
13 PRINT SPC(18) "TEST"
14 PRINT SPC(18) "PAGE": FOR T = 1 TO 4500: NEXT T:
   PRINT CHR$(147)
15 S = 1024: REM START OF SCREEN MEMORY
18 REM DRAW GRID
20 Y = 4: GOSUB 1000
30 Y = 160: GOSUB 2000
40 Y = 204: GOSUB 1000
50 Y = 320: GOSUB 2000
60 Y = 364: GOSUB 1000
70 Y = 480: GOSUB 2000
80 Y = 524: GOSUB 1000
90 Y = 640: GOSUB 2000
100 Y = 684: GOSUB 1000
110 Y = 800: GOSUB 2000
120 Y = 844: GOSUB 1000
130 PRINT CHR$(19): FOR X = 1 TO 4: PRINT: NEXT X
135 REM COLOUR BARS
140 A$ = "□□□□": REM 4 SPACES
145 FOR X = 1 TO 3
150 PRINT A$; CHR$(18); CHR$(5); A$; CHR$(158); A$;
    CHR$(159); A$; CHR$(30); A$;
155 PRINT CHR$(156); A$; CHR$(28); A$; CHR$(31); A$;
    CHR$(144); A$; CHR$(146)
160 NEXT X
165 FOR X = 1 TO 5: PRINT: NEXT X
168 REM GREY SCALE
170 A$ = "□□□□□□": REM 6 SPACES
175 FOR X = 1 TO 3
180 PRINT SPC(5)CHR$(18); CHR$(144); A$; CHR$(151);
    A$; CHR$(152): A$;
185 PRINT CHR$(155); A$; CHR$(5); A$; CHR$(146)
190 NEXT X
200 FOR X = 1 TO 6: PRINT: NEXT X
210 PRINT SPC(11)CHR$(18); CHR$(5); "□ CBM TEST
    PATTERN □"; CHR$(146): REM □ = SPACE
220 PRINT SPC(8)CHR$(18); "□ SOUND ON = F1, OFF =
    F3 □"; CHR$(146)
230 GET A$: IF A$ = "" THEN 230
240 IF A$ = CHR$(134) THEN GOTO 300
250 IF A$ = CHR$(133) THEN GOSUB 3000
260 GOTO 230
300 POKE 54296,0: REM SOUND OFF
310 GOTO 230
400 REM
1000 FOR X = Y + S TO Y + S + 160 STEP 8
1010 POKE X,101
1020 NEXT X
1030 RETURN
2000 FOR X = Y + S TO Y + S + 39
2005 IF PEEK (X−40) = 101 THEN GO TO 2015
2010 POKE X,119: GOTO 2020
2015 POKE X,79
2020 NEXT X
2030 RETURN
3000 FOR L = 54272 TO 54296: POKE L,0: NEXT L
3005 POKE 54296,15
3010 POKE 54277,190: POKE 54284,190: POKE 54291,190
3015 POKE 54278,248: POKE 54285,248: POKE 54292,248
3020 POKE 54272,75: POKE 54273,34
3030 POKE 54279,52: POKE 54280,43: POKE 54286,97:
     POKE 54287,51
3040 POKE 54276,33: POKE 54283,33: POKE 54290,33
3050 RETURN
```

Strangers in the day

Les Lawry-Johns

I could see that she had a chip on her shoulder the moment she walked in carrying a small Grundig portable (not colour I was glad to note). Despite the fact that I was breaking my heart over a Philips G11 power supply panel she plonked the portable in front of me and let loose.

"I've had this set repaired three times in the past few weeks and now it's gone again. No doubt the same thing."

"No doubt" I growled, "which is why you should take it back to the repairer and beg him or her to have another go instead of lumbering me with the thing."

I could see her change gear, the way they do when they see that a change of tactics is required for them to get their own way.

"I've given Quick Fix every opportunity to do the job properly and they've signally failed. I've been told you're good and not expensive . . ."

"That's right" I couldn't help saying, "I'm good for nothing."

She didn't even smile but went straight on ". . . so I thought I'd bring it along to ask your opinion."

I gave up on the G11. "All right, leave it with me and call back tomorrow. I'll just take the name before you go."

"Miss M. Lott – Mona Lott – from Park Avenue."

I wrote down Miss Moanalot and left it at that.

Off she went and I returned to the G11 power supply. I'd checked every transistor in situ and everything else in sight and was now down to taking out each transistor and rechecking it in isolation. T4086 (BC158) in the excess beam current protection circuit proved to have a reverse leakage of some 3kΩ, and on fitting a replacement the wanted 150V appeared at the h.t. fuse. It's fortunate that these boards can be checked on the bench with only an a.c. supply fed to plug B – one side to pin 1 or 2, the other to pin 4 or 5.

Having disposed of this minor irritation – several hours of sweat due to my stupidity – I turned to the little Grundig (1230GB) where I proceeded to make the same sort of mistake I'd made with the G11. As the fault appeared to be lack of line drive I made a start by checking the supply to the line driver transistor. It was present though a little high. This was to be expected since the line output stage wasn't working, i.e. there was reduced loading on the 11V rail. This was confirmed by the tube's heater, which was glowing a little too healthily.

I switched off and checked the line driver transistor – base to collector, base to emitter – watching the meter's swing out of the corner of my eye. It seemed to be o.k. so I chased around getting nowhere.

I switched on again and checked the voltages in the line driver stage, noting that the transistor's collector was loaded by only the primary winding of the driver transformer (no feed resistance). Raised eyebrows accompanied the check on the transistor's base voltage. Since its emitter went straight to chassis the base shouldn't be far off chassis potential. The reading was 2V. So I looked at the transistor again. It should have been a BD137. A BC142 looked at me, recently fitted. I whipped it out and found that it was open-circuit base to emitter. The reading I'd got with the transistor in circuit had been base to collector and then to the emitter via the driver transformer and the tube's heater.

I fitted a BD131 and told the set to make do with that for the time being. It did. The picture was good and the supply line voltage was correct. I must watch the meter more carefully in future. Like you do. The set was left on for a full day, just to be sure.

Mona came to collect it later, paid without a murmur but couldn't help saying "see you soon" as she went. Well she hasn't, so far.

Another Stranger

Amongst the usual procession of Decca, Thorn, Philips, ITT etc. sets this 14in. Amstrad colour portable turned up. Not a bad little set, of far eastern origin. A quick check revealed that the full h.t. voltage was present but as there was no activity in the line output stage the picture and sound were both missing. Once again I started by making checks in the line driver stage. The set immediately started up and wouldn't stop. So I left it on till the next day.

Once again it refused to start. This time when I checked for voltage at the collector of the line driver transistor there wasn't any. So I checked back to the primary of the driver transformer and found voltage at both ends. The set made a half-hearted attempt to start when the probe touched the transistor end of the winding. Although the joint looked good resoldering it produced instant action with no further hanky-panky. Lucky me. For once.

Easy Mende

If you remember, quite a time ago I told you of an encounter with Beardy and Non-beardy and how they departed never to return.

Well they did. Carrying of all things a NordMende colour portable of the type that frightens me.

"Get out of here with that thing" I bawled.

"Oh my friend" said Beardy, "let us let bygones be bygones."

"Yes" said Non-beardy, "let the sands show not a ripple."

"Never mind about bygones or the sands, I no mend NordMende."

"It's just a little thing" said Beardy. "It won't take a clever man like you a moment. Very very easy."

"Listen. If I was clever I wouldn't be doing this job."

"Just for old time's sake" said Non-beardy. "It's just a fuse you see."

"All right then" I said very calmly. "We'll just check the fuses."

So I whipped the back off, lowered the panel and checked the fuses. The 630mA fuse in the supply to the field timebase was open-circuit. My mind raced. The chances were that the TDA1170 field timebase chip had shorted or was shorting intermittently. Take a chance. Fit a new fuse and get rid of them.

"You're quite right" I told Non-beardy. "It was just a fuse. It's you who are clever, not I."

"Very good" said Beardy. "How much?"

"Fifty pence" I said, "if I don't see this set again."

"You give guarantee?"

"No I bloody don't. Take the set and sod off."

Do you know, it didn't go off again and each time Beardy walks by he raises his thumb and calls out "very good, very good".

I hate those sets.

Servicing the B&O 20AX Chassis

Eugene Trundle

This was Bang and Olufsen's second solid-state chassis and was in production during the late seventies. It was used in a range of TV sets – the 20in. Models 3000 (not to be confused with the much earlier hybrid Model 3000) and 3300; the 22in. Models 3502, 3602, 3702, 3800, 3802 and 3900; and the 26in. Models 4002, 4402 and 6002. The 6002 has a nice wooden cabinet with tambour doors and uses the on-screen channel status display and ultrasonic remote control system also used in the 3300, 3702, 3802, 3900 and 4402. The sets are characterised by their ridged channel selector buttons and control drawer covers (see December 1977 cover). Dished or domed control buttons characterise the remote control unit. The now familiar hallmarks of Bang and Olufsen products are all there: the slim, stylish lines, excellent sound quality, and superb picture performance. The auto-grey scale correction built into all solid-state Beovision sets ensures long-term picture stability.

Internally the chassis is conventional for its era, with a full-wave thyristor regulated power supply, diode-split line output transformer, modular construction and moderate power consumption of around 115W. Some of the features of its predecessor, the Beovision 3500/4000/5000/6000 series (covered by James Brice in the May 1978 issue) are recognisable but the design is totally different in many areas. The chassis is quite reliable and such stock faults as do occur are not too difficult or expensive to sort out once the set's habits and operating principles are understood. What we propose to do is to provide a rundown on common faults and some guidance on circuit operation and setting up in the sections that don't have counterparts in other makes of receiver – these are mainly confined to the remote control system, the power supply and the auto-colour tracking departments.

Tuner and IF Section

A straightforward and conventional receiver unit is used, with an MC1349P i.f. amplifier chip, TCA270 vision demodulator/a.g.c./a.f.c. chip and a TBA120U intercarrier sound chip – all well-tried i.c.s. The u.h.f. tuner gives little trouble but if it needs replacement be sure to order a U322 type, not the superficially similar and more common U321. Apart from odd i.c. failures (mainly the TBA120U) we've had little trouble with the i.f. circuits. Peculiar faults ranging from loss of all signals to apparent malfunction of the a.g.c. system can be caused by a faulty 12V stabiliser chip – 1IC4, type MC7812/LM340/μA7812. Check the 12·6V line with a meter and scope before delving further.

The luminance delay line lives on module 1 and, unusually, consists of separate *L* and *C* elements in a ladder network. This gives a well-defined passband and enables an edge-enhancement preshoot signal to be injected at a tap along the line. The preshoot signal comes from the collector of the delay line driver transistor 1TR6 and is differentiated by 1C64. In certain circumstances some viewers are happier without this refinement, in which case 1C64 can simply be removed. This gives a slightly softer picture. The small coils are glued to the panel and dry-joints at their terminations can be responsible for intermittent loss of luminance.

Tuning

The channel selector button unit is prone to intermittency due to internal contact tarnishing. It cannot be dismantled for cleaning but a go at the nooks and crannies with a switch cleaner aerosol can work and will in particular be required on the non-remote control versions where no latch-on circuit is used. The mains switch is also incorporated in the button unit: it can go open-circuit. The tuning potentiometers are better behaved than in most sets but tend to go latchety in a hostile environment. They come in two banks of four.

In all cases of tuning drift, check the tuning potentiometer isolating diodes 11D2/4/6/8/10/12/14/16 first. This is most easily done by winding the unused potentiometers up towards channel 68 – any that affect the tuning have suspect diodes connected to their wipers. Though they are not used in UK sets the band switching diodes 11D3/5/7/9/11/13/15/17 are still included and can cause drift if leaky. In view of the low cost of 1N4148 diodes it's often prudent where trouble is suspected to save time by replacing the lot.

Remote Control

The ultrasonic remote control system is a little unusual and merits a few words of description. Fig. 1 shows the operating principle. The handset contains an *LC* oscillator that runs at 44·01, 41·15, 38·29 or 35·43kHz depending on which button is pressed. These carrier frequencies can be 100 per cent amplitude modulated by any one of four audio frequencies derived from an SCS oscillator with *RC* switching. Four carriers plus four choices of modulation give sixteen permutations. They are used as follows: brightness up, brightness down, colour up, colour down, volume up, volume down, normalise ("granny button"), standby and selection of eight channels. The four carrier frequencies are given by the vertical columns of buttons on the handset while the four audio tones are given by the horizontal rows of buttons – this is a useful aid to diagnosis where a whole row or column of buttons fails. The modulated carrier waveform is stepped up to 210V peak-peak then rectified by a diode-capacitor combination and applied to the sending transducer whose capacitance resonates at 44kHz.

The pickup transducer in the set feeds the incoming signal to an amplifier which presents it to 17TR2. This pnp transistor's collector load consists of four series-connected resonant circuits, one for each frequency. Each feeds a transistor whose collector voltage goes low in the presence of its "own" carrier frequency, putting a "low" into the decoding matrix. The audio modulation tones are detected by four active bandpass filters, one for each modulation frequency. The outputs from these drive a further set of four transistors whose conduction again puts a "low" into the matrix.

The output from the matrix consists of sixteen control

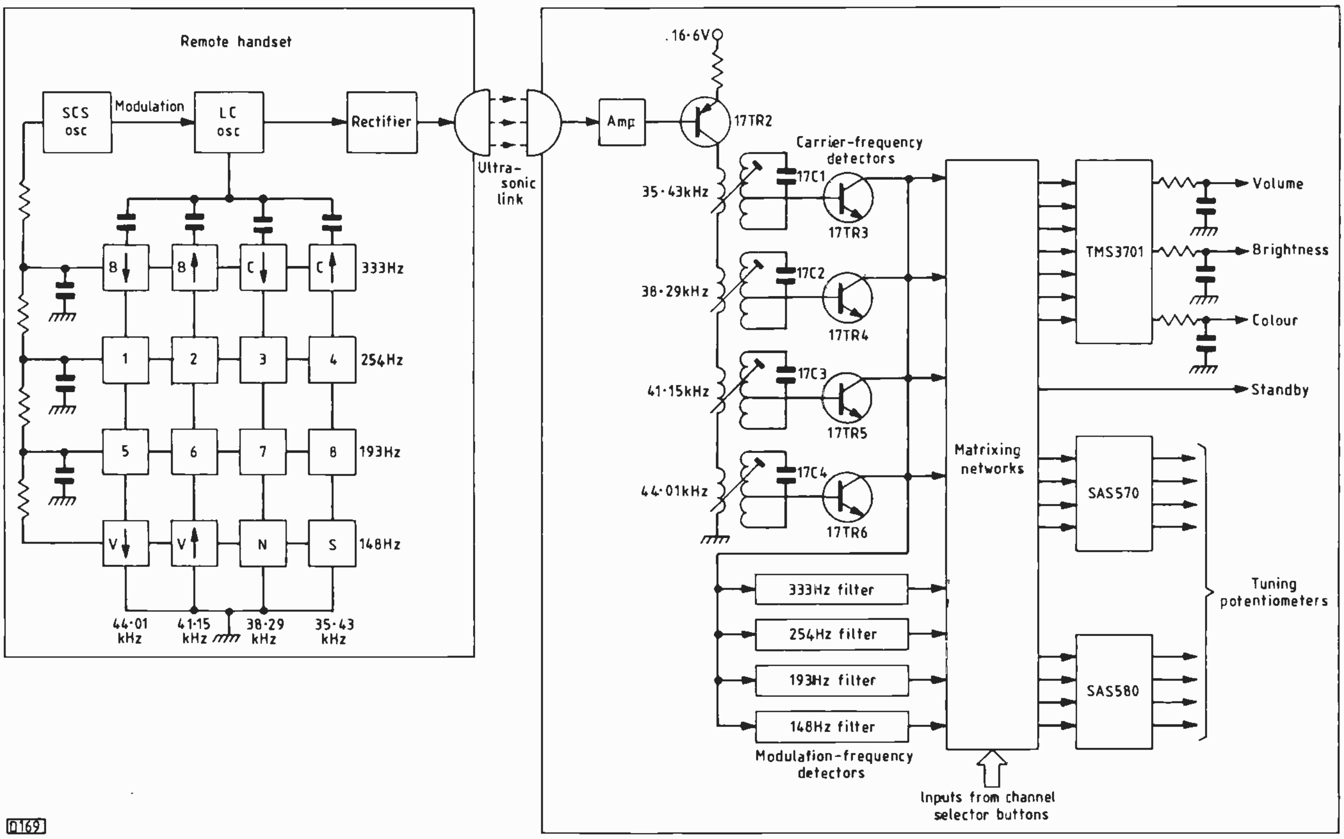

Fig. 1: Illustrating the operation of the ultrasonic remote control system used with some models.

lines, one of which will go to zero for each remote control button operation. These output lines control three memory i.c.s, an SAS570/SAS580 combination for channel selection and a TMS3701BNS whose outputs provide colour, brightness and volume control. The outputs from this latter i.c. consist of squarewave pulse trains with different mark-space ratios: these are integrated by low-pass filters to provide d.c. control voltages for the signal-handling chips.

Most of the problems with the remote control unit are due to environmental factors. Liquids spilt over the unit will corrode the contacts which usually respond well to cleaning – be sure to keep the unit face down when dismantling it to avoid losing 32 little treasures. If the unit has been dropped you'll often find that the oscillator coil 19L1 has parted company with the panel – reglue it and resolder the fine wires. Later versions have a modified coil soldered directly to the board. A common cause of no output is failure of the transducer, which is not the same as the receiving one. The symbols on the cleverly designed button faces (dished for down functions, domed for up functions) wear off rather easily, and the B154 12V battery is not always easy to find.

Realignment of the remote control system (either the transmitter or receiver) should not be undertaken lightly, especially in the absence of a frequency standard or accurate digital counter. Adjustment of the oscillator coil and trimmers in the transmitter unit has to be done with a special cut-down bottom cover plate that contains an iron block to load the oscillator and thus ensure that the frequencies are correct when the unit is reassembled.

Failure of the pickup transducer is the most common remote control receiver problem. We've also had occasional problems with the 0·0047μF polystyrene tuning capacitors 17C1-4 and leakage in the matrix diodes 17D15-28. As with the diodes in the channel tuning circuits, any diode whose reverse current moves the Avo's pointer so much as a hair's breadth on the $\Omega \times 100$ range' should be condemned.

Channel Display

The channel display module is a straightforward panel using an AY-5-8320 character generator chip (20IC1) many of whose features are unused in this application. It's fitted as standard in Model 6002 but can be installed if required in other remote-controlled sets. It examines the data in the tuning memory chips, via another diode matrix, producing a green digit (1-8) on a black square in the top right-hand corner of the screen, the display lasting for three seconds after changing channels.

Complete absence of the digit display should lead to a check on the 16V supply to pin 17 of 20IC1 and an investigation of the clock oscillator 20IC2 before 20IC1 itself is condemned. What's more important is that the background and character driver transistors 20TR5-6 have access to the luminance and G video channels respectively. Malfunction in these areas, i.e. no picture or a green screen, can be due to a fault on this board: unplug it to prove the point.

Decoder and Drive Circuits

The PAL decoder uses the well known TBA540 and TBA560C chips in conjunction with the less common TAA630T demodulator/colour-difference matrixing i.c. – RGB matrixing takes place in the output stages. The decoder has proved to be reliable, the occasional fault being easily traced with a scope and meter checks. To override the colour killer link test points 1 and 2. We've had trouble from time to time with the 0·01μF ceramic capacitors which couple the line-frequency trigger pulses

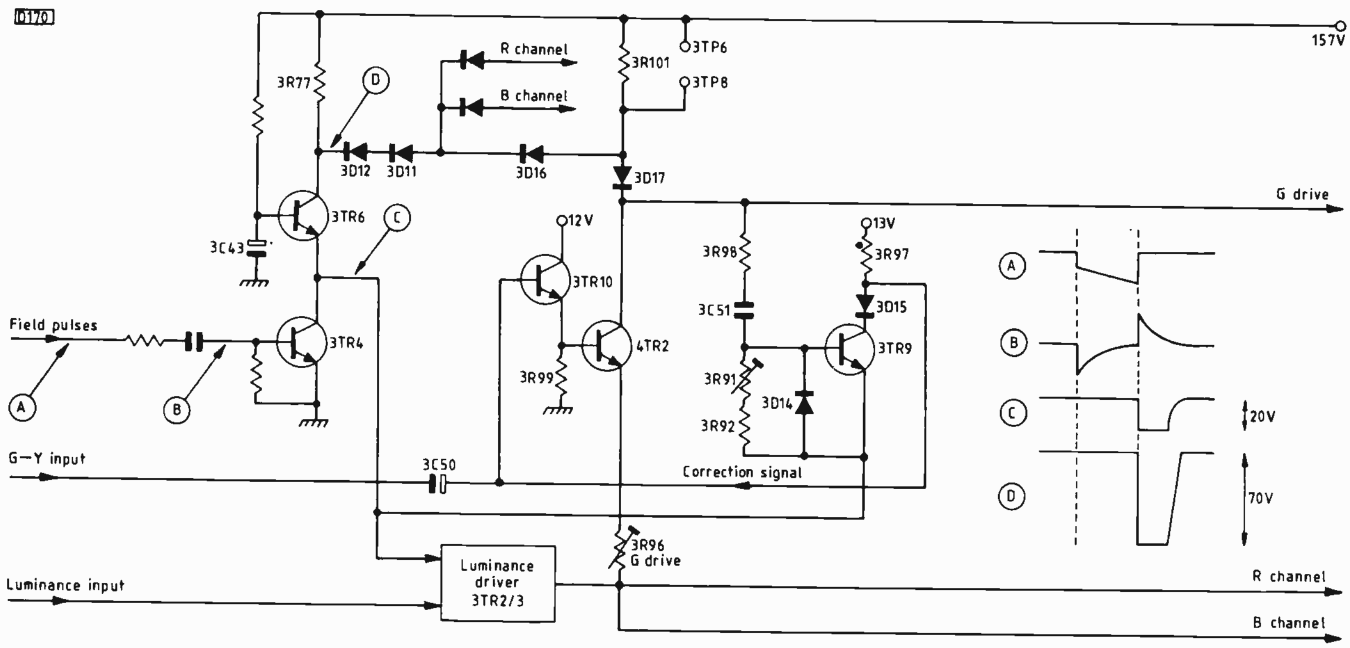

Fig. 2: Basic auto-grey-scale shift circuit. 3TR4/6 drive sampling circuits in all three channels.

and the subcarrier signals to the TAA630T chip – the results are random, from incorrect colour to complete loss of colour, and generally intermittent. The capacitors concerned are 3C26/27/28/29.

The RGB output stages employ tiny BF422 transistors working in the class A mode, mounted on a small subpanel. Class A operation with relatively high-value collector load resistors (12kΩ) is not conducive to the production of pin-sharp pictures – maybe this accounts for the use of the edge-enhancement circuit described earlier? In spite of their small size the failure rate of the output transistors 4TR1/2/3 is not too high. The colour-difference signals arrive at the bases of the output transistors while the luminance signal from a low-impedance driver stage (3TR2/3) arrives at the emitters via separate drive controls.

The auto-grey scale correction system operates on this section of the circuit. We'll briefly describe its working principle with the help of Fig. 2. Pulse A, which lasts for the duration of the field flyback, is differentiated and applied to the base of 3TR4. The result is a short (about 320μsec, say five TV lines) negative-going pulse C at the collector of 3TR4. This pulse occurs at the end of the field flyback, which is when the grey-scale correction takes place. The negative pulse switches 3TR6 on, driving the tube's cathodes via 3D12, 3D11, 3D16 (G channel) and the corresponding diodes in the other output stages. At this time the output transistors themselves are cut off by applying pulse C to their emitters via the luminance driver stage which provides inversion. Only a minute current flows in the tube and this is sampled by 3TR9 via 3R98 and 3C51 (in the case of the G channel). The amplified output from 3TR9, the black-level correction signal, charges the G – Y coupling capacitor 3C50, the charge thus set up on this capacitor determining the standing voltage at the tube's cathode. We thus have a control loop which holds the black level at the exact gun cut-off point regardless of tube ageing or tolerances. This correction circuit will also cancel the effect of varying the first anode voltages, so adjustment of the first anode presets has no effect on the grey scale – until the auto-grey scale system runs out of road! In fact the first anode presets are set up to give "central" operation of the correction system, indicated by the presence of 30V across the relevant RGB output transistor's collector load resistor. Any remaining imbalance between the three guns can be corrected by offsetting the cut-off balance controls – 3R91 in the G channel and 3R105 in the B channel – from their nominal centre positions.

So much for the principle, now for the practicalities. To set up the grey scale, leave the brightness and contrast controls set for a normal picture and link 3TP12 to 3TP13 (right-hand side of the decoder panel). Using a high-impedance voltmeter, adjust the red first anode control 13R1 (c.r.t. base panel) for 30V between 3TP6 and 3TP7, the green control 13R3 for 30V between 3TP6 and 3TP8 and the blue control 13R5 for 30V between 3TP6 and 3TP9. Separate 3TP12 and 3TP13 then adjust the luminance drive controls 3R84 (R channel), 3R96 (G channel) and 3R109 (B channel) for white highlights on a monochrome display. Finally trim the cut-off balance controls 3R91 and 3R105 for truly neutral highlights. The circuit works beautifully and justifies careful setting up. If a wider range of first anode voltage adjustment is required 13R7 on the c.r.t. base panel can be changed to 680kΩ.

Whenever an R, G or B problem arises, start by checking the first anode voltages at the c.r.t. base. They should normally be at around 450V, measured with a high-impedance meter. Correct any errors here before delving into the RGB output stages where faulty potentiometers and resistors and leaky capacitors or spark gaps can upset the cathode drive voltages and result in a first class goose chase as the auto-grey scale correction circuit goes hard one way or the other in an attempt to provide correction. Tube faults can be checked in the time honoured way by interchanging the RGB drive leads, but be sure to twiddle the appropriate first anode control while testing.

If the fault proves to be in the drive circuit, check the appropriate BF422 transistor, preferably by substitution, before suspecting leakage in one of the 1N4148 diodes 3D14/15/16/17 (G channel, Fig. 2) or the corresponding diodes in the other channels. We've also had the occasional leaky coupling capacitor (3C50 etc.) and high-resistance or open-circuit resistors in the beam sampling stages (3R97/98 and the corresponding ones elsewhere):

these items are best checked with an ohmmeter or by substitution because measuring instruments tend to load these high-impedance circuits. If the problem is with green, don't forget the link to the character generator where fitted.

If all three channels are affected, check the 12V and 13V lines derived from the stabiliser chip 3IC4 and the clamp circuit 3C59/3D23 respectively. Absence of the 13V supply will probably mean that there's a fault in the auto-grey scale stage 3TR4 or that the field flyback pulses are not reaching the base of this transistor. If all's well here check 3C43 (1μF) which decouples the base of 3TR6: when this dries up it can upset the high-level pulse in the RGB collector circuits.

Field Timebase

The field timebase gives very little trouble. It consists of a TDA1270 i.c. which drives the yoke via transistors 7TR2/3. Frame jitter and intermittent EW pincushion distortion can sometimes be caused by dirty plug and socket connections on the timebase module. Severe bottom cramping or loss of the bottom half of the picture is usually due to a faulty chip or sometimes an intermittently open-circuit base-emitter junction in 7TR2 – use of freezer will generally show which.

Failure of 7TR4 or the connection of pin 6, P19 will delete the field flyback blanking pulses and drive the tube to cut-off via the auto-grey scale correction circuit. This is a useful if misleading feature when the timebase fails – no horizontal line can be burnt on to the tube's phosphor, though a revealing flash of a horizontal line is visible at the instant of switching off. If a horizontal line is continuously visible the cause will probably be a dry-joint on the convergence panel, opening the field scan circuit.

Line Generator Module

The small line generator module rides piggy-back on the i.f. module. It consists of a TBA950 i.c. and associated components and is again quite reliable. Intermittent loss of line drive can usually be cured by cleaning and lubricating the pins of this module. Line speed variations are usually due to the timing capacitor 2C3 (0·01μF). A couple of modifications can be carried out to give better operation with a VCR: to enable the chip to cope with the non-standard vision/sync ratios produced by some machines change 2R1 to 4·7MΩ; to minimise top jitter in the freeze-frame mode reduce 2C2 to 0·01μF.

Audio Amplifier

The sound quality with these sets is excellent: the audio output circuit drives up to 6·5W into a small but wide-range, high-quality loudspeaker which is mounted in a sealed pressure chamber. The amplifier's response is tailored to the loudspeaker's characteristics and is adjustable by means of separate drawer mounted bass and treble controls. The output stage operates from a 150V line. The only breakdowns we've had have been due to the output transistors: the 47Ω safety resistor 10R10 then goes open-circuit.

The Power Supply

The power supply circuit is shown in Fig. 3. An understanding of its operation is essential for effective fault-binding in this chassis. Diodes 5D3/4 along with thyristors 5SCR1/2 form a full-wave bridge rectifier circuit whose output depends on the timing of the triggering pulses applied to the gates of the thyristors. These triggering pulses are also derived from the mains input, via the bridge rectifier circuit formed by 5D1/2/3/4. Waveform A in Fig. 3 shows the 100Hz output pulses produced by this bridge: these are phase-shifted by 5R19/5C6/5R20 and clipped by zener diode 5D6 – see waveform B. 5C7 and 5R21 then provide differentiation, as a result of which a positive-going pulse with an exponential decay – waveform C – is produced for application to the base of 5TR3. This pnp transistor can conduct only when its base voltage falls below the voltage at its emitter, so the point at which 5TR3 conducts during each cycle of operation is determined by its emitter voltage. At some time during the negative-going ramp 5TR3 will conduct, producing a positive-going pulse at its collector – waveform D. The sharp positive-going flank is passed via the coupling/differentiating capacitor 5C9 to the gates of the thyristors, which conduct on alternate positive-going excusions of the mains waveform. The reservoir capacitor 5C3 is thus charged to a voltage dependent on 5TR3's emitter potential. When the voltage across 5C10 rises, so the regulated h.t. voltage will rise, and vice versa: the time-constant provided by 5R24/5C10 gives a soft-start action.

The voltage across 5C10 is set by 5TR4/5, with 5TR5 acting as a comparator – its base voltage is held stable by the 32·5V zener diode 5D9 (actually a ZTK33B i.c.) while its emitter senses the h.t. voltage via the precision potential divider 5R5/6. Compensation for mains voltage variations is provided by 5R26.

The 164V supply produced across 5C3 contains a considerable 100Hz ripple which is eliminated by the active filter 5TR1/2/0TR1. The d.c. feedback from the 148V line via 5R12 is arranged so that the effective source impedance so far as the line output stage is concerned is 30Ω.

The protection circuit also operates at 5TR3's emitter. In the event of a short-circuit across the 148V line 5D13's cathode will be earthed. The diode will thus clamp 5TR3's emitter at chassis potential. As a result there will be no trigger pulses and a virtually dead set. The other protective operations result in a pumping action which is invoked by 5TR6. In the event of excessive h.t., 5TR8 will conduct: its base voltage is held at 32·5V by 5D9 while its emitter senses the 148V line via the precision potential divider 5R37/8/9. When 5TR8 conducts 5TR6 in turn switches on, reducing the voltage at the emitter of 5TR3. If the h.t. line is heavily loaded the voltage at the base of 5TR7 falls, again switching on 5TR6. To prevent this happening at switch-on (zero h.t. voltage) a delay is provided by the charging circuit 5C12/5R31. To override the protection circuit, link 5TP1 to hold 5TR6 off – preferably with a variac as the supply source to avoid possible damage.

If you're faced with a dead set whose fuses are intact, start by making a cold check on the h.t. line, say at the collector of the line output transistor, to see whether a short-circuit is present. The fault will often be found to be in the line output stage (we'll come to that later) and a fruitless session in the power supply will thus be avoided. If there's no short-circuit and overriding the protection circuit by means of 5TP1 has no effect, check whether 5D6 is short-circuit and 5D7/5TR3 for leakage. If any of these prove faulty the cause – would you believe?! – could be insulation breakdown in the e.h.t. lead.

A dead set with the mains fuse(s) violently blown usually means that one or more of bridge rectifiers 5D1-4 has gone short-circuit, with the odds heavily on 5D3/4. Their repeated failure can be due to a "spiky" mains supply, in which case fit an RS suppressor type 238-615 across each of them. The thyristors can also suffer from mains transients but will not necessarily go short-circuit as a result: connecting an 0·001μF, 5kV ceramic capacitor across each of them will help. The only other cause of a shattered mains fuse we've come across is 5C3 short-circuit.

A prolific troublemaker in the primary supply circuit is the dual choke 5L1. It can develop short-circuit turns which place a stress of 5D3/4 and the thyristors but far more common is a persistent buzz which, in theory anyway, can be cured by replacement.

A heavy 100Hz ripple on the raster should lead to a check on 5C3, then on the transistors in the active filter circuit for leakage. If the ripple is at 50Hz (single bulge travelling vertically over the picture) the cause will be one of the thyristors.

Now to faults in the drive and regulator areas of the power supply. Intermittent failure to start, or shutdown whilst running, can be due to dry-joints at 5C9. Low h.t. voltage, perhaps improving with time, has been traced to 5C10 failing to form properly. Poor regulation, sometimes leading to pumping, can be caused by 5D9 or – surprisingly – by 5R18 going high in value. If these items prove to be o.k., check the high-value resistors in 5TR1's base circuit, especially if 0TR1 runs hot or frequently fails. The protection transistors 5TR6/7/8 are often suspected but in our experience are seldom faulty, though leakage in them and in 5D12 and 5D13 is not unknown.

The pumping symptom usually indicates a fault elsewhere in the set, and much time can be saved by carefully studying the symptoms, via the screen and the loudspeaker, on each pump cycle. If for instance a burst of sound and a flash of picture keep popping up it's likely that the over-voltage protection circuit is coming into action – only an oscilloscope is fast enough to indicate the peak voltage on each rise of the h.t. line.

Line Output Stage

Since the line output stage is quite conventional we won't launch into a circuit description. It uses a diode-split line output transformer, a high-level EW diode modulator circuit and provides 16V and 37V lines for use elsewhere in the set.

Let's start by considering the dead set story referred to earlier, i.e. due to a short-circuit across the 148V line. The culprit is usually the BU208 line output transistor 0TR2, and in our experience replacing this should be the end of the matter provided the h.t. and e.h.t. voltages are correct. If necessary check the h.t. decoupler 6C11 (0·39μF). Another common cause of no results is a short-circuit EW modulator diode, 6D4 (BY223). When this diode goes short-circuit its companion 6D5 usually survives but the EW driver transistor 6TR6 (BD235) is almost always ruined. It lives way down at the bottom of the line deflection panel.

We're not finished yet with the pincushion correction circuit. The core of the EW transformer 6T3 consists of two ferrite U-pieces which tend to part company. Under these circumstances the raster takes on the peculiar shape shown in Fig. 4. A drop of Superglue on the end faces of the offending limbs will put this one right but before

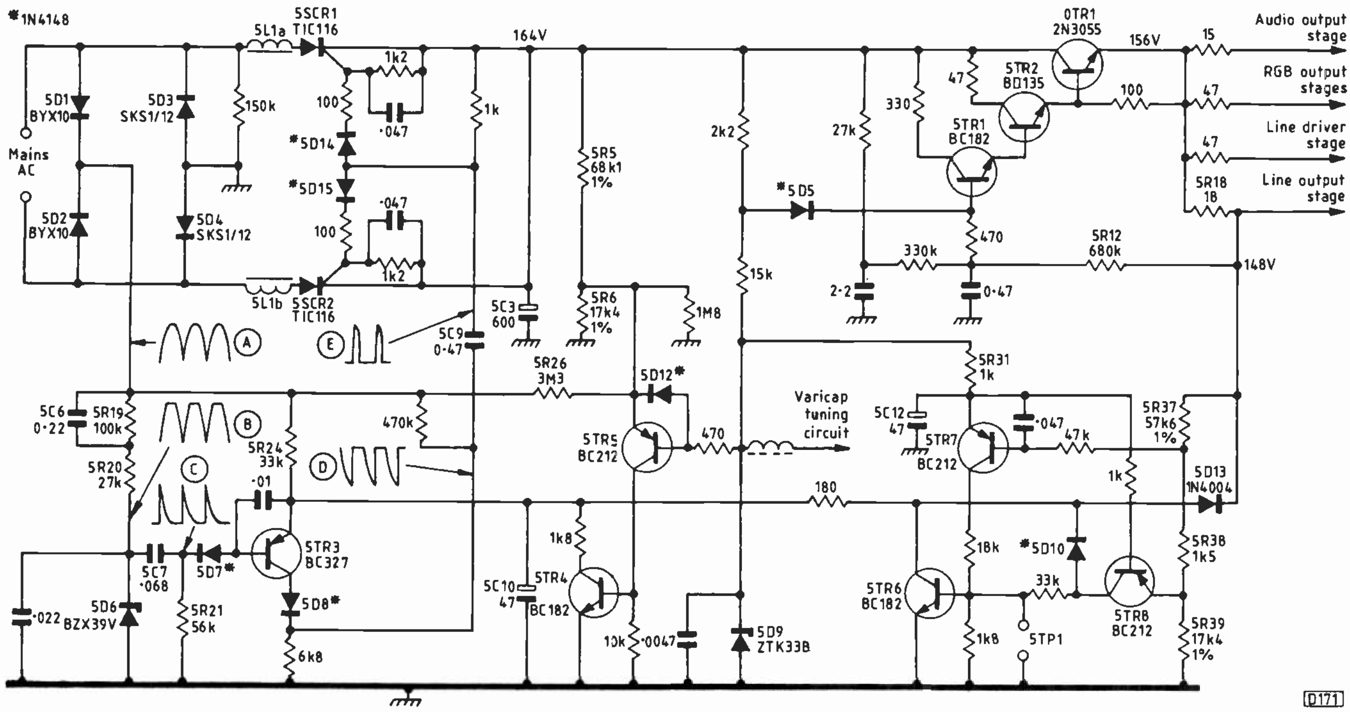

Fig. 3: The full-wave thyristor regulated power supply circuit.

glueing up make sure that the gapping spacers (in practice snippets of 32 s.w.g. wire) are in place. If a set has been running for long with the core of 6T3 apart its windings will have overheated and broken down: if the transformer looks suspect, replace it.

Another wound component that frequently offends is the double-wound line linearity coil 6L5 – incidentally it's not intended to be adjusted, the three-way switch 6S1 setting the linearity. Apart from the occasional dry-joint at its pins 6L5 is fine electrically. The trouble is that it often emits an excruciating whistle (beating 5L1's buzz hands down). The best cure is an application of white wood glue rubbed well in amongst the windings.

Apart from rare failure of the l.t. rectifiers 6D8 and 6D9 there are no other common offenders on this panel. The screened e.h.t. lead can break down intermittently however, with the nasty consequences in the power supply previously described. Trouble with this lead assembly also gives rise to various puzzling symptoms, the chief one of which is a tendency to pump at odd times. The same effect can be caused by a dirty or faulty focus spark gap (13G1): sometimes the spark gap will "grumble", giving sporadic horizontal black lines across the screen. A word of warning on removing the e.h.t. lead from the diode-split line output transformer: ensure that the other end is off the tube (or that the tube is discharged) to prevent a nasty bite as the cap comes out of the transformer – and beware of leaving the barbed clip in the transformer.

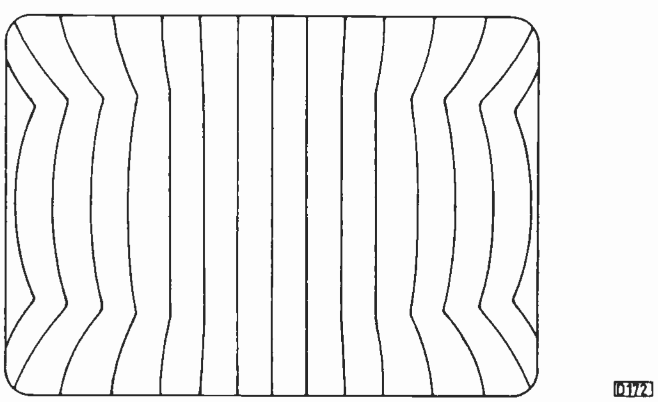

Fig. 4: The strange raster shape that results from loss of inductance in the EW transformer 6T3.

Convergence Module

The convergence module is quite reliable, with only the occasional dry-joint to cause complete or partial loss of one or other scan function. If you get a pyramid shaped raster, one of the line scan yoke feed resistors 8R1 or 8R3 will be open-circuit. Resistors manufactured by VTM are suspect in these positions and should be replaced with components of another make – they are 1·8Ω, 3W types. Some models differ in this area, with the addition of an adjustable horizontal parabola transformer (8L4). Sometimes poor lead dressing results in wires coming into contact with hot wire-wound resistors: the result, once the insulation has burnt through, is intermittent convergence problems or power supply pumping due to a short-circuited pulse feed from the line output transformer.

Miscellaneous Items

In models with remote control the remote power supply panel replaces the mains input module. It contains a simple power supply for the remote control receiver and decoder panels. The mains transformer has a tendency to become dry-jointed to the panel, leading to complete failure of the set with the standby LED out.

A retrofit teletext kit is available for this range of models, but in our opinion it's not worth fitting this. The tuner and the i.f. bandpass filter are not well suited to text operation, and data corruption is common unless the r.f. input signal is impeccable. Further, the class A RGB output stages cannot do full justice to steep-sided data drive pulses. In addition, the teletext panel is expensive and is complicated to fit!

Teletopics

UK DBS PROJECT COLLAPSES

Hopes of a start to a DBS TV service for the UK have been put back indefinitely with the collapse of the consortium of 21 (the BBC, the fifteen ITV companies and five non-broadcasting firms) project. The Home Secretary was formally notified by the consortium on June 21st that it had decided to abandon the project: the decision by the members was unanimous. Some £250,000 had been spent by the consortium on investigating the project's commercial viability. The conclusion reached was that the project was not economically feasible under the terms laid down by the government.

Factors that contributed to the decision included the cost of a satellite service from the government's chosen supplier Unisat and uncertainty amongst broadcasters as a result of the setting up of the Peacock Committee to inquire into ways of financing the BBC – the independent companies feel that their finances could be adversely affected should the committee recommend that the BBC carries advertising. For its part the BBC failed to get the full licence fee it had requested earlier this year and was finally infuriated by the government's decision to licence TV reception from low- and medium-power satellite transponders.

The consortium had spent a year or so seeking a way of getting the proposed DBS service started. It's a sad end to these efforts, though it's not likely to be the end of the UK DBS story.

Further information on licences for satellite TV reception is given in Roger Bunney's column this month. Our initial comments last month were misleading in saying that "planning permission to erect a dish aerial of any size" would be required. What we meant was any fairly large size: it seems that planning permission is in general required only for a dish of one metre or more diameter – additional regulations may apply in conservation areas etc. Guidance on the acceptability of SMATV installations can be obtained from the Cable Authority, Gillingham House, 38-44 Gillingham Street, London SW1V 1HU.

At the recent trade shows Salora demonstrated a full satellite receiving system for the reception of TV transmissions from the Intelsat and Eutelsat satellites. The package comes at some £1,500 and will be supplied initially to dealers for demonstration purposes.

TEN IN LIQUIDATION

TEN – The Movie Channel was put into liquidation earlier this month, on June 5th. It had been in difficulties for some months, with a falling number of subscribers: losses since TEN went live in March 1984 amounted to £6·1m. Two of the UK shareholders had sought to keep the service going but it appears that the US interests decided on liquidation. Since the end of the service Robert Maxwell, who had interests in TEN through Rediffusion and Pergamon Press, has been providing the Mirrorvision film channel instead.

Another of the original eleven cable TV franchisees, Windsor Television, has decided to go ahead. Cable laying is expected to start next month, with a ten-channel service starting in October. The original plans have been considerably modified however: there are now to be two separate services, an entertainment service for domestic subscribers and a quite different service concentrating on data storage, security, building services control etc. for business subscribers.

The Cable Authority has invited applications for franchises in the following five areas: Cardiff/Penarth; central Lancashire (Preston/Leyland/Chorley); Edinburgh; the London borough of Camden; Southampton/Eastleigh. Applications are due by September 30th. The areas involved together have some 565,000 households. In making the announcement the Cable Authority's director general Jon Davey said there are clear indications that the prospects for cable TV in the UK are improving.

ENHANCED C-MAC

The IBA's Enhanced C-MAC system was demonstrated in public for the first time during the Montreux Television Technical Symposium on June 8-12th. It's the only fully-compatible system capable of providing wide-screen (5:3 aspect ratio instead of 4:3) pictures in a standard DBS channel to take full advantage of the types of display devices and digital signal-processing systems likely to become available at economic prices up to the end of the century. The theory of Enhanced MAC was revealed by the IBA in 1982 though it wasn't until late 1984 that a fully engineered prototype system was produced at the IBA's Winchester Engineering Centre. The system is compatible in that it can be received by 625-line sets capable of C-MAC signal reception. The additional picture information for the wider display uses some of the data space employed in standard C-MAC for up to eight sound and/or data channels, leaving sufficient capacity for stereo sound. The extra resolution provided by the basic MAC system and the additional picture width are intended to provide home pictures that compare well with high-quality 35mm cine film. An interesting feature of Enhanced C-MAC is that a standard receiver could be made to pan across the full width of the transmitted picture to enable the centre of interest to be followed.

Speaking at the Montreux Television Technical Symposium Tom Robson, the IBA's Director of Engineering, commented that it would be wrong to choose an international high-definition television standard that would be more suitable for electronic cinematography. The reference was to large screen displays with 1,000 or more lines. These, he suggested, would be excessively costly for both manufacturers and viewers. His view on high-definition TV is that it "will be in every home at some time in the future, though I can't see it happening in less than twenty years, possibly longer."

WORRYING ABOUT THE FUTURE

One thing that Sony and Matsushita have in common is that they are both more dependent on the consumer electronics field than other Japanese electronics manufacturers. Both have been expressing concern at the fact that the domestic electronics market is becoming a mature one, i.e. one with reduced potential for increased production and sales. The obvious solution is to concentrate more on allied fields. Sony is implementing a programme to increase the proportion of its non-consumer electronics sales from the present 13·6 per cent of total production to 50 per cent by 1990. Matsushita has started to implement a campaign called Action 86, which is expected to give the firm a much stronger presence in the fields of component manufacturing and industrial electronics by November

1986 – the target is that these fields should by then account for 40 per cent of total production.

This is all very well but there are of course already many firms active in these fields and if everyone goes for the same market something rather nasty could occur. One thing is certain: with Japanese electronics manufacturers looking for every possible market competition throughout the electronics industry will become increasingly intense.

NEW UK TV PLANT

Tatung's new 400,000 square foot factory at Telford, Shropshire was officially opened on July 12th. The 40-acre factory site replaces the Bridgnorth premises that Tatung acquired with the take over of the Decca consumer electronics interests four years ago. The plant has an initial production capacity of 200,000 TV sets a year, with plenty of room for expansion, and employs a Japanese Hirata production line system arranged to move materials from one floor to exactly the right point on the assembly line on another floor. In addition to Tatung and Decca sets, receivers are being produced for GEC, Granada, Akai and Tandy and monitors for IBM. The Einstein personal computer is also in production at the new plant, which is some ten miles from the old Bridgnorth factory.

VCR TARIFF TO RISE?

The European Commission has proposed that, following the end of the three-year EEC/Japanese VCR import limitation agreement at the end of this year, the tariff on VCRs imported into the EEC should be raised from the present eight per cent to 14 per cent. This would cost consumers some £390 million a year: the aim is to help European consumer electronics goods manufacturers to meet the severe competition expected from far east manufacturers – the main pressure for an increase has come from Philips and Thomson. Under GATT international trade regulations tariff increases should be matched by compensatory tariff decreases: the Commission has proposed decreases in the tariffs levied on semiconductor devices, electronic calculators, magnetic tapes and films and alarm clocks. The proposals must be agreed by Community ministers before the Commission can enter into negotiations with GATT.

FLINTDOWN PHOTO-VIDEO SERVICES

Following a successful pilot scheme, Flintdown Channel Five (Montauban Chambers, 339 Clifton Drive South, Lytham St. Annes, Lancs FY8 1LP) are now offering their home movie to video cassette transfer service to colour film labs and photographic dealers. An overnight service is available to trade customers: all gauges of film, slides and still photographs can be handled, giving high-quality results on either VHS, Betamax or U-matic cassettes. The company uses broadcast television telecine equipment and also has a digital transcoding service to convert NTSC recordings to the PAL standard. In addition Flintdown has a fast duplication facility for customers who require a number of copies from an original tape.

KODAK ANNOUNCES STEREO 8mm VIDEOS

The Eastman Kodak Company of Rochester, USA has anounced an 8mm stereo VCR that will record up to eight programmes over three weeks or twelve hours of digital stereo sound. The system comprises the MVS5000 8mm VCR and MVS380 stereo tuner/timer. The VCR has standard and long-play modes, the latter providing a four hour record/playback time using the new Kodak P6-120 8mm tape. Kodak officials say that the system will be released in Canada and the USA later this year: there are at present no plans to make it available in other countries.

Kodak have also announced the T120 and L750 hi-fi video tapes, in the VHS and Beta formats respectively. There is also a new head cleaning kit for half-inch VCRs.

VCR SUPPORT BRACKETS

New VCR support brackets introduced by Dalen (Birmingham) Ltd. of 123 Woodcock Lane North, Acocks Green, Birmingham B27 6SE offer a cost-effective method of supporting VCRs. The brackets are made of heavy-duty plastic to a registered design and simply clip on the rectangular cross-rail that is a part of most TV stands. The brackets are available in several sizes and colours, the weight of the VCR clamping them to the cross-rail.

GRUNDIG ENDS V2000 PRODUCTION

Production of V2000 system VCRs at Grundig's Nuremberg factory has come to an end. In future the plant will be producing VHS machines only – it expects to produce over 550,000 of these in the current year. Stocks of V2000 Grundig machines stand at around 130,000 and are expected to move slowly. The only plant still producing V2000 machines is the Philips factory in Vienna – Philips remains committed to the system, which still has strong support in some European markets.

VIDEO NASTIES BILL

The Video Recordings Act, under which all new video recordings must be classified – and old ones after a period of three years – comes into effect on September 1st. Under the act anyone supplying uncertified tapes will face a fine of up to £20,000. In addition a maximum penalty of £2,000 is stipulated for anyone supplying material classified as adult to a minor. The video classifications will be basically the same as those used for cinema films, though there's to be an extra category for cassettes particularly suitable for children. The Home Secretary, in announcing his plans, commented that in classifying existing tapes priority would be given to those that have already caused concern.

NEWS FROM THOMSON

In addition to a range of TV sets Heron Electronics is now distributing Thomson video equipment in the UK. The initial products are two VHS machines, models V320 and V323, and the CVM 01P Videomovie camcorder.

Thomson Semiconductor of Grenoble is developing a TV receiver chip that combines the functions of tuner and i.f., chroma decoder, video processor, bus interface and the timebase generators. It's expected to be available in a couple of years time. A set of seven mixed linear/digital i.c.s for TV receivers is to be brought out shortly.

An economy drive in Thomson's TV plants, which are located in France, W. Germany, Italy and Spain, has been announced. At present the plants have a labour force of some 10,000. The Videocolour tube plant in Italy and the consumer products research and development laboratories at Angers in the Loire Valley are also being reviewed. Much of the R and D work is to be transferred to Thomson's laboratories at Villigen in W. Germany. The state-owned French group hopes to break even this year following the rationalisation measures.

Initial VCR Checks

William G. Lockitt

When a VCR comes into the workshop you can't be certain, until a few quick checks have been made, that it's safe to insert a tape. A few moments spent checking the deck and operating the machine without a tape can save a lot of time and expense. The notes below outline a few checks to make when tackling any type of machine. It's obviously only a general guide: different machines will call for different specific checks, e.g. different sensing arrangements – light or magnetic – etc.

Before inserting a tape, proceed as follows.

If everything appears to be o.k., apply the mains supply. Check the operation in the E-E mode, the clock display, tuning. If it's not a front loader, press eject.

Remove the top cover and carry out a visual inspection around the tape deck. Keep an eye out for hairpins, small toys etc. Check the guides for dirt and signs of liquid spillage.

Next, override the tape sensors. How this is done will vary depending on the machine. It's usually just a matter of one or two switches plus a bulb or LED. Press play, rewind, fast forward, cue, review, etc. If all operate correctly check that the sensors are working normally. Slow down the tape spools, remove the tape sensor overrides, hold back or push forward the tape tension arm, etc. The checks will vary from machine to machine.

Next take a closer look at the loading operation. Still without a tape inserted, press play. Several things should happen. (1) The head and loading motors should both start together. (2) When loading is complete, check the tension arm: the pressure roller should be engaged and the capstan and take-up reel should start to rotate.

What if any of these things fail to happen? If the head doesn't rotate (or is not sensed to be rotating) the machine should stop immediately. If spool rotation is not being sensed the machine should stop after approximately five seconds. If the pressure roller doesn't engage, most machines will immediately stop.

Insert Tape

If the checks have proved that everything is o.k. up to now it should be safe to insert a tape and check the playback/record operation of the machine.

If the machine hasn't loaded fully or the tape tension arm sticks the reproduction will be very poor. This may look like a tracking error.

You might find no picture or a noisy picture with the sound o.k. If a noisy picture appears the playback circuit must be working: it's likely that the heads are worn or dirty. Some TV sets give no sound when there's no picture, i.e. sound muting if a video signal is not detected, so check this.

The likely cause of the no or weak sound, picture o.k. symptom is a worn, dirty or badly aligned audio head.

For flashing on the picture check the tape for damage, also the picture via loop through. If the sound is o.k. the problem will probably lie in the drum servo. If the sound is defective check the capstan servo.

Checking the above points in sequence will save you a lot of time and money in the long run.

Reliability Factors

Malcolm Burrell

Being engaged not only in servicing but also in trying from time to time to design items of equipment to help in the quest I found myself pondering over an interesting question. You see, it's no use designing say a pattern generator that works beautifully when sprawled across the bench with the hot sun streaming through the window if it needs constant readjustment when the sun goes down and it's fitted into a case. No, it must work consistently whether it sits in a hot, dusty corner of the workshop, over the heating boiler, or when it's dragged into a customer's house after spending the night in a frost-covered car.

Environmental Factors

Apart from being a well-known cause of breakdowns in capacitors, especially when they've been under-rated for reasons of economy, heat has been a major cause of poor reliability ever since the days of the all-valved set. The use of switch-mode power supplies in modern sets reduces the power consumption and makes better use of the power that is consumed. No more dropper resistors to simply dissipate power, producing heat that flows out of the rear cover vents after drying up all the electrolytics in its path and scorching the boards as well. Nevertheless semiconductor devices remain susceptible to even minor temperature changes which can be very difficult to measure. Many intermittent faults caused by power transistors are undoubtedly due to this – such faults may not show up unless the receiver is boxed up and running in a hot place. A high ambient temperature is very different from the localised heat applied when using a hairdryer or soldering iron, and heat variations across a few inches of printed circuit board are not unknown. Thermocouple effects can occur where dissimilar metals are joined, often within components, and temperature gradients occur across resistors.

Humidity and oxidation also cause trouble, not only in the obvious case of switch contacts but also within components. How often have you removed an intermittent field output transistor, such as a TIP31 with plastic encapsulation, only to find that one leg has been left embedded in the board? Was the internal connection faulty when the device was made; was it caused by rough handling when the board was assembled; did moisture penetrate the encapsulation, causing corrosion of the joint; or was excessive heat generated? Would it be correct to assume that such devices are expected to deteriorate with age, sometimes accidentally succumbing at an earlier stage? In the Grundig 5010 series for example the field output transistors live on heatsinks at the top of the chassis which, being vertical, means that they are in the path of the heat rising from beneath. Failure in this case is common. Would these transistors have survived better if mounted lower down?

Here's another example. The heatsinks on the timebase panel in the Philips G8 chassis get pretty warm in free air, but have you ever dived inside a set that's been operating for a few hours in the corner of a hot room? Heatsinks work satisfactorily when they can pass the heat generated by the transistor or i.c. to the outside environment, but if the airflow is restricted the temperature within the set begins to approach that generated by the components themselves and as time passes the effect of any heatsink used is reduced. In some cases one can say that a heatsink simply delays the overheating of the component attached to it till the set warms up!

Contact Effects

Potentiometers produce heat as a result of the current they pass. Some of the miniature presets used in modern circuits are rated at only 0·1W. A mistake I made many years ago was to replace a 100kΩ linear brightness control in a valve receiver with a log type simply because it was to hand. Some days later a colleague had to replace its charred remains with the correct type. Now the power rating of a standard carbon linear potentiometer is about 0·4W but for a log type the rating is about half this, a point I'd not considered until I was called a few well-chosen names.

Potentiometers are undesirable items first because of their moving contact surfaces (more on this in a moment) and secondly because the actual contact area between the carbon track and the slider is very small. In a.c. applications this is not always a problem, but where d.c. is concerned we have a current path that can produce a small, localised temperature rise. There are two reasons for their use. First to provide an external variable control for the user: controls such as contrast, volume and brightness which are relatively harmless. Secondly to enable component tolerances and ageing to be catered for, e.g. hold and linearity controls. The setmaker cannot individually select the right resistor to balance the operation of a field output stage for example. The preset potentiometer is ideal for this purpose, but as time passes the control can become a source of intermittency and can even end up by destroying the output pair.

We can make our lives easier for ourselves at the design stage, first by ensuring that the potentiometer is adequately rated and secondly by examining the operation of the circuit under different conditions to ascertain the variable resistance needed for the purpose. Say we have a circuit that starts off with a 10kΩ potentiometer in series with a 10kΩ fixed resistor. If the adjustment range required is only 2·5kΩ we could use this instead with appropriate series resistors. Using a 2·5kΩ preset of the same size, e.g. one rated at 0·1W, we have in effect increased its rating since it's now 2·5kΩ at 0·1W instead of 10kΩ at 0·1W. More importantly the area of track covered by the slider contact has only a quarter of the resistance we had with the 10kΩ potentiometer, which means that less heat is generated. In addition the effective adjustment range, or "feel" of the control when rotated, is improved: for example if we're trying to adjust the field linearity the correct picture geometry may lie within 60° instead of just 15° of the total range of rotation.

Oxidation forms a "skin" on the surface of metal. The result of this is poor contact, i.e. resistance and the generation of heat. The localised heat thus produced may aggravate the problem further. Potentiometers are particularly prone to this trouble: oxidation occurs between the movable wiper and the track. Dismantling a volume control and thoroughly cleaning the surfaces will generally cure noisy operation, which is usually attributed to the track, despite the fact that the track may have ridges worn in it.

Press-button tuner assemblies, particularly the types used in some Decca sets and the GEC C2110 series, suffer from intermittency mainly due to the spring contact that touches the multiturn potentiometer's shaft when the button is pressed. Rotation of the button may restore the signal momentarily, leading to condemnation of the presets when a good scrape and smear with silicone grease is in most cases all that's required without having to dismantle the assembly. I've only once found a unit where the carbon tracks were worn away.

Dry-joints are another problem. An improperly tinned component lead that's badly soldered can give trouble years after the set was made. Some joints are worse than others, but it's always worth removing surplus solder from suspect joints, then scraping the leads clean and resoldering them. Connections that carry large pulses are vulnerable, particularly the leadouts from line output transformers and transductors. Hot components such as large wirewound resistors may need to be mounted farther off the board, on ceramic spacers: extending the leadout wires over as much print as possible will reduce the resistance at any given point and provide heat distribution.

Costs

We are constantly reminded of the need to be cost conscious, but it's not always easy to cost service work from the long-term point of view. If we merely repair the reported fault and turn a blind eye to the latent faults that stare us in the face we can end up wasting a lot of money – in terms of both labour and component costs. If there's an art in running a service department, it's in knowing what's worth doing and what isn't.

Alternative Approaches to TV Servicing: Tackling the ITT CVC20 Series

S. Simon

Servicing the ITT CVC20 chassis and its derivatives the CVC25/30/32 can at times be a positive headache. The first points to appreciate are that a switch-mode power supply is used and that this shuts down in the event of an overload. No resetting is necessary: normal supplies will be restored when the cause of the overload has been removed. In the presence of an overload the power supply will trip a few times and then lapse into silence.

If the complaint is "no results" or "a dead set" the first step to take is to switch the set on and listen very carefully to what it has to tell you. If it says tick, tick, tick you must proceed on the assumption that an overload is present. The chances are that the fault is in the line timebase, usually the output stage.

Set Tripping

Remove the side screws to allow the chassis to be hinged down. Remove the metal screen which covers the right side (top cover) by sliding it out of its catches – only slight movement is required – and lift it off. Note the position of the BU208 line output transistor, at the top. Also note the screws that retain it. Of the two, the farther one completes the circuit to the transistor. Thus if this contact is removed and the h.t. is then restored you know that the fault lies in the line output stage.

If this is so, take advantage of the fact that the BU208 is already disconnected and check it with an ohmmeter switched to a high-resistance range. Apply the red probe to the base or emitter and the black probe to the disconnected collector (body). Any reading proves that the transistor is faulty and a replacement should be fitted.

At this point we should mention that a frequent trouble spot here can be difficult to trace as it may be intermittent. We refer to the small line output transistor panel, where a dry-joint may be present on the reverse side, on the contact to the collector's washer. Check the red lead for good contact to the tab washer. It's best to check the reverse side when the base-emitter contacts have been freed, as they have to be if the transistor is to be replaced. When you've fitted a new transistor, checked the goodness of the collector contact and resoldered the base-emitter pegs, make a resistance check on all the diodes in the line output stage to make sure that none of them are short-circuit. Do this before you switch on. Then remove the lead from the line output transformer to the tripler and leave it well clear.

The set can now be switched on. Evidence of sound should be heard if the volume control is advanced and the set is in working order and a neon screwdriver advanced in the vicinity of the line output transformer should light. If this is so, switch off and replace the lead to the tripler. When the set is switched on the presence of e.h.t. should be heard and the neon should again light when brought near the transformer. If there's no sign of life and the tripping starts again switch off immediately and fit a new tripler.

If you get tripping with the tripler disconnected you know that an overload is still present and indeed it could well be that this is what killed the BU208 in the first place. Switch off before you get a repeat performance. Check the diodes again carefully and ensure that there are no shorts across the transformer's secondary windings. If all is clear suspect the line output transformer and fit a replacement, once more leaving the tripler disconnected. This is because it's common for the tripler to fail initially, damaging the transformer and the BU208. The tripler should be reconnected only after the set has shown its willingness to work. You can then switch on with one finger on the on/off switch to switch off immediately if there are any signs of distress.

Alternative Approaches

What alternative approaches can or could be used? The only one I can think of is to use a transformer tester to clear this item of suspicion and thus save a considerable amount of time and frustration, i.e. no change after fitting a new transformer. Apart from the items so far mentioned (including the diodes) one or two of the capacitors in the line output stage are liable to go short-circuit. This possibility should be checked, disconnecting one end completely for a conclusive test. Trying to test capacitors in circuit is in most cases a pretty useless exercise.

Dead Set – Not Tripping

If the dead set is not tripping the more methodical approach must be used, bearing in mind the fact that the chassis is live at all times, that the mains input goes to a bridge rectifier via two series-connected 2·4Ω resistors (R77 and R78), that the bridge's positive output is connected to chassis via a 2A fuse and that the negative output stands at −320V which is present at many points on the bottom right power supply panel including the emitter of the BSX21 chopper driver transistor T10 and the base and emitter of the BU126 chopper transistor itself (T11). The moral is, don't expect to find the 125V h.t. (160V in the CVC30 etc.) at the chopper transistor or the preceding circuitry. You find it (hopefully) at the cathode side of D18 (D19 in the CVC30/32), i.e. the positive side of C51 and C52. After the chopper has chopped so to speak.

Once these points have been digested, normal fault-finding procedures can be followed, i.e. check the mains voltage input to the bridge, check the negative to chassis output from the bridge (fuse intact?), and ensure that the −320V is reaching the emitter of the BU126 (its 1Ω emitter resistor could well be open-circuit).

If these points are in order, switch off and carry out a cold check on the BU126 and the BSX21 transistors. Also check the value of the BSX21's base bias resistor R80 (should be 150kΩ). Ensure that the presets on the chopper control panel have not been tampered with (set midway if in doubt). Check diodes D14 and D20 and ensure that R7 has not sprung (D15, D21 and R89 respectively in the CVC30 etc.). If all seems to be in order it's likely that there's a fault on the control panel. If the diodes are o.k. IC801 (TDA2640) is probably at fault. Check it by substitution. If you can't find anything amiss in the power supply, switch on again and listen more carefully for the tripping.

Signal Troubles

All too often one spends quite a lot of time (and money) overcoming the initial faults (line output stage etc.) only to find that there's a signal fault when the aerial is connected. The picture may be faint, perhaps difficult to discern at all, with the contrast control having no effect.

If this condition is met – and it's a common one – waste no time checking through the i.f. stages etc. Look at the upper left side and locate the two transistors in the beam limiter circuit, T1 and T2. T1 is a BC172 npn transistor, T2 a BC252 pnp transistor. Check them both very carefully, replacing whichever is found to be faulty. A replacement may not clear the trouble. In this case look for D3 (1N4148) which is in series with T1's emitter though it's situated way over on the right-hand side, roughly half way up (or down . . .). It will often be found short-circuit, and this may well have contributed to the demise of T1 or T2. A word of caution. This condition does not affect the sound which remains normal. If the sound is affected and/or the picture is grainy, stay with the tuner, a.g.c. and i.f. sections.

Pincushion Distortion

Here's another problem. When a repair has (you think) been completed and you get a picture for the first time you may well find that it's severely distorted, with the sides bowing in towards the centre. The cause is lack of EW correction. This is quite common and when faced with this condition we don't check the entire circuit through thoroughly, we tend to suspect immediately the EW modulator driver transistor T17 (BD233) – CVC20 chassis. Experience has shown that this is the weak point and that removing the small panel at the top right and checking the components on it is only occasionally necessary. We normally keep a quantity of BD131 transistors in stock for use in other receivers and find that they make a good substitute for the BD233.

The EW modulator diodes D23 and D24 (MR854 and BYX71-350 respectively) should not escape attention but as they tend to go short-circuit rather than open-circuit a defect here is likely to be more obvious – line output transformer loading and power supply tripping.

Having said all this we must hasten to admit that we have now and again found troubles on the small panel: if the BD233 proclaims its innocence, the small subpanel should be investigated. To do this, remove the main line output stage screening cover and spring off the nylon catch, removing the panel to avoid misleading readings.

On the CVC30 etc. the EW driver transistor is T13 (BD238) while the modulator diodes are D24 (BY223) and D25 (BYX55-600).

Field Collapse

There are considerable differences between the field timebase circuits used in the CVC20 and CVC30 series chassis. The following notes relate to the CVC20.

In the event of field collapse, i.e. a horizontal white line across the screen, look for R68 at the top of the main panel and confirm that there is 24V at both ends. It may have sprung open to denote (perhaps) an overload. Switch off and check T10 (TIP33), T9 (TIP31) and T8 (BC337). Also check diodes D8 (BY126) and D7 (BA316). If you can check these items properly your troubles will in the majority of cases be over – except for replacement of T9 or T10. They are heatsinked against the line output section and are not easy to replace as accessibility is decidedly poor.

When we say check the transistors and diodes we mean a cold check with an ohmmeter set to the low ohms range. The diodes should read low with the red probe to the cathode and the black probe to the anode, higher when the probes are reversed, depending upon circuit values. A more positive check is to disconnect one end to take the diode out of circuit, when the same low reading should be obtained one way and infinity the other. To check the transistors, bearing in mind that they are npn types, apply the black probe to the base and the red probe to the collector. The reading should be approximately 20Ω. The same reading should be obtained when the red probe is applied to the emitter. Reverse the probes and the reading should be much higher, if in circuit. The same high reading should be obtained with the probes applied to the emitter and collector. A very low reading indicates a short. If there's any doubt, remove the solder from the collector or emitter to free it from the circuit and recheck.

The Voltage Approach

An alternative method of arriving somewhere near the cause of the trouble is to leave the set on and make voltage checks. Along these lines. 24V should be present at the collector of T10. There should be 8·6V at its base and 8V at its emitter. T9 should have 7·3V at its collector, 0·6V at its base and zero volts at its emitter. If these voltage readings are obtained, check for dry-joints at the scan coil connections S9/10/11/12. Close visual examination will often reveal the source of the trouble without further checks.

In the case of the CVC30/32 this visual examination should also be carried out on the small subpanel over the scan coils. Unclip the top sides and lift the panel out. Reverse it and check the contacts. This should be one of the first checks carried out on these sets whatever the reported fault may be. The panel is not present in the CVC20.

VCR Clinic

Reports from Steve Beeching, T. Eng., Mick Dutton, Hugh Allison and Philip Blundell, Eng. Tech.

Panasonic NV7000

I've been having some trouble with a Panasonic NV7000. The customer complained that it kept stopping. Naturally it worked fine on the bench. The belts were changed and nothing was heard for some time. Then it came back with the same complaint. This time the cassette lamp was playing up so it was changed. Normal working again. The machine was given a daily soak test for three days – an E180 cassette was run from start to finish each day. There was no obvious fault but less than two weeks later the machine was back again with the same complaint. This time the customer brought it along and demonstrated the problem: the machine would play for a short period, then stop. Once the machine had warmed up it was o.k. – except that you couldn't hold it in cue or review for more than thirty seconds. It also made a funny noise like a bearing gone and the tape counter didn't rotate smoothly.

Again nothing showed up on the bench, apart from the cue/review problem, so we concentrated on this. After a long time we discovered that the auto-stop line at pin 21 of connector JE went high after about twenty seconds, shutting the machine off. All relevant diodes were checked but no source could be found for the supply that gave the high signal. After checking around the print I found that the circuit wasn't the same as that shown in the manual I was using, and after much digging around I found another version.

I rang Panasonic to ask whether they had any ideas. The chap who answered said he knew what it was – the supply reel rotation sensor. Well this had already been checked, and we'd found that its output remained low when this high appeared from nowhere. We then discussed the two types of system control circuit – the single and double board versions. "What about the alternative double-board version?" I asked. "There isn't one." "Then why have I got two circuits?" Answer, "you can't have." Come on, Panasonic!

In version one, the standard one, diodes D6041 and D6042 are connected to the control microcomputer i.c.'s B0 input (pin 21) via pins 4 and 5 of IC6004. This means that the outputs from the drum and capstan rotation detectors stop the machine via the microcomputer's B0 input. The auto-stop line is connected to the micro's stop input (pin 29). In version two the same two diodes are connected to the auto-stop line at JE21, where the error signals from the tape slack and supply reel rotation detector circuits come on to the syscon panel. Instead of going to the micro's stop input as before the signal is routed to the B0 input by using the end-sensor circuit's IC6012 via transistor Q6028 – pins 4 and 5 of IC6004 are connected to chassis.

The high that was coming on to the auto-stop line in my version-two machine was coming from transistor Q6022. This transistor is held on in playback by the capstan-lock signal. In cue the level of this signal was insufficient to hold Q6022 on. So its collector went high, taking the auto-stop line high via the diodes.

Much searching was done before the real culprit was discovered. The only voltage found to be wrong was at pin 7 of IC2004 in the capstan servo circuit. This is the capstan motor control output. It should read 2·9V but measured 2·1V and fell to about 1·9V in cue. It's also the capstan-lock signal. The capstan servo was locked and showd no signs of distress, apart from the signal at TP2011 – this wobbled quite a bit around the correct value of 5V. So the question was, why was the voltage at pin 7 of IC2004 low, the capstan-lock signal thus being low and Q6022 failing to stay on? The answer . . . oil. All that was required was a small drop of oil down the capstan motor phosphor-bronze bearing. This loosened the capstan motor – not that it felt tight. The signal at pin 7 of IC2004 then rose to 2·9V and the machine stayed happily in cue for ages.

I suppose that Panasonic will by now have found their copy of the right circuit, but even if they haven't you know that it wasn't the reel sensor! **S.B.**

Grundig VS200

This customer of ours, Wally, came in with a Grundig VS200. It wouldn't work and his electronic lock code had no effect. Full operation was naturally restored after a reset. I discussed the matter with my friend Grundig Pete who said that the customer had probably pressed the store button twice after putting in the 8500 code: this is a "quick lock" function and puts in the code 0000. Andy still reckons there's a killing to be made from customers who forget the four-digit code they've put in! **S.B.**

Hitachi VT11

There was colour break-up in the top portion of the screen with the machine's own recordings. It looked as if one of the oscillators in the colour circuitry was running out of lock during the first part of the field scan. After replacing the Y/C panel we found that the record a.f.c. detector's reservoir capacitor C257 (4·7μF) was hanging on by only one leg. **S.B.**

Sony SLC7

The complaint with this Sony SLC7 was slow running after three-four hours' playing time, usually after stop, fast forward or rewind had been selected. A new capstan motor had been fitted by the dealer who'd sent it in – he'd had the same symptoms some five weeks earlier.

When the fault appeared the tape ran slow, with sound. I also noticed squeaky sound in visual search due to the base of Q408 not being soldered. Oh, oh!, it's been got at . . . The machine worked happily for a few days, then one Monday morning the capstan wouldn't turn at all. Despite the presence of the power supply and the capstan drive voltage at pin 1 of connector CN3503 there was very little drive energy. That made two of us!

Another new motor was fitted and during this process we noticed that the main connector on the previous one hadn't been pushed fully home. This didn't clear the problem however. The servo was correctly set up whilst on test with the new motor and the original fault then reappeared. A scope check at pin 6 (error correction signal) of the capstan servo i.c. (IC2) revealed large pulses instead of a steady d.c. So this was why the capstan was running slow: the effect of the pulses was being well ironed out by the flywheel. The motor then suddenly gained speed and the servo locked.

A number of repeated stop/play operations would instigate the fault and it seemed that the capstan start system wasn't operating correctly. IC2 was changed and all went well. The machine ran on test for days but eventually came back with the same fault and I was back to square one. This time the start circuit failed only when the scope probe was connected, but how could a probe load the circuit? The answer was that diode D2 was ever so slightly leaky. I must admit that if I'd had the fault from scratch I would also have fitted a new capstan motor and returned the machine to its owner. **S.B.**

JVC HR7200/Ferguson 3V29

For months we've been plagued by this single machine that produced horizontal sets of spots on the picture. They appeared in small bands at irregular intervals down the screen: stationary, thin noise bands. At first dirt on the drum or dirty heads were blamed, but after some months we discovered that the interference didn't appear until the machine had warmed up. Pressure on the chassis removed or instigated the symptoms, which would then go away for weeks on end. Static brushes, earthing tags, joints and screws of all kinds came under scrutiny for possible intermittent earthing. A spring that earths the video preamplifier can was blamed for having become oxidised and was replaced. This cured the problem for three-four months after which it returned. The last time we had the machine there were colour drop-out problems as well and we discovered that the flywheel had been chaffing against a screened cable that's part of the colour circuit – the cable had been cut almost half way through. Could this have been the cause of the problem all along? Only this winter will tell! **S.B.**

Pye 64VR60

A common fault with this Philips made machine is that it won't accept or eject a cassette – nor thread/unthread. The cause is R3117 going open-circuit. This resistor supplies the cassette lift and threading drive i.c.s from the 11·9V line. Check for voltage on R3117 within a couple of seconds of pressing the standby button. **P.B.**

Sharp VC9300

This machine suffered intermittently from wow on sound and slight tracking noise on the picture. As my encounters with Sharp machines to date have shown that the electronics are very reliable I decided to fit a new capstan motor. No good. With the fault present both the capstan and drum servo voltages fluctuated wildly, but which servo was actually causing the fault? The nice man at Sharp suggested lifting R7714 and applying a fixed 3·3V to IC7753's input (to make the capstan run at a fixed speed) and then look for wrong waveforms.

The next time the fault appeared the sawtooth at TP1 was found to be low in amplitude on both play and record, the common link being R745 which was going high in value intermittently. Other things that can occur in this area are dry-joints around IC7753 and C738 becoming leaky. **P.B.**

Ferguson 3V39

One of these machines was brought in with the complaint "no functions". Sure enough it wouldn't switch on or accept a cassette. On removing the covers it was noticed that there was corrosion on several of the keyboard decoder i.c.'s pins. This corrosion had linked some of the pins, stopping the i.c.'s operation. **P.B.**

Ferguson 3V31

The complaint with this machine was no fast forward. There was also no forward picture search. Rewind was o.k., and as the same motor is used for both fast forward and rewind we concluded that the fault lay in the control or motor drive circuits. Motor direction is controlled by pins 2 and 3 of IC5. In fast forward pin 2 goes high as a result of which Q18 (2SC3070) switches on, earthing one side of the reel motor. Q18 proved to be faulty, though it measured perfectly on a cold test. **M.D.**

Sanyo VTC5000

This machine grew hungry and ate a tape. After we'd removed the remains and cleaned up the tape path – which had seen a lot of use – we slipped in an old tape and pressed play. The tape laced up and the head started to rotate. There was no tape take-up however. Further checks revealed that there was no supply to the reel motor, which is controlled by IC3006 (BA6209). As the supply to this i.c. was correct we decided to replace it. This provided a complete cure to the problem. **M.D.**

ITT VR3905/Ferguson 3V35

This machine had no clock display. It came to us with a history of difficulties because the fault was intermittent. After taking the machine apart and removing the clock/display panel the display came to life and stayed all right for a week. The next time it went off we managed to check some voltages. Those at pins 3 and 4 of IC2 were wrong – and identical. Careful examination showed that a capacitor had been added to the print side of the panel and that one of its legs intermittently shorted two printed tracks. Slight spacing provided a cure. **M.D.**

Hitachi GP4B Colour Camera

The complaint was an intermittent green wash over the picture. When the camera was run up on the bench with the covers removed we found that the fault was present. Tapping the video board with the plastic end of a biro narrowed the fault to roughly the top middle section, but all the joints looked o.k. On removing the board we noticed that R149 and R150 were touching. Separating them cured the problem, though there was a minor heart-stopping moment when the camera was reassembled and didn't work. Who'd left the lens cap on then?! **H.A.**

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

15/80H	2.48
15/85R	2.48
16029	1.24
16181	1.04
16182	1.04
16334	0.51
16335	0.80
16446	0.98
16600	1.38
16799	2.62
16801	0.54
16802	1.14
16803	5.30
16905	0.86
17052	5.61
17074	6.60
17088	4.80
17089	5.35
17127	5.51
17376	1.58
17523	1.32
17524	1.32
1N4001	0.06
1N4002	0.06
1N4003	0.06
1N4004	0.04
1N4005	0.08
1N4006	0.08
1N4007	0.07
1N4148	0.04
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.87
1N914	0.04
1S1555	0.20
1S44	0.09
1S5012A	0.81
1S921	0.10
1S689	2.06
1S751	2.06
2N1302	0.27
2N1303	0.38
2N2148	6.27
2N2218	0.42
2N2219A	0.40
2N2222	0.38
2N2646	0.80
2N2904	0.36
2N2905	0.43
2N2906	0.38
2N2926 GRN	0.15
2N2926 RED	0.19
2N3053	0.27
2N3054	0.99
2N3055	0.61
2N3055H	0.85
2N3442	1.16
2N3702	0.14
2N3703	0.14
2N3704	0.14
2N3705	0.14
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.71
2N3773	2.29
2N3819	0.40
2N3823	1.17
2N3904	0.62
2N3906	0.62
2N4101	1.33
2N4240	3.30
2N4444	0.90
2N4914	0.72
2N5064	0.71
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N5490	1.49
2N5496	0.50
2N6107	0.59
2N6109	1.58
2N6122	1.76
2N6130	0.72
2N6133	1.25
2N6178	0.73
2N6180	0.73
2N6292	0.62
2N696	0.43
2N698	0.43
2N707	0.43
2SA1011	1.65
2SA1027R	0.45
2SA1076	1.96
2SA1095	2.31
2SA1103	6.55
2SA329	0.40
2SA351	1.17
2SA489	1.17
2SA490	1.67
2SA493	1.05
2SA564	0.44
2SA614	4.88
2SA628	1.14
2SA637	1.46
2SA673	1.27
2SA683	1.61
2SA684	1.33
2SA699	1.75
2SA748	1.08
2SA817	0.48
2SA818	1.82
2SA835	2.50

2SA884	2.15
2SA940	1.81
2SA940-2	2.14
2SA951	1.26
2SA966	0.54
2SB325	3.87
2SB375	3.87
2SB400	0.40
2SB407	3.24
2SB411	3.30
2SB449B	6.60
2SB511	1.63
2SB54	1.39
2SB546	3.64
2SB56	2.23
2SB618A	1.83
2SB631	3.25
2SB643	0.40
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB75	1.04
2SB819	0.87
2SB861	0.85
2SC1050	4.03
2SC1061	1.26
2SC1096	1.16
2SC1104	2.60
2SC1106	4.54
2SC1114	6.75
2SC1124	1.26
2SC1128	0.00
2SC1129	0.34
2SC1131	0.50
2SC1151A	4.72
2SC1152	4.68
2SC1157	4.54
2SC1162	1.05
2SC1172 TR	2.22
2SC1172Y	2.20
2SC1195	3.02
2SC1213	0.89
2SC1226	1.46
2SC1306	1.98
2SC1307 TR	1.98
2SC1316	4.10
2SC1317	0.87
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.84
2SC1410	2.39
2SC1413	3.55
2SC1413A	5.26
2SC1475	0.37
2SC1514	1.37
2SC1573Q	1.25
2SC1578	8.74
2SC1617	3.89
2SC1670	3.13
2SC1678	1.98
2SC1810	1.70
2SC1815	0.66
2SC1829	2.22
2SC1875	4.77
2SC1881K	2.98
2SC1891	3.69
2SC1893	3.02
2SC1929	2.25
2SC1938	7.50
2SC1941	1.65
2SC1942	5.70
2SC1945	4.53
2SC1953	1.93
2SC1957	0.95
2SC1959	0.31
2SC1962	1.93
2SC1969	2.92
2SC2009	0.34
2SC2027	1.42
2SC2028	2.11
2SC2029	2.33
2SC2057	1.18
2SC2073	1.54
2SC2078	2.39
2SC2091	1.30
2SC2122A	5.12
2SC2141	1.86
2SC2166	1.98
2SC2216	0.69
2SC2233	2.20
2SC2271	3.64
2SC2278	1.14
2SC2314	0.87
2SC2320	0.21
2SC2335-KIT	10.41
2SC2526	1.87
2SC2551	1.26
2SC2570	2.39
2SC2570A	1.05
2SC2578	6.75
2SC264A	4.82
2SC2671	1.99
2SC2785	0.75
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC403C	
2SC41	2.19
2SC458	0.34
2SC495	0.92
2SC508	3.70
2SC515A	1.85
2SC536	0.05
2SC537	0.54
2SC558	3.69
2SC605L	1.16

2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC673	1.23
2SC681	4.40
2SC684	1.65
2SC685	0.00
2SC685A	2.89
2SC693	0.63
2SC710	0.69
2SC711A	0.50
2SC717	1.14
2SC734	1.43
2SC735	1.16
2SC782	2.47
2SC783	3.98
2SC806	11.29
2SC814	1.39
2SC828	0.28
2SC867A	3.04
2SC876	0.96
2SC926A	1.42
2SC930	0.54
2SC935	4.13
2SC937	3.58
2SC940	4.68
2SC940Q	4.68
2SC982	0.70
2SD1051	0.75
2SD1128	2.25
2SD1138	0.86
2SD1265	0.76
2SD1453	0.75
2SD198	3.87
2SD234	0.47
2SD235	0.60
2SD257	2.94
2SD288	0.00
2SD291	2.94
2SD292	2.59
2SD313	2.59
2SD315	2.94
2SD325D	0.91
2SD348	16.13
2SD350	5.20
2SD350A	2.29
2SD353 TRA	6.12
2SD389	2.41
2SD401	3.55
2SD551	2.42
2SD588A	1.99
2SD600	3.25
2SD621	12.67
2SD636	0.25
2SD657	2.80
2SD669	3.67
2SD679	3.35
2SD731	2.11
2SD787E	0.58
2SD811	5.54
2SD823	1.98
2SD837	1.07
2SD856	6.61
2SD869	7.17
2SD889	0.21
2SD894	0.30
2SD898B N	7.45
2SK105H	2.15
2SK152	2.46
2SK34	0.76
2SK41	1.07
2SK79	2.98
40408	0.50
40594	1.53
40595	1.53
40636	1.43
40871	1.53
40872	1.53
74LS00	0.40
74LS02	0.40
74LS04	0.40
74LS08	0.70
74LS10	0.40
74LS123	1.05
74LS13	0.53
74LS132	0.80
74LS138	0.94
74LS157	0.87
74LS161AN	2.72
74LS196	1.38
74LS20	0.41
74LS244	1.82
74LS245	2.81
74LS26	0.53
74LS30	0.32
74LS367	1.16
74LS373	1.79
74LS47	1.16
74LS73	0.43
74LS74	0.43
74LS75	0.58
74LS86	0.54
74LS90	0.83
74LS92	0.83
74LS93	0.41
74LS95B	0.94
7805 TO-220	0.63
7805 TO-3	1.16
7806	0.73
780B	2.39
7812 TO-3	0.64
7812 TO-220	1.16
7815	0.64
7818	0.70
7824	0.64
AC107	0.73
AC117	0.43
AC123K	0.43
AC128	0.28

AC138	0.09
AC141	0.29
AC151	0.28
AC153	0.34
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
AC187K	0.43
AC188K	0.43
AC194K	0.65
AC76003N	2.72
AD140	1.06
AD145	1.60
AD149	0.90
AD162	0.45
AD262	1.05
AF114	2.47
AF115	1.24
AF117	0.75
AF118	1.20
AF127	0.50
AF139	0.53
AF178	1.45
AF179	0.55
AF180	0.55
AF181	0.53
AF182	0.55
AF186	0.53
AF239	0.53
AF279	0.88
AL100	4.03
AL103	2.68
AL113	1.36
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN214	2.26
AN214Q	1.86
AN231	14.43
AN234	5.09
AN236	3.33
AN238	5.48
AN239	4.35
AN240P	1.72
AN241	1.71
AN245	4.49
AN247P	3.95
AN252	2.57
AN253	2.97
AN262	1.98
AN272	7.92
AN281	5.45
AN295	5.52
AN301	5.55
AN302	3.99
AN303	4.39
AN305	8.88
AN313	3.41
AN315	2.46
AN316	5.53
AN318	6.20
AN320	5.47
AN331	4.59
AN337	5.32
AN340P	1.17
AN355	5.98
AN362	1.75
AN5111	2.92
AN5132	4.39
AN5250	2.89
AN5435	3.08
AN5602	0.00
AN5610	7.43
AN5612	3.51
AN5613	3.41
AN5602	4.25
AN5703	1.42
AN6310	5.15
AN6320N	4.28
AN6340	6.46
AN6342	1.61
AN6344	5.87
AN6363	11.22
AN6531	1.95
AN6551	0.68
AN6552	0.58
AN6610	4.40
AN7114E	5.94
AN7115	2.52
AN7145	2.80
AN7146	9.90
AN7150	2.45
AN7151	2.26
AN7156	2.26
AN7158	6.75
AN7218	1.64
AP58076	4.68
AS560S	1.58
AU113	2.97
AY105K	2.08
AY106	1.09
BA130	0.14
BA1310 (IC)	1.98
BA1320	1.38
BA1330 (IC)	2.75
BA145	0.19
BA157	0.22
BA159	0.12
BA182	0.19
BA222 (IC)	1.66
BA284/2	0.17
BA301 (IC)	0.87
BA302 (IC)	1.24
BA311 (IC)	1.32
BA312 (IC)	0.97
BA313 (IC)	0.76
BA317	0.04

BA318	0.09
BA328 (IC)	4.77
BA333 (IC)	1.37
BA401 (IC)	0.64
BA5102A (IC)	5.97
BA511 (IC)	2.18
BA521 (IC)	2.02
BA526 (IC)	7.98
BA532 (IC)	1.83
BA536 (IC)	3.44
BA6209 (IC)	4.71
BA6304A (IC)	2.92
BA843 (IC)	3.96
BAV18	0.21
BAV19	0.11
BAV20	0.11
BAV21	0.34
BAX12	0.11
BAX13	0.11
BAX16	0.11
BB119	0.17
BC107	0.13
BC107A	0.11
BC107B	0.11
BC108B	0.15
BC109B	0.15
BC113	0.14
BC116A	0.25
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC141	0.31
BC142	0.34
BC147	0.11
BC147A	0.12
BC148	0.13
BC148B	0.13
BC148C	0.11
BC149	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC157	0.14
BC158	0.10
BC159	0.16
BC161	0.28
BC167	0.36
BC168	0.36
BC170	0.16
BC171	0.11
BC172	0.10
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.20
BC178	0.26
BC179	0.26
BC182	0.11
BC182	0.09
BC182B	0.26
BC182L	0.10
BC182LB	0.14
BC183	0.10
BC183L	0.11
BC183LB	0.26
BC184	0.13
BC184L	0.14
BC184LB	0.26
BC186	0.27
BC187	0.20
BC204	0.16
BC207	0.14
BC212	0.11
BC212B	0.26
BC212L	0.10
BC212LB	0.26
BC213	0.10
BC213L	0.10
BC213LB	0.15
BC214	0.10
BC214L	0.14
BC214LB	0.26
BC225	0.40
BC237	0.10
BC238	0.10
BC238A	0.13
BC239B	0.25
BC252	0.10
BC258	0.25
BC261A	0.22
BC262	0.22
BC287	0.50
BC294	0.50
BC300	0.45
BC301	0.45
BC302	0.53
BC303	1.04
BC307	0.18
BC307A	0.14
BC308	0.18
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.11
BC337	0.08
BC338	0.12
BC360	0.34
BC368	0.24
BC440	1.09
BC441	0.44
BC454	0.36
BC455	0.36
BC460	0.42
BC461	0.47
BC462	0.30

BC463	0.64
BC464	0.64
BC465	0.64
BC477	0.32
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.17
BC547	0.10
BC548	0.09
BC549	0.10
BC550	0.40
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC560C	0.10
BC635	0.20
BC636	0.20
BC637	0.24
BC638	0.20
BC639	0.20
BC640	0.24
BC879	0.31
BC880	0.31
BCX32	0.42
BCX33	0.27
BCX34	0.40
BCX37	0.67
BCY70	0.30
BCY71	0.21
BCY72	0.20
BD115	0.36
BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.36
BD137	0.36
BD138	0.46
BD139	0.34
BD140	0.37
BD144	1.43
BD150	1.19
BD157	0.67
BD159	0.53
BD160	1.60
BD163	0.71
BD165	0.62
BD166	0.42
BD168	0.73
BD175	0.43
BD177	0.43
BD179	0.49
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.39
BD190	0.65
BD201	0.67
BD202	0.60
BD203	0.60
BD204	0.40
BD207	1.22
BD208	1.23
BD222	0.49
BD225	0.49
BD228	0.63
BD229	1.05
BD231	0.50
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.45
BD240	0.37
BD241	0.39
BD242	0.50
BD243	0.50
BD243A	0.37
BD244	0.51
BD244A	0.85
BD245C	0.82
BD246C	0.86
BD253	1.05
BD278A	0.70
BD317	2.35
BD318	2.59
BD375	0.42
BD377	0.26
BD379	0.76
BD380	0.76
BD410	0.49
BD412	6.27
BD418	0.76
BD433	0.41
BD434	0.43
BD435	0.49
BD436	0.60
BD437	0.41
BD438	0.49
BD441	1.42
BD442	0.66
BD507	0.60
BD510	0.75
BD517	0.00
BD518	1.50
BD519	1.50
BD529	1.32
BD530	1.10
BD533	0.67
BD534	0.53
BD535	0.77
BD536	0.61
BD537	0.74

BD538	0.67
BD544B	0.83
BD580	1.17
BD590	1.17
BD598	1.25
BD677	0.53
BD680	0.76
BD681	1.48
BD695	2.30
BD696	2.47
BD697	3.60
BD698	1.85
BD699	3.49
BD700	3.70
BD701	3.48
BD702	3.70
BD709	1.12
BD710	0.80
BD807	0.34
BD809	0.75
BD810	0.69
BD879	0.71
BD880	0.79
BD895	2.18
BD899	2.48
BD901	0.70
BD902	0.61
BDV64B	1.26
BDV65B	1.26
BDX32	1.75
BDX53	0.88
BDX53A	4.05
BDX53B	3.35
BDX54B	2.61
BDX62A	1.96
BDX63A	1.96
BDX64A	2.61
BDX65A	2.61
BDX76	0.59
BDY20	1.21
BDY62/01	4.62
BDY81	1.18
BF115	0.40
BF117	0.40
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.13
BF137	0.13
BF152	0.31
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.16
BF198	0.17
BF199	0.17
BF200	0.37
BF216	0.36
BF218	0.36
BF222	0.55
BF237	0.65
BF240	0.17
BF241	0.17
BF244	0.47
BF245A	0.37
BF255	0.20
BF256	0.28
BF256LC	0.42
BF257	0.34
BF258	0.33
BF259	0.34
BF262	0.57
BF263	0.57
BF264	0.37
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.23
BF336	0.30
BF337	0.36
BF338	0.40
BF355	0.44
BF362	0.60
BF363	0.60
BF371	0.50
BF391	0.25
BF393	0.59
BF417	0.84
BF418	1.87
BF422	0.29
BF423	0.29
BF435	0.54
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.39
BF459	0.52
BF460	0.99
BF469	0.31
BF470	0.55
BF471	0.31
BF472	0.33

BF479	0.61
BF480	0.60
BF491	0.49
BF495	0.64
BF506	0.43
BF509	0.41
BF523	0.20
BF594	0.27
BF595	0.27
BF596	0.18
BF597	0.27
BF617	1.05
BF618	1.05
BF694	0.22
BF757	0.58
BF758	0.65
BF759	0.34
BF760	0.65
BF762	0.34
BF870	0.30
BF871	1.81
BF900	0.83
BF907	2.79
BF959	0.42
BF960	1.90
BF970	0.61
BFR39	0.44
BFR52	0.50
BFR62	0.50
BFR79	0.29
BFR81	0.50
BFR86	1.08
BFR89	0.43
BFT41	0.30
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX30	0.65
BFX84	0.37
BFX85	0.39
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.27
BFY52	0.27
BFY90	0.61
BLY49	2.20
BR100	0.22
BR101	0.70
BR103	0.66
BR303	1.26
BR88B	0.64
BRC-M-300	0.97
BRC116	0.67
BRC1330	1.76
BRC300	2.01
BRC4443	1.02
BRC4444	1.02
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.53
BRY39	0.69
BRY55	0.67
BRY56	0.50
BRS59	1.29
BSS38	0.59
BSTB0140G	4.34
BSTBD1409	2.73
BSTB0140E	4.81
BSTC0146	2.48
BSTC0233	6.12
BSTC0246	6.99
BSTC1233	4.34
BSTC3146	0.79
BSTCC0143	3.07
BSTC0643	3.37
BSTD1043	2.85
BSV57B	3.31
BSW68	0.60
BSX19	0.34
BSX20	0.34
BSX21	0.87
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT106	1.18
BT108	1.45
BT109	1.45
BT112	2.48
BT113	2.48
BT116	1.20
BT119	1.76
BT120	2.17
BT121	2.48
BT122	2.48
BT123	1.98
BT125	2.48
BT126	2.48
BT128	2.48
BT128P	3.07
TBA970	3.06
BT151-800R	1.15
BT151 500R	1.38
BTT6018	2.42
BTT6218	2.42
BTT8024	4.43
BTT8124	4.89
BTT8224	2.97
BU105	1.50
BU106	2.48
BU108	1.50
BU109S	2.25
BU110	5.69

BU111Y	4.16
BU124	1.38
BU125	2.48
BU126	0.90
BU134S	4.57
BU204	1.58
BU205	1.08
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.97
BU208A	1.12
BU208D	1.43
BU209	1.93
BU226	2.39
BU312	2.38
BU326	2.00
BU326S	2.20
BU406	1.35
BU407	0.82
BU407D	1.29
BU412	4.80
BU426	1.90
BU426A	1.67
BU500	1.78
BU508A	1.89
BU526	2.02
BU608D	1.57
BU705	3.81
BU800	1.57
BU806	1.79
BU806D	1.49
BU807	1.40
BU826A	3.94
BUV46	1.53
BUV84	1.24
BUW81A	3.06
BUW84	1.39
BUX84	1.00
BUY69A	2.04
BY126	0.13
BY127	0.13
BY133	0.11
BY176	1.52
BY179	1.42
BY182	1.05
BY184	0.47
BY187	0.77
BY189	1.76
BY198	1.62
BY201/2	1.50
BY203/20	0.20
BY206	0.17
BY207	0.22
BY208	0.46
BY210-400	0.18
BY210-600	0.27
BY210-800	0.34
BY223	0.85
BY224-400	0.99
BY225-100	1.13
BY226	0.25
BY227	0.49
BY228	0.60
BY229-800	0.00
BY255	1.07
BY295-600	0.81
BY298	0.20
BY299	0.60
BY409	1.49
BY448	0.67
BY476A	0.84
BYV95C	0.46
BYW56	0.34
BYX10	0.29
BYX55-350	0.53
BYX55-600	0.15
BYX71-600	1.25
BYX84	0.83
BYX93-C24	1.75
BYX93-C7V5	1.35
BYX94	0.14
BYY56	1.20
BZV15-C12	0.58
BZV15-C12R	1.28
BZV15-C24	0.80
BZV15-C24R	1.09
BZV15-C30R	0.80
BZY93C30	1.86
C10188	16.52
C106D	0.30
C1129	0.58
CA1310E	2.70
CA1352	2.05
CA3044	3.50
CA3046	2.06
CA3060	1.65
CA3065	1.29
CA3089	0.83
CA3089E	1.43
CA3090	1.38
CA3094	2.20
CA3131EM	3.12
CAH7023N	2.67
CAH76023N	6.60
CBF16848N-07	1.56
CD4001	0.38
CD4002	0.27
CD4008	1.06
CD4011	0.29
CD4013	0.47
CD4016	0.45
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4047	1.06

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

CD4049	0.58	HM9015	3.24	M58478P	6.75	OA90	0.08	SAF1039	3.35	SN76131	1.92	T6059	1.16	TBA120AS	1.24	TDA1104	6.55
CD4050	0.55	HT4207	17.16	MA06	1.07	OA91	0.09	SAS5010	8.39	SN76226DN	1.98	T8001V	1.20	TBA120S	1.05	TDA1151	1.17
CD4052	0.75	ITT2003	0.22	MA1457	2.72	OA95	0.09	SAS560	1.85	SN76227N	0.75	T9003V	0.95	TBA120SB	1.05	TDA1170	2.37
CD4053	0.80	K174YP	3.25	MA8001	0.82	OC28	2.52	SAS560S	1.65	SN76228N	3.27	T9005V	2.38	TBA120T	0.95	TDA1170S	2.04
CD4069	0.24	KA2101	2.65	MB3705	1.79	OC29	2.15	SAS560T	3.14	SN76231	2.55	T9007V	0.00	TBA120U	2.50	TDA1180	2.90
CD4081	0.29	KC581C	6.32	MB3712	1.85	OC35	1.06	SAS570	1.78	SN76242	5.23	T9008V	1.29	TBA1440	2.03	TDA1190	2.11
CD4093	0.72	KC582C	3.97	MB3713	1.69	OC36	1.28	SAS570S	2.61	SN76243	5.23	T9010V	0.96	TBA1440G	7.20	TDA1190Z	2.48
CD4511	1.10	KC583C	5.54	MB3730	3.49	OC44	0.35	SAS570T	2.75	SN76322	2.77	T9011V	1.27	TBA240A	3.99	TDA1200A	1.43
CD4516	1.17	KIVI5B		MC13002	6.22	OC45	0.18	SAS580	2.85	SN76360	2.17	T9013V	7.96	TBA395	1.10	TDA1220	1.95
CP5521	17.83	L129V	0.25	MC1303P	2.16	OC72	0.44	SAS5800	2.89	SN76390	3.08	T9014V	1.68	TBA395Q	1.10	TDA1230	3.23
CX034	11.83	L200CV	1.69	MC1307P	1.92	OC75	0.44	SAS590	2.85	SN76396	2.90	T9016	1.02	TBA396	0.80	TDA1235	3.88
CX095D	3.14	LA1111AP	0.88	MC1310P	1.30	ON188	1.87	SAS5900	2.56	SN76510N	1.05	T9019W	1.98	TBA400	2.39	TDA1236	4.30
CX104	9.64	LA1201	1.02	MC1327P	1.33	ON236	1.06	SAS660	2.97	SN76530P	1.57	T9034V	1.38	TBA440C	5.75	TDA1270	3.74
CX108	8.16	LA1210	1.38	MC1330P	1.69	OT112	1.08	SAS6600	1.33	SN76532N	0.91	T9035V	1.39	TBA440P	2.45	TDA1327A	1.50
CX109	7.86	LA1320	2.87	MC1349P	0.81	OT121	1.32	SAS660S	1.33	SN76533N	1.65	T9038V	9.42	TBA480	1.57	TDA1327B	1.82
CX121	11.83	LA1352	1.54	MC1350P	1.21	PD144	2.24	SAS6610	1.33	SN76540N	1.98	T9051	3.71	TBA480Q	1.30	TDA1330	1.76
CX130	5.55	LA1357N	6.49	MC1351P	1.33	PT2014	3.04	SAS670	3.96	SN76544	2.89	T9053V	1.40	TBA500P	6.58	TDA1365	6.99
CX131	11.83	LA1363	6.21	MC1352P	1.12	PT5006	2.48	SAS6700	1.33	SN76545	4.87	T9054V	1.19	TBA510	1.37	TDA1412	1.05
CX134	11.04	LA1364	3.02	MC1357P	2.15	PT6042	1.79	SAS670S	1.33	SN76546	1.65	T9057V	0.70	TBA520	1.84	TDA1420	1.52
CX136	11.49	LA1365J	3.44	MC1358P	1.30	PT6045	6.12	SAS6710	1.33	SN76549	2.59	T9063V	3.24	TBA520Q	1.68	TDA1470	2.90
CX137	11.83	LA1378	6.52	MC14001	2.40	R1038	2.19	SAS6800	2.53	SN76550	0.37	T9064	2.02	TBA530	1.30	TDA1512	2.89
CX139	11.83	LA1385	1.87	MC14011	0.26	R1039	2.19	SAS6810	1.43	SN76551	1.49	TA16420	5.98	TBA530Q	1.30	TDA1670	4.48
CX157	4.84	LA1387	7.60	MC14013	0.41	R2008B	1.33	SBA750	1.61	SN76570	3.08	TA16421	5.98	TBA540	1.15	TDA1770	2.90
CX158	4.10	LA3155	1.25	MC14016CP	0.84	R2009	1.98	SC9488P	2.09	SN76600	1.21	TA5814	1.49	TBA540Q	1.15	TDA1905	1.76
CX170	7.62	LA3300	1.54	MC14025	0.60	R2001B	1.33	SC9503	1.65	SN7660N	0.00	TA6002	4.20	TBA550	5.25	TDA1908	3.20
CX177	6.75	LA3301	1.28	MC14049UBC	0.58	R2029	1.33	SC9511P	2.09	SN76611	2.59	TA7020P	4.80	TBA550Q	5.25	TDA1940	1.95
CX187	5.26	LA3350	1.43	MC1438R	1.05	R2030	1.33	SCR957	1.33	SN76620	2.59	TA7027	4.80	TBA560C	1.40	TDA1950	4.81
CX20004	6.74	LA3361	1.23	MC14493P	2.82	R2257	2.38	SDA2112/2	10.28	SN76622	1.65	TA7050	1.74	TBA560CQ	1.60	TDA2002	0.90
CX506	9.33	LA4030P	4.20	MC14497	14.99	R2265	1.49	SG264A	5.26	SN76623	0.69	TA7051	1.74	TBA570	1.60	TDA2003	1.20
CX507	7.62	LA4031P	3.20	MC14510BAL	4.43	R2305	1.18	SG608	5.26	SN76630	2.55	TA7060AP	0.71	TBA570A	1.71	TDA2004	2.25
CX758	7.62	LA4032P	1.92	MC14511BCP	1.10	R2306	1.36	SG613	8.75	SN76640	4.24	TA7061AP	1.27	TBA625A	2.17	TDA2005	5.08
D1693	2.59	LA4050P	1.57	MC1455	0.28	R2322	0.59	SG629	8.27	SN76650N	2.05	TA7069	3.13	TBA625B	2.17	TDA2006	1.55
DEC2	2.20	LA4051P	1.79	MC14556BCP	3.47	R2323	0.76	SG6533	10.31	SN76651	1.49	TA7070P	1.68	TBA625C	2.17	TDA2010	1.85
E1222	0.40	LA4100	1.25	MC1712	3.88	R2348	2.01	SI-1020H	10.89	SN76660N	2.48	TA7071	3.69	TBA641A12	4.13	TDA2020	2.77
E5024	0.28	LA4101	1.30	MC7724CP	3.49	R2354A	2.01	SI-1125HD	13.86	SN76665N	1.49	TA7072P	2.57	TBA641B11	3.03	TDA2030	1.99
E5386	0.25	LA4102	2.81	MC7818C	2.18	R2354B	2.01	SI1125H	13.86	SN76666N	1.41	TA7073AP	5.86	TBA641BX1	1.79	TDA2140	1.59
E5529	0.25	LA4112	4.83	MC7824CP	4.68	R2441	1.36	SI-1130H	6.93	SN76705N	1.34	TA7073P	5.86	TBA651	1.76	TDA2150	6.20
E8021	1.29	LA4125	2.13	MC78M12	0.83	R2443	0.88	SKE1/02	1.20	SN76707N	4.39	TA7074P	1.98	TBA673	2.45	TDA2151	1.93
E9003	0.46	LA4138 IC	3.38	MC78M24	0.94	R2461	1.50	SKE2F 1/04	1.39	SN76708	4.86	TA7076P	7.50	TBA700Q	2.00	TDA2160	4.01
E9005	0.50	LA4140	0.88	MCR101	0.67	R2477	1.02	SKE2G 2/04	0.95	SN76709	5.12	TA7089M	1.56	TBA720	2.50	TDA2161	1.85
ESM310BP	4.15	LA4192	3.65	MCR106/5	1.57	R2501	1.28	SKE2G 3/04	1.05	SN76730	4.66	TA7089P	1.50	TBA730	2.14	TDA2190	
ESM432C	4.60	LA4220	1.62	MCR220/7	2.28	R2540	1.98	SKE4F 1/02	1.39	SN76810N	0.60	TA7092P	6.84	TBA750Q	2.90	TDA2510	2.47
ESM532C	4.60	LA4400	2.25	ME0402	0.17	R2540X	3.30	SKE4F 1/06	0.73	SN76920N	2.90	TA7102P	5.88	TBA760	1.71	TDA2520	2.37
ESM632C	4.60	LA4420	1.72	ME0404	0.26	R2615	0.67	SKE4F 2/06	0.85	SN94041	5.54	TA7108P	1.61	TBA780	1.65	TDA2521	3.30
ESM732C	4.60	LA4422	1.72	ME0404/2	0.47	RC4195NB	2.16	SKE4F 2/08	0.86	SN94042	4.35	TA7109	3.71	TBA800	1.08	TDA2522	1.50
ML232B	2.92	LA4430	1.47	ME0411	0.28	RCA16029	2.01	SKE4F 2/10	1.24	SP5422	1.83	TA7120P	0.64	TBA810AS	1.00	TDA2523	3.03
ETTR6016	3.33	LA4440	4.95	ME0412	0.24	RCA16083	5.30	SKE4G 2/02	0.96	SP8385	0.55	TA7122B/P	0.92	TBA810S	1.61	TDA2524	4.50
FND500	5.78	LA4460	2.32	ME4102	0.50	RCA16334	1.02	SKE5F 3/10	1.60	SPS5384	1.95	TA7124P	2.34	TBA810T	1.50	TDA2525	3.90
FT3055	1.16	LA4461	2.95	ME545B	10.02	RCA16335	1.36	SKS1/10	2.15	ST1702L	0.99	TA7130P	1.27	TBA820M	0.74	TDA2530	2.70
GC374	1.33	LA5112N	2.65	ME6002	0.26	RCA16600	1.38	SL1310	3.14	STA401	6.76	TA7136AP	1.27	TBA890	1.85	TDA2532	2.50
GF758	0.84	LA7020	7.33	ME6102	0.28	RCA16799	2.38	SL1327E	1.33	STA441C	2.75	TA7137P	0.98	TBA900	2.48	TDA2533	2.30
GF759	1.13	LA7025	8.05	ME8001	0.29	RCA16801	0.95	SL1430	1.39	STK0029	5.54	TA7141AP	3.87	TBA920	1.65	TDA2540	2.15
GF761	1.20	LA7027	9.35	MED411	0.75	RCA16802	1.08	SL1430T	2.31	STK0039	5.35	TA7146P	4.23	TBA920Q	2.31	TDA2541	2.48
GH3F	1.82	LA7800	2.34	MJ2501	3.30	RCA17028	2.48	SL1432	2.25	STK0050	7.67	TA7148P	1.67	TBA940	1.87	TDA2545Q	5.94
HA11211	2.53	LA7801	4.15	MJ2955	0.99	RCA17074	6.60	SL414	3.69	STK0059	7.13	TA7149P	3.26	TBA950	1.55	TDA2560	2.17
HA11215	5.06	LB1274	2.49	MJ3000	2.37	RCA17376	1.58	SL432A	3.44	STK0080	9.16	TA7152P	1.52	TBA970	1.79	TDA2571A	3.10
HA11223W	0.00	LC4011B	1.24	MJ3001	1.43	RCA17523	0.83	SL437	7.43	STKC11	3.96	TA7161P	6.23	TBA970Q	3.28	TDA2571AQ	3.60
HA11225	4.29	LC7800	7.89	MJ3028	2.65	RCA2060	2.00	SL439	2.48	STKC13	7.75	TA7162P	2.59	TBA990	1.82	TDA2575A	0.50
HA11226	8.71	LD3120	1.13	MJ481	1.53	RCA60857	4.95	SL471	3.28	STK014	8.84	TA7169	9.54	TBA231	2.57	TDA2576A	3.96
HA11229	2.88	LM1011N IC	3.46	MJ802	5.45	RGP10	0.50	SL480	3.14	STK015	7.75	TA7171P	2.79	TC4001	1.42	TDA2577	2.95
HA11235	2.48	LM1017N IC	3.41	MJE2955	1.89	RT402	1.58	SL490	2.37	STK016	6.91	TA7172P	1.41	TC4053BP	4.34	TDA2581	2.69
HA1124	5.25	LM1101	3.94	MJE3055	1.65	RT905A	2.38	SL901B	8.32	STK022	5.25	TA7176P	2.48	TC4069	1.52	TDA2590	2.50
HA11244	2.82	LM1111	4.29	MJE340	0.49	S0280	2.14	SL917B	11.96	STK025	8.27	TA7193AP	6.67	TC9002BP	10.38	TDA2591	2.50
HA1125	4.29	LM1303P/N	1.65	MJE520	0.49	S0281	2.14	SL918A	6.32	STK031	12.37	TA7193P	4.95	TCA150	1.79	TDA2591Q	0.83
HA11251	4.47	LM1310P/N	1.38	ML231	0.99	S1299	4.74	SN16848	11.07	STK054	7.13	TA7201P	2.71	TCA160B	1.79	TDA2593	2.47
HA1138	5.03	LM2808 IC	5.94	ML232B	2.15	S15H	1.27	SN16861AN0	4.95	STK070	22.31	TA7202P	2.47	TCA270Q	1.71	TDA2594	3.08
HA11414	5.65	LM2877	4.93	ML237B	2.51	S175	31.48	SN16861N-07	2.72	STK077	7.67	TA7203P	2.18	TCA270S	2.15	TDA2600	5.00
HA1144	7.52	LM3065N	0.85	ML238	5.77	S2062D	2.07	SN16862AN	2.98	STK078	8.52	TA7204P	2.16	TCA270SQ	1.65	TDA2610	2.79
HA1156	1.16	LM317CKC	1.38	ML741CS	0.59	S2800	5.78	SN16880N	3.63	STK082	11.86	TA7205	1.38	TCA290A	2.39	TDA2611A	1.25
HA11580	9.00	LM324N	0.50	ML923	3.28	S2800D	5.54	SN16965	8.95	STK086	10.89	TA7207P	3.34	TCA420A	2.16	TDA2611AQ	2.81
HA1160	3.80	LM339N	0.80	ML926	3.58	S2802	3.47	SN16966N	6.04	STK2101	6.32	TA7208P	2.15	TCA440	1.62	TDA2612Q	4.68
HA1166	2.22	LM3407	1.42	MM5314N	4.02	S2818	4.05	SN29715N	6.04	STK2110	7.33	TA7210P	3.58	TCA4500A	2.15	TDA2620	1.96
HA1166X	5.36	LM340T5	0.83	MM5316N	3.96	S3702S	5.21	SN29716N	3.66	STK2230	7.70	TA7214P	3.63	TCA530	2.16	TDA2631	2.73
HA1167	5.36	LM340K	11.85	MM5318N	3.11	S3703F	5.21	SN29717N	7.19	STK2240	0.00	TA7215P	2.58	TCA640	10.26	TDA2640	2.59
HA11711	18.33	LM340T	0.00	MM5369N	2.01	S3707	4.32	SN29722	11.95	STK4019	4.50	TA7217AP	1.37	TCA650	2.04	TDA2643	12.12
HA11713	8.13	LM340T12	0.83	MM5387AA/N	6.20	S40W	10.63	SN29723AN	7.65	STK415	7.70	TA7222	1.95	TCA660B	3.30	TDA2651	2.95
HA11714	7.76	LM340T5	0.83	MM5841N	6.49	S551	4.54	SN29744N	2.29	STK433	4.95	TA7226	10.25	TCA730	3.81	TDA2652	6.95
HA11715	7.76	LM342N	0.62	MN1405	9.52	S552	4.54	SN29764AN	1.38	STK435	5.94	TA7227P	2.81	TCA740	2.48	TDA2653	6.18
HA11724	22.25	LM342P 12V	1.62	MN6016A	20.56	S6080B	7.57	SN29767	4.98	STK436	7.21	TA7229P	4.45	TCA750	1.93	TDA2654	4.73
HA11725	18.26	LM342P 15V	1.62	MP8112	1.49	S6087AR	4.90	SN29770BN	4.24	STK437	7.80	TA7232P	6.60	TCA800	5.95	TDA2660	2.47
HA11738	22.25	LM342P 5V	1.62	MP8113	1.49	SAA1006	1.59	SN29770AN	2.25	STK439	8.31	TA7240AP	6.75	TCA800Q	5.95	TDA2661	2.47
HA1192	0.00	LM348N	2.15	MP8512	1.57	SAA1020	4.76	SN29771BN	4.93	STK441	11.28	TA7310P	2.15	TCA830M	2.25	TDA2670A	1.94
HA1196	7.43	LM380N	2.80	MPC1356C	1.98	SAA1021	4.76	SN29772BN	4.64	STK443	10.29	TA7312P	2.45	TCA830S	2.38	TDA2670	2.48
HA1203	1.72	LM384N01	3.25	MPC596	2.13	SAA1024	2.81	SN29773	2.51	STK459	8.27	TA7313AP	1.50	TCA890	4.95	TDA2680	3.20
HA1306	2.26	LM567CN	1.43	MPF256C	0.60	SAA1025	4.40	SN29791	1.67	STK460	10.75	TA7314 IC	5.94	TCA900	2.04	TDA2690A	2.65
HA1322	2.18	LM6402A093	10.15	MPS6570	0.48	SAA1050	4.16	SN29798N	5.56	STK461	9.68	TA7323P	5.78	TCA910	1.65	TDA2780AQ	5.14
HA1339	2.33	LM6402A127	0.00	MPSA42	0.65	SAA1051	5.83	SN29799N	8.88	STK463	11.50	TA7324P	0.96	TCA940	1.80	TDA2790Q	6.52
HA1342	2.23	LM748	1.82	MPSA56	0.27	SAA1061	3.61	SN29845	2.36	STK465	10.31	TA7325P	0.98	TCA940E	2.93	TDA2791	2.50
HA1350	3.27	LM8360	3.22	MPSA92	0.45	SAA1075	4.86	SN29861	2.29	STK466	11.77	TA7607AP	13.90	TCE330	3.89	TDA2795	2.78
HA1365	4.02	LM8361	3.57	MPSU05	0.86	SAA1082	8.85	SN29862	2.29	STK501	6.32	TA7609	3.17	TCE527	1.86	TDA2800	12.98
HA1366WR	1.86	M1024	2.81	MPSU10	1.56	SAA1121	4.43	SN72709	0.44	STK502	5.74	TA7611AP	4.05	TCE82	1.08	TDA2910	13.25
HA1367	4.32	M1025	5.17	MPSU55	0.99	SAA1124	2.45	SN7400N	0.34	STK5314	9.48	TA7622	7.50	TCE83	1.08	TDA3000T	2.55
HA1368	1.90	M1124	2.80	MPSU56	0.60	SAA1130	4.13	SN7401N	0.27	STR1096	4.50	TA7628P	9.38	TCE84	1.08	TDA3030A	11.49
HA1368R	1.98	M1130	5.35	MPSU60	1.33	SAA1174	7.77	SN7402N	0.65	STR441	10.73	TA7640AP	1.19	TCEP100Q	10.25	TDA3190	2.68
HA1370	3.71	M191	6.32	MR510	0.67	SAA1250	3.90	SN7404N	0.24	STR451	4.95	TA7676P	2.81	TD190	0.95	TDA3300B	6.47
HA1374A	8.80	M193	18.55	MR812	0.21	SAA1251	4.90	SN7408N	0.27	STR453	8.16	TA7726P	10.25	TD3F700H	6.60	TDA3500	4.25
HA1377	3.96	M21C	0.83	MR818	0.27	SAA3027P I	9.37	SN7410N	0.27	STR454	7.50	TAA300	2.97	TD3F800H	4.86	TDA3501	12.09
HA1389	2.39	M23C	0.83	MR914	0.51	SAA5000	4.02	SN74121	1.60	STR6020	8.31	TAA310A	1.16	TD3F900H	4.16	TDA3506	13.01
HA1389R	2.05	M51102L	6.35	MSM4069	2.95	SAA5010	5.39	SN74122	1.05	T6007V	0.95	TAA320A	1.27	TD3F900R36	4.16	TDA3510	6.55
HA1392	3.90	M5115P	5.24	MSM5816RS	5.69	SAA5012	4.50	SN7413N	0.37	T6016	0.40	TAA350A	0.80	TDA1001B	2.31	TDA3520	9.71
HA1394	8.00	M51231P	3.04	MSSD7002	0.72	SAA5020	5.78	SN74151AN	1.51	T6017	0.72	TAA435	1.82	TDA1002	1.98	TDA3521	13.39
HA1397	3.76	M5124P	4.82	MVS240	0.51	SAA5030	8.25	SN74154N	1.27	T6018V	0.72	TAA550	0.37	TDA1003A	1.79	TDA3541	3.80
HA1398	3.98	M5134-9341	4.13	MVS460	0.34	SAA5040A	16.23	SN74190	2.00	T6021	0.40	TAA570	1.74	TDA1005A	2.22	TDA3560	5.00
HA1406	2.07	M51394P	11.97	MVS460-02	0.61	SAA5050	7.74	SN7420N	0.34	T6022V	3.92	TAA611B12	1.30	TDA1006A	1.69	TDA3561	6.50
HA1452	1.63	M5139AP	7.43	NE545B	3.94	SAA661B	1.98	SN7430	0.49	T6026	0.98	TAA621AX1	2.48	TDA1010	1.33	TDA3561A	5.77
HA17723	5.94	M5142P	5.49	NE545B	4.18	SAA700	3.30	SN7440N	0.27	T6027	0.81	TAA630	2.95	TDA1011	2.08	TDA3562A	4.50
HBF4030AF	2.48	M5143P	7.33	NE5534N	1.63	SAB1009B	4.99	SN7473	0.62	T6028V	0.39	TAA661B	1.00	TDA1028	2.45	TDA3571Q	2.48
HD4480	17.16	M5144P	3.77	NE555	0.38	SAB1046P	4.03	SN7474N	0.44	T6029V	4.86	TAA691	8.58	TDA1029	4.89	TDA3571A	6.24
HD44801A05	17.49	M51513L	2.55	NE556	0.83	SAB3011	7.34	SN7490AN	0.93	T6032V	0.98	TAA700	2.59	TDA1034B	2.42	TDA3576	7.09
HEF4001	0.67	M51515BL	3.10	NE5560N	3.48	SAB3012	5.88	SN75110	0.75	T6033V	0.60	TAA840	2.50	TDA1035T	2.55	TDA3590	6.79
HEF4011	0.00	M51516L	3.95	NE565N	1.33	SAB3013	5.61	SN76001ANQ	1.65	T6035V	0.73	TAA930	4.87	TDA1037	2.95	TDA3651A	2.96
HEF4528	0.00	M51517L	3.71	NE645BN	3.35	SAB3021	7.90	SN76003	0.00	T6036	0.67	TAA970	2.83	TDA1037D	5.55	TDA3950	3.40
HM6231	9.81	M5152L	2.88	NE646N	2.98	SAB3022B	13.58	SN76003N	2.50	T6037	2.11	TAD100	2.52	TDA1041	2.16	TDA4040	6.12
HM6232	8.89	M51522	5.39	NE650N	4.34	SAB3023B	12.30	SN76013HDG	8.88	T6041V	0.73	TAD110	2.52	TDA1044	2.31	TDA4050A	3.47
HM6251	5.70	M5191P	4.94	NE654BN	4.18	SAB3024	6.36	SN76013N	3.99	T6044V	0.95	TAG232-600	0.73	TDA1047	4.10	TDA4180P	1.92
HM7103	2.46	M5192	2.20	NP1106	4.80	SAB3209	5.23	SN76013ND	2.48	T6045	1.20	TAG626-600	1.06	TDA1054M	1.21	TDA4260	1.54
HM9032	3.22	M5194AP	5.74	OA200	0.11	SAB3210	3.23	SN76023N	2.59	T6049	1.45	TBA11701	6.25	TDA1059B	0.80	TDA4280	7.20
HM9102	3.22	M53273P	1.02	OA202	0.11	SAB4209	14.03	SN76033N	2.68	T6052V	0.87	TBA120	1.05	TDA1060	2.59	TDA4290	4.47
HM9104	3.24	M53274P	1.33	OA47	0.14	SAF1031	2.53	SN76115AN	1.61	T6058	0.59	TBA120A	1.05	TDA1082	3.06	TDA440	4.90

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Letters

THE STRAIN CLUB

I was sorry to read in the June issue about Les Lawry-Johns' bad experience with the Ferguson/NordMende set (Model 3787) that uses a thyristor line output stage. One consolation for Les is that he now seems to have attained the necessary qualifications to join the exclusive S.T.R.A.I.N. Club (Society of Television Repairpersons In Need). If he doesn't receive an invitation to join S.T.R.A.I.N.'s elite but growing membership soon I suggest he approaches one of the members to ask why. It's easy to spot them. They always look harassed and positive identification is simple to establish by quietly remarking "it's still doing the same thing . . ." The giveaway reply to this is a choking sound and "but it ran for two weeks in the workshop . . ." As to the advantages of being a member, I can't spill all the beans but there are arrangements for such things as discount brain transplants and hernia operations, cheap one-way tickets to Bonga-bonga, draft whisky, punch-bags in the shape of small European CTVs and cut-price variacs.

If Les is still having trouble with the wee portable, he could save Honey Bunch and himself a lot of bother by replacing the line drive emitter-follower transistor TZ06 (BC327) on the horizontal generator panel. By the way, if you get any small Hitachi colour portables (NP6C chassis) that make weird noises in the chopper transformer and keep you running to the kitchen for silver foil to put over the fuses, just change the 220Ω resistor (R937) beside the potential divider reference chip.

Alastair Downs,
Downs Electronics, Dalkeith.

COMMODORE COLOUR BARS

The Commodore colour bar program (letters, June 1985) can be modified to produce the bars in the normal left-to-right sequence, i.e. W, Y, C, G, M, R, B, Bk, by changing the figure after the comma in all the "POKE55296+X+40*Y,–" statements as follows: change line 15 to Y,1; change line 20 to Y,7; change line 25 to Y,3; change line 30 to Y,5; change line 35 to Y,4; change line 40 to Y,2; change line 45 to Y,6; change line 50 to Y,0.

S. Bowdler,
Bournemouth.

FERGUSON 3787

Les Lawry-Johns asked for some tips on the Ferguson 3787. Here's a list of faults I've had with the NordMende version of the chassis. After servicing hundreds of these sets I can say that the list covers 95 per cent of the faults you're likely to encounter.

In the event of tripping, check:

(1) For dry-joints on the centre of the main panel, to the left of the tube base, where the metal frame is soldered to the copper print on the panel.

(2) For a loose core in the line output transformer.

(3) The flyback and scan thyristors DA12 (17075) and DA14 (17028) – change them as a pair.

(4) Capacitor CA24 (0·068μF) and spark gap VA26 in the first anode supply circuit. These items can go short-circuit or leaky.

For no results, check whether the core has fallen out of the line output transformer. If the set still won't come on or trips when the core is replaced, check the 4·7Ω, 11W surge limiter resistor RA05 which may be open-circuit and is situated at the top of the main panel, also if necessary the soft-start/shutdown thyristor DU04 (S2800) and the associated diode DU05 (1P643) – both these items can go short-circuit.

Gerry Hoey,
Dundalk, Co. Louth.

PULSE-STRETCHER CIRCUIT

It's not clear whether the monostable pulse-stretcher circuit shown in Fig. 4 on page 372 of the May issue, for use with the Decca 30 series chassis to prevent tube reflections during teletext reception, should be connected in parallel with the existing connections to pin e of the field output transformer and pin 6 of IC2, and if not what alterations may be necessary to the existing connections. I'm also puzzled as to whether the circuit is correct as shown. It appears that Tr1 is normally off and requires a positive-going flyback pulse at its base to switch it on, but D1 would seem to block such a pulse.

A.T. Brand,
Colchester, Essex.

Editorial comment: The blanking circuit shown in Fig. 4 should be connected in parallel with the existing connections to the points mentioned and no other alterations are required. The circuit is correct as shown and our thoughts on the polarity of D1 are that it conducts as a result of the differentiating action of the 0·015μF coupling capacitor.

SHORT COLOUR BAR PROGRAM

Further to D. J. Jackson's Commodore 64 colour bar program (letters, June 1985), here's a much shorter one that may be of interest:

```
10 PRINT CHR$(147):POKE 53280,15:POKE 53281,15
15 PRINT CHR$(18);:FOR A = 1 TO 24
20 PRINT CHR$(5)"     " CHR$(158)"     "
         CHR$(159)"     " CHR$(30)"     ";
25 PRINT CHR$(156)"     " CHR$(28)"     "
         CHR$(31)"     " CHR$(144)"     ";
30 NEXT A
35 GOTO 35
```

Note that there are five spaces between each pair of quotation marks.

M.J.H. Jevons, Eng. Tech.,
Dudley, W. Midlands.

SONY MODEL KV1810

I've just come across an interesting fault in a Sony KV192SA (UK Model KV1810). The symptom was repeated failure of the line driver transistor Q509 after a few days' service. Overheating of R569, the predriver transistor's collector feed resistor, was also evident. A check on the shape of the drive waveform at the collector of Q509 revealed that it was rounded instead of sharp-edged. The fault was eventually traced to the coupling capacitor C538 (0·47μF electrolytic) being leaky. As a result Q509 was not being completely switched off, the excessive dissipation leading to eventual failure.

A tip on setting up the decoder. After one of these sets

has been in service for some years you might find that Hanover blinds which can't be removed by adjusting T306 and VR304 are present. The problem can be overcome by adding a capacitor of 100-330pF across T306's primary winding, i.e. across R397. This permits adequate phase balancing.
M. Pomeroy,
Johannesburg, S. Africa.

BBC MODEL B PROGRAM

In the June letters page a program is given for the BBC Model B. Note that in lines 70 and 80 6% should read a%. The program will then run. Readers may also like to know that the program will run on the Electron.
Bob Smallbone,
Bognor Regis, W. Sussex.

Editorial comment: We misread b% as 6% in the original: a, b or c (see last month) will do.

REPLACEMENT GCSs

The suggestion was made in *Television* a few months back that a type SG264A GCS could be successfully used as a replacement for the SG613 in Model KV1810UB. I must point out that these two devices are not interchangeable in this model and that there is a possibility of failure due to excessive temperature rise or transients. Taking tolerances into account, the safety margin with the SG264A is not considered sufficient to prevent random failures. The correct replacement for the SG613 is the SG6533.
David Meyer, Assistant Engineering Manager,
Sony (UK) Ltd.

BBC TEST PATTERN PROGRAM

Some corrections to the BBC Micro test pattern program as published in the July issue are required, as follows.

First, in lines 100 to 180 the BBC string escape character must be used instead of colons. This character is not present on an ordinary keyboard, which presumably caused the confusion.

Secondly, two hyphens instead of minus signs appear in line 390.

Thirdly, line 510 should be DRAWX,Y+1.

Fourthly, the end of line 1500 should read STEP 0.02 (stop not comma).

A couple of other points. Lines 1000 to 1220 if copied as set would result in TV   SERVICING   AID appearing as TV   SERVICING AID, as a BBC program does not indent beneath the line numbers. More importantly, the procedure used in line 740 does not give a true circle. Servicemen beware!
G. Beard,
Sutton, Surrey.

WHAT NEXT – MICROFACTORIES?

The problems faced by the European electronics industry were mentioned in your June leader. Financial opinion on the future of the electronics industry has been demonstrated on the stock market by falling share prices of the major electronics companies despite rising dividends.

One of the problems is that having supplied a VCR and a home computer to everyone who wants one what is the next item that can be mass marketed? The replacement market is simply one of rising prices and disgruntled customers if the white goods sector is anything to go by (clothes washers in particular). In the case of electronic apparatus the equipment is longer lasting and the replacement market is thus even thinner.

One possibility is to market microfactories. These are machines that people can use at home to produce useful everyday items for sale locally at a profit. Ideally a microfactory would be totally automatic: all the user would have to do is to shovel or pour the raw material in at one end and collect the product at the other.

The ideal technology for these products may not be totally electronic. Ideas about the possibility of molecular or nanoengineering are appearing in the USA. Submillimetre machines have been proposed for a number of tasks ranging from computing through energy production to chemical manipulation. Those interested in this subject can refer to a series of articles by Conrad Schneiker in *Cryonics* magazine: there is also a book to be published by Doubleday entitled *Engines of Creation*, by Erik Drexler. An electronically controlled reactor submillimetre machine could be used to fabricate useful items from a sludge of general domestic rubbish.

The important thing for the electronics industry is that such ideas are at the moment not fixed to any single scientific discipline, so that they could be taken up by any industry amongst the many that could benefit. In his articles in *Cryonics* Conrad Schneiker states that all the technology required for this new engineering is already here and that simple self-replicating submillimetre machines should be possible within fifteen years.
John de Rivaz, B.Sc.(Eng.),
Truro, Cornwall.

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Mick Dutton, Hugh Allison, Keith Hamer and Garry Smith

Telefunken 615 Chassis

If you come across one of these sets with a dead power supply look to see whether the mains bridge rectifier's reservoir capacitor C99 has been leaking. If it has, the chances are that it will have eaten into R242 (330kΩ) causing this resistor to go open-circuit.

The fault with one of these sets was no picture. The e.h.t. rustled up at switch on but after a split second the line timebase cut out. It seemed that the protection circuit was sensing a fault but a check on the EW modulator diodes and the flyback tuning capacitors failed to reveal anything amiss (note that the 615A1 chassis with the hi-bri 670-type c.r.t. has a higher e.h.t. than the 615 chassis). Attention was then turned to the protection circuit where T482 (BC237B) was found to be leaky. **P.B.**

NordMende Spectra 3601

This colour portable had a very unusual fault description on its ticket. It said "gets a black patch which creeps down the screen in centre when warm". Sure enough when the set warmed up a black mark appeared at the top of the screen and slowly spread downhill until it nearly filled the screen. The slightest tap anywhere near the set would remove the fault. We checked carefully for dry-joints etc. but it was quite a time before we found the cause of problem. It turned out to be the result of a poor joint on the earth tag that connects the print to chassis next to the field timebase module, where DA06 and RA06 are connected to earth. **M.D.**

Editor's note: This appears to tie up with the **Ferguson 3787.**

Philips G8 Chassis

I've recently had two problems I've not met before on these sets. The first was a simple one – severely distorted sound due to the audio output coupling capacitor C2226 (50μF) having gone low in value. The second set had a bright raster with flyback lines. We fitted a new i.f./decoder panel but the problem remained. We then found that the positive line pulses were missing due to the safety resistor R5576 (4·7Ω) on the line scan panel being open-circuit. **M.D.**

ITT CVC800 Chassis

This colour portable wouldn't always come on from cold. Several presses of the on-off switch were sometimes required to get it to start. We checked for h.t. across the mains bridge rectifier's reservoir capacitor to prove this side of the power supply before going on to the chopper circuit where we eventually found that R731 (820kΩ), which provides a reference feed from the 290V line to the base of T730 in the pulse-width modulator circuit, had gone very high in value. **M.D.**

Decca 100 Chassis

Lack of height with bottom foldover was the problem. As usual, R371 (2·2kΩ) was burnt. Replacing this didn't cure the fault however, neither did changing the field output transistors. The problem cleared up when the three diodes D309/10/11 which bias the second driver transistor Tr309 were replaced.

Another of these sets was fitted with a touch tuner, the problem being that it wouldn't change channels. We found that there was no bias at the base of transistor Tr703, which is associated with touch-button one on the assembly, due to R12 (390kΩ) being open-circuit. This resistor is mounted on the tuner panel. **M.D.**

Philips 3723 (KT3/RC5 Chassis)

This brand new set wouldn't change channels and would sometimes go into the standby mode when switched on. We didn't have the circuit but managed to prove that the fault was on the panel with the TMS microcomputer i.c. by swapping it over with one from another set. The cause of the problem was TS004 open-circuit base-to-emitter. **M.D.**

Thorn 9000 Chassis

The customer complained that the picture narrowed after the set had been on for a while. We left the set on soak test and when the fault appeared we found that there was a line fold in the centre. This was intermittent and could be made to come and go by tapping the set. We had a look around and found that R424 (1·5Ω), which is in series with the base of the syclops transistor VT701, had been getting very warm. We changed it and the parallel diode W413 (1N4001) and the problem has not reappeared since. **M.D.**

Philips G11 Chassis

Field collapse was the problem here. The field timebase supply fuse hadn't blown and we could find no sign of dry-joints on the line scan, timebase or convergence panels. We changed the TDA2600 field timebase chip but the problem persisted. Voltage checks then revealed that there was no voltage at pin 14 of the i.c. due to R2066 (1·5kΩ) being open-circuit. **M.D.**

Fidelity CTV14S

There was no tuning on this set. We removed the front panel and checked the 33V tuning supply which was present and correct. There was no voltage on the tuning line however. We assumed that the SL470 tuning control i.c. was faulty but replacing this failed to cure the problem. We then found that whilst the 33V supply was present at the TAA550 stabiliser i.c. it wasn't present at pin 11 of the SL470. The fault was due to a crack in the print. **M.D.**

GEC 20AX Chassis

There was a blank white raster with flyback lines. The chassis has complementary-symmetry RGB output stages and checks here showed that the voltages around the top transistors of each pair were high while those around the bottom transistors were very low. The coupling to the top transistors employs d.c. restoration with the 3·6V zener diode D204 providing a reference. The zener diode turned out to be o.k. but the voltage across it was incorrect. R258 (82kΩ) which is in series with D204 was open-circuit.

M.D.

Galaxy Portable

This little portable was new to us. Apparently they're sold by Woolworths. The complaint was that the width would come in and the field would fold up from the bottom as the set warmed up. We discovered that the h.t. dropped as the set got warm. A touch on the h.t. preset brought the supply back to full voltage and the fault didn't reappear. To be on the safe side we changed the potentiometer.

M.D.

ITT CVC5 Chassis

This elderly set had a very weak picture with no colour. The problem looked like an a.g.c. or i.f. fault. Voltage checks in the i.f. strip revealed that transistor T16d's collector voltage was incorrect because its load L50d was open-circuit. When this had been repaired the set produced a very reasonable picture.

M.D.

Thorn 9600 Chassis

This set had severe EW trapezium distortion. A nice easy fault: the EW keystone potentiometer R453 had a crack in it.

M.D.

DAFRN Varicap Tuners

This type of varicap tuner unit was used in a number of Thorn chassis over the years, two examples being the popular 9000 and 8800 chassis. It's fair to say that 99 per cent of the faults encountered have consisted of intermittent signal loss, with sometimes a very faint picture remaining. In all cases we've come across the cause has been a hairline fracture on the printed board within the tuner unit can. The print in question comes from the i.f. output coil, which is towards the top left-hand corner of the board when viewed from the print side – the print runs parallel with the side of the can for approximately 25-30mm. To overcome the problem, simply use a couple of strands of wire twisted together: run them between both end connections, carefully following the print. A low-wattage soldering iron should be used for this operation.

We recently came across a standard ELC1043 tuner in a Thorn 8800 chassis with a "DAFRN" sticker attached. Intermittent loss of signals was the problem, due to a poorly soldered connection between the print and the tinplate screening member that runs the length of the tuner. The joint is approximately a quarter of an inch from the right-hand side, as viewed from the print side, and is in the lower half of the tuner.

K.H.-G.S.

ITT CVC32 Chassis

The fault on this set gave the impression of field bounce. It was eventually traced to R2's metal end-cap which had split. This 15kΩ, 6W resistor feeds the TAA550B tuning voltage stabilizer and is mounted approximately half way down the main panel, immediately to the left of the central cut-out.

K.H.-G.S.

Decca TVS11

This sound-only TV set, which seemed to contain some Bradford chassis bits, was sent in by a blind lady who said it buzzed like a demented bee when switched on. Sound-on-vision? Mains hum? No, it turned out to be loose laminations in the mains transformer. After its removal from the set no amount of strong arm work with a vice would cure the buzz, but a very liberal coating of thin, high-temperature varnish (obtained from a local model engineering shop) plus an overnight period to cure fixed the problem. I get the good jobs . . .

H.A.

Book Review

Here's Looking at You by Bruce Norman, published jointly by the Royal Television Society and the BBC at £12·95.

"BH (Broadcasting House) was always less than enthusiastic about letting this youngster television exist let alone expand . . . We had to send our wonderful vans (OB units) to be regularly washed and greased so that for two days a week we couldn't do any OB work at all." This quote from Lord Orr-Ewing comes from a marvellous book that's a must for all those interested in blowing the cobwebbs from the mystique surrounding the history of television from 1908 till 1939. It describes in considerable detail the founding of a medium that's now taken for granted by most people. There are some sixty photographs and a great many quotes from those who worked on the early systems.

The Baird system is covered in excellent detail from the early 30-line experiments up to the final 240-line system. There are fascinating bits of information on every page – you tend to end up engrossed whenever you pick the book up. We learn for example that the early Emitron camera tubes were hired from EMI by the BBC and had a rather unpredictable life. They were delivered in large wooden crates, slung in a harness, and had to be carried over to the camera in the studio when replacement was needed. It was not unknown for one or two tubes to break down during a transmission, and maintenance during transmissions was common. Faulty tubes were returned to EMI to be reconditioned. Especially when new, they were particularly red sensitive. The Super-Emitron tube came in 1937 and made outside broadcasts and the use of telephoto lenses more practical. Some were so sensitive to red that they made London buses look white on the screen, but they were very good at penetrating a fog! A particularly red-sensitive tube was carefully nursed for use on bad days.

There's plenty that's non-technical in the book, and plenty that's amazing. The first "telerecording" was of a long and expensive play, "The Scarlet Pimpernel". It was decided to try to film this from a monitor screen as it was broadcast in order to keep a record. Next day Alexander Korder phoned to protest that he'd heard the BBC were filming the play, for which he had the exclusive film rights. He insisted that the film be publicaly burnt – so no film record exists of any pre-war TV production apart from a "demonstration film" that was made and regularly updated, using film cameras.

If you're interested in the history of television you'll find this book a gem. It's made a welcome and attractive addition to my bookshelf.

M.B.

The Strangest TV Sets Ever

Chas E. Miller

None of the TV sets that were produced by Murphy Radio of Welwyn Garden City could be regarded as wholly conventional. In most cases they resembled neither their contemporaries in the ranges of other setmakers nor immediately preceding and succeeding Murphy designs. Most of them had superhet vision and sound receiver strips. In only one case was this principle abandoned in favour of the t.r.f. approach. And having decided on this technique for the V134C and V136C it seems that the Murphy designers decided to let their imaginations run riot over the rest of the circuitry – and the cabinet as well!

Cabinets

There were some pretty strange looking sets around in the late forties and early fifties. The V134C/V136C, which were released in August 1948, took the medal as the oddest of all by a wide margin. What was either a tall table cabinet or a short console, depending on one's point of view, was mounted on four spindly legs made of strip wood. The front legs were either straight or bent forwards in a sort of curtsying attitude. No mention is made in the contemporary literature as to whether the latter feature was optional or not. Perhaps customers took pot luck. The nine inch aperture for the c.r.t. could be covered when not in use by some curiously cranked short doors which, when closed, matched in shape the loudspeaker baffle at the bottom of the cabinet. The doors, baffle and feet were of much darker wood than the rest of the set. Twixt doors and baffle there were three user control knobs – for volume/on/off, contrast and line hold. Evidently Murphy were not too confident of the stability of their line timebase, as well they might – see later. There may have been more grotesque sets than the V134C/V136C: if so I've yet to come across them.

Receiver Circuits

The basic model was the V134C. It was baldly described as being for use in "swamp areas" only. This didn't mean that it was for export to the Everglades area of the USA but that it was, to put it bluntly, damned insensitive, requiring a lot of signal input. The centre of the coaxial aerial socket was capacitively coupled to the slider of a 200Ω sensitivity potentiometer, a rather curious arrangement when one considers the design's inherent lack of sensitivity. The V134C had a single vision and sound r.f. amplifier stage which was followed by a single vision only r.f. amplifier stage and, on the sound side, two r.f. amplifier stages. All these stages used 6F13 valves. There followed two 6D2 double diodes, one as sound detector and interference limiter and the other as vision detector and sync separator.

The V134C's lack of sensitivity might have been a bit of an embarrassment. The V136C, which was otherwise identical, included a two-stage preamplifier (two more 6F13s) with the second stage untuned. You had to pay an extra £2.5s.0d for this – the basic V134C was priced at £55 plus purchase tax. As an added touch, the vision strip was aligned to accept the upper sideband only, making it virtually impossible to convert either model for Band III reception – always assuming that any of them lasted that long.

The demodulated sound signal was handled by a single 6P25 beam tetrode – with the focus control in its cathode circuit. This latter arrangement may seem strange but was not all that unusual at the time: the idea was to take the sound output valve's anode supply from the focus coil. The video output stage was simple enough: another 6F13 which controlled the c.r.t.'s grid.

It's in the timebases that the really weird and wonderful (?) bits of circuitry are to be found, starting with the diode sync separator whose cathode was fed from the undecoupled screen grid of the video output pentode.

Line Timebase Circuit

The unique line timebase circuit is shown in Fig. 1. It consists of a pair of parallel-connected beam tetrodes in a self-oscillating arrangement. Nominally both valves were 6P28s, though EL38s might be found instead. Apparently a preferred approach was to use one of each type for maximum stability! You'll notice that the two valves are operated without bias, so they'll start to conduct at switch on, with positive feedback to the screen grids via a winding on the output transformer T1. At saturation point the positive feedback will cease and the collapsing field in the transformer will then cut off the valves and produce the flyback. The line hold control provides an *LR* time-constant in the feedback circuit: no capacitors anywhere to be seen in the oscillatory circuit. Line sync pulses from the anode of the sync separator diode are differentiated by C18, R21 and applied to the control grid of V8 to ensure that the flyback commences at the right time.

The output produced by this ramshackle hook-up was passed from a tapping on the transformer's primary winding to a complicated system consisting of a tapped width coil (L11) and tapped scan coils. This had to be set up with infinite finesse if the correct balance of scan amplitude and frequency was to be obtained. Correct line lock could in fact be achieved in this manner if all else failed! Should the width prove to be insufficient after all

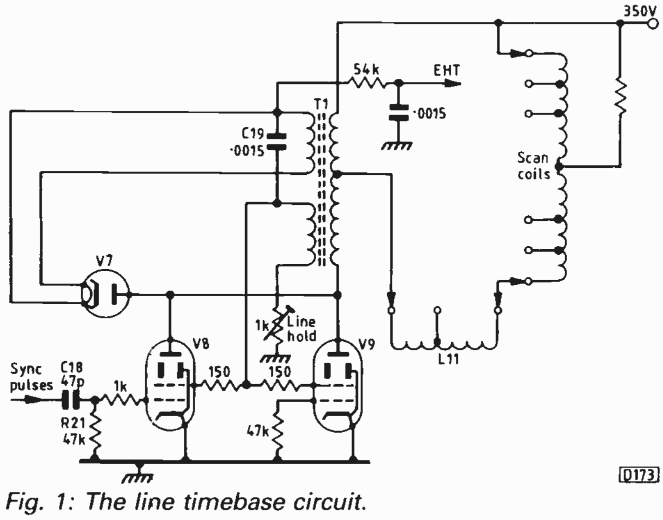

Fig. 1: The line timebase circuit.

this monkey business a rod magnet could be fitted to the scan coil assembly to drag the picture over to one side. Evidently the designers expected a fair degree of non-linearity. . . .

At least there was flyback e.h.t. The anode of the U22FH e.h.t. rectifier was connected directly to the anodes of the beam tetrodes without the benefit of an overwinding. Presumably the flyback pulse voltage was considered to be sufficient to provide the e.h.t. (5·4kV) for the CRM92 triode c.r.t., though to help matters along the e.h.t. reservoir capacitor C19 was connected to the screen grids of the tetrodes instead of to chassis to provide a boost. The e.h.t. rectifier's heater was fed from another winding on the line output transformer, a method employed intermittently by Murphy over several years – as if they couldn't make up their minds whether this or a highly-insulated mains transformer pleased them most (or least).

Field Timebase Circuit

If you're thinking that the line timebase was bizarre beyond words, get a load of the field timebase circuit (see Fig. 2). This used a single 6F14 video type pentode (what else?!) in another self-oscillating arrangement with feedback to the screen grid, the actual scan coils being arranged as the output/feedback transformer. This necessitated fitting the coils with a massive laminated core. Since the anode and screen grid currents were markedly dissimilar (27mA and 6·5mA respectively) one cannot help but wonder at the linearity. This must have exercised the designers' minds as well. Their solution in part was to add an externally shorted winding (L14) to the core. The next problem was that the current flow through the coils shifted the picture off centre, so yet another winding (L13) was added to counter the effect by taking a current flow in the opposite direction. A variable resistor across this winding enabled the picture to be centred.

The field hold control provided an *LR* time-constant with the feedback winding L15 – R34 could be shorted out to aid hold control setting. Height was controlled by altering the cathode bias while R52 provided a start-up feed – though you were advised that it might be necessary to switch the set off and on again! The field sync pulses were integrated by R51 and C37 and applied to the control grid circuit. Linearity correction was provided by the damping network R56 and C39 in conjunction with

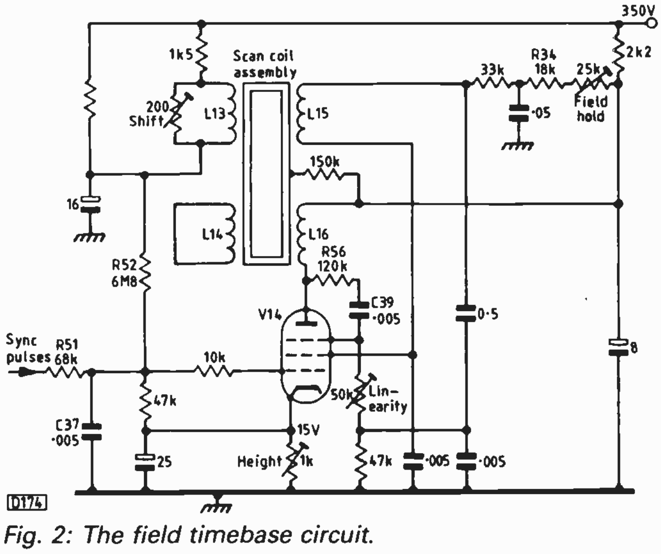

Fig. 2: The field timebase circuit.

the linearity potentiometer. It was said that any remaining non-linearity – at the beginning of the scan – was taken care of by connecting the valve's suppressor grid to this network. Yes folks, they don't write timebases like that any more!

To supplement all those d.c. currents flowing around the neck of the c.r.t., a large electromagnet was fitted for focusing. It carried the h.t. to the anode of the sound output beam tetrode in whose cathode circuit, as previously mentioned, the focus control was to be found.

The above maze of obfuscatory electronics might in all conscience have been deemed punishment enough for the hapless service engineer of the day, but Murphy added a spice of danger to the proceedings. The whole, massive field scan coil assembly was insulated from chassis and held at h.t. potential, the stated object being to preclude electrolytic action between the coils and core. Since the h.t. was supplied via a fairly large resistor (150kΩ) shocks were more likely to be a nuisance than a threat to personal safety. Nevertheless, a trap for the unwary.

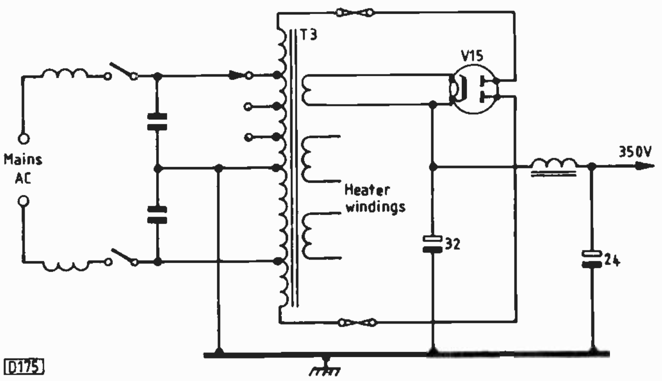

Fig. 3: The h.t. circuit, a full-wave arrangement that left the chassis at some 120V live with respect to earth.

The HT Supply

Far more likely to cause actual flashes, bangs and voluble cursing was the eccentric h.t. supply system (see Fig. 3). In recent years engineers have become used to chassis that are always at some mains derived potential above earth, regardless of the plug polarity. In the vintage days however sets were either a.c. only and totally mains isolated or of the a.c./d.c. or semi-a.c. (with autotransformer) type that could be rendered safe to touch by ensuring that the neutral side of the mains supply was connected to chassis. Not so the V134C/V136C which used a full-wave h.t. rectifier circuit with overwindings at the top and bottom of the mains transformer's primary winding and a chassis-connected centre tap. This ensured that the chassis was at some 120V live to earth whenever the set was in use no matter how careful the engineer had been to connect the mains plug correctly. One wonders how many fuses went west due to the aerial cable being inadvertently dropped on to the chassis, and how many nerve-shattering shocks were suffered by engineers who might well grasp the coaxial plug in one hand and the chassis in the other. . . .

Did You Know Them?

Should any readers have any personal recollections of either installing or servicing these truly odd sets I'd be glad to hear from them – always assuming that they managed to last out!

The Lid off Microcomputers

Part 4

Mike Phelan

This month we'll look first at the CPC464's sound department. Most of the work in this section is done by an AY-3-8912 sound generator i.c. which has one input port (1D0-1D7), one input/output port (D0-D7) and several other connections – see Fig. 1. A, B and C are the sound outputs – there are three as the i.c. is capable of producting three different sounds at once (a chord). There's also a facility to add white noise to one or more channels. All three outputs are summed by R114/5/6 and then go to an audio amplifier which is on the cassette deck electronics board. The three outputs are also matrixed to give two stereo channels for connection to an external amplifier. The PIO (parallel input/output) chip sends data for the sound functions to the 8912's D port.

The three tone outputs produced by the 8912 can be made to cover a range of six octaves. There's also a comprehensive set of variable envelope shapes – this is partly due to the operating system/BASIC interpreter, i.e. it's software controlled. In effect, this means that instead of the 8912 being addressed directly with machine code near-English BASIC commands are used.

The status of the BC1 and BD1R control lines determines whether the D port is in the input or output state. Why should we want data from a sound generator i.c.? Because of the way in which the system is divided between the i.c.s used.

The 8912 is also connected to the keyboard: in fact the 8912 is used to route the signals from the keyboard to the PIO and thence to the CPU. This operates as follows. The PIO generates a four-bit keyscan every 20msec, under the control of the operating system (in the ROM). The CPU tells the PIO to do this of course. Decoder IC101 converts this four-bit code to decimal, which means that one of the eleven outputs from IC101 will go low for a particular input code. These outputs are connected to the keyboard in an 11 × 8 matrix – we could therefore have 88 keys, but there aren't quite that many! The 8-bit matrix return from the keyboard goes into the 8912 at port 1D and emerges at port D after which it goes to the PIO's A port (note that the buses between IC107/1/2 and the keyboard were shown incorrectly in Fig. 1 last month).

To summarise this rather complicated series of operations, fifty times a second the PIO sends a sequence of 11 codes to IC101 which sends eleven pulses to the keyboard. If a key is pressed, one of these pulses is returned to the 8912. At the same time that it generates the keyscan, the PIO switches the 8912's D port so that this sends data back to the PIO's A port. Thus the result of pressing a key is that a low pulse enters the PIO at port A. This pulse can be on one of eight lines and can fit into one of eleven time slots. The PIO sorts this out by referring to the code at C0-C3 at the instant the return pulse arrives. The end result is that a code is fed to the data bus to inform any interested device the state of the keyboard.

Four links on the main panel are associated with the PIO chip. They are used to switch between 50/60Hz operation and to allow the sign-on message to be changed for different nationalities. They go to port B.

The PIO also looks after the cassette read/write operations and receives the "printer busy" signal (to halt processing until the printer has dealt with the contents of the printer latch). Consistent with routing the cassette data to and from the RAM, the PIO drives transistor Q101 to switch the cassette motor on and off.

A few details of how data is loaded and saved on tape. The principle used is that of FSK (frequency shift keying). This system uses two audio frequencies, one for binary 0 and the other for binary 1. To record and play these back accurately we need a good treble response and few dropouts. The cleanliness of the tape transport system is vital, as is the correct azimuth setting of the record/playback head. One missing bit could be a disaster!

The data is saved (recorded) on the tape in a particular sequence. First there's a short bust of 010101 etc. to synchronise the PIO. This is followed by a short block of data that gives information about the file – its name, what addresses it should be loaded into, etc. Then comes the data proper, split into 2K blocks. At the end there's a checking procedure that ascertains whether any 0s have been read as 1s and vice versa. This works as follows.

Each block of data contains what's called a "checksum" – simply the binary sum of all the 2K bytes. If, on loading,

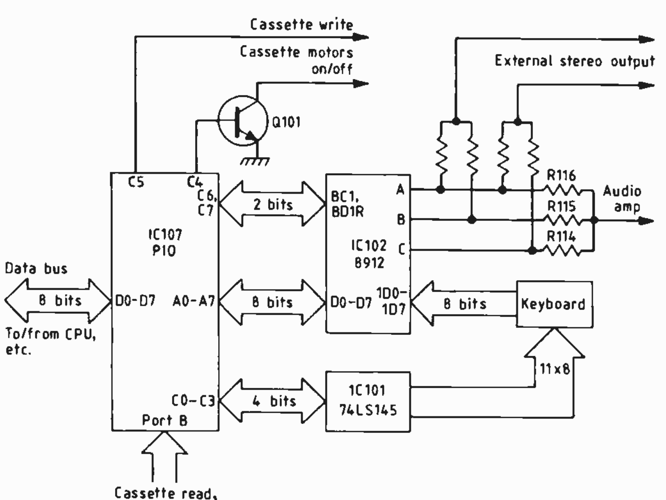

Fig. 1: The sound generator, keyboard system and parallel input/output (PIO) chip arrangement in the CPC464.

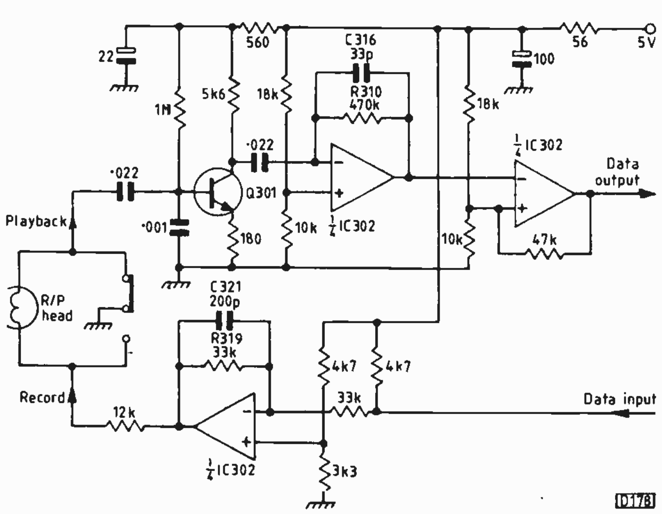

Fig. 2: The CPC464's simple cassette deck record/playback amplifier circuitry.

the loaded checksum disagrees with the computed one something is obviously amiss. The check procedure also highlights dropouts, since these show up as missing bits. Missing bits cannot be read as either 0 or 1 since they are at neither frequency used.

The CPC464 allows for a twenty per cent or so variation in tape speed, so the system is quite reliable.

The cassette deck electronics are very simple. Most of the circuitry is contained in IC302, an LA6324 i.c. which incorporates four operational amplifiers. One of these is used as the audio preamplifier. Two of the operational amplifiers are used as the playback amplifier, with R310 and C316 providing equalisation and Q301 acting as a preamplifier (see Fig. 2). The remaining operational amplifier is the record amplifier, with R319/C321 giving a falling record current/frequency characteristic. The circuit is simple since the equalisation doesn't have to conform to any audio standard – the severe record equalisation provides a better performance for this purpose.

The relay on the cassette deck electronics panel, driven by Q101 on the main panel, starts the motor.

There are several disadvantages to using an audio cassette for storing data. First it takes typically minutes to load a program. Secondly if there's more than one program on a tape it has to be scanned until the required program is found and loaded. It pays therefore to have only one program on each side of a tape. To this end tapes with a playing time of five minutes upwards (C5) are available in computer quality.

Both these disadvantages are overcome by using a floppy disc to store the data – access and loading takes seconds, and typically 300-400K can be stored on a disc. Next time we'll discuss disc drives, in particular the DD1 used with the CPC464.

SOVEREIGN TV

There's no great mystery after all about the brand name Sovereign. It's used by Telefusion who tell us that equipment bearing this brand name has come from a number of sources, both UK and overseas. The address of the service department is: Telefusion Ltd., Service Department, Cornford Road, Blackpool, Lancs (telephone 0253 65078).

The main problem is with the Sovereign Model C140 colour portable which was originally imported by another firm and subsequently handled by Telefusion. It's also known as the Fara Sovereign and the Plustron Palladium Model CTV14. Unfortunately the far east manufacturer of these sets is no longer in business, hence the difficulty in obtaining parts. The main problem is the line output transformer whose e.h.t. overwinding tends to break down. Overwindings can be obtained from Papworth Transformers, 80 Merton High Street, London SW19 1BE (telephone 01-540 3955).

The design of the C140 is credited to Toshiba, and we find that some sections, including the line timebase and the regulated power supply but not the field timebase and the colour decoder, are similar to the Toshiba Model C400B. The line output transformer has the same circuit reference number though the pinning shown on the circuits differs.

Our thanks to Telefusion Ltd, Greenline Electronics Ltd., Michael Harris, G.C. De Fraine and J.D.D. McNaughton for their help in this matter.

Long-distance Television

Roger Bunney

May and early June saw quite remarkable conditions, with very intense Sporadic E signals – at times Band I was completely jammed with signals and on several occasions the m.u.f. rose above 100MHz. Iran ch. E2 has been received as an exotic signal, as have other Arabic stations. On June 1st at 0945 BST Tony Brittain (Northampton) received frequency gratings carrying the identification UAE (United Arab Emirates) on ch. E3. This station is not as yet officially listed – can anyone help? At 1100 Tony received the NTV (Nigeria) Sokoto identification slide for some five minutes on ch. E2. These double-hop signals were dramatic catches – our congratulations to Tony. Tropospheric openings have also been plentiful, with several sustained periods of enhanced propagation in Band III and at u.h.f. This activity was aided during late May/early June by a dominant high-pressure system that was centred over the UK: it terminated with heavy thunderstorms on June 4/5th. Several instances of lightning scatter have been reported in recent weeks: Tim Anderson (St. Leonards) experienced very strong lightning pings from Belgian Band III transmitters; Cyril Willis (Downham Market, Norfolk), using a near ground level group A u.h.f. array, noted pings on otherwise unoccupied channels corresponding with the lightning flashes of a distant storm.

The first period of tropospheric activity, over May 11-14th and then again on the 18th, produced enhanced Band III/u.h.f. reception from Benelux/France in the central/southern UK and Scandinavian reception in east coast/Scottish locations. There was a similar lift on the 19th/21st, but the major event occurred from the 29th onwards as a result of the previously mentioned high-pressure system. Signals from NRK (Norway) and SR (Sweden) were received along the east/Scottish coasts on the 29/30th, extending across the UK over June 1st/4th along with enhanced reception from Benelux/French stations. Conditions on the 3rd/4th were particularly rewarding, with BFBS ch. D43, many Band III/u.h.f. Swedish stations, NRK on most Band III channels and DR (Denmark) Band III. The storms on the 4th put an end to this activity. The Norwegian Band III signals were intense for many enthusiasts, though we had to put up with a staple diet of Benelux/W. German Band III/u.h.f. stations along the south coast.

Mike Gaskin (Caterham) received Canal Plus on ch. F3 (Band I) with horizontal polarisation on May 19th at 1400. On the following day he logged suspected MS RTE-1 (Eire) Gort ch. B at 1055. Aircraft scatter was initially suspected but the ping was both strong and was not repeated.

Sunspot activity was very low during the period, with a zero count on several days. Unfortunately the Aurora expected on May 18/19th, following a 27 day solar rotation after an excellent event in April, didn't materialise.

The SpE log is long and comprehensive, indicating the really excellent conditions during the period.

7/5/85 RAI (Italy) ch. IA, B; TVE (Spain) E3; ARD (W. Germany) E2; CST (Czechoslovakia), R1.
8/5/85 TSS (USSR) R1; TVP (Poland) R1.
9/5/85 TVE E3; RAI IA.
10/5/85 NRK (Norway) E3, 4; RAI IB.
11/5/85 TVE E2.
12/5/85 TSS R1; MTV-1 (Hungary) R1; RAI IA.
13/5/85 TSS R1; CST R1; RUV (Iceland) E4.
14/5/85 RAI IA; ARD E2; NRK E2, 3, 4; SR (Sweden) E4.
15/5/85 TSS R1, 2; CST R1; TVP R1; NRK E2; TVE E2.
16/5/85 RTP (Portugal) E3; CST R1.
17/5/85 TVE E2; RTP E3; SR E3; JRT (Yugoslavia) E3.
18/5/85 RAI IA; TVE E2, 3; TVE-2 E2; RTP E2.
19/5/85 RAI IA, B; TVE E2, 4; SR E2; TVR (Rumania) R2.
20/5/85 CST R1; TSS R1; TVP R1.
21/5/85 TVE E2, 4.
22/5/85 SR E2.
23/5/85 RAI IA, B; ORF (Austria) E2a; JRT E3; TVR R2; TVP R1; TSS R1; CST R1 (RETMA card).
24/5/85 TVE E2-4; TVE-2 E2; RTP E3; RAI IA; JRT E3, 4; ORF E2a, 4; +PTT (Switzerland) E3, 4; MTV R1, 2; TVR R2; TVP R1, 2; TSS R1-3; ARD E2; SR E2; NCT Udine (Italian free station) IA (chessboard); JTV (Jordan) ch. E3 at 1840. A new Valencia region TVE test pattern was noted: a grey-scale rectangle at top centre, with horizontal grey scales at each side of the rectangle and the identification Valencia beneath. The m.u.f. reached 150MHz this day: Band II was jammed with Italian f.m. signals.
25/5/85 TVP R1, 2; MTV R1, 2; RAI IA, B; NCT Udine IA; JRT E3; TVE E2-4; TSS R1, 2; RTP E2, 3; ARD E2, 4; CST R1, 2; NRK E3; JTV E3.
26/5/85 TVE E2-4; JRT E2.
27/5/85 TSS R1, 2; TVP R1, 2; TVE E2-4; TVE-2 E2; RTP E2.
28/5/85 SR E2; NRK E2, 3; RAI IA, B; CST R2; TVE E2-4; RTP E2, 3; JTV E3.
29/5/85 TVE E2-4; TVE-2 E2; RTP E2, 4 (Azores); TSS R1, 2; RAI IA. The m.u.f. reached 144MHz. The AFN US Navy broadcasting station in S. Spain was heard at 96MHz. English language E3 sound was monitored but no picture.
30/5/85 TVE E2-4; RTP E2, 3; RAI IA; SR E3.
31/5/85 TVE E2-4; RTP E3; RAI IA; TVP R2; SR E3.
1/6/85 RUV (Iceland) E4; TVE E3; RAI IA; NIRT (Iran) E2 (FUBK pattern). See also above.
2/6/85 RAI IA, B; NCT Udine IA; JRT E3, 4; TVE E2-4; TSS R1, 2. Band I eventually jammed, making reception impossible. The m.u.f. reached 144MHz (Bristol and Yugoslavian amateurs were in contact).
3/6/85 SR E2-4; TSS R1-5; DR (Denmark) E3; CST R1, 2; NRK E2; JRT E3; +PTT E2; EPT (Greece) E3; YLE (Finland) E3; TVE E2-4; RAI IA, B; JRT E3 at 2018 BST – a PM5544 test pattern was noted in the south as a floater, with test tone, can anyone help? The opening lasted for some 14 hours with the m.u.f. rising above 100MHz, giving Arabic N. African f.m. stations on car radios in the rush hour at Southampton!
4/6/85 TSS R1, 2; CST R1, 2; RAI IA, B; TVE E2-4; RTP E3; EPT E3.

In all, an extremely active and rewarding month, and the first time that notch filters have not been required to remove local Band I signals for over two decades! The Iranian signals on the 1st were noted by Cyril Willis, Tony Brittain and Ray Davies. At the time of writing there have been no reports of SpE reception in Band III, though repeated checks have been made here whenever the m.u.f. has risen above 100MHz. Pleasing to note the new TVE Valencia regional test pattern, while farther to the east the vintage Russian 0249 monoscope test pattern was seen on ch. R3 during a torrid opening.

My thanks to Tony Privett (Basingstoke), Reg Roper (Torpoint), Tim Anderson (St. Leonards), Tony Brittain (Northampton), Paul Hardy (Caversham), Cyril Willis

(Downham Market), Dave Shirley (Hastings), Ray Davies (Norwich), Simon Hamer (Powys), Bill Cotterill (Tipton), Iain Menzies (Aberdeen), Steve Smith (Chelmsford), Mel Thurlbourn (Hemel Hempstead), Lyn Berry (Eastleigh) and Keith Chaplin (Barrow-on-Soar) for sending in details of their reception to supplement my own observations.

Multi-Standard Sound

One of the problems with using a system I TV set for DX-TV reception is that the 6MHz intercarrier sound doesn't allow reception of the 5·5MHz system B/G sound. Alan Beech has sent in a simple circuit that provides for 5·5, 6 and 6·5MHz (E. European system D) sound, see Fig. 1. It uses a TBA120AS intercarrier sound chip and is based on the circuit employed in the Philips KT3 chassis. Ceramic resonators are used in the input filter and detector circuits, with a four-pole, three-way switch for system selection. Construction is simple, but ensure that lead lengths are short. In the prototype the ceramic resonators were mounted on the switch contacts and wired back to the board with screened cable. Set the d.c. volume control connected to pin 5 to suit the following audio amplifier. 5·5 and 6MHz filters are available from various sources including PV Tubes. The whole range of filters (4·5-6·5MHz) is available from T. Powell, 16 Paddington Green, London W2 1LG. Note that the input and demodulator filters are not the same type.

Satellite Receiving Licences

As mentioned in Teletopics last month, individuals can now apply for a licence to receive satellite TV signals. You apply to the Department of Trade and Industry, Radio Regulatory Division, on form BR39 "Application for a Licence for Television Receive Only Satellite Receiving Equipment (TVRO)". The licence covers a specific terminal system for a once only payment of £10: additional systems used on the same premises each require a separate licence. It's essential to obtain the licence before any receiving equipment is bought or operated. The application form comes with a page of explanatory notes. Further information can be obtained from the DTI on 01-275 3363 or 3221.

The explanatory notes are interesting. For example, no frequency bands are mentioned, which implies that the 4GHz, 11GHz cable downlink and 12GHz proposed DBS bands can all be received. Paragraph (3) states that "the licence is confined to the reception of television programmes forming part of a television programme channel intended ultimately for general reception". This suggests that international links, e.g. via Intelsat or Gorizont, can be received since the signals are "ultimately for general reception". Paragraph (6) points out that "the issue of a TVRO receiving equipment licence does not affect any requirements for licences under the Telecommunications Act 1984 or the Cable and Broadcasting Act 1984" while paragraph (7) comments that "the issue of a TVRO receiving equipment licence does not affect any rights in the television programmes".

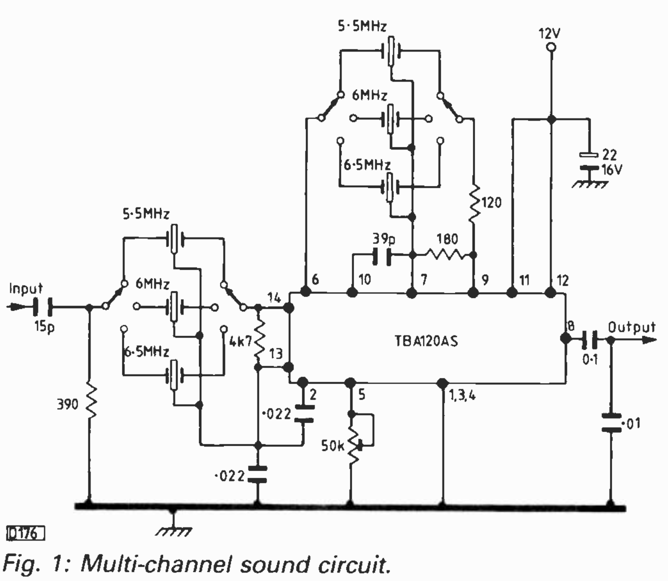

Fig. 1: Multi-channel sound circuit.

Paragraph (4) makes the points that the issue of a licence doesn't mean reception will be feasible and that TV transmissions from low-powered telecommunications satellites are not protected from interference from other authorised radio services, existing or future. The need for planning permission is mentioned in paragraph (8).

Cordless Phones

A problem that's causing heartache amongst many TV-DXers, particularly those who live in heavily populated areas, is interference from illegal cordless phones operating in the 49MHz band. When picked up by a TV set, even one with a reduced bandwidth capability, the interference can seriously impair reception of chs. E2 and R1. Generally an informal approach to the user, telling him that his calls are being monitored and are causing interference, will be more successful than an official approach through the appropriate bodies. If this fails the next step is to advise British Telecom of an illegal attachment of non-approved apparatus to their circuits, with information relating to the offender: there's a department that deals with this problem, in theory at least. The DTI is the body to approach regarding illegal radiation, but it seems that unless the equipment is causing interference to normal broadcast or other services action is unlikely – mainly because the DTI is currently under great pressure as a result of other abusers of the r.f. spectrum.

As from last October 1st, manufacture of 1·7MHz base transmitters for use in the USA ceased. It's quite likely that the new FCC standard 46/49MHz units will appear in the UK in the near future – in addition to dumped 1·7/49MHz equipment. We'll then experience cordless operation in the 46, 47 and 49MHz bands. For the record the new FCC allocations, base station first, handset second, are as follows: ch. 1 46·61/49·67MHz; ch. 2 46·63/49·845MHz; ch. 3 46·67/49·86MHz; ch. 4 46·71/49·77MHz; ch. 5 46·73/49·875MHz; ch. 6 46·77/49·83MHz; ch. 7 46·83/49·98MHz; ch. 8 46·87/49·93MHz; ch. 9 46·93/49·99MHz; ch. 10 46·97/49·97MHz.

It's sobering to note that sales of cordless phones in the USA passed the six million level last year. The latest 46/49MHz units enable the user to change channels without need for dealer/factory adjustment. Current research is aiming at automatic dialling by merely speaking a name into the device which recognises the requirement and dials via a preprogrammed memory.

Canal Plus

Four Canal Plus stations can now be received at fair/good strengths on a daily basis in the southern UK – Lille ch. F5 (176MHz vision), Paris ch. F6 (184MHz vision), Rouen ch. F7 (192MHz vision) and Caen ch. F9 (208MHz vision). In addition at least four Band I relay stations are in operation – Plessis ch. F3 and Etampes ch. F4 in the Paris/Nord region, Mont Brian ch. F 4 and Clermont Ferrand (Ville) ch. F4 in the Rhone/Alpes region. These use horizontal polarisation and although the powers are not known they are probably rather low. As noted earlier, ch. F3 was received recently by Mike Gaskin in Caterham during a recent tropospheric opening. Ch. F3 has the vision at 60·5MHz, ch. F4 has 63·75MHz vision.

News Items

UK: Considerable change is afoot following decisions made at the Regional Conference for VHF/FM Sound Broadcasting last year. Band II broadcasting allocations are to be gradually changed, starting in September 1985, with sub-bands for UK local radio (both BBC and ILR). From July 1987 the band will be subdivided as follows:

88-94·5MHz	Three national BBC programmes as at present.
94·6-96MHz	Lower local radio sub-band, mainly BBC.
96-97·6MHz	Lower local radio sub-band, mainly ILR.
97·7-99·8MHz	Fourth national service.
99·9-102MHz	Fifth national service.
102-103·5MHz	Upper local radio sub-band, mainly ILR.
103·5-104·9MHz	Upper local radio sub-band, mainly BBC.
105-107·9MHz	Community radio, fill-ins etc.

One of the national service sub-bands is for a commercial radio service. It's expected that the mobile/Home Office services will be cleared from Band II by 1990, six years earlier than previously anticipated. Our thanks to the IBA for the above information.

Now for a "stop press" item: Kiss-TV, a Craigavon (N. Ireland) based pirate TV operation, is likely to take to the air at weekend evenings from late June, probably on ch. 33 or 34. The coverage is expected to be about twenty miles in radius, centred at Lurgan.

France: Unscrambled Canal Plus transmission times at present are as follows: Saturdays 1655-1935; Sundays 1845-2000; weekdays 0600-0800 and 1655-1935 with an extension to 2005 on Fridays. These times are BST.

The French DX-TV club AFATELD has resumed operations, covering TV and f.m. radio. The address is PO Box 24, 40001 Mont de Marsan Cedex, France and the annual subscription 100 Francs. This includes a monthly bulletin called *Teleplus*. Please include return postage with any enquiries. AFATELD tell us that the first private French TV stations are expected to open in September/October this year and that Canal Plus may go 100 per cent unscrambled at that time.

New BATC Publication

The latest publication from the British Amateur Television Club is *Micro and Television Projects* by Trevor Brown. It includes a number of circuits, e.g. a test pattern source, vision switcher, electronic test card, a PAL and SECAM coder, and an extensive section on the home computer and its TV applications. There are several constructional projects for use with microcomputers and the various boards are available from the BATC. The book is a valuable reference source: highly recommended at £3·50 including postage from BATC Publications, 14 Lilac Avenue, Leicester LE5 1FN. Additional postage is required for overseas sales. For general enquiries please include a stamped SAE.

Satellite News

Turner Broadcasting plans to start a 24-hour news service for the European area this September. Apparently a seven year lease has been negotiated with Comsat/British Telecom International for a 4GHz band Intelsat uplink cross-strapped to a 12GHz band downlink. For product familiarisation the service is to be free until December. Customers would then be expected to negotiate fees with Turner (CNN) and BTI for continued use of the service. It's anticipated that high-quality reception should be possible using a 2m dish.

A dual-band scalar feedhorn for use at 4 and 12GHz has been introduced in the USA. The second, smaller 12GHz section is integrated in the main reflector ring system, the idea being to allow a single dish to be used for both bands, with a slight compromise in feedhorn positioning to optimise 12GHz pickup.

An interesting alignment aid now comes with all Chaparral Communications feedhorns in the USA. It consists of a durable plastic clip-on arrow which simplifies feedhorn alignment relative to the polar axis of the dish, ensuring correct vertical/horizontal positioning when used with a polarity servo motor.

It seems that the 714MHz Ekran satellite at 99°E, for TSS-1 downlinking, has been received by an Australian DX enthusiast: the vision buzz was heard via an AR2001 scanner and an outboard u.h.f. converter. Further news about this reception is awaited. Finally a cry for help from Doru Virlan of Str. Dorobanti, Block 11c, Et. 4, Apart. 14, RO-5100 Buzau, Rumania who is seeking help and information on building a satellite receiver.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 cheque or postal order (made out to IPC Magazines Ltd.), the query coupon and a stamped addressed envelope. We can deal with only one query at a time. We regret that we cannot supply service sheets nor answer queries over the telephone.

DECCA 70 SERIES CHASSIS

The problem is incorrect field lock at switch on. Repeated channel changes will produce correct field lock, alternatively retuning a channel will bring the picture to the correct position. When a channel change is made however the picture is split. The field timebase and i.f. i.c.s have been replaced with no improvement and the voltages in these areas are roughly correct. The a.g.c. action seems to be correct.

This sort of problem is generally due to faulty electrolytics. The suspects in this case are C307 (10μF) in the field sync pulse integrator stage and the two electrolytics 1C11 (1μF) and 1C12 (33μF) associated with the a.g.c. circuitry. An oscilloscope to check the quality of the field sync pulses at the base of the video emitter-follower 1Tr1 would be invaluable.

PYE 731 CHASSIS – VCR OPERATION

I'm having difficulty using this set with a VCR (Sony C5). There's a lot of line tearing, more on prerecorded tapes, and the tracking control has no effect.

The 731 was the first Pye solid-state chassis and used an SN76544N07 line/field timebase oscillator i.c. mounted on a subpanel: it's not an ideal chassis for use with a VCR . . . The flywheel line sync filter components are connected to pin 7 of the i.c.: try reducing the value of C516 from 0·022μF to 0·01μF and C516 from 10μF to 4·7μF. Some experimentation with the values of these capacitors may be necessary to strike a good compromise between VCR and off-air performance.

ZANUSSI BR1026

The focus control had negligible effect and there was intermittent sparking from an unusual resistor (R218) on the c.r.t. base panel, accompanied by black spots and crackling on sound. Subsequently the picture went very faint and dark.

R218 is a 47MΩ resistor which is in series with the focus control. Replace it along with R347 (28MΩ) on the tripler (feed to the focus control) or alternatively replace the whole lot with a Thorn 8500 chassis or similar focus control.

THORN TX10 CHASSIS

The original fault with this remote-control set was that the picture would suddenly revert to monochrome with the volume going high. At the same time a white line would streak down the screen. The picture could be reset with the normal button on the remote control unit. In addition the picture would dim slightly when subtitles were present. Now the set cuts out altogether instead, coming on again an instant later. The symptoms occur mainly just after switch on, the set settling down once it has warmed up (except for the odd occasion).

The most likely cause of these troubles is a faulty focus control unit. If replacing this doesn't cure the problem, check for dry-joints at the chopper driver transistor TR721 and the chopper driver transformer T704. A further possibility is that the chopper control/trip i.c. is faulty. To check whether the excess current trip is operating, connect pin 6 of this i.c. to chassis and run on test.

PHILIPS N1700 VCR

On bright colours vertical lines appear on the screen. I've tried adjusting the chroma current control R710 but this has very little effect. At minimum setting the machine still records colour and the lines are still present: at maximum setting the colours are fully saturated and the lines are worse.

Set R710 to its centre position, then adjust R21 in module U515 (chroma a.g.c.) to eliminate the effect. U515 is on panel 51. Adjustment is critical: if reduced too far the result will be intermittent chroma.

BUSH BC6004

When the set is switched on from cold it trips as soon as the picture becomes visible. After about five minutes it switches on again. After four trip cycles it remains off unless switched off for about twenty seconds. Once the set has warmed up the tripping stops. Disconnecting the tripler makes no difference.

Tripping often means excessive h.t. voltage. Set P943 for 122V at R836 (transformer end). If the tripping persists, check the 22V zener diode D956 on the sync/control module.

HITACHI CWP132 (NP6C CHASSIS)

This set will work perfectly for long periods then suddenly you can hear arcing coming from the area of the chopper transformer T902, the h.t. falls to about 80V and the picture decreases in size. The power supply has been checked for dry-joints and the two reference voltage modules CP901/2 have been swapped over (one is for over-voltage protection only). A new chopper transistor has also been tried.

This trouble is usually due to dry-joints on T902 or maybe the line ouput transformer T703, though we have had these exact symptoms caused by the h.t. reservoir capacitor C925 (220μF, 160V). If necessary, try replacing R937 (220Ω) which is associated with CP901.

QUERY COUPON

Available until 21st August 1985. One coupon, plus a £1·50 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice printed above.

TELEVISION AUGUST 1985

PYE 715 AND 725 CHASSIS

I've one of these sets with a six push-button tuner head and another with a four push-button tuner head. They've both been plagued by the same fault – breakage of the interlocking metal strips between the push-buttons. Both heads have been replaced twice. Is there an alternative solution?

The easiest course is to fit a four- or six-way rotary switch to the front panel, close to the tuner resistors, and wire one connection to each of the broken push-button unit contacts – the unit will still be needed for tuning purposes. Philips produced a version of the 715 chassis with a rotary switch and this never gave any trouble.

PYE RC4001 REMOTE CONTROL UNIT

Despite fitting a new battery the operation of this remote control unit is erratic – it doesn't operate in the proper sequence. Any ideas?

The common failing with this unit is that the flexible printed circuit flakes off, causing shorts. Keypads and contact strips to replace the faulty ones can be obtained from Philips at considerably less than the cost of a new unit.

TEST CASE

272

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.

With any TV or VCR fault the first and most important step in diagnosis is a careful analysis of the symptoms, especially where they are displayed on the screen! With logical thought and reasoning large areas of circuitry can be eliminated from suspicion, narrowing down the field of investigation to a few key points. Having said that, we must agree that some visual symptoms are more difficult to analyse than others!

How about this one? The set was a Mitsubishi CT2206TX. It's of modern, conventional design and has infra-red remote control and teletext. The reported symptom was diagonal black lines across the screen, and there they were. Close inspection showed that the lines were not black but grey: in fact the lines were colourless, and detuning the set to lose the chroma signal completely eliminated them. The number and angle of the lines suggested that their base frequency was within a few hundred Hz of the line scan rate, and there was little drift. A second symptom was that the user colour control had little effect – we were unable to try the effect of the colour up/down buttons on the remote control unit as our customer had hung on to it.

Plainly the interference was not tied to the mains frequency or to that of either of the timebases, so we reasoned that it must be occurring as a result of the action of some other timing source. But where? And why did it affect only the chroma signal? Having pondered over this for some time we removed the set's back cover, clipped the scope probe's earth lead to the chassis and wavered uncertainly over the colour decoder panel, whose main feature is a single chip (M5194P) that contains virtually all the chroma signal processing circuitry. The 12V supply was clean; the reference oscillator was locked and its output was smooth and continuous; the incoming line pulses at pin 3 were o.k. so far as we could judge, no waveform being given in the manual to guide us; and the only strange scope reading we got was at pin 2 of the i.c. This pin receives the d.c. voltage from the colour control: what we found was a substantial squarewave at some frequency in the kHz range!

Disconnecting pin 2 of the i.c. showed that the spurious waveform was not coming from within the chip, while an externally applied source of 5V d.c. gave a perfectly satisfactory picture. We're now getting dangerously close to giving the game away! The problem lay not in the colour decoder board circuitry of course, and if you consider the previously listed features of this set it shouldn't be too difficult to suss out what was wrong. With hindsight all the screen symptoms made sense and the offending diagonal lines were clearly caused by an independent timing source within the set. There was one other vital clue to be had without removing the set's back. What was it, and where was the source of the trouble? See next month's issue.

ANSWER TO TEST CASE 271
– page 519 last month –

It wasn't necessary to be familiar with Bang and Olufsen TV sets to solve last month's puzzle. The presence of a full supply line amplitude squarewave at the output of a class B transistor field output stage is a sure indication of an open-circuit in the vicinity of the field scan coils: with no effective load, the output pair of transistors simply switch their mid-point between the chassis and supply line voltages.

Seldom do the scan coils themselves go open-circuit, which is fortunate in view of the cost of a complete scan coil assembly! In the case of our Beovision 6002 the trouble was on the convergence panel – there was a dry-joint at P11-6, which links the series connected coils via transformer 8L3 on the panel.

The other clue we mentioned? In many sets (not this B and O chassis however) the energy in the adjacent line scan coils during the flyback induces some current (perhaps via stray capacitance, an external damping resistor or whatever) in the field scan coils: the result is a telltale undulation of the horizontal white line across the screen. It generally takes the form of a slight sinusoidal wriggle at the left-hand side of the line. If you see such a display, look no further than the field yoke circuit itself.

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BC108	7p
BC109	7p
BC115	10p
BC118	11p
BC140	19p
BC141	19p
BC142	19p
BC143	19p
BC147	6p
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BC149	6p
BC157	6p
BC159	6p
BC182	6p
BC182L	6p
BC183	6p
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BC184	6p
BC184L	6p
BC212	6p
BC212L	6p
BC213	6p
BC213L	6p
BC214	6p
BC214L	6p
BC237	7p
BC238	7p
BC300	16p
BC301	18p
BC302	18p
BC303	18p
BC327	6p
BC328	6p

BC337	6p
BC338	6p
BC557	6p
BCY32	150p
BCY33	150p
BCY34	150p
BCY42	20p
BCY56	16p
BCY70	16p
BCY71	16p
BCY72	16p
BD115	26p
BD124P	50p
BD124	110p
BD128	35p
BD131	25p
BD132	25p
BD135	20p
BD136	20p
BD137	20p
BD138	20p
BD139	20p
BD140	20p
BD144	90p
BD150	30p
BD157	38p
BD158	38p
BD166	30p
BD175	30p
BD177	30p
BD179	32p
BD181	45p
BD182	60p
BD183	60p
BD187	30p
BD201	33p
BD202	38p
BD203	42p
BD204	42p
BD222	31p
BD225	31p
BD232	31p
BD234	32p
BD235	28p
BD236	30p
BD237	21p
BD238	24p
BD244	50p
BD245	50p
BD433	28p
BD434	30p
BD435	31p
BD437	28p
BD438	36p
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BD535	38p
BD536	38p
BD537	40p
BD538	40p
BD675	40p
BD676	40p
BD677	38p
BD678	40p
BD679	40p
BD680	40p
BD681	45p
BD682	45p
BDX32	100p
BDX65	80p
BDY92	100p
BF180	16p
BF181	16p
BF183	20p

BF184	20p
BF185	20p
BF194	5p
BF195	5p
BF196	6p
BF197	7p
BF198	7p
BF199	6p
BF200	25p
BF240	16p
BF241	10p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
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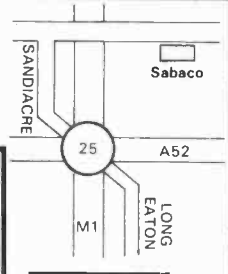

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BYX 10 6p
BYX 36/600 35p
BYX 38/300 25p
BYX49/600R 75p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYX 36/600 50p
BYV 95B 10p
BVY 95C 12p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v G11 8p
BZU 15/24 54p
BZY 93c75 50p
BZV 15/18 30p
BZV 15/30 30p
BZW 70c6v2 10p
BZX 79.3v 10p

Bush thyristor RCA 76122 £1
Transformer 240v/20v-500Ma 75p
Chassis type Transformer 240v/12 Volts 500m/a 75p
CVC 20 tube base £2
Tube Base Rank & G11 £1.20
6v-9v-13v tape motor 75p
Swiss made 250rpm/240V motor very small 75p
Infra red led LD57CA 15p
Mono scan coil £3
G 8 transductor £1.25
AT 4041/41 transductor £1
VHF 3 Transistor rotary tuner DX-TV £1
15K-20 turn pots 20p
Thorn panel 6×100 pot + changeover switch (Irish) 50p
Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £6
Thorn 3500 2A cut out 50p
Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit £6

SPECIAL OFFER
Decca-ITT etc.
FEO4/1/250AC/4
Mains filters
(grey type) × 4
80p

BRIDGES
SKB 2/08 L5A 30p
KBL 005 30p
KBL 02 30p
KBP 04 30p
W02 15p
W004 15p
W005 20p
AT 2076/35 £7
AT 2076/55 GEC split diode transformer £10
AT 2048/11 LOPTI Mullard £2.50

HITACHI CPT2225 CHASSIS WITH TELETEX £30

10 Mixed TV & radio speakers £4
Philips car radio speaker door pair £7
2× Hi-Fi Philips car tune up tweeter EN8320 £10
ITT CVC45 8 way resistor unit for v/cap £3
4700/10v × 10 50p
68/16 × 10 50p
150/16 × 10 50p
47/25 × 10 50p
220/25 × 10 50p
1/250 × 10 50p
G8 Speaker £1
8000/30v 50p
470/40v × 10 £1
22/100v × 10 £1
100/350v 70p
400/350v 70p
.47/500v 25p
1/600v 25p
.022/1kv 10p
VIEW DATA PANELS NEW £3

Philips GP422.4CH (£40 cost) £6

VM6101
MULLARD TELETEX DECODER
With interface panel and data command panel
New £6 Post £2

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

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

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

20AX GEC Split Diode lead £1.00

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

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

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

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

Plastic Boxes 4¾ × 4 × 1 × ¼ 50p
100 Fuses £2.00
100 W/W Res. £1.50
BF 199 20 for £1
10 × 20 Turn 100k pots. Rank £2
Thorn 9 volt power supply regulated £3.00
BF 470 20 for £2
20 Slider Knobs 70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

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

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Thorn Spares

New 9000 Decoder	£8.50
9000 Frame panel	£8
9000 Cyclops panel	£1.50
8000/8500 timebase panel	£8
8800 convergence panel	£6
8500 convergence panel	£6
4000 Power supply	£3
1600 Mains lead, switch	
3500 6 push button + cable form	£1.50
T605 1vNPN T066 80v/6A	10p
9000 Sound output panel	£1
3500 Focus unit	£1.50
3500 Mains Trans	£4
3500 cut outs	10 for £4
3500 IF panel	£2
3500 Frame panel	£3
3500 Line panel	£3
3500 AI Diode	20p
Export 3500 IF panel	£2
IC board with set of SN74LS	£1
4000 Tube base	£4
3500 AI pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA	£3.50
Rank/Toshiba preh unit 0354	£9.50
2 banks of 3 PB unit. Pye 731	£2
4 Push button unit preh	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button Unit fits GEC & Decca etc.	£6.00
Hearing aid unit	£3
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

Pair 25 watt 4Ω speaker & tweeter in cabinet		£15.00
15Ω 12" speaker, 90 watts		£12.00
6×4 G11	25 ohm	£1.00
5½×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
8×5 8 ohm	15 watt	£2
8×5	8 ohm	£1
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6½" dia	4 ohm	£1.50
6½" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
4½" sq.	15 ohm	75p
KT3 speaker	K30	75p
3" dia	15 ohm	60p
1690 5×3	12 ohm	£1
K45 Philip	15 ohm	75p
K30 15 watt		£1

KT3-K30

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

Diodes

BY 127	10p
BY 133	10p
BY 134	10p
BY 164	50p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600; 4 8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 229/400	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 602	10p
F 247	10p
XK 3102	50p

International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p

XK 3123 THORN	50p
Hitachi 2A/1500V metal case wire end FARST/REC	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
Ex panel "14" Fidelity portable	£5
3500 L.O.P.T. & HT Trans	each £2
LOPT Rank Z763	£5

Triplers

ITT CVC 5-8-9	£3.50
Rank T25LE Tripler	£2.00
Rank HTCP A823	£3.50
TU 25 30K Rank	£3.00
8500 Triplers	£6.50
11 TEZ 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
HTBQ Pye 731	£3.00
HTHY	£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

TELETEX DECODER

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

BTW 92/800R	£3
25A473 PNP C/P	10p

5 Volt Mains Transformer 2 Amp	50p
30V Power Supply 500M/A 4×2¼	£2.50
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/LOPTI	£10
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£16.90
Pye/Chelsea Timebase panel with LOPTI	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
Pye 607/205 Line panel with transformer	£10.00
Pye CDA/205 panel	£6.00
GEC portable chassis + LOPTI 2114 New	£4.00
Thorn 1613/1713 chassis	9.75
G9 Line Panel	£12.00
G9 Power Panel	£7.00

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	£10.00
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 1 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
Fedility Focus Unit 14R–14S	30p
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

CLOCK DISPLAY

4 SEG ACDM45	£1.00
4000 thick film	£2.00

DISPLAYS

4040 Clock	£1.00
7seg Red LED	50p
2 digit LED 8.8	50p
2 digit LED ÷1.8 with panel + MC14511	£1.00
4700/63	£1.50

250/64	10p
3300/70	50p
.1/100	5p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
2000/100	70p
4700/100	75p
47/160	10p
300 300/300V	80p
800/160	50p
.1/250 Pulse	5p
2.2 250v	10p
3n3/250 A.C.	10p
.33/250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
.91/250	35p
.91/400	30p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
GEC600/250	60p
700/250	£1
300+300 MFD 350v	£1.00
800/250	40p
32/300	20p
4/350	5p
8/350	8p
4.7M/350v	10p
33/350	20p
220/350	30p
300/350	40p
400/350	50p
10/375	10p
22/375	15p
220/385	75p
330/385 CVC 820HT	60p
0.1/400	15p
KT3 E/W .39/400	20p
.56K/400v	20p
4700pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
400/400	40p
394K/400V	20p
220/450	40p
.47/500	25p
0.1/600	15p
.047/600	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
.47/1000v	65p
.47/250V A.C	10p
.001K/1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n0/1500	10p
2n2/1500	15p
.01/1600	15p
G11.8200/2KV	15p
0.1/2KV	20p
10n/2KV	15p
3n9/2KV	15p
0.0015/2KV	10p
5n2/2KV	10p
6n2/2KV	15p
2n0/2KV	15p
2n2/2KV	15p
7500pf/2KV	10p
4n7/2KV	15p
8n2/2KV	15p
0.0082/2500	15p
150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p
170/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p
.47/100V	80p

CVC 20-25-30 Mains Switches	75p
Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Mains Remote Switch 2865 ohm	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	30p
KT3 Mainswitch	£1.00
THORN Rotary Mains Switch	50p
G8 Mains Switch	75p
Thyristor 600/4 amp C106/2	24p
G11 Preh Red LED P/Button for C.H. Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
Mains Switch ITT Long Type Print	75p
Mains Switch Philip Long Type TAG	75p
Mains Switch GEC Long Type TAG	75p
Thorn 12 or 24 volt battery convertor for portable colour T/V	£6.00
Tape Heads R/Play/Back Mono/Stereo	£1.00

Mains Isolation Transformer (R.S. 500V/A Type) in case	£25.00
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 LOP. TP preamplifier Tuning board. Colour RGB. LED Board Deflection Board

From £3 to £8

Multi-Caps

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

ITT Panels

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

Hand Sets

G11 Ultrasonic Teletex Handset	£24.00
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H	£15.00
New Replacement for G11 Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£24.00
Rank, Infra-red	£10.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18
Philips full remote KT3, 16C928/20C934; 7228/7324, K12 26C 797/1ST 66K 1826	£12.00
G11, Full remote top button assy.	£12.00
G11, Full remote repair service (exchange unit)	£12.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
Philips Key Pad set KT3/K30	£3.00
KT3/K30 T/Text	£15.00
KT3/K30 Full remote	£15.00
KT3 Power supply	£4.00
Hitachi 8 button unit with resistor unit. Last year mod.	£7.00
GEC infra-red 2236-2026	£4.00
GEC push pad hand set button blobs	**10p each**
Pye & Philips handset KT3-K30 chassis. No RC4001-RC5150-RC5176-RC5171-RC5177 **Special Price**	£13.00
ITT Hand Set with TV-Teletex-VCR	£12.00