JULY 1985

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

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

11GHz Low-noise Amplifier

VCRs and the Mains Supply

BBC Micro Test Pattern Program

Making PCBs • VCR Clinic

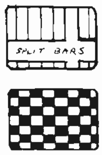
Approaches to TV Servicing

DX-TV • TV Fault Finding

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE



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

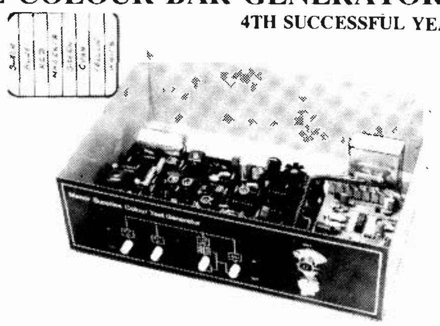
Price of Kit	**£70.00**
Case (10"×6"×2¼") app.	**£7.40**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£105.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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

PAL COLOUR BAR GENERATOR (Mk4)

4TH SUCCESSFUL YEAR



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

PRICE OF MK 4 COLOUR BAR GENERATOR KIT £30.00. CASE £7.40. BATT HOLDERS £2.80. MAINS SUPPLY KIT £4.20 (Combined P&P £2.20).

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Mullard Decorder panel + Interface **£35.00** p.p. £1.80
THORN TX10, PHILIPS G11 PRESTEL
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TELEVISION

July 1985

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Issue 417

this month

OUR NEXT ISSUE DATED AUGUST WILL BE PUBLISHED ON JULY 17

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74LS04	58	74LS42	80	74LS109	58	74LS163	85	74LS257	1.20
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74LS20	35	74LS75	65	74LS139	65	74LS194A	75	74LS366	82
74LS21	35	74LS76	65	74LS151	85	74LS197	95	74LS367	1.65
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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

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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
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'4000 B' SERIES CMOS

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		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
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4008B	72	4038B	99	4075B	22	4516B	76	4554B	1.20
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4012B	21	4042B	58	4077B	22	4519B	64	4560B	1.76
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4022B	70	4053B	72	4163B	72	4531B	72	4597B	1.84
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DECCA 27R/47R	1.40
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R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 713/15 3R5/15/45R	1.80
PYE 725/31 3R0/56R/27R	1.84
PYE 725 56R/27R	1.04
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PHILIPS 210/5051 -/118R/148R	93
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ECC88	1.35	GY501	1.45	PCL82	1.20	UCH81	2.25
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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

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	0.22mF	
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	0.1mF	
	0.22mF	

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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

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DECCA 30	6.76
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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)	
DECCA 1700 (200/200/400/350V)	5.32
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		Mfd	Price
			63V	1	12
6V3	33	9		2.2	12
10V	22	10		4.7	12
	47	10		10	11
	100	10		15	12
	220	15		22	13
	470	20		47	19
16V	33	11		100	23
	68	11		220	37
	220	16		470	49
	1000	27		1000	85
	3300	53		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			

CONVERGENCE POTS

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

METRIC CONVERGENCE POTS

PHILIPS G8 5R-10R-15R-20R-50R — 60

FUSES

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

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		

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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

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

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

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EVER READY

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

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PHILIPS G8 550 22"	£8	PHILIPS G8 550 22"	£15
PHILIPS G8 520 22"	£6	PHILIPS G8 520 22"	£12
PHILIPS G8 560 20"	£18	PHILIPS G8 560 20"	£25
★★★★★		★★★★★	
THORN TEXT 9650	£45	THORN 9600 REMOTE	£40
THORN REMOTE 9600	£30	THORN 9800	£35
THORN 9800	£25	THORN 9000	£30
THORN 9000	£20	THORN 8800	£20
THORN 8800	£14	THORN 8500	£15
THORN 8500	£10	THORN 3500	£10
THORN VERYCAP 3500	£5		
★★★★★		★★★★★	
DECCA 80	£20	DECCA 80	£30
DECCA 88	£30	DECCA 88	£40
DECCA 100	£25	DECCA 100	£35
DECCA HYBRID	£5	DECCA HYBRID	£10
★★★★★		★★★★★	
PYE 200 18"	£14	PYE 200 18"	£20
PYE CHELSEA 18"	£18	PYE CHELSEA 18"	£25
PYE 222	£10	PYE 222	£15
PYE 725 20"	£18	PYE 725 20"	£25
★★★★★		★★★★★	
ITT SOLID STATE	£23	ITT SOLID STATE	£30
ITT FULL REMOTE	£50	ITT FULL REMOTE	£60
ITT HYBRID	£5	ITT HYBRID	£10
★★★★★		★★★★★	
GEC 18"–20" IN-LINE	£20	GEC 18"–20" IN-LINE	£30
GEC SOLID STATE	£10	GEC SOLID STATE	£15
GEC 2201	£18	GEC 2201	£25
		JAP STOCK	£20

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

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

Telegen-2

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

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

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A switchable power supply ideally suited to both Telegen 1 and Telegen 2.
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Up to 19"	£28
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420 ERB	£45
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510 UFB/A51-590	£55
510 VSB	£60
AXT 51-001	£60
560 DYB-560 DTB	£62
560 EGB	£62
560 CGB	£62
560 DMB	£62
AXT 56-001	£62
660 AB	£65
A67-701	£65
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UPC1353C	2.78
UPC1356C2	3.40
UPC1365C	8.70
UPC1367C	3.40
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UPC1382C	1.88
UPC2002V	2.78
CA723	0.35
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400mW Plastic 3V–75V 8p each. 10/75p.
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1.5W Flange 4.7–47V £1.26 each
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400mW – 5 each value – 11 values – individually marked and packed – 55 Zener Diodes £3.00 per pack.

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50V Ceramic Capacitors – 5 each value 25 valves – each value individually marked and packed – 125 total. **£3.50 per pack.**

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

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Single Junc Socket	0.80
Plastic Phono	0.15
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Soldering Station complete with 30W or 40W Iron (state which)	49.95
XS25 Watt Iron complete with steel and plug attached	7.20
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Antex 18W iron	5.00
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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

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	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
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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

VDRs, etc.

E220ZZ 02/	0.28
E298CD /A258	0.25
E298ED /A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E299DD/P116-P354	all 0.23
E299DH /P230	0.72
VA1015	0.92
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

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)	£1.95	10/£1.95 each
PP3	£3.80	10/£3.70 each

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

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.

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

CHART RECORDER SPECIAL

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

SERVICE AIDS

ALL SERVISOL PRODUCTS

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

Additional P&P on above 30p each

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.

SCREENED CURLY LEADS

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

RESISTORS – CARBON FILM 5%

¼W 1R0 to 10M (E12 Range)	2p each. 15p/10. 75p/100
½W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	7p each. 65p/10. 6.00/100
2W 10R to 2M2 (E6 Range)	8p each. 70p/10. 6.00/100

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

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

D.C. MOTORS (Mini) 6-12V 75p £3.00/5

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
BA102	0.34
BA110	0.67
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12

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

Type	Price (£)
BC302	0.32
BC303	0.32
BC307	0.10
BC308A	0.10
BC323	0.99
BC327	0.14
BC328	0.14
BC337	0.12
BC338	0.12
BC350	0.14
BC440	0.30
BC441	0.32
BC461	0.32
BC547	0.12
BC548	0.12
BC549	0.12
BC550	0.18
BC550C	0.18
BC557	0.12
BC558	0.12
BCX34	0.27
BCY70	0.15
BCY71	0.17
BCY72	0.18
BCZ10	1.68
BCZ11	1.45
BD124P	0.80
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

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

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

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

Type	Price (£)
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ITT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.48
MJE2955	0.99
MJE3055	0.70
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
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70

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

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

I.C. SOCKETS

Dil to Dil

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

CAPACITORS

Metallised Paper

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

HV Disc Ceramic (†)

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

ORDERING: All components are brand new and to full specification. Please add 50p postage/packing (unless otherwise specified) to all orders and then add 15% VAT to the total. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome.
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Reflections at Show Time

This year's radio and TV trade shows were not noteworthy for displays of innovatory consumer electronics products. But then what should we expect? You can hardly have major advances on an annual basis. For the present it's stand still time, though business appears to have been good. What lies ahead? Well, there must obviously be satellite TV receiving equipment to sell once DBS services have started, but for the present the satellite TV equipment field is very much a specialised one, with small batch production.

One impression left behind is of the overwhelming dominance nowadays of the Japanese in the consumer electronics field. Japanese manufacturers certainly had a good year in 1984 – it's been company reporting time. As mentioned last month, Matsushita had a record year. Since then Hitachi have reported profits up 37 per cent, Mitsubishi Electric profits up 52·3 per cent, Sharp profits up 21·5 per cent and Toshiba profits up 38 per cent, all on substantially increased turnover. These profit/turnover increases are for the parent companies however and cover a wider field than just consumer electronic products. In this connection it's perhaps more relevant that JVC, which is predominantly a producer of consumer electronic products, managed a profit increase of only four per cent on turnover up by 18 per cent. Stiff price competition in the VCR field was one of the main factors blamed for this relatively poor result.

Japanese manufacturers have had a good run for their money. It looks as if they will do well again in 1985. This time the extraordinary thing is a sudden explosion in consumer demand in China, where over seven and a half million TV sets (a market size similar to that of Japan itself) are expected to be sold this year. The market is on Japan's doorstep, but it could well be an unpredictable one – demand has also been high recently for the whole range of domestic electrical products, from refrigerators and washing machines to pocket calculators. China is at present running a trade deficit and it's unlikely that the authorities will allow the situation to deteriorate to any marked extent. Furthermore the increased demand has been fuelled by an explosion of credit, which is unusual to say the least in a communist country. The central bank has expressed concern. There is of course a way around the trade deficit problem – another traditional Japanese ploy. This is to start up plants in the Chinese home market. Several joint venture projects have already been announced, by Philips as well as by Japanese manufacturers. It's a way of ensuring continued presence in a particular market, but one wonders how successful the ploy is financially. Japanese TV and VCR plants in the UK presumably exist primarily to guarantee a presence in the large EEC market, but they don't seem to have been wildly successful on a trading profit basis.

Internationally however fate has smiled upon the Japanese electrical manufacturers. When the European market reached saturation a couple of years ago there was a sudden increase in US demand. Now that the US market has turned flat the Chinese are clamouring for Japanese products. For how long can such a run of luck last? No sales chart has ever shown indefinite rising growth, and at some stage a halt to the rise is bound to occur. The developing world could certainly take a lot more production, but could it pay for this? One thing the Japanese expect is payment (you don't see Japanese banks lending billions upon billions to shaky S. American regimes – they leave that sort of thing to US and UK banks!). There is also the prospct of increased competition from Korea, which expects to export some two million VCRs over the next twelve months. We shall be seeing some of these in the UK, and they will sell at highly competitive prices. But Japanese electronics firms have managed to maintain their position despite competition from a number of lower cost producers in the far east. It will be interesting to see how the situation develops. After all Korea put the Japanese shipbuilding industry out of business many years ago now. But shipbuilding and steel manufacture are at the low-technology end of modern manufacturing. With consumer electronics the situation is rather different: the Japanese now dominate the technology, while the sheer size of their investment in modern plant would be hard to match. For the time being the Japanese lead in the field of TV and VCRs, but these are now mature markets in every sense. Product sales levels have reached saturation point in most markets, while technical development seems to have reached the end of its present phase. Money wouldn't have been poured into the FS tube if flat-screen displays were likely to be competitive, in terms of performance and price, in the foreseeable future, while digital TV doesn't for the present seem to offer much by way of improved performance. The field memory will give trick performance of the sort we're used to with VCRs, but will consumers want such features? One field that does offer scope for development and increased business is satellite TV of course.

In this connection the government's decision to relax the regulations on satellite TV reception in the UK is a curious one. Unnecessary restrictions should certainly be removed, but an odd situation could develop. Just suppose that a reasonable market develops for equipment to receive the medium-power satellites at present in operation providing signals intended primarily for cable networks. Mightn't this make it more difficult to get true DBS broadcasting, started, something that's proving difficult enough as it is? The decision looks to be a bit of a gamble, maybe just to get something, somehow, moving.

OBSCURE BRANDS

Many thanks to several readers who have provided information on Sovereign TV. We will be reporting next month. We have also received letters asking about Sonatel TV but have been unable to trace any source of spares, data etc. Can anyone provide information on this brand?

A DIFFICULT MONTH

Our apologies for any shortcomings this month. We've been involved in an office move (the address remains the same) which hasn't helped exactly. More seriously Dave Davies, who does our technical drawings, is in hospital. We are sure all readers will join in wishing him a speedy recovery.

FRONT COVER

This month's cover photograph shows a night scene at The London Teleport, British Telecom International's satellite-earth station in the Docklands. The Teleport transmits TV channels to cable networks in the UK and continental Europe. Our thanks to BTI for permission to reproduce the photograph.

Letters

IBA's TELETEXT EXPERIMENTS

Eugene Trundle's words of wisdom on "Dealing with Teletext Interference" (May issue) were useful and timely. As a result of the IBA tests he mentioned, the use of up to seven lines per field for teletext has now been authorized for all ITV regions. We had hoped to extend this to perhaps ten lines per field, but the tests in selected ITV regions showed that significant numbers of receivers that experience top-of-the-picture interference when a higher number of lines is employed are still in regular use. These are mostly older models and the number of lines will be limited to seven until most of these sets have either been modified or discarded.

On a point of history I'd like to make a correction. It was the IBA that made the first experimental transmissions of teletext-type signals from the Crystal Palace transmitter, during April 1973 – including "live" computer editing. The very first transmission was made during our "Engineering Announcements" on April 3rd, 1973. It was announced by Peter Ashforth as follows: "Just before we go this week, some of you may be interested to hear that for the past ten minutes or so during the bulletin we've been transmitting a special type of signal which carries information in data form: the information is transmitted during the blanking interval of the television and so, of course, can't be seen on a normal receiver." A filmed report of that early IBA teletext system, by Peter Fairley, then science correspondent of ITN, was broadcast during May 1973.

The IBA later willingly co-operated with the BBC, BREMA and the Home Office in establishing in 1974 the unified UK standard for teletext now used in some twenty countries across the world. Transmissions to this standard were first made by both the IBA and the BBC during the September 1974 International Broadcasting Convention. During our 1973 tests we identified the problems of data buzz and top-of-the-picture interference and the 1974 teletext specification took care to minimise the problem, which is inherently a question of receiver design.

The IBA "Engineering Announcements" referred to above still continue on the Channel 4/S4C network on Tuesdays at 9·15 a.m. and 12·15 p.m. IBA engineering information is also available at all times on Oracle page 590 (C4/S4C), with a list of Channel 4 transmitter conversions on page 390 (ITV).

Pat Hawker,
IBA Engineering Information Service.

SCOTCHTAPE CASSETTES

With reference to Mr. Henniker's letter in your May issue, the Lifetime Guarantee that 3M pledges with its market-leading Scotch videocassettes is supported by prompt, responsive action whenever a VCR owner or a retailer brings a faulty tape to our attention. It's a necessary part of the Guarantee that tapes presumed to be faulty are returned to us. To make returns painless – and free – for our customers all Scotch cassettes are sold with a Freepost label addressed to our Gorseinon, Swansea videotape factory. We check returned tapes to identify the problem – which in seven cases out of ten is due to machine damage or mishandling. We work closely with hardware manufacturers and retailers' service departments to ensure fault elimination and constant product improvement. What we cannot do is to replace tapes without seeing them.

Before writing to you Mr. Henniker was contacted by our Glasgow sales office, by our Bracknell head office, and was visited personally by our area representative – all in an attempt by 3M to give him satisfaction for his allegedly faulty L250 tape. On all occasions he has refused to return the tape to us.

Perhaps I can use your columns to appeal again to Mr. Henniker to send us the cassette? It will be replaced immediately with a new tape, and we would welcome the opportunity for our engineers to investigate the alleged fault.

D. J. Skinner, Field Service Manager,
Video Technical Centre, 3M United Kingdom PLC.

PYE HYBRID CTV MODIFICATION

I was recently asked by a friend to repair an ageing Pye hybrid colour set (691-697 chassis). The main fault was quickly dealt with. On viewing the picture however there appeared to be a lack of d.c. restoration, which I found annoying. The set had at some stage been fitted with a LEDCo CDA panel, so I looked up the circuit diagram given in the June 1979 issue of *Television.* This revealed a design problem with the link to the brightness control and since I wanted to do a good job for my friend (and I might occasionally have to watch the set myself) I decided to seek a solution. Although these sets are old many of them must still be in use so other readers may be interested in the solution I found. It's not perfect since the beam limiter action isn't as effective as it was.

Fig. 1(a) shows the initial arrangement with the luminance signal coupled by C39 to the first transistor (VT701) on the LEDCo panel. It will be seen that the base of VT701 is forward biased by R701/2. The voltage at the slider of the brightness control will be negative however (or possibly slightly positive – D39A will prevent the voltage at the top end of the control being much above zero). Hence the d.c. restorer diode D39 will always be heavily reversed biased and no d.c. restoration can take place. In the original valve circuit the luminance output pentode's control grid would have been biased negatively from the brightness control via R201 and D39 would have prevented any part of the video signal going below the voltage on C201, set by the brightness control. D.C. restoration of the signal was thus achieved.

The solution adopted was to remove R701 and R702 from the LEDCo panel and alter the brightness control

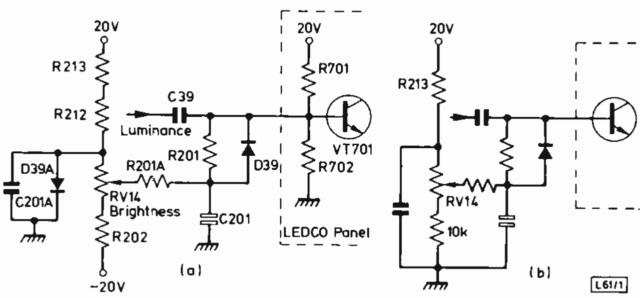


Fig. 1: Brightness control/d.c. restorer circuit used in the Pye 691-697 series chassis, (a) before modification, (b) after modification. Modification was required due to the use of a LEDCo solid-state CDA panel. Note that the collector of the beam limiter transistor VT35 is connected to the junction of resistors R212/R213, so the modification affects the limiting action.

circuit to provide a positive voltage on C201 so that the circuit could bias the base of VT701 directly, as it did the PL802's control grid in the original valve circuit. The modification is quite simple – see Fig. 1(b): D39A and R202 are removed, R212 is replaced with a link and an extra 10kΩ resistor is added between the bottom end of the brightness control and chassis.

The results were quite rewarding: dark pictures are really dark and bright pictures bright, with no black crushing. The only slight drawback is inadequate beam limiting: if the brightness or contrast is set too high there's severe loss of focus. This is no problem however with sensible settings of the controls. Time prevented further investigation into this problem – and I'm not sure that the tube wasn't partly responsible anyway. All in all a worthwhile exercise which should help keep these sets alive even longer.

Anthony Marlow, M.A.,
Sale, Cheshire.

BBC MICROCOMPUTER PROGRAM

Some alterations are required to the BBC microcomputer program in the June issue (page 446). First, the bit in brackets at the end of line 50 should be (10, " ."). The difference is in the spacing – the string is too long with the additional spaces you had at each side of the stop. Secondly, in lines 70 and 80 6% should in each case read c%.

Adding an extra line at the beginning of the program as follows:

```
5 *TV0,1
```

stops the interlace jitter.

Changing the last line to:

```
180  IF GET=9
     MODE7:PRINTTAB(13,12)"GOODBYE":
     END ELSE UNTIL 0
```

causes GOODBYE to be printed when exiting the program.

Roger Goodman,
Wandsworth, London SW18.

POINTS ON VCRs

In the May VCR Clinic Steve Beeching said that the Hitachi VT8700 was the first VCR he'd come across that would work without a cassette lamp. This gives the impression that the machine will work in the event of cassette lamp failure, which is not the case. As with all the VCRs in the Hitachi 8000 series, lamp failure is detected by the control microcomputer i.c.'s dew sense input (IC901, pin 33). Failure results in the stop condition with the stop light flashing. The relevant bit of circuit (for the VT8700) is shown in Fig. 2. Under normal operating conditions the lamp is alight and the cathode of zener diode ZD651 is held at a low voltage. If the cassette lamp fails there's no current flow via R653 and ZD651's cathode is at 15V. Being a 9V zener diode it conducts and, via D651, provides a high to IC901's dew sensor input. In Steve's case the lamp was o.k. but the feed resistor was open-circuit, so the safety circuit didn't operate. A weakness in the design perhaps, but it's the first case of this resistor going open-circuit I've heard of – and I've had only two faulty cassette lamps.

On the subject of liquids spilt into VCRs, a colleague recently had a Panasonic NV2000 which a pet had used as

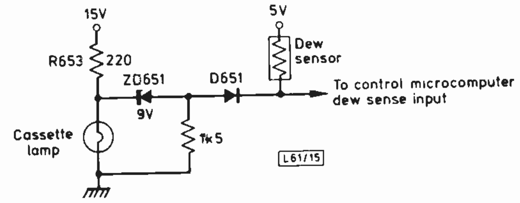


Fig. 2: Cassette lamp/dew sensor circuit used in the Hitachi VCR Model VT8700.

a toilet. It took three weeks to clean and locate the faults, was back with the customer for two weeks then had to come back for further repairs (it's still not fixed). The problem is that as fast as one fault is cured another appears, and they are all obscure faults that wouldn't happen under normal circumstances. I reckon we average one machine a month with spillage of some sort. With chargeable jobs, if the household insurance won't cover the repairs it can be uneconomical to try even without replacement panels – which some manufacturers won't provide anyway.

Finally, I must make a few comments concerning the letters about the present state of the TV trade and its future. I consider training in all industries to be the employer's responsibility, and that this is one of the country's biggest failings in the present economic climate. As to the future, while the service side is no longer expanding the increasing number of VCRs and microcomputers requiring attention are beginning to take up the slack caused by the increased reliability of TV sets. I agree that it's going to be difficult to get into the trade, but for those already in it the future should be reasonably secure, at least for another five to ten years – provided you keep up with the trends.

Derek Snelling,
Brownhills, Staffs.

TELETEXT BLANKING CIRCUIT

While chasing an intermittent fault in a Beovision 2600 I thought I'd try out the blanking circuit shown in Fig. 3(a) on page 372 of the May issue. I was suspicious about the connection shown to the field output transformer, feeling that the phasing was incorrect. Sure enough it is! If you connect up as shown the bottom half of the picture is blanked out with teletext flashing merrily in the upper half. The 0·1μF capacitor has to go to the same point on the transformer as the blanking circuit feed, i.e. the top of the winding shown in Fig. 3(a) not the bottom. Wired like this is works fine.

Keith Cummins,
Southampton, Hants.

PORTABLE CRT TESTER

With reference to Tony Thompson's comment about a portable CRT tester (May 1985) the converter circuit shown in Fig. 3 will produce a 240V a.c. output from a

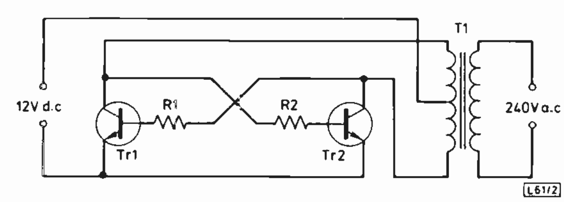


Fig. 3: Converter circuit for 12V d.c. to 240V a.c. Tr1, 2 type 2N3055; R1, 2 100Ω, 10W w.w.; transformer T1 is rated at 20VA and has 12-0-12V and 240V mains windings.

12V rechargeable dryfit lead-acid battery. It can be used with James Dilworth's CRT tester/booster which was described in the August 1981 issue of *Television.*
N. E. Hawkins,
Milton Keynes, Bucks.

THAT G11 MULTIFAILURE

With reference to Ivan C. Tucker's article on G11 problems, I'm sure that a lot of us have by now had first-hand experience of the *red* 470μF capacitor causing damage to the tube, the TDA2600 and the BU208A. Unfortunately the blue capacitors are not 100 per cent reliable either: I had to replace one two weeks ago because it destroyed BU208As.

So what happens if the same thing occurs again six months after replacing these parts? The customer complains to you! You return the tube with its unmistakable little star in the neck to the supplier, who won't replace it because he knows it was caused by the capacitor! The supplier of the capacitor *might* replace that but not the chip etc. Has anyone out there got a sensible answer before one of us gets really stung?
J. Hopkins, The TV Workshop,
Wisbech, Cambs.

SLIPPED SHADOWMASK

Here's an unusual "horror story" concerning a Bush set fitted with the Z718 chassis. On switching on one evening the picture showed severe colour errors, e.g. the snooker table was brilliant purple. A replacement decoder panel made no difference, so maybe it was a degaussing fault or a slipped shadowmask? The degaussing circuit turned out to be o.k., and putting the set on its side in the hope that the mask might return to its correct position brought no change.

We checked to see which guns were firing at which phosphors. Result, red was firing at green, green at blue and blue at red. So let's reconnect the video outputs appropriately. This gave true colours but shameful convergence. At this point we had a bit of luck, which we needed. Whilst examining the convergence strip at the top of the chassis we accidently removed the convergence waveforms by disconnecting the plug from the line output board. With no waveforms to displace the beams we found we had an almost correctly converged picture. This was optimised by adjustment of the red and blue static convergence magnets, giving correct colour across four fifths of the screen with aberrations on the left-hand side. Viewing from ten feet gives a very reasonable picture which has remained stable for some three years.
P. R. Atkins,
Southall, Middx.

SPECTRUM TEST PATTERN PROGRAM

As a result of correspondence following my Spectrum test card program (May) I've discovered that not all editions of the Spectrum manual contain a colour bar program. Also when the colour bar program is included it has the bars at two brightness levels and they don't fill the bottom lines of the screen. They also have numbers printed on them to indicate the keys relating to the colours. This feature may be required to set up the Spectrum with a TV set or monitor, but for TV test purposes full-brightness bars filling the entire screen area are required.

Unfortunately there's no way in which the bars can extend all the way to the border, but it's possible to use the bottom two lines by using the PRINT #1 command.

The original program can be modified as follows. Load the program, then enter the following lines:

```
472 IF i$="b" THEN BRIGHT 1: CLS: FOR n=0 to 21:
    FOR c=1 to 8: PRINT PAPER c(c);
    "    ";: NEXT c: NEXT n: PRINT #1;AT 0,0;: FOR
    n=0 to 2: FOR c=1 TO 8: PRINT #1; BRIGHT 1;
    PAPER c(c); "    ";: NEXT c: NEXT n: LET i$=""
474 IF i$="c" THEN BRIGHT 0: CLS: RUN
572 IF i$="b" OR i$="c" THEN GO TO 472
```

In addition, change line 100 to:

```
100 POKE 23658,0: LET nn=0: BORDER 1: PAPER 0:
    INK 7: CLS
```

Adding the POKE in this line ensures that the shift is in lower case. Note that there are four spaces between the first two sets of quotes. After testing, resave the whole thing on your cassette or microdrive.

When the program is run the card now appears as usual. If you press "b" you get bars, if you press "c" you get the test pattern. Pressing ENTER stops the program. Pressing any other key turns the music on or off.

If you wish to enter the bars as a stand-alone program, enter just line 472 without the IF . . . THEN and leave out (c), i.e. use PAPER c instead of PAPER c(c). Then enter line 474 as follows:

```
474 IF INKEY$=""THEN GOTO 474
```

Do not leave this line out. The colours won't appear in the same order as the full program. Pressing any key ends the program.

All cassettes sent out from the address in the original article after May 10th contain the additions.
John de Rivaz, B.Sc. (Eng.),
Truro, Cornwall.

MORE ON PLUGTOPS

I've not seen all the correspondence mentioned in the letter headed "plugtop hints" in the March issue. It seems that readers have been concerned about burning of the neutral pin in 13A plugs. My working life mainly involved trouble-shooting for a large manufacturer of switchgear, control gear and accessories, and in my experience burning of the neutral pin is almost always due to the pin having receded into the plug moulding. In most plugs the neutral pin retention is different from that of the live pin. The neutral pin is usually held in position by the cap moulding pressing against its square head, there being a recess in the cap to accommodate the head of the pinching screw.

When a poorly designed plug or one made of inferior material is pushed into a good quality socket with good socket pressure, either the neutral pin cap retaining corners crumble (thermosetting material) or the neutral pin pushes into the cap (soft PVC or some other thermoplastic materials). The metal head in cheap plugs is often smaller than in good ones so that there's less area of plastic to withstand the force. If the cap is of soft PVC the heat from a well loaded fuse softens the whole cap and the pin recedes even more readily.

Once the pin has receded, contact in the socket is reduced and burning of the pin end occurs.
L.E. Bevan,
Moseley, Birmingham.

Big Foot

Les Lawry-Johns

I thought I was the only one here who put his foot in it at least once a day – often more frequently. Now there are two of us. That puppy Zeb has grown rapidly and is now rather large. He'll get bigger – if he lives that long. Honey Bunch tried to bash in his brains (?) the other day after he'd ripped her prize plants out of the ground and then pulled them to pieces. I tried to act as peacemaker and ten minutes later was ready to kill him myself. He'd chased the cat through the shop and she'd leapt up on to a shelf and knocked off a record player just as the owner called to collect it.

Now that the weather is warmer I get a brief respite because he stays outside on a long lead for at least five minutes during which I can get just a little work done. To be fair though that's all we seem to be getting lately – just a little work, not really enough to pay the bills. Charge more they all shout. No. Not when there's not much work coming in. The time to charge more is when there are plenty of jobs and you can afford to lose a few.

What am I rabbiting on about? Sorry, it's the dog you see, he's having an effect on my nerves. When customers try to talk to me I stare past them with my face twitching and they think I'm going funny. Of course I'm not . . . I'm not . . . I'm not.

The CTV14R

Like the chap who brought in the Fidelity CTV14R. "It didn't cost much to buy so I don't want to spend much on having it repaired. Not more than say fifteen pounds."

So I took it in, hoping for a nice dry-joint. What a hope. The fuses were intact and there was a high voltage at the collector of the BUX84 chopper transistor. There was the same voltage, instead of 120V, at its emitter. It was short-circuit. So I stuck another one in. Switched on and there was a funny tripping noise as the h.t. started to rise and then collapsed. I was afraid that the line output transformer was at fault but didn't want to think about it. I checked the line output transistor carefully and then the diodes fed from secondary windings. One (D34) was short-circuit. Glory be. Now normally I would have checked around to see what had killed it, but I had to put my big foot in it. I put another diode in and of course the result was the same tripping. The reservoir electrolytic has shorted I thought, but although a short was found to be present it wasn't the capacitor's fault. When I isolated pins 2 and 5 of the TDA1170 field timebase i.c. the tripping stopped and a nice bright white line appeared across the screen to show that the set was happy to work without the chip to upset things.

So I looked for a TDA1170. I looked where they should be and then where they shouldn't. Perhaps I couldn't see properly? I looked at my glasses. They were smudged. I wiped the lenses and one broke away from the frame as the screw snapped off. Not my new glasses, my old ones – as you'll recall I can't wear my new ones as I can't see close up with them. I even have to take my old ones off to see really close. I knew I didn't have any screws small enough so I had to stick a piece of wire through the metal frame and solder both sides as I'd done when the lens at the other side broke away long ago. That's why I got the new ones I can't wear. I still couldn't find any TDA1170s however.

"What's wrong" asked Honey Bunch, who was playing ball with the dog.

"I can't find any TDA1170s love, even though I've cleaned and mended my glasses."

"Perhaps you've used them all."

"If I'd used them they'd be on the order sheet."

So I looked at the order sheet and they were on it. Then back it came in a blinding glimpse of the obvious. The Normende. That's where they went, together with the 630mA fuses. So I whipped a TDA2600 off the shelf and dashed down to swap it with Don and Ray.

"Ah Les" they greeted me. "Glad to see you. You don't happen to have a spare TDA2600 up at your shop do you? We're right out what with all these G11's gobbling them up." So I produced the TDA2600 from my pocket and they were astounded. I modestly looked at the ceiling and then at the teapot.

"What do you want in exchange for it?" asked Don.

"Nothing really, but I'll take a TDA1170 if you like."

So after joining them over a cup of tea (they don't have whisky down there) I nipped off carrying my precious chip which completed the Fidelity repair when fitted. The heatsink is a pest to get off but nowhere near as difficult as the one on the Normende. Perhaps it's my Weller soldering gun that's getting old (tighten up the nuts you fool).

Mack and Millie

These very nice people are old friends of mine and live not too far away in a select area where not very much happens except when their grandchildren visit and all hell breaks loose. Mack had phoned to say that their 26in. G11 had broken down. Their house was on the right as I drove up so I pulled over and ran the nearside wheels on to the path outside their gate and switched off the lights. Now Millie is a local magistrate, and when I went in she was going on about thoughtless motorists parking on the pavements all over the town. After exchanging the usual pleasantries I got on with the set and found a funny fault in the power supply. To save time I nipped out to the car to get my spare panel and was back in a flash.

"My God that was quick" commented Millie.

"Well I've parked on the pavement just outside" I admitted.

"YOU'VE DONE WHAT?"

"See you in court Millie."

The Estimate

A chap had left an ITT CVC20 and a message to the affect that £25 was his limit. After quite some time it transpired that the tripler was faulty and that the line output transformer was overheating with the tripler disconnected. After replacing the BU208 and fitting all new parts (I was curious) a blank raster with just a shadow of a picture was resolved. The sound seemed to be o.k. but the contrast control had no effect. Tests cast doubt upon the TBA560 but replacing this merely produced an overbright raster with no signal (vision) at all. At this point I removed all the new stuff and carefully replaced all the faulty items. I should suffer. He was most upset when given an estimate.

Teletopics

Agreement has been reached between Ireland, Spain and Portugal to share a DBS satellite – the three countries were allocated the same orbital position at 31°W under the 1977 Geneva ITU agreement.

IT'S NOW LEGAL

The government has altered the rules on satellite TV reception. Until now it has been necessary to apply to the Department of Trade and Industry for a licence, which was granted only to cable TV operators and organisations carrying out research. Individuals can now apply for a licence under the Wireless and Telegraphy Act – local planning permission to erect a dish aerial of any size is also likely to be necessary. Licences will also be available for linking TV signal distribution systems, for example in hotels and blocks of flats, to a master satellite TV receiver. Restrictions will be imposed to protect the interests of cable TV networks – a licence for SMATV (satellite master aerial TV) operation will not be provided in areas where a wideband cable franchise has been awarded or where a franchise has been advertised or is pending. The move has been welcomed by cable concerns and the TV industry, the hope being that business opportunities will be openned up, leading to increased UK production of satellite TV receiving equipment. Thorn EMI, Telefusion and Visionhire are amongst the companies that have already announced plans to supply satellite TV receiving installations.

SHOWTIME

As we go to press the annual London hotel radio and TV trade shows are in full swing. The main theme on the TV side is a far wider range of models fitted with FS tubes and greater emphasis on cabinet styling – the FS type tube seems to favour "monitor-look" cabinets. Mullard have announced the FSQ tube which is supposed to be even flatter and squarer and should be available in Philips and Pye sets later this year. Doric were showing large-screen (20-26in.) sets fitted with the new Rediffusion Mk.6 chassis. The new Network 14in. colour portable, Model NWC1430, is of interest in that full remote control can be added to an initially manually controlled version.

SATELLITE TV NEWS

Fresh hopes for the start of a UK DBS service have come with the announcement from Unisat of sharply reduced quotes for the provision of a satellite system. Unisat have offered the DBS consortium ten options for different degrees of satellite system management and operation. Meanwhile tentative agreement has been reached on what should be shown on the three DBS channels: the first channel would be used for recently released films and for TV series prior to their being shown on the existing networks, the second would concentrate on live sports coverage and a 24-hour news service while the third would feature popular entertainment such as TV games and soap operas.

GEC McMichael have developed an elliptical dish aerial which is claimed to offer much improved performance compared to the conventional circular designs. The dish is already being used in the Newshawk 14GHz portable satellite news gathering system. It features an offset feedhorn, maximum side-lobe rejection, reduced wind resistance and excellent portability.

AUTOMATED TV PLANTS

Most TV receiver assembly lines have been highly automated for many years now, with the use of automatic component insertion in the PCBs. This is fine for the smaller components but larger, more awkward components have always presented problems. The difficulty is being overcome by adding robots to the assembly lines. The use of computer-controlled robots by Toshiba has for example increased the proportion of components that can be auto-inserted to 95 per cent. Use of computer control has additional advantages in that board revisions can be put into effect simply by keying the required information into the computer. Once a board design has been changed it can take as little as half an hour for the computer to revise the operation of the line robots.

Thorn EMI Ferguson have set up an advanced manufacturing development centre at their Enfield factory to investigate the application of the latest automation technology to the assembly of TV sets and VCRs. Amongst its facilities is a pilot assembly line using IBM robotics systems to insert a range of odd-form electronic components. The centre undertakes feasibility studies based on experimental data from working models. IBM's robotics systems employed at the centre are programmed using the IBM Advanced Manufacturing Language (AML), a high-level language designed for manufacturing engineers and manufacturing application programmers. Its key features are manipulator control, sensing, intelligence (the ability to modify system behaviour in accordance with preprogrammed ways) and data processing. These are being harnessed to investigate flexible assembly techniques.

SINGAPORE'S TELEVIEW SYSTEM

A consortium of UK firms lead by GEC has been awarded the contract to develop Singapore's Teleview system. This is an advanced system that combines features of teletext and viewdata: it's also a high-capacity system, enabling the service to carry high-definition pictures, graphics and Chinese language characters in picture form. Marconi are to supply an initial 1,100 terminals to Telecoms of Singapore – 800 with hand-held keypads for residential use and 300 keyboard versions for business use. The contract also includes editing terminals, some with full typewriter style keyboards: each terminal will double as a 256K RAM personal computer. Teleview uses both telephone links and off-air data transmission: users send out requests via the telephone link and receive signals off-air on their terminals. The service will also operate in both directions via the telephone links in the event of TV signal interruption. The Singapore Telecommunications Authority hopes to have a million subscribers to the service by 1990.

SERVICE BRIEF – THORN TX90

Cases of failure of the line output transistor TR112 in the Thorn TX90 chassis have been traced to leakage in transistor TR109 (BC307B) in the overvoltage trip circuit. This leakage results in reduced line drive. To overcome the problem R246 (47kΩ) has been added between the base and emitter of TR110: it's recommended that this resistor is added in all cases of failure of TR112.

VCR NEWS

1984 was certainly the year of the VCR in the USA: sales increased by over 86 per cent, from just over four million to well over seven and a half million. The markets are now awaiting VCR exports from Korea – up till now these have been prohibited under the terms of the licence agreements with Japanese manufacturers. Models from Samsung are expected to be available in the UK this autumn – two models were on display at the Samsung trade show. The basic model is expected to sell for around £370.

VCRs using an improved Betamax specification are to be introduced in the USA. The new system – Super Beta – features increased luminance bandwidth plus new video noise reduction and pre-emphasis circuitry. According to Sony the result is a picture resolution of 300 lines and a signal-to-noise ratio of around 45dB.

The launch of Kodak 8mm video equipment in the UK has been postponed until next year "at the very earliest".

The Ferguson Videosafe is an anti-theft device that sells for around £24. It's in the form of a VHS cassette that can be slotted in the machine and locked in place. If an attempt is made to move the machine or eject the device a 98dB alarm signal is produced until switched off using the right key. It's also available as the Videolok.

NEW TV SCREEN FILTER

A new range of easy-to-fit filters for use with TV sets and VDUs has been announced by Wireless and Electronics Ltd., 5 Lansdowne Way, London SW8 1HL (01-735 7910). The filter covers the whole screen and is available in sizes from 9in. to 26in. Each one is individually boxed and comes with neat brackets and clips to make fitting a simple matter. The filters are made of a hard plastic material and result in reduced flicker and the removal of most of the ultra-violet light radiation from the tube.

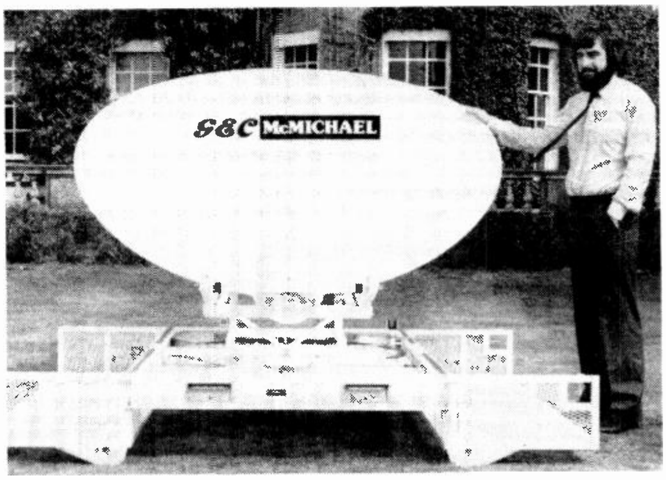
VIDEO CERTIFICATION

Certification of prerecorded videocassettes under the Video Recordings Act is to be carried out by the British Board of Film Censors which is to be renamed the British Board of Film Classification. Certification relates to films – music programmes are exempt unless they include depiction of sex and violence to "a significant extent". There are 58,000 titles on the Department of Trade and Industry's register: certification of these will be carried out over a three year period from the implementation of the act – new releases will require immediate certification. Lists of certified films will be available from the Home Office at about £20 a set.

CABLE NEWS

Work has started on the installation of the Clyde CableVision and Croydon Cable Television systems. The Clyde system is of the switched-star type, qualifying for a 23-year licence. A key component is a new switch jointly developed by GEC and Delta Kabel for the UK market. British Cable Services have started work on the Guildford service. This will use the advanced System 8 network.

Just one application has been made for each of the five



GEC McMichael's Newshawk satellite news gathering system features their new elliptical dish aerial.

recently advertised second group of cable TV franchises – London Docklands, W. Surrey/E. Hampshire, Wandsworth, Bolton, and Cheltenham/Gloucester. The Cable Authority has announced that it is not disappointed with the lack of competition for these franchises and that each application will be given the fullest scrutiny.

A monthly publication in full colour, the *Cable TV Guide*, started with the May issue. It covers the five main channels (The Movie Channel, Screen Sport, Sky Channel, Music Box and The Children's Channel) seen by 90 per cent of UK Cable viewers and is being sent free to some 500,000 cable TV subscribers and potential subscribers. It will also be available through newsagents at 35p a copy.

Qualified optimism on cable TV is expressed in a new report from Communications and Information Technology Research. 8·5 per cent of households in W. Europe are now connected to a cable network and the percentage is expected to double over the next ten years. Holland, Belgium and Switzerland have the highest percentage of households connected to cable systems. CIT believes that 6·5 per cent of UK homes will be linked to a cable network by 1989.

The Joint Industries Committee for Cable Audience Research (JICCAR) has carried out the first audience research survey of UK cable TV users. It gives cable TV a somewhat down-market image, though the incidence of VCR and microcomputer ownership amongst cable users is well above average. The specific cable channels account for 19 per cent of viewing in households connected to a cable network.

ODDS 'N' ENDS

A 13A moulded plug-and-lead set is now available to equipment manufacturers from Mullard. It's been introduced in the interests of improving the safe use of both industrial and domestic electrical equipment. The advanced design of the CW3102 plug-and-lead set incorporates the usual safety features plus extras including sleeved line and neutral pins, a built in fail-safe system and very high mechanical strength.

Non-electrical soldering is what you get with the Oryx Portasol soldering iron which is available from STC Electronic Services, Edinburgh Way, Harlow, Essex CM20 2DE. The iron uses a built-in butane gas supply that provides a power equivalent to 60W with a variable bit temperature up to 400°C. A single gas refill gives up to one hour's continuous use.

11GHz Low-noise Amplifier

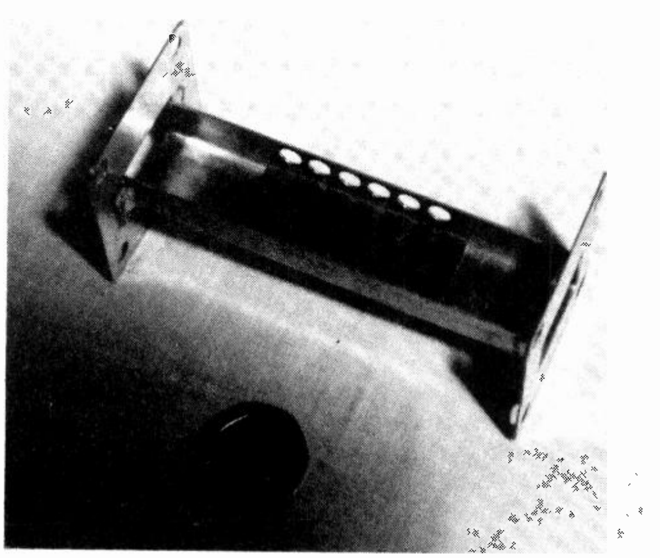
Hugh Cocks

The 11GHz low-noise amplifier to be described is intended as a companion to the low-noise downconverter featured in the February issue. The use of waveguide at the input and output means that different LNA and downconverter combinations can be tried. Construction of the unit is reasonably straightforward if one is experienced in r.f. techniques. Those who have built LNAs for use at 4GHz will find the unit similar but more compact. A matching regulated power supply built around a d.c.-d.c. converter i.c. is used: alternatively the power unit described in the 4GHz LNA article (September 1983) can be adopted, though it's much larger physically.

The LNA's housing is similar to that of the downconverter module. Fairly elaborate screening is required between each of the gallium arsenide f.e.t.s to prevent instability which could occur since the width of the housing is sufficient to support waveguide propagation. Constructional details of the metalwork will be provided, though ready made metalwork and p.c.b.s are available. Before going farther a word of warning. If you're unsure about your abilities with this type of construction it's advisable to leave well alone – the GaAs f.e.t.s alone cost over £100 and are quite easily destroyed if care is not exercised.

Circuit Description

The design of the LNA is based on an application note from California Eastern Laboratories covering an 11·7-12·2GHz (US satellite band) LNA which employed two transistors. The circuit has been rescaled for 10·95-11·7GHz and an extra transistor has been added to increase the gain. The overall gain should be at least 25dB with a noise figure of around 3dB. The first two GaAs f.e.t.s are NEC type NE71083, the final one being an NE70083. Other devices, such as the Mitsubishi series, will work but since the board is not optimised for these odd tuning effects will occur due to mismatches. The circuit is shown in Fig. 1; the PCB track layout is shown in Fig. 2.



Photograph of the LNA case, with the input and output flanges and the LNA board fitted and the side holes for the power supply feeds drilled.

The incoming signal is transferred by a pickup wedge (see later) to a 50Ω section of printed track. A 10pF chip capacitor then couples the signal to a section of track that acts as a 36Ω, quarter-wave transformer which is followed by two 23Ω open-circuit stubs. This network matches the 50Ω input impedance to the optimum source impedance of 26Ω. The coupling between the first and second stages is less complex because the source and load impedances are similar: a 50Ω, 0·538 wavelength transmission line is used. The second stage's output matching network is series resonated with a 50Ω, 0·04-wave line and a 21Ω, quarter-wave stub which is then coupled into the third stage via a 50Ω transmission line section and a 50Ω, quarter-wave stub (in practice this must be shortened, see later). The output from the third stage uses the same series resonant network as the second stage. This is coupled by a 10pF chip capacitor to a 50Ω section of track which feeds the output wedge, i.e. microstrip to waveguide launcher.

The bias and drain supplies for each stage are brought in via printed chokes, with 1,000pF decoupling chip capacitors. The arrangement is identical to that used in the 4GHz LNA. The 10pF coupling chip capacitors are special types with a high Q at 11-12GHz. Mount them with the body's dot indication on the side rather than parallel with the board. This is due to the unwanted resonance effects that can occur with capacitors used at this frequency – the 4GHz type of 10pF capacitors shouldn't be used.

Mechanical Details

The f.e.t. source leads go through the board. Due to the slight inductance still present a screen is placed across each transistor, with silver epoxy adhesive used to bond the screen to the source lead protruding above the board. These screens also prevent 11GHz signals being propagated down the housing.

The PCB is Teflon based, has a dielectric constant of around 2·2, and is 0·01in. thick! Both 3M Cu-Clad 217 and Rogers Duroid 5880 have been used with good results. Working with a PCB as thin as this takes a little getting used to: the main point to remember is that with too much heat the track will start to peel away, also that the board is easily marked by sharp objects.

The case is similar to that of the downconverter modulator. Make the main body of about 0·9mm thick tinplate. With the prototype units the two sides and the bottom were bent from a single piece (see photo), flanges being soldered to each end. It's convenient to make the flange size identical to that of the downconverter module.

The unit's lid is sectional and may be made from thinner gauge tinplate if required. The input and output sections of the lid have the pickup wedges (see Fig. 3) attached to them. The upper, rear sections of the wedges go through slots in the lid, to which they are soldered: the wedges must not be soldered on the inside of the case.

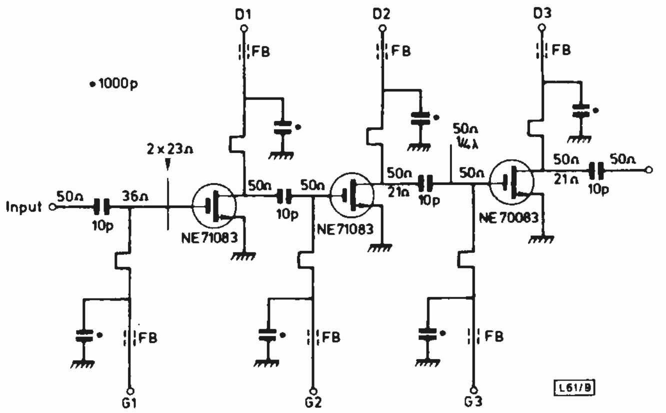


Fig. 1: Circuit diagram of the low-noise LNA.

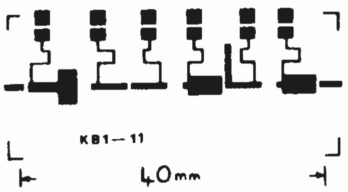


Fig. 2: LNA board, actual size.

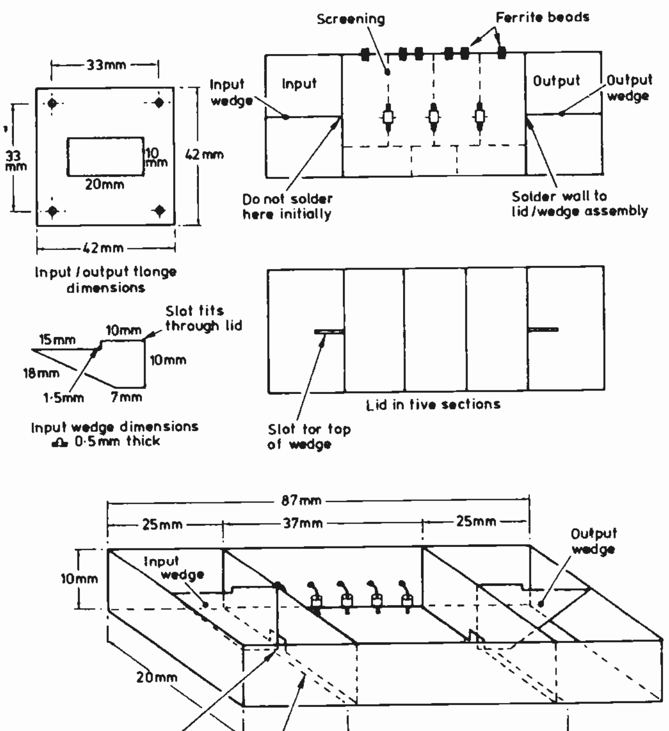


Fig. 3: Details of the case and screening.

Once the panel has been mounted in the case the wedge/cover assemblies are put in place and the "tips" of the wedges are soldered to the input and output striplines. Tuning screws can be inserted in the input and output waveguide sections in the same place as the downconverter input tuning screw. Wedge thickness does not appear to be too critical. The Mitsubishi downconverter module uses very thick metal: the prototype LNAs used about 0·5mm thick tinplate. Some experimentation here may prove beneficial.

Attach the PCB to the bottom of the case in a similar manner to that used in the downconverter: drill a small number of holes in the bottom of the case, tin the bottom

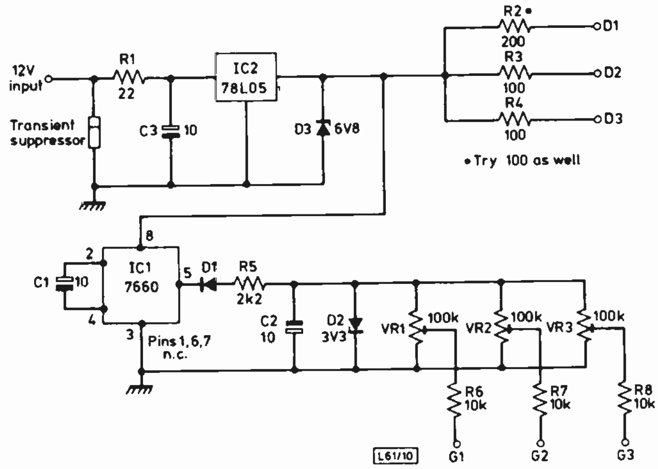


Fig. 4: Power supply circuit. Veroboard can be used.

of the PCB, then put solder through the holes carefully. It's a good idea to hold the board in place with a block of metal to act as a heatsink and prevent it warping in the heat. Make larger holes where the transistor source leads go through the board so that they can go right through to the outside of the case.

Six holes must be drilled in the side of the case to allow the bias and drain supply connections to be made. Because of the extremely small size of the circuitry normal feedthrough capacitors cannot be used – they are much too large. With the prototype units a ferrite bead was used on the inside, covering each lead going to its pad, and a ferrite bead was used in each hole. Sufficient decoupling is provided with the chip capacitors on the board. Solder the decoupling capacitor earthing pads to the side of the case.

After the amplifier has been built screening must be placed over the PCB. An internal wall runs along the length of the PCB over the dead area of the board to prevent any waveguide propagation. The three screens covering the f.e.t.s are then attached to this wall and to the unit's outer wall. By the time the ferrite beads are in place there's not too much room to attach the screening to the outer wall. Silver epoxy adhesive can be used here if it's difficult to use a soldering iron. A cutout for each transistor must be made in the screening: it must be a tight fit and silver epoxy must then be used to cover the remaining sections of source lead and connect to the screen (do this with extreme care, see later).

The lid covering the PCB must be cut into three sections. Odd effects can occur when these are put in place and this must be checked during construction.

The Power Supply

The power supply is relatively straightforward (see Fig. 4). The incoming 12V supply is fed via R1 to a 78L05 5V regulator i.c. which has a 6·8V zener diode connected across its output to provide protection in the event of regulator failure. Resistors R2-4 provide the drain supplies for the f.e.t.s. A simple d.c.-d.c. converter chip, type 7660 (RS stock no. 304-598), is used to generate the negative gate bias required by the f.e.t.s. The output from pin 5 of the i.c. is rectified by D1 and smoothed by R5/C2, with the 3·3V zener diode D2 providing regulation. VR1-3 set the gate bias voltages, the sliders being linked to the gates via R6-8. Miniature presets (RS 185-937) were used to fit the small board. By mounting the feed resistors vertically the board is small enough to fit on the bottom of the LNA housing.

I recommend fitting a transient suppressor across the 12V input to prevent possible spikes killing the transistors. Provision for this is not made on the board but the suppressor can be soldered to the top of the input resistor (R1) and to the ground plane on the component side of the board. The type used is RS stock no. 283-261 which cuts in at 16V. Its response time to a transient is of the order of a picosecond – so far no transistors have blown in mysterious circumstances! The band end goes to the positive side of the supply.

As previously mentioned the 4GHz LNA power supply could be used but is much larger.

Test the unit thoroughly before connecting it to the f.e.t.s. On some boards D2 tends to load down IC1 a little. If this occurs, disconnect D2 – the negative supply obtained from the chip is fairly stable and only a small percentage of the available supply is required. By increasing R5 to say 22kΩ the potential dividing action with the presets will drop the voltage sufficiently.

Construction

Start soldering the components on the board after soldering the board to the case. Solder all six decoupling capacitors in place first then check for possible shorts across them – this can happen, and once a transistor is in place it's all too easy to blame it. Next fit the 10pF coupling capacitors. Follow the previously mentioned instruction about mounting them the correct way and use a very fine soldering iron bit and as little solder as possible, consistent with a good joint.

At this point it's advisable to connect the power supply and check that the voltages are reaching the stripline. The board can be fitted to the bottom of the case using either copper wire legs or double-sided tape: ensure that the print side of the board cannot be short-circuited to the case if pushed hard. Use thin, insulated wires through the ferrite beads. It's easiest to glue each bead on to the board and into the holes after taking the wire through.

Next comes transistor fitting – always a worrying time! Ensure that the thick source leads fit through the board: the best way to do this is to use a small, flat screwdriver blade to punch the board gently. The gate and drain leads must be cut as short as possible to connect with the stripline that buts right up to them: no appreciable length of lead should be on the stripline. The lead with the diagonal slash in it is always the gate lead, the one at 180° to it being the drain (the two source leads are much wider). NEC have moved the position of the red dot from being adjacent to the drain to adjacent to the gate lead recently so this is not an accurate guide. Once the leads have been cut it's all too easy to mount the device the wrong way round, so make a note of which way round the dot is to the gate/drain leads.

Solder the source leads initially using only a small amount of solder underneath, consistent with good earthing, in case the transistor (heaven forbid!) should need to be removed if it has died. Lay the gate and drain leads – what there is of them, no more than 0·1in. – flat on the stripline and solder quickly, using a minimum amount of solder. Normal soldering precautions should be taken with the GaAs f.e.t.s – earth the iron's bit to the case and make sure that you're not at a potential to the whole assembly. Never use a soldering gun if you wish the transistors to work afterwards!

When all three transistors have been connected, and before the screening is inserted, check each one *individually* with its connections made to the power supply. Set the gate bias at around 0·5-1V negative (avoid using a meter at the gate connections) and monitor the drain current by checking the voltage at the drain feed resistor. The voltage should vary between 5V with high negative bias at the gate to less than 1V with minimum bias. Optimum bias is with around 2·5-3V at the drain. If all three transistors are connected to the power supply without screening and without the input/output terminations in place bad instability will occur. This will show as erratic drain current variations.

If all's well, solder the source leads properly on the bottom. If you find that the drain voltage won't move from around 0·5V there's either a short-circuit in the feed to the gate or the transistor has died. If the drain voltage is stuck at 5V it's not reaching the stripline. If there's a problem here cut the feed choke on the board to isolate the transistor as it could well be that the decoupling capacitor has shorted out or has a sliver of solder underneath it.

The screening must next be fitted. Fig. 3 shows the approximate positions of the screens. The sub-wall is attached to the main wall by two stand-off pieces of tinplate. The end of this sub-wall should be soldered to the output wedge/lid assembly in due course but avoid soldering to the input wedge/lid assembly initially – sometimes the signal is better with it disconnected (check on a live signal later).

It's a good idea to smear the silver epoxy between the transistor and the screen as each transistor screen is fitted. Start with the centre screen and work outwards. Smear the adhesive just where the source leads protrude from the body. Be very careful not to smear any between the gate or drain leads and earth or the transistor won't work, being effectively shorted out by the glue. Silver epoxy has a consistency that's slightly different from normal epoxy – it's similar to hard butter. Small granules can come adrift, so make sure that it's firm. It also takes a long time to dry, but this doesn't affect the electrical performance materially.

Once this has been done, solder the input and output wedge lids to the case (on the outside only) and carefully solder the rear tip of each wedge to the panel, using only a small amount of solder. Leave any tuning screws at the input/output screwed fully out and check that all three transistors behave correctly as the d.c. bias is varied. Leave each transistor with about 3V at its drain. If all's well here we can proceed with the testing.

Testing

First of all cut down the stub between the second and third transistor to about half its original length – this is easier to do before the screening is in place. Access to it will be needed when the LNA is being tuned however.

Bolt the LNA (initially less any image filter) to the downconverter module and switch on the downconverter but not the LNA. When the LNA is switched on a vast increase in noise should be seen on the screen – the noise will vary depending on the settings of the bias presets.

If you find a mass of carriers/patterning on the screen as you tune across the band there's instability. See if it disappears when the output lid is placed over the third transistor. If it does, solder the lid in place, preferably leaving the cut down stub exposed for adjustment. If this doesn't cure the instability, try soldering the internal wall

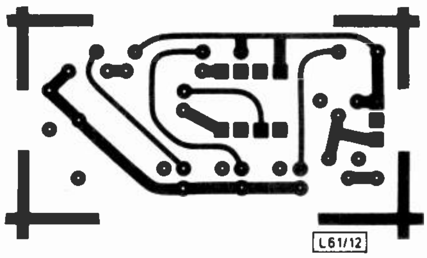


Fig. 5: PSU board track pattern.

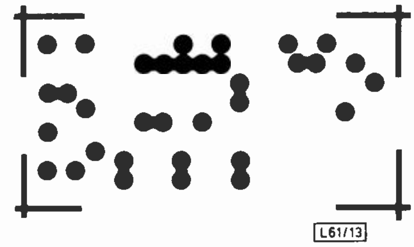


Fig. 6: PSU board groundplane side.

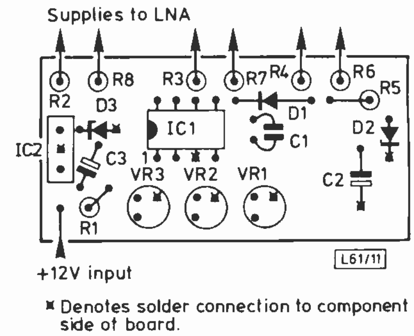


Fig. 7 (right): Power supply component layout.

to the front cover – these two actions should stop any instability. It's also worthwhile checking that the source leads are well earthed as poor earthing here will produce instability. Instability is in general much easier to cure than with a 4GHz LNA, though it can look more violent on the screen.

Connect the LNA to the feedhorn and keep a fairly high i.f. (700-800MHz). Use of a subreflector feed system helps a lot when testing and peaking the unit as all the electronics will be at the rear of the dish. When the dish is aligned with the satellite the signals should appear a lot stronger and u.h.f. breakthrough from local transmissions should be minimal. Without an image filter, signals at the top end of the band may seem noisier than those at the low end. This effect is caused by image frequency noise. With an i.f. of 700MHz the image of a signal at 11·6GHz is around 10·2GHz: the amplifier's gain at 10·2GHz will still be quite high and the noise produced will be superimposed on the wanted 11·6GHz signal. With the same i.f. and an 11GHz signal the image at 9·6GHz will be at a point where the LNA's response is much lower.

Peak the tuning screws and voltage presets for optimum pictures. If the signals are too strong for subjective evaluation of the picture quality move the dish slightly off the satellite. Screwing the downconverter tuning screw inwards from fully open will produce a notch where the wanted signal is lost. Just beyond this point the image frequency will be notched out, giving an improvement to a specific signal. The exact notch point will vary from signal to signal. If a signal meter is being used the signal strength will appear to fall due to the loss of image frequency noise drive to the meter.

If no microwave test gear is available alignment of the LNA is virtually impossible without a wideband image filter. Arrangements have been made to supply a filter in waveguide form to fit between the LNA and the downconverter. It has an insertion loss of 0·5dB and an attenuation of some 30dB at 10GHz. Because of the tight tolerances of the tuning elements in the waveguide it's not practical to give constructional details. Assuming that a filter has been obtained, final alignment of the LNA can begin.

Final Alignment

Check the effect of placing the remaining two covers over the first two stages of the LNA. The signals may increase slightly with the middle cover in place but with the input cover on they may decrease. If this is a problem it's probably best to glue a stout piece of plastic in place of the first metal cover.

Note the effect on the third stage of varying the length of the 50Ω stub. A useful tuning tool consists of a flat piece of wire on the end of a holder – note that due to the dielectric effect of the plastic this can peak the LNA as well! Some performance compromise may be needed between the top and bottom end of the band. A small piece of wire soldered to the rear end of the input wedge can increase the signal level.

In general the input stripline won't need adjustment. The optimum settings of the bias presents may vary a little across the band. This is fairly normal and is caused by slight variation of the transistor S parameters with different currents – this alters the stripline tuning. If you get a violent effect the transistors aren't matched to the board: this should not occur if the specified types are being used.

It should be possible to achieve good signals from ECS-1 in the UK using a 1·5m dish and this LNA. The noise figure is around 3dB or a little better.

Once the system is working well, find a box to house the electronics. It may be best to use a "dead" section of waveguide at the input so that the LNA is a little away from the elements: cover the front with plastic to prevent ingress of moisture. Take great care to prevent this: microwave signals hate any form of corrosion!

Sources and Acknowledgements

Aspen Electronics Ltd. of 2 Kildare Close, Eastcote, Ruislip, Middlesex (01-868 1188) are the UK agents for the Dielectric Laboratories Inc. (DLI) 10pF chip capacitors type DI 2A 100K 50 LD. The 1,000pF decoupling capacitors are not too critical. Hugh Cocks TV Services of Cripps Corner, Robertsbridge, Sussex TN32 5RY (058-083 317) can supply the 10pF capacitors, ready etched LNA boards, metal housings and waveguide bandpass filters.

The NEC GaAs f.e.t.s can be obtained from Castle

Microwave Ltd., Brookfield Drive, Aintree, Liverpool L9 7AN (051-523 4011). Printed circuit board material is available from Walmore Electronics, 11-15 Betterton Street, Drury Lane, London WC2 (01-836 1228) – the board must have a dielectric constant of 2·2 and be 0·01in. thick. The silver loaded epoxy adhesive is RS type 555-673.

Finally my thanks to everyone who helped with this project: Dave Lewis for the PCB drawings and prototype case design, the two Johns for the image filter, and Mike Stone who had great fun playing with the prototypes and put much work into getting the project off the ground.

VCRs and the Mains Supply

Derek Snelling

The mains supply, or to be more accurate various forms of interference associated with it, can be responsible for many problems with VCRs. The most obvious problem is random fuse blowing: the mains fuse or fuses blow for no apparent reason, a replacement restoring normal operation. Less obvious are the effects on the various microcomputer i.c.s in a VCR caused by transients appearing on the supply lines.

Clock/Timer Problems

Clock/timer circuits are particularly susceptible, with faults such as all the days displayed, a.m./p.m. appearing on a 24-hour clock, the clock losing time dramatically, a meaningless display such as 64·83 hours, or inability to set various timer functions. The problem is often that an internal switch in an i.c. gets tripped into the wrong state: for example, some microcomputer i.c.s have automatic 50/60Hz switching which can get tripped into the 60Hz condition with the result that the clock loses time. The cure in such cases is to unplug the machine from the mains supply, count to ten, then reconnect it. This resets the microcomputer and clears the problem. In some cases a longer disconnection time is required to discharge the backup battery.

Control Circuit Troubles

Microcomputer troubles we've had apart from the clock/timer circuit have been confined to the Mitsubishi HS700 and HS304. With the former the usual symptom is that the cassette can't be ejected or that the lid won't stay closed. Luckily this machine has a reset button near the clock setting controls. Pushing the button with the point of a biro resets the micros and clears the fault. With the HS304 the symptoms are difficulty with closing the cassette lid, the motor running without a cassette in, very slow response to the controls or no response at all. With this machine you need to unplug from the mains, as for clock faults.

Fuse Blowing

Many years of experience have shown that with the exception of some Toshiba V31 and V33 VCRs, for which a modification was introduced, intermittent fuse blowing is generally caused by a faulty mains socket. On a couple of occasions the problem was due to a faulty wall socket; in a few more cases it was caused by a worn multiplug; in over ninety per cent of such cases however the cause has been a worn or faulty two-three way adaptor – the sort of thing where you can put plugs in at the top, front and sides. These adaptors are often worn to the point where a plug will fall out under its own weight. I even had a case where the live pin stayed in place when the adaptor was pulled from the wall socket.

It's fair to say that when a VCR has a wall socket to itself and the socket is in good condition random mains fuse failure is very rare. One other possible source of trouble however is when the machine is unplugged each night. Not all VCRs have a mains on-off switch (the Mitsubishi HS306 for example), so unplugging and plugging in can result in sparking at the socket and a blown mains fuse.

In view of this, why do some VCRs suffer from random mains fuse failure more than others? The difference lies in the design of the mains filter and the choice of fuse size. For example, the Ferguson 3V29/30 have a 1·25A fuse and an 0·022μF mains filter capacitor while the Toshiba V31 was originally fitted with a 315mA fuse and an 0·1μF filter capacitor. The Ferguson machines don't suffer from fuse blowing while the Toshiba V31 does. Obviously the smaller the fuse value the more likely it is to fail under surge conditions: fuse sizes have been reduced to the limit in recent times in order to get BEAB approval. Also, the higher the mains filter capacitor value the lower the impedance presented by the capacitor at any specific frequency.

To overcome the problem of random mains fuse failure two courses can be adopted: increase the fuse rating and/or decrease the value of the filter capacitor. Care is required when increasing the value of the mains fuse otherwise safety problems will arise. Toshiba have officially increased the rating of the fuse used in the V31/33 to 630mA. Decreasing the value of the mains filter capacitor is less risky but reducing it to too low a value could allow too many mains-borne spikes to enter the machine and do damage. Toshiba recommend reducing the value of the mains filter capacitor in the V31/33 to 0·0047μF.

In Conclusion

To sum up, mains or mains related troubles can cause microcomputer confusion and fuse blowing. Can they cause one-off faults? The two established mains related faults have been confirmed by their relatively frequent occurrence. Apart from these I've had one instance where the capstan i.c. in a Mitsubishi HS306 failed and I'm ninety per cent sure that the cause was a faulty wall socket – I recall that when I did TVs repeated line output transistor failure in the Philips G11 chassis was often caused by faulty mains plug wiring. It would be interesting to hear from readers of any faults they can squarely attribute to a spiky mains supply.

Finally I'd like to emphasize that when I mention a spiky mains supply or mains interference the cause in the vast majority of cases lies within the household rather than coming via the mains distribution network.

Approaches to TV Servicing

S. Simon

We all have our own ways of tackling faulty equipment and tend to get rather set in our ways if we are not usually in the company of others engaged in the same profession. My own approach is to weigh up the symptoms reported and try to make a direct attack on the likely source of the trouble, basing this attack on my previous experience of the model concerned.

With a "no raster, sound o.k." condition for example the approach depends wholly upon the model. If the voltage supply for the sound circuits is obtained from the line output stage, as in most sets manufactured in recent years, it's likely that the line output stage is working and that e.h.t. is present. My first action therefore would be to check the tube base voltages to ensure that the cathode voltages are not too high and that the first anode voltages are high enough, i.e. about 150V at the cathodes and 400V at the first anodes. The next move depends on what these readings reveal.

It's quite common for example to find the first anode voltages missing in a receiver such as one of the GEC C2110 series though the line timebase is clearly in order (e.h.t. o.k. and sound present). My first move in this case would be to check the first anode supply presented to the convergence panel. I would expect to find it present and it usually is. The common failing is the resistor on this panel between PL30-4 and the first anode presets – R506, 560kΩ. In later production this resistor is not on the convergence board – instead it's on the small panel over the line output transformer where it's designated R616. The two nearby 1MΩ resistors R607/8 are also highly suspect in this chassis and are often found burnt up.

Thoroughness

I had an occasion recently to visit a local workshop and was present when one of these sets was put on the bench for servicing. The symptoms were as described above and I was interested in the young man's approach. First he stripped the supply plug and rewired it, checking the fuse etc. He then checked the condition of the 3·15A mains fuse in the set itself – at the top left – and its holder. Next he checked for shorts across the h.t. line and across the thyristor mains rectifier. Satisfied that all was well, he plugged the set in and listened for the e.h.t. to rustle up. He proceeded to check the h.t. voltage against that given in the manual, then most of the voltages on the video panel. Finally he turned to the tube base and found that the first anode supply was missing.

He saw my look and turned his nose up. "We were taught to be thorough in order to avoid comebacks" said he. I crept away and vowed that I too would be more thorough in future. But old habits die hard and I still tend to jump in at the deep end and leave the plugs etc. unchecked.

The Ferguson 9600 Chassis

Shortly after this a Ferguson set fitted with the 9600 chassis required attention. The no raster condition this time seemed to be the result of high cathode voltages at the tube base. We chased this condition back to the signals panel where we found the 24V supply absent. So we moved over to the power supply panel where we expected to find fuse F511 open-circuit (34V feed to the 24V regulator on the scan panel). There was no voltage at either side of F511 and we then found that the relevant rectifier diode W518 (SKE2G2/02) was non-conductive in either direction. If we'd been more thorough and checked the supplies first we would have saved ourselves some time. Next time we'll check at the diagnostic sockets fitted as the makers suggest.

Pye 725 Chassis

The Pye 725 chassis is the one with the vertical panels. It's given us some headaches in the past. In this case the mains supply was present at the anode of the mains rectifier thyristor but there was nothing at the h.t. fuse and the associated resistors (surge, smoothing and anti-breathing). Not wishing to fall for the old one we carefully checked the continuity of these wirewound resistors (if the surge limiter section goes open-circuit there's no h.t. at either end and nothing starts up). As all was well we returned to the power unit. The two 82kΩ charging resistors R898/9 in the trigger pulse generator circuit are suspect and one of them was found to be open-circuit. In went another and we confidently switched on, expecting to hear the rush of sound and e.h.t. Silence.

We spent a lot of time checking this panel before we returned to the centre h.t. fuse. We were then surprised to find just over 100V present. Resetting the h.t. presets brought the voltage up to normal and the set then behaved impeccably. How were we to know that eager little fingers had adjusted the presets wrongly?

Incidentally if the centre h.t. fuse is found to be open-circuit, waste no time – look into the top of the screened line output section and note the position of the capacitor right at the top (C561, first anode supply reservoir). Note its leadout wires to the print and check for a direct short. Failure to do this can lead you on a merry dance – a replacement tripler can be the first of many unnecessary acts as disconnecting this may leave the fuse intact. We all know this one by now of course, but it's an example of how methodical testing according to the book can lead one astray. Incidentally C561 is 0·1μF, rated at 1·25kV.

Rank T20/T22 Chassis

Mention of the Rank T20/T22 chassis will bring groans from those who are fully conversant with these sets. This isn't for you: it's for the majority who are not so fortunate. It's essential with these models to have a clear idea of how the system works. The power supply module is situated beneath the tube. It's a fairly complex self-oscillating chopper circuit designed to deliver a 200V h.t. supply to the right side line output panel. In most cases it does this, the fault or faults being elsewhere.

If the 200V supply is absent, remove the plug from the upper right side, thus isolating the power supply for fault tracing. There are two fuses. The front left side one is the mains fuse. Failure of this should direct attention to the bridge rectifier diodes 7D14-17: it's common to find two of them shorted, not one. BY127s are suitable for replacement purposes – they have a higher voltage rating than the BY126s originally fitted. If the diodes are not at fault, check the degaussing circuit posistor 7TH1 and the mains filter capacitor 7C19. Remove them for a positive check, though their appearance will often leave no doubt as to which one is at fault. If there is doubt, remove the posistor and shake it: if it rattles, fit a new one (there's science for you). In all probability however the mains fuse will be intact and the fuse that will have failed will be the one at the rear of the panel – the 1·6A HRC (high rupture capacity) d.c. fuse which is connected in the negative side of the supply. If it's open-circuit, carry out a general check on the BU326 chopper transistor and the associated diodes and thyristors.

HT Present

It's far more common to find that the 200V supply is present at the line output panel although the tube's heaters (fed from a winding on the line output transformer) show no signs of life. If the 27Ω wirewound anti-breathing resistor 5R11 is hot or the 800mA fuse 5FS1 (if fitted) has failed, the voltage at the body of the BU208A line output transistor, which is on the metal panel, will be low, suggesting that the transistor has gone short-circuit collector-to-emitter. Check for this. But don't replace it and reconnect the supply until further checks have been carried out. Possible causes of the death of the transistor could be failure of the 9·1nF tuning capacitor 5C14, which goes open-circuit, a shorted tripler (disconnect from the line output transformer) or a poor earth connection at pin 2 of 4Z2 on the centre, swing-down timebase panel. This is the long plug on the right side: if in doubt about the earth connection solder a long lead from pin 2 to the earthing on the line output panel.

BU208A Intact

It's more common to find that the full 200V is present at the body of the BU208A. In this event it's logical to check that the supply is also present at the collector of the driver transistor 5VT3. Under normal conditions the voltage here should be 125V: it's common to find the full 200V present, thus showing that the driver is inactive. In this event it's essential to appreciate the nature of the kick-start circuit used in these sets. The line oscillator is provided with an initial kick by 4C19 (10μF) on the right centre swing-down panel. With the set switched on this capacitor has 200V on one plate at all times: at the moment of switch on it charges via 4R49 and zener diode 4D14 on its negative side, the kick being applied via 4D13 to pin 3 of the TBA950 so that this i.c. gets going for long enough to enable the rest of the line timebase to come into operation – if it's in a condition to do so. The 12V regulator circuit should then start up and take over the supply to the TBA950 and the other low-voltage circuits. Shunting 4C19 with a wirewound resistor of some 5-10kΩ will maintain the supply to the TBA950 so that the trouble can be sorted out.

Short Cuts

That's the logical way to start fault tracing. In practice the writer employs a short cut once he's established that the 200V supply is present at the body of the BU208A. Release the top screws and unhinge the chassis outwards – with the set switched off. With the meter switched to the low ohms range, check the EW modulator diodes 5D7 and 5D6 at the front end of the print. 5D7 should read about 20Ω both ways due to the circuit. 5D6 should read about 20Ω one way and 200Ω the other. One of the diodes could well be open-circuit or perhaps short-circuit. If these are o.k. move farther to the rear and check 5R8 which is in series with the BU208A's base. It should read 1Ω. It will often be found to read higher and when removed be found to be open-circuit. If 5R8 is in order, move over to the left side of the swing-down panel to check the value of 4R16 in the 12V regulator circuit. It should read 910Ω. If it's open-circuit the 12V regulator won't provide an output and the set will fail to get going after the initial kick start. These few quick checks will save a great deal of time.

Philips G11 Chassis

We've discussed the Pye/Philips G11 chassis in the past. There are now large numbers on the second-hand market however, so it will do no harm to outline the habits of this chassis briefly.

Most of these sets have two 3·15A anti-surge fuses mounted on the lower rear panel (some sets have only one fuse here). This is a convenient starting point in the event of a dead set. Are these fuses intact and is there 240V between them? If they have obviously blown one would assume that the fault is on the lower right power panel, and this would be so if the h.t. fuse F4037 on the upper left of the power panel is 1A as it's supposed to be. All too often however a higher rated fuse is found in this position so that if the fault is on the upper line timebase panel the excess current flows via the mains fuses which accordingly fail. So check this point first. If the h.t. fuse is rated at 1A, concentrate on the power supply panel: in particular, check the four diodes in the bridge rectifier circuit. Two of the diodes also form a bridge with the two thyristors which are far less often at fault. This "double bridge" arrangement means that the two diodes that form part of both bridges work harder than the other two: these will most often be found to be short-circuit, thus explaining the blown fuses.

If the fuses are intact and there's about 120V a.c. at the anode of each thyristor but no voltage at the h.t. fuse it's likely that trigger pulses are not being applied to the gates of the thyristors. There can be many reasons for this but a weak point is transistors T4085/6 in the excess beam current protection circuit. Since these two transistors are d.c. coupled and one is an npn device while the other is a pnp device it's impossible to check them by means of in-circuit ohmmeter readings: the pins from which a reading is required must be isolated. T4085 is the BC148 npn device and T4086 the BC158 pnp device.

A prime cause of trouble in these sets is poor connections – where the original soldered connections have become dry or burnt away, possibly due to arcing. Examine the panels very closely for signs of minor volcanic eruptions. Don't omit to look into the partially concealed corners of the panels.

HT but No Results

If there's h.t. at the 1A fuse but otherwise no results continue the search in the upper line timebase panel: this is a hotbed for dry-joints and close inspection really does pay dividends. The h.t. from the power panel does not go direct to the line output stage. It's routed via the dynamic convergence correction panel (top centre) – through pins 3D7, 15A15, 15A16 and back to 3D6. This ensures that the h.t. is removed from the line output stage when the scan coils are disconnected. Check these contacts carefully if h.t. is not reaching 3D6 and pin 12 of the line output transformer. Check also the plug and socket connections that go off to the BU208A – these are at the top of the panel.

Remove this white plug in order to check the BU208A properly. The only readings to be obtained are from the base to the emitter and from the base to the collector (body). Switch to a high range to ensure that there's no reverse leakage.

If the h.t. supply is reaching the BU208A, check the supply to the driver transistor T3102 (BF355). There should be 127V at its collector. The supply comes via R3106 (820Ω) which often goes open-circuit.

HT Fuse Blown

If the 1A h.t. fuse has blown, check whether the BU208A (remove the plug to do this) or the BY223 EW modulator diode D3133 has gone short-circuit. The BY223 is the flat, black diode with the heatsink clip on it. There should be a low reading in one direction only. If it has gone short-circuit, the condition of the EW driver transistor T2150 (BD238) – upper left on heatsink – should also be checked. A shorted BY223 often signals the demise of the BD238. Failure to check this may result in the raster sides being curved in, i.e. no EW correction.

Access

To gain access to the components, fuses etc. check whether the original transit screws are still fitted, one at either side. Remove them and swing open the top clip. Lift the frame slightly and swing it open. The separate panels can be removed if necessary once the edge connectors have been pulled off (carefully, noting their positions and the holes for the locating pins). There are clips on the same side as the plugs: these allow the panel to be eased off the locating pegs and out of the slots at the outer edges.

We mentioned fuses. There's a row of them on the line timebase panel. Of these, the one most likely to fail is FS3143 (800mA) in the 37V supply to the field timebase.

Field Timebase

The TDA2600 field timebase chip is located on the left side upper panel. It's concealed beneath a Vee-shaped heatsink which is secured in position by two soldered tags above and below the staggered pins of the i.c. holder. Check the soldering to these pins in the event of erratic height variation, particularly the upper right pin 16 (output) – this is the most likely one to be found dry-jointed. If the holder is found to be discoloured at pin 16 when the heatsink is removed it must be replaced.

Apart from this pin, the holder can be responsible for erratic height, linearity etc., as can the TDA2600 itself. The chip has an appetite for fuses: the associated components can also be responsible for fuse blowing – amongst other things. The two 1,000μF scan coupling capacitors C2099/C2100 are particularly likely to short and blow the fuse. As they are shunted by a 470Ω resistor they should be isolated for checking.

The Lid off Microcomputers

Part 3

Mike Phelan

In the first two parts of this series we took a fairly general look at the subject of home microcomputers. This time we'll take a closer look at a particular machine, the Amstrad CPC464. Its features include a 64K RAM, fairly powerful BASIC and a built-in cassette deck for saving/loading programs. Saving is recording on tape something that's in the computer's memory – usually a program, but it can also be other data, e.g. the screen part of the memory or a data file. Loading is playing back from the tape into the computer. The CPC464 comes with a monitor – either colour (RGB drive) or green screen monochrome (green instead of black and white to make viewing for long periods easier on the eyes).

To reduce the tangle of wires, the 5V supply for the computer/tape deck is obtained from the monitor. Thus there's a mains lead to the monitor and only two leads from the monitor to the computer – for RGB/sync and 5V. A modulator unit which contains a 5V supply and a PAL encoder is available to enable the computer to be used with a TV set that doesn't have RGB inputs (or 5V out!).

The layout inside the CPC464 is quite neat: apart from the cassette electronics, everything is on one large PCB. The keyboard is of the rubber membrane type, giving a nice feel and offering a degree of protection for the PCB against the various comestibles and liquids which descend in showers from the owners and their friends/relatives. Phelan's Law states that the amount of feeding electronic equipment receives is in proportion to the square of its intrinsic value.

A simple block diagram for the CPC464 is shown in Fig. 1. The CPU/microprocessor chip is a Z80A. The 16-bit address and 8-bit data buses are shown along the top. A simple reset generator consisting of an *RC* charging circuit and a couple of gates is used. The inverted reset line goes to the Z80A, the CRT controller i.c. and the ULA i.c. (uncommitted logic array – a collection of gates etc. used for various purposes): the reset line goes to the PIO (parallel input/output) chip. The 64K RAM consists of eight i.c.s – one for each bit of the data word. At this point it's useful to take a look at the CPC464's memory map – see Fig. 2.

This shows the ROM divided into two blocks of 16K. The addresses used are also used by the RAM. So how does the CPU know whether an address refers to ROM or RAM? This brings us to the first function of the ULA, which starts life as just that – an assortment of gates and other logic units with no interconnections. The i.c. can be used for a variety of purposes therefore since the connections can be tailored to suit the job in hand. As far as home micros go the ULA is simply an assortment of bits of circuitry that don't fit in anywhere else – in early computers a dozen or so i.c.s would have been required to do the same work. One of the ULA's jobs is to produce control signals for the ROM and RAM. If the CPU is writing to a memory it must obviously be the RAM, but if it's reading information either the ROM or RAM could be the source of the required data. If the address is between #4000 and #BFFF it can't be the ROM. ULA produced control signals sort the matter out otherwise.

ROM Functions

When the computer is switched on the "bottom" section of ROM is started, clearing the memory etc. This then transfers control to the "top" BASIC interpreter section which awaits an input from the keyboard.

RAM Functions

Part of the RAM is used as working space by the operating system. The character set is also loaded into the

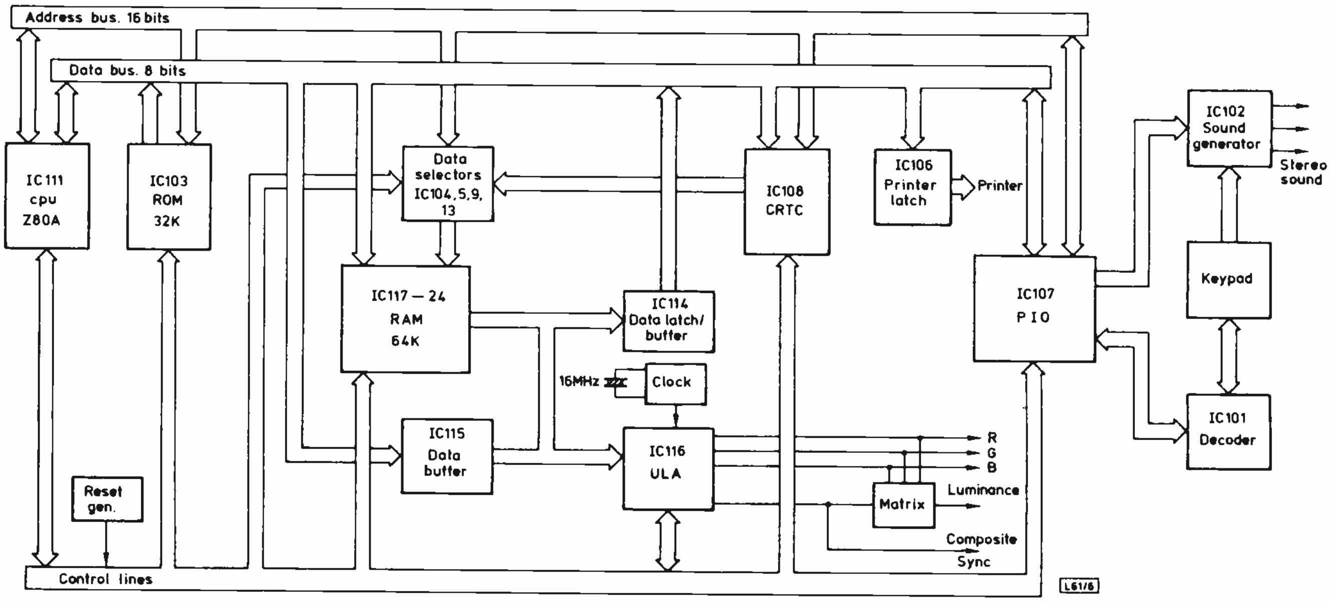


Fig. 1: Simple block diagram for the Amstrad CPC464.

RAM by the operating system. This is done so that we can redefine characters without in any way affecting the permanent character set. The screen memory is the "top" 16K section of the RAM and is arranged as follows. Each line of the screen consists of 80 bytes or 640 bits. This gives us 200 lines for 16K. Since each character consists of an 8 × 8 matrix it occupies eight lines, giving us 25 lines of characters. The top 80 bytes is the top line across the screen, the next 80 the ninth line and so on – this means that the top lines of all character rows are stored in a block, then the second lines, etc. Or, to put it another way, there's a 2K jump between adjacent lines.

The CPC464 has three screen modes. Mode one gives forty characters per line and four colours, mode zero twenty characters and sixteen colours, mode 2 eighty characters and two colours. The information stored in the screen section of the RAM is arranged to have what are called parallel attributes: this means that each byte contains information on what colour is to be displayed. Those who have had much to do with teletext will have met the alternative system where each screen memory byte contains either a character (ASCII) code or a control code that sets the foreground or background colour, graphics, double height etc. for the rest of the line. Some home micros use this system, which has the advantage of using less memory for the screen – 25 × 40 takes up 1K, not 16K. On the debit side, a control code (attribute) takes up one character square which can be occupied by nothing else – so you cannot, for example, have two adjacent letters of different colour. The parallel attribute system used in the CPC464 uses a lot more memory space but is much more flexible since each individual pixel colour can be determined by the user.

Each character consists of 8 × 8 pixels irrespective of mode. Since there are always 80 bytes or 640 bits per line of the screen the number of bits per pixel varies with the mode. In mode two there are 80 characters per line, so each character is one byte and each pixel is one bit which can be only zero or one – therefore only two colours can be used, one for foreground and one for background. In mode one the characters are wider, so each pixel is two bits giving four possible values or four colours. In mode zero with only twenty characters per line each pixel consists of four bits so we can have values from 0 to 15, giving sixteen colours. Table 1 summarises this.

From the software point of view there is no reason why a complete screen cannot be put in the portion of RAM from #4000 to #7FFF (it will be invisible of course) and then instantly (or nearly so) transferred to the top 16K. The effect from the user's point of view is that the whole display changes within a fraction of a second. This idea is made use of extensively in games software, where a complete screen can be loaded without being visible: a machine code program is then used to shift it to the visible screen section of the RAM.

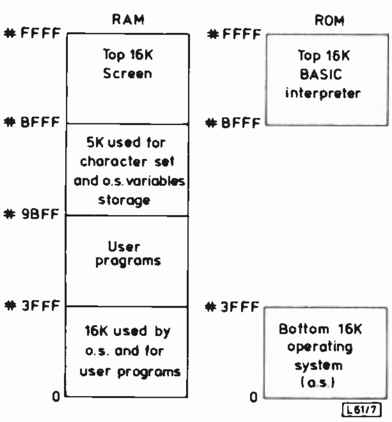


Fig. 2: RAM/ROM memory map for the CPC464.

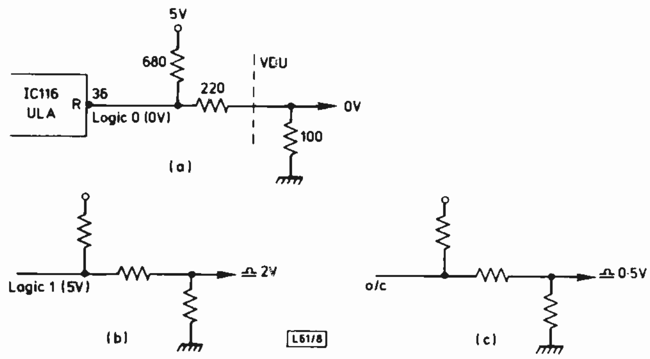


Fig. 3: Tri-state switching. (a) Logic zero output from the ULA provides 0V at the VDU; (b) logic one (5V) provides about 2V at the VDU; (c) the open-circuit state provides about 0·5V at the VDU.

Uses of the ULA

The ULA is driven by a 16MHz crystal clock. It divides this by four to provide a clock signal for the CPU. The clock signal also goes to the CRT controller IC108 whose job is to select the correct addresses in the RAM to provide screen information to the ULA, also to generate sync and blanking signals. The RAM is shared between the CRTC and CPU by means of the data selectors IC104, 5, 9 and 13 which switch the address bus between the CRTC and the CPU with a time ratio of 3:1 respectively. These i.c.s are controlled by signals from the ULA.

Next on the list of jobs for the ULA is the provision of a composite sync signal from the separate sync outputs provided by the CRTC. The ULA also contains a "palette latch" which is fed with information from the data bus to decide which colours to use – the CRTC decides which parts of the screen are to be of a particular colour. The software determines this. A total of 27 colours can be used, the number in use at any one time being restricted by the mode in use.

The palette latch output consists of a five bit code which is decoded within the ULA to give R, G and B outputs. How can we get 27 colours with only three bits? If each bit can be only zero or one we would have eight possible combinations. The answer lies in tri-state logic, in which each output can be one, zero or open-circuit. If you look at Fig. 3 you'll see how this works: each input to the colour monitor can be at one of three possible levels, i.e. there are $3^3 = 27$ possible combinations. Matrixing is used to produce a luminance signal to which the sync signal is added.

The ULA also stores the mode information until it's changed. It also generates the switching signals for RAM section selection: these are synchronised with the 4MHz clock. Each CPU instruction can take up to four clock cycles to complete. On the fourth, the CPU is halted by a

Table 1: CPC464 display modes

Mode	0	1	2
Bits per line	640	640	640
Characters per line	20	40	80
Colours available	16	4	2
Bits per pixel	4	2	1
Bytes per character	4	2	1

signal from the ULA: the CRTC is then connected to the RAM for one clock cycle.

Buffers

In an earlier instalment we mentioned that in computer parlance a buffer is a temporary storage area for small amounts of data. Computers also need to use the other sort of buffer with which we are more familiar – a stage to provide impedance conversion or isolation between its input and output. The various buses – data, address etc. – are connected to several parts of the circuit. It would not do for this to be done directly, otherwise if one bit went high or low the corresponding connections everywhere else would follow suit. To prevent this, tri-state buffers are used at the inputs and outputs: if a device is not in immediate use its ports are switched to the open-circuit state.

We also have buffer i.c.s that store one byte of information and read it out later. IC114 and IC115 are examples. The printer latch IC106 is another. Since a printer operates at a much slower speed than a computer we must stop the computer after each byte has entered the latch. This is done by a "busy" signal from the printer. The CPU is restarted when each byte has been printed (one byte = one character). Larger computers have print buffers of typically 64K capacity: the computer ends up quite a long way in front!

VCR Microcomputer ICs

All this should have given you a better understanding of the operation of microcomputer i.c.s in video and TV equipment. The popular μPD552 and μPD553 used in JVC products are CPUs with their own ROM – the suffix number tells us which one. The ROM contains a complete program to operate the machine – and spends most of its time waiting for the user to press a key! These are 4-bit micros. The other main type is that used by Sharp and Toshiba, with a few parallel inputs for safety functions (these can be regarded as several levels of interrupt) and a serial input bus for key scans etc.

Next month we'll look at the PIO, sound and cassette electronics in the CPC464.

TV Fault Finding

Reports from J. K. Potts, Mick Dutton, Philip Blundel, Eng. Tech., David Rainey, Malcolm Burrell and Stephen Howe

GEC C2110 Series – Touch Tuning

Erratic channel changing and difficulty with changing stations are common problems with these sets. The usual solution is to change the neons then if necessary to change the high-value resistors. On one occasion this approach had little effect so we decided to strip down the touch tuner head assembly. When the aluminium escutcheon was removed we found that the centre carbon insert which connects the escutcheon to the rear panel via a spring had seized up and was not making contact due to an accumulation of dirt. We removed the insert and connected the escutcheon directly to the rear panel with 20 s.w.g. wire bent and trapped between the escutcheon and the front panel. This remedy has worked reliably on several of these sets. **J.K.P.**

Thorn 9800 Chassis

The fault was excessive width plus e.h.t. flashover after ten-fifteen minutes. A quick check revealed that the h.t. was high at about 210V instead of 181V. Further checks suggested that the fault lay in the ramp generator circuit. R724 (120kΩ) in the ramp generator transistor's base bias circuit turned out to be high in value. It's mounted on the little auxiliary panel on the power supply board. **D.R.**

ITT CVC1200 Chassis

I've been having a few problems with the power supply in this chassis. Here's an example of how to learn the hard way. The set was dead since a short-circuit BU508A chopper transistor had blown the mains fuse. In went a new BU508A, fuse and protective zener diode D702. Switch on: bang! – another BU508A short-circuit. Another BU508A was fitted, the other seven transistors in the power supply were replaced, a dummy load was connected instead of the line output stage and the set was powered from a variac set to 90V. The bulb (dummy load) lit but an arcing noise could be heard coming from the set and a burning smell drifted across the workshop. A puff of smoke could be seen coming from the filter capacitor C701 which was arcing internally. So now the drill is to fit a new BU508A, D702 and C701, connect the dummy load and variac, then switch on with your left hand touching wood . . . **P.B.**

Philips CTX-E Chassis with VST

The report by P. Walsh in the May issue made interesting reading – it showed that I wasn't the only one having problems with these sets. When the mains bridge rectifier or the 4·7Ω surge limiting resistor fails the TDA2541 i.f. i.c. sometimes goes short-circuit, open-circuiting its supply resistor and a coil in the earth line – L9157, which is not shown on the circuit diagram. With this coil open-circuit the supplies to the tuner and VST module go haywire, causing them dire distress. The VST microcomputer i.c. often dies, but when you've replaced it you could well find you've still got problems. Such as:

No green tuning line – check D5852.

Will not stop tuning when a station is found. If the tuning speed slows down when a station is found, suspect the LM339 or an incorrect a.f.c. signal from the main panel. If the tuning speed doesn't slow down, check that the mute/transmission ident signal at pin 2 of VST module plug V11 goes to 0V on station. If it does, the microcomputer isn't reading the signal. Suspect transistor T7856 and diodes D6840, D6841. The mute signal is generated in the line oscillator i.c. **P.B.**

Sharp C1491/Rediffusion Mk V

One of these colour portables came in with the complaint that the picture went off when the set warmed up. Sure enough when we tried it the set worked o.k. for about twenty seconds then the raster disappeared and a loud ticking noise came from the power supply. When the back was removed it was clear from the way in which all the semiconductor devices in the power supply had been changed for European types that an unknown engineer had had a long and meaningful relationship with this part of the set. Now the switch-mode power supply and the line output stage work together in this set, and if the line timebase doesn't start up that ticking noise is what you get. A scope check showed that the line oscillator stopped when the fault occurred, so attention was turned to the protection circuit which acts to shut the oscillator down. Sure enough pin 9 of the i.c. in which the line oscillator lives (an IX0065CE) went high just before the oscillator stopped. The protection circuit monitors the beam current, the amplitude of the flyback pulses and the conditions in the field output stage. It transpired that zener diode ZD602 in the beam current sensing circuit was short-circuit. **P.B.**

Grundig 2210

Last August I mentioned a tuning fault on the Grundig 2210 (not 2222 – sorry). I've since learnt that the tuning system is very prone to board cracking. The solution is to replace the board containing the carbon tracks. It's quite easy. Unsolder the lugs and slide the old one out. Move the contact wipers to one end, raise them with a strip of paper, then slip in the new board. Don't forget to remove the strip of paper. **M.B.**

Rank T20 Chassis

This set was described as dead though a loud whistle came from the power supply. The h.t. was about 50V instead of 200V so I dived for the line output transistor which turned out to be faultless. Only then did I notice the tell-tale burn mark around plug 5Z1. Replacing this together with its socket provided a cure. The moral is, and always has been – make a quick visual inspection first. **M.B.**

Binatone 01/9860

This set came in with the description "smoking". R512 which supplies the line driver stage was a little discoloured but not open-circuit. The line output transistor TR503 was short-circuit. Replacing this failed to produce any appreciable e.h.t. and I was beginning to have expensive thoughts. I then found that the boost reservoir capacitor C512 (220μF, 16V) was hot. It turned out to be leaky, a replacement restoring normal operation. I think this could become a common problem and since it upsets the operation of the line output stage it's always worth a check. Incidentally the line output transistor is type 2SC508 or 2SC2233: a BU508 (expensive) or a BD535 can be used. **M.B.**

Grundig 5012

We got caught out nicely the other day with this set. It had two problems. First there was no blue tilt or parabola control. Simple this – C725 (0.22μF) had gone open-circuit. I've come across this one on several occasions. The second problem was excessive width. The width control worked, but at minimum the picture was still several inches too wide. We spent a lot of time checking the width control circuit – as everything seemed to be running cool we thought we were looking for a control circuit fault. Eventually we turned our attention to the scan circuit. The scan-correction capacitor was an 0·68μF metal type. We thought this couldn't possibly be faulty. Wrong: a replacement cured the problem. **M.D.**

Thorn 9800 Chassis

This set had no blue. There was no blue first anode voltage due to the 100kΩ series resistor R612 being open-circuit. A replacement got very warm however and we found that the associated spark gap was leaky. **M.D.**

Philips TX Chassis

A quickie: the fault was no sync, due to R370 (820kΩ) which provides the sync separator transistor TS370 with base bias having gone open-circuit. **M.D.**

Philips KT3 Chassis

The complaint with a Philips colour portable fitted with this chassis was no picture when warm. We ran the set up and found that after a few minutes the screen went blank. Turning up the brightness control produced a very faint picture. We checked the voltages around the decoder panel, which was of the older two-chip type, and found that with the contrast control at maximum the voltage at pin 16 of the TDA2560Q chrominance/luminance amplifier i.c. was only 0·7V instead of something like 4V. C3205 (0·022μF) which decouples this pin turned out to be leaky. **M.D.**

Rediffusion Mk III and Mk V

Now that Rediffusion has been taken over by Granada we're finding that calls to service Rediffusion sets are beginning to come in. One of the first sets to come our way was fitted with a Sharp chassis (Rediffusion Mk. V chassis). The problem was field collapse. As we didn't have a circuit we wasted a lot of time trying to work out what did what.

Eventually we found that R513 (1·2kΩ) was open-circuit: come to think of it this was the subject of a Test Case item not so long since.

Another set was fitted with the Mk. III chassis. This one was dead. The fuse had blown and as we could find no obvious shorts we fitted a replacement and switched on. The set started to come on then tripped. We removed the power supply panel and found a dry-joint on the regulating thyristor 6THY2, but resoldering this failed to stop the tripping. Now regulation with this type of circuit is a sort of line output stage damping action, and for this purpose 6THY2 has to be fired – if it isn't fired excessive voltages build up and the trip operates. 6THY2 wasn't receiving trigger pulses because 6R17 (68Ω) was open-circuit.

A couple of weeks later we had another of these sets tripping. This time the trouble was due to a faulty tripler. **M.D.**

Thorn TX10 Chassis

The set would start up at switch on but after a few seconds it would shut down again. The set didn't go through the normal shut down/start up sequence: it simply remained dead after its first shut down. The fault was traced to the BC547 regulator transistor TR801 which provides the 12V supply for the chopper control i.c. It had gone short-circuit. In addition the associated 12V reference zener diode D802 was leaky. **S.H.**

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

CD4049	0.58
CD4050	0.55
CD4052	0.75
CD4053	0.80
CD4069	0.24
CD4081	0.29
CD4093	0.72
CD4511	1.10
CD4516	1.17
CP5521	17.83
CX034	11.83
CX095D	3.14
CX104	9.64
CX108	8.16
CX109	7.86
CX121	11.83
CX130	5.55
CX131	11.83
CX134	11.04
CX136	11.49
CX137	11.83
CX139	11.83
CX157	4.84
CX158	4.10
CX170	7.62
CX177	6.75
CX187	5.26
CX20004	6.74
CX506	9.33
CX507	7.62
CX758	7.62
D1693	2.59
DEC2	2.20
E1222	0.40
E5024	0.28
E5386	0.25
E5529	0.25
E8021	1.29
E9003	0.46
E9005	0.50
ESM310BP	4.15
ESM432C	4.60
ESM532C	4.60
ESM632C	4.60
ESM732C	4.60
ML232B	2.92
ETTR6016	3.33
FND500	5.78
FT3055	1.16
GC374	1.33
GF758	0.84
GF759	1.13
GF761	1.20
GH3F	1.82
HA11211	2.53
HA11215	5.06
HA11223W	0.00
HA11225	4.29
HA11226	8.71
HA11229	2.88
HA11235	2.48
HA1124	5.25
HA11244	2.82
HA1125	4.29
HA11251	4.47
HA1138	5.03
HA11414	5.65
HA1144	7.52
HA1156	1.16
HA11580	9.00
HA1160	3.80
HA1166	2.22
HA1166X	5.36
HA1167	5.36
HA11711	18.33
HA11713	8.13
HA11714	7.76
HA11715	7.76
HA11724	22.25
HA11725	18.26
HA11738	22.25
HA1192	0.00
HA1196	7.43
HA1203	1.72
HA1306	2.26
HA1322	2.18
HA1339	2.33
HA1342	2.23
HA1350	3.27
HA1365	4.02
HA1366WR	1.86
HA1367	4.32
HA1368	1.90
HA1368R	1.98
HA1370	3.71
HA1374A	8.80
HA1377	3.96
HA1389	2.39
HA1389R	2.05
HA1392	3.90
HA1394	8.00
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HA17723	5.94
HBF4030AF	2.48
HD4480	17.16
HD44801A05	17.49
HEF4001	0.67
HEF4011	0.00
HEF4528	0.00
HM6231	9.81
HM6232	8.89
HM6251	5.70
HM7103	2.46
HM9032	3.22
HM9102	3.22
HM9104	3.24

HM9015	3.24
HT4207	17.16
ITT2003	0.22
K174YP	3.25
KA2101	2.65
KC581C	6.32
KC582C	3.97
KC583C	5.54
KIVI5B	
L129V	0.25
L200CV	1.69
LA1111AP	0.88
LA1201	1.02
LA1210	1.38
LA1320	2.87
LA1352	1.54
LA1357N	6.49
LA1363	6.21
LA1364	3.02
LA1365J	3.44
LA1378	6.52
LA1385	1.87
LA1387	7.60
LA3155	1.25
LA3300	1.54
LA3301	1.28
LA3350	1.43
LA3361	1.23
LA4030P	4.20
LA4031P	3.20
LA4032P	1.92
LA4050P	1.57
LA4051P	1.79
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	4.83
LA4125	2.13
LA4138 IC	3.38
LA4140	0.88
LA4192	3.65
LA4220	1.62
LA4400	2.25
LA4420	1.72
LA4422	1.72
LA4430	1.47
LA4440	4.95
LA4460	2.32
LA4461	2.95
LA5112N	2.65
LA7020	7.33
LA7025	8.05
LA7027	9.35
LA7800	2.34
LA7801	4.15
LB1274	2.49
LC4011B	1.24
LC7800	7.89
LD3120	1.13
LM1011N IC	3.46
LM1017N IC	3.41
LM1101	3.94
LM1111	4.29
LM1303P/N	1.65
LM1310P/N	1.38
LM2808 IC	5.94
LM2877	4.93
LM3065N	0.85
LM317CKC	1.38
LM324N	0.50
LM339N	0.80
LM3407	1.42
LM340T5	0.83
LM340K	11.85
LM340T	0.00
LM340T12	0.83
LM340T5	0.83
LM342N	0.62
LM342P 12V	1.62
LM342P 15V	1.62
LM342P 5V	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.43
LM6402A093	10.15
LM6402A127	0.00
LM748	1.82
LM8360	3.22
LM8361	3.57
M1024	2.81
M1025	5.17
M1124	2.80
M1130	5.35
M191	6.32
M193	18.55
M21C	0.83
M23C	0.83
M51102L	6.35
M5115P	5.24
M51231P	3.04
M5124P	4.82
M5134-9341	4.13
M51394P	11.97
M5139AP	7.43
M5142P	5.49
M5143P	7.33
M5144P	3.77
M51513L	2.55
M51515BL	3.10
M51516L	3.95
M51517L	3.71
M5152L	2.88
M51522	5.39
M5191P	4.94
M5192	2.20
M5194AP	5.74
M53273P	1.02
M53274P	1.33

M58478P	6.75
MA06	1.07
MA1457	2.72
MA8001	0.82
MB3705	1.79
MB3712	1.85
MB3713	1.69
MB3730	3.49
MC13002	6.22
MC1303P	2.16
MC1307P	1.92
MC1310P	1.30
MC1327P	1.33
MC1330P	1.69
MC1349P	0.81
MC1350P	1.21
MC1351P	1.33
MC1352P	1.12
MC1357P	2.15
MC1358P	1.30
MC14001	2.40
MC14011	0.26
MC14013	0.41
MC14016CP	0.84
MC14025	0.60
MC14049UBC	0.58
MC1438R	1.05
MC14493P	2.82
MC14497	14.99
MC14510BAL	4.43
MC14511BCP	1.10
MC1455	0.28
MC14556BCP	3.47
MC1712	3.88
MC7724CP	3.49
MC7818C	2.18
MC7824CP	4.68
MC78M12	0.83
MC78M24	0.94
MCR101	0.67
MCR106/5	1.57
MCR220/7	2.28
ME0402	0.17
ME0404	0.26
ME0404/2	0.47
ME0411	0.28
ME0412	0.24
ME4102	0.50
ME545B	10.02
ME6002	0.26
ME6102	0.28
ME8001	0.29
MED411	0.75
MJ2501	3.30
MJ2955	0.99
MJ3000	2.37
MJ3001	1.43
MJ3028	2.65
MJ481	1.53
MJ802	5.45
MJE2955	1.89
MJE3055	1.65
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	2.15
ML237B	2.51
ML238	5.77
ML741CS	0.59
ML923	3.28
ML926	3.58
MM5314N	4.02
MM5316N	3.96
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.49
MN1405	9.52
MN6016A	20.56
MP8112	1.49
MP8113	1.49
MP8512	1.57
MPC1355C	1.98
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.45
MPSU05	0.86
MPSU10	1.56
MPSU55	0.99
MPSU56	0.60
MPSU60	1.33
MR510	0.67
MR812	0.21
MR818	0.27
MR914	0.51
MSM4069	2.95
MSM5816RS	5.69
MSSD7002	0.72
MVS240	0.51
MVS460	0.34
MVS460-02	0.61
NE545B	3.94
NE545B	4.18
NE5534N	1.63
NE555	0.38
NE556	0.83
NE5560N	3.48
NE565N	1.33
NE645BN	3.35
NE646N	2.98
NE650N	4.34
NE654BN	4.18
NP1106	4.80
OA200	0.11
OA202	0.11
OA47	0.14

OA90	0.08
OA91	0.09
OA95	0.09
OC28	2.52
OC29	2.15
OC35	1.06
OC36	1.28
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON188	1.87
ON236	1.06
OT112	1.08
OT121	1.32
PD144	2.24
PT2014	3.04
PT5006	2.48
PT6042	1.79
PT6045	6.12
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2001B	1.33
R2029	1.33
R2030	1.33
R2257	2.38
R2265	1.49
R2305	1.18
R2306	1.36
R2322	0.59
R2323	0.76
R2348	2.01
R2354A	2.01
R2354B	2.01
R2441	1.36
R2443	0.88
R2461	1.50
R2477	1.02
R2501	1.28
R2540	1.98
R2540X	3.30
R2615	0.67
RC4195NB	2.16
RCA16029	2.01
RCA16083	5.30
RCA16334	1.02
RCA16335	1.36
RCA16600	1.38
RCA16799	2.38
RCA16801	0.95
RCA16802	1.08
RCA17028	2.48
RCA17074	6.60
RCA17376	1.58
RCA17523	0.83
RCA2060	2.00
RCA60857	4.95
RGP10	0.50
RT402	1.58
RT905A	2.38
S0280	2.14
S0281	2.14
S1299	4.74
S15H	1.27
S175	31.48
S2062D	2.07
S2800	5.78
S2800D	5.54
S2802	3.47
S2818	4.05
S3702S	5.21
S3703F	5.21
S3707	4.32
S40W	10.63
S551	4.54
S552	4.54
S6080B	7.57
S6087AR	4.90
SAA1006	1.59
SAA1020	4.76
SAA1021	4.76
SAA1024	2.81
SAA1025	4.40
SAA1050	4.16
SAA1051	5.83
SAA1061	3.61
SAA1075	4.86
SAA1082	8.85
SAA1121	4.43
SAA1124	2.45
SAA1130	4.13
SAA1174	7.77
SAA1250	3.90
SAA1251	4.90
SAA3027P I	9.37
SAA5000	4.02
SAA5010	5.39
SAA5012	4.50
SAA5020	5.78
SAA5030	8.25
SAA5040A	16.23
SAA5050	7.74
SAA661B	1.98
SAA700	3.30
SAB1009B	4.99
SAB1046P	4.03
SAB3011	7.34
SAB3012	5.88
SAB3013	5.61
SAB3021	7.90
SAB3022B	13.58
SAB3023B	12.30
SAB3024	6.36
SAB3209	5.23
SAB3210	3.23
SAB4209	14.03
SAF1031	2.53

SAF1039	3.35
SAS5010	8.39
SAS560	1.85
SAS560S	1.65
SAS560T	3.14
SAS570	1.78
SAS570S	2.61
SAS570T	2.75
SAS580	2.85
SAS5800	2.89
SAS590	2.85
SAS5900	2.56
SAS660	2.97
SAS6600	1.33
SAS660S	1.33
SAS6610	1.33
SAS670	3.96
SAS6700	1.33
SAS670S	1.33
SAS6710	1.33
SAS6800	2.53
SAS6810	1.43
SBA750	1.61
SC9488P	2.09
SC9503	1.65
SC9511P	2.09
SCR957	1.33
SDA2112/2	10.28
SG264A	5.26
SG608	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI-1020H	10.89
SI-1125HD	13.86
SI1125H	13.86
SI-1130H	6.93
SKE1/02	1.20
SKE2F 1/04	1.39
SKE2G 2/04	0.95
SKE2G 3/04	1.05
SKE4F 1/02	1.39
SKE4F 1/06	0.73
SKE4F 2/06	0.85
SKE4F 2/08	0.86
SKE4F 2/10	1.24
SKE4G 2/02	0.96
SKE5F 3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1327E	1.33
SL1430	1.39
SL1430T	2.31
SL1432	2.25
SL414	3.69
SL432A	3.44
SL437	7.43
SL439	2.48
SL471	3.28
SL480	3.14
SL490	2.37
SL901B	8.32
SL917B	11.96
SL918A	6.32
SN16848	11.07
SN16861AN0	4.95
SN16861N-07	2.72
SN16862AN	2.98
SN16880N	3.63
SN16965	8.95
SN16966N	6.04
SN29715N	6.04
SN29716N	3.66
SN29717N	7.19
SN29722	11.95
SN29723AN	7.65
SN29744N	2.29
SN29764AN	1.38
SN29767	4.98
SN29770BN	4.24
SN29770AN	2.25
SN29771BN	4.93
SN29772BN	4.64
SN29773	2.51
SN29791	1.67
SN29798N	5.56
SN29799N	8.88
SN29845	2.36
SN29861	2.29
SN29862	2.29
SN72709	0.44
SN7400N	0.34
SN7401N	0.27
SN7402N	0.65
SN7404N	0.24
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN74122	1.05
SN7413N	0.37
SN74151AN	1.51
SN74154N	1.27
SN74190	2.00
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7473	0.62
SN7474N	0.44
SN7490AN	0.93
SN75110	0.75
SN76001ANQ	1.65
SN76003	0.00
SN76003N	2.50
SN76013HDG	8.88
SN76013N	3.99
SN76013ND	2.48
SN76023N	2.59
SN76033N	2.68
SN76115AN	1.61

SN76131	1.92
SN76226DN	1.98
SN76227N	0.75
SN76228N	3.27
SN76231	2.55
SN76242	5.23
SN76243	5.23
SN76322	2.77
SN76360	2.17
SN76390	3.08
SN76396	2.90
SN76510N	1.05
SN76530P	1.57
SN76532N	0.91
SN76533N	1.65
SN76540N	1.98
SN76544	2.89
SN76545	4.87
SN76546	1.65
SN76549	2.59
SN76550	0.37
SN76551	1.49
SN76570	3.08
SN76600	1.21
SN76600N	0.00
SN76611	2.59
SN76620	2.59
SN76622	1.65
SN76623	0.69
SN76630	2.55
SN76640	4.24
SN76650N	2.05
SN76651	1.49
SN76660N	2.48
SN76665N	1.49
SN76666N	1.41
SN76705N	1.34
SN76707N	4.39
SN76708	4.86
SN76709	5.12
SN76730	4.66
SN76810N	0.60
SN76920N	2.90
SN94041	5.54
SN94042	4.35
SP5422	1.83
SP8385	0.55
SPS5384	1.95
ST1702L	0.99
STA401	6.76
STA441C	2.75
STK0029	5.54
STK0039	5.35
STK0050	7.67
STK0059	7.13
STK0080	9.16
STK011	3.96
STK013	7.75
STK014	8.84
STK015	7.75
STK016	6.91
STK022	5.25
STK025	8.27
STK031	12.37
STK054	7.13
STK070	22.31
STK077	7.67
STK073	8.52
STK082	11.86
STK086	10.89
STK2101	6.32
STK2110	7.33
STK2230	7.70
STK2240	0.00
STK4019	4.50
STK415	7.70
STK433	4.95
STK435	5.94
STK436	7.21
STK437	7.80
STK439	8.31
STK441	11.28
STK443	10.29
STK459	8.27
STK460	10.75
STK461	9.68
STK463	11.50
STK465	10.31
STK466	11.77
STK501	6.32
STK502	5.74
STK5314	9.48
STR1096	4.50
STR441	10.73
STR451	4.95
STR453	8.16
STR454	7.50
STR6020	8.31
T6007V	0.95
T6016	0.40
T6017	0.72
T6018V	0.72
T6021	0.40
T6022V	3.92
T6026	0.98
T6027	0.81
T6028V	0.39
T6029V	4.86
T6032V	0.98
T6033V	0.60
T6035V	0.73
T6036	0.67
T6037	2.11
T6041V	0.73
T6044V	0.95
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	0.59

T6059	1.16
T8001V	1.20
T9003V	0.95
T9005V	2.38
T9007V	0.00
T9008V	1.29
T9010V	0.96
T9011V	1.27
T9013V	7.96
T9014V	1.68
T9016	1.02
T9019W	1.98
T9034V	1.38
T9035V	1.39
T9038V	9.42
T9051	3.71
T9053V	1.40
T9054V	1.19
T9057V	0.70
T9063V	3.24
T9064	2.02
TA16420	5.98
TA16421	5.98
TA5814	1.49
TA6002	4.20
TA7020P	4.80
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.68
TA7071	3.69
TA7072P	2.57
TA7073AP	5.86
TA7073P	5.86
TA7074P	1.98
TA7076P	7.50
TA7089M	1.56
TA7089P	1.50
TA7092P	6.84
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7120P	0.64
TA7122B/P	0.92
TA7124P	2.34
TA7130P	1.27
TA7136AP	1.27
TA7137P	0.98
TA7141AP	3.87
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7152P	1.52
TA7161P	6.23
TA7162P	2.59
TA7169	9.54
TA7171P	2.79
TA7172P	1.41
TA7176P	2.48
TA7193AP	6.67
TA7193P	4.95
TA7201P	2.71
TA7202P	2.47
TA7203P	2.18
TA7204P	2.16
TA7205	1.38
TA7207P	3.34
TA7208P	2.15
TA7210P	3.58
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.37
TA7222	1.95
TA7226	10.25
TA7227P	2.81
TA7229P	4.45
TA7232P	6.60
TA7240AP	6.75
TA7310P	2.15
TA7312P	2.45
TA7313AP	1.50
TA7314 IC	5.94
TA7323P	5.78
TA7324P	0.96
TA7325P	0.98
TA7607AP	13.90
TA7609	3.17
TA7611AP	4.05
TA7622	7.50
TA7628P	9.38
TA7640AP	1.19
TA7676P	2.81
TA7726P	10.25
TAA300	2.97
TAA310A	1.16
TAA320A	1.27
TAA350A	0.80
TAA435	1.82
TAA550	0.37
TAA570	1.74
TAA611B12	1.30
TAA621AX1	2.48
TAA630	2.95
TAA661B	1.00
TAA691	8.58
TAA700	2.59
TAA840	2.50
TAA930	4.87
TAA970	2.83
TAD100	2.52
TAD110	2.52
TAG232-600	0.73
TAG626-600	1.06
TBA11701	6.25
TBA120	1.05
TBA120A	1.05

TBA120AS	1.24
TBA120S	1.05
TBA120SB	1.05
TBA120T	0.95
TBA120U	2.50
TBA1440	2.03
TBA1440G	7.20
TBA240A	3.99
TBA395	1.10
TBA395Q	1.10
TBA396	0.80
TBA400	2.39
TBA440C	5.75
TBA440P	2.45
TBA480	1.57
TBA480Q	1.30
TBA500P	6.58
TBA510	1.37
TBA520	1.84
TBA520Q	1.68
TBA530	1.30
TBA530Q	1.30
TBA540	1.15
TBA540Q	1.15
TBA550	5.25
TBA550Q	5.25
TBA560C	1.40
TBA560CQ	1.60
TBA570	1.60
TBA570A	1.71
TBA625A	2.17
TBA625B	2.17
TBA625C	2.17
TBA641A12	4.13
TBA641B11	3.03
TBA641BX1	1.79
TBA651	1.76
TBA673	2.45
TBA700Q	2.00
TBA720	2.50
TBA730	2.14
TBA750Q	2.90
TBA760	1.71
TBA780	1.65
TBA800	1.08
TBA810AS	1.00
TBA810S	1.61
TBA810T	1.50
TBA820M	0.74
TBA890	1.85
TBA900	2.48
TBA920	1.65
TBA920Q	2.31
TBA940	1.87
TBA950	1.55
TBA970	1.79
TBA970Q	3.28
TBA990	1.82
TBA231	2.57
TC4001	1.42
TC4053BP	4.34
TC4069	1.52
TC9002BP	10.38
TCA150	1.79
TCA160B	1.79
TCA270Q	1.71
TCA270S	2.15
TCA270SQ	1.65
TCA290A	2.39
TCA420A	2.16
TCA440	1.62
TCA4500A	2.15
TCA530	2.16
TCA640	10.26
TCA650	2.04
TCA660B	3.30
TCA730	3.81
TCA740	2.48
TCA750	1.93
TCA800	5.95
TCA800Q	5.95
TCA830M	2.25
TCA830S	2.38
TCA890	4.95
TCA900	2.04
TCA910	1.65
TCA940	1.80
TCA940E	2.93
TCE330	3.89
TCE527	1.86
TCE82	1.08
TCE83	1.08
TCE84	1.08
TCEP100Q	10.25
TD190	0.95
TD3F700H	6.60
TD3F800H	4.86
TD3F900H	4.16
TD3F900R36	4.16
TDA1001B	2.31
TDA1002	1.98
TDA1003A	1.79
TDA1005A	2.22
TDA1006A	1.69
TDA1010	1.33
TDA1011	2.08
TDA1028	2.45
TDA1029	4.89
TDA1034B	2.42
TDA1035T	2.55
TDA1037	2.95
TDA1037D	5.55
TDA1041	2.16
TDA1044	2.31
TDA1047	4.10
TDA1054M	1.21
TDA1059B	0.80
TDA1060	2.59
TDA1082	3.06

TDA1104	6.55
TDA1151	1.17
TDA1170	2.37
TDA1170S	2.04
TDA1180	2.90
TDA1190	2.11
TDA1190Z	2.48
TDA1200A	1.43
TDA1220	1.95
TDA1230	3.23
TDA1235	3.88
TDA1236	4.30
TDA1270	3.74
TDA1327A	1.50
TDA1327B	1.82
TDA1330	1.76
TDA1365	6.99
TDA1412	1.05
TDA1420	1.52
TDA1470	2.90
TDA1512	2.89
TDA1670	4.48
TDA1770	2.90
TDA1905	1.76
TDA1908	3.20
TDA1940	1.95
TDA1950	4.81
TDA2002	0.90
TDA2003	1.20
TDA2004	2.25
TDA2005	5.08
TDA2006	1.55
TDA2010	1.85
TDA2020	2.77
TDA2030	1.99
TDA2140	1.59
TDA2150	6.20
TDA2151	1.93
TDA2160	4.01
TDA2161	1.85
TDA2190	
TDA2510	2.47
TDA2520	2.37
TDA2521	3.30
TDA2522	1.50
TDA2523	3.03
TDA2524	4.50
TDA2525	3.90
TDA2530	2.70
TDA2532	2.50
TDA2533	2.30
TDA2540	2.15
TDA2541	2.48
TDA2545Q	5.94
TDA2560	2.17
TDA2571A	3.10
TDA2571AQ	3.60
TDA2575A	0.50
TDA2576A	3.96
TDA2577	2.95
TDA2581	2.69
TDA2590	2.50
TDA2591	2.50
TDA2591Q	0.83
TDA2593	2.47
TDA2594	3.08
TDA2600	5.00
TDA2610	2.79
TDA2611A	1.25
TDA2611AQ	2.81
TDA2612Q	4.68
TDA2620	1.96
TDA2631	2.73
TDA2640	2.59
TDA2643	12.12
TDA2651	2.95
TDA2652	6.95
TDA2653	6.18
TDA2654	4.73
TDA2660	2.47
TDA2661	2.47
TDA2670A	1.94
TDA2670	2.48
TDA2680	3.20
TDA2690A	2.65
TDA2780AQ	5.14
TDA2790Q	6.52
TDA2791	2.50
TDA2795	2.78
TDA2800	12.98
TDA2910	13.25
TDA3000T	2.55
TDA3030A	11.49
TDA3190	2.68
TDA3300B	6.47
TDA3500	4.25
TDA3501	12.09
TDA3506	13.01
TDA3510	6.55
TDA3520	9.71
TDA3521	13.39
TDA3541	3.80
TDA3560	5.00
TDA3561	6.50
TDA3561A	5.77
TDA3562A	4.50
TDA3571Q	2.48
TDA3571A	6.24
TDA3576	7.09
TDA3590	6.79
TDA3651A	2.96
TDA3950	3.40
TDA4040	6.12
TDA4050A	3.47
TDA4180P	1.92
TDA4260	1.54
TDA4280	7.20
TDA4290	4.47
TDA440	4.90

All goods should be delivered within 4 working days

REGISTERED OFFICE: THE COACH HOUSE, MUXTON LANE, TELFORD

VCR Clinic

Reports from Steve Beeching, T. Eng., Derek Snelling, B. Ross, John Coombes and Philip Blundell, Eng. Tech.

Sharp VC381

This machine would play back in colour but wouldn't record in colour. Everything was checked – a.f.c., 4·35572MHz carrier, there was even a down-converted output to the record drive stages. The level of the 625kHz signal seemed to be low however, though there were no levels shown in the service manual to confirm this. So the i.c. was changed – to no avail. At this point Andy made coffee and was asked to prohibit all disturbances whilst intense concentration took place. The conclusion reached was that the 5·06MHz output from filter FL503 was very low. Although a large difference does occur between the input and output from this filter, in this case the output was very, very low. The filter was suspected with some trepidation, since filters don't usually fail – unless it's in a Sharp VC381 that is! So beware: it's now a known stock fault. Just as a point of interest, the down-converted colour signal level at pin 1 of the colour i.c. should be 500mV p-p on colour bars. The carrier signal at pin 28 should also be around 500mV. **S.B.**

Mitsubishi HS300

The fault on this machine could be termed a video nasty. It was a classic symptom to put the blood pressure up a few points. The machine would run for a couple of seconds then stop – a system control fault. On closer inspection we noticed that the playback picture broke up into noise bars just before the machine stopped. This indicated that the r.f. switching pulse (flip-flop to you) was breaking up, which was confirmed when the trusty scope was connected to TP4C. The signal from the drum pick-up coil was correct at IC401 (AN6340) and no other problems were evident, so the i.c. was diagnosed as faulty and was replaced. Well, er, anyway the fault remained.

The monostable signals from within the i.c., at pins 21 and 22, were checked and found to remain stable even as the flip-flop pulses disintegrated. Rather disconcerting, since everything that followed was within the i.c. which we'd just changed. I then noticed that the pulse level at pin 22 was not as high as that at pin 21 – it was only about a third of the amplitude. Both monostables within the i.c., PG1 and PG2, are identical, with the same time-constants, but there's an extra "switching control" external to the PCB linked to pin 22. This control is mounted at the back of the machine and is labelled "still adjustment". We found that a screened cable to a plug marked ED had been badly positioned at some time and was forced tight against the potentiometer tag, cutting the PVC coating and forming a resistive path chassis. This reduced the voltage to the potentiometer. While the time-constant remained the same, the pulse level was reduced and this affected the triggering of the following internal bistable flip-flop. Phew! **S.B.**

Sony SLC7

The 400mA fuse (F004) had blown. Another blew whilst I tried to check the operate and standby switches. With a six inch nail across the fuseholder I was able to ascertain that the machine didn't switch off – it was on all the time. First impressions were that the clock display was reading "E:E" and that all the red LEDs on the programme timer were lit. The power supplies were o.k. and something smelt hot: it was transistor Q3 on the timer panel – I got a blister on my finger! The programmable timer IC1 didn't have any switching pulses at pins 22-27, though the clock pulses at pin 1 were present and correct. A new i.c. (MB8841-180) and Q3 restored normal operation. The reason for the machine failing to switch off was that pin 11 of IC1 remained high, holding the power supply on via D1. It seems that most of the i.c.'s output pins were set high, hence the demise of Q3. **S.B.**

Sony SLC5

Eject and rewind were o.k. but there was no playback or fast forward. Move straight to the forward sensor i.c. (IC8) on the systems control panel. Output pin 8 was high with the result that the system control microcomputer i.c. thought the tape end sensor had operated. I think IC8 (BX342) also has a tendency to play up intermittently. **S.B.**

Grundig VS200

This is a fine machine but we have had a couple of problems. One had a faulty r.f. amplifier. As this is fixed to the tuner/i.f. panel it must be removed before being returned to Grundig – it's not necessary to replace the lot. A second VS200 produced spots on playback, similar to static discharge: there was also some noticeable sideways shift to the picture, as though the drum speed was changing. The cause was found to be grease on the motor wiper contacts, inside. If you have to remove the bottom fixing plate, mark it with respect to the outer casing of the motor – the reason for this is that rotating the plate with respect to the motor body (stator) will cause more interference. The plate is rotated during assembly for minimum electrical noise: either reassemble it where it was or carry out the "tuning" adjustment as specified in the manual. **S.B.**

Watch this Space!

We've just purchased some duff Sony SLC5s and SLC7s from one of the bulk suppliers in Birmingham. Most of them seem to have been abandoned due to system control faults. Watch this space! **S.B.**

The New Mitsubishis

A few words on the new Mitsubishi models. The HS307 is a two-speed version of the HS306, with infra-red remote control. No skew correction etc. is incorporated in the long-play mode so visual search in this mode is poor. On the other hand narrower heads have been used than in the HS330, giving a better long-play picture. One possible problem is that there's no indication as to whether L.P. or S.P. has been selected.

The HS400 is a single-speed hi-fi machine. The standard sound is in mono and the pause is of the "instant stop" type with a noise bar where it happens to stop.

There are facilities for TV/external stereo/simulcast recording and the machine can be used as an audio only hi-fi recorder. The record levels can be set manually or automatically, two bar-type meters giving indication of the levels. There's audio dropout compensation for head switching. **D.S.**

Mitsubishi HS304

A fault we've had several times recently with these machines is dry-joints on IC2A0 (M51450P). This can give rise to various symptoms – intermittent picture on record, intermittent colour on record, intermittent speed variation and intermittent plackback luminance. Care must be taken when resoldering this i.c. as many machines have a soft varnish sprayed over the solder side of the panel in this area: the varnish must first be scraped off thoroughly to make correct soldering possible. In fact it seems to be the machines with this varnish that suffer from dry-joints.

A weakness that's shown up on this model is the remote control socket. It's mounted directly on the corner of the presetter board and we've had four cases so far where the customer has pushed too hard when inserting the remote control plug with the result that the corner has broken off the panel. This can cause loss of signals as the return path for the tuning potentiometers passes near the socket. If the customer wishes to continue using the remote control system the panel should be replaced, since any repair is likely to fail after a couple of insertions of the remote plug. Fortunately the panel is quite cheap. **D.S.**

Ferguson 3V32

Dead VCRs are usually easy, aren't they? Don't be fooled, not all of them are! This one looked dead at first glance, until you noticed that the off light was illuminated. A quick check on the supply lines showed that nothing was wrong except that the switched 12V line was missing because the relay wasn't energising when the on switch was operated. Attention was turned to the tuner/timer board as this drives the relay. The clock oscillators were running and the reset/interrupt lines were normal. A study of the manual was called for. One of the tables shows the functions of all the microcomputer pins in detail. Using this we scoped each pin in turn. Pin 36 of the i.c. (IC206) is shown as being the power off/a.c. detector and was low when it should have been high. D207 rectifies an a.c. input from the tuner/timer subpanel and was found to be open-circuit. **P.B.**

Grundig 2 × 4 Super

The machine was playing back when unthreading was selected by remote control. It unthreaded and ejected the cassette but thereafter refused to load a cassette. Switching on subsequently started the head and reel motors, the machine appearing to be in the "stop" (still frame) mode. Fifteen seconds later the tape fault logic put a stop to things – confirmed by the keyboard (system control) module lines WS1/2/3 all reading high. The threading ring switch contacts and cassette compartment switches were checked, including the one hidden inside the cassette retaining lip. All were in order, as was the operation of the reel brake solenoid and the c/o switch.

We turned the threading motor manually to load and thread a cassette, switched on and found that the machine unthreaded correctly. Attention was then directed to the keyboard module, particularly to the power supplies. During fault chasing the symptoms changed to playback LED lit, no motor action, with lines WS1/2/3 all low, meaning "tape" (stop mode). The relay remained de-energised.

At switch on a 150μsec reset pulse is sent to the microcomputer i.c. This is followed by an initiation cycle. If the power supplies to the keyboard module are low or slow to build up this time window may be missed. The back-up batteries and accumulator module were removed and tag A and AC1-5 on the power board linked. No improvement. Meter and scope checks on the reset line revealed a blip at switch on, implying that the reset pulse was present. The 15V rail was correct and the 5V line read 4·8V (it comes via a transistor until the relay energises). Further checks were made on the keyboard module. The clock signals were present and no obvious faults could be found. The previously mentioned switches were meter checked from strobe lines 5 and 6 to input lines AF1/2/3, proving that the connections via the motor connection board were sound – this is an area where poor connections can give trouble.

We diagnosed a faulty microcomputer i.c., but as the cost of this is half the cost of an exchange module and much of the board logic is interrelated an exchange unit was fitted. This produced play, record and the wind functions but cassette eject produced nothing followed by no other control functions. Controlled anxiety (deep depression) followed. We wound the threading motor manually to unload the cassette and return the slide rack to the end stop. Thereafter cassettes would load and unload and all functions worked. We can only assume that during fault finding the relative positions of the sliding rack and ring drive gear on the threading mechanics became displaced. One question remains: did the remote control unit that operates the strobe and input lines to the microcomputer i.c. cause the damage? **B.R.**

Mitsubishi HS320

For poor or no fast forward check the pinion cog which can slide down the shaft, removing the drive to the take-up reel. If you order the pinion cog for the HS330 you'll find that it has two grub-screw fitting, giving more secure positioning on the shaft. This fault can also break the tape in the playback or rewind modes and has been known to chew the tape in playback. **J.C.**

Hitachi VIP201P Disc Player

In the event of no stylus arm movement first ensure that the cartridge cover is locked in. If this is all right and the disc loads correctly but there's no arm movement check the arm motor. In one case we found the motor seized up: a drop of oil released the shaft to prove the point, a new arm motor restoring correct operation. **J.C.**

Panasonic NV333

The fault was no field lock in playback. The sync signal amplitude turned out to be only 1V p-p instead of 2V due to IC3003 (AN6327) in the luminance channel being defective. **J.C.**

Mitsubishi HS303

In the event of intermittent hum on sound, check the audio head switching relay K3F0 by replacement. **J.C.**

Long-distance Television

Roger Bunney

April saw a dramatic improvement in long-distance signal propagation, particularly towards the end of the month with improved Sporadic E conditions. There has also been productive auroral activity. A small event on April 9-10th gave Band I reception from Scandinavia in the northern UK. Over April 19-21st there was a much larger auroral event. A sudden, high-level disturbance on the sun produced storm conditions which were particularly intense on the 20th, giving auroral 144MHz amateur band propagation from Leningrad to the UK. During this period Band I was full of characteristically "hummy" vision signals from Scandinavian and E. European sources. The auroral conditions continued through to the early hours of the 21st, a smaller auroral opening occurring during the afternoon. Following this major event, ionospheric conditions remained very unsettled up to the end of April.

Tropospheric conditions also improved marginally over the month. During the evening of the 19th Benelux and W. German signals were received in the south and east of the UK in Band III and at u.h.f. A more intense tropospheric opening late on the 22nd produced more sustained Benelux, French and W. German signals over much of the UK, as far as the Midlands. As I write this on May 6th it looks as if a further tropospheric opening is about to occur. Several enthusiasts have reported an increased number of Band III Canal Plus stations during the slightest of tropospheric lifts. Caen ch. F9 has proved to be an easy catch here in the Southampton area. Lille ch. F5 can be received throughout much of the UK and along the N.E. coast – as it could be when the old 819-line system E transmissions were in use.

SpE provided the main excitement towards the end of the month, with four consecutive days of openings, most being of long duration with intense signal strengths. This is undoubtedly a sign of better things to come. Unfortunately some of the openings occurred during weekday working hours and will thus have been missed by many. The SpE log is as follows:

9/4/85 SRG (+PTT – Switzerland) ch. E2; ARD (W. Germany) E2; TSS (USSR) R1; CST (Czechoslovakia) R1.

15/4/85 ORF (Austria) E2a; CST R1.

29/4/85 TSS R1, 2; CST R1; ORF E2a; JRT (Yugoslavia) E3; RAI (Italy) IA, B; SRG/+PTT E2; TVE (Spain) E2.

1/5/85 TSS R1 (very strong during the early morning); ORF E2a, 4;MTV (Hungary) R1; RAI IA; TVP (Poland) R1; TSS R1, 2.

2/5/85 ORF E2a; JRT E3, 4; unidentified ch. R1 and 2 signals.

3/5/85 EPT (Greece) E3; JRT E3, 4; RAI IA, B; TVP R1, 2; TVR (Rumania) R2.
An opening during the morning lasted up to 1200. Ray Davies (Norwich) received EPT during much of the morning period.

My thanks to Iain Menzies (Aberdeen), D. Patuzzo and Roger Pates (both in Nottingham), Dave Shirley (Hastings), Reg Roper (Torpoint), Cyril Willis (nr. Cambridge) and Ryn Muntjewerff (Holland) for their reception reports which supplement my own log.

Roger Pates mentions a mystery transmitter radiating Anglia TV in colour on ch. E10. It was noted towards the end of April – a query to the IBA failed to produce any information. Roger checked his immediate neighbourhood for a faulty, i.e. radiating, receiver then set out on a trip to try to establish the source of the signals, which are weak in the Nottingham area. He thinks they come from the Lincoln area.

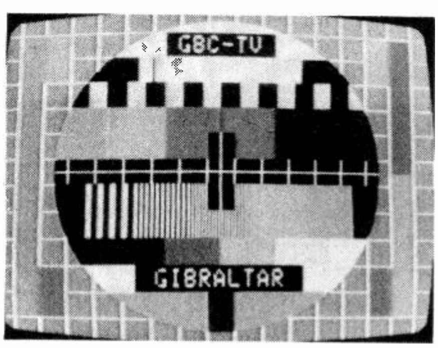
From our Correspondents . . .

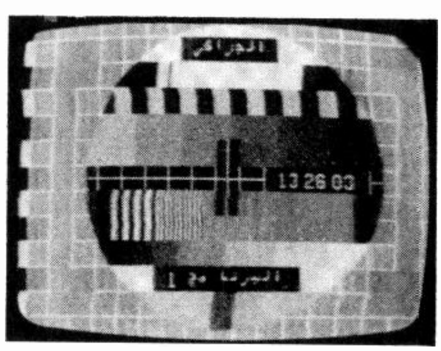
Fred Pilkington (Newmarket) lives for part of the year near Torremolinos in Southern Spain. In addition to TVE, signals can be picked up there from Morocco and Gibraltar. He reports that GBC presents problems, with only 250W e.r.p. at 70 miles – Fred is now using a ZL special Yagi to receive GBC, which has moved from ch. E12 to ch. E11 to avoid interference from RTM (Morocco).

News Items

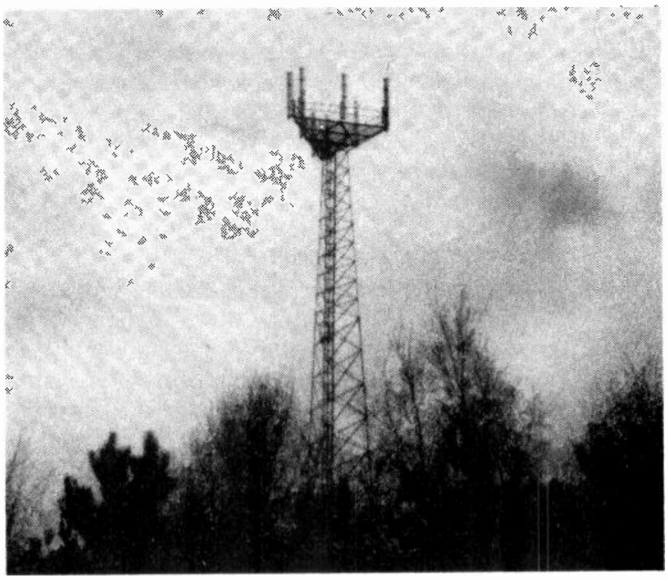
France: Advertisements on Canal Plus during unscrambled transmission times started in early May: the service now claims to have over 300,000 subscribers. The TV5 French language satellite channel is to increase programming to four and a half hours this autumn: a further extension to eight hours is planned. A reciprocal agreement for the exchange of programmes has been reached by TV5 and Canada.

Greenland: The 50·045MHz amateur radio beacon OX3VHF at Denmarks-Haven has closed down. Plans are to start up from another location in late July/early August.





Left: Gibraltar PM5544 test pattern received by Fred Pilkington at his flat near Torremolinos, S. Spain. Centre: Moroccan test pattern received by Fred Pilkington in S. Spain. Right: EBU News exchange at 4GHz, received by Frank Lumen in Denver, Colorado via a Satcom downlink.



Lattice aerial mast for the 900MHz cellular phone network, at Rhownams near Southampton. The mast carries several vertically polarised colinear arrays with corner reflectors.

New Zealand: Advertisements are to be allowed on the TV1 and TV2 networks for a similar amount of time daily – but not on Sundays, Christmas Day or Good Friday.

Pakistan: A second network is under construction. Programmes will be mainly educational. Three studio centres are being established, at Lahore, Karachi and Islamabad, feeding a network of eighteen transmitters via an extensive microwave link system.

USA: Ted Turner's CNN cable news service is to be made available to European cable networks this autumn, linked via an Intelsat satellite.

High Spec Ch. E2/R1 Amplifiers

The end of UK TV broadcasting in Band I has left the band relatively wide open for DX reception, though cordless phones are causing headaches for some enthusiasts. Multiple-hop SpE sometimes brings in ch. E2 signals from the Ghana/Nigeria region. In the past such signals have often been marred by distant BBC-TV signals on ch. B2. Along the south coast it would be worthwhile monitoring ch. E2 for the weak, scattered SpE signals that are commonly seen in central and southern France but are less frequently noted in the UK.

There's great interest at present in the 50-52MHz amateur radio allocation, use of which is currently on an experimental basis and restricted to non-TV hours. This interest has resulted in the appearance of high-specification 50MHz aerial amplifier kits on the market. It occurred to me that this type of preamplifier could be retuned to cover ch. E2, providing high gain, very low noise and good selectivity (i.e. no overloading from local CB operators, something that can happen with wideband preamplifiers). Apart from the specialised Mutek Model BBBA500u 20-500MHz aerial amplifier with its 1·5dB noise figure, most commercial amplifiers tend to have a noise figure of around 4dB at best.

The Cirkit Holdings PLC (Park Lane, Broxbourne, Herts EN10 7NQ) kit type 40-08006 is available at £7·25 plus 60 postage, excluding VAT, for use on the six metre amateur band. I bought the kit with a view to using it to cover the ch. E2/R1 section of the band, though there's enough gain to pass ch. E3/R2 signals (ch. E4 signals suffer attenuation). Maximum gain of some 20dB is available over a bandwidth of around 3MHz, the gain falling rapidly on each side: the noise figure is 1·5-2dB. Construction is very simple apart from the need to wind a wideband toroidal transformer. The kit comes complete with a metal case, BNC sockets, PCB and all components. A dual-gate m.o.s.f.e.t., type 3SK45, is used: fitting a 3SK88/BF960 provides increased gain with a slightly reduced noise figure. The preamplifier was originally a REW project by Graham Leighton. Using the tuning capacitors and Toko coils provided I found that the input circuit wouldn't peak to give maximum gain on ch. E2 – further shunt capacitors were needed. With 4·7pF added across C1 and 3·9pF across C3 the bandpass coils L1 and L2 could be peaked as required. As a specialised amplifier for ch. E2/R1 DX use this project can be highly recommended.

For the more adventurous the narrow-band 50MHz

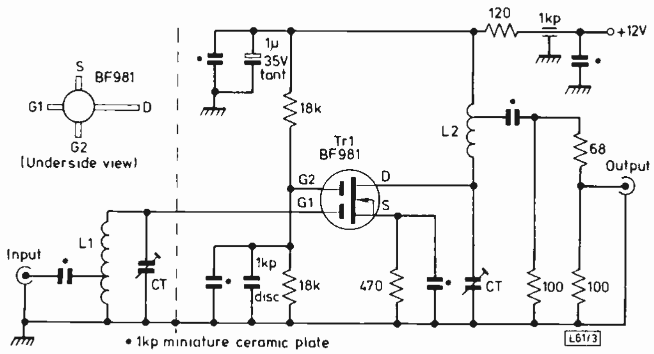


Fig. 1: G4IJE's 50MHz narrow-band preamplifier. L1 consists of 9 turns, 22g, tapped 2½ turns from the chassis end; L2 has 10 turns, 22g, tapped 1½ turns from the 12V end.

preamplifier (see Fig. 1) designed by Paul Turner (G4IJE) is worth serious consideration. Once again a dual-gate transistor is used, this time the higher performance BF981 which provides higher gain and lower noise than the device used in the Cirkit project. The input and drain load circuits are both tuned by miniature variable trimmers (5-65pF, RS type 125-660) and can be peaked above and below the 50MHz band. This circuit is for the more experienced r.f. operator, since care must be taken over the screening, decoupling and close observation of v.h.f. constructional techniques (i.e. minimal lead lengths etc.) if stability is to be achieved. Our thanks to Paul and the Six Metre Group for permission to reproduce the circuit which originally appeared in their bulletin *Six News*.

We'd be interested to hear from DXers of the results they achieve with narrow-band Band I amplifiers and if possible any observations on comparisons with the use of wideband amplifiers.

PAL/SECAM Converter Module

News of a converter module which can be fitted to a normal PAL-only colour receiver to enable it to display PAL or SECAM signals has come from our Dutch DX-TV friends. It's made in W. Germany by Dahner Elektrik and is available from S.A.P. of Wiesbaden-Bierstadt as Module KS478/SM1. It's suitable for use with most PAL only sets and will switch automatically on reception of an E. European SECAM signal, i.e. from GDR or another OIRT source. There are just eight wired connections and the module requires 85mA (typical) at between 12-30V d.c.

We understand that 6·5MHz system D sound adaptors are also available. The S.A.P. company will indicate connection points for specific receivers and the cost, at early April 1985, was DM 142 plus 14 per cent VAT. Ryn Muntjewerff tells us that he has been using one of these modules and that good SECAM is resolved.

For French system L SECAM reception, a VTK1 module can be used in conjunction with an SM1 to give vision and sound on a standard PAL receiver. It appears however that certain teething troubles have been experienced as a result of which marketing of the package has been delayed. We will pass on any further news received from our Benelux/German friends.

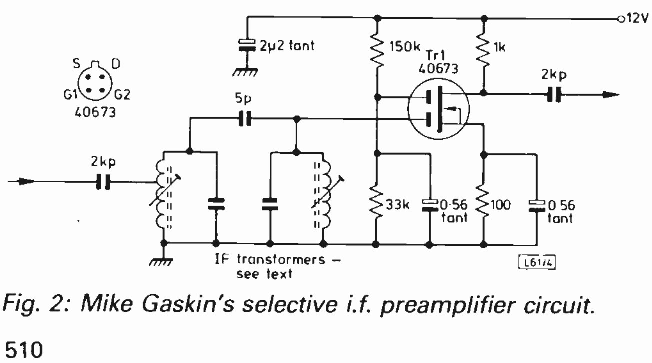


Fig. 2: Mike Gaskin's selective i.f. preamplifier circuit.

Simple Selective IF Preamplifier

Mike Gaskin (Caterham) has sent in the simple but effective i.f. preamplifier circuit shown in Fig. 2. It provides good selectivity using a 40673 dual-gate m.o.s.f.e.t. in a simple, non-critical circuit. The double-tuned, lightly coupled input transformers give (depending on whether peaked or stagger tuned) a variable bandpass characteristic. It's suitable for cascading, each stage providing a gain of some 12-15dB.

Mike used i.f. transformers taken from old transistor i.f. strips. He feels that they may give less than optimum matching to the 40673 transistor and suggests that experimentation could give improved results. Cirkit have a range of Toko 35MHz i.f. transformers that could be used in the circuit. Although Mike's prototype has the input tapped in at the hot end of the first coil there's no reason why the input shouldn't be experimentally coupled to the top of this coil.

Commercial Corner

East Cornwall Components (119 High Street, Wem, Shropshire SY4 5TT, telephone 0930-32689) tell us that they can supply 22in. remote-control v.h.f.-u.h.f. Decca/Tatung TV sets in single-standard format (e.g. system B/G with 5·5MHz sound) for either PAL or SECAM colour (the latter with a slight delay) at £295 inclusive of VAT, carriage paid in the UK. Apart from the French system L, sets for any system in use throughout the world can be supplied – apparently the service is used by people returning from the UK to countries where the prices of TV sets are vastly in excess of UK prices. Send enquiries to Mr. M. Cox at the above address.

The Worthing and District Video Repeater Group has available for ATV enthusiasts considering 23cm/1·3GHz operation a kit of parts to make a three full-wave colinear plus reflector aerial system with a gain of 10dBd over a dipole and a horizontal beamwidth of 60° (−3dB points). The array covers the whole 23/24cm band and has been found to give excellent results into France as far as Paris. The kit of parts costs £10·95, with instructions, and can be obtained from Mr. R. Stephens, Toftwood, Mill Lane, High Salvington, Worthing, W. Sussex – the price includes post and packing. The group has no other products available at present.

Satellite News

We understand that Sky Channel is to drop scrambling – this should be of interest to exiled UK residents along the south coast of Spain/Portugal.

The 4GHz Spacenet-2 satellite at 69°W has been received in Yorkshire (elevation 5°) with the CNN cable news feed.

The Intelsat organisation has given permission for their TV programme feeds to be downlinked via several US satellites, including Satcom 1, 3, 5, Comstar D4, Spacenet-1 and Galaxy-1. Frank Lumen in the USA checked and found that various European news feeds, including ITN, TG1 (Italy) and certain EBU services, were available via transponder 11 on Satcom F1.

Making PCBs

Malcolm Burrell

It often happens that you want to build something or even replace a damaged subassembly in a piece of equipment but the cost of a new board is exorbitant or one simply isn't available. The disadvantage of using Veroboard is that you can easily make mistakes while the amount of cutting and wiring can be time consuming. Varying the component layout can also sometimes cause problems. The solution is to make your own board.

Unless you are likely to be involved with a large number of projects the investment required for photographic board production is not worthwhile. It also remains a time consuming process. Recently I wanted to make a small number of boards. I couldn't afford much time or money but devised a compromise method that worked well.

Layout Design

The first step was to design the layout. I'd a working prototype built on Vero V-Q board and it was quite easy to sketch in the components on the paper template supplied. The previously wired sections were then linked as tracks and gradually a layout was developed. One thing to remember is that the print pattern is the reverse of the component layout. Dealing with this is quite easy really: draw your design on paper then soak it in varnish so that you can see the layout on the reverse side. This can be photocopied so that you have a record of the original design however much you mutilate the original drawing.

Making the Holes

Starting with the original drawing, it's easiest first to mark out the component mounting holes. Tape the drawing to the top of the board and use a 1mm drill to make the holes. The miniature drills advertised by firms such as Maplin are a useful investment. It's possible to use the average household DIY type of drill but these are clumsy and you'll all too easily break the small bits. If you intend to make two or three boards to the same circuit they can be stuck together with tape and drilled in one go. It's best to drill the mounting holes in the corners first, then temporarily fix the boards together using say 6BA screws.

Print Pattern

This will leave you with a plain board full of holes but with no print pattern. The holes will act as a guide: you can join them up by sketching in the print design with a felt-tipped pen. For a really neat job you can buy dry-print transfers – these are especially useful for i.c. pads.

Using this method of drilling the holes first you must make sure that all burrs have been removed. Then clean the board with alcohol to leave a clean surface for the transfers. A pen and ruler can give quite a good pattern without transfers however.

One way to make neat i.c. pads is to link all the holes with a paint marker pen When the paint is completely dry, score lines between the holes with a knife so that the bright copper shows through.

Having laid out the tracks I like to make each one as thick as possible without adjacent tracks touching. The paint marker pen is useful for this purpose since it gives thick, even lines that are less likely to be eroded by the etching acid. There are two other reasons for keeping the tracks thick – unless you're concerned with v.h.f. circuits. First, some circuits take a considerable current: there's nothing worse than to spend a lot of time making a neat board only to see the tracks melt like fuses when the power is switched on. Secondly, the acid can be reused several times: since its strength decreases as more copper is dissolved it's best to etch away only as much copper as necessary, leaving the rest behind to strengthen the board and ensure satisfactory connections.

Etching

Check the board before etching it. For the etching bath a good disposable plastic tray such as an old polythene sandwich box can be used, preferably with some plastic tongs. If you wish, attach a piece of thread to one corner of the board so that it can be moved without direct contact.

Take everything into the garden shed away from everyone – and wear old clothes! Pour enough acid into the tray to cover the board. Etching is a tedious business: agitate the acid every minute or so or it will take a very long time indeed. Etching should be complete after twenty to thirty minutes. Carefully remove the board from the etchant and plunge it into cold water. Cover the acid and rinse the board thoroughly under a tap – remember that all traces of acid must be removed from the holes.

Hints and Tips

If you wish to store the acid, either pour it into the original bottle using a funnel or use a secure glass bottle labelled "acid". I understand that it's dangerous and undesirable to dispose of acid into the sewerage system. If no neutralising agent is supplied the best course is to dig a hole in the garden and pour the used acid into this.

Painted markings on boards can be quite easily removed with alcohol. A touch with emery cloth will leave a bright copper surface for soldering. Once the components have been mounted and soldered it's a good idea to brush the print with varnish to help protect it from corrosion.

The print patterns are often given with projects in the magazine. If they are to scale it's better to photocopy them rather than to cut the magazine, using the photocopy as a template for drilling. It's all rather like painting by numbers, but you have the option to vary the layout or increase the size of the circuit to suit yourself.

Mounting the board in its case is easy if you use 6BA threaded spacers. Screw these into the case first, then use ¼in. 6BA screws to secure the board. Alternatively plastic stand-offs can be used. These need slightly larger fixing holes, typically 0·2in. – I find a 3/16in. drill useful for these.

Prototype Working

A final hint. For prototype working, off-cuts of printed circuits can be etched without drilling and the components mounted on the print side.

More on the Philips G8 Chassis

Dennis Apple, B.Sc.

Tony Thompson's article in the May issue contained much valuable information on the Philips G8 chassis. The following notes may also be of interest to readers – they are based on experience gained servicing a large number of these sets.

Connector and Panel Faults

Before switching on, check the various plugs and sockets on all panels. A small needle can be used to close up slightly all tired spring holders within these connectors. Don't forget the tube base. Also ensure that the various fuses are all securely fitted in their holders. Finally the flying leads, especially those on the line scan panel, should be checked for tightness. A quick spray of cleaning fluid such as WD40 on all connectors prior to reassembly helps prevent further problems. It's surprising how many baffling, intermittent faults disappear after this treatment!

You may also find hairline cracks around each panel where the edge connectors are located, no doubt caused by someone's over-zealous attempt in the past to tighten the two retaining screws without first ensuring that the edge connector is correctly mated. The timebase panel is the one most likely to be affected by this problem. You will almost certainly find that the print under the contrast and field hold controls has suffered stress due to careless back cover fitting in the past: insert the knobs through the holes in the cover before locating the cover in its retaining groove.

Setting up the HT

The correct h.t. voltage at TP67 (either of the h.t. fuses) should be 205V under normal working conditions. The official setting up procedure is as follows:
(1) Turn the set h.t. control R1370 to approximately mid-position.
(2) Turn the overvoltage preset R1396 fully anticlockwise to disable the overvoltage protection circuit.
(3) Turn R1370 until the reading at TP67 is 225V.
(4) Turn R1396 clockwise until this reading falls to 220V. On a working set the picture will then flutter, showing that the overvoltage protection circuit is operating.
(5) Turn R1370 to obtain 205V at TP67.

If you cannot carry out this procedure the power supply is faulty. The most common faults are picture flutter, inability to obtain the correct voltage, and intermittent fuse blowing.

Picture Flutter

The causes of picture flutter are usually as follows:
(1) Defective BR100 trigger diac (D1377) in the power supply. In an emergency this device can be reversed. Testing is difficult since the device measures virtually infinite resistance both ways – substitution is the best way of proving the guilt or innocence of this component.
(2) Defective power supply thyristor (SCR1379). A standard fault on the G8. It should be replaced whenever the power supply is suspect. The thyristor can appear to be all innocent when checked with a tester but play silly games when in circuit. For example, in one case of picture flutter the thyristor was found to be light sensitive: its anode-cathode resistance fell to a few thousand ohms when a bright inspection light was shone on to it! Gentle heat had the same effect.
(3) H.T. smoothing capacitor C5536 (600μF) on the line scan panel defective.
(4) Very low field sync pulse amplitude due to a defective TBA550Q i.c. on the signals panel.
(5) H.T. reservoir capacitor C1385 (600μF) on the power supply panel defective: this capacitor tends to leak horrible-looking gunge as it slowly loses capacitance.

Incorrect HT

Causes of inability to obtain correct h.t. voltage (205V) are usually:
(1) Thyristor becoming leaky as the set warms up.
(2) Assuming that no other faulty component is found, you'll probably find that one or both of the two high-stability resistors R1368 (470kΩ) and R1369 (8·2kΩ) has changed value. Such changes are usually small and difficult to detect using a normal test meter – substitution is by far the quickest way of testing these components. Temporarily dabbing a 1MΩ resistor across these suspects will show which – if either – has changed value. Be careful not to blow the set up by careless testing in this area: as you probably know, the line output transformer in this chassis has suicidal tendencies.

Fuse Blowing

The mains fuse is rated at 3·15A and is of the anti-surge type. It's useful to distinguish between violent fuse blowing (blackened, charred debris) and peaceful demise. In either case check the thyristor first by substitution.

Violent fuse blowing is often caused by:
(1) The insulation between the "mains dropper" R1367/R1381 and the chassis mounted fixing lugs becoming defective.
(2) A defective mains switch, especially when of the earlier open variety.
(3) A short-circuit mains filter capacitor – C1366, 0·33μF.

In the event of non-violent fuse blowing simple replacement may restore normal operation. If not, suspect the h.t. reservoir capacitor C1385 and the line output transformer – the latter may blow fuse FS5557 (800mA) on the line scan panel.

Timebase Panel

The most common fault on the timebase panel is failure of the transductor, which can suddenly go up in a cloud of smoke. A quick check is to disconnect plug H, which will take the line section of the transductor out of circuit, but leaving the plug out permanently will impair the picture geometry. This can normally be observed only on a crosshatch pattern. Its importance depends on the screen size and the cost of repair.

Inability to set up the line hold can be caused by the 18V zener diode D4531.

Poor field lock and picture jumping between scenes can be caused by the TBA550Q i.c. on the signals panel.

Field collapse sometimes occurs when R4533 (if fitted) springs open. Resoldering often provides a permanent cure. Later boards were modified to prevent this.

C4452 in the field charging circuit can leak to give bottom foldover when cold.

Note that although the field scan coupling capacitor C4479 is shown with the correct polarity on circuit and wiring diagrams on some panels the connections are incorrectly printed. If the capacitor is fitted the wrong way round the whole picture floats gently upwards, no amount of field shift control adjustment restoring correct conditions. This occurs because as C4479 becomes more leaky more unwanted d.c. flows through the field scan coils.

Lack of height can be caused by the bootstrap capacitor C4469 ($220\mu F$) falling in value.

Line Scan Panel

The line scan panel, on which the driver and output stages are mounted, causes the majority of faults in the G8 chassis. The dreaded line output transformer lives here. Anyone attempting to service G8 chassis should have a stock of replacement transformers to hand if only to prove the innocence of this component should a weird symptom present itself. The cost of replacement transformers is fortunately not high and they are easy to obtain – perusal of advertisements in the magazine will soon confirm this.

For the uninitiated, the line output transformer can cause the following symptoms: (1) failure of fuse FS5557 (800mA), often intermittently; (2) reduced width with overheated windings; (3) intermittent crackles and picture fluctuations; (4) smoking from the overwinding.

If both line output transistors go short-circuit FS5557 blows. It's more common for one transistor to go short-circuit however, leaving the other to plod on. In this event the symptoms are a slightly oversize picture with low brightness and contrast, the picture size changing with alteration of the brightness control setting. In general the picture looks drab and lacks sparkle, giving the impression that the tube is about to meet its maker. Low h.t. voltage will also produce this state of affairs of course, so the prudent engineer will always start by checking the voltage at the two fuses on the power supply panel.

A quick, reliable check on the output transistors is to measure the voltages at the two heatsinks. Under normal conditions one voltage should be about half the other, i.e. 190V and 90V. If both collectors are at about 190V one transistor is probably short-circuit. The originals were BU105s: a pair of BU208s make ideal replacements.

There's a trap here for the unwary however. After replacing both transistors with known good ones the original fault symptoms may persist, with both heatsinks still at about 190V. In this case the fault is nearly always due to the balancing coil L5003, which is at the extreme top of the panel. In fact this may be all that was originally wrong. You'll almost certainly find that the core is stuck, and any attempt to force it will result in the little metal cap breaking off. A replacement coil can be purchased, but a quick way of dealing with it is as follows:

(1) Unscrew the four mounting screws then unsolder the whole coil from the upper board (take care not to leave little solder bridges across the print).
(2) Very carefully cut around the centre of the coil former with a junior hacksaw until you just hear the blade contact the stuck ferrite core (see Fig. 1).
(3) Unscrew one half of the assembly from the other, gently – they are not connected electrically.
(4) Gently unscrew the protruding ferrite core from one half of the assembly, using hand pressure only.
(5) The threads of the former can now be cleaned and the core reinserted with a trace of silicone grease on its threads. The whole assembly can then be resoldered to the board. Use a small amount of Araldite to hold the cut halves of the coil together.

After refitting the coil, turn the core while observing a stationary test pattern. At the correct core position the picture will be of minimum width and the e.h.t. will be at its correct, maximum value. The voltages at the two transistor heatsinks should then be at approximately 190V and 90V. Note that zero voltage at the heatsink of the "lower" transistor T5532 can also be caused by misadjustment of L5003.

The whole surgical operation on the coil takes about five minutes and is easily carried out using the simplest of tools.

Always make the output transistor heatsink voltage test when dealing with this chassis – it saves so much heartache!

Failure of F5557 has been traced to D5567 (OA91) going short-circuit (very early version of the panel with original type of beam limiter circuit). Failure of F5560 (1·25A – late version of the panel) has been traced to the 25V rectifier diode D5539 (BY210-400).

It pays to check the various diodes on the line scan panel before condemning the output transformer.

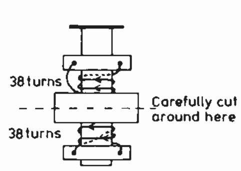


Fig. 1: Details of the line output transistor balancing coil L5003, which is at the extreme top of the line scan panel.

Sound Faults

A crackling sound with the volume control turned to zero has been traced to noisy BD131 audio output transistors, also a noisy TAA570 intercarrier sound i.c. This i.c., used in the earlier versions of the chassis, has also been responsible for a range of symptoms including no sound and severe buzz. If the associated quadrature coil L2601 is misadjusted the result will be low sound with buzz.

Crackling on one channel only (or when using a VCR) can usually be removed by very careful adjustment of the extreme left-hand core in vision selectivity can U2800, i.e. L2807. Distorted sound can occur when one of the BD131 audio output transistors goes open-circuit. Usually however the print to one of these transistors becomes detached, giving the same symptom even though the voltages may not appear to be too far from their correct values.

Convergence Panels

The earlier, sturdy vertically mounted front convergence panel was very reliable. This cannot always be said of the later, rear chassis-mounted panel used in the 550 series. Convergence drift is caused by the heat-sensitive AC128 transistors and the electrolytics on this panel. The electrolytics dry up in the heat produced by the convergence potentiometers, especially the infamous R1934 (10Ω – R/G parabola) which often causes the whole board to burn up. A replacement panel may well cost more than the set is worth. Guard against R1934 overheating by removing the printed card and placing a heatsink around R1934. Noisy potentiometers on this panel can easily be cleaned with a spray of silicone oil. This should be done before attempting convergence.

Chroma Panel

Faults on the chroma panel are usually due to defective i.c.s. Sometimes a dry-joint develops on the luminance delay line (or the print underneath it), causing a double side-by-side image. This symptom is very often intermittent and can make one feel schizophrenic until one realises the cause. Loss of one primary colour is usually caused by a dud output transistor, a broken track or a dry-joint, e.g. on one of the output transistor emitter resistors. The 39kΩ TBA530 load resistors R7326/R7346/R7363 change value to give incorrect colours.

In General

I agree with Tony Thompson's remarks regarding trade disposal sets. A sharp eye is indeed required when examining sets prior to purchase. One supplier swore on a stack of bibles that all his sets were complete but denied all responsibility when I later found that two panels were missing from one set.

A very good indication of what's wrong with a set is often given by the state of its interior. A line scan panel hastily put back in position so that it almost falls out of the set usually means line output transformer trouble. The tube base left disconnected suggests bad news about the tube. A thick layer of dust over everything usually means that the set has simply died and the owner decided to exchange it for a new one. In such cases the fault is often a trivial one and the set can be got going as good as new – bearing in mind that the tube may not be in its prime.

The biggest problem is usually with the state of the cabinet. Very often an otherwise excellent looking set bears horrible scratches on its highly polished surface. Attempts to mask such defects usually fail because the wood becomes discoloured. The only complete solution when dealing with cabinet defects is to scrape the wood along the grain, in the same direction, using a very sharp wide chisel, until the whole surface is restored to its original pristine condition. Two coats of semi-matt clear varnish will then bring the appearance back to new. The discoloured wood veneer surrounding the tube can also be given this treatment – be careful not to crack it as it's very brittle. Use a barely wet fine brush and silver paint to restore the worn tracery around some models. With patience the cabinet can be made to look like new, but only you can decide whether the time spent on this is worthwhile for the return it brings.

It's essential to soak test a G8 before delivering it to the customer. Some faults, such as convergence drift or varying field height, may make their appearance only the morning after delivery, the set having worked faultlessly the previous day. Generally speaking the G8 is an excellent chassis with readily available spares: provided it has been conscientiously serviced and adjusted, a set will give many years of trouble-free viewing.

Sonys and Suchlike

Nick Lyons

Oriental chassis can sometimes be a little mysterious to an old "Empire" brain. Few are more mysterious than Sonys. Although generally very reliable and providing good pictures, there are some models I find it hard to forgive. I do forgive the modified NTSC decoders used in the early colour sets, honest. Also the otherwise superb KV1340 which just looked as if it had two dozen boards, half of which were no bigger than a large box of matches, linked together with a wiring loom like a telephone exchange. There's one sin so vile however that I cannot find forgiveness within me: the gate-controlled switch. Why Sony found it necessary to use these when everyone else managed without I don't know. Anyway, enter on cue a KV1810 with a terminal tube, the bottom of the picture a third of the way up the screen and atrocious linearity. Ever wishing to avoid this set with its GCSs, I suggested to the owner that any fault worse than a loose mains plug wasn't worth bothering about with the tube in such a shocking state. This was not his view however, so without further ado battle commenced. At least the bloody GCSs hadn't gone I thought. More on that later.

The KV1810, Part 1

A linearity control tweak just made matters worse, i.e. the bottom started to fold over. Never trusting linearity networks my first and entirely useless move was to check the two 2·2μF electrolytics that are connected in series with the linearity control. Let's move to the other end of the field timebase I thought and see what the output stage is doing. Well, what it was doing wasn't quite right. The Avo proved that the output transistors were o.k. but the scope revealed drive problems. Always suspicious of electrolytics, especially non-polarised ones, I pulled out the bootstrap capacitor C520 (10μF, 16V) and also the similar but polarised coupler C522. Both were useless: having replaced them (C520 with a non-electrolytic type – it was huge, but as half the circuit was on the back of the board anyway . . .) things looked better but not completely right. It was not until C529 (10μF, 16V) in the height circuit and C533 (1μF, 160V) in the field amplifier circuit had also been replaced that the correct range of height and linearity could be achieved.

This left the set displaying a remarkably linear picture on a very weak tube – not only dim and largely green, but it was of the "by the time it's bright enough to see you can't focus it any longer" variety. Focus adjustment on these sets is another pain, being a solder tag effort – this really isn't good enough on a colour set. It did however improve the performance – to pretty bad!

Attention was next turned to the grey scale – magenta blacks, pink dark greys and lime green white. Not very promising. Much twiddling proved that this was about the best of which the tube was capable – at this heater voltage. Now naughty though this is, I thought that the only recourse with this tube was to bump up the heater voltage. The mains transformer in these sets (it was a Mark I version) supplies only the c.r.t. heaters and the primary is tapped at 200, 220 and 240V. I thought it would be a good idea to put a crocodile clip on the transformer tap flyhead so that I could quickly change taps with the set running to see whether any worthwhile improvement was achieved. Well it did seem a good idea at the time, but I'd reckoned without the GCSs. As soon as I moved the flylead from the 240V tap and dabbed it on the 220V tap – bump, hum and the set was dead. The back-e.m.f. from the transformer had put enough of a pulse on the mains to kill off the GCSs. By now I was beginning to think that the whole thing was a bad idea: both GCSs had gone dead short – heaven alone knows how well these sets fare in households with poorly suppressed vacuum cleaners and the like.

After replacing the GCSs and putting the tube on the 200V tap a barely passable image could be discerned in a dimly lit room, but at least it was in focus. Time to get it back to the customer in haste. It was to return however, almost as hastily. But first for something completely different.

Monitor Trouble

Professional video monitors are a strange breed and never like to do anything by halves. Here's a case in point. At switch on the e.h.t. rustled up: all should have been well but there was no raster. In this suutation, with e.h.t. present but absolutely no screen illumination, it's always been a habit of mine to glance at the tube's heater before doing anything else – of course it's always been lit and the trouble has been elsewhere. Always that is except this time. No light at all. Out with the Avo which recorded around 1V across the heater pins. So the heater wasn't open-circuit, but something was amiss. The circuit diagram showed that there's a heater winding on the mains transformer, but this isn't connected directly to the heater. Nothing as crude as that. A bridge rectifier, reservoir capacitor, series resistor and an 8V regulator chip were all present. As with all hi-tech equipment it was the hi-tech bit, i.e. the chip, that had failed.

Slow Slog

It seems to me that I have to slog through even the simplest of faults. I must have been the last person on Earth to attribute almost any fault on a Rank T20 chassis to 4R16. I always attribute faults on these sets first to the start-up circuit then to the line output transistor's series base feed resistor. It seems however that there are those who are slower than I: a colleague was amazed at my revelation that the field cramping on his ageing relative's set (Thorn 1400 chassis) was due to the diode dropper in the heater line going short-circuit. It's successful diagnosis like this that keeps me going. Going where?

The Damaged Portable

Well, on my way to do a little training the chap at the sports centre counter waylaid me to recount a tale of woe. Apparently his dog had had a little sport with the family's Contek portable, bowling it over in the process. Although the case had suffered minimal damage, the same couldn't alas be said of the PCB. Quite extensive damage had occurred in the general area of the heaviest component, the line output transformer. Fortunately the cracks were for the most part visible and the board could be patched up. In cases like this I always find switch-on to be a bit dicey. This was no exception. A fearful display of arcing from the line output transformer occurred, though the rest of the set seemed quite happy. Close examination showed that the transformer's case was cracked, with particularly bad damage around the moulding where the e.h.t. lead leaves. A new transformer would have cured the fault but one wasn't to hand and the expense had to be considered.

Repairing the LOPT

Strips of tape were used to make a pouch over the cracks in the casing, the tape forming the outer wall of the pouch which stood about an eighth of an inch away from the casing. A proprietary epoxy resin was then mixed and poured into the pouch. A piece of plastic pipe about ¾in. in diameter and about as long was used to repair the damaged e.h.t. moulding. The pipe was slit open so that it could be got over the e.h.t. lead without having to remove the cavity connector, then positioned on top of the transformer around the lead moulding. Preparations were completed by taping the bottom of the pipe to the transformer and taping up the slit. Epoxy was poured in and left for half a day to set, after which the tape was removed, revealing a neat-looking job. But would it stand the best part of 30kV across it? I switched on with trepidation. The set sprang to life and all was well. Some weeks later it still is. So for a couple of feet of tape, a bit of tube, about a quarter of a pack of epoxy and not a lot more time than it would have taken to fit a new transformer if I'd had one the set was back in service. I wouldn't expect this to work with all transformers or in every case but with transformers of this type of construction (similar to TX10 types) a reasonable success rate looks likely.

The KV1330

Set dead said the report, and so it was. This particular Sony KV1330 had run faultlessly from new (must have been the best part of ten years). The input fuse had popped with some force. On replacing it and measuring the mains input with an Avo a dead short was recorded. Clearly the mains filter capacitor had died and there it was, obvious on the input panel. I removed it, a brown toffee-looking thing, and fitted a purpose-designed mains filter capacitor. Sony had been generous, drilling several sets of spare holes in the panel to accommodate various lead spacings. Incidentally I'd recommend fitting purpose-designed mains filter capacitors for both safety and reliability – if you do use a standard type, use one rated at 1kV d.c. or 400V a.c. at least. Having said all this, as you'll probably have guessed by now the fuse blew at switch on. Why? Well there are actually two such capacitors in this set, the other one residing on the power regulator panel. It was actually this one that had died, C601 by name.

Return of the KV1810

Which brings us back to the KV1810 which had by now reappeared with more field trouble. We'd replaced most of the electrolytics last time. What was left? Well the scan coupling capacitor C517 (22μF, 160V) for a start. When it was removed a ring of goo was left on the panel. It had indeed gone to its maker.

BBC Micro Test Pattern Program

Patrick Kniveton, B.Sc.Eng.

The following program was designed to provide most of the patterns normally produced by a TV pattern generator plus one or two extras. All operations are called from the function keys – a small identifying strip can be used to label each key. Operation of one of the keys calls up the appropriate procedure: these are all initially listed on the Menu screen which can be recalled at any time by pressing f8. The program is written in BASIC and is therefore slow in parts – readers will no doubt be able to suggest improvements.

The patterns available are: crosshatch; colour bars; dots; vertical lines; horizontal lines; circle (for linearity setting); red, green, blue, magenta, cyan, yellow, white and black rasters; a composite test card. The program can be saved on tape or disc.

```
 20 REM TV SERVICING AID
 40 REM BBC MICRO B
 60 REM (C) P.E. KNIVETON 1985
100 *KEY0 MODE0:M PROCxhatch:M
110 *KEY1 MODE2:M PROCcbars:M
120 *KEY2 MODE2:M PROCdots:M
130 *KEY3 MODE0:M PROCvert:M
140 *KEY4 MODE0:M PROChoriz:M
150 *KEY5 MODE0:M PROCcircle:M
160 *KEY6 MODE5:M PROCraster:M
170 *KEY7 MODE2:M PROCcard:M
180 *KEY8 MODE7:M PROCmenu:M
190 PROCmenu
200 END
210 DEFPROCxhatch
220 CLS
230 FORY=0TO1023 STEP 64
240 MOVE0,Y
250 DRAW1279,Y
260 NEXTY
270 FORX=91TO1188 STEP 91
280 MOVEX,0
290 DRAWX,960
300 MOVE(X+2),0
310 DRAW(X+2),960
320 NEXT X
330 ENDPROC
340 DEFPROCcbars
350 CLS
360 MOVE0,1000
370 PLOT85,0,0
380 FORbar=1T08
390 IF INT(bar/2)=bar/2 THEN colour=(8-bar)/2 ELSE
      colour=(8-bar)+INT(bar/2)
400 GCOL0, colour
410 PLOT85,(bar*160),1023
420 PLOT85,(bar*160),0
430 NEXTbar
440 VDU23,1,0;0;0;0;
450 ENDPROC
460 DEFPROCdots
470 CLS
480 FORX=91TO1188 STEP 91
490 FORY=0TO1023 STEP 64
500 MOVE X,Y
510 DRAW,Y+1
520 NEXTY
530 NEXTX
540 VDU23,1,0;0;0;0;
550 ENDPROC
560 DEFPROCvert
570 CLS
580 FORX=91TO1279 STEP 91
590 MOVEX,0
600 DRAWX,959
610 MOVE(X+2),0
620 DRAW(X+2),959
630 NEXTX
640 VDU23,1,0;0;0;0;
650 ENDPROC
660 DEFPROChoriz
670 CLS
680 FORY=0TO1023 STEP 64
690 MOVE0,Y
700 DRAW1279,Y
710 NEXTY
720 VDU23,1,0;0;0;0;
730 ENDPROC
740 DEFPROCcircle
750 CLS
760 VDU29,640;512;
770 MOVE350,0
780 FORC=0TO2.1*PI STEP 0.05
790 PLOT5,350*COSC,350*SINC
800 PLOT5,352*COSC,352*SINC
810 NEXTC
820 VDU23,1,0;0;0;0;
830 ENDPROC
840 DEFPROCraster
850 CLS
860 IF GET$="K"THEN VDU19,0,0,0,0,0
870 IF GET$="R"THEN VDU19,0,1,0,0,0
880 IF GET$="G"THEN VDU19,0,2,0,0,0
890 IF GET$="Y"THEN VDU19,0,3,0,0,0
900 IF GET$="B"THEN VDU19,0,4,0,0,0
910 IF GET$="M"THEN VDU19,0,5,0,0,0
920 IF GET$="C"THEN VDU19,0,6,0,0,0
930 IF GET$="W"THEN VDU19,0,7,0,0,0
940 IF GET$="E"THEN GOTO960
950 GOTO860
960 VDU19,0,0,0,0,0
970 ENDPROC
980 DEFPROCmenu
990 CLS
1000 PRINT TAB(9,2);CHR$(141);CHR$(130);"TV
      SERVICING AID"
1010 PRINT TAB(9,3);CHR$(141);CHR$(130);"TV
      SERVICING AID"
1020 PRINT CHR$(129);CHR$(157);CHR$(135);"f0";
      CHR$(156);CHR$(135);"Crosshatch"
1030 PRINT
1040 PRINT CHR$(129);CHR$(157);CHR$(135);"f1";
      CHR$(156);CHR$(135);"Colour bars"
1050 PRINT
1060 PRINT CHR$(129);CHR$(157);CHR$(135);"f2";
      CHR$(156);CHR$(135);"Dot pattern"
1070 PRINT
1080 PRINT CHR$(129);CHR$(157);CHR$(135);"f3";
      CHR$(156);CHR$(135);"Vertical lines"
1090 PRINT
1100 PRINT CHR$(129);CHR$(157);CHR$(135);"f4";
      CHR$(156);CHR$(135);"Horizontal lines"
1110 PRINT
1120 PRINT CHR$(129);CHR$(157);CHR$(135);"f5";
      CHR$(156);CHR$(135);"Circle"
```

```
1130 PRINT
1140 PRINT CHR$(129);CHR$(157);CHR$(135);"f6";
     CHR$(156);CHR$(135);"Raster"
1150 PRINT TAB(9);"(Press R for Red, G for Green,"
1160 PRINT TAB(10);"B for Blue, C for Cyan,"
1170 PRINT TAB(10);"M for Magenta, Y for Yellow,"
1180 PRINT TAB(10);"E to ESCAPE raster routine)"
1190 PRINT
1200 PRINT CHR$(129);CHR$(157);CHR$(135);"f7";
     CHR$(156);CHR$(135);"Test card"
1210 PRINT
1220 PRINT CHR$(129);CHR$(157);CHR$(135);"f8";
     CHR$(156);CHR$(129);"RETURN TO THIS MENU"
1230 VDU23,1,0;0;0;0;
1240 ENDPROC
1250 DEFPROCcard
1260 CLS
1270 FORY=0TO1023 STEP 64
1280 MOVE0,Y
1290 DRAW1279,Y
1300 NEXTY
1310 FORX=91TO1188 STEP 91
1320 MOVEX,0
1330 DRAWX,960
1340 NEXTX
1350 COLOUR 132
1360 PRINT TAB(8,28);"      "
1370 PRINT TAB(8,29);"TSA1"
1380 PRINT TAB(8,30);"      ":COLOUR 128
1390 PRINT TAB(0,0)
1400 VDU29,640;512;
1410 GCOL0,0
1420 MOVE0,0
1430 MOVE0,1
1440 FORD=0TO2.1*PI STEP 0.1
1450 PLOT4,0,0
1460 PLOT85,315*COSD,315*SIND
1470 NEXTD
1480 MOVE320,0
1490 GCOL0,7
1500 FORC=0TO2.1*PI STEP 0,02
1510 PLOT5,320*COSC,320*SINC
1520 NEXTC
1530 MOVE0,0
1540 MOVE309,75
1550 FORF=0.24TO3.0 STEP 0.1
1560 PLOT85,309*COSF,309*SINF
1570 PLOT85,0,0
1580 NEXTF
1590 MOVE-100,0
1600 MOVE-100,-201
1610 PLOT85,100,0
1620 PLOT85,100,-201
1630 GCOL0,0
1640 MOVE-100,0
1650 MOVE-100,201
1660 PLOT85,100,0
1670 PLOT85,100,201
1680 GCOL0,7
1690 MOVE-60,0
1700 DRAW-60,303
1710 MOVE-300,-75
1720 MOVE-300,75
1730 L=-225
1740 FORJ=1TO8
1750 IF INT(J/2)=J/2 THEN B=(8-J)/2 ELSE
     B=(8-J)+INT(J/2)
1760 GCOL0,B
1770 PLOT85,L,-75
1780 PLOT85,L,75
1790 L=L+75
1800 NEXTJ
1810 VDU23,1,0;0;0;0;
1820 ENDPROC
```

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.

BEOVISION 4000 CHASSIS

The problem is fluctuating h.t. It will steady if the voltage is reduced to below 150V by using the h.t. preset.

A common cause of this problem is failure of one of the two 56kΩ resistors 6R29 and 6R30 in the thyristor's trigger pulse generator circuit. They tend to go high in value. If necessary go on to check 6C20 (47μF), 6R27 (1Ω) and the setting of the current limiter trip preset 6R33. We've also known leakage in the 39V zener diode 6D19 in the excess current sensing circuit to cause this fault.

WAX-SEALED CORES

I've been trying to convert a foreign Hitachi portable (Model 1A-51) for use in the UK. 6MHz coils have been fitted but there's still a buzz present. Hitachi have suggested tuning T401 and T402 for best sound but the cores are fixed with hard wax.

We've found that the most effective way to deal with waxed-up cores is to invert the chassis and gently heat the relevant can, using a hairdryer, until the wax runs out. The cores should then be movable after applying a couple of drops from a commercial ear-drop preparation. Tune carefully for minimum buzz on a vision with teletext or similar transmission with lots of hard white captions.

BUSH BC6004

The trouble with this Saba manufactured 14in. colour portable is that the chopper/line output transistor (Wessel circuit) lasts for only a few weeks. We've replaced the damping components C841/R841 and have made thorough checks but have been unable to find anything amiss. To start with the transistor would last for about three months: now it's down to a few weeks.

On past experience we'd suggest replacing D687 (SKE4F1/10) which is in series with the line scan circuit, the efficiency diode D688 (BY223) and the flyback tuning capacitor C688 (0·0013μF), also R941 (100kΩ, 1·5W) which biases the base of the driver transistor. In addition, check thoroughly for dry-joints and similar "physical" faults.

DECCA 10 SERIES CHASSIS

The colour control has to be turned by at least three-quarters of its travel before there's any colour. The colours are otherwise all right, but surely the control shouldn't operate like this?

This effect is not uncommon on some Decca 10 series sets. There may however be some lack of chroma gain. If there's any sign of Hanover bars, check the setting and condition of the controls in the chroma delay line matrixing circuit – VR267 and L206. If the matrixing is all right, check the following components in the order given: the second chroma amplifier transistor's emitter decoupling capacitor C230 (5μF), the a.c.c. reservoir capacitor C222 (5μF) and the chroma delay line driver transistor's emitter resistor R268 (82Ω).

SONY C5

The trouble with this machine is failure to record sound off-air. There's sound with playback of prerecorded tapes. I understand that this is not uncommon.

On every occasion when we've encountered this fault the cause has been the TBA120U intercarrier sound i.c. If replacing it fails to restore the sound an oscilloscope will be necessary to check and trace the signal.

RANK T20 CHASSIS

There's ringing on the left-hand side of the screen, similar to the effect that occurs when a line linearity coil's damping resistor goes open-circuit. Adjusting the fifth harmonic tuning coil has reduced the vertical bands considerably but they are still noticeable.

We assume that you've checked the line linearity coil's damping resistor 5R12 (680Ω). If not, check this, the EW correction coupling capacitor 5C15 (1μF) and if necessary 5C16 (0·068μF) in the first anode supply network. For reliability, it's important that the fifth harmonic tuning coil 5L3 is correctly adjusted as per the manual. If replacing the above mentioned components fails to clear the fault and 5L3 cannot be set up correctly it's likely that the line output transformer is defective.

THORN 1690 CHASSIS

The original problem with this set was caused by a faulty line output transformer. When this was replaced the picture was found to be greatly expanded in the middle. The height control will correct the top and bottom of the picture but the linearity control has very little effect. I've checked the electrolytics and transistors in the field amplifier/driver/output stages.

The field waveform is generated across C104 (0·047μF). Check this item and the associated charging resistor R128 (330kΩ). The next suspects are the 390Ω resistors R133/4 which bias the emitters of the driver transistors. They can and do change value. This is also true of R132 (27kΩ), the amplifier transistor's load resistor.

SONY SLC7 VCR

After fitting a Sony chopper power supply replacement kit and a new control i.c. the machine came to life for five seconds then went dead again. On investigation the chopper transistors, the surge limiter resistor and the mains fuse had failed. With a replacement fuse the readings on the control i.c., powered via the start-up supply, were found to be correct – apart from the pins linked to the chopper supply output of course. Any suggestions before a second replacement kit is fitted?

The operation of the control i.c. can be checked by disconnecting D204 (soft-start control circuit) and applying an external source of 12V to C203. A 3V sawtooth should then be seen at pin 5 of the i.c. (TP1) and a 20V p-p squarewave at pins 8 and 11. If these waveforms are o.k., the rectifier diodes D201/2 and the 4·7μF electrolytics C110/1 are in order, and no excessive loading is present on the 12V line, suspect short-circuit turns in the chopper transformer T102 – it can happen.

DECCA 30 SERIES CHASSIS

The problem is intermittent horizontal bands across the screen. They are about half an inch wide and comprise six scanning lines, the first two lines being quite dark while the rest are progressively less intense.

This sort of thing can be caused by discharges inside the focus spark gap. Try replacing it – also check the earthing connections between the tube's outer coating and the base panel, thence to chassis.

TEST CASE

271

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.

It's generally acknowledged that Bang and Olufsen TV sets have always had the edge over the competition in terms of picture and sound quality. Their reliability has not always been of the best however, and early solid-state chassis from this stable are no strangers in our workshop. No matter what the source, many of the faults that arise in these sets result in a "pumping" action in the power supply as a result of one or other of the protection circuits coming into operation. This month's story is about one such Beopump . . .

The set was a Beovision 6002 (type 3522-3532) with a beautiful rosewood cabinet – and a complete lack of raster and sound. A gentle pumping sound at a rate of about once per second came from within it. Some quick preliminary checks showed that no obvious short-circuits were present in the line output stage while the h.t. line, which should record 148V at 6TP2, was pulsing to about 100V on each pump cycle. A scope check at 5R18 (18Ω) which is in series with the 148V h.t. line produced a waveform with an amplitude of about 16V, about twice what's normal, indicating that excessive current was flowing in the line output stage.

It didn't take long to unload the various power supplies derived from the line output transformer: 6D9, which produces a 37V supply for the field timebase and the EW modulator drive circuit, was found to be heavily burdened – its removal brought the set to life, albeit with no field scan. We decided to check the field timebase module, 8003200, where a dead short to chassis was found at the supply input point – P19-5. A few more minutes investigation showed that the TDA1270 field timebase chip 7IC1 was the culprit – pin 2 was solidly shorted to the heatsink tabs.

After fitting a new chip we confidently replaced the module and switched the set on. No pumping – but no field scan either! In the next twenty minutes we had the module in and out several times while we checked the output transistors, their joints, the module socket connections and so on. Then we got sensible and reasoned that if there was no field scan activity the white line on the screen would fade within seconds of switching on – which it didn't – due to lack of gating pulses in the auto grey-scale shift circuit. Sure enough a scope check at the i.c.'s output pin 4 produced a 50Hz waveform which was also found to be present at the emitters of the output transistors 7TR2/3. The waveform wasn't the usual "spiked-sawtooth" however: it was virtually a squarewave with a peak-to-peak amplitude of almost 40V. At this point experienced TV trouble-shooters will be leaping up and down with the correct answer. Are you amongst them? If so, what's the accompanying symptom that sometimes gives a further clue to the cause of the trouble? For the answer to both these questions, see next month . . .

ANSWER TO TEST CASE 270
– page 456 last month –

In our last "tableau" we were huddled around a Philips colour set fitted with the G8 chassis. Its problem was an intermittent red raster that occurred only spasmodically and only when the set had thoroughly warmed up. Various substitution checks had been made in the field and the set was now on the workshop bench for investigation.

The simple and effective way to deal with this situation is to interchange the video drive between the suspect channel (red in this case) and a known good one. So the red and green leads to the tube base were swapped over and the resulting strange colours were suppressed by turning the saturation control to zero. When the fault next occurred the monochrome picture became suffused with red, and since the red gun was now being driven by the green channel this implied that the tube was faulty.

So it turned out to be, though exactly what was happening within the tube was not clear. Any interelectrode short involving the red control grid would have elevated all three grids to a high potential and turned on all three guns. We suspect that the red grid connection to pin 3 was going open-circuit intermittently, though this is very uncommon with the type of Mullard tube used.

No, the customer didn't have a new tube fitted – and we didn't get a bean for all our efforts!

QUERY COUPON

Available until 17th July 1985. One coupon, plus a £1·50 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 518.

TELEVISION JULY 1985

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BB105B	18p
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BC107	7p
BC108	7p
BC109	7p
BC115	10p
BC118	11p
BC140	19p
BC141	19p
BC142	19p
BC143	19p
BC147	6p
BC148	6p
BC149	6p
BC157	6p
BC159	6p
BC182	6p
BC182L	6p
BC183	6p
BC183L	6p
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
BD439	40p
BD440	40p
BD441	40p
BD442	40p
BD533	50p
BD534	38p
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	18p
BF183	20p
BF184	20p
BF185	20p
BF194	5p
BF195	5p
BF196	6p
BF197	7p
BF198	7p
BF199	6p
BF200	16p
BF240	16p
BF241	10p
BF255	12p
BF256	18p
BF257	18p
BF258	18p
BF259	18p
BF262	25p
BF263	25p
BF270	18p
BF273	15p
BF311	21p
BF324	25p
BF336	20p
BF337	20p
BF338	20p
BF355	28p
BF362	30p
BF367	13p
BF371	17p
BF414	18p
BF420	16p
BF421	18p
BF422	21p
BF423	15p
BF440	16p
BF451	17p
BF455	14p
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BF459	19p
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BF462	62p
BF469	30p
BF470	28p
BF471	28p
BF479	30p
BF493	18p
BF494	16p
BF595	16p
BF596	16p
BF597	10p
BF615	30p
BF758	41p
BF869	22p
BF870	22p
BF872	23p
BF960	38p
BF963	40p
BF964	38p
BF966	40p
BFR40	25p
BFR51	21p
BFR62	21p
BFR79	25p
BFR90	52p
BFR91	99p
BFX29	20p
BFX84	20p
BFX85	20p
BFX87	15p
BFX88	15p
BFX89	60p
BFY17	30p
BFY18	40p
BFY41	28p
BFY50	14p
BFY51	14p
BFY52	14p
BFY56	25p
BFY57	25p
BFY64	25p
BFY90	45p
BLY48	85p
BLY49	85p
BR100	14p
BR101	43p
BR103	37p
BSX20	15p
BSX26	18p
BSX29	19p
BT106	90p
BT109	90p
BT116	80p
BT119	100p
BT120	100p
BU100A	110p
BU104	100p
BU105	80p
BU108	100p
BU110	110p
BU111	140p
BU124	60p
BU126	70p
BU204	75p
BU205	70p
BU208	75p
BU208A	80p
BU208D	100p
BU325	55p
BU326	85p
BU406	85p
BU406D	95p
BU407	75p
BU407D	95p
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BU408D	95p
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MJE29A	30p
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TAG4444	76p
TIP29	15p
TIP29A	22p
TIP29C	25p
TIP30	25p
TIP30C	30p
TIP31A	24p
TIP31C	30p
TIP32	24p
TIP32A	24p
TIP32C	28p
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TIP34	50p
TIP41A	22p
TIP41C	25p
TIP42A	22p
TIP42C	25p
TIP47	40p
TIP48	40p
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ECH81	49p
ECH84	52p
ECL80	57p
ECL82	59p
ECL84	57p
ECL85	57p
ECL86	49p
EF80	31p
EF85	34p
EF89	43p
EF183	45p
EF184	53p
EL34	190p
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EL84	50p
EL95	50p
EL500	80p
EL504	100p
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LA-1352	120p
LA-1365	140p
LA-3301	120p
LA-3350	120p
LA-3361	115p
LA-4030	200p
LA-4031	140p
LA-4032	140p
LA-4050	130p
LA-4051	160p
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74LS22	24p
74LS24	47p
74LS26	24p
74LS27	24p
74LS28	24p
74LS30	24p
74LS32	24p
74LS33	26p
74LS37	24p
74LS38	24p
74LS40	24p
74LS42	48p
74LS47	78p
74LS48	78p
74LS51	24p
74LS54	24p
74LS55	24p
74LS73	28p
74LS74	33p
74LS75	36p
74LS76	28p
74LS78	35p
74LS83	65p
74LS85	75p
74LS86	32p
74LS90	45p
74LS91	85p
74LS92	50p
74LS93	48p
74LS95	60p
74LS96	80p
74LS107	39p
74LS109	39p
74LS112	40p
74LS113	32p
74LS114	42p
74LS122	56p
74LS123	70p
74LS124	95p
74LS125	38p
74LS126	42p
74LS132	53p
74LS133	46p
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BA536	£2.25	LA4440	£2.20	TA7120P	£0.60		
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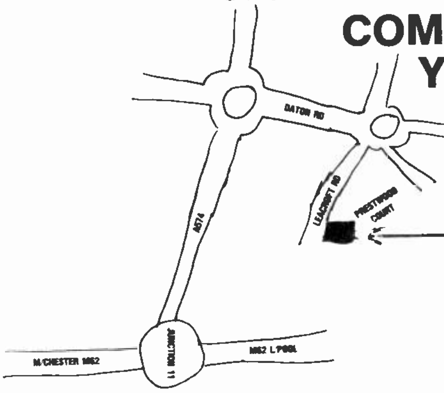

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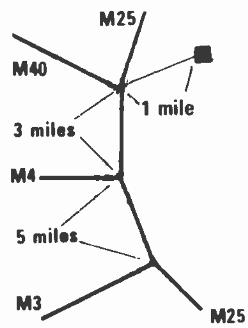

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(minimum 12 words), box number 70p extra. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television Room 2612, IPC Magazines Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5846).

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PYE 205	3.00	3 50	5.00	10.00	–	–
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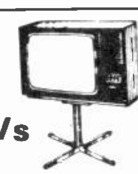

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BUSH T20	8.00	15.00	20.00	20.00	5.00	—	15.00
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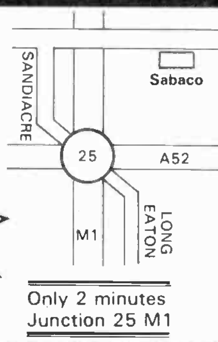

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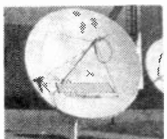

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8500 convergence panel	£6
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3500 6 push button + cable form	£1.50
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Pye 3R5/15R/45R	50p
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120/20/20/48/117	£1.00
270/10/6 for Thorn 4000	50p
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Thorn 50-40R-1K5	50p
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6×4 G11	25 ohm	£1.00
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1690 5×3	12 ohm	£1
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KT3-K30

OF-550	E.W.	10p
OF-513	correction	10p
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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
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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 11TCP 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
11TBQ Pye 731	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
KT3 BG200/43	£3.50
T/text ultrasonic rec'r panel	£14.00
Video cassette lamps on lead. 12-14V.	50p or 3 for £1.00
20 for £5.00	200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots	£4.00
G11 E.W. Transformer	50p
G11 E.W. coils	£1.00
G11 Transient Suppressors 245V for £1.00	10
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	£10.00
Pye/Chelsea Timebase panel with LOPTI	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
Pye 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 + MCI4511	£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

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Tuner Units

V/Cap Rank UHF Z776T/Unit	£6
V/Cap Rank VHF Z773T/Unit	£5
NEW G8 Tuner V/Cap	£5.50
ELC2000 on Panel	£2.50
GEC 6 Push Button Unit	£6
ITT 6 Push Button Unit	£6
DECCA 6 Push Button Unit	£6
GEC or Hitachi 6 push button unit 2110 Conversion	£8
GEC 2110 V/Cap	£5
ELC1043 (Ex Panel)	£3.75
ELC1042 NEW	£5.00
ELC2000	£4.00
ELC2004	£10.00
ELC2006 NEW	£10.00
GEC Tuner V/Cap Hitachi Alter 1979 ET548, ET547, E1451	£10.00
U322 (UHF) ..	£4.00
V314 (VHF) ..	£5.00
V317 (VHF)	£5
V334 (VHF)	£5
U321	£6
U341 UHF	£7.00
U342 (UHF)	£5
U411 UHF	£7.00
U.V. 411 Tuner	£10.00
ELC1043/05 Thorn	£5.90
ELC1043/06 Thorn	£5.00
Small V/Cap Mitsumi UHF	£4.00
VHF ..	£3.00
G8 Tuner	£6.00
Portable & rotary Tuners Sanyo & Mitsumi UHF	£5.00
NSF-UHF/VHF Varicap (old type)	£8.00
Mosfit UHF/VHF (new type)	£8.00
UE2-B31 Fidelity V/Cap T/Unit	£6.00
Thorn Tuner PANEL with 6×100K pots + cursors NO TUNER	£1.00
HITACHI 20 Turn Pot	40p
U321 on panel	£6.00
Tuner unit VHS Sylvania GTR Videon MTS 900	£2.50
Mullard Video Modulator. Application, video tape recorders, TV cameras, video games, closed circuit T/V, C.C.I.R. system. Data supplied.	£10.00
VT 100 Sound Tuner Kit. TV. Viosound. The latest design in low noise fitted with DNR, RF output and audio	£30.00
Sylvania UHF F4720B	£6.00
Sylvania VHF 900	£6.00
Small Tuner DX 175-220MHz Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00
D.P.D.T. switch Black knob. Chassis or PCB mount	4p each or 40 for £1.00

Mechanical Tuners, Delay Lines, Misc.

THORN 1400 4P.B. Mech. Tuner	
THORN 1500 4P.B. Mech. Tuner	
THORN 1590 4P.B. Mech. Tuner	
THORN 3500 4P.B. Mech. Tuner	
THORN 8000 4P.B. Mech. Tuner	
THORN 8500 Mech. Tuner	
All new & boxed.	£4.00 each
Delay Lines	
DL20A 80p	DL600 £1.00
G8 (Old Type)	£1
DL600	£1.00
DL710	£1.00
UDL11	30p
KT 3 Luminence	75p
Luminance Delay Line (CVC 45)	
10×630ma fuse	25p
10×2A fuse	50p
10×3.15 fuse	50p
10×500mA	80p
10×1 amp	80p
20 3.15 AS Fuses	£1.70
Co-Ax Joint	15p
Co-Ax Belling Lee Plug	12p
Co-Ax Splitter	£1.00
UHF Modulator CCIR	£3.00
Infra Red Emitting Diode	20p
NE2860 Small Neon Lamps GEC & Philips	5p
Mullard 5 Watt Amps. LP1162 New	75p

T.V. Tubes

12" A31/300 Hitachi	£10
15" A38/170W Hitachi	£8
18" Hitachi PIL tube with scan coils 470 KCB22-TC03	£25
10" Black and white tube scan coils & line trans	£6.00
12" 90° Tubes Type 310GNB4	£12
14" 110° Tubes Type 310GNB4	£12

Integrated Circuits

AC76003	£1.50
AM25LS23PC	10p
BAV40	40p

Semiconductors

BF694	10p
BF758	30p
BF760	30p
BFT34	15p
BFT43	10p
BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BLY49	25p
BPW41	25p
BRC116	25p
BRX43	15p
BRX48X	10p
BRY56	30p
BSS68	10p
BSY79	10p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
FT3055	30p
TCF82	30p
2N930	5p
2N2221	8p
2N2222	8p
2N2906	10p
2N3055	40p
2N3566	10p
2N3702	10p
2N3711	10p
2N3583	50p
2N3904	15p
2N4355	10p
2N4442	£1.00
2N4444	£1.00
2N5296	40p
2N5983	30p
2N6099	40p
2N6109	40p
2N6130	50p
2N6133	20p
2N6348	20p
2N6399	10p
2X 2N6099 on heat sink	50p
2SA437	20p
2SB407 Sanyo TO3	10p
2SB474	30p
2SB566	10p
2SC381	10p
2SC458	50p
2SC515	10p
2SC732	10p
2SC733	10p
2SC1030	£1.00
2SC1546	20p
2SC1725	20p
2SC2068	20p
2SC2073	8p
2SC2122A	£1.00
2SC2229	15p
2SC7350	15p
2SD180 TO3 80v/ 6A	15p
2SD200	£2.00
2SK30A	10p
BC107	10p
BC108	10p
BC109	5p
BC113	10p
BC114	10p
BC115	10p
BC116	10p
BC117	20p
BC119	20p
BC125	10p
BC126	10p
BC139	10p
BC140	30p
BC141	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC158	10p
BC159	10p
BC160/16	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC183	10p
BC184	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	30p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	15p
BC559	10p
BC635	10p
BCX31	25p
BCX32/36 Pair	75p
BCX32	25p
BD116	25p
BD124	50p
BD124 (metal)	60p
BD130Y	25p
BD131	30p
BD132/238	30p
BD135	25p
BD136	30p
BD138	30p
BD140	30p
BD176	25p
BD182	£1.00
BD183	70p
BD202	60p
BD204	60p
BD221	20p
BD222	30p
BD228	30p
BD226	20p
BD233	30p
BD235	30p
BD238	30p
BD239	15p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD439	50p
BD678	30p
BF761	30p
BF858	30p
BF871	30p
BFR39	15p
BFR52	7p
BFR79	15p
BFR81	15p
BFR87	10p
BFS60	10p
BF142	20p
MR1366	20p
BRC-M-200	40p
BRC-M-300	50p
BRC 1330	75p
BRC 3064	£1.00
BTT822	£1.00
BTT6016	£1.20
BTT6018/ML237B	£1.50
BTT6218	£1.50
BTT8124	£1.00
BTT8224	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AE	£1.00
CA1310	50p
CA3065Q	50p
CA3089Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBF16848	50p
CD4510	30p
DM7492	50p
HA1196	40p
HA1370	£2.00
HA11223	40p
HEF4001	10p
HBF4011AF	10p
HEF4053B	30p
HD3890C	£3.00
K5731D 1001012	£1.00
LA3220	50p
LM1011N	£1.00
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
MC476p	£1.00
MC1307	75p
MC1312	
MC1330	75p
MC1349	50p
MC1352	£1.00
MC1358	£1.00
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14514	50p
MC1748	80p
MEM4956	£1.00
ML231	£2.50
ETT6016	£2.00
ML232	£2.00
ML236E	£1.00
ML237B	£1.00
ML238B	£4.00
ML239	£2.00
MM5387	£1.00
MM5611	£1.00
MM5840	75p
MM5290N-4	75p
MM53108N	£4
MR1366	20p
N64100	£1.00
NE555P	60p
NE555	60p
HD38980C	£3.00
IL-1	20p
OPT600	20p
OPT601	20p
SAA611	50p
SAA661	£1.75
SAA1020	£4.00
SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
SAA1176	£3.00
SAA1250	£3.00
SAA1251	£4.00
SAA1272	£3.00
SAA1276	£3.00
SAA3027P	£4.00
SAA5000A	£1.50
SAB3013	£2.00
SAB4209	£2.00
TBO0124	£1.00
SAA5000A	£1.50
SAA5012A	£5.00
SAA5020	£3.50
SAA5030	£5.00
SAA5040	£3.50
SAA5040A	£4.40
SAA5050	£3.50
SAF1032p	£2.50
SAF1039	£2.00
SAS560	£2.00
SAS660	£1.00
SAS670	£1.00
SAS580	£1.50
SAS590	£1.50
SL901B	£4.50
SL918	£4.50
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	50p
TAA621	£2.00
TAA661	50p
TAA641	£1.50
TA7108P	£1.00
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7607AP	40p
TA7609P	50p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1441	£1.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA550Q	£1.75
TBA560CQ	£1.00
TBA570	£1.50
TBA625	50p
TBA641	£2.00
TBA651	£2.00
TBA673	£1.00
TBA720A	£1.50
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA890	£1.00
TBA900	£1.50
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.50
TBA990Q	£1.00
TMS1000NL	£2.00
TMS1943 N2L (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2216	75p
UPC566H	£1.00
UPC585C	£1.00
UPC1031H	£2.00
UPC1353C	£1.00
UPC1366C	£1.00
UPC2002	75p
UPD8049HC	£2
SN29848	50p
SN29770BN	£1.00
SN29771BN	£1.00
SN29772BN	£1.00
SN7402N	£1
SN7472N	£1
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76013ND	£1.50
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50
SN76033	£1.50
SN76110N	£1
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00p
SN76228N	£1.00
SN76270	£1.00
SN76532N	50p
SN76544N	£2.00
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76650	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£1
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA640	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£5.00
TCA830	£1.00
TCEP100	£2.25
TCE120CQ	£1.00
TDA440Q	£1.00
TDA1003A	£1.00
TDA1010	£1.00
TDA1060A	£1.50
TDA1035T	£3.50
TDA1035S	£2.00
TDA1072	£1
TDA1151	30p
TDA1170	£1.00
TDA1190	£1.00
TDA1200	75p
TDA1327A	£1.00
TDA1365	£3.00
TDA1412	50p
TDA2003	80p
TDA2004	£2
TDA2010	£1.00
TDA2140	£3.50
TDA2030	£2.00
TDA2525	£1.00
TDA2640	£2.00
TDA2522	£1.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2571AQ	£2.50
TDA2575A	£1.00
TDA2581	£2.50
TDA2590	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£5.00
TDA2611A	£1.00
TDA2611AQ	£1.00
TDA2653	£4.00
TDA2002	£1.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3560	£4.00
TDA3571Q	£1.50
TDA3710	£3.50
TDA9403	£3.00
TDA3651AQ	£3
UPC1365	£3.00
TDA3300B	£6
SN74LS 125AN	30p
SN74LS 248	50p
SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
SN29764AN	£1.00
UA721	40p
UA7300	40p
RGP30G	10p
MPSA14	10p
MPSA43	10p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	30p
Sanikron Diode	30p

Philips Cartridges

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

Transistors

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

Filters

5.5MHz	15p
6MHz	30p
BFU455K	5p

Thyristors

BT151/800R	80p
TD3F800	£1.50
BT106 Plastic	30p
BT106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
GI1 Thyristor	60p
Decca 80-100	60p
2N4444	£1.00
MCR72-6	25p

Thermistors

G8 Degausing	35p
Philip type VA1104	70p
ITTP7266312	15p
PTH451 AOR	15p
PT37P Fits Pye & PT34	20p
Degausing Thermistor (fits most sets)	20p
GEC Double Thermistor	25p

Miscellaneous

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

TV Crystals

4MHz	
4.433-619	
6MHz	
8.867238	
Large or small	50p each
GEC Power Panel	
TV106 Thermistor PT34 New	£1.00
NEC 4730312	£3.00
Line Tran Tripler in Case	
Antistatic Isolators Disc Type	20p

I.C. Holders

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