DECEMBER 1984 Australia $1.80, New Zealand $2.20, Malaysia $5.50 £1.00

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Servicing the Sony KV1612UB

Video Cameras • Vintage TV

VCR Clinic • TV Fault Finding

Replacing GCSs with Transistors

DX-TV • Teletalk on Colour

Scrambling for French TV

TELEVISION

December 1984

Vol. 35, No. 2
Issue 410

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

SUBSCRIPTIONS
An annual subscription costs £11 in the UK, £12 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BINDERS AND INDEXES
Binders (£4·50) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders, add 60p.

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

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

this month

OUR NEXT ISSUE DATED JANUARY WILL BE PUBLISHED ON DECEMBER 19

P. V. TUBES

TEL: 0254 36521/32611

104 ABBEY STREET, ACCRINGTON

T.T.L. 74LS SERIES

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

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

'4000 B' SERIES CMOS

		4027B	39	4069B	22	4511B	76	4539B	77
		4028B	64	4070B	22	4512B	72	4541B	96
		4029B	90	4071B	22	4513B	1.68	4543B	1.12
4001B	21	4032B	1.04	4072B	22	4514B	1.88	4551B	96
4002B	21	4035B	80	4073B	22	4515B	1.88	4553B	2.40
4008B	72	4038B	99	4075B	22	4516B	76	4554B	1.20
4011B	21	4040B	72	4076B	80	4518B	76	4556B	48
4012B	21	4042B	58	4077B	22	4519B	64	4560B	1.76
4013B	30	4043B	71	4078B	22	4520B	76	4561B	74
4014B	74	4044B	71	4081B	22	4521B	1.68	4566B	1.20
4015B	76	4046B	96	4093B	43	4522B	88	4580B	3.60
4016B	31	4047B	70	4094B	1.56	4526B	88	4581B	1.84
4017B	66	4049UB	32	4099B	1.20	4527B	1.20	4582B	80
4018B	72	4050B	32	4160B	72	4528B	88	4583B	1.00
4020B	76	4051B	72	4161B	72	4529B	1.04	4584B	40
4021B	70	4052B	72	4162B	72	4530B	62	4585B	88
4022B	70	4053B	72	4163B	72	4531B	72	4597B	1.84
4023B	21	4060B	96	4502B	72	4532B	1.00	4598B	2.40
4024B	50	4066B	43	4505B	1.88	4536B	2.64	4599B	2.00
4025B	21	4068B	22	4510B	76	4538B	1.04		

I.C. SOCKETS

DIL to DIL

8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	32
24 way	34
28 way	45
40 way	84

DIL to QUIL

14 way	32
16 way	34
18 way	37

QUIL to QUIL

14 way	32
16 way	36

MAINS DROPPERS

DECCA 20	2.48
DECCA 27R/47R	1.40
DECCA 56R/6R8	1.40
R.B.M. A823 56R/68R	94
R.B.M. 161	82
GEC 2000/2018	70
GEC 27840	64
PYE 713/15 3R5/15/45R	1.80
PYE 725/31 3R0/56R/27R	1.84
PYE 725 56R/27R	1.04
PHILIPS 210/5050 30R/125R/2k85	1.75
PHILIPS 210/5051 -/118R/148R	93
PHILIPS G8/5081 47R Section	50
PHILIPS G8/5083 2R2/68R	95
THORN 1400	1.20
THORN 1500	1.38
THORN 1600	1.77
THORN 3500	94
THORN 8000	1.24
THORN 8500	1.36
THORN 9800	1.30
DECCA 3R9 Modulohm	60

NEW VALVES

30FL2	1.70	EF183	99	PCF800	1.38	PL508	2.90
DY802	98	EF184	1.09	PCF801	1.13	PL509/19	5.30
DY86/7	66	EH90	1.02	PCF802	1.12		
ECC81	1.08	EL34	3.50	PCF805	1.80	PY88	81
ECC82	98	EL84	1.05	PCF806	1.30	PY500A	2.30
ECC83	1.07	EY86/7	68	PCF808	1.63	PY800/1	69
ECC84	80	EY500A	1.50	PCH200	1.45	UCH81	2.25
ECC85	98	EZ80/1	56	PCL82	1.20	UCL83	1.82
ECC88	1.35	GY501	1.45	PCL84	1.20	UY85	1.35
ECF80	80	GZ34	3.50	PCL86	92	PL802T	4.00
ECF82	88	KT66	8.50	PCL805	1.09	40KD6	5.30
ECH81	1.60	KT88	12.00	PD500	2.93	21LU8	3.00
ECH84	1.66	PC92	3.00	PFL200	1.86	17DW4A	1.60
ECL80	84	PC97	1.65	PL36	1.87	3AT2B	5.00
ECL82	1.30	PCC85	85	PL81	94	12BY7A	3.75
ECL86	1.99	PCC805	1.40	PL83	1.43	12HG7	3.20
EF80	95	PCF80	1.00	PL84	84		
EF86	1.96	PCF200	1.35	PL504	1.65		

THERMISTORS

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

THERMAL CUT OUT

THORN 3000 2A Metal	1.60
GEC 2040 Metal	2.50
THORN 8000 Plastic	2.35

L.E.D's

5mm Red, Green, Yellow	14
T1 ¾ Amber	22
T1 3mm Red, Green, Yellow	14
Flashing Red CQX21	62
CQX22	66
3 Colour VJ18P	76
Panel Clips 3mm	4
5mm	4

CRYSTALS & FILTERS

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

MULTITURN POTS

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

SERVICE WITH A SMILE

DISC CERAMIC CAPS

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

63V/100V A range of pref. values 22pF-4700pF — 8p

POLYESTER CAPS

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

TANTALUM CAPACITORS

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

CONVERGENCE POTS

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

METRIC CONVERGENCE POTS

PHILIPS G8 5R-10R-15R-20R-50R — 60

LINE OUTPUT TRANS.

R.B.M. T20A	13.95
R.B.M. A774 Mono	11.74
R.B.M. Z179	15.00
R.B.M. Z718 22"	19.50
PHILIPS 320	8.70
PHILIPS 210/300 Mono	10.00
PHILIPS G8	8.75
PHILIPS G9	7.75
PHILIPS G11	13.50
PYE 697 (Printed)	14.50
PYE 713/731	10.00
PYE 725 90°	10.50
PYE 169	10.00
DECCA 80/100	8.58
DECCA 1700	9.00
DECCA 1730	8.58
DECCA 2230	8.58
GEC 2110	16.75
GEC 2040	9.50
ITT CVC 1-9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
THORN 3000 EHT	9.95
THORN 3000 SCAN	7.95
THORN 8000	11.33
THORN 8500	11.33
THORN 9000	10.65
THORN 3000/3500 Mains	10.00
THORN 1591	8.68
THORN 1691	9.68
THORN TX10	12.50
THORN 1615	9.75
PHILIPS KT3	9.70
RANK BUSHRANGER	£10.00
PYE 741	8.20
THORN 9800	26.50
B+O (2000, 3000)	12.70
B+O (3000 EHT)	18.90

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	5.20
THORN 1500 3 Stick	5.20
THORN 1500 5 Stick	5.29
THORN 1600	4.95
THORN 3000/3500	7.98
THORN 8000	5.28
THORN 8500/8800	7.15
THORN 9000	7.93
DECCA 1730/1830	4.48
DECCA 30	6.76
DECCA 80	6.60
DECCA 100	7.50
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	6.75
PHILIPS G8 Long Focus 550	6.75
PHILIPS G9	6.37
Pye/Philips K3 Tripler	10.65
PYE 691/3	6.58
PYE 713/4 Lead	8.79
PYE 713 Doubler 5 Lead	8.79
PYE 731/725	7.60
R.B.M. A823 (plug in) AV	7.60
KORTING (similar to Siemens TVK1)	7.32
ITT KB CVC5/9	6.90
ITT KB CVC20/25/30 (Mullard)	5.95
RRI T20	6.80

RECTIFIER STICKS

TV11	90	TV18	1.10
TV13	93	TV20	1.23

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	3.40
PHILIPS 320 (400/400/200V)	2.74
DECCA 30 (400/400/350V)	3.40
DECCA 80 (400/350V)	3.97
OECCA 100 (800/250V)	
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.30
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.70
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.66
RBM A823 (600/300V)	2.83
RBM Z146 (300/300/350V)	3.55
RR1 T20A (220/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.98
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.20
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.78
THORN 3500 (1000/63V)	86
THORN 3500 (1000/70V)	86
THORN 8000/8500 (2500/2500/63V)	3.38
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.28
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25
THORN 4700 P/C 25V	1.20
THORN 1591/1691 4700/25V	1.20

CAPACITORS AXIAL

Volts	Mfd	Price			
			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	58
	3300	53		2200	94
25V	10	11	100V	10	13
	22	13		22	15
	47	15		47	20
	100	15		100	36
	220	29		220	70
	470	30	450	1	33
	1000	55		4.7	30
	2200	51		10	30
	4700	98		22	65
40V	10	10		33	75
	22	10	500	10	32
	400	48	600	0.1	41

MIXED DIELECTRIC CAPS

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

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"	15.00
A61/120WR 110° 24"	17.50
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.

SLIDER POTENT

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

MIDGET CONTROLS

Insulated Spindle Length 44mm

Log or Lin Without Switch 5K-10K-25K-50K-100K-250K-500K-1M — 39p

With D.P.S.T. Switch

Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M — 81p

Dual gang Controls — 1.25

16mm Rotary Controls 10K, 22K, 100K, 1M, 10K — 39p

SKELETON PRE-SET POTS

Standard or miniature Horizontal or Vertical 100R-2M2 — 18p

THICK FILM RESISTOR NETWORK

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

WIREWOUND RESISTORS*

4W 1R-10K	24p
7W 1R-22K	26p
11W 1R-22K	29p
17W 1R22K	32p

(Preferred values)*

EVER READY BATTERIES

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

CARBON RESISTORS*

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

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

RECHARGEABLES

EVER READY

RX6 (HP7)	1.10
RX14 (HP11)	1.95
RX20 (HP2)	2.15
RX22 (PP3)	3.75
Universal Charger	6.00

STOP PRESS

Special Prices

5¼" Floppy Disc

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

SERVICE MANUALS (Zero VAT)

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

P. V. TUBES

PLEASE NOTE OUR NEW ADDRESS – COME AND SEE US

104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.

Tel: 0254 36521/32611 Telex: 635562 Griffin G (For P.V.)

HOW TO ORDER

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

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

SEMICONDUCTORS

AC107	35
AC126	30
AC127	32
AC128	32
AC128K	40
AC141K	39
AC142K	38
AC176	35
AC176K	35
AC186	41
AC187	38
AC187K	38
AC188	35
AC188K	39
AD143	82
AD161	54
AD162	54
AD161/62 MP	1.15
AF106	49
AF114	89
AF118	1.20
AF121	75
AF124	48
AF125	46
AF126	46
AF127	38
AF139	58
AF178	1.54
AF239	60
AL102	2.00
AU106	2.50
AU113	2.00
BC107	20
BC108	20
BC109	20
BC114	12
BC115	17
BC116A	16
BC117	30
BC118	24
BC119	36
BC139	28
BC140	32
BC141	26
BC142	30
BC143	31
BC147	13
BC148	9
BC149	12
BC157	16
BC158	16
BC159	15
BC160	25
BC161	28
BC170B	15
BC171	15
BC172	15
BC173	12
BC174	10
BC177	27
BC178	26
BC162L	9
BC183L	12
BC184L	14
BC186	18
BC187	25
BC204	10
BC208	13
BC209	10
BC212	9
BC212L	13
BC213	13
BC214	10
BC237	14
BC238	14
BC251A	18
BC252	12
BC261	18
BC262	18
BC300	50
BC301	53
BC303	33
BC307	20
BC308	25
BC323	99
BC327	18
BC328	18
BC337	18
BC338	18
BC461	30
BC547	13
BC548	13
BCX32	30
BC549	8
BC550	7
BC557	8

BC558	9
BCY72	13
BD115	45
BD116A	65
BD124P	79
BD131	50
BD132	49
BD133	60
BD135	38
BD136	38
BD137	38
BD138	35
BD139	35
BD140	44
BD144	1.70
BD150	60
BD159	65
BD166	52
BD179	70
BD182	1.20
BD183	75
BD201	85
BD202	91
BD203	80
BD204	99
BD222	46
BD223	56
BD225	47
BD232	68
BD233	60
BD234	63
BD235	60
BD236	65
BD237	57
BD238	65
BD243	85
BD244	85
BD410	79
BD434	74
BD437	86
BD438	94
BD507	52
BD508	55
BD509	56
BD510	86
BD278A	81
BD517	60
BD520	75
BD535	82
BD536	91
BD696A	1.49
BD697	1.24
BD695	1.39
BD698	1.50
BD707	95
BDX32	2.10
BF115	38
BF117	36
BF125	26
BF127	47
BF154	23
BF158	18
BF160	27
BF167	24
BF173	22
BF177	52
BF178	46
BF179	28
BF180	39
BF181	39
BF182	36
BF183	29
BF184	36
BF185	36
BF194/394	16
BF195	16
BF196	16
BF197	16
BF198	18
BF199	21
BF200	35
BF224	25
BF225	20
BF241	25
BF256	55
BF257	28
BF258	25
BF259	35
BF262	84
BF263	75
BF271	24
BF273	24
BF274	24
BF336	36
BF337	41
BF338	41

BF355	56
BF362	68
BF363	72
BF371	30
BF392	35
BF422	34
BF423	46
BF435	35
BF457	35
BF458	43
BF459	43
BF460	86
BF462	86
BF469	46
BF470	66
BF597	10
BF757	54
BF758	54
BFR39	27
BFR40	30
BFR79	85
BFR90	1.74
BFT42	39
BFT43	39
BFW10	60
BFX29	40
BFX84	42
BFX85	30
BFX86	30
BFX88	46
BFY50	30
BFY51	30
BFY52	24
BFY90	95
BR100	34
BR101	45
BR103	83
BR303	1.46
BRC4443	94
BRC4444	98
BRX46	40
BRY39	56
BRY55	45
BRY56	57
BSR59	1.80
BSV57B	89
BSW67	68
BT100	1.65
BT101	1.20
BT102/500	1.20
BT106	1.60
BT108	1.69
BT109	99
BT116	1.21
BT119	3.66
BT120	3.66
BT151/800	1.20
BU104	2.00
BU105	1.58
BU108	1.80
BU124	1.90
BU126	1.75
BU204	1.50
BU205	1.42
BU206	1.80
BU208	1.60
BU208A	1.65
BU208D	2.20
=BU800	
BU208/02	2.10
BU326A	1.75
BU407	1.70
BU426	3.07
BU500	2.30
BU526	2.46
BU508	3.20
BU806	1.40
BU807	2.94
BUW84	1.45
BUW91A	3.84
BUX84	1.50
E1222	40
MCR101	45
MCR220	1.50
ME0411	20
MJE340	68
MJE520	50
MJ3000	1.98
MPSA92	35
MR814	45
MR854	55
MR475	2.46
MR479	2.60
ON447	99
ON448	99
OT112	1.91

OT121	1.91
R2008B	1.90
R2010B	1.92
R2265	1.50
R2322	62
R2323	67
R2461	1.50
R2540	2.80
RC4558	2.20
RCA16334	90
RCA16029	99
RCA16039	99
RCA16091	2.95
RCA16092	99
RCA16040	96
RCA16041	84
RCA16334	90
RCA16335	90
RCA16799	99
RCA16957	2.88
TIC45	90
TIC46	60
TIL32	65
TIL78	48
TIP29C	43
TIP30A	47
TIP30C	43
TIP31C	55
TIP32C	42
TIP33B	75
TIP34B	1.06
TIP41C	47
TIP42C	50
TIP47	70
TIP120	65
TIP2955	90
TIP3055	63
TIS91	21
TU106/02	1.80
2N696	21
2N918	82
2N2904	51
2N2905	28
2N3054	60
2N3055	60
2N3702	11
2N3703	10
2N3705	10
2N3706	10
2N3708	17
2N5294	48
2N5296	48
2N5298	69
2SB337	1.86
2N5496	53
2N6107	75
2N6109	81
2SA715	1.98
2SC495	1.10
2SC496	1.31
2SC643A	1.50
2SC1096	1.72
2SC1172Y	2.20
2SC1173Y	1.69
2SC1306	2.73
2SC1307	3.00
2SC1449	1.67
2SC1520	68
2SC1678	2.67
2SC1909	2.90
2SC1953	1.44
2SC2028	1.82
2SC2029	2.60
2SC2078	2.90
2SC2091	1.34
2SC2166	2.73
DEC1	2.20
DEC2	2.20
THY15/80	2.20
THY15/85	2.20
BU208B	2.20
BUW81A	3.84

We will try to supply the original part when we can. Under certain circumstances we may have to supply an equivalent.

INTEGRATED CIRCUITS

AN214Q	3.91
AN240	3.84
AN318	3.98
AN262	2.45
AN301	5.15
AN715Q	3.97
AN6340	7.85
AN6341N	5.10
AN6344	7.85
BA521	2.80
BA536	3.00
CA555	46
CA556	84
CA741	25
CA748	45
CA3065	1.80
HA1151	3.89
HA1322	2.65
HA1342	2.49
HA1306N	2.60
HA1366WR	2.80
HA1392	3.95
HA11219	2.49
HA11244	1.98
LA4031P	3.21
LA4032P	2.90
LA4102	3.37
LA4250	3.57
LA4400	3.05
LA4422	3.28
LC7130	5.93
LC7120	5.87
LC7137	5.50
LM1011	3.25
LM1340T	75
LM1303N	2.63
MB3712	1.95
MC1307	1.99
MC1310P	1.60
MC1327	1.70
MC1351P	2.93
MC1330P	90
MC1349	1.99
MC1350	1.50
MC1352	1.75
MC1358P	1.50
MC1495L	3.00
MC13002	3.90
MC14011BCP	66
MC14049UB	43
MC7742	1.35
MC7812	1.35
ML231	2.20
ETTR6016	
ML232	2.20
ML236	5.35
ML237	2.50
ML238	6.00
ML239	2.50
ML920	4.12
ML922	3.29
ML926	2.85
ML928	2.18
MM5387ANN	4.15
MM5402N	6.65
MRF475	2.50
MRF477	10.00
MSN5807	7.87
MS1513L	2.80
MS1515L	3.28
SAA1025	4.40
SAA1124	2.50
SAA1250	3.94
SAA1251	4.90
SAA5000	4.39
SAA5010	6.30
SAA5012	6.50
SAA5020	5.90
SAA5030	8.25
SAA5050	8.50
SAA3210	2.93
SAS560S	1.89
SAS570S	1.89
SAS660	3.25
SAS670	3.25
SAS580	2.90
SAS590	2.90
SL901B	5.50
SL917B	6.50
SL1310	1.80
SL1327Q	1.20
SL1430	1.25
SL1432	3.36
SL76544	2.05

SN76003N	2.49
=SN76013N	
SN76023N	2.00
SN76110N	1.15
SN76115N	2.27
SN76131N	2.00
SN76226DN	2.00
SN76227N	1.18
SN76533N	1.70
SN76033N	2.49
SN76544N	2.35
SN76650N	1.05
SN76660N	80
SN76666N	80
SN76530A	1.47
STK015	6.25
STK032	13.25
STK043	11.05
STK433	5.65
STK435	9.06
STK436	5.50
STK437	7.85
STK439	6.62
STK459	8.20
STK441	8.10
STK461=465	9.60
STK463	14.30
SW153	2.74
TA7050P	95
TA7051P	95
TA7063P	2.20
TA7074P	1.00
TA7108P	3.43
TA7120P	2.43
TA7129AP	3.76
TA7130P	1.93
TA7141P	95
TA7146P	4.67
TA7193P	5.67
TA7171P	1.85
TA7172P	1.85
TA7173P	1.85
TA7176P	2.50
TA7202P	4.27
TA7204P	3.77
TA7205AP	3.72
TA7208P	3.40
TA7210P	6.60
TA7222	2.42
TA7223P	3.74
TA7227P	5.98
TA7228P	5.98
TA7310P	2.78
TA7609P	4.39
TA7611AP	2.92
TAA300	58
TAA310	2.83
TAA320	2.00
TAA550	55
TAA630	3.90
TAA8400S1	1.96
TAA661B	1.20
TBA120A	80
(A),(S),(AS),(SA).	
TBA120B	1.30
TBA120SB	1.37
TBA120T	95
TBA120U	1.10
TBA395	1.20
TBA396	80
TBA440N	2.75
(TBA1441)	
TBA440P	2.50
TBA480Q	1.50
TBA510	3.00
TBA520(Q)	1.68
TBA530(Q)	1.38
TBA540	1.68
TBA550(Q)	1.58
TBA560Q	1.59
TBA570	1.79
TBA690	1.50
TBA641BX1	3.50
TBA673	2.45
TBA700	2.12
TBA720	2.64
TBA750	2.98
TBA800	1.62
TBA810AS	1.10
TBA820	1.70
TBA820M	1.25
TBA890	3.94
TBA920(Q)	3.00
TBA950(2X)	3.05
TBA970	4.09
TBA990	1.90
TBA14406	2.44

TCA160	2.50
TCA760	2.30
TCA270SQ	2.50
TCA800	3.10
TCA830	2.44
TCA830S	1.75
TCA900	2.20
TCA910	2.20
TCA940	1.95
TDA440	2.20
TDA1002	1.95
TDA1003A	5.50
TDA1004A	3.35
TDA1006A	2.50
TDA1005	3.60
TDA1010	1.54
TDA1035	4.70
TDA1037	2.95
TDA1044	4.37
TDA1060A	4.44
TDA1062	1.56
TDA1083	1.68
TDA1170S	3.00
TDA1190	3.50
TDA1180	2.91
TDA1200	2.95
TDA1220A	2.12
TDA1270	3.95
TDA1327	1.70
TDA1352B	1.60
TDA1412	1.20
TDA1415	1.40
TDA1470	4.67
TDA1770	5.60
TDA2002	2.80
TDA2003	1.20
TDA2004	2.52
TDA2006	1.78
TDA2010	2.00
TDA2140	5.95
TDA2150	2.22
TDA2020	4.66
TDA2030	2.80
TDA2521	4.17
TDA2522	2.40
TDA2523	3.40
TDA2524	2.25
TDA2525	3.64
TDA2530	2.70
TDA2532	2.56
TDA2540	3.84
TDA2541	3.84
TDA2560	3.50
TDA2571	2.56
TDA2576	3.75
TDA2576A	3.75
TDA2577	3.25
TDA2581	3.30
TDA2582	2.60
TDA2590	3.25
TDA2591	2.95
TDA2593	2.95
TDA2600	5.30
TDA2610	3.20
TDA2611A	1.95
TDA2640	2.92
TDA2652	7.31
TDA2653	5.90
TDA2680	3.40
TDA2690	1.35
TDA3190	2.00
TDA3500	6.90
TDA3560	6.00
TDA3561	6.50
TDA3571	3.75
TDA3950	3.50
TDA4420	4.22
TDA4600	2.95
TDA9503	2.50
TEA1002	3.50
TEA1009	1.37
UPC554	1.34
UPC566H	2.95
UPC575C2	3.40
UPC576H	1.90
UPC587C2	1.60
UPC1025H	2.95
UPC1028H	2.52
UPC1032H	64
UPC1042C	1.56
UPC1156H	4.26
UPC1158H	78
UPC1163H	98
UPC1167C2	94
UPC1168C	1.28
UPC1176C	1.46
UPC1177H	1.56

UPC1178C	1.28
UPC1180C	1.84
UPC1181H	1.62
UPC1182H	2.95
UPC1183H	1.38
UPC1185H	3.66
UPC1188H	2.20
UPC1190G	1.20
UPC1197C	1.06
UPC1198C	84
UPC1200V	1.18
UPC1211V	2.70
UPC1212V	1.34
UPC1215V	1.66
UPC1216V	1.20
UPC1217G	1.13
UPC1218H	1.80
UPC1223C	2.20
UPC1225H	2.00
UPC1226C	1.50
UPC1227V	1.20
UPC1228H	54
UPC1230H	3.95
UPC1238V	1.16
UPC1245V	1.35
UPC1350C	4.15
UPC1353C	1.92
UPC1365C	6.38
UPC1356C2	2.08
UPC1367	2.08
UPC1378H	2.70
UPC1358H	1.88
UPC1360C	2.20
UPC1363C	2.16
UPC1366C	1.84
UPC1368H2	2.15
UPC1370C2	2.58
UPC1382C	1.08
UPC1384	3.78
UPC1447H	58
UPC41C	2.80
UPC5743	38
UPC577H	2.46
UPC585C	1.28
TDA 1011	4.00
11A 4112	75

IC/Transistor equivalent leaflet £2.25 for the pair

COMPUTER SPARES

PLEASE ASK FOR ITEMS WHICH ARE NOT LISTED

2764	7.50
4116-2	3.40
4532	3.00
Z80 CPU	2.43
ZTX 213	13
ZTX 313	13
LM1889	84

ALSO SEE 74LS RANGE

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA317	26
BAX13	4
BAX16	8
BB105B	30
BB105G	30
BY126	12
BY127	11
BY133	15
BY164	45
BY176	85
BY179	63
BY182	87
BY184	55
BY199	28
BY206	14
BY210/600	28
BY210/800	33
BY223	90
BY227	28
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX55/600	30
BYX71/600	90
OA47	9
OA90	10
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	5
IN4007	6
IN4148	2
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	20
ITT2002	11
Y969 – Disc. REP BZX85 30V	
BZY15-24R	1.18
BZY15-12R	1.18

SPECIAL DIODES

SKE 4F	£1.09
SKE 5F	£1.19
Y723	£1.30
Y827	£1.42

ZENER DIODES

BZX61 Range (1.3W)	20
BZX79 Range (400mV)	10
BZY88 Range (400mV)	10
BZY93, 90 (18V)	1.18

SPECIAL OFFER FROM OUR COMPUTER DEPT.

HIGH RES. GREEN SCREEN MONITORS £69.95 + CARRIAGE £5.95

TAPE RECORDER SUITABLE FOR COMPUTER USE – WITH CONVERTER ONLY £16.95 + CARRIAGE £2.50

WHILE STOCKS LAST

It's Christmas again and Sheila's misses send you all their Christmas kisses. But this last year we've had to change. We've added men to our staff range. So for Christmas sparkle in their lives, our lads send kisses to your wives!! Sheila, Brian, Christine, Susan, Margaret 1, Margaret 2, Dawn, Julie, Janet, Maureen, John, Christopher, Richard and Jack would like to wish all their friends a very happy Christmas and a prosperous new year.

P.V.

104 Abbey St., Accrington, Lancs.

TELEVISION

EDITOR
John A. Reddihough

ADVERTISEMENT MANAGER
Roy Smith
01-261 6671

CLASSIFIED ADVERTISEMENTS
Barbara Blake
01-261 5897

Cable TV – bordering on farce

The cable TV situation in the UK is becoming a greater shambles by the day. We were given to believe, by those who produced the Information Technology Advisory Panel report on cable TV back in January 1982, that by now the cable layers would be busy ripping up the roads while people would be falling over themselves in the scramble to get connected up to the new multi-channel cables. It's all turned out rather differently. So differently that many of the firms that promoted the idea of "recabling Britain" are now falling over each other in the scramble to get out and forget the whole thing as fast as possible.

As mentioned on a later page, the two largest cable operators in the UK, BET (Rediffusion) and ERG (Visionhire), are in the process of pulling out. For many years Rediffusion virtually was cable TV in the UK. The company started with audio cable distribution in 1928, adding TV to the network in 1951. Its service is available to about six per cent of households in the UK and it has 600,000 subscribers. There are 128 Rediffusion networks, 53 of which are reasonably large scale. Thirty one of the larger networks have been converted to provide a four-channel service (channels other than the broadcast ones). But Rediffusion is reputed to be losing around £3 million a year on its UK cable networks. The company operates in several overseas countries and has much technical expertise. It obtained only one of the initial batch of eleven new cable franchises awarded last year. Visionhire entered the cable field in 1978 when it bought networks with 240,000 subscribers. All but ten of the networks have been closed down in recent times and the company failed to win any of the new franchises. Both BET and ERG have decided that the economics of cable no longer make commercial sense over any acceptable time span for business investment. Rediffusion is being sold off while Visionhire is closing down and will make no applications for future franchises.

Whether BET came to its decision to sell unaided or was forced into it by others' refusal to provide financial backing is not clear. Thirty million was required to establish the Guildford network but the sum couldn't be raised. Of the eleven cable franchises awarded last year, only Thorn-EMI's Swindon network has actually started operations, though it will take some time, and an investment of £16 million or so, before all 53,000 households in the area can be offered the service. Most of the other franchise holders seem to have put their schemes into mothballs, some after failing to obtain any financial backing whatever from the city.

The government has come in for some criticism over all this – for failing to act promptly and for changing the financial conditions with the last budget. This is perhaps a little unfair. That famous ITAP report did after all place great emphasis on the fact that "recabling" the UK would require no public assistance and could be done with readily available private sector finance. In fact a lot of the blame for what's gone wrong can be attributed to that ITAP report, which put forward a number of reasons for encouraging cable operations without providing a coherent overall view of what cabling was to be about or for. Was it to be a cheap and cheerful addition to existing off-air services? Or the start of a much more sophisticated information network? Or a bit of both? No one seemed too sure, perhaps with good reason. A complex information network, computers and all, could have ended up as an expensive white elephant. One feels that the ITAP emphasised the information network aspect because it lent prestige to the idea of cable. In retrospect it would probably have been better to encourage cheap and cheerful entertainment to start with, moving on to the computer network approach at a later date when the usefulness of such a service would have been easier to assess.

The government seems to have been particularly badly advised on the subject of cable. But some criticism nevertheless seems justified. Firstly on the financial aspects. The cable companies could before the last budget take advantage of tax allowances to offset their initial investments in installing the networks. The aim of the government's change however was to encourage investment that made money sense rather than tax sense. Cable was always doubtful without tax concessions. Criticism over dilatoriness on the other hand is probably more justified. Compare the haste with which the Hunt committee was set up and ordered to report on cable in 1982 with what's happened since. The Cable and Broadcasting Act was not passed until July 1984, confirmation of the initial franchises was delayed, and the Cable Authority which is to supervise the whole thing has still be to established – at present it has a chairman but no members.

One of the strangest aspects of the whole fandango is the emergence of Robert Maxwell as almost a monopoly in cable TV. Having bought (assuming the sale is approved) Rediffusion's cable interests, which bring with them a 14 per cent interest in Ten — The Movie Channel, Robert Maxwell has been having talks with Merseyside Cablevision and Clyde Cablevision. Thorn-EMI Cable Television's managing director Peter Gosling commented "it's very encouraging to see that someone like him is prepared to invest in the future of cable". That may be so, but surely the original intention was not monopoly tendencies in the cable field. Why Robert Maxwell should be so interested in cable is hard to say. But if you were to back cable TV with powerful press support (Maxwell now owns the Mirror newspaper group) the whole thing could possibly be made worthwhile. Just think – a bingo channel maybe?

All this is surely far from what was originally intended. Whatever was envisaged at the start of the great "recabling Britain" saga – and it was always rather vague – the result so far has been a shambles bordering on farce.

QUERY SERVICE CHARGE

We regret the need to increase the charge made for replying to readers' servicing queries to £1·50 (inc. VAT) from this month. The service is a non-profit one for the benefit of readers but it's essential to cover some of the cost of running it.

READERS' PCB SERVICE

The readers' PCB service will continue in operation until further notice. For details of the boards available see page 389, May 1984. Enquiries should be sent to: Readers' PCB Services Ltd. (TV), Fleet House, Welbeck Street, Whitwell, Worksop, Notts.

ADDRESS PLEASE

Would Freddie Archer, who wrote on the Philips N1700 in the October issue, please send us his new address.

CORRECTIONS

Frowds Ltd.'s post code is PO6 3TJ, not as given on this page last month. Robert Barwick's VCR lock patent application was taken out on November 4th 1983, not 1984 (Teletopics last month).

RGB-Linear Interface Circuit

K. M. Curtis, B.Sc. (Hons)

The advent of microcomputers has brought with it a need to be able to demonstrate software to large audiences. Most microcomputers are equipped with a u.h.f. modulator so that they can be connected to a standard domestic or projection TV set. Modulating a computer's characters/graphics then demodulating them introduces distortion however. This, combined with the fact that most projection television systems have a relatively narrow frequency response, makes them unsuitable for displaying 80-column text. Some microcomputers come with a 1V peak-to-peak composite video output that can be directly plugged into many projection receivers.

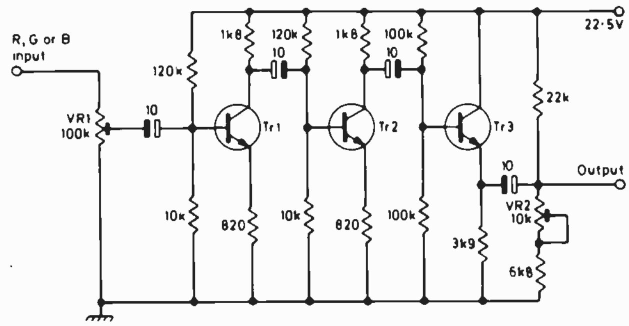
Most microcomputers provide either RGB-linear (RML 380Z etc.) or RGB-TTL (BBC etc.) outputs. With both of these there are four separate signals. In the case of RGB-linear there are three analogue R, G and B signals that vary between 0V and 1V and a composite sync signal. RGB-TTL differs in that the RGB signals are at either 0V = off or 5V = on.

Our problem at the Computing Studies Unit, University of Leicester, arose when we wanted to demonstrate software using a Panasonic TC6200G/H/A projection receiver. We decided to interface the RML 380Z microcomputer's RGB-linear outputs with the projection set's RGB output stages. The RGB-linear input signals need to be amplified 4·5 times to drive the output stages. We decided to use two common-emitter stages for the purpose, each with a gain of 2·25 (see Fig. 1). The reason for this was the good frequency response and low cost. A final emitter-follower was incorporated in each RGB amplifier to supply the current drive required. VR2 sets the bias at the output.

The RML 380Z's composite sync output is handled by a single 2N2222A transistor (see Fig. 2) which is driven into saturation by the sync pulses, providing a pulse output with sharp rising and falling edges.

The outputs from the three emitter-followers are fed to pin 4 on L(R), L(G) and L(B). The sync output is connected to pin 2 on board D2.

The system has been used successfully for over three years.



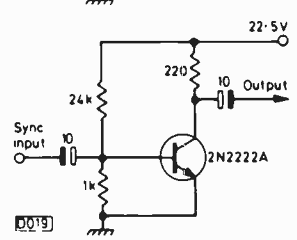


Fig. 1 (above): Single video channel. All transistors type 2N2222A.
Fig. 2 (left): Sync pulse shaper circuit.

VCR Clinic

Reports from Steve Beeching, T. Eng., Derek Snelling and John Coombes

JVC HR7350

Star date: Aug 1984. Place: Newark Video Centre ... Beam the spares down Scotty!!!

Sorry, I got carried away again. Andy reckons that I should be! After a short holiday in Chroma (sorry, Cromer) for a much needed rest I returned to find a large pile of broken VCRs.

First a JVC HR7350 with an intermittent tape transport fault. Every third blue moon the pinch roller failed to operate, sometimes. In one fleeting moment I saw the solenoid drive pulse on the scope at a time when the pinch roller didn't move. Obviously an intermittent solenoid wasn't it? No it wasn't! The trouble with a fault like this is that one doesn't know one's got it wrong until the item in question has been replaced (after a struggle), the machine's been sent back to the customer after meticulously testing it for three days, and the call then comes to say it's happened again.

It's fairly well known that the UL switch slider in these machines is liable to stick because the grease has aged and hardened, thus preventing the drum motor switching off. A similar problem was the cause of the fault under investigation. In the front right-hand corner of the chassis a sliding lever from the solenoid was found to be sticking on the grease, thus preventing solenoid operation from time to time. **S.B.**

Sharp VC381 and VC9300

For poor fast forward, rewind and visual search within the warranty period I usually replace the idler pulleys, though they sometimes respond to cleaning with emery paper. One customer had the cheek to complain that visual search was too fast after I'd replaced the pulley. Sound warble can be due to the reel motor, the capstan motor or both. **S.B.**

Sony C7

As this machine ages various common faults are appearing – there's also the well known rewind kit job. Lately I've encountered worn audio/sync heads, some audio and some sync. The capstan bearings are tending to squeak loudly: the only cure is to replace the motor, which is a bit of a bind. Failure of the power supply is now more often due to electrolytics than to semiconductor devices: I suggest that replacement of all the high-voltage electrolytics is in order if one fails. Use only Sony replacements. **S.B.**

Sharp VC7300

The tape was looping after rewind. No messing about here, I replaced the take-up turntable, the main brake and idlers. It's more economical in the long run to replace all suspect items. **S.B.**

Toshiba V9600

In a few cases we've had head failure after 15 to 20 months. We also have a lot of trouble with upper cylinder wear. As with the earlier V5470, a mechanical overhaul can be very beneficial – Toshiba machines repond well to this, giving them many more years' life. **S.B.**

Toshiba V8600

There was no colour on playback – probably none on record either. The colour a.f.c. loop was working normally – all waveforms checked out – but there was no 685kHz input to the submixer as the divide-by-eight circuit wasn't functioning. It's in IC208 (MB14300). **S.B.**

The New Machines

To my mind Sony have dropped a b . . . k with their new hi-fi machine. It has mono sound on the linear audio track, making it non-compatible with SLC9 stereo tapes if the customer wants to upgrade. The machine of the autumn is without doubt the JVC hi-fi (Ferguson will say that their's has the best sound Previn has ever heard and for once be right). I can say no more at this stage than six heads on the drum, no glass delay line in the luminance replay system, multi-speed playback and a host of other goodies that boldly go where no video has ever gone before . . . Beam me up Scotty!! It's getting too much: I have to work with this idiot. **S.B.**

Mitsubishi VCRs – Colour Trouble

Here's a fault that's becoming common on Mitsubishi VCRs. The symptom may be no colour on playback, no colour on record or both, and may be intermittent. The problem is that the various 4·43MHz oscillators need adjustment. A frequency counter is essential for this as they must be within 50Hz of the nominal figure. You'll usually find that at least one of them is over 200Hz out. The trouble seems to show up when the machines have had about eighteen months' use. **D.S.**

Sanyo VTC9300

A problem that's showing up on Sanyo VTC9300s is intermittent playback. The cause is dry-joints in the can that houses the head preamplifiers. It's on board W1 – the one on the left. **D.S.**

Toshiba V8600

A grainy picture/no test signal can be due to low supply to the r.f. converter as a result of the switching transistor Q661 (2SC2236Y) on the servo/logic panel being high-resistance. **J.C.**

TV Fault Notes

Michael Pitt

Philips K30 Chassis

One of the main chassis we deal with is the Philips K30. The arrival of the 30AX tube caused a lot of unnecessary worry, with lots of complaints about "coloured patches" around the edges – remember? I wonder how many engineers had to go out just to push the scan coil assembly back into its correct position? Things like that become routine after a while, and worth checking anyway.

An interesting fault we had recently with one of these sets was red static convergence errors. This caused havoc for a while as the merits of adjustmentless tubes were discussed. Then we noticed that one of the small metal shields just in front of the screw collar which locks the position of the scan coils had disappeared – though the locking substance used by Philips was in full view. The missing shield was retrieved from right inside the yoke and realigned back to the existing marks: hey, presto – instant convergence!

An old favourite that crops up occasionally to keep you awake is partial field collapse, generally the lower half: the usual cause is the field scan coupling capacitor C1521 (1,500μF).

Always check that the chopper's h.t. output (HT2) is 139V on this chassis. I've found it set anywhere between 125V and 146V, which can give you some pretty awkward moments.

The sync ran wild on another of these sets about ten seconds after switching on. A replacement TDA2571AQ sync/line generator chip produced only a slight improvement and it was necessary to replace the four transistors on this panel (line/field generator module) to get a complete cure.

Philips KT3 Chassis

A loud "clack" woke up the department when a KT3 was switched on. On inspection we found that C1581 (0·033μF, 600V) which decouples the first anode supply was flashing across to the focus preset.

Decca 80 Chassis

The problem with a Decca set fitted with the 80 chassis and touch-button tuning was no channel change. We found that Tr713 on the little panel behind the buttons, associated with the AV button, was at fault. D300 on the timebase panel was also defective – replace it with a 1N4003 as in later production (not 1N4148).

Hitachi NP8CQ Chassis

Hitachi sets are another of our lines. A dead CBP222 (NP8CQ chassis) came along recently – not really dead, the tube heaters were very intermittent. The cause was a dry-joint on pin 11 of the line output transformer. Another set fitted with this chassis produced an audible whine from the power supply and once again the heaters were out. Hitachi have a fault-finding guide to help with this problem: it points to a number of possible candidates. All too frequently however, as on this occasion, it's simply R717 (1Ω) open-circuit. As a result there's no 12V rail. A fairly common fault with the remote control version of this chassis is that the set comes on in standby only. In this event investigate stand-by panel PC036, paying particular attention to the two 10V zener diodes, the two BC548 transistors and the 4·7μF and 22μF electrolytics. The 1000μF electrolytic may also need to be replaced.

Sanyo CT7118

It's not often that a Sanyo CTV comes my way nowadays. A CT7118 however had the EW fault that was so common with this model initially. D601/2 and R626 in the diode modulator circuit required replacement, also the driver transistor's (Q752) emitter resistor R764. At switch on the collector of Q752 was at 48V, as a result of which R626 again died. A new Q752 (BD537) and R626 restored normal operation.

Mitsubishi on/off switches

Finally a moan. If you get called to a Mitsubishi set with an intermittent on/off button, be prepared to stay there a while. Not one of the easiest components to change, as it's right down in the bottom left-hand side. On Model CT2027TX you have to remove the remote control receiver panel then the huge mains transformer just to reach the required position to undo the screws holding the mains switch assembly in place. If you don't secure the mains transformer out of your way its sheer weight will encourage it to flip over and crash down on the main panel – the effect can be compared to hitting the board with an 11lb hammer. Care is essential here, which is o.k. in the workshop but not with the customer watching your every move.

N1700 Timer Modification

A. Bouskill

A major drawback remains after modifying the Philips N1700 for half-speed operation as described in the April 1983 issue of *Television*. This is the inability to make an unattended recording of more than two hours due to the timer i.c.'s limitations. A two-hour timer limit is inconvenient at normal speed: on long-play, with up to six hours' recording time available, it's restrictive to say the least.

Users of the N1700 will know that if the VCR is set to make an unattended recording and starts at the preset time, pressing the on/off button for a few seconds will return the machine to the untimed mode so that it will record to the end of the tape. This feature of the design is the basis of the modification to be described.

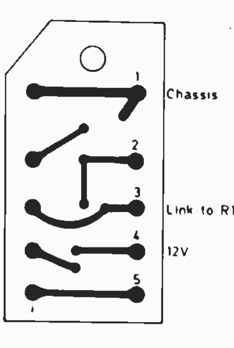
An examination of the timer board and a few measurements showed that to modify the timer itself would be complicated and, if the timer i.c. was damaged, probably expensive as well. Five colour-coded leads emerge from the timer board and go via a plug and socket to the timer connection subpanel (see Fig. 1). They are then linked via another plug and socket to the rest of the machine. Pin 3 of the timer plug goes high during a timed recording and this aspect of the design can be used to operate a relay.

The circuit adopted is shown in Fig. 2. When pin 3 of the timer plug goes high transistors Tr1 and Tr2 switch on. They form a Darlington pair that energises relay RL1. With RL1 energised, the normally-open contacts 1 and 2 close, short-circuiting the normally-open contacts of the N1700's on switch. Contacts 3 and 4 also close, connecting R2 across C1. The capacitor discharges slowly, and after a few seconds Tr1 and Tr2 switch off, releasing the relay. D1 protects the transistors against the relay coil's back e.m.f.

To install the modification, remove the cassette lift then the top cover (bearing in mind that it's a tight fit). Take off the top half of the cabinet by removing the four cross-headed screws in the corners and then a fifth screw, visible when the record key is depressed, in the front centre of the cabinet. When the right-hand side panel is hinged vertically the timer connection subpanel can be seen, held by a single screw.

Build the modification circuit on a piece of Veroboard approximately 50 × 25mm, with two 75mm long wires to connect to pins 1 and 3 on the subpanel. Use two longer wires (approximately 500mm) to connect contacts 1 and 2 of RL1 to the N1700's on switch, in parallel with the existing wires which in the modified machines are white and blue/white tracer. Use two wires about 150mm long to connect the 12V supply at pin 4 of the timer connection subpanel via a single-pole switch to the modification panel. Label this switch "timer override" and mount it on the front panel between the tuner buttons and the timer control panel, where the plastic is thin and accessible to the rear. The modification panel can be fitted to the base of the VCR, close to the fixing screw for the timer connection subpanel, by means of a stiff wire soldered to the Veroboard copper and trapped under a convenient screw.

The cost of this modification shouldn't exceed £2·00. It will greatly extend the machine's flexibility – this is worth doing since these VCRs are basically very reliable. The prototype has worked well for some months now. Use a small double-pole relay with two sets of normally-open contacts and a coil with a resistance of more than 180Ω.



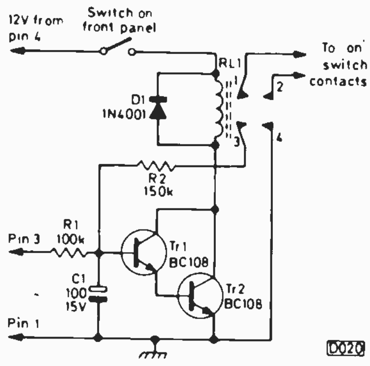


Fig. 1 (left): Timer connection subpanel.
Fig. 2 (right): Relay circuit adopted.

Don't Panic

Les Lawry-Johns

If there's one thing you can't get in this job it's a big head. As soon as you've cleared up one impossible problem and are congratulating yourself (no one else will) on being a clever boy, along comes another swine that completely deflates you, leaving you lonely, frightened, deflated (always that) and dreading the next customer with a set that's "an easy job – won't take you more than five minutes".

It's all right for ET down there on the south coast, surrounded by his comrades, senior, medium and junior technical advisers plus a caravan full of thin wire specialists, but when you're on your own and there's no one to turn to except Honey Bunch who always diagnoses a dry-joint (very helpful except in the case of G11s where even I can often find the right one) it's more awesome. I can phone Geoff but he tends to laugh and say "you've a weirdie there old boy, let us know what it turned out to be – cheers". It's nice to have friends, real friends who send you funny cards when you're in hospital, wishing you the best of bad luck. Thank you Jan, Geoff, Eddie – I know you didn't mean it, er . . .

The T20

Listen to this and wonder. A friend from the Medway towns sent the set along but I won't mention his name because he's a reader. I confidently approached it with my one ohm resistor, my BU208A, my 910Ω resistor and my BYX71s at the ready. But the problem turned out to be that the remote control receiver showed only a 0, which couldn't be moved, in the window. Despite my inclination to rush at the chips (SAS580/590) on the touch-tune panel I employed the slowly, slowly catchee monkey approach, which is to check the voltages carefully throughout to see where they vary from normal. I had the correct 200V h.t. supply on the line output stage panel so I checked at the EW modulator diodes – and was surprised to find negative voltages here. I looked at the meter and checked the 200V again. Yes, the leads were right. Move over and check the 12V regulator. Negative.

Feeling a bit shaken I made sure the diodes were the right way round and then checked the earth pin 4Z2-2 – second one up on the swing-down timebase panel. It was heavily negative, as was the earth on the line output stage panel. I could have kicked myself. The panel screws were loose and tightening them restored normal voltages and my sanity. The window still said 0 however and wouldn't

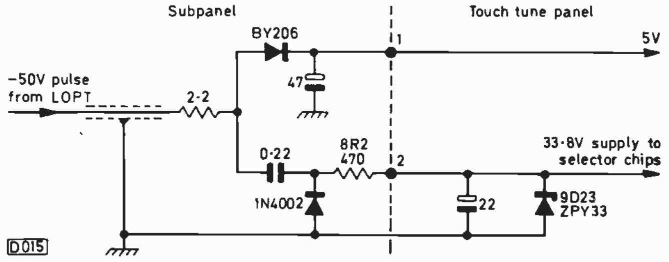


Fig. 1: Rank T20 chassis, touch tune power supply circuit. The tuning voltage is separately derived.

shift. So out came the panels involved with tuning and I soon found that 8R2 (470Ω) on the supply subpanel (see Fig. 1) had burnt out. I replaced it and the new resistor got hot with the voltage low at the pin 2 end. I accused zener diode 9D23 of being leaky but it wasn't. I replaced the SAS580 and the voltage remained low so I refitted it. Remove the SAS590 and the voltage goes up to normal. Ah ha! In went a replacement and we could now select half the numbers. A new SAS580 also had to be fitted before we had full selection. The set now worked well and we were left wondering whether the poor earthing on the line output panel had had anything to do with the demise of the SAS chips.

Later that day

A chappie in the trade popped in. "Hallo Les, you don't happen to have a line output transformer for the ITT CVC32 chassis do you? I'll pay you for it."

I looked on the shelf. Only one left. So I let him have it. After all I wasn't likely to need another right away, was I? Not right away, no. Just next morning. I told the customer I'd phone him as soon as I'd got one and fitted it. Right away I phoned those nice people at SEME and, bless them, the parcel was in my hands within 24 hours. What a contrast to . . . well, never mind, you probably know who I mean.

When Stan Westover came in for his order later in the week I told him how pleased I was with this speedy service. "Think nothing of it" he smugly replied. "Yes Stan, but when I give the order to you it takes four days to come through."

"Well it has to be processed you see Les."

"Oh I see. Thanks for explaining it Stan."

Stan wasn't happy. The true explanation dawned on him.

"And in addition to that Les, I do take your order on Friday, so taking the fourth day as Monday it's still speedy service."

"Er, yes, of course" I mumbled. "Should have thought of that."

Why is it that whenever I try to shoot someone down in flames I always seem to get fried myself? Still he's not a bad bloke, really, and I don't mind HB making him a cup of coffee when he calls, not really. It would be different if he took milk and sugar in it. No wonder his humour has a bitter edge.

More Panic

This chap came struggling in with a white Philips G11. I smiled and suggested that he waited a minute or two for my immediate diagnosis. He said it had given a couple of short cracks, then the picture had severely decreased in size and finally gone, leaving the sound and a small blank raster.

Two possibilities raced through my muddled head. The line output stage tuning capacitor could have gone open-circuit, resulting in a large increase in e.h.t. (hence the arcing). In doing so the beam limiter might have suffered, hence the partial shut down and loss of signals.

With these things mulling around in my mind I whipped out the power supply panel and attacked the beam limiter. The transistors read all right but I've been fooled by this before – they're interconnected. I unsoldered the npn one (BC148) and it read faulty. "What about that!" I thought as I fitted another BC148 and refitted the panel.

Switch on and check the voltage at the h.t fuse. 100V instead of 150V. I pulled out the BU208A's plug to disconnect it, at the same time wondering why the fuse hadn't failed if the load was excessive. The voltage remained low. Out with the panel and in with my spare one. Still 100V – and the line output stage was still inoperative. Either the fault was still there or my panel was faulty in exactly the same way. I didn't believe that. Check beam limiter voltages which were again wrong. There was a line coming off marked "only on some chassis" – remote control ones. This was such a set. So I pulled out the lower plug and the voltage immediately rose above 150V. I replaced the line output transistor plug and the set burst into life.

"It's on the remote control panel" I explained.

"Never use it" he said. Coward to the last I let him take the set away without investigating further – having cleaned off the e.h.t. cap etc.

The Final Drama

We'd sold this Fidelity CTV14S some months ago to a couple we knew. We'd sung its praises and here it was tripping like mad. "Put it right in no time" I assured them.

I checked the usual things (the TDA2581 chip and dry-joints in the power supply) but they were without fault. When the line output transistor was disconnected the tripping stopped, but the transistor itself was all right. The services provided by the line output transformer all declared their innocence, so we were left with the line output transformer itself. This was of the original type, round and black. I whipped a stock set out of its box. The LOPT was smaller and white with the focus and first anode presets on it (these were on the tube base board on the set we'd sold).

"I'll have to phone for one. Won't keep you long. I'll give you a ring."

The husband was back a couple of days later, looking a bit peeved. "It's not come in yet" I explained. Just at that moment it arrived. "Oh good" he said. "I can wait for it then."

"Well, er, if you wish" I said dubiously. How right I was. The replacement transformer was of the same type as the one in the stock set, white with knobs on. It came with a small subpanel and a note giving instructions on the modifications required. So I suggested he popped off for an hour or so unless he wanted to stay and see me suffer. He said he didn't mind and elected to watch.

It's no easy job to remove the original type and I could hear him sighing as I struggled. Eventually it was out and the new one went in – much better. The original focus and first anode controls had to be removed from the tube panel and the leads from the new transformer fitted directly, but it was done at last.

Now was the time to test it. What if I'd been wrong? What if the set still tripped? Not giving a sign of my inner turmoil, I smiled and switched on. There was the usual grrump and on it came. A pig looked at me from the screen and winked. I winked back.

"Well done" said Mr. Savage. "How much do they pay you for doing that?"

"They don't. They only supply the parts. The labour is one of love."

"Oh well. I suppose it comes out of the profit you make when you sell the set."

"Yes sir, all seven pounds fifty of it."

I could see that he didn't believe me but it's true, give or take a penny or two. I suppose I should buy in larger quantities to get larger discounts. Never mind, I was never cut out for business.

Vintage TV: The View Master

Chas E. Miller

For several years after World War 2 home constructors of TV sets relied extensively on ex-services equipment – in particular the Pye radar i.f. strip, which operated at a frequency close to that of the Alexandra Palace transmitter, and the VCR97 electrostatic c.r.t. The latter had a screen diameter of about 6in., a length of just over 16½in., and a green fluorescent screen, so it could hardly be called ideal for domestic viewing! Nevertheless it found its way into innumerable amateur sets of the late 40s. As a matter of fact I've one on the desk as I write this, complete with its Mumetal shield!

It was obvious that something better was needed, and in 1949 a group of component manufacturers sponsored the design of a set that was to be made available in kit form and would be up to the standards of contemporary commercial models – in fact it excelled them in some respects. The result was the View Master, designed by W.I. Flack. Constructional details were sold in a packet for 5/- and the various parts were available from the sponsoring firms. Considering the general complexity of most commercial receivers at that time, W.I. Flack's design was little less than inspired and fully realised his hope that it would result in "a television set that embodies all the latest technical developments and when finished will be a credit to the constructor's workmanship and skill, one he'll be proud to own".

So that the set's receiver section could be aligned by an amateur enthusiast without the aid of a signal generator, a t.r.f. design was chosen. The valves used were the well known (one might almost say notorious) EF50s. For the benefit of younger readers, these were among the first all-glass valves designed for h.f. amplification and were widely used in wartime radar equipment. They were not particularly small – somewhat larger than the latter-day PL508 – and were permanently fitted with a metal screening can that extended right round the base pins as well. The pins were a little too short for comfort, and much of the criticism levelled at the EF50 was due to poor base connections. For applications where expense was unimportant the valves were supplied with gold-plated pins to help alleviate the problem. On the good side the valve's mutual conductance was high for the period, at 6·5mA/V. Depending on circuit application, it could be controlled by applying between 0V and —6V to the control grid or 0V to —55V to the suppressor grid. Another advantage so far as the home constructor was concerned was the fact that services equivalents (ARP35, VR91) could be obtained from surplus stores at a fraction of the price.

Three EF50s were used to amplify the vision signal prior to detection, the first being common to the sound signal as well. The detector was one half of an EB91 double diode whose second half acted as the sync separator. Another EF50 was used as the video amplifier (see Fig. 1). As an example of Mr. Flack's attention to detail, a negative bias supply was provided for the valve's control grid to avoid the loss of gain that would have occurred with a cathode bias resistor. As a result, the stage gain was just over 30, only slightly below the theoretical maximum. The shunt peaking coil L10 was adjustable to increase the response at 2·7MHz by some 6dB. Interference suppression was provided by a Westinghouse miniature metal rectifier (MR5) and capacitor connected across the video amplifier's anode load. This clipped signals above peak white. Since there was inevitably some peak white clipping and the rectifier's capacitance degraded the video response, the recommendation was to omit the interference suppression network where there was little interference or the signal strength was high.

The simple diode sync separator V4b was driven into conduction by the positive-going sync pulses at its anode, developing the sync pulse output across its load resistor R20. The diode's heavy conduction charged C18 whose time-constant with R21 resulted in the diode remaining cut off until the arrival of the next sync pulse.

The sound receiver was a simple three-valve affair – EF50 r.f. amplifier, EBC33 detector/amplifier and EL33 output. Sound interference was again undertaken by a Westector metal rectifier – hardly surprising as Westinghouse was one of the firms involved!

Timebases

Both timebases used thyratron generators driving pentode output valves but, wonder of wonders, the line output stage was right up to the moment with flyback e.h.t. and a boost diode (the boost voltage was 320V). As Mr. Flack pointed out, this reduced the line output stage consumption to 20W as opposed to the 32W a straight class A amplifier output stage would have consumed. The boost and e.h.t. diodes were both Westinghouse metal rectifiers, though provision was made for using an EY51 e.h.t. rectifier instead if wished.

Power Supply

The power supply was very simple, with a transformer to supply the heaters and a Westinghouse 14A86 metal rectifier plus choke-capacitor filter to provide the 285V h.t. line. The only complications were a network to provide the negative bias for the video output stage and a neon tell-tale to guard against live-chassis operation – it gave instant indication that the mains plug should be reversed.

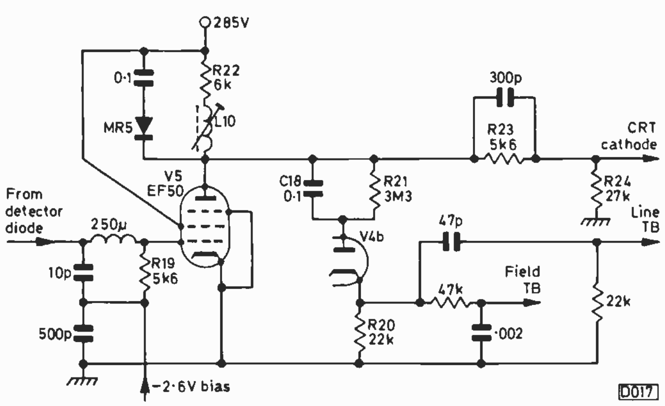


Fig. 1: The View Master's video output stage and the diode sync separator circuit.

Getting it Together

Several alternative c.r.t.s were available for use with the set: 9 or 12in. tubes could be used, from the Ferranti, GEC, Mazda or Mullard ranges. Focusing was by means of a permanent magnet, a much better idea than the electromagnetic system then prevalent (this usually required frequent adjustment during the course of an evening's viewing). Cabinets of either the table or console type could be bought in flat kit form for home assembly.

When correctly assembled and aligned the View Master's performance was first rate. This was as well, since it was in no way a cheap proposition for the constructor, even though the individual items sound remarkably cheap at a first glance at the price list. The receiver chassis for example, of 24 s.w.g. tin plate, was supplied by the Whiteley Electrical Radio Co. Ltd. with eight valveholders, insulating bushes, screens and all screws at an inclusive price of £1 2s 6d. The larger timebase chassis with its four valveholders cost the same – but I could just have afforded both for one week's wages at the time! A complete set of 59 capacitors, made by the Telegraph Condenser Co. (for whom Mr. Flack was a senior engineer) cost £7 complete with fixing clips. The Morganite resistor kit retailed at £1 15s 11d while the Plessey line output transformer was priced at £1 1s 3d. My copy of the original construction manual has an annotated shopping list by an unknown hand totalling £55 7s 11½d, of which the major items were the tube (£11 6s 5d), the valves (£10 10s 0d) and the cabinet (£6 17s 6d).

Despite omission of the cost of the constructor's time, this total was a lot more than the price of some contemporary commercial sets. The 9in. GEC model BT2147 and 12in. Model BT5144 cost £36 17s 5d and £48 0s 4d respectively for example. But then, as the instruction manual said, "the satisfaction and thrill of being able to say 'I built it and it works' is the great incentive."

Firms Involved

The firms associated with the View Master project were Belling and Lee, Bulgin, Colvern, Ediswan, Morganite Resistors, T.C.C., Wearite, Westinghouse and Whiteley Electrical. Assistance was provided by Cossor, Ferranti, GEC, Mazda and Mullard.

Taming the Sony KV1810UB

Bernard Pruden, B.Sc., A.M.I.E.E.

There can be few service engineers who don't greet the request to repair a Sony KV1810UB with some trepidation. The cause of this is the tendency of the expensive gate-controlled switch devices (GCSs) used in the chopper circuit and line output stage to commit hara-kiri for no obvious reason. The main cause of the problem relates to GCS characteristics. The GCS is basically a thyristor that can be turned on and off by applying positive and negative pulses respectively to its gate. Troubles usually begin when there is a momentary interruption of gate drive to either or both of these two GCSs. Such a seemingly trivial fault may leave either or both GCSs on for a long enough time to destroy the two devices well before mains fuse F601 blows. Repair by GCS replacement is likely to lead to further expensive failures at switch on or perhaps hours or days later unless the underlying cause is found. If the fault is intermittent this can be a difficult and frustrating task, with large numbers of components being replaced in an attempt to eliminate the fault.

When my own KV1810UB (Mk.I) ate its third pair of GCSs I set about designing a modification to eliminate these troublesome devices. The modification replaces the two main GCSs used in the chassis (Q603 chopper, Q510 line output) with modern high-voltage silicon transistors. Use of transistors in these positions ensures that any drive interruption will leave them in the off condition. This will stop the set working, but won't result in destruction of the transistors.

The modification involves some minor mechanical changes to mount the different case styles of the transistors. In addition, as the transistors require a greater current drive than the GCSs, modifications to the drive circuits are necessary. These include replacement of the chopper and line drive transformers (T603 and T502 respectively). The cost of the components for the modification is less than the cost of two GCSs. This assumes the use of new components: if driver transformers from scrapped chassis are used, which is quite feasible, the cost is significantly reduced. The suggested modifications could save many a KV1810UB from being declared beyond economic repair.

Modified Chopper Circuit

Fig. 1 shows the modified chopper circuit. The changes are confined to board PR, its heatsink and surrounding metalwork. Note that new or modified items are asterisked and have reference numbers starting "16". The transistor selected for the chopper position is the BU426A, which is in a plastic TO218 package. It lends itself to being conveniently mounted in approximately the same position as Q603 which it replaces. The increased drive current is provided by a BFX85 transistor (Q1601) plus heatsink in the driver position and a driver transformer (T1600) of the type used in the Thorn 3500 chassis. It's also preferable to use a crowbar over-voltage protection circuit if the set hasn't already been modified in this way.

To carry out the modification, proceed as follows. Remove Q603 (SG6533 or equivalent), D607 (HF-1Z) and R619 (15Ω) from board PR. Make a small bracket to mount the replacement driver transformer T1600 on the PR board's metal frame (see Fig. 2). The replacement transformer's spring clip has to be dismantled to accept the bracket, then reassembled. Mount the bracket and transformer as shown, using two suitable self-tapping screws. Fig. 2 also shows how to mount the BU426A (Q1600), using one of the bush clearance holes vacated by Q603. Take care to use heatsink compound on the mica washer and the high-voltage type of insulating bush, which requires a 6mm clearance hole. Incorporate a solder tag on the transistor mounting screw, on the copper side of the board. Connect the BU426A to the pads vacated by Q603 – emitter to cathode, base to gate and collector to anode. Connect Q1601 (BFX85) directly in place of Q604 and fit it with a short corrugated heatsink. Connect R1602 (3·9Ω, 4W) in place of D607 on the copper side of the board. This completes the chopper circuit modifications.

Crowbar Circuit

The suggested over-voltage protection circuit shown in Fig. 1 can be built on a piece of Veroboard approximately 60mm x 40mm and mounted, using two suitable self-tapping screws, on the PR board's surrounding metalwork, alongside the ETC board. The layout is not critical. On the PR board itself, cut the track joining R607 and R610. Remove R607, replacing it with R1600 (10Ω, 17W). Connect R1601 (2·2Ω, 4W) between R1600 and R610, effectively bridging the track cut just mentioned. All these components should be mounted on the copper side of the board. This change ensures reliable operation of the crowbar thyristor THY1. Disconnect the supply end of R608 and reconnect it to the junction of R1600 and R1601. As Fig. 1 shows, this point should also be connected to the crowbar thyristor. This ensures that in the event of R1600 going open-circuit the start-up circuit is disabled, thus protecting R608 and Q602 on the PR board.

The voltage sensing input connection is made to pin 19 on the PR board. Don't make the connection at this stage however.

Modified Line Output Stage

The modified line output circuit is shown in Fig. 3 and is confined to the VH board and associated heatsink. The type of line output transistor chosen is the BU208A. Base drive for the transistor is obtained from the modified driver stage, which uses a BD131 transistor (Q1500) and the driver transformer from the Rank A823 chassis (use one secondary winding only).

Since the BU208A has a different outline from the GCS it replaces, it's mounted in a different position on the VH board heatsink – see Fig. 4. This diagram also shows the mounting positions for the BD131 (Q1500) and the new driver transformer.

Carry out the modification as follows. First remove the following components from the VH board: driver transis-

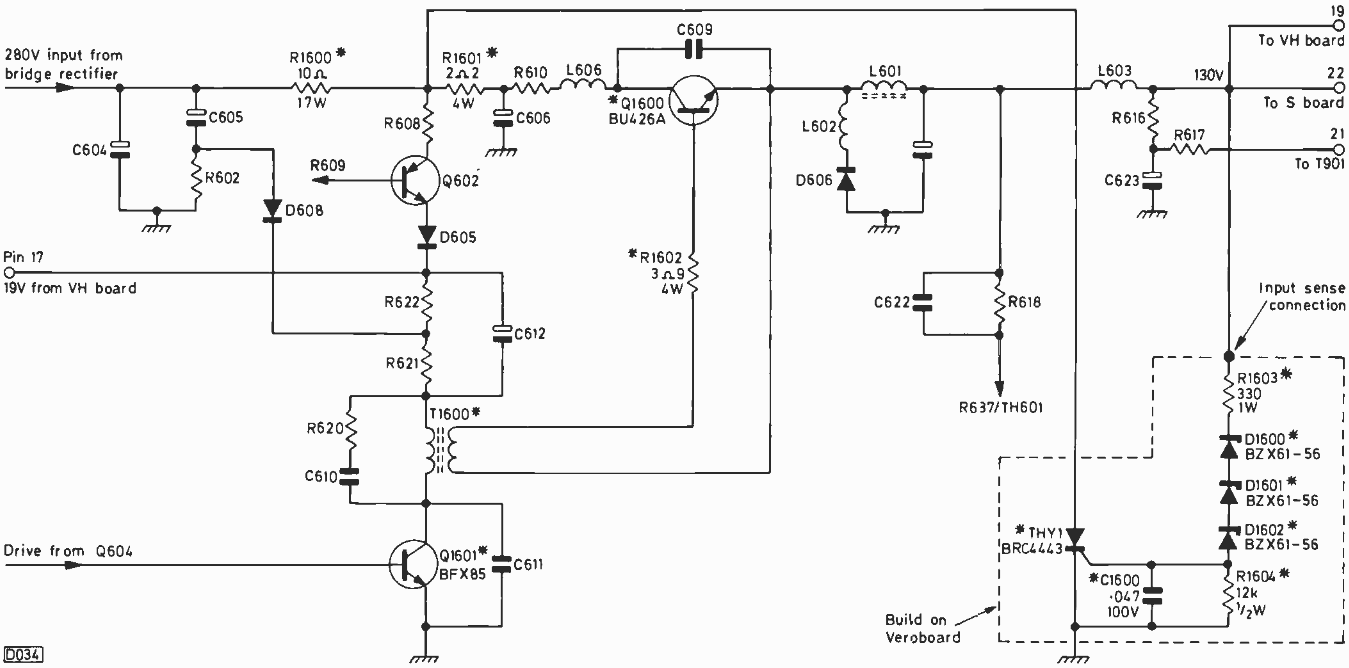


Fig. 1: Modified chopper circuit. Asterisks indicate new or modified items.

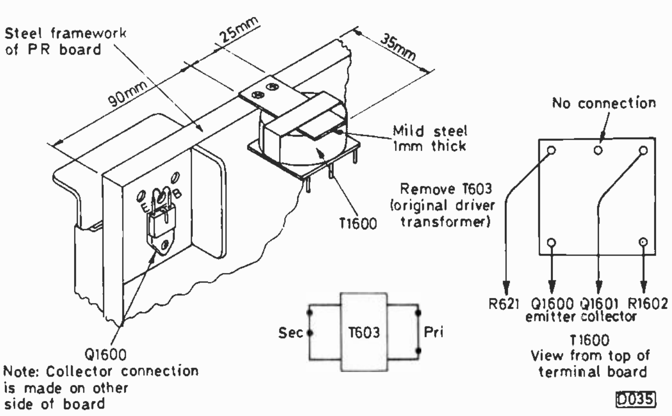


Fig. 2: PR board – physical details.

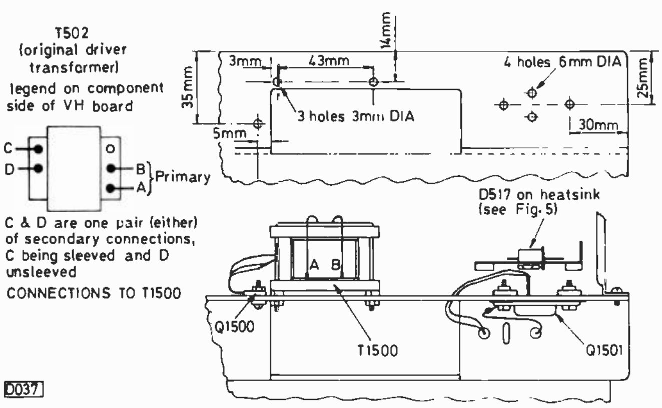


Fig. 4: VH board – physical details.

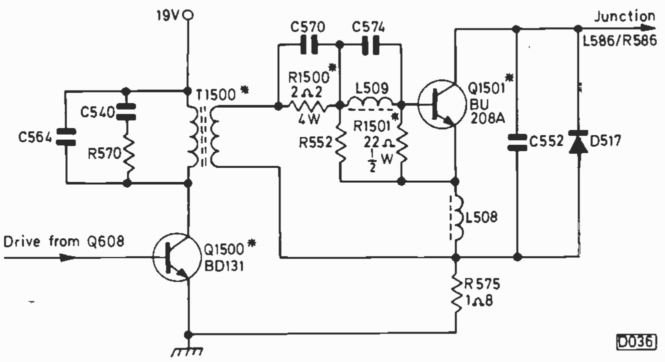


Fig. 3: Modified line output circuit.

tor Q509 (2SC1475); driver transformer T502; D585 (SIB01-02); R597 (56Ω, 2W); GCS Q510 (SG6533 or equivalent). Note that D585 may be marked as D582 on the copper side of the board. Also remove the field output transistors Q503 and Q504 (2SC867) and the efficiency diode D517 (TD15) with its heatsink – do this carefully as these items have to be replaced later.

The VH board heatsink can now be removed. Make holes to mount the BU208A as shown in Fig. 4: using a TO3 mica washer as a marking template, drill the transistor fixing holes for the high-voltage type of insulating bush, as used for the BU426A. Then drill the mounting

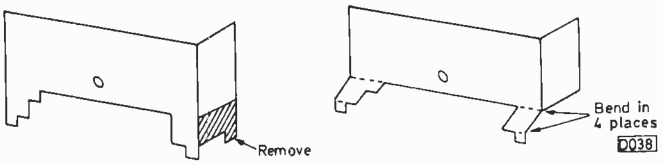


Fig. 5: D517 heatsink modification.

holes for the BD131 and the new line driver transformer in the approximate positions shown. Mount the BD131, BU208A and the transformer on the heatsink – remember to use heatsink compound with the transistors, and make sure that the heatsink surfaces in the area beneath the mica washer are free from burrs. Incorporate a solder tag for the collector connection to the BD131 – on the top face of the transistor.

Mount the following components on the VH board itself: R1500 (2·2Ω, 4W) in place of D585 and R1501 (22Ω, 0·5W) across the gate-cathode junction of Q510 (now the base-emitter junction of Q1501). These two items should be mounted on the copper side of the VH board.

Modify D517's heatsink as shown in Fig. 5 and replace this assembly on the board. This modification ensures adequate clearance between Q1501's base-emitter pins and D517.

Reassemble the heatsink on the VH board, taking care

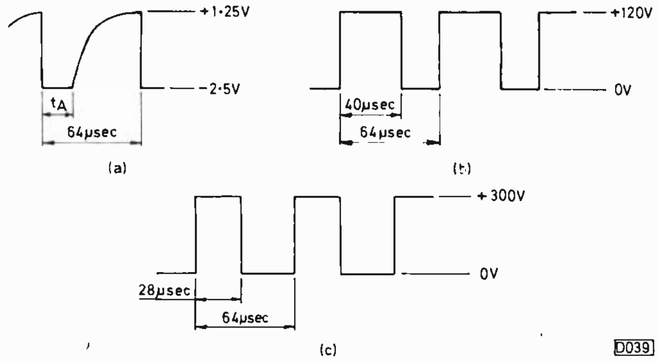


Fig. 6: (a) Chopper drive waveform – at secondary of the driver transformer. (b) Waveform at the emitter of Q1600 with 100V r.m.s. input. (c) Waveform at the emitter of Q1600 with 240 r.m.s. input.

to ensure that Q503 and Q504 are properly mounted and that the mica washers are in good order. Connect Q1500 directly in place of Q509, using sufficiently thin wire to pass through the holes in the board (1/0·4mm is suitable). Connect the replacement transformer directly to the connection pads vacated by the previous one (see Fig. 4). Connect Q1501 to the pads vacated by Q510, using 1/0·4mm wire as follows: emitter to the cathode connection, base to the gate connection, collector to the anode connection. Use additional sleeving over the wire from Q1501 where it passes through the heatsink to avoid any possibility of insulation breakdown.

The VH board can now be replaced in the chassis. Check for broken wires at pins 1 to 15 on the board – these single-strand wires are particularly prone to breakage during the above modification.

Setting up

Now to get the modified set working. The following procedure assumes that a variac and an oscilloscope with 10:1, 10MΩ probe are available.

Start with the chopper circuit.

(1) Disconnect the wires from pins 19, 21 and 22 of board PR. This prevents the h.t. from the chopper circuit reaching the rest of the receiver. Do not connect the set to the mains supply.

(2) Connect a 19V supply between chassis and pin 17 on the PR board (positive to pin 17), using a stabilised supply or two PP9 batteries (the former is preferable since the current drain is a substantial 280mA or so).

(3) Connect the oscilloscope to monitor the chopper drive – earth probe to the emitter of Q1600, probe tip to the transformer side of R1602. The waveform should be as shown in Fig. 6(a). Adjust VR504 (line frequency) until the period of the displayed waveform is 64μsec. Time tA should then be approximately 18μsec.

(4) Turn the h.t. control VR601 fully clockwise (as viewed from the copper side of the board) and temporarily connect pin 17 to the junction of R618/R637. This should have no effect on the waveform.

(5) Turn VR601 slowly anticlockwise whilst monitoring the waveform. Ensure that at some point during the travel of VR601 time tA increases to approximately 40μsec with some increase in amplitude. This test provides a manual check on the ability of the control circuit to vary the mark-space ratio of the chopper drive.

Remove the temporary connection and set VR601 to mid-position.

(6) Disconnect one end of D605. This will keep Q602 turned off during subsequent testing and prevent R608 overheating. Connect the set's mains input to a variac, set initially to zero volts. Connect a 240V, 150W lamp between pin 19 on board PR and chassis. Connect a multimeter between pin 19 and chassis, and the scope between the emitter of Q1600 and chassis.

Increase the input from the variac to approximately 100V r.m.s. The d.c. output should be about 70V and the waveform should be roughly as shown in Fig. 6(b). If all is well, continue to increase the input from the variac whilst monitoring the chopper output voltage. At about 200V r.m.s. from the variac the output should settle at around 130V and remain at this value after increasing the input to 240V r.m.s. The waveform displayed by the scope should approximate to Fig. 6(c). Check that adjusting VR601 from end to end varies the multimeter's reading by about 30-40V. Reset VR601 for 130V output at 240V r.m.s. input. Then set the variac to zero output and disconnect the scope.

(7) With the lamp load still connected to pin 19, connect the overvoltage circuit's sense input to pin 19. Set the variac for 240V r.m.s. input and check that the voltage at pin 19 is 130V as before.

(8) Momentarily short-circuit zener diode D1602. This should result in F601 blowing in spectacular fashion and the 130V rail dropping to zero. Disconnect the mains input, replace F601 and remove the short from D1602. Reconnect the mains input and check that the h.t. supply at pin 19 returns to 130V with 240V r.m.s. input.

Disconnect the lamp load and the multimeter. This completes the chopper circuit checks. Now to the line output stage.

(9) Leave the 19V supply connected as during the chopper tests (no mains input). Connect the oscilloscope to check the waveform between the transformer side of R1500 and chassis. The waveform should be as shown in Fig. 7(a). If it's not correct, find out why not and take whatever action is necessary before proceeding further.

(10) Connect an 82Ω, 1W resistor between the positive side of the 19V supply and pin 7 on board VH. Measure the voltage between pin 7 and chassis with the multimeter. The reading should be approximately 14V. This test checks the impedance of the 130V input to board VH.

(11) Connect the scope between the collector of Q1501 and chassis. The waveform should be as shown in Fig. 7(b).

If all's well it's time to connect the chopper and line output stages together.

(12) Disconnect the scope and multimeter and remove the 82Ω resistor. Reconnect the wires disconnected from pins 19, 21 and 22 on board PR. Connect a rectifier diode, e.g. 1N4001, in series with the external 19V supply, with the cathode end to pin 17. This diode ensures that the 19V supply generated in the line output stage and the external 19V supply don't interact.

(13) Connect the mains input via the variac. Increase it from zero to 100V while monitoring pin 10 (200V supply) on board VH with the meter. The reading should be about 150V at 100V r.m.s. input. Slowly increase the input from the variac. The multimeter reading should increase and stabilise at approximately 200V from 200V r.m.s. input through to 240V r.m.s. Disconnect the meter.

(14) Disconnect the 1N4001 diode and the external 19V supply. Reconnect D605 on board PR. Increase the input from the variac from zero. If the chopper start-up circuit is working, the 130V rail (pin 19 on board PR, monitored with the meter) should jump to about 20V with an r.m.s. input of 70V. Increase the input and ensure that the

voltage at pin 19 stabilises at 130V between 200V and 240V r.m.s. input.

The set should now be working satisfactorily and the variac can be disconnected. Check for overall satisfactory performance with the set connected directly to the mains supply. No adjustments other than those mentioned should be required as a result of the modifications.

The KV1810UB Mk. II

As noted earlier, the modifications described were carried out with the Mk. I version of the KV1810UB. Although we've not had an opportunity to try out the modifications with the Mk. II version, they should be applicable when due account is taken of Q510's slightly different drive circuitry. The following approach is suggested for anyone wishing to modify a Mk. II set.

Carry out the chopper modification as described above. With the line output stage, proceed as for the Mk. I but instead of removing R597 remove R556 and R574 (both 22Ω, 2W). This will result in a line output stage as shown in Fig. 3 apart from the fact that L508 will not be present. This difference should have little effect on the operation of the circuit.

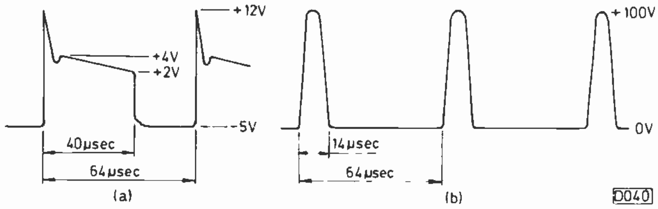


Fig. 7: (a) Line drive waveform – at secondary of the line driver transformer. (b) Waveform at the collector of Q1501 in the test condition.

In conclusion, I hope that the modifications described will be of value to anyone wishing to extend the useful life of a Sony KV1810UB. The author's modified set has worked faultlessly for many months and can be used with confidence that if anything goes wrong it won't be the fault of a GCS – unless of course Q602 should fail. But then it can probably be replaced with a transistor . . .

Servicing the Sony KV1612UB

David Botto

We rather like the Sony KV1612UB: it's a well-made 16in. set that gives a good picture. Though the circuitry is quite complex it's arranged on just a few boards that, as usual with Sony sets, are identified by letters.

Panel Layout

After removing the casing you'll see the large D board, which contains the power supply and the complete line and field timebase circuitry, mounted horizontally at the bottom of the set. To the left, again mounted horizontally at the bottom, is the M2 board which contains the circuitry for the a.f.t., the remote control, mute, volume and the picture and colour control. At the left side (we're looking in from the rear) you'll see the vertically mounted A board. This contains the tuner, the i.f. strip and the decoder. Also on the left, towards the front, are two small horizontally mounted boards, one above the other. The smaller is the X board that carries the remote control receiver; the larger one is the M1 board which contains the channel selection circuit and presets. Slightly towards the right are two vertically mounted boards, H which carries the customer controls and M3 with the channel indicator and its drive circuit. The letter C is used for the tube base panel which houses the RGB output stages. There's also provision for a plug-in teletext board.

Power Supply

At first sight the power supply looks a lot like those used in earlier Sony models. There are some significant differences however. The circuit is shown in Fig. 1 from which it can be seen that the main elements are a series chopper, its driver, a pulse-width modulator, protection circuits and the mains rectifiers.

The 240V a.c. mains supply comes in at plug D1. It passes via the mains fuse F601 and filter circuit, also thermistor TH605, to the bridge rectifier D601/2/8/9 (all U05Gs). A mylar polyethylene capacitor is connected across each side of the mains filter coil T601 – C601 and C602. We've been waiting for one of these to go short-circuit, but to date this hasn't happened!

The power switch S901 has an extra switch pole which is used to reset the remote control i.c. (IC002, M58485P) at switch on. This i.c. is on board M2 and is the heart of the remote control system. If it was not reset the receiver would switch on in the standby mode.

The a.c. mains input also goes to the degaussing circuit and to transformer T603 which drives a full-wave rectifier (D611/612). This produces 39V across the reservoir capacitor C623. The following regulator circuit (Q607, D613) provides a stabilised 13V supply for the remote control i.c. on board M2 and remote control receiver board X.

A 5V supply derived from the line output transformer is fed via connector D3 (pin 3) to boards M1–M3. Suspect R804 (1·2Ω, 0·25W carbon nonflammable) if this supply is missing.

Chopper Action

The chopper circuit is conventional and produces a regulated 110V supply. Q605 is the chopper transistor and L603 the series choke. Diode D606 conducts to maintain the current flow when the chopper transistor is off. The driver transistor Q604 receives its base drive from the astable multivibrator circuit Q602/3 which acts as the pulse-width modulator under the control of the error detector/amplifier transistor Q601.

Protection Arrangements

In the event of excessive h.t. current the voltage developed across R637 will be sufficient for Q608 and Q609 to switch on, shorting the base of Q602 to chassis. The chopper drive will thus be temporarily removed. In the event of a short or serious overload the voltage developed across R651 will turn transistors Q651/2 on. These will latch on and stop the multivibrator, shutting the set down.

Dealing with a Dead Set

The problem when confronted with a dead set is whether the fault is in the power supply or elsewhere. The way to tackle this is to remove R513, R514, L501 and R563 from board D, thus rendering the line oscillator, driver and output stages and the field output stage inoperative. Connect a 240V, 100W bulb across the smoothing capacitor C621 and supply the set from a variac or a tapped mains transformer. Gradually increase the mains input to 240V. If the bulb lights at about half brilliance, the power pack is o.k. When you replace the choke and resistors, make sure you fit the right one in the right place or the results will be horrible!

Should the power pack prove to be faulty the first items to check are Q651/2 (a component tester will enable you to check these quickly). These transistors sometimes fail, removing the 110V supply. If necessary carry out further component checks in the following order: D651, C654, Q608, Q609, Q607, D613. Smoothing capacitor C621 changing value can give rise to all kinds of trouble, including excessive h.t. The chopper circuit transistors are very reliable. If necessary check them in the following order: Q605, Q604, Q601 – then D603.

The multivibrator circuit can be tested by disconnecting the set from the mains, connecting a scope via its 10:1 probe to the collector of Q602, and powering the circuit from an external 18V supply (two PP9 batteries or a very well smoothed supply) connected between the junction of R603/R609 and chassis. The waveform seen should be similar to that shown in Fig. 2. As the multivibrator is running free you might not get quite this waveform – the important thing is that it's there.

Fig. 3 shows the waveforms at the collector of Q604 and at the junction of coils L601/2/3 when the receiver is working correctly with a 240V a.c. mains supply.

The Timebases

If all's well with the power supply and R513/R514/R563/L501 have been replaced correctly there's probably a fault in the line timebase. It's possible that a fault on one of the other boards could be loading down the 110V line, but we've not had this happen yet.

The first item to check is the 2SD869 line output transistor. Then check the driver transistor's feed resistor R514 (2·2kΩ, 2W). If necessary check rectifier diodes D801, D802, D803, D811 (all type GH3F), the line oscillator transistor Q501 (2SA677) and the line driver transistor Q502 (2SC2230A).

A few failures have been experienced as a result of shorted turns in the line output transformer T801. The only reliable test is by substitution. Since the e.h.t. rectifier is encapsulated within the transformer, you'll need to remove the tube's e.h.t. connector. It helps a lot if you've got the correct tool – part number 3-702-436-01. Don't forget to short both the cap and the tube's anode to chassis: high voltage could be lurking there in waiting for you . . . Note that the tube's anode cap has two connections. Short them together and you'll have three nice pictures!

Line timebase waveforms are shown in Fig. 4.

Field timebase faults are uncommon. The coupling capacitors C555 (33μF, 25V) and C557 (330μF, 25V) can cause no or reduced field scan if they fail. We've not so far had any problems with the transistors used in the field timebase.

The Receiver Side

From serial number 523,001 some changes were made. Boards M1, M2, M3, C and D were altered though the circuitry remains the same. Modifications were made to the remote control unit and board A.

The first version of the remote control unit used a 6V battery supply: with the second version the supply is 4·5V. Version one contains two transistors (type FRB828B, 2SC945 or 2SC1364): the second version has a single 2SC1364 transistor. Both use the same M58484P encoder i.c. There's little to go wrong with these units. A scope (with 10:1 probe) and counter should show 6V and 6·2V peak-to-peak 480kHz signals at pins 2 and 3 of the i.c. The best and fastest check is to try the unit with a known good receiver.

On the remote control receiver board the scope and counter should show a 15V 480kHz waveform at pins 12 and 13 of IC002 (M58485P). The only problem we've had with this board is the tendency for transistor Q005 (2SA733 or 2SA1027R) to fail. This can have a couple of effects: the sound and picture can mute, or the set may go into the standby condition and refuse to come out.

We've not had any faults on boards X, M1 and M3.

In the earlier version of the set a U321 tuner followed by a couple of 2SC2009 i.f. preamplifier transistors were used on board A. The later version has a BT882 tuner followed by a single 2SC1128 i.f. preamplifier transistor. The earlier panel has a tuner a.g.c. drive transistor Q214 (2SC1128, 2SC1364 or equivalent) which can fail. In the later version the tuner a.g.c. drive is taken direct from pin 5 of the TDA1440G i.f. i.c. (IC201). These seem to be the only differences between the two versions of the panel.

If the fault is a raster but no picture and Q005 on board M2 is all right, the cause of the trouble could well be in the beam limiter circuit. Short the emitter of Q304 (2SC633A, 2SC1364 or equivalent) to chassis. If this restores the picture, the beam limiter circuit is at fault. Check Q304 first. Next suspect C318 (0·47μF, 50V), C319 (3·3μF, 50V) and then R802 (180kΩ, 0·5W – on board D).

If necessary check Q301 (2SA733), C305, C306 (both 470pF) and make sure that the video mute diode D304 (1S1555) is in order.

The decoder i.c. is a μPC1365C (IC301). Don't be in a hurry to take it out – so far faults have always proved to lie elsewhere. We've found no simple way of disabling the colour killer – Sony didn't know either! – but it's quite easy to check the waveforms. With a colour-bar input signal, start at TP12 on board A where the composite video signal should be present. Next check at the collector of Q305. The waveform should be as shown in Fig. 5. The 4·43MHz reference signal should be present at pin 21 of IC301. Other waveforms are clearly shown on the official circuit diagram. If all is not well, suspect components associated with the i.c., starting with capacitors C320 (4·7μF, 25V) and C321 (3·3μF, 50V) which can give various strange effects when they fail.

Decoder adjustments are best left untouched. The only one that may, not all that often, need to be adjusted is the a.p.c. control RV303. To do this, solder a 100kΩ resistor from pin 13 of IC301 to chassis and a 10μF, 25V capacitor

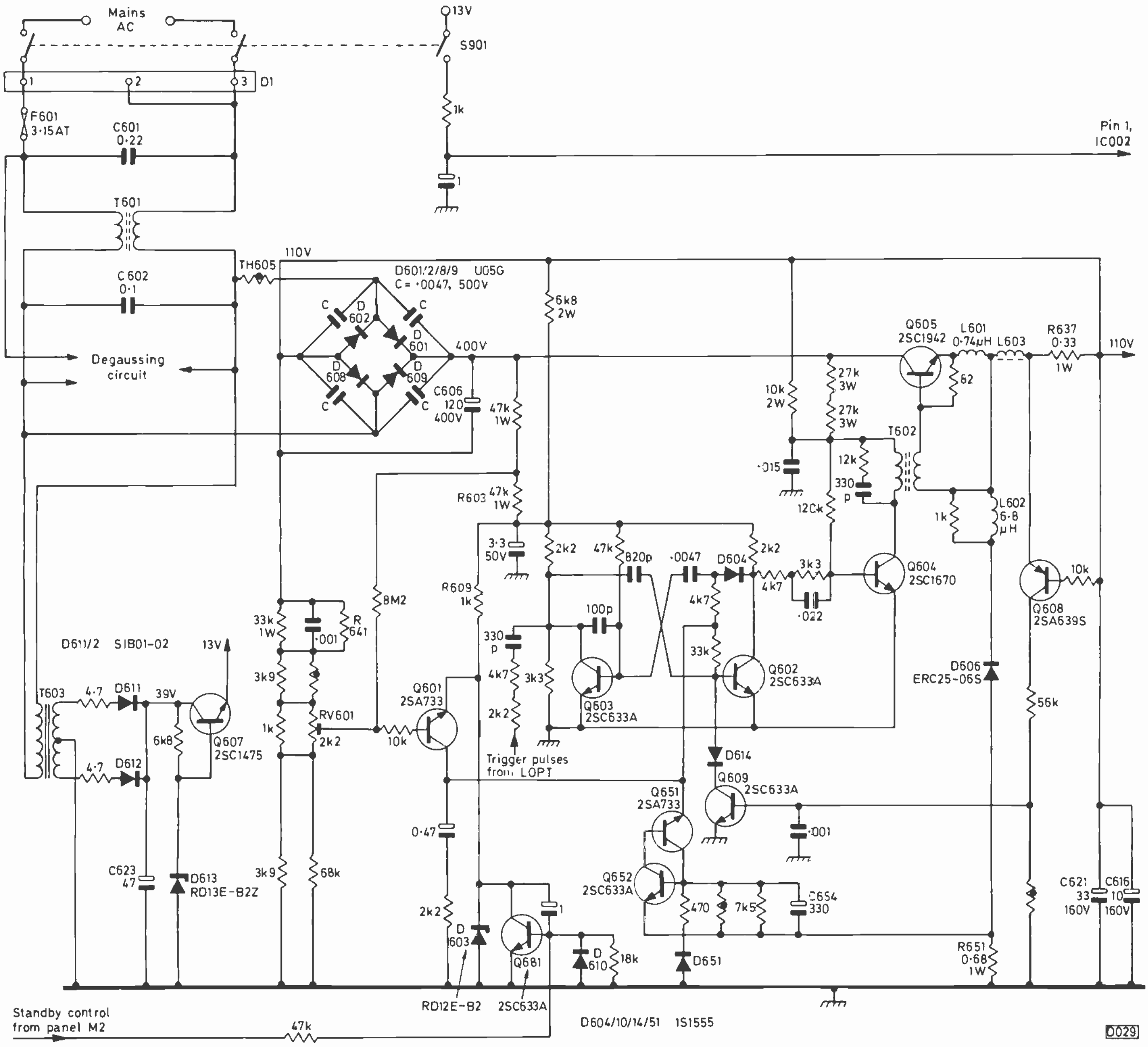


Fig. 1: Power supply circuitry, Sony Model KV1612UB.

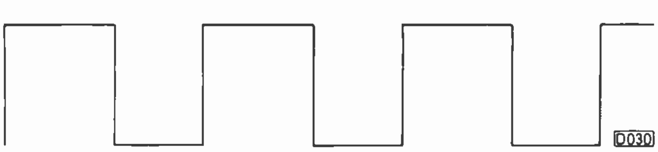


Fig. 2: Waveform at the collector of Q602 with an 18V supply. The waveform can vary a lot – the important thing is that it's present.

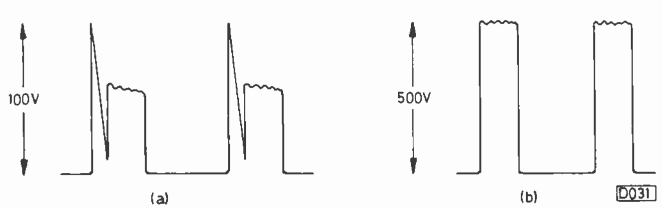


Fig. 3: (a) Waveform at the collector of Q604 with 240V input. (b) Waveform at the junction of L601/2/3.

from the junction of C335/6 to chassis. Set up RV303 on a colour transmission for a steady picture.

The RGB output transistors on panel C are of the reliable 2SC2278 type. Only very rarely does one fail,

Fig. 4: (a) Waveform at the collector of Q502. (b) Waveform at the collector of Q503 (measure with care).

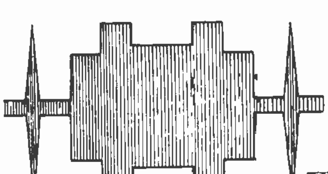


Fig. 5: Chroma waveform at the collector of Q305: 0·4V peak-to-peak.

giving the predominance or absence of one colour symptom.

If the sound has failed, check whether R230 (180Ω, 0·25W carbon nonflammable) has gone high-resistance.

Finally, it's best to use a digital meter for all measurements.

Video Servicing

Mike Phelan

This month we'll take a look at the principles involved in TV (or perhaps we should now say video) cameras – in particular the non-professional types intended for the consumer market. There are not many monochrome cameras in this category so we'll concentrate on colour ones. Apart from the electronics, the camera consists of a lens system to focus the image on the target, the tube itself (usually a vidicon type) and some sort of viewfinder.

The Lens

Taking these in order, the lens will be a high-grade optical component with the front element movable for focusing purposes. Most video camera lenses also have a zoom facility. This means that by operating a lever the positions of some of the elements in the lens system can be altered in the longitudinal direction so as to vary the effective focal length, i.e. the magnification. A typical range is ×6.

With a photographic camera there are two ways of altering the amount of light that passes through the lens: the lens aperture and the length of time during which the shutter is open can both be varied. Since video is a continuous process there's no shutter and only the aperture can be varied. This is done by means of an iris diaphragm that's similar to that used in a still camera but has the option of automatic setting by means of a small servo motor. This is operated by a type of a.c.c. system that senses the mean signal level and adjusts the iris accordingly. Unfortunately the auto-iris tries to make the average picture content a medium grey. This is all right if the picture content averages out at this level, but at the extremes, e.g. snow scenes or night shots, it's not much good: these subjects need to end up at high and low average brightness respectively. Because of this there's always a manual override for the iris, with some sort of warning in the viewfinder to draw attention to under- or over-exposure. There's also occasionally an auto position giving "one stop above" for back-lit subjects etc.

The motor and reduction drive to operate the zoom are also attached to the lens assembly. As this has to be manually adjustable as well, some sort of a slipping clutch arrangement is used. Many lenses have a macro setting for focusing down to less than one inch, operated by turning the zoom ring beyond the end of its travel.

Some cameras, e.g. the Ferguson 3V06, have interchangeable lenses with a screw fitting known as a C mount. This means that the connections to the iris servo and zoom motor must be made by plug and socket and that care must be taken to cap the camera when the lens is out.

With artificial light it's necessary to take the colour temperature of the light into account. To put this simply, a tungsten bulb gives a redder (lower colour temperature) output than natural light. To correct for this a filter must be inserted in the light path. It can be fitted on to the front of the lens or built into the camera and operated by means of a knob. There may also be a semi-opaque filter to insert when the camera is not in use. The Grundig FAC1900 (Sony) camera has a four-position switch for different light sources, introducing both mechanical and electronic correction.

Precautions

Before we go any further, a word on the care of camera equipment. The most important "don't" is not to point the camera at a very bright scene (with or without the lens) for any length of time. Otherwise an impression that may be permanent will be made on the tube's target. Accidentally pointing the camera at the sun will almost certainly write off the tube.

Next lenses. I know that there are such things as lens tissues, brushes and all sorts of other paraphernalia around for cleaning lenses, but my advice is don't rub the surface of a lens with anything. O.K., you may pick up a few specks of dust on the surface. But if they won't blow off, leave them. The amount of light lost is infinitesimal – anything on the surface of the lens is completely out of focus and therefore invisible on the picture. Far worse is the pattern of fine scratches produced by rubbing the soft lens coating with a tissue. This scatters light, reduces the picture contrast and impairs definition. The resultant "soft-focus" effect may look great for still portraits but is of little use for anything else. Lenses are coated to reduce light scatter. The coating is soft and will also be etched by fingermarks. If you should be unfortunate in having a lens with a thumb print on it, don't dry to rub it out.

The kindest thing you can do for a camera lens is to buy it an ultra-violet filter. These are available to fit any front thread and will reduce haziness on distant summer shots. Much more importantly, the filter will protect the lens. It should be left on all the time therefore. The light loss is minimal and a UV filter is much cheaper than a lens!

The Tube

The next thing in the chain is the vidicon tube (see Fig. 1) which looks something like a long, thin valve. The usual size is ⅔in., so the deflection angle is very narrow. It's essential that the lens and tube are held in rigid mechanical alignment with each other – especially in the case of a colour camera. The tube is clamped in a Mumetal shield to provide magnetic screening, the shield being rigidly mounted on the diecast chassis. The deflection coils are inside the shield – due to the narrow scan angle they are cylindrical in shape. A couple of beam alignment magnets (like purity rings) are mounted on the tube's neck.

The vidicon has six grids (or anodes, if you like). The sixth is the mesh electrode which in operation is at about 1·5kV. It acts as the final beam accelerator. G3 and G5 form a converging lens with the focus electrode G4. G2 is at about 350V and G1 is held negative with respect to the cathode, the bias being adjustable.

The target, a layer of semiconductor material on a glass plate, closes the front of the tube: the minute signal is taken off via a metal ring connector. A stripe filter in front of the target produces colour signals. It also has an optical black portion at the bottom to provide a reference level during the field playback. In front of the stripe filter there's an optically flat glass faceplate.

Without going into detail on the theory of operation, what basically happens is that the beam scans the target and a signal corresponding to the light falling on each part of the scanned target is taken off at the ring connector. This signal enters the head preamplifier, which is mounted

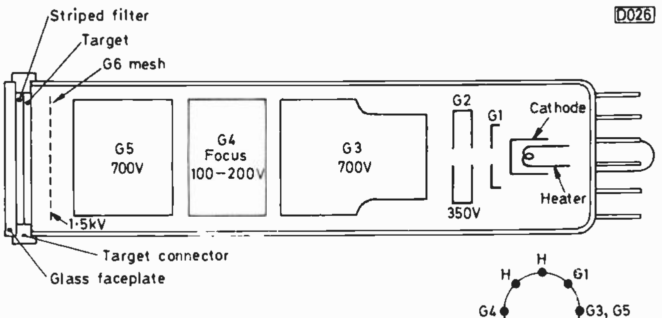


Fig. 1: Vidicon tube – colour version.

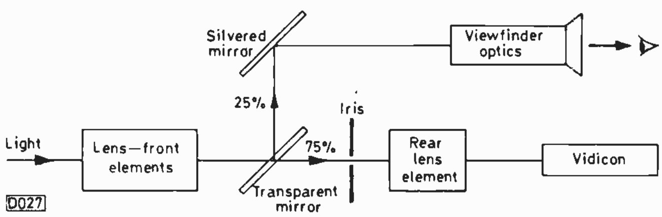


Fig. 2: Optical viewfinder arrangement.

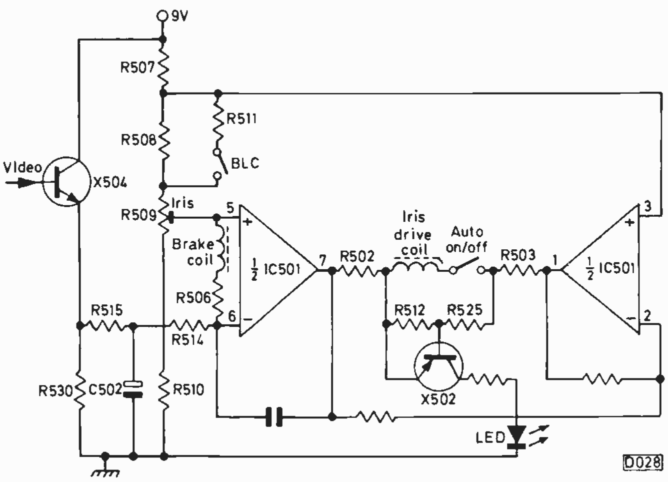


Fig. 3: The auto-iris circuit used in the Ferguson Model 3V20 colour camera.

in a screened box adjacent to the tube's shield in order to keep the input lead very short. The signal is thus amplified to a value suitable for passing to the later signal stages without loss or stray pickup.

Viewfinders

Viewfinders fall into two categories. At the lower end of the camera price range an optical viewfinder is used (see Fig. 2). About a quarter of the light from the scene is reflected into the viewfinder by an unsilvered mirror, leaving the remainder of the light to pass to the tube. A second mirror is required to turn the light path through a right angle for ease of viewing. Note that the light for the viewfinder is taken off prior to the iris to allow maximum viewfinder image brightness. This type of viewfinder is found on the Ferguson 3V17 and other similar cameras, especially monochrome ones.

The other type of viewfinder is the electronic type (EVF) – used on the Ferguson 3V06 and 3V20 for example. In effect it's a very small TV monitor with a c.r.t. screen about 1·5in. square. As the input is video (CVBS) there's no tuner, i.f. strip or sound channel. The timebases use very little power, so the unit is extremely compact. It's mounted separately on the 3V06: an extension lead together with a remote start/stop control can thus be used – useful when filming in a situation where there's no access to the camera. In the 3V20 the EVF is built into the camera's body. To facilitate mounting, the EVF's c.r.t. is in some cameras aimed at a 45° mirror.

One advantage of the EVF is that with suitable switching the camera can receive a playback signal. A recorded section of the tape can thus be checked and if necessary retaken. For the same reason an earpiece to check the audio can be plugged into most cameras. The EVF screen can be used to display other information along with the picture. One of the most common arrangemenets is to have a horizontal white line whose position on the display varies with the iris setting – for correct exposure it should be about half way up. When the trigger is pulled the line shortens to prevent the picture being obscured.

Both types of viewfinder can incorporate LEDs to show various items of information. Three LEDs may show correct, over- or under-exposure; alternatively one LED may illuminate the whole display if there's insufficient light available (as with the Sharp XC30). There's usually an LED to show whether the VCR's battery is going low – this is often done by making one of the diodes flash rather than using an extra LED. On cameras with an optical viewfinder an indication that the tape is running is necessary – again a LED. On the Grundig/Sony 3000 it's duplicated on the front of the camera so that the subject knows he or she is "on the air"!

Before considering the main parts of the camera's electronics we'll look at the auto-iris and power zoom circuitry – these items have no connection with the rest of the circuitry.

Power Zoom

The power zoom circuit is simply a four-transistor bridge that drives the motor, opposite quadrants being switched on by the switches. The motor has a built-in reduction gearbox and the final pinion drives a toothed ring on the lens assembly. This ring is a friction fit so that manual zooming places no strain on the gear teeth.

Auto-iris Circuit

The auto-iris circuit can take various forms. On the 3V20 (see Fig. 3) the iris is controlled by a type of motor that resembles a moving-coil meter's movement. The moving parts are very light so little power is required – the motor is driven by an operational amplifier. This particular circuit is rather ingenious, as it eliminates the potentiometer that's usually driven by the servo motor in similar arrangements – this is a source of extra friction of course. The emitter-follower X504 is fed with a video signal whose amplitude depends, amongst other things, on the light passing through the lens. The voltage at pin 5 of IC501 is set by the preset iris control R509. R515/R514/C502 form a T-filter that removes instantaneous video level variations, giving the circuit a time-constant.

If the iris is closed and the ambient light level decreases the amplitude of the video signal will decrease. The voltage at pin 6 of IC501 falls and as a result the voltages at pins 7 and 2 increase, driving current through the motor in the direction required to open the iris. If the voltage at pin 2 rises above that at pin 3, pin 1 will fall to nearly chassis potential and the current through the drive coil will further increase. The system eventually finds a balance with the voltages at pins 5 and 6 equal. To prevent hunting, a brake coil and limiting resistor (R506) are connected across pins 5 and 6 – while there's a voltage difference between the two pins, current flows through the coil and damps the movement of the iris motor.

If insufficient light is available the iris will open fully. The voltage at pin 6 will be low and current will continue to flow through the drive coil. The voltage developed across R512 will forward bias X502, illuminating the under-exposure LED. It will be apparent that this LED may flash momentarily each time the iris opens: these flashes are of very short duration however and of no consequence.

Next month we'll take a look at the rest of the electronics.

Letters

BAIRD'S STUDIOS

Thank you for Harold Peters' interesting article on pre-war TV. I feel I must make a correction about the Baird studios however. As I understand it, the flying spot of light technique was used in only the earliest studios, to increase the sensitivity of the "camera" by using large arrays of photocells and also to avoid frying the performer with the enormous amount of light that would otherwise have been necessary. By the time the Baird intermediate film technique came into use the studio lighting was of the conventional type, the scanning process taking place in the telecine unit. Apart from the fact that there would have been no point in scanning twice, it would have been impossible to record in this way using any conventional film process.

Antony P. Marsden, MBKS,
Poole, Dorset.

PRE-WAR TELEVISION

I found Harold Peters' article on pre-war TV (October issue) very interesting, particularly his recollections of the programmes: I hope there'll be no offence if I correct one or two technical points.

Baird's high-definition system of 1936 used 240 lines, not 202. I think Mr. Peters has confused the intermediate film system with the spotlight studio. In the former a cine camera was used to record the scene in a studio lit by conventional film lighting. The film, which incidentally was 17·5mm not 35mm, was then immediately processed and scanned in the manner described by Mr. Peters. In the spotlight studio the single performer sat in darkness except for a flying spot of light that came from an arc lamp via a Nipkow disc. The light reflected from the subject was picked up by sensitive photocells that produced a video signal directly. Both these systems were in use at Alexandra Palace in 1936-7 but they were clearly clumsy compared to the flexible Emitron cameras. It was this operational difference rather than considerations of picture quality that led to the Baird system being abandoned after only three months of regular service.

As Harold Peters correctly points out, the fact that the electron gun in the Emitron tube was mounted at an angle to the target resulted in the need to use keystone correction in the scanning waveforms. This correction could be preset however, rather after the manner of EW and NS correction in a shadowmask tube, and was not the reason for the famous tilt and bend controls. These were needed because the Emitron tube was subject to spurious shading effects due to the clouds of secondary emission electrons that were released from the target by the high-velocity electron beam. These secondary emission electrons upset the charge distribution across the target and hence the average brightness of the picture. To provide correction, sawtooth (tilt) and parabolic (bend) waveforms were added to the video signal. As the effect was picture dependent, these controls had to be readjusted for every scene. The Emitron tube had a gamma of 0·5 which was ideal for transmission purposes: thus gamma correction wasn't necessary.

For anyone interested in this period of TV history Bruce Norman's recent book *Here's Looking at You*, published by the BBC, makes fascinating reading.

David Looser,
Ipswich.

HISTORICAL RECORD

I gather that other correspondents have dealt with various technical points arising from Harold Peters' article on pre-war TV. May I put the record straight on some historical matters?

(1) It was not the EMI team who developed radar in the UK, though many of them worked on it later, during the war, when two of the team — Alan Blumlein and C.O. Browne — were killed in an aircraft crash while flight-testing H2S. Credit for the early radar experiments is due to Sir Robert Watson-Watt, a scientific civil servant. The work was done at the Radio Research Station, Slough. Most of the electronic equipment for the early radar chains was manufactured by A.C. Cossor. It was originally called "RDF", later "radiolocation": it was finally agreed to adopt the American term "radar".

(2) The EMI team didn't develop the complete 405-line package. The original transmitters and aerials were contributed by the Marconi Company, with whom EMI formed Marconi-EMI in 1934. While the Ally Pally station took about 18 months to complete, the electronic TV system was the result of several years' work. The Emitron camera tube, though developed independently, owed something to Zworykin's work at RCA where electronic interlaced scanning was developed. The early work on v.h.f. television in Germany should not be overlooked — the intermediate film technique used by Baird was also developed in Germany. Baird used this for his "live" transmissions, but he also had a good telecine for transmitting film. In fact apart from more flicker his film transmission gave significantly better results than the original Marconi-EMI 405-line telecine.

(3) Finally the article was less than fair to the BBC in suggesting that they came near to backing the wrong horse. The BBC had been virtually forced by the PMG to transmit Baird's 30-line system and were much impressed by the EMI work as early as 1932. The decision to share the high-definition service between Baird and Marconi-EMI stemmed from the Selsdon Television Committee of 1934 and the subsequent Television Advisory Committee. Baird's pioneer work on low-definition TV and his later wartime work on high-definition colour deserve to be acknowledged but the 405-line fully-electronic system was what the UK needed in 1936 (though not in 1946) and that came from the EMI and later Marconi-EMI team: the BBC seems to have recognised early on that this would be

the final solution to their long and often bitter struggle with Baird lasting, with occasional lulls, from about 1927.
Pat Hawker,
Dulwich.

RADIOLYMPIA

I must be in the same age bracket as Harold Peters, for I too can remember the burning down of the Crystal Palace, though it was only a faint glow in the clear night sky to us at Herne Bay some 60 miles distant. Because of my enthusiasm for wireless my father took me to the pre-war Radiolympias. The 1937 one stands out in my memory as the first and last time that I saw a television set operating from the Town Gas supply. Hundreds of little bunsen burners heated thermocouples and the set showed what appeared to be an OB from Henley. In 1937 there were still thousands of houses in the London area with gas lighting only, so there may have been a market for such a device.

Harold Peters mentions the 1939 theatre show. In fact the show was being televised live from the theatre in 1937 — I still have my 1937 theatre programme, autographed by the stars of the show. The TV cameras were on the stage, supported on frames equipped with bicycle wheels, and the compère made jokes about the colour of the shirt he had to wear so that it would appear as a proper white in viewers' homes. There must have been public doubts about the reliability of the push-button tuners used on some radio sets at the time, as several manufacturers' displays had life testing machines punching away at the push-buttons in turn: as the radios were on, the sound kept changing from programme to programme, causing absolute bedlam around the stands.

The 1938 Radiolympia was more disciplined in that all receivers had to be tuned to the same programme. For a mischievous schoolboy this naturally took some of the fun from the show. I still have my Bulgin component catalogue from that show, price 3d, which I could just about afford. I didn't get to the 1939 show.
W.R. Harris,
Potters Bar.

TV AUDIO VALVES

Nick Lyons suggested in the October issue that the PCL86 is a less reliable valve than the PCL82. I can only say that during a period of six years servicing ITT and Decca hybrid colour sets I had to replace over fifty PCL82s while just two PCL86s failed. This might of course be due to the better design of the ITT audio circuit but certainly doesn't point to the PCL86 being unreliable.
Derek Snelling,
Brownhills, Staffs.

THE PLUGTOP MYSTERY

I've read with interest the various letters on the great plugtop mystery. Here's my solution. Think of the neon bulb. When it lights, it's the negative connection that "holds" the glow. If you consider the neutral and live plugtop connections as the leads of a neon bulb and whatever consumes the current as the neon gas you'll appreciate why it's the neutral plugtop connection that gets burnt.
Lim Chin Siang,
Singapore.

next month in TELEVISION

● **SIMPLE PATTERN GENERATOR**
The heart of this pattern gernerator is a Ferranti ZNA234E i.c. which provides grey-scale, dot, crosshatch plus vertical and horizontal line outputs. The circuit used also enables black and peak white rasters to be selected. The PCB has been designed to fit into a compact Vero box with battery holder. Though originally intended for video circuit testing, a u.h.f. modulator will fit into the case to provide an r.f. output.

● **THE VHS HI-FI SYSTEM**
VHS and Betamax VCRs featuring hi-fi stereo sound have recently appeared on the market. The same basic system is used with both formats. Extra heads on the drum record the audio, on f.m. carriers, along helical tape tracks. Derek Snelling explains the system and the techniques involved.

● **GOODBYE TO 405**
January sees the close down of the 405-line network that's served us well for nearly fifty years – since the BBC started the world's first public high-definition service in 1936. Pat Hawker looks at the technical history and some of the things that never happened – you could have had two networks in Band III for example, with colour!

● **SERVICING THE S-S INDESIT T24**
The solid-state Indesit T24 was technically one of the most interesting sets sold – a sort of big brother to the T12. Mike Phelan describes common faults and some of the unusual circuitry – the line output transistor is emitter driven for example.

● **CHRISTMAS LIGHTS!**
Well the next issue will be published just before Christmas, so William Harrison decided to present a flashing light circuit using LEDs and a 12V supply.

PLUS ALL THE REGULAR FEATURES

ORDER YOUR COPY ON THE FORM BELOW:

TO ....
(Name of Newsagent)

Please reserve/deliver the January issue of TELEVISION (£1), on sale December 19th, and continue every month until further notice.

NAME ....

ADDRESS ....

....

....

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

18029	1.58
16181	1.13
16182	1.13
16334	0.88
16335	0.72
16446	0.89
16800	1.25
16799	2.16
16801	0.86
16802	1.03
16803	4.81
16805	1.35
17074	6.00
17127	3.91
17376	1.43
1N4001	0.05
1N4002	0.05
1N4003	0.05
1N4004	0.06
1N4005	0.07
1N4006	0.07
1N4007	0.07
1N4148	0.03
1N4448	0.12
1N5401	0.12
1N5402	0.13
1N5403	0.14
1N5404	0.15
1N5408	0.18
1N914	0.05
1S44	0.06
1S5012A	0.73
1S921	0.09
2582	1.94
2N1302	0.24
2N1303	0.34
2N2218	0.38
2N2219A	0.29
2N2222	0.34
2N2646	0.75
2N2904	0.32
2N2905	0.39
2N2906	0.34
2N3053	0.24
2N3054	0.90
2N3055	0.55
2N3055H	0.77
2N3442	1.05
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3707	0.14
2N3711	0.14
2N3771	1.85
2N3772	1.55
2N3773	1.65
2N3819	0.28
2N3823	1.06
2N3904	0.56
2N3906	0.56
2N4101	1.10
2N4240	3.00
2N4443	1.35
2N4444	1.12
2N4914	0.85
2N5064	0.64
2N5293	0.45
2N5294	0.45
2N5296	0.40
2N5297	0.45
2N5298	0.55
2N5490	1.35
2N5496	0.85
2N6107	0.53
2N6109	1.43
2N6122	1.80
2N6130	0.85
2N6133	0.57
2N6178	0.86
2N6180	0.86
2N696	0.39
2N698	0.39
2N707	0.39
2SA1027	1.15
2SA1076	1.78
2SA329	0.36
2SA351	1.06
2SA489	1.06
2SA490	1.51
2SA493	0.95
2SA628	1.03
2SA637	1.32
2SA673	1.11
2SA683	1.46
2SA684	1.33
2SA748	0.88
2SA818	1.85
2SA835	2.27
2SA940	1.64
2SA951	1.23
2SA966-Y	0.54
2SB325	3.51
2SB337	1.85
2SB375	3.51
2SB400	0.36
2SB407	2.94
2SB411	3.00
2SB511	1.40
2SB54	1.26
2SB56	1.26
2SB618A	1.40
2SB681	2.44
2SB695	1.70
2SB75	0.94
2SB861	0.88
2SC1034	5.61
2SC1050	3.06

2SC1061	0.54
2SC1096	1.85
2SC1104	2.80
2SC1106	4.12
2SC1114	5.61
2SC1124	1.10
2SC1151A	4.29
2SC1152	4.25
2SC1157	4.12
2SC1162	0.95
2SC1172	1.92
2SC1195	2.83
2SC1213	0.75
2SC1226	1.32
2SC1306	0.85
2SC1307	1.35
2SC1316	3.40
2SC1364	0.49
2SC1383	1.39
2SC1398	0.51
2SC1410	2.17
2SC1413	3.88
2SC1505	0.56
2SC1578	6.67
2SC1617	3.35
2SC1670	2.84
2SC1678	1.25
2SC1810	1.40
2SC1815	0.41
2SC1829	2.01
2SC1875	4.77
2SC1891	3.35
2SC1929	2.25
2SC1942	5.70
2SC1946	4.11
2SC1953	1.75
2SC1957	0.86
2SC1959	0.36
2SC1962	1.75
2SC1969	2.92
2SC2027	2.67
2SC2028	1.91
2SC2029	1.49
2SC2057	1.07
2SC2073	1.40
2SC2078	1.25
2SC2091	0.59
2SC2122A	4.85
2SC2141	1.89
2SC2166	1.35
2SC2216	0.62
2SC2233	2.20
2SC2271	3.64
2SC2278	1.03
2SC2335-KIT	7.61
2SC2526	1.70
2SC2551	0.95
2SC2570	1.80
2SC2570A	0.95
2SC264A	4.30
2SC2671	1.99
2SC2728	0.95
2SC372	1.27
2SC373	1.05
2SC383	1.20
2SC388	0.45
2SC41	1.99
2SC458	0.55
2SC495	0.83
2SC508	3.30
2SC515A	1.20
2SC537	0.49
2SC558	3.35
2SC605L	1.05
2SC620	1.32
2SC643A	1.40
2SC673	1.11
2SC681	4.00
2SC684	1.50
2SC685A	2.82
2SC693	0.89
2SC710	0.62
2SC717	1.92
2SC734	1.30
2SC735	1.05
2SC782	2.24
2SC790	1.15
2SC806	10.26
2SC814	1.26
2SC828	0.25
2SC867A	2.49
2SC926A	1.29
2SC930	0.49
2SC935	3.75
2SC936	1.58
2SC937	3.25
2SC940	4.25
2SD1138	0.78
2SD198	3.51
2SD234	0.42
2SD235	0.54
2SD257	2.67
2SD291	2.67
2SD292	2.35
2SD313	2.59
2SD315	2.67
2SD325D	1.36
2SD350	7.83
2SD350A	2.08
2SD353	3.25
2SD389	2.19
2SD401	1.57
2SD551	2.20
2SD588A	1.25
2SD621	8.88
2SD657	2.54
2SD731	1.72
2SD811	3.86
2SD869	2.40

2SD898B	2.67
40408	0.45
40594	1.39
40595	1.39
40636	0.86
40871	1.39
40872	1.39
60857	1.10
74LS132	0.72
74LS138	0.85
74LS157	0.79
74LS161AN	1.18
74LS196	1.25
74LS20	0.25
74LS244	1.65
74LS30	0.29
74LS367	1.05
74LS373	1.55
74LS47	1.05
74LS73	0.39
74LS74	0.39
74LS75	0.52
74LS86	0.49
74LS90	0.75
74LS92	0.75
74LS93	0.75
74LS95B	0.85
7805 TO-220	0.63
7805 TO-3	1.05
7806	0.86
7808	0.54
7812 TO-3	0.54
7812 TO-220	1.05
7815	0.55
7818	0.55
7824	0.55
AC107	0.86
AC117	0.39
AC123K	0.39
AC128	0.28
AC138	0.08
AC141	0.26
AC142K	0.39
AC151	0.25
AC153	0.30
AC153K	0.36
AC176	0.17
AC176K	0.40
AC179	0.25
AC183	0.85
AC186	0.30
AC186K	0.50
AC187	0.35
AC187-01	0.40
AC187K	0.39
AC188	0.33
AC188-01	0.40
AC188K	0.39
AC193K	0.59
AC194K	0.59
AD140	0.96
AD142	0.96
AD143	0.96
AD145	1.45
AD149	0.81
AD161	0.30
AD162	0.30
AD262	0.95
AF114	2.24
AF115	0.79
AF116	0.79
AF117	0.75
AF118	0.75
AF121	0.50
AF124	0.36
AF125	0.36
AF126	0.36
AF127	0.36
AF139	0.48
AF178	0.75
AF179	0.50
AF180	0.50
AF181	0.48
AF182	0.50
AF186	0.40
AF239	0.40
AF279	0.80
AL100	3.86
AL102	1.75
AL103	2.43
AL113	1.80
AN208	3.22
AN210	2.07
AN214	2.05
AN214Q	2.05
AN231	5.56
AN234	5.02
AN235	4.84
AN236	3.02
AN238	4.98
AN239	3.95
AN240P	1.88
AN241	1.55
AN245	2.54
AN247P	2.82
AN252	2.33
AN253	2.70
AN262	1.58
AN272	5.36
AN281	5.52
AN295	5.01
AN301	3.30
AN302	3.62
AN303	3.25
AN305	8.07
AN313	3.10
AN315	2.12
AN316	5.58
AN318	4.75

AN320	4.97
AN322	4.38
AN331	2.99
AN337	3.99
AN340P	1.06
AN355	3.36
AN362	1.47
AN5111	2.34
AN5132	3.99
AN5250	3.33
AN5435	2.80
AN5610	6.75
AN5613	3.72
AN5620X	4.63
AN6320N	3.89
AN6342	1.36
AN6344	4.88
AN6363	10.20
AN6551	0.56
AN6552	0.52
AN7145	2.04
AN7150	2.22
AN7151	2.05
AN7156	2.05
AN7158	2.34
AN7218	1.49
AP58076	4.25
AS580S	1.43
AU106	1.96
AU110	1.96
AU113	2.15
AY102	2.62
AY105K	1.89
AY106	1.98
BA102	0.30
BA1310 (IC)	1.72
BA1320 (IC)	1.22
BA1330 (IC)	1.82
BA145	0.17
BA154	0.08
BA155-01	0.12
BA156	0.12
BA157	0.17
BA159	0.12
BA182	0.17
BA222 (IC)	1.26
BA284/2	0.15
BA301 (IC)	0.92
BA302	0.90
BA311 (IC)	1.06
BA312 (IC)	0.98
BA313 (IC)	1.28
BA316	0.07
BA317	0.07
BA318	0.08
BA328 (IC)	0.80
BA333 (IC)	1.24
BA401 (IC)	0.58
BA511 (IC)	1.98
BA521 (IC)	1.81
BA532 (IC)	1.88
BA536 (IC)	2.72
BA6304A (IC)	2.65
BA843 (IC)	3.80
BAV10	0.10
BAV18	0.10
BAV19	0.10
BAV20	0.10
BAV21	0.17
BAX12	0.10
BAX13	0.10
BAX16	0.10
BB105B	0.22
BB119	0.15
BC107	0.13
BC107B	0.14
BC108	0.12
BC108A	0.12
BC108B	0.15
BC109	0.11
BC109B	0.13
BC113	0.12
BC114	0.17
BC115	0.14
BC116	0.20
BC116A	0.53
BC117	0.18
BC118	0.18
BC119	0.30
BC125	0.18
BC126	0.18
BC132	0.12
BC135	0.12
BC136	0.15
BC137	0.16
BC138	0.30
BC139	0.32
BC140	0.33
BC141	0.28
BC142	0.30
BC143	0.28
BC147	0.10
BC147A	0.42
BC148	0.11
BC148B	0.11
BC148C	0.11
BC149	0.10
BC149B	0.11
BC153	0.12
BC154	0.12
BC157	0.14
BC158	0.09
BC159	0.14
BC160	0.36
BC161	0.36
BC168	0.32
BC169C	0.14
BC170	0.14

BC171	0.10
BC172	0.09
BC172B	0.24
BC173	0.15
BC174B	0.24
BC177	0.18
BC178	0.23
BC179	0.23
BC182	0.08
BC182B	0.23
BC182L	0.09
BC182LB	0.12
BC183	0.09
BC183L	0.09
BC183LB	0.23
BC184	0.09
BC184L	0.09
BC184LB	0.23
BC186	0.24
BC187	0.18
BC204	0.14
BC207	0.12
BC212	0.10
BC212B	0.23
BC212L	0.09
BC212LB	0.23
BC213	0.09
BC213L	0.09
BC213LB	0.23
BC214	0.09
BC214L	0.12
BC214LB	0.23
BC225	0.24
BC237	0.09
BC238	0.09
BC238A	0.11
BC239B	0.08
BC251A	0.15
BC252	0.12
BC258	0.22
BC261A	0.20
BC262	0.20
BC287	0.45
BC294	0.45
BC301	0.36
BC302	0.30
BC303	0.34
BC307	0.09
BC307A	0.14
BC308	0.12
BC308A	0.09
BC309	0.15
BC317A	0.11
BC323	0.92
BC327	0.15
BC328	0.10
BC337	0.08
BC338	0.10
BC360	0.30
BC368	0.23
BC440	0.99
BC441	0.40
BC454	0.32
BC455	0.32
BC460	0.38
BC461	0.42
BC462	0.27
BC463	0.58
BC464	0.58
BC465	0.58
BC477	0.25
BC478	0.29
BC479	0.29
BC532	0.25
BC546	0.15
BC547	0.09
BC548	0.09
BC549	0.08
BC550	0.36
BC556	0.12
BC557	0.08
BC558	0.09
BC559	0.09
BC560C	0.10
BC635	0.18
BC636	0.18
BC637	0.18
BC638	0.18
BC639	0.18
BC640	0.18
BC879	0.28
BC880	0.28
BCX32	0.33
BCX33	0.24
BCX34	0.36
BCX37	0.80
BCY70	0.27
BCY71	0.19
BCY72	0.18
BD115	0.29
BD116	0.63
BD124	1.19
BD124P+KIT	0.62
BD131	0.38
BD132	0.38
BD133	0.48
BD135	0.32
BD136	0.32
BD137	0.32
BD138	0.41
BD139	0.27
BD140	0.33
BD144	1.30
BD150	1.08
BD157	0.80
BD159	0.40
BD160	1.45
BD163	0.64
BD165	0.56

BD166	0.38
BD168	0.86
BD175	0.39
BD177	0.39
BD179	0.44
BD181	0.90
BD182	0.90
BD183	0.90
BD184	1.10
BD187	0.40
BD189	0.35
BD190	0.59
BD201	0.54
BD202	0.54
BD203	0.54
BD204	0.54
BD207	1.00
BD208	1.00
BD222	0.44
BD225	0.44
BD228	0.57
BD229	0.63
BD231	0.45
BD232	0.44
BD234	0.38
BD235	0.43
BD236	0.45
BD237	0.38
BD238	0.29
BD239	0.44
BD240	0.36
BD240D	0.47
BD241	0.45
BD242	0.45
BD243	0.44
BD243A	0.50
BD244	0.44
BD244A	0.77
BD245C	0.88
BD246C	0.74
BD253	0.95
BD278A	0.80
BD317	1.96
BD318	2.08
BD375	0.38
BD377	0.23
BD379	0.89
BD380	0.89
BD410	0.44
BD412	5.70
BD418	0.76
BD433	0.33
BD434	0.39
BD435	0.42
BD436	0.42
BD437	0.41
BD438	0.44
BD441	1.29
BD442	0.56
BD507	0.54
BD508	0.54
BD509	1.29
BD510	0.45
BD518	1.36
BD519	1.36
BD529	0.38
BD530	0.80
BD533	0.80
BD534	0.36
BD535	0.44
BD536	0.55
BD537	0.80
BD538	0.80
BD544B	0.75
BD580	1.06
BD590	1.06
BD598	1.13
BD645	3.62
BD677	0.55
BD680	0.69
BD681	1.34
BD695	2.09
BD696	2.24
BD697	3.27
BD698	1.08
BD699	3.17
BD700	3.36
BD702	2.94
BD707	0.55
BD709	0.72
BD710	0.72
BD807	0.80
BD809	0.80
BD810	0.80
BD879	0.84
BD880	0.65
BD895	1.98
BD899	2.25
BD901	0.55
BDV64B	1.14
BDV65B	1.14
BDX32	1.50
BDX53	0.88
BDX53A	3.08
BDX54B	2.37
BDX62A	1.92
BDX63A	1.95
BDX64A	2.37
BDX65A	2.37
BDX76	0.53
BDY20	1.10
BDY62/01	4.20
BDY81	1.07
BF115	0.36
BF117	0.36
BF118	0.80
BF121	0.22
BF123	0.11
BF127	0.11

BF137	0.11
BF152	0.20
BF153	0.52
BF154	0.23
BF157	0.23
BF158	0.16
BF159	0.16
BF180	0.28
BF167	0.34
BF173	0.30
BF177	0.50
BF178	0.36
BF179	0.32
BF180	0.32
BF181	0.29
BF182	0.30
BF183	0.35
BF184	0.39
BF185	0.35
BF194	0.15
BF195	0.12
BF196	0.15
BF197	0.14
BF198	0.15
BF199	0.15
BF200	0.33
BF216	0.32
BF218	0.32
BF222	0.50
BF224	0.15
BF237	0.59
BF240	0.15
BF241	0.15
BF244	0.23
BF245A	0.33
BF255	0.18
BF256	0.25
BF256LC	0.30
BF257	0.30
BF258	0.29
BF259	0.30
BF262	0.51
BF263	0.51
BF264	0.33
BF271	0.30
BF273	0.18
BF274	0.18
BF324	0.16
BF336	0.27
BF337	0.36
BF338	0.36
BF355	0.36
BF362	0.54
BF363	0.54
BF371	0.45
BF391	0.36
BF393	0.90
BF417	1.20
BF418	1.70
BF422	0.26
BF423	0.26
BF435	0.49
BF450	0.30
BF451	0.26
BF457	0.37
BF458	0.35
BF459	0.35
BF460	0.54
BF469	0.27
BF470	0.28
BF471	0.28
BF472	0.28
BF479	0.55
BF480	0.54
BF495	0.58
BF506	0.39
BF509	0.37
BF523	0.18
BF594	0.24
BF595	0.24
BF596	0.16
BF597	0.24
BF617	0.95
BF618	0.95
BF694	0.20
BF757	0.59
BF758	0.59
BF759	0.30
BF760	0.59
BF762	0.30
BF870	0.27
BF871	0.84
BF900	0.88
BF907	1.62
BF959	0.38
BF970	0.55
BFR39	0.36
BFR52	0.45
BFR62	0.36
BFR79	0.29
BFR81	0.45
BFR86	0.98
BFR89	0.39
BFT41	0.27
BFT42	0.39
BFT43	0.39
BFT84	0.36
BFW10	0.79
BFX29	0.30
BFX30	0.59
BFX84	0.33
BFX85	0.25
BFX87	0.50
BFX88	0.30
BFX89	0.36
BFY50	0.24
BFY51	0.24
BFY52	0.24
BFY90	0.96

BLY49	2.80
BR100	0.20
BR101	0.37
BR103	0.45
BR88B	0.58
BRC-M-300	1.58
BRC116	0.80
BRC1330	1.80
BRC300	1.82
BRC4443	1.12
BRC4444	1.12
BRC5296	0.70
BRC6109	0.75
BRC82	0.98
BRC83	0.98
BRC84	0.98
BRX44	0.54
BRX49	0.45
BRY39	0.50
BRY55	0.80
BRY56	0.38
BSR59	1.17
BSS38	0.30
BSTBD1409	2.40
BSTB01405	4.37
BSTC0146	2.25
BSTC0233	2.25
BSTC0246	4.51
BSTC1233	3.91
BSTC3146	0.71
BSTCC0143	2.79
BSTC0643	3.86
BSV57B	2.06
BSW68	0.38
BSX19	0.38
BSX20	0.30
BSX21	0.45
BSY52	0.45
BSY79	0.46
BT100A	1.46
BT106	1.20
BT108	1.31
BT109	1.31
BT112	2.25
BT113	2.25
BT116	1.52
BT119	1.80
BT120	1.80
BT121	2.25
BT122	2.25
BT123	1.80
BT125	2.25
BT126	2.25
BT128	2.25
BT128P	2.79
BT129	2.25
BT151-800R	1.47
BT151 500R	1.25
BTT8018	2.20
BTT6218	2.20
BTT8024	4.82
BTT8124	4.44
BTT8214	5.44
BTT8224	2.70
BU105	1.86
BU106	2.25
BU108	1.90
BU109S	1.90
BU110	2.52
BU111Y	3.78
BU124	1.25
BU126	1.11
BU134S	4.15
BU204	1.29
BU205	0.98
BU206	1.20
BU207	1.50
BU208	0.98
BU208/02	0.98
BU208A	0.98
BU208D	1.43
BU209	1.80
BU226	2.88
BU312	2.16
BU326	0.75
BU326A	1.40
BU326S	2.25
BU406	1.35
BU407	0.74
BU407D	1.29
BU412	4.80
BU426	1.95
BU426A	1.67
BU427	2.67
BU500	1.61
BU508A	1.33
BU526	1.85
BU608D	1.42
BU806	1.29
BU806D	1.35
BU807	1.40
BU826A	2.79
BUV46	1.13
BUV84	1.12
BUN81A	3.15
BUN84	1.56
BUX84	1.47
BY126	0.11
BY127	0.11
BY133	0.11
BY164	0.50
BY176	1.38
BY179	1.42
BY182	0.95
BY184	0.42
BY187	0.70
BY189	1.28
BY198	2.30
BY201/2	1.36

BY203/20	0.18
BY206	0.17
BY207	0.22
BY210-400	0.24
BY210-600	0.27
BY210-800	0.30
BY223	0.85
BY224-400	0.90
BY225-100	0.79
BY226	0.20
BY227	0.44
BY228	0.54
BY255	0.97
BY298	0.25
BY299	0.25
BY476A	0.76
BYW56	0.30
BYX10	0.26
BYX55-350	0.40
BYX55-600	0.25
BYX71-350	0.67
BYX71-600	0.85
BYX94	0.18
BYY56	1.09
BZV15-C12	0.72
BZV15-C12R	0.72
BZV15-C24	0.72
BZV15-C24R	0.72
BZV15-C30R	0.72
BZX61 Range	0.16
BZX70-C11	0.54
BZX70-C12	0.54
BZX70-C15	0.54
BZX70-C30	0.54
BZX70-C47	0.54
BZX79 Range	0.09
BZY88 Range	0.09
BZY93-C12	0.99
BZY93-C18	0.99
BZY93-C24	0.99
BZY93-C24R	0.99
BZY93-C30	0.99
BZY93-C47	0.99
BZY93-C68	0.99
BZY93-C7V5	0.99
ZTK33	0.39
ZX18	2.47
C106D	0.46
C1129	0.52
CA1310E	2.45
CA3044	3.18
CA3046	2.23
CA3060	1.50
CA3065	1.17
CA3089	3.35
CA3089E	1.30
CA3090	1.25
CA3094	2.00
CA3131EN	2.83
CA3132EN	2.83
CAH78023N	6.00
CBF16848N-07	1.41
CD4001	0.24
CD4002	0.24
CD4008	0.96
CD4011	0.23
CD4012	0.24
CD4013	0.37
CD4016	0.37
CD4017	0.74
CD4020	0.92
CD4021	0.24
CD4023	0.25
CD4025	0.54
CD4028	0.76
CD4047	0.96
CD4049	0.52
CD4050	0.50
CD4052	0.88
CD4053	0.72
CD4069	0.23
CD4081	0.26
CD4093	0.72
CD4511	1.00
CD4517	1.06
CP5521	16.20
CV-12E	2.49
CX034	10.75
CX095D	2.85
CX104	8.49
CX108	6.92
CX109	6.92
CX121	10.75
CX130	4.90
CX131	10.75
CX134	10.75
CX136	10.75
CX137	10.75
CX139	10.75
CX157	4.40
CX158	3.44
CX170	6.92
CX177	5.99
CX506	8.40
CX507	6.92
CX758	6.92
D1693	2.35
DEC1	1.52
DEC2	1.52
E1222	0.36
E5024	0.25
E5386	0.22
E5529	0.22
E8021	1.17
E9003	0.41
E9005	0.45
ER1400	10.12
ESN310BP	3.86
ESM432C	4.18

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

ECONOMIC DEVICES, REGISTERED OFFICE: 14, BEE LANE, FORD HOUSE, WOLVERHAMPTON WV10 6LF.

All goods should be delivered within 4 working days.

ESM532C	4.18
ESM632C	4.18
ESM732C	4.18
ETT6016	2.65
ETTR6016	2.16
FND500	5.25
FT3055	1.05
GF758	0.82
GF759	1.82
GF761	0.78
GH3F	1.65
HA11211	2.30
HA11215	4.00
HA11225	3.90
HA11226	7.56
HA11229	2.51
HA11235	3.80
HA1124	4.70
HA11244	4.32
HA1125	3.90
HA11251	3.38
HA1137W	2.57
HA1138	3.56
HA11414	2.50
HA1144	6.38
HA1156	1.23
HA11580	7.80
HA1160	3.45
HA1166	3.08
HA1167	5.13
HA11711	16.13
HA11713	6.70
HA11714	7.05
HA11715	7.05
HA11718	6.79
HA11724	15.80
HA11725	16.00
HA1180	4.08
HA1203	1.56
HA1306	1.74
HA1322	1.74
HA1339	1.76
HA1342	1.80
HA1350	2.97
HA1365	3.65
HA1366WR	1.62
HA1367	3.20
HA1368	1.69
HA1368R	1.86
HA1370	2.97
HA1377	2.08
HA1389	1.62
HA1389R	1.74
HA1392	2.08
HA1397	2.97
HA1398	2.88
HA1406	1.80
HA17723	5.40
HBF4030AF	2.25
HD4480	15.00
HD44801A05	15.90
HM6231	8.50
HM6232	7.71
HM9102	2.92
HM9104	2.94
HT4207	15.80
IS689	1.87
IS751	1.87
ITT2003	0.20
K174YP	2.95
KA2101	2.65
KC581C	5.47
KC582C	3.45
KC583C	4.80
L129V	1.78
L200CV	1.88
LA1111AP	0.80
LA1201	0.90
LA1210	1.38
LA1320	1.46
LA1352	1.40
LA1357N	5.90
LA1364	2.74
LA1365J	2.79
LA1385	1.70
LA1387	4.57
LA3155	0.90
LA3300	1.40
LA3301	1.28
LA3350	1.30
LA3361	1.30
LA4030P	2.37
LA4031P	3.80
LA4032P	1.48
LA4050P	1.42
LA4051P	1.62
LA4100	1.62
LA4101	1.18
LA4102	2.55
LA4112	4.35
LA4125	2.46
LA4138	2.00
LA4140	0.80
LA4192	2.08
LA4220	1.34
LA4400	2.04
LA4420	1.56
LA4422	1.56
LA4430	1.48
LA4460	1.92
LA4461	2.80
LA5112N	1.62
LA7020	6.06
LA7025	7.31
LA7800	2.12
LA7801	3.00
LD3120	1.20
LM1011N	2.95
LM1017N	1.96

LM1303P/N	1.50
LM1310P/N	1.25
LM3065N	0.77
LM317CKC	1.30
LM339N	0.88
LM3407	1.29
LM340T5	0.75
LM340T12	0.75
LM340T5	0.75
LM342N	0.56
LM384N01	1.84
LM567CN	1.30
LM748	1.65
LM8360	2.78
LM8361	2.78
M1024	2.55
M1025	4.70
M1124	2.54
M1130	4.86
M191	5.74
M193	18.55
M51102L	4.02
M5115P	4.34
M51231P	2.79
M5124P	4.38
M5134-9341	3.75
M51394P	6.25
M5142P	4.38
M5143P	6.06
M5144P	3.42
M51513L	2.06
M51515BL	3.10
M51516L	3.40
M51517L	2.90
M5152L	1.00
M51522	4.90
M5191P	4.49
M5192	2.00
M53273P	0.92
M53274P	1.20
MA06	0.97
MA8001	0.74
MB3705	1.62
MB3712	2.65
MB3713	1.30
MB3730	2.94
MC13002	4.06
MC1303P	1.96
MC1307P	1.90
MC1310P	1.25
MC1327P	1.20
MC1330P	1.23
MC1349P	1.20
MC1350P	1.10
MC1351P	0.75
MC1352P	1.01
MC1357P	1.95
MC1358P	1.55
MC14001	7.15
MC14011	0.23
MC14013	0.37
MC14016CP	0.37
MC14025	0.54
MC14049UBC	0.52
MC1438R	0.95
MC14493P	2.56
MC14510BAL	3.15
MC14556BCP	3.15
MC1712	3.52
MC7724CP	3.17
MC7818C	1.98
MC7824CP	4.25
MC78M12	0.75
MC78M24	0.85
MCR101	0.80
MCR106/5	1.17
MCR220/7	1.34
ME0402	0.27
ME0404	0.23
ME0404/2	0.42
ME0411	0.45
ME0412	0.21
ME4102	0.45
ME545B	9.10
ME6002	0.23
ME6102	0.45
ME8001	0.26
MJ2501	4.95
MJ2955	1.34
MJ3000	2.15
MJ3001	1.30
MJ3028	2.40
MJ481	1.39
MJ802	4.95
MJE2955	1.71
MJE3055	0.78
MJE340	0.44
MJE520	0.44
ML231	2.28
ML232B	3.30
ML237B	2.28
ML238	4.02
ML741CS	0.36
ML923	2.18
ML0926	3.25
MM5314N	3.72
MM5316N	3.72
MM5318N	2.82
MM5369N	1.82
MM5387AA/N	11.50
MM5841N	5.90
MP8112	1.35
MP8113	1.35
MP8512	1.23
MPF256C	0.54
MPS6570	0.43
MPSA42	0.59
MPSA56	0.24
MPSA92	1.11

MPSU05	0.78
MPSU10	0.78
MPSU55	0.90
MPSU56	0.30
MPSU60	1.20
MR510	0.30
MR812	0.80
MR914	0.46
MSSD7002	0.65
MVS240	0.52
MVS460	0.30
MVS460-02	0.55
ME545B	2.95
ME545B	3.88
ME5534N	1.48
ME555	0.34
ME556	0.75
ME5560N	3.16
ME565N	1.28
ME645BN	3.80
ME646N	3.80
ME650N	3.94
ME645BN	3.80
MP1106	4.80
OA200	0.10
OA202	0.10
OA47	0.10
OA90	0.07
OA91	0.08
OA95	0.08
OC28	0.96
DC29	1.95
OC35	0.96
OC36	1.16
OC44	0.40
DC45	0.40
OC75	0.40
ON188	1.70
ON236	2.90
DT112	0.98
OT121	0.70
PD144	2.83
PT1017	2.43
PT2014	2.76
PT8042	1.82
R1038	1.99
R1039	1.99
R2008B	1.20
R2009	1.20
R2001B	1.20
R2029	1.20
R2030	1.20
R2257	2.16
R2265	1.95
R2305	1.07
R2306	1.23
R2322	1.26
R2323	1.23
R2348	1.82
R2354A	1.82
R2354B	1.82
R2441	1.23
R2443	0.80
R2461	2.10
R2477	0.92
R2501	1.16
R2540	1.80
R2540X	3.00
R2615	0.80
RC4195NB	1.96
RCA16029	1.82
RCA16083	4.81
RCA16334	0.92
RCA16335	1.23
RCA16600	1.25
RCA16799	2.16
RCA16801	0.86
RCA16802	0.98
RCA17028	2.25
RCA17074	6.00
RCA17376	1.43
RCA60857	4.50
RGP10	0.45
RT402	1.40
RT905A	2.80
S0280	1.94
S0281	1.94
S041P	1.26
S042P	1.46
S1299	4.30
S175	18.95
S2062D	1.88
S2800	5.25
S2800D	2.55
S2802	3.15
S3702S	4.73
S3703F	4.73
S3707	3.92
S40W	7.99
S551	4.12
S552	4.12
S6080B	2.75
S6087AR	4.45
SAA1020	4.32
SAA1021	4.32
SAA1024	2.55
SAA1025	4.70
SAA1050	3.78
SAA1051	5.30
SAA1061	3.28
SAA1075	4.41
SAA1082	8.04
SAA1121	4.32
SAA1124	2.55
SAA1130	4.86
SAA1174	5.75
SAA1250	3.78
SAA1251	5.30
SAA5000	3.85

SAA5010	4.90
SAA5012	6.50
SAA5020	5.25
SAA5030	7.50
SAA5040A	14.75
SAA5050	8.50
SAA661B	1.80
SAA700	3.00
SAB1009B	4.53
SAB1046P	3.86
SAB3011	7.34
SAB3012	5.34
SAB3013	3.28
SAB3021	7.18
SAB3022B	12.34
SAB3023B	11.18
SAB3024	4.77
SAB3209	4.75
SAB3210	2.93
SAB4209	12.75
SAF1031	2.30
SAF1032	5.80
SAF1039	11.66
SAS5010	7.62
SAS560	1.08
SAS560S	2.97
SAS560T	2.85
SAS570	1.61
SAS570S	0.80
SAS570T	2.50
SAS580	4.41
SAS5800	2.62
SAS590	4.55
SAS5900	2.32
SAS660	2.50
SAS6600	1.20
SAS660S	1.20
SAS6610	1.20
SAS670	2.50
SAS6700	1.20
SAS670S	1.20
SAS6710	1.20
SAS6800	2.30
SAS6810	1.30
SBA550B	1.95
SBA750	1.46
SC9488P	1.90
SC9503	1.50
SC9504P	1.46
SC9511P	1.90
SCR957	1.20
SG264A	4.38
SG613	7.08
SG629	6.28
SG6533	9.37
SI-1020N	4.76
SI-1125HD	10.70
SI-1130N	6.30
SKB2/08	0.70
SKE2F 1/04	1.26
SKE2G 2/04	0.95
SKE2G 3/04	0.95
SKE4F 1/02	1.26
SKE4F 1/06	0.66
SKE4F 2/06	2.10
SKE4F 2/08	0.80
SKE4G 2/02	0.87
SKE5F 3/10	1.45
SL1310	2.85
SL1327E	1.20
SL1430	1.26
SL1430T	2.10
SL1432	2.25
SL414	3.35
SL432A	3.12
SL437	6.00
SL439	2.25
SL480	5.00
SL490	1.78
SL901B	6.08
SL917B	7.95
SL918A	5.63
SN0848	8.82
SN16861N-07	1.59
SN16862N-07	1.08
SN16880N	3.30
SN16985	8.13
SN16966N	5.49
SN29715N	5.49
SN29716N	3.32
SN29717N	6.53
SN29722	10.65
SN29723AN	6.95
SN29744N	2.08
SN29764AN	3.38
SN29767	3.61
SN29770AN	2.04
SN29771BN	4.23
SN29772BN	4.21
SN29773	2.28
SN29791	1.51
SN29796N	3.89
SN29845	2.14
SN29848	1.86
SN29861	2.08
SN29862	2.08
SN72709	0.40
SN7400N	0.24
SN7401N	0.24
SN7402N	0.59
SN7404N	0.21
SN7408N	0.24
SN7410N	0.24
SN74121	1.20
SN74122	0.95
SN7413N	0.33
SN74141	1.41
SN74151AN	1.51
SN74154N	1.15

SN74190	1.81
SN7420N	0.30
SN7430	0.28
SN7440N	0.24
SN7473	0.56
SN7474N	0.72
SN7490AN	0.93
SN75110N	0.75
SN76001ANQ	2.25
SN76003N	2.81
SN76013N	3.63
SN76013ND	2.25
SN76013NDG	8.07
SN76023N	2.35
SN76023ND	1.04
SN76033N	2.33
SN76105N	2.36
SN76110N	1.13
SN76115AN	1.46
SN76131	1.74
SN76226DN	1.20
SN76227N	0.88
SN76228N	2.97
SN76231	2.31
SN76242	4.75
SN76243	4.75
SN76322	2.51
SN76360	1.97
SN76390	2.80
SN76396	2.63
SN76510N	0.95
SN76530P	1.90
SN76532N	1.80
SN76533N	1.56
SN76540N	1.80
SN76544	1.60
SN76545	4.55
SN76546	3.15
SN76546N	3.15
SN76549	2.35
SN76550	0.30
SN76551	1.35
SN76570	2.80
SN76600	1.10
SN76611	2.35
SN76620	2.35
SN76622	1.50
SN76623	0.62
SN76630	2.31
SN76640	3.85
SN76650N	1.24
SN76651	1.35
SN76660N	2.25
SN76665N	1.35
SN76666N	0.98
SN76705	3.38
SN76705N	3.99
SN76707N	3.99
SN76709	4.65
SN76709N	4.95
SN76730	4.23
SN76810N	0.62
SN76920N	2.63
SN94041	3.45
SN94042	3.95
SP8385	0.50
STA441C	2.27
STK0029	3.42
STK0039	4.00
STK0050	4.96
STK0059	6.48
STK0080	8.32
STK011	3.86
STK013	7.04
STK014	7.14
STK015	5.12
STK016	4.82
STK022	4.77
STK025	7.20
STK040	7.09
STK043	7.09
STK054	6.48
STK070	20.28
STK077	7.00
STK078	5.52
STK082	7.54
STK086	9.90
STK2101	5.74
STK2110	6.66
STK2230	6.66
STK415	6.04
STK433	9.35
STK435	5.44
STK436	5.70
STK437	8.10
STK439	6.26
STK441	8.96
STK443	9.35
STK459	6.56
STK460	5.78
STK461	7.14
STK463	8.06
STK465	7.32
STK466	10.70
STK501	5.74
STK502	5.74
STR441	6.34
STR453	6.75
STR6020	7.20
T6007V	0.69
T6007N	0.82
T6016	0.36
T6017	0.65
T6018V	0.65
T6021	0.36
T6022V	3.56
T6026	0.89
T6027	0.73
T6028V	0.35

T6029V	4.41
T6032V	0.89
T6033V	0.73
T6035V	0.06
T6036	0.44
T6037	1.91
T6041V	0.06
T6044V	0.06
T6045	1.09
T6049	1.10
T6052V	0.76
T6058	0.46
T6059	1.05
T9001V	1.09
T9003V	0.06
T9005V	2.16
T9010V	0.87
T9011V	1.27
T9013V	5.81
T9014V	1.52
T9016	0.92
T9022N	0.39
T9034V	1.25
T9035V	1.26
T9038V	6.15
T9051	2.55
T9053V	1.03
T9054V	0.92
T9057V	0.63
T9063V	2.94
TA5814	1.35
TA7020P	4.36
TA7027	4.36
TA7050	1.58
TA7051	1.58
TA7060AP	0.60
TA7061AP	0.78
TA7069	2.84
TA7070P	1.52
TA7071	3.35
TA7072P	1.35
TA7073P	4.05
TA7074P	1.95
TA7076P	4.95
TA7089N	1.41
TA7089P	1.36
TA7092P	3.85
TA7093P	1.64
TA7102P	5.34
TA7108P	1.40
TA7109	3.37
TA7120P	0.58
TA7122B/P	0.54
TA7124P	2.00
TA7130P	1.15
TA7136AP	1.15
TA7137P	0.85
TA7141AP	3.51
TA7146P	8.04
TA7148P	1.51
TA7149P	2.10
TA7153P	4.53
TA7161P	5.66
TA7162P	4.25
TA7169	4.80
TA7171P	2.53
TA7172P	1.28
TA7176P	2.25
TA7193P	4.44
TA7201P	3.25
TA7202P	2.24
TA7203P	1.95
TA7204P	1.95
TA7205	1.25
TA7208P	1.95
TA7210P	3.25
TA7214P	2.90
TA7215P	2.09
TA7217AP	1.36
TA7222	1.95
TA7227P	1.69
TA7229P	4.10
TA7310P	1.95
TA7313AP	1.36
TA7314	5.10
TA7609	3.00
TA7611AP	3.54
TA7676P	3.05
TAA300	2.99
TAA310A	0.27
TAA320A	1.15
TAA350A	1.62
TAA435	1.65
TAA550	0.33
TAA570	1.58
TAA611B12	1.50
TAA621AX1	2.00
TAA630S	3.31
TAA640	3.85
TAA661B	1.59
TAA700	2.35
TAA840	2.27
TAA930	4.42
TAA970	2.57
TAD100	1.91
TAG232-600	0.86
TAG626-600	0.84
TBA120	0.95
TBA120A	0.95
TBA120AS	0.95
TBA120S	0.95
TBA120SB	0.95
TBA120T	0.95
TBA120U	0.95
TBA120UB	3.47
TBA1440	2.08
TBA1440G	3.40
TBA1441	1.59
TBA240A	3.42

TBA395	1.35
TBA395Q	1.80
TBA396	1.80
TBA400	2.17
TBA440P	1.55
TBA480	1.42
TBA480Q	1.67
TBA500PQ	4.95
TBA510	1.55
TBA510S	6.39
TBA520	1.67
TBA520Q	1.35
TBA530	0.86
TBA530Q	0.85
TBA540	0.98
TBA540Q	1.15
TBA550	1.95
TBA550Q	2.25
TBA560C	0.86
TBA560CQ	1.15
TBA570	1.55
TBA570A	1.55
TBA570Q	1.35
TBA625A	1.97
TBA625B	1.97
TBA625C	1.97
TBA641A12	3.75
TBA641BX1	2.07
TBA651	1.80
TBA673	2.35
TBA700Q	2.19
TBA720	2.85
TBA730	1.75
TBA750Q	1.46
TBA760	1.55
TBA780	3.00
TBA800	0.00
TBA810AS	1.46
TBA810S	1.46
TBA810T	1.46
TBA820	0.83
TBA820M	1.65
TBA890	1.85
TBA900	2.25
TBA920	1.50
TBA920Q	2.10
TBA940	1.70
TBA950	1.55
TBA970	2.08
TBA970Q	2.98
TBA990	1.65
TBA990Q	1.95
TBA231	2.33
TC4001	1.29
TC4053BP	3.94
TCA150	1.62
TCA160B	1.62
TCA270Q	1.55
TCA270S	1.95
TCA270SQ	1.65
TCA290A	2.05
TCA420A	1.90
TCA440	1.65
TCA4500A	1.95
TCA530	1.80
TCA640	2.63
TCA650	1.85
TCA660B	2.63
TCA730	3.84
TCA740	2.25
TCA750	1.75
TCA760B	2.79
TCA800	1.65
TCA800Q	2.25
TCA830S	1.94
TCA900	1.85
TCA910	1.50
TCA940E	1.68
TCE330	3.53
TCE527	1.37
TCE82	0.98
TCE83	0.98
TCE84	0.98
TCEP100	4.80
TCEP100Q	9.31
TD190	0.54
TD3F700H	6.00
TD3F800H	2.25
TD3F800R	3.21
TD3F900H	3.78
TD3F900R36	3.78
TDA1001A	2.10
TDA1003A	2.15
TDA1004A	2.15
TDA1005A	2.15
TDA1006A	2.15
TDA1010	2.43
TDA1011	2.60
TDA1028	2.22
TDA1029	4.44
TDA1034B	2.20
TDA1035T	1.83
TDA1037	1.45
TDA1041	1.96
TDA1044	1.61
TDA1047	2.14
TDA1054M	1.10
TDA1059B	0.98
TDA1060	2.01
TDA1062	2.65
TDA1104	5.95
TDA1151	0.65
TDA1170	2.15
TDA1170S	1.85
TDA1180	2.25
TDA1190	1.91
TDA1190Z	2.25
TDA1200A	1.30
TDA1220	2.25

TDA1230	2.93
TDA1235	3.52
TDA1270	2.84
TDA1327A	1.65
TDA1327B	1.65
TDA1330	1.80
TDA1365	6.35
TDA1412	0.95
TDA1420	1.48
TDA1470	2.63
TDA1512	2.20
TDA1670	3.85
TDA1770	5.56
TDA1905	1.25
TDA1908	2.95
TDA1910	2.38
TDA1940	2.54
TDA1950	2.54
TDA2002	1.20
TDA2003	1.05
TDA2004	2.52
TDA2006	1.25
TDA2010	2.79
TDA2020	2.75
TDA2030	1.65
TDA2140	1.44
TDA2150	5.63
TDA2151	1.75
TDA2160	3.64
TDA2161	1.68
TDA2190	3.11
TDA2510	1.82
TDA2520	2.15
TDA2521	2.15
TDA2522	2.81
TDA2523	2.75
TDA2524	4.50
TDA2525	2.96
TDA2530	2.19
TDA2532	2.51
TDA2533	2.09
TDA2540	1.95
TDA2541	1.95
TDA2545Q	3.16
TDA2560	1.97
TDA2571A	2.81
TDA2575A	2.95
TDA2576A	2.58
TDA2577	5.31
TDA2581	1.95
TDA2582	1.98
TDA2590	2.80
TDA2591	2.80
TDA2591Q	2.80
TDA2593	2.24
TDA2594	2.80
TDA2600	5.00
TDA2610	2.53
TDA2611A	1.25
TDA2611AQ	2.55
TDA2612Q	4.25
TDA2620	1.96
TDA2630	2.34
TDA2631	2.48
TDA2640	2.25
TDA2643	6.93
TDA2651	2.95
TDA2652	7.05
TDA2653	2.95
TDA2654	2.91
TDA2655B	3.15
TDA2660	2.24
TDA2661	2.24
TDA2670	2.50
TDA2670A	1.76
TDA2680	2.30
TDA2690A	2.40
TDA2780AQ	2.18
TDA2790Q	5.92
TDA2791	2.50
TDA2795	2.95
TDA2800	6.12
TDA3000T	2.31
TDA3030A	10.44
TDA3190	1.75
TDA3300B	7.75
TDA3500	5.95
TDA3501	10.99
TDA3506	10.12
TDA3510	5.95
TDA3520	8.82
TDA3521	12.17
TDA3560	6.87
TDA3561	7.50
TDA3571Q	2.25
TDA3571A	5.67
TDA3576	4.76
TDA3950	2.81
TDA3950B	1.40
TDA4050A	3.15
TDA4180P	1.74
TDA4260	1.40
TDA4280	6.45
TDA4290	4.06
TDA440	1.95
TDA4400	2.06
TDA4420	4.25
TDA4422	5.63
TDA4430	4.34
TDA4431	2.06
TDA4432	2.06
TDA4440	2.52
TDA4600	2.58
TDA4610	2.42
TDA4620	4.50
TDA5500	2.48
TDA5600	2.08
TDA5700	2.10
TDA9403	2.90

TDA9503	2.60
TDA9513	2.40
TE527	1.25
TE538	0.36
TE626	1.35
TEA1002	3.15
TEA1009	0.96
TEA1020SP	5.34
TEA1087	0.46
TIC106C	0.55
TIC106M	0.55
TIC116D	0.80
TIC44	0.65
TIC45	0.70
TIC47	0.70
TIP120	0.96
TIP110	0.48
TIP112	0.80
TIP117	0.86
TIP120	0.73
TIP121	1.08
TIP126	0.96
TIP127	1.30
TIP2955	0.78
TIP29A	0.41
TIP29B	0.57
TIP29C	0.40
TIP3055	0.65
TIP30A	0.41
TIP30B	0.63
TIP31B	0.35
TIP31C	0.63
TIP32B	0.35
TIP32C	0.66
TIP33C	1.25
TIP34	1.07
TIP41A	0.39
TIP41B	0.28
TIP41C	0.44
TIP42A	0.39
TIP42B	0.71
TIP42C	0.44
TIP47	0.65
TIP48	0.83
TIP49	3.28
TIS43	1.21
TIS90	0.22
TIS91	0.26
TL071CP	2.02
TMS1000NL	10.78
TMS3748NS	11.66
TMS4116	1.87
TV106	1.20
TY6010B	2.70
U05G	1.03
U143M	2.80
U3700	0.55
U37003	0.44
UA723CA	5.02
UA758PC	3.06
UA783P3C	1.07
UAA170	2.14
UAA180	2.14
ULN2165	1.35
ULN2204	7.00
ULN2216F	1.95
UPC1001H	2.50
UPC1009C	5.74
UPC1020H	2.12
UPC1025H	2.49
UPC1026C	1.24
UPC1028H	0.90
UPC1030H	2.06
UPC1031H	8.05
UPC1031H2	6.00
UPC1032H	0.94
UPC1154H	1.75
UPC1156H	1.45
UPC1181H	1.25
UPC1182H	1.82
UPC1185H	2.94
UPC1186H	0.95
UPC1212C	0.95
UPC1213C	0.95
UPC1217C	2.24
UPC1350C	1.75
UPC1351C	1.64
UPC1353	6.75
UPC1360C	4.10
UPC1362	7.95
UPC1365	5.79
UPC1366	4.23
UPC1458	7.87
UPC2002	1.48
UPC30C	2.22
UPC32C	4.49
UPC41C	3.72
UPC554C	1.68
UPC558C	3.67
UPC566H	2.78
UPC572	3.51
UPC575C2	3.72
UPC576H	2.60
UPC577H	0.64
UPC587C2	2.34
UPC592H	1.02
UPD1514C	7.56
UPD851	14.39
UPX27C	1.98
X0022CE	3.67
X0035TA	4.35
X0056CE	3.90
X0062CE	4.95
X0085CE	3.48
X0109CE	6.10
X1074AF	6.36
XC949P	1.20
Y730	0.24
Y969	0.60

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

Long-distance Television

Roger Bunney

September was a very poor month for long-distance signal propagation of all types. By tradition, September is usually a good month for tropospheric reception. Not this time however. The rains have caught up with those who spent a dry, hot summer! There was the usual autumn SpE decline, so there's little to report. Solar storms and associated ionospheric disturbances towards the end of the month produced auroral activity – from the 17th onwards – though the effects of this were restricted to northern locations. The main auroral activity occurred on the 23rd and 30th. This month's short SpE/auroral log is as follows:

7/9/84 TSS (USSR) ch. R1; ARD (W. Germany) E2.
8/9/84 TVE (Spain) E2.
9/9/84 TSS R1, 2; TVP (Poland) R1, 2; CST (Czechoslovakia) R1, 2; ORF (Austria) E4; ARD E2, 4; +PTT (Switzerland) E2, 3; JRT (Yugoslavia) E3; RAI (Italy) IA; TVE E2, 4.
10/9/84 TSS R1, 2; TVP R1, 2; CST R1.
11/9/84 TSS R1, 2; TVP R2; CST R1, 2; ORF E2a; JRT E3, 4.
12/9/84 TSS R1.
13/9/84 TVE E2, 3.
17/9/84 Auroral activity noted in Band I.
23/9/84 Strong auroral activity throughout Band I, with signals (of sorts) seen on all channels – though with the usual identification problems. RTE (Ireland) IB.
29/9/84 TVE E2.
30/9/84 Strong auroral activity in Band I.
1/10/84 CST R1; ORF E2a.

My thanks to Dave Shirley (Hastings), Cyril Willis (Ely), Paul Barton (Harrogate), Simon Hamer (Powys) and Iain Menzies (Aberdeen) for sending in reception reports. Dave mentions that the present World Television Club series (Antenne-2, TDF) has come to an end. It will be resumed next year.

TV Pirates – UK Style

On the evening of October 7th a pirate TV transmitter was noted testing from 1930 on ch. E28 with the caption "Thameside TV". Observations from the Esher and Teddington areas suggest that the station's location is in the Croydon/Thornton Heath area. The caption features a circle within which there's an outline of London buildings and the "Thameside TV" identification – a further identification, "Channel 28 Thameside TV", appears at the bottom. The background colour is orange and the sound channel carries music. The transmission continued for several hours, with programmes from 2200. The sound is also transmitted at 90·5MHz (f.m.). Press reports earlier in the week had suggested that the transmissions would be on ch. E36.

Thameside returned at 2200 on the 8th, with programmes from 2300 until 0100. On the 9th a pirate transmission with excellent quality was received in the Twickenham area with the carrier some 1MHz below ch. 21. The identifications were "36" and "Late Night London Television" – there were no signs of signals on ch. 36. Programmes started at 0100 and continued until 0230, with pop videotapes and an Egyptian film – the programme content is intended for Greek/Arabic viewers. It was announced that this "test transmission" will be followed by future programmes. It seems that the London airwaves could become an interesting field for late night DXing.

News Items

UK: The Dolby company is working on a stereo TV sound system using delta modulation as a possible alternative to the digital system proposed by the BBC.
France: Although Canal Plus transmissions started on November 4th, scrambling is not likely to be used before January 1985 – the idea is to get some initial publicity for the programming on offer. Apparently over 100,000 subscribers had signed up by the end of September. Boulogne and Amiens-St. Just will operate on ch. F10.
Denmark: Some independent (of Danmarks Radio) low-power local TV transmitters are now in operation, including Horsens ch. E52 (seen at over 100 miles during tropospheric openings), Copenhagen-1 E52, Odense E53, Aarhus E54, Copenhagen-2 E56 and Bornholm E59.

Satellite Equipment

Frank Lumen has sent further details of his satellite reception in Colorado (see last month). His garden sited parabolic dish is a 12ft diameter mesh type with a gain of 41dBi and a beamwidth of 1·5°: it can be swung from 53°W to 143°W and elevated to 45°. The LNA is a 90°K Aventek that feeds a Dex downconverter mounted just below the actuator arm. The receiver is a Drake ESR240 with infra-red remote control. Interesting that the downcoverter provides a single conversion to 70MHz at 72Ω, with an image rejection figure of 20dB. The receiver has an i.f. bandwidth of 25MHz (−3dB) and a threshold at 8dB carrier-to-noise ratio. The audio is tunable and the modulated output is available on ch. A2 or A3 at 3mV.

We've received information from North East Satellite Systems on some relatively inexpensive dishes and supports they can supply. A 1m diameter dish complete with stand, elevation/azimuth adjustment mount and a feed tripod is available at £140 plus VAT and carriage (depends on distance). The dish is of spun aluminium and is accurate to within ±3mm. It can be used at 4 or 12GHz but as there's little margin for signal attenuation, e.g. in wet weather, a 1·5m dish has also been produced. Both Hugh Cocks and North East can supply electronics for Music Box and other downlink transponders in the 11-12GHz band. For rock music fans North East offer a stereo decoder/expander for disco use, taking its feed from a satellite baseband output receiver. The cost of the 1·5m dish assembly, based on an initial production run of 50, is quoted as £249 plus VAT. For further information write to the company at Cropton, Pickering, N. Yorkshire – telephone 075 15 598.

Wideband Band I Aerial

Weston Developments (33 Cherville Street, Romsey, Hants SO5 8FB) have introduced a new four-element wideband (47-68MHz) Band I array with the emphasis on higher gain. The elements are spaced for optimum gain over the band, matching back to 75Ω unbalanced with an in-line matching cable section. A 1:1 balanced-to-unbalanced ferrite transformer is available for use with this and other aerials in the WB1-4 series. Gain is 2dBd at 50MHz rising to 5·5dBd at 65MHz with the front:back ratio typically 20dB. Wideband aerials for the higher OIRT channels R3-5 and the OIRT 67-73MHz f.m. band are also available.

TV Station List

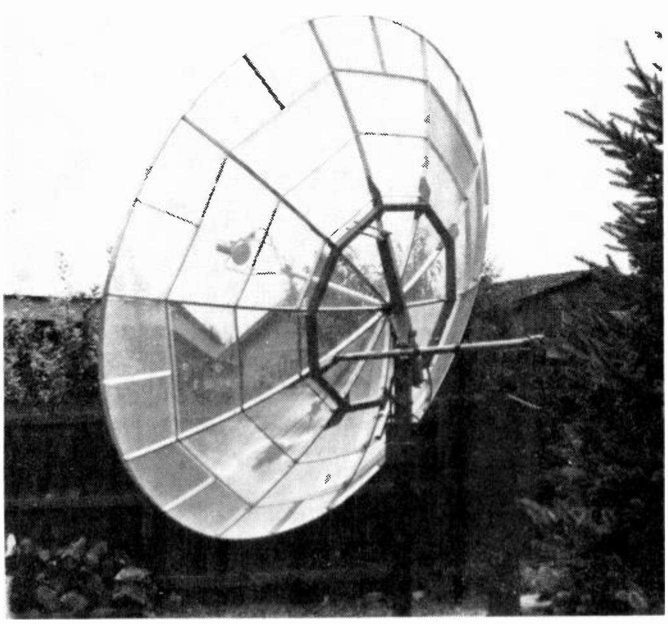
The EBU's "List of European Television Stations, No. 29" is now available at 750 Belgian Francs from the EBU, 32 Avenue Albert Lancaster, B-1180, Bruxelles, Belgium. This annual publication lists TV transmitters with powers down to mW operating in the European broadcasting area, including N. Africa and the closer Middle East, and is updated bimonthly with supplements. Highly recommended to all TV-DXers.

Circular Polarisation

In his Technical Topics column in *Radio Communication* (September 1984) Pat Hawker mentions the use of circular polarisation, particularly in Band II. The advantage is that reception is more acceptable and siting less critical with the types of aerials commonly used with portable receivers. For amateur satellite reception, crossed Yagi arrays with a phasing harness for switching between rotation modes gives circular polarisation. Bill Sykes (G2HCG), well known in the aerial industry and previously associated with J-Beam, has designed a device called "Polaplex" for use with crossed Yagi arrays: it provides accurate matching and control of the phasing between the two feeders over a full 360° so that all polarisation modes can be catered for using a control next to the receiver. This would make it easy to optimise reception from a satellite as it passes across the sky and might also make it possible to minimise ghosting and co-channel interference problems. It's hoped that the device will be made available commercially though there are no firm plans to do so at the time of writing.

TV from the Air

In the late 60s there was great press excitement when Ronan O'Rahilly announced that he intended to start commercial u.h.f. TV transmissions from an aircraft flying a figure-of-eight over the North Sea. No more was heard of it however and nothing was seen. The subject of airborne transmissions came up recently in an American magazine. In addition to a project for Band III transmissions from a Super Constellation flying over Vietnam a considerable number of test transmissions were carried out in the USA. Harry Caul (KIL9XL) writes that radio transmissions at 19,100kHz and 532kHz with "This is the Voice of Blue Eagle" were heard over a wide area. The FCC took no action apart from announcing that the pirate station had been warned of the penalties, and it subsequently transpired that the transmissions were being organised by the military to gain information on coverage at various heights. It seems that a converted C121 was used as a flying radio/TV studio. These tests continued throughout 1964, then ceased. In 1965 the aircraft was used over the Dominican Republic following an attempted revolt and in 1966 it appeared over Saigon with two u.h.f. TV transmitters aboard – though there were no u.h.f. receivers in the area at the time! Rumour has it that some 1,500 receivers were subsequently distributed to the local population, and a second TV plane arrived. The planes seem to have operated at 20,000ft, on ch. A12. Information is rather vague however – has anyone more substantial details?



Frank Lumen's 12ft. dish in Colorado, USA.

Band I

The use of cordless phones in the 49MHz band has been a considerable nuisance to TV-DXers in recent times. Their use has now become a criminal offence and if a unit is attached to the public network BT are obliged to report this to the DTI – prosecution could result in a fine of £2,000 for both the user and retailer, with the latter's stocks liable to be seized.

A further 60 special permits for operation in the 50-

52MHz band are expected any time now. The RSGB's 50·05MHz beacon is operating on a 24-hour basis at 15W from the Potters Bar HQ, using crossed dipoles.

From our Correspondents . . .

Reg Roper (Torpoint) has been experimenting with CB aerials. He's found that two "Firestick" CB mobile aerials fitted on to an X 90° insulator work very well as a DX-TV aerial! I'd anticipate that direct connection to a 75Ω coaxial feeder would result in considerable mismatch, though this could be corrected by using a transistor amplifier for each element, combining down to 75Ω. Since 2 × 27MHz = 54MHz performance could be good – further details are awaited.

Robert Copeman (Melbourne, Australia) reports that closure of SBS-TV ch. 0 has been delayed until 1986 to allow more people to obtain u.h.f. sets (there are at present parallel transmissions on chs. 0 and 28).

I've received a long letter from Peter Tomlinson (Bristol), who works for the r.f. design company Iosis, following comments in this column on microcomputer interference. He says that the AR2001 general-coverage receiver seems to suffer from poor cross-modulation performance, with breakthrough from police, radio amateurs, radar and other sources. Others have reported this problem in areas where there's a strong local group A u.h.f. TV signal and Lowes (Matlock) apparently have available a modification sheet to overcome it. Peter continues: "There's a new generation of high-resolution video display units at present being designed with video dot rates in the range 200-300MHz. One display designer tells me that he can stop radiation through the c.r.t. by using a metal shield that acts as a waveguide. Properly designed, this blocks r.f. The video signals have large components at submultiples of the dot rate however. The same designer reports that the electronics generating the digital video signals seem to be more of a problem from the radiation point of view than the c.r.t." All this suggests increasing interference problems ahead. Perhaps the DTI should introduce legally enforceable standards as required by the FCC in the USA rather than guidelines.

East Germany

An official DFF transmitter list has been published by *Tele-Audiovision*. The channels for the first and second services respectively are as follows (V = vertical polarisation, H = horizontal):

Berlin	E5 H	E27 H	Leipzig	E9 V	E22 H
Brocken	E6 H	E34 H	Lobau	E27 H	E39 H
Dequede	E12 V	E31 H	Marlow	E8 H	E24 V
Dresden	E10 V	E29 H	Schwerin	E11 H	E29 H
Helpterberg	E37 H	E22 H	Sonneberg	E12 H	E33 H
Inselberg	E5 H	E31 H	Cottbus	E4 H	
Karl Marx Stadt	E8 H	E32 H			

The Cottbus E4 transmitter may close in 1986, transmissions moving to ch. E53.

Teletopics

CABLE CONFIDENCE FADES

The two largest operators in the UK cable TV industry, BET (Rediffusion) and Electronic Rentals Group (Visionhire), have decided to pull out. In addition, Thorn EMI is reconsidering the extent of its financial commitment to CATV. The Visionhire East Kilbride network is being closed and other networks will be continued only until contractual commitments come to an end. The company will not participate in any further cable TV activities. BET is selling its Rediffusion cable interests, subject to Home Office and DTI approval, to Robert Maxwell's Pergamon Press for £11 million. Rediffusion had the "showcase" Guildford cable TV franchise, which was expected to be the most successful of the systems approved last year, but had been unable to raise the £30 million it would have required to install the cables. Robert Maxwell, whose other interests include the British Printing and Communications Corporation and Mirror Group Newspapers, is also chairman of the small and so far loss-making cable company SelecTV. He now becomes the UK's largest cable operator and it will be interesting to see whether he can make a go of cable where others have so far largely failed.

BET and ERG both blame delays in getting cable TV started, and the changes in the treatment of capital allowances introduced with the last budget, for their decisions to withdraw from cable TV. As David Hurley, managing director of ERG, put it "we now believe that the prospects of generating meaningful profits from this area on a normal commercial time-scale are too remote to justify our continued involvement". Thorn EMI says it has no intention of pulling out but is looking for minority shareholders to assist with financing some of its franchises.

Earlier this year (see Teletopics, July) BET sold its Rediffusion TV rentals operation to Granada. This has led to union trouble since Granada recognises the electricians' union EEPTU while Rediffusion recognises the General, Municipal and Boilermakers' Union. Strike action has been threatened over Granada's plans to rationalise the Rediffusion operation.

HIGH STREET CHANGES

Changes are afoot amongst the high street electrical chains. Dixons, which has 280 stores, has announced a take-over bid for the family-run Currys group which has 531 outlets plus 25 Bridgers discount centres and 16 Carousel Colourhire shops. The bid follows the announcement of poor interim results by Currys and is being opposed by the Currys board. It seems that Dixons' trading has not been as badly affected as most other electrical retailers in recent months. The general situation is highlighted by Amstrad's announcement that it is for the time being withdrawing from the large-screen CTV and VCR markets to concentrate on audio and its home computer, which has been well received. Amstrad's founder and chief executive Alan Sugar has predicted a price war in the video and large-screen CTV fields.

Further high street rationalisation has resulted in the merger of the Trident retail and Telefusion rental chains to form the new Connect group.

DIGITAL TVs AND LCD DISPLAYS

TV sets using digital signal processing circuitry have been announced by Toshiba, Panasonic and Zenith in the USA. It's understood that all these sets use the ITT Digivision range of chips. Most have a "picture-within-picture" feature enabling a picture from an external video source, e.g. a VCR, computer, etc., to be displayed in the corner of the screen, with remote switching between the two as the main picture. Mitsubishi have also announced a digital TV set, in this case with a still picture function using a one frame video memory. Other features of the set are a time-lapse mode that enables nine different TV programmes to be monitored on the screen simultaneously, with image renewal at four second intervals. Alternatively the nine-section display can be used to provide stroboscobic pictures, the intervals between shots being variable with a minimum of one thirtieth of a second – this feature is useful for studying golf form and providing other slow-action sport's shots. The set is expected to go on sale in Japan next autumn.

Casio has demonstrated a prototype 6in. liquid crystal colour TV display in Tokyo and plans to start production next year in various screen sizes from 2·5 to 12in. Seiko have announced a 2in. screen colour TV set in the USA, using a liquid crystal display with fluorescent backlighting and 52,800 pixels, each separately driven by a thin-film transistor. The liquid crystal is of the twisted-nematic type. Similar sets are planned by Citizen and Sanyo.

DISCS

Interactive video discs have been launched by JVC in Japan. The VHD discs can be used with a domestic computer to give realistic displays on the screen. As a result of interfacing the disc player and computer the user can modify and control the display. Programmes on the initial discs include road racing, casino games and chemical experiments. The move could well boost the prospects for disc systems – Philips have already announced an interactive LaserVision disc player in the UK, Model VP831, for the professional market, with computer interconnection via an RS232 port.

Thorn EMI is to supply VHD discs to Toshiba for sale in Japan. Deliveries are expected to reach 50,000 a month by the end of the year.

Hitachi have announced that spares for their CED disc players, now no longer in production, will be available for at least seven years.

FERGUSON CAMCORDER

The Videostar C Model 3V41 camcorder has been added to the Ferguson range of video equipment. This combined colour camera/VHS-C recorder has numerous features including an electronic viewfinder with eight recorder/camera mode indicators, a half-inch saticon tube, colour picture search and back space edit. The comprehensive range of accessories includes a super-directional microphone (which can be used with other Ferguson cameras) and a character generator. The latter enables the user to generate captions and titles when filming – four different types of pages, different sizes of lettering and options for positioning on the page make a variety of styles possible.

8mm VIDEO

The Kodavision series 2000 8mm video system has now been launched in the USA. A significant advance is a two-hour cassette which is to be made available for worldwide distribution in mid-1985. The tape is produced for Kodak by TDK and is 10 microns thick – the present ninety minute cassette uses 13 microns thick tape. There's still no date for the UK launch of the Kodavision system.

Sanyo has announced an 8mm video system in the USA, comprising a separate VCR and a camera that looks like a 35mm photographic one and takes standard 35mm lenses. The Electronic Industries Association of Japan expects sales of 8mm equipment to reach six million annually in seven years' time, accounting for some 20 per cent of the world VCR market.

JAPANESE-EEC MOVES

The Japanese Ministry of International Trade and Industry has asked Japanese VCR manufacturers to reduce their exports of complete, i.e. non-kit, VCRs to the EEC by over ten per cent during the current financial year in order to avoid excessive price cutting. There has already been an 11·7 per cent decline in Japanese VCR exports to the EEC, where demand is currently slack. Not that the Japanese VCR manufacturers need worry unduly: exports rose to a record 1,993,000 in August, with 52·5 per cent going to the USA and only 19·1 per cent to Europe.

A standing joint committee to decide on common standards for consumer electronics goods has been proposed at a Japanese/EEC conference attended by eighteen leading electronics companies. The Japanese delegation was led by Sony's chairman Akio Morita while the European delegation was led by Philips' president Wisse Dekker.

CHANNEL FOUR COVERAGE

Almost fifty million people can now receive the Channel 4/S4C transmissions, roughly 97 per cent of the population. Ultimately the coverage should equal that of ITV/BBC at over 99 per cent. During 1985 another one hundred low-power relay stations will be equipped for Channel 4/S4C transmission, bringing a further 600,000 people within range. This will leave roughly 200 transmitters to be equipped in 1986/7 to complete the programme. In addition, new fill-in relays for all IBA/BBC channels continue to be built at the rate of about one a week.

PRESTEL MAILBOX NATIONWIDE

Prestel's 24-hours a day electronic message service Mailbox is now available throughout the country at local call rates, enabling messages to be sent instantly between any of the 47,000 terminals on the Prestel network. There are no sending/receiving charges above the normal Prestel operating costs. Mailbox was launched in 1981 as a local service for London subscribers, though users elsewhere could use it by making a long-distance call to the Mailbox computer. Users can either send their own messages via a typewriter keyboard or, if they have only a standard Prestel numeric keypad, they can select from a list of over 400 stock messages and phrases. To despatch the message the sender keys in the recipient's Mailbox code: the recipient is informed that a message awaits him whenever he calls Prestel. Up to five messages can be stored indefinitely in the Mailbox computer until called up by the recipient. The use of personal code numbers ensures that messages go only to the correct destination without interception by other users. A recorded delivery feature is to be added next year.

V2000 HI-FI

Now that Betamax and VHS VCRs with hi-fi sound are with us, using the same basic techniques, what about the V2000 system? Not to be left out, a prototype V2000 hi-fi machine was on display at the recent Dusseldorf Hi-Fi and Video Show. Models are expected to be released during 1985, though whether they will appear in countries other than the Netherlands and W. Germany, where the system has a reasonable share of the market, remains to be seen.

The technology involved is quite different from Beta/VHS: the audio is converted to digital form, using pulse-code modulation, and is compressed so that it can be inserted in the video waveform's field blanking period – it's laid down in the 0·325mm centre section of the tape originally intended as a cue track but never in practice employed for this purpose. The introduction of models on the market awaits the development of i.c.s to carry out the audio signal processing, which in addition to compression/expansion and coding/decoding involves noise reduction in both the recording and playback modes. The audio heads are mounted on the same piezoelectric actuators as the video heads so that both are subject to the dynamic track following that's a major feature of the V2000 system.

As to the future of the V2000 system, it's interesting that Philips' president Wisse Dekker commented in a recent interview with *Electronics Weekly* that "Philips is certainly not as strongly committed to V2000 as it was a year or so ago". In his view the decision by Philips to manufacture and market VHS machines should have been taken earlier while "now it's up to the market to decide". Grundig expects its VCR production to settle at two thirds VHS to one third V2000.

CHANNEL 7

Atlas Leisure has launched a video service called Channel 7 for the 2,000 large-screen video projectors installed in pubs and clubs by TeleJector. The service will consist of a mixture of sport, comedy, films, music, travel and news and will carry advertisements (the advertising rate is £2,800 for two thirty second slots shown daily for a week). Atlas hopes to increase the number of installations to 3,000 by mid-1985 and eventually to serve one in five of the UK's pubs and clubs. The use of satellite transmission is planned.

FOREIGN NEWS

The Australian government has decided to use the MAC-B transmission system for the AUSSAT satellite radio/TV service which is due to start next year, carrying ABC programmes to the outback . . . The Italian government has issued a decree making the three private TV networks legal – magistrates had earlier closed the networks in three areas on the grounds that they infringed the state-run service's monopoly . . . Grundig is to supply VHS VCRs in kit form to China for local assembly under licence. The company already has an agreement with China on CTV production . . . The launch of the first French DBS satellite, originally planned for November 1985, has been postponed until late 1986 due to technical problems with the high-power output tubes.

BBC AT IBC 84

The BBC's sound-in-syncs system for the distribution of mono sound and video signals via a single link was developed over fifteen years ago and has since been widely used throughout the world. The BBC is at present developing a system for two-channel sound, taking advantage of an important development in digital audio techniques – the NICAM-3 near-instantaneous companding system. In order to get twice the information into the same bandwidth and much the same time slot, a quaternary coding system and slightly more of the line sync pulse period are used. The technique was amongst several interesting exhibits shown by the BBC at IBC 84.

Of particular interest to TV engineers will be the fact that the BBC now have a digital generator for test card F. The geometric patterns are generated by computer techniques with reference to the original drawings, with edges both vertically and horizontally anti-aliased for optimum accuracy. The central picture with the little girl was copied from a slide by means of a YUV "picture grab", the resulting data being inserted into the geometric pattern during the computer preparation process. So it seems that the well known and much appreciated pattern will be with us for some time yet.

VIDEO NOTES

Panasonic's latest VCR, Model NV730, is less than four inches high. It's a two-speed machine expected to retail at about £633·50. BSR is to manufacture under licence Mitsumi r.f. modulators for VCR use at its Stourbridge, W. Midlands factory. Akai's new European VCR factory is to be built at Honfleur, western France, where the company already has a plant manufacturing hi-fi equipment and assembling VCRs. It had been hoped that Akai would set up the factory in the UK.

Panasonic have developed a still-picture camera using electronic technology. Up to 25 colour shots can be stored in digital form on a magnetic disc. The system is similar to Sony's Mavica camera and is expected to go on sale in a couple of years' time.

WILLOW VALE TRADE SHOW

The next Willow Vale Electronics trade show will be held at the Ladbroke Mercury Motor Inn, Exeter on November 28th, 1984. For further details apply to the Sales Manager, Willow Vale Electronics Ltd., 11 Arkwright Road, Reading, Berks (telephone 0734 876 444).

HEAD CLEANER AEROSOL

Electrolube have introduced a Video Tape Head Cleaner aerosol that loosens and removes accumulated deposits of dirt and tape oxide, drying quickly without leaving any residues on the tape. It's designed for use on all magnetic tape heads and comes in a 110 gram can. Application is by spraying directly on to the heads and the tape path – alternatively it can be sprayed on to cleaning tapes or other cleaning devices such as cotton buds. For further details contact Electrolube Ltd., Blakes Road, Wargrave, Berks RG10 8AW (073 522 3014).

PROPOSED ATV REPEATERS

A number of people have expressed interest in a 23cm ATV repeater for the Southampton/Bournemouth area and several possible locations have been considered. It has been suggested that two separate repeaters, one for the Bournemouth/Poole area and another for Southampton, would give better coverage of low-lying areas. Amateurs interested in 23cm operation are invited to contact Nick Foot, G4WHO, 47 Mallard Road, Colehill, Wimbourne.

EXHIBITIONS

The next Berlin Radio Show, now known as the Audio and Video Fair Berlin, will be held on August 30-September 8 1985. Details can be obtained from AMK GmbH, Postfach 19 17 40, Messedamm 22, D-1000, Berlin 19.

The twelfth annual Audio Visual Exhibition, AV85, will be held on April 22–25 1985, at the Wembley Conference Centre. The organisers are Maclaren Exhibitions Ltd., PO Box 138, 79-81 High Street, Croydon CR9 3SS. AV85 will be sponsored by *Audio Visual* magazine.

Teletalk on Colour

Malcolm Burrell

I was mulling over the question of colour picture quality recently. It seems that one result of so much circuitry being taken over by the silicon chip is greater consistency with our colour pictures. When colour started in 1967, and became more popular in 1969 as it spread to all channels, everyone would remark on the variation between the sets on display. True, variation still exists, but it's now more a matter of how well the set is tuned in and things like that. Most of us probably tend to take colour pictures for granted: the quality is more consistent than it was, but I feel that it's settled at a rather mediocre level of consistency.

The Early Sets

In 1967 we had dual-standard hybrid sets like the Decca CTV25, the GEC 2028 and the Philips G6. They used valves in the output stages and colour-difference drive, i.e. luminance at the tube's cathodes and the three colour-difference signals at its grids. This made grey-scale adjustment much simpler and somehow gave slightly better colour. To me the first G6s had a certain something that amounted to richer colour. The reds were red and flesh tones had a certain Technicolor golden hue that few other sets matched.

By 1969 we had single-standard sets. These often bore a more than passing resemblance to their predecessors but had somehow begun to loose something. I personally thought that the Thorn sets of the era, with their solid-state circuitry and RGB drive, never quite made it for colour quality, though a friend of mine still has a 25in. one that gives quite exceptional pictures for one of this breed. Decca went on to make the famous 10 and 30 series Bradford chassis which, though beloved by many engineers – they were excellent for quick servicing – somehow lacked something when it came to colour quality. They gave good pictures but the colours were not outstanding. Even the single-standard G6 didn't quite match its elder brother unless you got a really good one.

The K70

Then suddenly the Philips K70 came upon the scene. A few of these appeared in discount stores while some went to the rental outlets. The first thing of note about them was the use of varicap tuning, something we'd not experienced before in the UK. Imagine, I thought, no more mechanical tuners to fall to pieces! When you switched one of these sets on the next thing that became apparent was the superb sound quality, which was almost as well matched by the picture.

I remember being bewildered when I first made a call to service one of these sets. It had an elaborate but flimsy chassis that hinged outwards. The layout looked much the same as the G6 – but there were two line output valves! I always admired the sound reproduction, which came from the combination of just a single PCL86 and two speakers. I wondered what the secret was. The speaker at the front was a tweeter while the side-mounted bass unit was of special construction. I can remember substituting (temporarily) an ordinary type to compare the results. The difference was startling. I'd secret designs on the speaker in the set but had to return it reluctantly to its rightful place. In subsequent years I did manage to get one from a scrap set but found that it didn't give much of an improvement when installed in a conventional TV set. It just shows how much thought was put into this Philips system – the loudspeaker, the circuit, the output transformer and the cabinet.

Orientals

I first encountered a 13in. Sony portable a good few years ago. The Trinitron system impressed me, as did the overall picture and colour quality. I subsequently bought a KV1810UB and found the pictures acceptable though not quite so outstanding. My main reason for buying this set however was its hue control – it was the last set sold in the UK to feature one of these. It enabled me to trim the phase of the reproduced colour slightly – unlike the tint controls provided on some sets (these altered the grey-scale as well). The 1810 had a 114° 18in. tube that didn't quite seem to have the sparkle associated with the earlier 90° types. It seems that the early 110° tubes that were used mainly in sets of Continental origin didn't produce sparkling pictures for very long.

I had thought that most 90° delta-gun tube sets had long passed their prime. Then last year I encountered an Hitachi CNP190 that had never required a service call in all its nine years of operation. Amazingly, the tube gave a superb, clearly defined picture with vivid, rich colours and would have put many a new set to shame. I must admit however that most of these sets are now well passed their best.

I live with a Sony KV2704 now, and though the colours don't sparkle they're certainly very good. Why did I buy it? First because I wanted a large screen and prefer the Trinitron's shape to the conventional goldfish bowl type. Secondly the Trinitron grill principle seems to me to be a more sensible one for in-line gun tubes than the segmented-slot arrangement. Thirdly the "turbo-drive" – a sort of dynamic focus system that was described briefly in the November 1981 issue (page 39) – really does seem to give sharp images right out to the edges of the screen.

What is True Colour?

As to what is true colour, it depends I suppose on what you're watching. A newsreader should look natural. If he's been sitting inside a studio all his life perhaps he should look pasty-white, but isn't it nice to see an old British film with scenes of London where the buses are much redder than they would ever have been in real life?

Then I think of photographs and slides. Do you remember the experimental colour test transmissions during the 50s and 60s, with endless slides of telephone boxes and young ladies in hats?! I came across a slide recently of a picture taken from a GEC 405-line colour receiver (TT4, see Practical Television early 1959) working on the NTSC system. Being from a photograph, the flesh tones were rich and golden. I once wrote to the IBA with some comments on Test Card F – that one should aim to get a sort of warm golden brown in the upper arm area of the little girl. I think this caused some amusement, but I found that subjectively if you got this then a vectorscope was irrelevant!

In Conclusion

This is not to suggest that we return to the days of the G6. Most engineers who remember them prefer today's sets. In any case, I think that for clarity the in-line tube is preferable. It's not likely that one can improve on years of design work. A TV set is designed to give a certain picture quality at a price. Minor improvements sometimes work, also correct adjustment. Why for example was it that almost every Decca 30, certainly the ones I've encountered, seems to have left the factory with Hanover bars when quite a simple adjustment puts this right?

A few weeks ago I had to attend an elderly Thorn 8000. It was working with a grotty aerial but the picture was noisier than usual. Out came the decoder/i.f. panel and we soldered the broken print around the i.f. input from the tuner. Having checked that there was indeed a colour picture I zoomed off. One whole month later the call "green faces" came. In my haste I'd accidentally swapped the green and red leads to the tube. I could go on about the old lady who watched a GEC set with a flat blue gun (all yellow) and after I'd fitted a new tube said "it's not as good as it used to be", but I'll close here.

TV Fault Finding

Reports from Mick Dutton, Hugh Allison, John Coombes and Malcolm Burrell

ITT CVC801 Chassis

The problem with this set was no results, though on closer examination we found that there was 320V across the mains bridge rectifier's reservoir capacitor C658. The chassis has a chopper power supply, with the drive coming from the line oscillator chip and the line output transistor driven from a secondary winding on the chopper transformer. Quick checks showed that none of the obvious semiconductor devices was at fault, so the question was where to go from here?

We decided to power the line oscillator from an external supply, and were rewarded with line whistle and a chopper output of some 30V instead of 110V. We then replaced the line output transistor with a low-wattage bulb. The h.t. remained low, proving that the fault was in the chopper control circuit. Voltage and waveform checks were then made in the power supply. Everything was o.k. up to the collector of T731, the pulse-width modulator transistor that drives the chopper driver transistor T750. T750's base waveform was incorrect, T731's collector voltage was slightly high and the voltage reading at the collector of T750 was low. The problem was traced to D750 (1N4148) being slightly leaky – this diode is connected between T750's 28V supply and the 20V rail that supplies the rest of the chopper control/drive circuit. **M.D.**

ITT CVC1100 Chassis

Another case of no results. There was 300V across the mains bridge rectifier's reservoir capacitor C658 but no 115V h.t. rail. This was due to the fuse being open-circuit and the over-voltage zener diode D658 short-circuit. It's important that the set isn't run with D658 removed as excessive h.t. can result in the e.h.t. rising alarmingly, with possible damage to the tube. The recommended procedure is to check for obvious shorts, then connect a low-wattage bulb across D658 as a load for the power supply. Next disable the line output stage by shorting together the base and emitter of the line output transistor. When we did this the bulb lit and the h.t. line was steady at 115V.

With the bulb still in circuit, we removed the line output transistor short. This produced an h.t. line of about 40V with some obvious straining noises from the chopper transformer. Fine we thought, the power supply is o.k. and there must be an excessive load somewhere. We checked the secondary supplies provided by the line output transformer and found that the 150V rectifier D504 was short-circuit. This is quite common but usually the associated safety resistor R514 is burnt out. In this case it was intact and replacing the diode made no difference to the overload condition. We checked everything, including the line output transformer by replacement, without success.

Time for thought. Maybe the fault was in the power supply after all? The chopper circuit is self-oscillating, the feedback pulses from tag e on the chopper transformer going via a winding on the line output transformer (to synchronise the action), R722 (4·7Ω), C714 and R723 to the base of the chopper transistor. It turned out that R722 was open-circuit, as a result of which the chopper was operating in the start-up mode. Replacing R722 restored the correct h.t. voltage, but there was a lack of brightness and the picture was much overscanned. We'd left the replacement line output transformer in the set – refitting the original one produced a perfect picture. Our replacement transformer and the two others we had in stock turned out to be faulty. **M.D.**

ITT CVC20 Chassis

The trouble started with faint horizontal lines across the picture when the chassis was in the normal, raised position. To cut a long story short, there was a high-frequency ripple on the h.t. line caused by a spurious oscillation in the TDA2640 chopper control i.c. Before we discovered this another engineer had changed the line output transformer in an attempt to cure the fault. Having sorted things out I had to replace the original transformer. This led to loss of the 24V and 12V lines due to an earthing lug on the transformer connected to D24. Then the contrast became low with no colour. This turned out to be due to D3 (1N4148) in the beam limiter circuit having gone short-circuit. It would have been cheaper to leave the new transformer in the set and say nothing! **M.B.**

Rank Colour Portable

One of these sets, manufactured in W. Germany by Saba, came in with the complaint that there was line pulling and field jitter when it was first switched on. This looked like an a.g.c. problem, and we found that bridging the a.g.c.

time-constant capacitor C284 (4·7μF), which is connected between pin 4 of the TDA440 i.f. chip and chassis, cured the field jitter. We were left with bent verticals except when the channel 8 button was selected. Replacing C923 (47μF) which decouples the supply to the TDA2590 sync/line generator i.c. cured this problem. In both cases the capacitors seemed to be o.k. when tested. **M.B.**

Thorn TX9 Chassis

The fault was field cramping a third of the way from the top of the raster. Voltage checks around the TDA1170S field timebase i.c. (IC55) revealed the fact that the output pin 4 was at around 18V instead of 13·8V. Everything else seemed to be o.k. A replacement i.c. failed to cure the trouble and I eventually found that R288 in the d.c. feedback loop was high at 50kΩ instead of 18kΩ. If R288 goes open-circuit you get complete field collapse – I tried it out of curiosity! **M.B.**

Hitachi CNP190/CNP192

These sets are built like battleships and seem to soldier on and on. One came in with various complaints that were cured once the main problem was appreciated. The picture was oversize, with a ripple, and the clue was that the h.t. rail was at 150V instead of about 120V. The set h.t. control R911 had no effect and almost every voltage around the series regulator seemed to be 150V. R912 (18kΩ) which links one end of R911 to chassis turned out to be open-circuit – it must be checked out of circuit. **M.B.**

Hitachi NP81CQ Chassis

No sound led to a quick check at the d.c. supply pin (pin 10) of the TDA1035S sound channel i.c. The supply was missing, due to a dry-joint at pin 8 of the chopper transformer T901. Note that a lot of intermittent faults are caused by dry-joints in this area. **M.B.**

Thorn TX9 Chassis (Stereo)

This stereo sound version of the chassis came in with a tricky problem. Sometimes when the set was first switched on there would be no sound and field collapse! Of course it wouldn't go wrong in the workshop to start with, and when it did go wrong it corrected itself when dismantled. I tried to find a common link between the field and sound circuits on the main board, but there isn't one. There is on the stereo board itself however, since this incorporates 50-60Hz selection for video disc reproduction. Probing here brought to light a hairline crack in the print from PL121/1 to R1243 (12V supply line). **M.B.**

Thorn M2080

The elderly lady who owned this set said that it had spent longer in various workshops than in her own home in the four years she'd had it, while the repairs had cost more than the set itself. The complaint was intermittent tuning instability.

The stabilised supply to the tuning potentiometers was clean, but the output at the tuner was a bit jumpy. The a.f.c. to the tuner was jumping around like a fiddler's elbow but became clean when the aerial was disconnected. So it wasn't an a.f.c. fault. We decided to connect the set's aerial socket to the input of a spectrum analyser and wind the tuning potentiometers to minimum voltage. The tuner's local oscillator was found to be rock steady: on winding up the potentiometers the oscillator became more and more unstable. Feeding in a tuning voltage from the bench supply produced the same results, so it seemed that the tuner was at fault. We removed it and fed 12V to the tuning pin, with no other supply, scoping the varicap diodes in turn. One of them had a volt of noise across it while the rest were quiet. Since the tuner is an oddball type that we didn't have in stock we replaced the varicap diode and realigned the tuner. After refitting it the set worked perfectly.

The old lady and I are both a bit puzzled why the last "engineer" called in to deal with the fault disconnected the infra-red remote control unit and charged £45 for doing this. If you're reading this, I hope you feel ashamed! **H.A.**

Mitsubishi CT2206TX/CT2217TX

For no sound, a green/purple display and no remote control operation check the voltage at the collector of the 12V regulator transistor Q7P1 on the remote control panel. There should be 16V at this point. If it's missing the series resistor R7Q2 (4·7Ω) is probably open-circuit. **J.C.**

National Panasonic TC492G/TC682GR

For high brightness with flyback lines check the 190V line. You'll probably find this low due to the reservoir capacitor C555 (10μF) being open-circuit. **J.C.**

Decca 70/90 Chassis (Touch-button tuning)

In the event of a noisy raster, noisy sound and no LEDs alight, check the voltages on the tuning panel, in particular around the SN76705AN channel selector i.c. The voltage at pin 15 should fall to a low reading when the channel one push button is operated. If this doesn't happen, short the pin to chassis. If this restores results, check the contact between pin 15 of the holder and chassis. If you don't get a short-circuit reading, replace the holder or solder the i.c. into the panel directly. **J.C.**

Toshiba C1695

This set wouldn't switch on from standby. We found that the 16·5V supply on the remote control panel was missing due to D408 (BY210) on the mother board being open-circuit. **J.C.**

Canal Plus Scrambling

Andy Emmerson

With the official opening of the Canal Plus service on November 4th, pay-TV took to the French airways. It is, I believe, the first instance of a normal, over-the-air TV broadcast service using encryption, in Europe at any rate. The principles involved can be outlined quite easily, but instructions for a DIY decoder would be a different matter!

Canal Plus is France's fourth national TV network. It's organised by the advertising agency Havas and is backed by various financial interests. Subscribers sign up for six months or a year, paying about £10 a month for the programmes – films, interviews, news and sport – and a deposit of some £35 for the decoder. The programming should turn out to be somewhat livelier than the normal French TV fare and is intended for French viewers only: probably for copyright reasons, there will be no foreign subscribers. Reception is nevertheless possible in many parts of southern England. Canal Plus is hoping to attract 200,000 subscribers initially. To protect cinema revenue, it's not allowed to announce programme schedules more than two months in advance.

Canal Plus transmissions are mainly in the v.h.f. Bands I and III. Twenty of the planned 57 transmitter sites will use u.h.f. however. Some of the channel allocations and frequencies were given in the October Long-distance Television column. Apart from a v.h.f. aerial, reception requires a hired tuner/decoder and preferably a modern TV set – because the decoder's output is designed to be connected to the set via a SCART socket, which has been a standard feature of new French TV sets for the past three years. To use one of the six million or more pre-1981 sets a modulator costing some £66 is required.

The decoder deals with the encryption of course. Each month paid-up subscribers receive through the post a secret eight-digit number which they tap out on the decoder's keyboard. While the number could easily be discovered (ask your neighbour!) this wouldn't be of much help as Canal Plus repossesses decoders on rental default.

A double scrambling system is used: the sound channel is rendered inaudible by suppressing the carrier, while the picture is scrambled by altering the line timing throughout each frame. The first thing the decoder has to do is to compare the control number keyed in by the subscriber with the equivalent number transmitted by Canal Plus, probably during the field flyback time. If the two correspond the decoder is unlocked, restoring normal sound and vision.

Listening to the encrypted sound on a normal TV set produces a sputtering noise, since it consists of the a.m. sidebands with no carrier. The decoder supplies a carrier so that the receiver can carry out demodulation in the normal manner (the French TV system uses a.m. for the sound channel). The carrier frequency is pretty low, 12·8kHz. There's a reason for using this particular frequency. The oscillator that provides the carrier must have great stability, and the easiest way of achieving this is to reference it to a frequency of known accuracy. The reference chosen is the line frequency, 15·625kHz. When multiplied by 512 (which is a power of two) you get 8MHz. Divide this by 625 and you get 12·8kHz. All this is easy to do using binary counters and phase-locked loops.

If unscrambling the sound encryption appears to be a relatively simple matter the vision signal is rather more of a problem. Whereas in a conventional vision transmission the active video commences at a fixed time after the sync pulse on each line, with Canal Plus the period between the sync pulse and the start of the vision signal varies line by line. As Fig. 1 shows, the delay introduced is either nil, 1μsec or 2μsec. It varies in a quasi-random manner line by line. On a conventional set a serrated image is displayed. The decoder deals with the problem by switching compensating delay lines into circuit in the required order.

A six-field sequence is used for the pattern of delays. The decoder holds this sequence in a memory which is likely to be a PROM (programmable read only memory). A reference signal is required to indicate to the decoder the start of the sequence. It takes the form of a peak white signal that indicates the last line of the six-field cycle.

The encryption characteristics described have been noted by observation (not by me unfortunately – acknowledgement is due to the magazine *Science et Vie*). The PROM's programme holds the quasi-random delay sequence but there's nothing to prevent the programme being altered from time to time – provided the alternative programmes have been programmed into the PROM. Signals could be transmitted during the field flyback period to tell the decoder to switch to "sequence two" or whatever. Whether this additional complication has been designed into the system is not so far known.

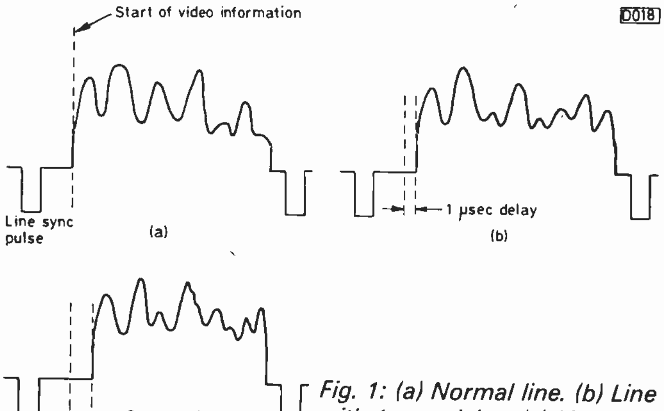
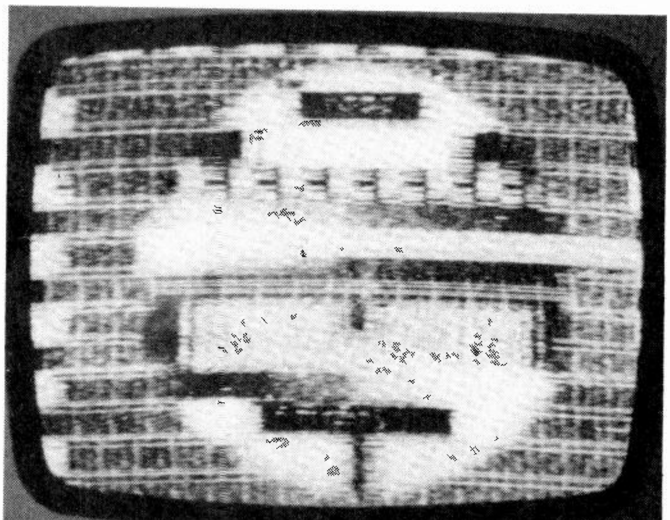


Fig. 1: (a) Normal line. (b) Line with 1μsec delay. (c) Line with 2μsec delay.



Effect of the type of scrambling described – photo courtesy of Roger Bunney.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 postal order (made out to IPC Magazines Ltd.), the query coupon printed below 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.

PHILIPS G11 CHASSIS

The set won't start up at switch on – all that happens is that resistors R4019, R4051 and R4052 in the active filter circuit burn up. I've replaced the associated BCX32 transistor but the trouble persists.

This fault is generally caused by the 27V zener diode D4021 (BZX79-C27) which not only burns up the three resistors mentioned by also carries off the two transistors (BCX32 and BD201) in the active filter circuit.

AKAI VS4

There's intermittent sound distortion during playback of prerecorded and self-recorded tapes. Occasionally part of the picture fluctuates sideways when a prerecorded tape is being played back.

If the sound distortion is in the form of a wow, check that all guide rollers and the capstan are clean and that the reel discs rotate freely. Note whether the tape wrinkles during its passage across the audio/control head – if so the pinch wheel is out of vertical or there's no back tension. Replace the pinch wheel if badly worn. Finally, suspect the capstan motor: if a scope is available, check for less than 0·5V ripple across the motor in record pause.

TELEFUNKEN 711 CHASSIS

Bowing at the sides was found to be due to the EW modulator driver transistor T591 (BD135) having gone short-circuit. A transistor with the same voltage rating was tried but this blew. The set is otherwise performing well.

The driver transistor needs to be of the correct type and properly heatsinked. Before fitting a replacement, check the two BYX55 modulator diodes D562 and D563 and the pre-driver transistor T592. BYX55s are best replaced with the beefier and better MR854s.

SONY C7

The machine threads but doesn't play. Fast forward won't operate either. With the end-alarm switch on you get the sound and the tape will rewind.

It seems that the forward sensor oscillator has stopped. If pin 8 of IC8 on the syscon panel is above 2V, check the continuity of the connectors and the sensor coil, then suspect the chip.

RANK Z718 CHASSIS

The height has collapsed from full to about half, even with the height control at maximum.

If the field scan is linear, the trouble is likely to be due to one of the resistors in series with the height control. You will probably find that 4R9 (470kΩ) has gone high in value. If the linearity is poor, check the 32V line then suspect the electrolytic capacitors and transistors in the field timebase. Check back from the output stage to the field oscillator.

PANASONIC NV7000

When play is pressed the tape threads then unthreads. The same thing happens when a timed recording is attempted. The only way to get the machine to play or record is to press the play button then a moment later the forward one.

The syscon is getting a stop message at the end of threading. Watch the drum to confirm that it starts and reaches a reasonable speed within a second or two. If so it's likely that the after-load microswitch is not making or is mechanically defective. Also ensure that the take-up spool gets going – a slipping drive to this will result in the rotation sensor signalling stop to the syscon.

GRUNDIG 1500GB

There's horizontal foldover at the centre of the screen. The line timebase valves have been replaced and all the waveforms seem to be right.

We've seen this fault in similar sets that use valves in the line timebase. It usually stems from lack of decoupling in the line oscillator stage: check C609 (16μF) by substitution. This set is a bit unusual in having a transistor driver stage: if the oscillator is o.k., check this transistor (Tr621, BF259G) and its base bias resistor R623 (1·2MΩ).

NATIONAL PANASONIC TC381G

The line output transistor was replaced using a BU208 instead of the 2SD299 originally fitted. This lasted for a month or so then went short-circuit. Is there some intermittent condition that's killing off the line output transistors?

It's important to use a genuine 2SD299 in this set. Before switching on after fitting a replacement, check the condition and jointing of R520, which is in series with its base, and the line driver transformer T502; also check the anti-breathing resistor R527 (5·6Ω, 5W) and the efficiency diode D503 (for leakage).

SONY C7

Playback of programmes recorded on this machine is accompanied by severe smearing that cannot be improved with the tracking control. All other functions work perfectly and the only other fault we've had has been the usual rewind problem.

If replay of prerecorded tapes is o.k. and the self-recorded tapes are smeary rather than having a tracking band the problem lies in the luminance record department. Oscilloscope checks in this area should pinpoint the

QUERY COUPON

Available until 19th December 1984. One coupon, plus a £1·50 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice printed above.

TELEVISION DECEMBER 1984

cause of the fault. If no fault can be found, or tracking is a problem with playback of the machine's own tapes, it's likely that the head drum is in need of replacement.

NATIONAL PANASONIC TC2201

The complaint with this set is sound but no picture. The c.r.t. cathode voltages are high but nothing else seems to be amiss. Apparently there was low saturation before the screen blanked out. I suspect the AN281 chroma demodulator/output chip – any other ideas?

First make sure that the 12V supply is present and correct. If so, check the luminance amplifier transistors and clamp transistor TR605. It could be that the beam limiter transistor TR604 is turning down the brightness because it thinks the beam current is excessive. Condemn the AN281 only if its output pins 11, 13 and 15 are at a low voltage.

RANK T22 CHASSIS

When the field output stage bias preset is adjusted correctly as given in the manual there's bottom foldover. Increase the bias so that the voltage at 4C1 is 20V instead of 16·5V and the foldover has gone, though it's difficult to get reasonable linearity. The field output transistors have been replaced and when the bias is set correctly all the voltages in the output stage seem to be correct.

Some samples of the 17466 transistors used in the output stage can show a tendency to produce this fault. It's sometimes worth swapping over 4VT3 and 4VT4, or trying a different make in the 4VT4 position. The trouble can also be caused by the 36V line having a high source impedance. If a scope across 4C4 shows a parabolic waveform, check this electrolytic and the 36V line. Other possibles are diodes 4D1/2, the field scan coupling capacitor 4C1 and the amplifier/driver transistors 4VT1/2. Finally ensure that 4VT2's load resistor 4R4 (1kΩ) hasn't changed value.

ITT CVC20 CHASSIS

With the chassis in the working position there are three or four black lines at the bottom on the screen. When the chassis is hinged back about four-five inches they disappear.

First check that the c.r.t.'s Aquadag coating is properly earthed, then check for dry-joints around the NS correction transductor and the NS phase coil. That there's a problem in this area can be confirmed by shorting out C30, i.e. shorting out the NS correction circuit. If necessary check transistor T9 in the field output stage and the flyback blanking pulse coupling capacitor C24 (1μF).

GRUNDIG GSC100 CHASSIS

Two-three minutes after the set is switched on there's suddenly a half inch foldover at the bottom of the screen while the top third of the raster is distorted and slightly brighter than the rest. The field timebase module has been checked by replacement, also the scan coupling capacitor, the components in the centring circuit, and C628 which is the reservoir capacitor for the 18·6V line that supplies the field timebase.

The checks already made don't leave very much! It seems likely that the cause of the trouble is in the supply to the field timebase. We have had a case of a high-resistance fuse (Si627) here. Otherwise, suspect the rectifier diode Di627 or dry-joints at pins e or i on the line output transformer. A scope check on the 18·6V line when the fault is present should show what's happening.

TEST CASE

264

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.

Monochrome portables seem to have a very long life – we regularly see ten and twelve year old specimens in good condition. Well made sets getting only occasional use will probably last for many more years, but a recent servicing job involving a Ferguson Model 3816 (1590 chassis) put years on us! It's easy to get blasé about simple monochrome sets and the diagnosis of their ills. Now and again however we come across really sticky faults that are interesting, intriguing even, but don't do much for the workshop production schedule or the bottom line of the profit/loss account.

Such a job has just passed through the mill. The symptoms were plain enough – complete loss of sync and a vastly over-contrasted display. On the strength of this we decided that some sort of a.g.c. problem was present and a modest estimate was given to the owner. This was accepted, and with a "ready tomorrow" promise we hung up the phone and returned to the set.

The sync separator transistor VT7 is followed by a phase-splitter transistor VT8 which drives the flywheel line sync discriminator diodes and also provides the field sync pulse feed from its collector. An oscilloscope check at VT8's collector showed that there were no sync pulses at this point. This proved to be due to the transistor's collector being open-circuit. A replacement restored sync of sorts but the picture was jittery, wobbly and had a "soot and whitewash" effect, indicating problems elsewhere.

The voltages at the emitters of the gain-controlled i.f. amplifier transistors VT2 and VT3 and the video driver transistor VT6 were way out, so to avoid a chicken-and-egg puzzle in the a.g.c. department we connected a 6V battery across the a.g.c. reservoir capacitor C2, thus overriding the a.g.c. action and providing the correct d.c. conditions for VT2 and VT3. This gave us a correct-level video output from the vision detector diode W2 (manual waveform B) with the contrast now at a reasonable level. The sync performance was still very poor however, with ragged verticals and horizontal pulling: field lock would be lost at the drop of a hat.

The cause of this seemed to lie in the video driver stage – the sync separator transistor is driven from the collector of the video driver transistor VT6. We found that the voltage at this point was abnormally high, the signal level being low and "crushed". VT6's collector and emitter load resistors were both o.k., so we turned to the base where the voltage was markedly low at some 1·8V instead of 5V. This voltage is normally set up by the potential divider network R32/33, which produces 5·8V across the decoupling capacitor C36 – the output from the vision detector is superimposed on this bias voltage.

Why was the voltage at this point so low? Literally every component between the collector of the final i.f. amplifier transistor VT5 and the base of VT6 was checked and double checked. The voltage across C36 stood at about 3V: increasing this by artificial means increased VT6's conduction but still wouldn't reduce its collector voltage (normally 8·5V) below about 12V! We came to the conclusion that some spurious signal was present in the i.f. stages and was being rectified by the vision detector diode to produce a large negative offset voltage across C36. This theory was checked by turning VT5 off (base-emitter leadouts temporarily linked). VT6's base voltage then rose, but only to about 2·5V. Its collector voltage remained high.

The breakthrough came when we monitored VT6's collector signal with the scope while VT5 was cut off. There still appeared to be sync pulses present! They were upside down however, and therein lay the key to the whole sorry business. You've had an easier ride through the diagnostic process than we had, so we're sure you'll have the answer before it's published in the next issue . . .

ANSWER TO TEST CASE 263
– page 49 last month –

Last month we had a line drift with a difference fault – the trouble was with a Panasonic TC481GR which suffered from intermittent loss of line hold. Our extensive checks in the line oscillator and flywheel sync circuits had been quite fruitless.

Now this set incorporates an excess-voltage protection circuit that comes into operation in the event of excessive flyback pulses being generated in the line output transformer. The output from one pulse winding is rectified and monitored by an 11V zener diode which, when it conducts, switches on a pair of transistors (TR551/2) that latch on and short out the supply to the line oscillator transistor. This of course shuts everything down by way of protection. What's significant however is that the oscillator transistor's supply voltage is crucial to the frequency generated. So the protection circuit mustn't load this down in any way.

We found that the symptoms disappeared when we disconnected the protection line and that a varying resistance to chassis was present on the now open-circuited line. Replacing the protection transistors TR551/2 did the trick, though why they didn't latch on when this leakage effect was present remains a mystery. Incidentally the official circuit diagram is incorrect, which doesn't help with a fault like this – it shows a connection from the base of the line oscillator transistor to the protection circuit.

Published on approximately the 22nd of each month by IPC Magazines Limited, King's Reach Tower, Stamford Street, London SE1 9LS. Filmsetting by Trutape Setting Systems, 220-228 Northdown Road, Margate, Kent. Printed in England by The Riverside Press Ltd., Thanet Way, Whitstable, Kent. Distributed by IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Sole Agents for Australia and New Zealand – Gordon and Gotch (A/sia) Ltd.; South Africa – Central News Agency Ltd. Subscriptions: Inland £11, overseas (surface mail) £12 per annum, payable to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. "Television" is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first having been given, be lent, resold, hired out or otherwise disposed by way of Trade at more than the recommended selling price shown on the cover, excluding Eire where the selling price is subject to currency exchange fluctuations and VAT, and that it shall not be lent, resold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. ISSN 0032-647X.

CENTRAL T.V.

LATE MODEL T.V. NOW IN STOCK

G.11 REMOTE + TEXT, ITT REMOTE, THORN 9600, 9800, BUSH T20/T22/T26, DECCA 80/100, G.E.C. IN LINE

SPECIAL OFFERS ON WORKING SETS

10 550 G8 22″	**£220**
10 520 G8 22″	**£180**
10 ITT CVC 5-8-9	**£180**
10 DECCA HYBRID	**£180**
10 BUSH MIXED	**£140**
10 THORN 8500	**£250**

SPECIAL OFFERS ON OFF THE PILE SETS

10 550 G8 22″	**£130**
10 520 G8 22″	**£90**
10 ITT CVC 5-8-9	**£120**
10 DECCA HYBRID	**£120**
10 BUSH MIXED	**£90**
10 THORN 8500	**£170**
10 THORN 3000, 3500	**£100**

VHS VIDEOS – 100's IN STOCK

BRAND NEW 14″ AND 16″ PORTABLES

BRAND NEW PYE 20″, 22″, 26″ WITH STEREO – TEXT – REMOTES

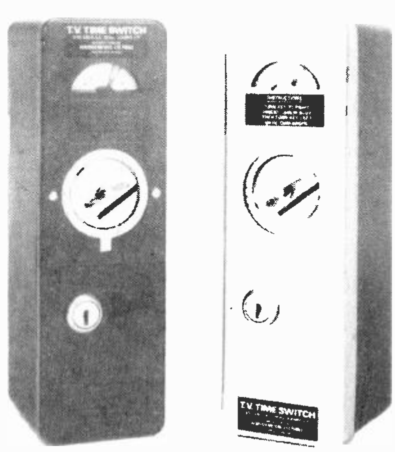
MANY MORE BARGAINS IN STOCK – PHONE AND HAVE *YOUR* ORDER READY FOR COLLECTION
LORRY LOADS DIRECT FROM SOURCES DELIVERED TO YOUR DOOR

HOT LINE BIRMINGHAM
021-622 1023
021-622 1517
48/52 PERSHORE STREET
BIRMINGHAM B5 4RR

HOT LINE LONDON
01-807 4090
01-884 1314
CEDAR HOUSE, NOBEL ROAD,
ELEY ESTATE, EDMONTON, LONDON

CUSTOMER CAN'T PAY?

DONT LOSE HIM FIT A TV METER



COINAGE AVAILABLE
10p
50p
£1

COMPLETELY VARIABLE TIMINGS

Alberice METERS LIMITED

MANUFACTURERS OF TV COIN OPERATED METERS CONTACT (0202) 674272
87-89 Sterte Avenue,
Poole, Dorset. BH15 2AW.
Telex: 418253 LUMIC G

2 YR. GUARANTEE **APOLLO** 20/30 AX

TRADE AND QUANTITY DISCOUNTS

FREE LOCAL DELIVERY — SAME DAY ● FITTING SERVICE £20.
FAST MAIL ORDER GB 2-3 DAYS — OVERSEAS ON REQUEST.

A47 32/343X 470 BCB22	£37
470 ESB22/EFB22/ERB22	£45
A51-161X	£45
A51-220X/192X	£37
510 JKB22/JEB22/JDB22/ALB22	£45
A56-120X/123/140/410	£38
560 DZB22/HB22/AKB22	£45
A63-120X	£39
A66-120X A67-120X/140/150/200X	£39
20AX A56-500X/510X A66-500X/510X	£48
30AX A56-540X/A66-540X	£48

If your tube type is not in stock we can arrange collection – rebuilding + redeliver

PLEASE PHONE BEFORE CALLING
061-799 0854. 24 hour answering service
43 Clarke Crescent, Little Hulton, Worsley, Nr Manchester M28 6XL

SEND NO MONEY

Your order despatched C.O.D. from our comprehensive stocks of Audio, Video and T.V. spares.
Price list sent with your first order.

Simply phone us
0934-419147

Freeway Components, The Airport
Weston Super Mare, Avon BS24 8RA

SETS & COMPONENTS

JAPANESE COLOUR TVs. Panasonic, Hitachi, Mitsubishi, Toshiba, Sharp. Fully refurbished. Trade only. J.M. Pearson Television. 0484 863489.

SECOND HAND Colour TV spares and tubes. Most makes. Telephone Southport (0704) 74411. Anytime.

PHILIPS G11 and Bush T20. Regular supplies. For prices phone 01-845 2036.

GRUNDIG SETS, PANELS, MANUALS. Nordemende and Telequipment spares, manuals. Ochre Mill. Tel. 0785 814643.

TELEVISION

No other consumer magazine in the country can reach so effectively those readers who are wholly engaged in the television and affiliated electronic industries. They have a need to know of your products and services.

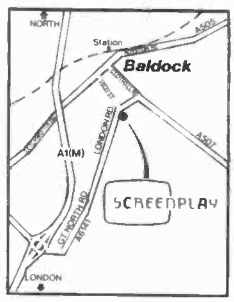
The prepaid rate for semi display setting £6.00 per single column centimetre (minimum 2.5 cms). Classified advertisements 35p per word

SCREENPLAY

Your Friend in the TV Business

Guaranteed – Complete Sets from £5.00
Trade Workers from £25.00
Panels by Post from £3.00
Mono's from £1.00
Stands Aerials Accessories Etc.

TO CLEAR
BUSH SINGLE/DOUBLE CHIP 5 for £25.00
BRADFORD DECCA 5 for £45.00
PHONE US FIRST FOR WORKING SETS IN QUANTITY, WE'LL GIVE AN UNBEATABLE PRICE.
OPEN 6 DAYS 10-6.30pm/10-5.00pm SAT.
Phone:
Baldock 894905
SECTION THREE, UNIT FOUR, SERL COMPLEX, LONDON ROAD, BALDOCK, HERTS.



GRUNDIG 6010 R/C £30. Sony 1820 £25. GEC 2110 R/C £25. A44 -271X £35, 560DZB22 £35, Z179 chassis new £30, GEC 2040 decoder £12, CDA £6. 5 Pye 691 triplers £20. Gravesend 65782.

TELEVISION

GOOD QUALITY TRADE TVs COLOUR OR MONO SUITABLE FOR SALE OR RE-RENT, WIDE CHOICE OF MAKES AND MODELS

GENERAL FACTORS
UNION STREET
DONCASTER
DN1 3AE
TEL (0302) 68416

GOOD MOTORWAY ACCESS

WETSTED TUBES

PRESENTS AN UNBEATABLE OFFER

£26 ALL DELTAS ONE PRICE
£40 ALL P.I.L. ONE PRICE

* SPECIAL CRT POLISHING SERVICE WHILE U WAIT **Only £5**
* ALL DELTA SIZES FROM STOCK
* DISCOUNT FOR ORDERS OF 5 CRTs OR OVER
* FREE DELIVERY WITHIN 20 MILE RADIUS OF MAIDSTONE

Ring Now
Maidstone 872400
or visit our factory.
Unit 32, Branbridges Ind Est.
East Peckham, Kent.

* **Agents required in South**

Prices do not include VAT

CANVEY COLOUR TUBES

Unit 3, Charfleets House, Charfleets Industrial Estate, Canvey Island, Essex.
Tel: Canvey Island (0268) 690577

CURRENT PRICE LIST

DELTA TUBE TYPE FROM **£27.50** to **£31.50**
INLINE TUBE TYPE FROM **£35.00**
MONO TYPES **P.O.A.**

ALL PRICES EXCLUSIVE OF VAT.

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

EX GRUNDIG TEST EQUIPMENT. E.g. 0-15V power supply with voltmeter £13.50 + £2.95 P&P. Also millivoltmeters isolating transformers and units for spares, etc. S.A.E. lists, S.H.E. 5 St Josephs Park, Ballycruttle, Downpatrick BT30 7EN.

MULTISTANDARD Colour Television. **LUXOR** VHF/UHF TV/Monitors to most standards, including PAL'L/SECAM'L (UK/French) option. 20", 22" & 26" from £280. ex VAT. PORTATEL CONVERSIONS LTD., 25 Sunbury Cross Centre, Sunbury, Middlesex. Tel. 09327 88972.

TELEVISION TUNER REPAIRS

BRITISH, EUROPEAN JAPANESE ETC.

ELC 1043/05 TUNERS AS NEW £4.60 inc.

MEN-TU ELECTRONICS LTD.
SALTERNS LANE,
FAREHAM, HANTS.
Tel: 0329-235116

CATHODE RAY TUBES

Extensive range of guaranteed rebuilt mono & colour tubes

BRITISH & JAPANESE IN LINE – COILS FITTED AS REQUIRED
P.I.L., 20 AX, 30 AX, DELTA & MONO EX STOCK

TRINITRON TYPES REBUILT

Free delivery London area by own vehicles
Rest of U.K. by carrier

SUFFOLK TV TUBES

1 Park Road, Hackbridge, Nr. Wallington, Surrey SM6 7ER
Tel. 01-669 7825/7826

SERVICE PAGES

(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).

IRISH TV TRADE

CAN WE BE OF SERVICE TO YOU?

Regular supplies of Quality Colour TVs

LOWEST PRICES

Working Sets from **£18** Non-working Sets from **£8**

FREE DELIVERY ANYWHERE

contact:

J. M. G. Electronics

Omagh, Co. Tyrone,
Northern Ireland.
Omagh (0662) 46032 night
Omagh (0662) 47911 day

COLOUR TV PANELS Fully Tested & Working

	IF	*CDA/ Video*	*Decoder*	*LTB*	*Line Board*	*Power*
GEC 2040	3.50	3.50	4.00	5.00	–	–
DECCA 13/30	3.00	–	7.00	5.00	–	4.00
BUSH A823	4.00*	–	10.00*	5.00*	2.50	4.00
THORN 8/8½	–	–	10.00	5.00	–	5.00
PYE 205	3.00	3.50	5.00	10.00	–	–
THORN 3/3½	5.00	5.00	5.00	8.00	–	10.00
G8	6.00	–	8.00	7.00	15.00 fitted with brand new transformer	5.00

*Please specify prefix A or Z.

Please add 15% VAT to above prices, then add post + packing.
Post + Packing: 1 panel £1.50; 2 panels £2.25; 3 panels £3.00 etc.

Hybrid panels do not include valves. *Terms cash with order.*

Also a vast selection of modern working and non-working TVs at low prices. Please ring for current stock.

GOLCAR T.V. SERVICES (formerly LAVITE LTD.),
Old C of E School, Church Street, Golcar, Huddersfield. Tel.: 0484 643273
Callers by appointment only.

TORBAY (TRADE) T.V.

Have now moved to larger premises. Good quality small screen colour TVs Chelsea's, 560, 207, 9000, etc.

178 Union Street,
Torquay, Devon.
Tel. (0803) 22767.

STARLITE ELECTRONICS

NOW MOVED TO:
WILLOWS FARM,
A13 RAINHAM, ESSEX.
Rainham 23225 also
Hornchurch 50238.

– TV TUBES –
2 year guarantee
Most types available
Japanese including Sony
Ex-Rental TVs from **£15.00**
Untested Panels.......................**£4.00**

11GHz Satellite TV Receiver

Receives 'Music Box' Pop music TV Channel on ECS satellite. Can be supplied with or without dish (1.5M minimum in most of UK). Stereo sound decoders available shortly for this channel. *Phone or write for more details.*

HUGH COCKS TV SERVICES,
Cripps Corner, Robertsbridge,
Sussex TN32 5RY.
Tel: 058083 317.

PANELS PARTS, Tanberg CTV2 A823 Decca 30 GEC 2110 Grundig 5010 tested tubes, all cheap. 731/725 panels wanted. S.A.E. lists 2 North Street, Newton, Derbyshire DE55 5TS.

A.B.D. TELEVISIONS

Suppliers of colour and mono televisions to the trade.

Workers and non-workers:

Pye Chelsea, Philips, Pye, GEC, Thorn 8500, 8800, 9000 and 9600, Bush T20 and TT22, ITT 600 series, Japanese, Hitachi, Nat. Pan J.V.C.

Many other modern sets by popular manufacturers.

For quotation and prompt service:
Ring Notts (0602) 864627
UNIT 3+3A,
Meadow Trading Est.
Meadow Lane,
Nottingham NG3 3HQ.

TURN YOUR SURPLUS capacitors, transistors, etc., into cash. Contact COLES-HARDING & CO, 103 South Brink, Wisbech, Cambs. 0945 584188. Immediate settlement.

WOODSDALE COMPONENTS

RANK BUSH MURPHY

TRANSFORMERS

Line Ouput
Z718 (T703A, T706A)

New (Complete)	**£20.50**
Less Focus Module and Rectifier	**£10.50**
T20, T22 (T705A)	**£11.00**
T26 (T705B)	**£11.00**
Switch Mode T114A/B	**£8.00**

Genuine RBM Units.

AERIALS

UHF Aerials P & C Wideband 4 Bay Bowtie (12.5 dB)	**£20.00**
Above with built-in Broadband amp. (27dB) plus stabilised power supply	**£45.00**

Prompt Postal Service P&P Paid.
Add 15% VAT to all prices.
DISCOUNT for QUANTITIES.

34 Field End Road, Eastcote,
Pinner, Middlesex. HA5-2QT.
Tel: 01-868 5580.
N. Skehan
Agents Office. Callers by appointment only.

KM

- **Britain's most reliable source of quality TVs.**
- **Hundreds of working polished TVs.**
- **GEC Starline**
- **Decca 80**
- **Decca 88**
- **Decca 100**
- **Pye G11**
- **Thorn 8800**
- **Pye 222 Series**

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

Krystal Marketing Ltd, Braedon Cross Storage, Dale Road, Selly Oak, Birmingham B29 6AQ.

Phone 021-471 3023
Telex 335540-G
Ask for Les

T.V. SPARES, PANELS AND MANUALS
PHILIPS · GRUNDIG

TELEVIEW 01-994 5537
194, Acton Lane, London W.4.

Thorn 3000/3500
Thorn 9000
UNIVERSAL
1 year guarantee

TRIPLERS £4.95 inc. p&p

The UNIVERSAL TRIPLER can be used in most G.E.C., I.T.T., Pye, Rank, Decca & Continental sets.

WING ELECTRONICS
15 Waylands, off Tudor Rd, Hayes End, Middlesex

Order form

Please insert the enclosed advertisement in the next available issue of Television

Heading ....

Signature ....

Date ....

No. of ins.......... Chq/PO ....

TELEVISION
Classified Advertisement Department,
Room 2612,
King's Reach Tower,
Stamford Street,
SE1 9LS.

12/84

NAME AND ADDRESS

EAST ANGLIA SUPPLIES

Fully working colour TVs from £25.00 plus VAT straight from our retail shelves. Most makes are available and small regular orders are welcome. Personal services guaranteed and if we can help you boost your rental or retail trade we would be delighted.

Free delivery available (only petrol charged).

Contact John, Dave or Steve at
Barry T.V. Services
on Cambridge 69215
or Ely 61462

WIZARD DISTRIBUTORS MANCHESTER

Visit our trade counter and see the huge range of components inc. tubes and video heads.
Only minutes from the town centre and motorway routes.
Fast friendly service and technical assistance available.
Come in and see our trade counter special offers.

Open Monday to Friday 9 am to 4.45 pm
Trade Only

EMPRESS STREET WORKS
Empress Street
Manchester M16 9EN
Tel: 061-872-5438, 061-848-0060

WORKING CTV's

The Best & Cheapest in Lancashire

I.E. Decca 18" to 26"	**£24.00**
GEC 20" to 26"	**£30.00**
Philips G8 22" to 26"	**£25.00**
Bush 20" to 26" 2 chip	**£18.50**

All sets are tested & working

Many more makes & types available. Working mono's only **£3.50**. Non workers available.

Phone: John Powney at Kirkham, near Preston (0772) 683392.

T.V PANELS

REPAIR EXCHANGE SALES SERVICE
PRICES FOR REP. EXC. AS FOLLOWS

Chassis	IF	Decoder	Line Scan	Power Supply	Frame
Philips GII	18	16	20	18	16
Bush T20	X	12	16	15	12
Bush T26	X	16	18	15	X
Bush 718	X	12	18	X	12

All panels are repaired and aligned according to rank std.
Ring for prices to buy panels. Prices shown inclusive of postage, etc.
All panels guaranteed for 3 months.

T. K. PANELS SERVICE
31 Bronte Paths, Stevenage (0438) 61567

TRADE COLOUR TVs ALWAYS 200 IN STOCK

Colour from £5.00 Mono £2.00
Tested colour tubes from £5.00 plus p+p

BRAND NEW VIDEOS
V2022 and V2023
VHS and BETA

Just in
20" + 22" GEC
Boxed with stand £85.00

ALL STOCK CHANGES WEEKLY

(0934) 514047/512792/27560
P&R SUPPLIES, Unit 5, Worle Industrial Estate, Weston-Super-Mare. Exit 21 M5.

TELEVISION

Always hundreds in stock **COUNTY DURHAMS ONLY WHOLESALER** All markets catered for

	UNTESTED	WORKING
G8 520	From £12.00	From £20.00
G8 550	From £12.00	From £30.00
GEC S/S	From £15.00	From £25.00
All Hybrids	From £12.00	From £20.00
Jap	From £20.00	From £30.00

All sets sold as working are fully prepared to the highest standards and are ready for retail or rental.

REGUNNED TUBES

Up to 22" Delta	£27.00	2 yr guarantee
Up to 26" Delta	£30.00	"
Pil & Inline	£45.00	"

All tubes are regunned to the highest specifications. We are the best because we want our customers to come back.

INTERTEL
Unit 27 Whessoe Road, Darlington (0325) 486896 Co. Durham.

REBUILT COLOUR TUBES

EXAMPLE PRICES DELTA
All sizes up to 22" — **£28.00**
26" From — **£32.00**

All In Line P.I.L. Mono Gaming Machine C.R.T.s 560EGB22 56-611-510JKB22

20 AX £40.00
30 AX £48.00

Fast U.K. Delivery
Call or Phone:

RE-LIFE T.V. TUBES
PLANE STREET, OLDHAM, LANCS.
061-665 2668

Wholesalers REG in North & South Wales
Competitive Prices

VIDEO

ARE YOU A TV ENGINEER WHO WANTS TO KNOW ABOUT VIDEO RECORDERS?

THEN YOU NEED

"DOMESTIC VIDEO CASSETTE RECORDERS A SERVICING GUIDE"
by S. R. BEECHING

Available for only **£15.50** inc. p&p

From: **NEWARK VIDEO CENTRE,**
108 London Rd., Balderton, Newark, Notts.
Tel: 0636 71475 **ACCESS OR VISA**

EQUIPMENT FOR SALE

COMPLETE TUBE REGUNNING PLANT in good working order. Electric ovens. Re guns 15 colour (Sony Trinitron, Pil, in line etc) tubes in 24 hour cycles. Only £6,000 plus VAT, plus training provided. Tel: 0582 410787.

BUSINESS FOR SALE

BOOMING TV/VIDEO Business, Kent. Absolutely unique! Audited turnover £71,500. Current year predicted £120,000+. Gross profit 150%! Behind-the-scene secrets just cannot be copied. Must sell quickly for family reasons. Full written details: Box TV189.

WANTED

WANTED. We will clear any amount of colour sets from small Rental Companies, Hotels, etc. Please phone P & R Domestic Electrical Clearance Supplies, Weston Super Mare (0934) 514047.

VARIABLE TRANSFORMER WANTED. Preston, Lancashire. Tel. 0772 617329.

TELEVISION September 1975 to March 1981 approx. Phone Burnley 50574 evenings and weekends.

WANTED. Rediffusion Doric Mk3 20". Price, particulars, Phone 0388 745185, 746197 evenings.

WANTED. "Radio and television servicing" post 1970. Any service manuals. Lincoln 695678.

BOOKS AND PUBLICATIONS

"RADIO AND TELEVISION SERVICING" books, new editions for the last 6 years always in stock. Prices on request. BELLS TELEVISION SERVICES, 190 Kings Road, Harrogate, N. Yorkshire. Tel. 0423 55885.

FULL SIZE TOP QUALITY service sheets £2.50 + l.s.a.e. CTV/Music Centres £3.50 + l.s.a.e. Repair data almost any named TV/Video £10.50 inc. circuits. L.s.a.e. brings any quite free magazine/pricelists. TIST, 76 Churches, Larkhall, Lanarkshire. Tel. 0698 883334.

RADIO AND TELEVISION SERVICING BOOKS. New 74/75 £15. 76/77, 77/78, 78/79, 79/80, 80/81, 81/82, 82/83, 83/84 £22.50 each. Free delivery. U-VIEW, 29, Warmsworth Road, Doncaster. 0302 855017. Callers ring first.

COURSES

FULL-TIME TRAINING COURSES

15 MONTHS
B-TEC NATIONAL CERTIFICATE in TELEVISION & VIDEO SERVICING

15 MONTHS
B-TEC NATIONAL CERTIFICATE in COMPUTING TECHNOLOGY

9 MONTHS
B-TEC HIGHER CERT (HNC) in COMPUTING TECHNOLOGY & ROBOTICS

- PRINCIPLES OF ELECTRONICS
- TELEVISION (MONO/COLOUR)
- VIDEO CASSETTE RECORDERS & CCTV
- COMPUTERS & MICROPROCESSORS
- INDUSTRIAL ROBOTICS

Short courses (from 6 weeks) with previous electronics knowledge.

Courses commence Jan '85, April '85, September '85.

Prospectus from:

LONDON ELECTRONICS COLLEGE

Dept: AA, 20 Penywern Road, London SW5 9SU. Tel: 01-373 8721.

SERVICE PAGES

SERVICE SHEETS

30,000 SERVICE SHEETS IN STOCK
ALSO COLOUR MANUALS AVAILABLE

TV Sheets, Black and White, also Radiograms, Record Players, Music Centres. Japanese models in stock. Curcuit diagrams only. Also Tape Recorders etc etc., ALL AT £3. Please forward s.a.e. Send cheque or P.O.

C. CARANNA, 71 BEAUFORT PARK, LONDON NW11 6BX.

BELL'S TELEVISION SERVICES for service sheets on Radio, TV, etc. £1.50 plus S.A.E. Service manuals on colour TV and Video Recorders, prices on request. S.A.E. with enquiries to B.T.S., 190 Kings Road, Harrogate, N. Yorkshire. Tel. (0423) 55885.

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

TECHNICAL INFO SERVICES – 76 Church St – Larkhall – Lanarks

(By return of post service in most cases.)

Sole suppliers of the Unique Comprehensive T.V. Practical Course and The Complete Radio Repair and Servicing Course .... **ONLY £9.50 each.**

We stock every published service sheet plus produce more ourselves.
All service sheets are top quality, full-size sheets supplied in complete sets.
£3.50 + l.s.a.e. for CTV or Music Centres – £2.50 + l.s.a.e. any others.

WORLD'S LARGEST COLLECTION SERVICE MANUALS

Can be seen at our premises any evening 4–6pm. Manuals from 1930 to the latest issue. Col + Mono TVs, Videos, Audio, Com + Test Eqpt. in stock for immediate despatch – Over 400 dif. CTV – Over 200 dif video!

Sample CTV prices: G8 or Pye 697 or A823 or Autovox early (poor copy) at **£7.50 each**

Most manuals are unobtainable anywhere else.

WORLD'S BIGGEST PUBLISHER OF TV/VIDEO REPAIR MANUALS

British CTV Integrated Repair System (3/5) £85
Foreign CTV Integrated Repair System (2/4) £60
Mono TV Integrated Repair System (2/6) £70
Video Integrated Repair System (2/10) £49

First figure for giant collections of circuits/layouts in binders,
2nd figure for number of repair manuals. Other items not shown.

The Complete Integrated TV Repair System – covering TVs colour & mono, British & foreign, circuits, layouts, repair data plus much servicing data. Around £300-worth .... **ONLY £220**

Free 50p magazine with pricelists, etc. to every query or order – please enclose s.a.e.

FOR FAST QUOTES – PHONE 0698 883334

TELEVISION SERVICE SHEET SPECIALISTS

Thousands of British, European, and Japanese models in stock.
Colour **£2.00** Mono **£1.50 (post free)**
Manual prices on request.

Send stamped envelope for free catalogue and enquiries

SANDHURST TV SERVICES (MAIL ORDER)
49C Yorktown Road, Sandhurst, Camberley, Surrey GU17 7AG

FOR SALE

TUBE REGUNNING. All plant and equipment. Will not split. £3000. 0932 223426 WALTON.

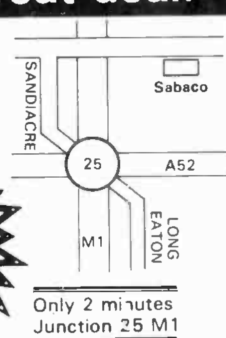
HEATHKIT CMOS TLL Logic Probe complete with instructions £16 only. Tel. 01-289-0598.

Sabaco For a great deal!

VAN LOAD DIRECT FROM SOURCES

Remember all sets cleaned and soak tested. Most makes available, any quantity e.g. GEC, Bush, Decca, ITT, Pye G11, T22, 9000, 9800 etc.
WORKING SETS FROM £20 upwards. e.g. GEC 2110 **£25** min cf 6 and etc.
COMPLETE NON-WORKERS from **£10** in quantities.
Black/White in batches of 10 at **£1.50**.
SPECIAL OFFER!
26" G8/3500/HYBRIDS
QUANTITIES OF 10 @ **£5 each**
SPARE PARTS AVAILABLE AT COMPETITIVE PRICES.
PLEASE SEE SEPT/OCT ISSUES.
N.B. Add 30p extra per panel.
ALL PRICES SUBJECT TO VAT & AVAILABILITY.

VHS VIDEOS **£90.00** BRAND NEW SETS AT COMPETITIVE PRICES



Only 2 minutes Junction 25 M1

Sabaco
Elastic Yarns Building,
Derby Road, Sandiacre,
Nottingham.

Open 6 days a week
9.30 a.m. – 6.00 p.m.

Telephone: (0602) 397555

AERIALS

SPECIALIST VHF AERIALS, 28-170 MHz, OIRT/TV-DX, Amateur, AB/MB/Cordless. Folder SAE, AERIALTECH, 33 Cherville Street, Romsey, Hants SO5 8FB.

AERIAL BOOSTERS

B45H/G-UHF TV next to the set fitting, gain about 20dbs, PP3 battery or 8V to 14V/working. **Price £8.70. P&P 30p.**
UHF TV BOOSTER MODULE. PCB ready made up to cover the complete UHF TV band. Gain 10dbs, noise 1.9dbs. 8V to 14V/W. **Price £2.50. P&P 30p.**
AMPLIFIED SET TOP AERIALS. Trebles the gain, fully portable, price includes batteries. **Price £9.70. P&P 50p.**
B11 VHF/FM RADIO next to the radio fitting, gain 14dbs. **Price £7.70. P&P 30p.**

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

S.A.E. for leaflets. Access/Visa Welcome.

EX-EQUIPMENT DISH, 1.5 metre on mount, as new £130 o.n.o. Tel. 0789 764040.

CLEARVIEW AERIALS

Clearview have pleasure in announcing a full and comprehensive range of signal amplification equipment. For example: low noise electronically remote controlled masthead pre-amp 1.6db noise. CH. 17-69. Set side amplifiers, distribution amplifiers, notch filters 4 in 1 or 2 in 1 etc. Combiners for 2 UHF aerials 3db gain or 4 6db gain. Trade and retail.

Send large SAE for our comprehensive catalogue

CLEARVIEW AERIALS,
173 Kings Road,
Kingston Upon Thames, Surrey.

MISCELLANEOUS

BURGLAR ALARM EQUIPMENT. Latest discount catalogue out now. Phone C.W.A.S. ALARM 0274 731532.

VIDEO/TV TEST EQUIPMENT (PAL)

Philips PM5519 pattern generator **£480**
Digitel D4060-01 noise meter **£480**
(VAT extra)

Contact:
Hi-Test, 64 Castellain Road,
London W9 1EX. Tel: (01) 289 3533

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

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

VHS★★★V2000★★★
BETAMAX★★★UMATIC

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

Or send for precise details
FLINTDOWN CHANNEL 5
339 CLIFTON DRIVE SOUTH,
LYTHAM ST ANNES FY8 1LP
(enclosing this advert)

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

- 2110 GEC Power Panel £8.00
- Line o/p frame panels GEC 20AX £10.00
- GEC 20 AX Transductor £1.00
- All diodes at 10p or less in this list 20 of one type £1.00
- OA 47 8p
- OA 90 8p
- IN 60 5p
- IN 541 5p
- IN 914 3p
- IN 2069a 10p
- IN 2070 10p
- IN 4001 3p
- IN 4002 3p
- IN 4003 4p
- IN 4004 4p
- IN 4005 4p
- IN 4006 4p
- IN 4007 5p
- IN 4148×40 £1
- IN 4448×40 £1
- IN 4722 10p
- IN 4751 10p
- IN 5235 10p
- IN 5254 10p
- IN 5349 10p
- IN 5392 10p
- IN 5928B 10p
- IAV 30 10p
- IM 72Z55 10p
- IR 106a 20p
- IR 3051 10p
- IS 164 10p
- IS 921 10p
- IS 3011a 10p
- IS 3072a 10p
- IS 5024a 50p
- IS 5030 50p
- ITT 921 10p
- ITT 923 10p
- ITT 1075 10p
- ITT 2001 10p
- ITT 2002 10p
- ITT 4150 10p
- ZE 1.5 10p
- ZF 3, 3.3, 4.3, 10, 11, 12, 15, 33, 43, 47, 82 10p
- ZPD 3.9, 4.7, 5.6, 10, 47 10p
- ZPY 8v2, 12, 16, 24, 43, 47, 56 10p
- ZTK 22 10p
- ZTK 33 10p
- ZTK 33a 10p
- ZW 13 12p
- ZW 27 10p
- ZW 4-3 10p
- ZW 310 10p
- ZX 68 30p
- ZY 47 10p
- ZY 72 10p
- AA 113 10p
- AA 119 8p
- AA 144 10p
- BA 102c 10p
- BA 157 8p
- BA 159 8p
- BA 173 8p
- BA 182 8p
- BA 201 8p
- BA 202 8p
- BA 243 8p
- BA 248 8p
- BA 316 5p
- BA 318 5p
- BAV 10 10p
- BAV 21 10p
- BAW 21 10p
- BB 103 10p
- BB 105A×12 £1
- BB 105B×12 £1
- BB 105G×12 £1
- BB 121a 10p
- BRC 83c13 10p
- BZX 46c22 15p
- BZX 61 9-1 6p
- BZX 61c110 6p
- BZX 61c20 10p
- BZX 61c30 10p
- BZX 61c220 10p
- BZX 70c6v2 8p
- BZX 70c12 20p
- BZX 70c33 8p
- BZX 79c3v9, 4v7, 5v1, 5v6, 6v2, 6v8, 7v5, 11, 12, 30, 47 10p each
- BZX 83c4v3, 5v6, 8v2, 12, 13, 24, 27, 33 10p each
- BZX 84c6v8×10 30p
- BZX 85c8v2 10p
- BZX 88c0v7, 3v9, 4v3, 6v2, 8v2,12 10p each
- 1A/1600V 10p
- 2 amp bridge rec. wire end 15p
- CV 8617 10p
- Y 716 10p
- Y 729 30p
- Y 730 10p
- Y 827: 6A/1KV 20p
- Y 860 30p

- T/V S54A Oscilloscope 10Mc/s £90.00
- Min 12 volt Relays 75p
- Y 933 5p
- Y 969 50p
- Y 997 30p
- R 1038 40p
- R 1039 40p
- R 2009 80p
- R 2010b £1
- R 2029 50p
- R 2210 60p
- R 2257 60p
- R 2265 50p
- R 2305 50p
- R 2306 50p
- R 2322/2323 pair 80p
- R 2323 15p
- R 2396 50p
- R 2461 80p
- R 2030 50p
- R 2443=BD124 40p
- R2737 40p
- R2738=TIP41 30p
- R2775=TIP41c 40p
- R3129=TIP47 40p
- S 2008b 80p
- BU 105/04 80p
- BU 108 £1
- BU 124 50p
- BU 126 80p
- BU 180a 65p
- BU 204 70p
- BU 205 £1
- BU 206 £1
- BU 207 £1
- BU 208 80p
- BU 208 on heat sink 70p
- BU 208A £1.10
- BU 208D 90p
- BU 222 £1
- BU 326 £1
- BU 407 60p
- BU 426V 60p
- BU 500 £1.10
- BU 508A £1.20
- BU 526 75p
- BU 807 £1
- BUX 84 50p
- BUW 84 30p
- BUY 71 £1
- TIC 106a 30p
- TIC 116m 40p
- TIC 116n/Y 1003 35p
- TIC 126N 40p
- TIC 206m 30p
- TIC 225S 40p
- TIC 226E 40p
- TIC 226m 30p
- TIC 236m 30p
- TICV 106D (T092 case 2A/400V) 10p
- TIP 29 20p
- TIP 30 35p
- TIP 30A 35p
- TIP 30B 40p
- TIP 30C 45p
- TIP 31 30p
- TIP 32 25p
- TIP 33B 50p
- TIP 33C 70p
- TIP 34A 50p
- TIP 34B 60p
- TIP 34C 70p
- TIP 35B 50p
- TIP 35C 70p
- TIP 35D 80p
- TIP 36 50p
- TIP 36C 70p
- TIP 41B 40p
- TIP 41D 70p
- TIP 42/BRC 6109 30p
- TIP 48 40p
- TIP 49 30p
- TIP 57 30p
- TIP 100 30p
- TIP 102 30p
- TIP 112 30p
- TIP 115 50p
- TIP 117 50p
- TIP 120 35p
- TIP 125 35p
- TIP 130 30p
- TIP 131 25p
- TIP 136 30p
- TIP 140 50p
- TIP 147 50p
- TIP 640 50p
- TIP 2955 35p
- T 6032 30p
- T 6036 40p
- T 6040 40p
- T 6047 40p
- T 6049 40p
- T 6051 40p
- T 6052 40p
- T 9004 40p
- T 9005 40p
- ZTX 102c 10p
- ZTX 107 10p
- ZTX 108c 10p
- ZTX 109k 5p
- ZTX 213 5p
- ZTX 341 10p
- ZTX 342 10p
- ZTX 384 10p
- ZTX 451 10p
- ZTX 550 10p
- MJ 2253 60p
- MJE 3040 60p
- MJE 2209 10p
- SP 8385 50p
- SAB 3205 £1.00
- SAB 4209 £1.00

SPECIAL OFFER CVC 21
Chassis complete £35
Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3

- BD 517 30p
- BD 519 30p
- BD 534 30p
- BD 544 30p
- BD 595 30p
- BD 610 30p
- BD 646 30p
- BD 676 30p
- BD 678 30p
- BD 681 30p

Voltage Regulators

- +5V/UA78PO5SC 30p
- −5V/LM79MO5CP 25p
- −8V/79M08c 30p
- +6V/78M06c 30p
- +10v/78LA10 20p
- LM 337 30p
- LM 342/18 30p
- LM 340T 5.0 50p
- +12V/LM 340T12 50p
- +15V/78M15 15p
- +18V/MC78M18 20p
- +24V/78M24 30p
- MC 7724cp 40p
- MC 7824 40p
- TIS 90 10p
- TIS 91 20p
- TIS 92 20p
- TIS 93 20p
- U 19885 40p
- U 3832 15p
- U 3845 15p
- MR 508 10p
- MR 501 10p
- MR 502 10p
- BCW 71R 30p
- BYF 1202 10p
- BYF 1204 10p
- BYF 3126 40p
- BYF 3214 40p
- BYX 10 6p
- BYX 36/600 35p
- BYX 38/300 25p
- BYX49/600R 75p
- BYX 55/350 10p
- BYX 55/600 (Bead) 10p
- BYX 71/350 20p
- BYX 71/600 50p
- BYX 72/300 20p
- BYX 36/600 50p
- BYV 95B 10p
- BVY 95C 12p
- BYZ 106 10p
- BPW 41 15p
- BYW 56 2A/1000v G11 8p
- BZU 15/24 54p
- BZY 93c75 50p
- BZV 15/18 30p
- BZV 15/30 30p
- BZW 70c6v2 10p
- BZX 79.3v 10p
- Bush thyristor RCA 76122 £1
- ITT computer bookset 2020 £2
- G8 20 turn 100K pot 35p
- Transformer 240v/20v-500Ma 75p
- Viewdata torroidals £6
- CVC 20 tube base £2
- Tube Base Rank & G11 £1.20
- Sankyo tape motor 75p
- Swiss made 250rpm/240V motor very small 75p
- Mono scan coil 110° small neck £1.50
- Infra red led LD57CA 15p
- Mono scan coil £3
- G 8 transductor £1
- AT 4041/41 transductor £1
- 2K5 Lin pot with 40mm spindle 20p
- 1982 Hitachi Ae isolator 50p
- Mullard FM decoder 1401 £1
- Philips service pack, flat films, 57 condensers 56nf-2.2uf £2
- VHF 3 Transistor rotary tuner DX-TV £1
- 15K-20 turn pots 20p
- Thorn panel 6×100 pot + changeover switch (Irish) 50p
- Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £6
- Thorn 3500 2A cut out 75p
- Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit with circuit £6

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

BRIDGES

- SKB 2/08 L5A 30p
- KBL 005 30p
- KBL 02 30p
- KBP 04 30p
- W02 15p
- W004 15p
- W005 20p
- GEC remote panel. Main transformer 3/ic SAA 1025/SN 74141/TBA 231 £6
- AT 2076/35 £7
- AT 2076/55 GEC split diode transformer £10
- AT 2048/11 LOPTI Mullard £2.50

PHILIPS DIY HOME SECURITY ALARMS KITS
Send for details. Prices £54 to £112.

10 Mixed TV & radio speakers **£5 + £2 post**

8Ω 4" speakers £1

- 4700/10v × 10 50p
- 68/16 × 10 50p
- 150/16 × 10 50p
- 47/25 × 10 50p
- 220/25 × 10 50p
- 1/250 × 10 50p
- 8000/30v 50p
- 470/40v × 10 £1
- 22/100v × 10 £1
- 100/350v 70p
- 400/350v 70p
- .47/500v 25p
- 1/600v 25p
- .022/1kv 10p

VIEW DATA PANELS NEW 19 I.C. **£5**

Philips GP422.4CH (£40 cost) **£6**

Stereo Dynamic Cartridge

12 Volt Aerial Changer over Relays 144 Mc/s 45 watts £1

GEC Hitachi
V/Cap tuner, after 1979 Series £8
6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £12

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

20AX GEC Split Diode lead **£1.00**

GEC Dynamic 20AX Convergence C2233H-R223GH **£2.00**

Mullard 12.5V/170 Mc/s 45 watt
- BLW60 £5.00
- BLW60C £5.00

Mullard Broadband R.F. power modules
- VHF. BGY33 £15
- UHF. BGY22E
- £5 PT4236C
- £5 PT8706C
- £5 PT9783

Various Tools and Accessories

- Philips £1.00
- Philips Neon Lamps for TV sets 5p
- Freeze £1.00
- Foam Cleaner £1.00
- Contact Cleaner £1.00
- Push Button Mains 75p
- Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt £1.00
- Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket £3.00
- Sellotape PVC Electric Insulation 25mm × 20M 50p; 50mm × 20M 70p
- ITT CVC £8.25 Chassis £40.00
- Screen locking agent, large can £1.50
- 20 GEC Service Manuals £5.00
- Red E.H.T. LAED and Anode Cap £1.00
- 10 × G11 Cap 470/250 £15.00
- Soldering iron 6v/23w £2.50
- TX 10 Focus Units £6.00
- Weller solder iron 15 watt/25 watt £5.00
- 2 way baby alarm/intercom with long leads £5
- Phillips universal battery tester/charger, fuse/bulb tester To Clear £4
- Eisenmann NICAD CHARGER 5.5V/150 ma £2
- 12V Nicad pack. "AA" £2.50
- Hitachi 7.2v/1.8A Nicad pack £6.00
- Hitachi TP 007 Battery pack 7.2v/1.6A £7
- Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V 60p
- 70ML Silicone Sealer (clear) £1
- 100 Coax Plugs £10.00
- De-solder pump + 2 nozzels £5.20
- Plastic box for i.c.s with anti-static pad 6"×3"×½" 75p
- Can of handy oil 'mobil' 40p
- Flat Red LED 12p
- 500gm 60/40 solder reel £7
- Clearweld glue pack 30p
- Dual v/u meter -20 – +10db £1
- 3 × C90 Cassettes 70p
- K30 thermistor 232266298009 75p
- GEC Mains Power Supply R.E.G. £3.00
- 1Kg reel of solder £8.00

- 75R/25 Watt 25p
- 18R/11 Watt 25p
- 120R/17 Watt 20p
- Front End Music Center. VHF/MW/LW 13"×3½" £3
- Output Stage for music center £5
- SONY 1400KV Chroma Panel £6
- SONY 1400KV Tuner unit £3.50
- SONY 1400KV Touch button unit £3.50
- 12 Volt Mains Trans 500M/A £1.00
- 18V or 12 Volt Mains Trans 500M/A 75p
- Texas Viewdata Decoder VDP 12/80 Issue 3 with all IC's £10.00

Quantity Reductions

- BY204/4 25 for £1.00
- BY206 25 for £1.00
- W005 bridge 20 for £2
- KT3 touch button black 6 for £1
- G11 touch button red 6 for £1
- K30 full remote Dawer Ass with 3 I.C. £7.00
- K30 VHF. UHF Dawer Ass £6.00
- BY298 3 amp/fast/R 20 for £1.50
- BD239 20 for £2.00
- MR856 25 for £1.50
- BU126 10 for £6.00
- BU205 10 for £8.00
- BU105 10 for £6.00
- 2SC2122A 10 for £8.00
- BF458 10 for £1.00
- BD136 10 for £1.25
- BF224 20 for £1.40
- OA90 40 for £1.00
- BYX10 100 for £4.00
- KT3 multicaps 10 for £7.50
- 50 Ceramic Condensers £1.50
- Mixed Mounting Kit for Power Transistors 50p
- 300 Condensers £1.50
- 300 Resistors £1.50
- 150 Electrolytics £2.00
- 15 Bulbs 40p
- Antistatic Discloth 5 for £1
- 100 Diodes £1.50

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

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

Mixed Packs

- TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits £1.00
- 50 Mixed AC series Transistor £4.50
- 15 Panel mount rocker switch 250V/10A £1.50
- 25 Panel Mount Bulbs & Neons £1.50
- 10A £1.50
- Mixed ribbon cables £1.00
- 25 LED red/yellow/green £1.50
- 20I/C Holders £1.20
- 20 Large LED Red £1.00
- 20 Small LED Red £1.00
- 10×20 Turn 100K Pots £1.00
- 100 Transistor £2.50
- 20 Convergence Pots 80p
- 100 Sticks £1.00
- 10 Thermistors 50p
- 20 Slider Pots £1.00
- 30 Presets 50p
- 15 VDR + thermistors, degaussing, HT, etc. £1.00
- 40 glass reed switch £1
- 10 press to make switch 70p
- 40 Pots £1.50
- 10 Gun Switches 50p
- 5 Tube Bases £1.00
- 1,000 Diodes, Condensers, Resistors on Bandolier £2.00
- Lucky Dip 600 gram £1.00
- Jungle Bag 5Kg £3.00
- 20 Knobs £1.00
- 40 Pots, ¼"+6mm spindles for audio/TV £3
- 20mm Fuse Holders Chassis Mount 20 for £1
- IN4001/6 100 mixed £2.50
- EHT Diodes, small 20 for £1

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Thorn Spares

9000 Frame panel	£8
9000 Cyclops panel	£1.50
8000/8500 timebase panel	£8
8800 convergence panel	£6
8500 convergence panel	£6
4000 Chroma	£20
4000 Power supply	£3
1600 Mains lead, switch	
3500 6 push button + cable form	£1.50
T605 1vNPN T066 80v/6A	10p
9000 Sound output panel	£1
3500 Focus unit	£1.50
3500 Mains Trans	£4
3500 2amp thermal cutout	75p
3500 IF panel	£2
3500 Frame panel	£3
3500 Line panel	£3
3500 A1 Diode	20p
Export 3500 IF panel	£2
IC board with set of SN74LS	£1
4000 Tube base	£4
3500 A1 pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA	£3.50
Rank/Toshiba preh unit 0354	£9.50
2 banks of 3 PB unit. Pye 731	£2
4 Push button unit preh	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button Unit fits GEC & Decca etc.	£6.00
6 Push button unit for GEC 2040 and ELC 1043/05	£6.00
Hearing aid unit	£3
6 Push button unit PYE 713	£7.00
7 Button Unit GEC with Lamps	£7

Mains Droppers

G8 2R2+68R	£1.25
G8 47R 15 watt	75p
Pye 731 3+56+27R	50p
Pye 3R5/15R/45R	50p
Thorn 50/17/1K5	£1.00
120/20/20/48/117	£1.00
270/10/6 for Thorn 4000	50p
18/320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ae Socket & Lead GEC, ITT, Philips, Pye	25p
7×3½ Thorn	£1
Rank Toshiba Tube Bases	30p

Speakers

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

K30

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

Diodes

BY 127	10p
BY 133	10p
BY 134	10p
BY 164	50p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 208/800	8p
BY 210/400	5p
BY 210/800	10p
BY 223	60p
BY 224/600, 4.8A/600v bridge	50p
BY 226	15p
BY 227	15p
BY 228	20p
BY 229/400	30p
BY 237	5p
BY 254	10p
BY 255	30p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 602	10p
F 247	10p
XK 3102	50p
XK 3123	50p
Hitachi 2A/1500V metal case wire end	20p

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

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

20.AX

GEC Degausing Panel 809 with PT37	£1.00

Line Transformers

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
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
GRC 20 AX Split Diode Trans	£7.00
CVC20 ITT	£3.50
CVC32 ITT	£7.50
AT2080/15 600M/300V	£1
CVC800 Line Trans	£6.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
EHT Split Diode Leads ITT	£1.00
EHT Cable/Metre	20p
Ex panel "14" Fidelity portable	£5

Triplers

8500 Triplers	£6.50
11 TEZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.50
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 Philips (Mullard) with cap	£6.00
CVC 825 ITT CVC 20/25/30/32	£3.50
Decca 80 100	£4.50
Grundig TVK 52	£2.50
11TBQ Pye 731	£3.00
11 THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
BG 100/61	£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. coils	£1.00
G11 Transient Suppressors 245V	10 for £1.00
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3/K30 infra-red receiver head	£3
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AE Sockets	25p
KT3 receiver panel	£8
KT3 line driver transformer	50p
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	
I.C. SAA 5042	
I.C. SAA 5030	
I.C. SAA 5020 etc.	£12.00
BTW 92/800R	£3
25A473 PNP C/P	10p

NEW PYE 725 line O/P panel with L.O.P.T. & Tripler	£10.00
Thorn Mains Isolator unit for 70-80Ω. 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 line O/P panel with transformer + tripler	£12.00
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
Hills 520 multimeter + case. 20,000Ω/volt, fuse diode protected + logic test facility. 10meg/1200 volt	£19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230)	£15.00
Panel 6101	£15.00
Panel 6330	£15.00
G8 Tuner Unit + Panel	£6.00
G8 Convergence Panel (late type)	£12.00
G8 Power Supply	£6.00
G8 6 Sloping PBU	£8.00
G8 IF & Chroma	£12.00
G8 Chroma	£6.00
G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz 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
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
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	
Focus Rod	25p
G11 focus	£2.00
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
16 Button Key Pad 1 to 0 + * + #+ 4 blank (Cherry)	£3.00
G7000 Philips Video Games Packs 11 types	£8.75 each
G11 drawer ASS 3 pots Mains switch and lead	£2.00
Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228	£10
3500 thick film	£2.00
4000 thick film	£2.00
PYE 731 thick film	£2.00

DISPLAYS

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

250/64	10p
3300/70	50p
.1/100	5p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
2000/100	70p
4700/100	75p
47/160	10p
600M/300V	£1.00
800/160	50p
.1/250 Pulse	5p
G11 0.47/250	10p
2.2 250v	10p
3n3/250 A.C.	10p
.33/250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
.91/250	35p
.91/400	30p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
GEC600/250	60p
700/250	£1
800/250	40p
32/300	20p
4/350	5p
8/350	8p
12/300	10p
4.7M/350v	10p
16/350	25p
33/350	20p
50/350	10p
220/350	30p
300/350	40p
400/350	50p
10/375	10p
22/375	15p
220/385	75p
330/385 CVC 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
.15/1000	20p
.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
G11.11000/1500	15p
.01/1600	15p
G11.8200/2KV	15p
0.1/2KV	20p
10n/2KV	15p
3n9/2KV	15p
0.0015/2KV	15p
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
210/12KV	10p
1000/12KV	10p
1200/12KV	10p

Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Mains Remote Switch 2865 ohm	£1.50
RANK & ITT Remote Switch 2800 ohm	£1.50
G11 Mains Switch	50p
4 amp Mains Switch	25p
GEC Mains Switch 4 amp	30p
KT3 Mainswitch	£1.00
THORN Rotary Mains Switch	50p
G8 Mains Switch	75p
Thyristor 600/4 amp C106/2	24p
G11 Preh Red LED P/Button for C.H. Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
CVC 5 Mains on/off +250K+100K+500K+50K+500K Pot on Panel	£2.00
Thorn 12 or 24 volt battery convertor for portable colour T/V	£12.00
Tape Heads R/Play/Back Mono/Stereo	£1.00 Post £1

Multi-Caps

470/250 G11	10 for £15
Thorn 3500	
175/100/100/350v	£1.75
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
470/470/250v	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
300+300/300	£1.00
225+25/380	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
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
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

Transducer Hand Set Insert, crystal, transducer, SAA 1124 & lead	£3.50
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	£19.00
C11 Ultrasonic full teletext for G26c 674/02 and G22c 66/02	£16.00
G9 Philips R/C Transmitter	£8.00
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