MARCH 1987

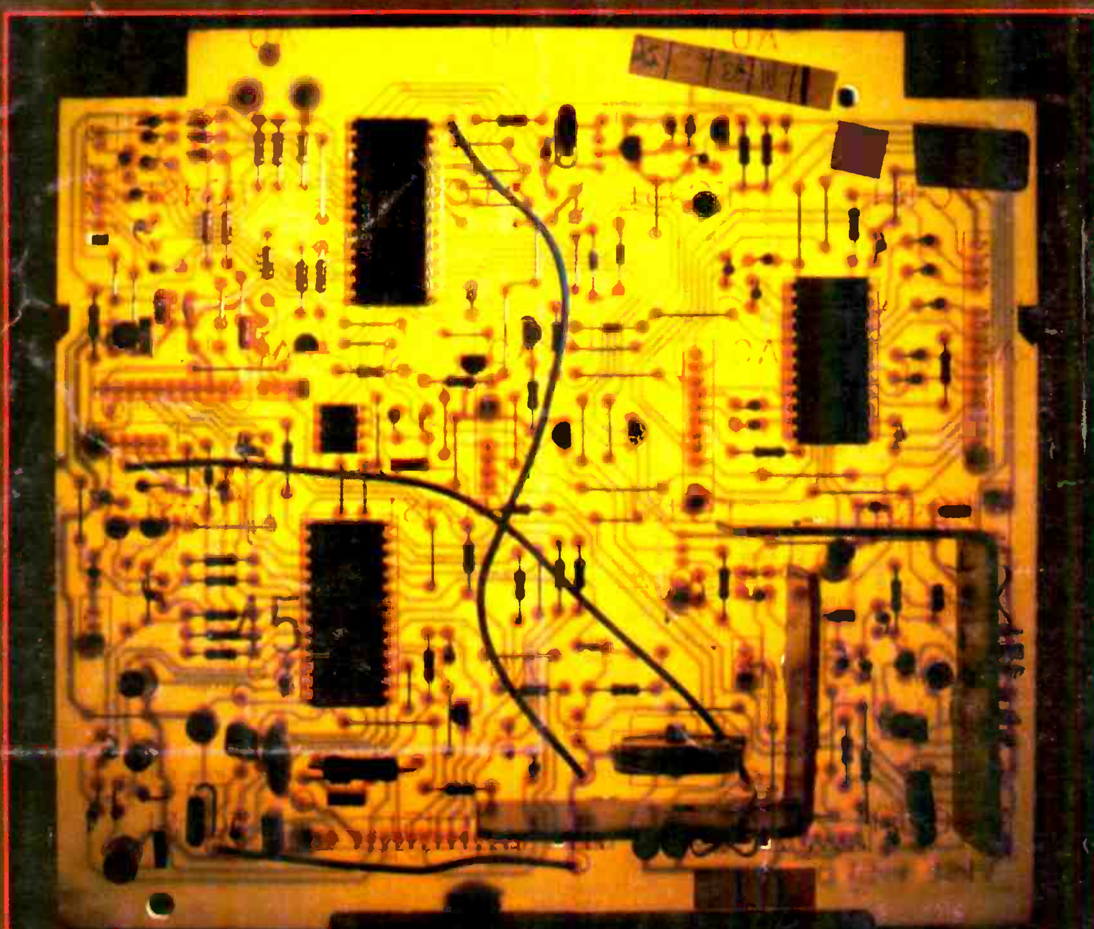
Australia $2.20, New Zealand $2·95 (inc. CST), Malaysia $5·95 £1·30

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Free Screwdriver

with integral wire-stripper



Microcomputer chips in TV sets

Dealing with Spillage in VCRs

Faults in CCTV Systems • DX-TV

VCR Clinic • TV Fault Finding

TELEVISION

March 1987

Vol. 37, No. 5
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On sale February 18th

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 £14 in the UK, £17 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
Send orders for binders (£4·50) and indexes (vols. 30-35 only, 75p each) to the Editorial Office, Television, IPC Magazines Ltd., King's Reach Tower, Stamford Street, London SE1 9LS. Prices include VAT and postage. Add 60p for overseas orders.

BACK NUMBERS
Some back issues published during the last six months are available from the Editorial Office at £1·40 inclusive of postage and packing. Address as above.

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 APRIL WILL BE PUBLISHED ON MARCH 18

P.V. TUBES

0254 36521
32611
390936

HITACHI/GEC – Semiconductorsd

LA7801	2.20
STR454	4.73
SN76709	8.00
TDA1870	6.46
TDA4503	5.68
2SD1453	2.20

HITACHI/GEC – VCR GEC V4000H/ Hitachi 8000

Belt Counter (122)	47
Belt Loading	43
Belt Take Up	30
Idler FF/Rewind	1.87
Lamp Tape Sensor	65
Play Idler Assy V6414221	3.74
Pressure Pinch Roller	5.16
Pulley FF/Rewind V6383531	52
Relay	2.54
Upper Cylinder (Head)	35.62

HITACHI/GEC – VCR GEC V40001H/ V4002/Hitachi 9300/9500E

Belt (259)	47
Belt (289)	47
Belt Take Up (213)	30
Capstan Motor	31.00
Idler FF/Rewind	1.80
Lamp Tape Sensor	91
Play Idler Assy VS861482	3.72
Pulley FF/Rewind V6345173	36
Video Head	35.62
Remote Cont. Handset	9.33

HITACHI/GEC – VCR GEC V4004/ Hit.VT33E

Belt (302)	30
FF/Rewind Arm V6886971	2.90

HITACHI/GEC – VCR GEC V4100/ Hitachi VT11E

Belt 312	30
Belt 313	30
Belt 317	47
Belt 318	40
Capstan Motor	22.18
Upper Cylinder (Head)	33.35

HITACHI – Sundries

Vertical Output Module	
GECC2286, Hit. CPT2226	3.98
C2067	
C2069	

HITACHI/GEC – Service Manuals (Zero VAT)

GEC	Hitachi	
V4000H	8000	6.49
V4004	VT33E	7.18
V4005E	VT63	4.77
V4100	VT11E	6.49

THORN NEW LIFE EXCHANGE VHS VIDEO HEADS

Send us your old VHS head. We'll send an exchange one by return. **Special offer price £19.99.**

FIDELITY – Semiconductors

ML923	2.21
SL490	1.77
TDA2270	1.65
TDA3330	2.21
TDA8180	4.00
BC638	33
BU5080	1.77
TDA3810	3.86

FIDELITY – Switches

On/Off AVS	94
On/Off Remote Cont.	2.43
On/Off CTV 140	94

FIDELITY – Transformers

Flyback FCC2015BE up to 22"	12.00
FCC2215AE 22"	12.00
Mod. Kit included	

FIDELITY – Remote Controls

4 Button CTV20R/22R/140R	12.75
8 Button F14R	13.81
12 Button IS500	13.81
14 Button AVS	12.75
32 Button Teletext	15.90
Tuner Flap CTV 14S	83
Loudspeaker CM14/CTV140R	1.99

FIDELITY – Service Manuals (Zero VAT)

Audio	IS500	2.20
	IS700	2.20
	IS750	2.20
TV	CM14	2.20
	CTM1400	2.20
	F14R	2.20
	TV140	2.20
ZX2000TV	CTV20R	2.20
ZX3000TV	AVS1600	1.70
ZX3000TV	CTV20	2.20
ZX3000TV	Teletext	2.20
VCR 2 Parts VCR		2.90

FEW ONLY SPECIAL OFFER

14" Mono tubes
110° £10 + VAT
Please ring for carriage costs

MAINS DROPPERS

Decca 20	2.48
Decca 27R/47R	1.40
Decca 56R/68R	1.40
R&M 823 56R/68R	94
PYE 725/31 3R/56R/27R	1.84
PYE 725 56R/27R	1.04
Philips 5050 30R/125R	1.75
Philips 5051 118/14B	1.93
Philips G8 47R	72
Philips G8 2R7/68R	1.38
Thorn 1400	1.52
Thorn 1500	1.47
Thorn 3500	1.20
Thorn 8000A	1.24
Thorn 8500	1.36
Decca 2R5	96
Decca Modulohm 3R9	60

PLUGS AND SOCKETS

Din Plugs		
5 pin 180°/240°/360°		20
6 pin		28
7 pin		35
8 pin		56
Chassis Sockets DIN		**Line Sock.**
5 pin din 180°/240°360°		28
	28	28
6 pin din	36	28
7 pin din	36	30
8 pin din	64	55
Phono plugs		12
2.5mm Jack plugs		11
3.5mm Jack plugs		15
3.5mm Jack Plugs Stereo		35
6.3mm Jack Plugs Stereo		36
Standard mono jack plugs		20
2 pin speaker plugs		10
I.D.C. plugs 36 way conn.		5.90
BNC plugs		1.15
Car aerial plugs		18
FM plugs		25
Coax plugs metal		18
Line connectors		16
Female plugs		75
In line socket metal		52
Crocodile Clips		25
Phono line socket		20
Phono chassis socket		10
2.5mm jack line socket		17
2.5mm jack chassis socket		14
3.5mm jack line socket		18
3.5mm jack chassis socket		24
3.5mm stereo line jack socket		28
3.5mm stereo jack chassis socket		18
6.3mm stereo jack socket		25
IDC 36 way socket		6.90
PL259 with reducer		1.30
Reducers for PL259		16

ADAPTORS

3.5mm Plug/6.3mm Soc.	25
3.5mm Plug/2.5mm Soc.	25

LEADS

2mm Fly m/m	70
2mm Fly m/f	70
4m Fly m/m	1.20
10m Fly	1.90
Fig. 8 Mains	62
Computer/TV	97
5 pin din/5 pin din	98
5 pin din/7 pin din	98
TA81 car bat. Thorn 1691	4.47
TA51 car bat. Thorn 1615	3.66
Car battery Philips	3.95
Scart Leads 2m (open end)	3.50

FILAMENT LAMPS

HES ROUND BULBS	15p
LILLIPUT (L.E.S.) BULBS	12p
CAPLESS LAMPS	28p
WIRE NEONS	9p
TUBULAR LAMPS CAPPED	31p
TUBULAR LAMPS (Wire ended)	31p
WIRE ENDED LAMPS	31p

AUDIO HEADS

Mono record/playback	4.32
Stereo playback	4.79
Stereo record/playback	4.99
Stereo record/playback (Dolby)	6.90
Mono/stereo erase	2.25

MOTORS ELECTRONIC/ ROTATION CLOCKWISE

6V MD6515	4.95
9V MD9516	4.95
12V MD12517	4.95

EVER READY BATTERIES

HP2/R20	
LR20 Gold	82
R20S Silver	39
R20B Blue	27
RX20 Rechargeable	2.61
HP11/R14	
LR14 Gold	74
R14S Silver	33
R14B Blue	24
RX14 Rechargeable	2.31
HP7/R6	
LR6(BC4) Gold	41
LR6(BC2) Gold	43
R6S Silver	21
R6B Blue	15
RX6 Rechargeable	1.31
PP3/6F22	
6LF22 Gold	1.53
PP3S Silver	74
PP3B Blue	54
RX22 Rechargeable	4.89
HP16/R03	
LR03 Gold	41
Blue	18
No.8 Battery	30
Univ. Batt. Charger	7.50
5 Hour Chg.	9.18

We have been appointed official distributors for Shorrock's security equipment.

ANTEX

C15W Iron 240V	6.20
C240 Element	2.75
Bits 102, 106, 820, 821	1.10
CS17W Iron 240V	6.40
CS240 Element	2.75
Bits 1100, 1101, 1106	1.10
XS25W Iron 240V	6.50
XS240 Element	2.75
Bits 50, 5¹	1.10
Temp. Controlled	
30W Iron CSTC	16.95
40W Iron XSTC	16.95
Unit TCSU1	68.95
Antex Stand	2.10
MLXS Auto Rep. Kit	8.40
Sundry Irons	
Cordless Gas Iron	15.99
Tips for Gas Iron	5.00
25 Watt Philips	5.50

WELLER

Heat gun	15.95
Heat gun tips	83
3/16" Iron tips 25W	83

SERVISOL

Freeze-It	1.20
SUPER SERVISOL	1.04
Foam Cleanser	1.02
Plastics Seal	1.14
Silicone Grease	1.30
Tubes Silicone Grease	1.66
Aero Klene	94
Aero Duster	1.28
Excel Polish	96
Video Head Cleanser	90
Super 40	1.66
Fire Extinguisher 640G	3.08
Heat Sink Compound 25G	1.10
Solda Mop standard reel	77
Hylosil Silicone Rubber	2.98

SECURITY EQUIPMENT

	CONTROL PANELS	
NEW	1011 Hilclare	29.50
	Hilclare Zone Exp.	32.50
	BELLS/BOXES	
	"C" Type Dummy	3.25
	"C" Type Polyprop.	4.55
	"C" Type Translux.	7.80
	6" MO Bell	5.52
	CABLE	
NEW	4 Core	5.43
	6 Core	7.84
	8 Core	10.37
	INFRA-RED PASSIVE	
	6JD Mini	26.15
	Invader	24.00
	SECURITY LIGHTS	
NEW	Floodlights	17.74
	Infrascan	62.94
	S.A.B. MODULES	
	Castle SAB	13.49
	P.A. BUTTONS	
	Stainless	2.88
	CONTACTS	
NEW	5 Term Flush M	59
	5 Term Surface M	59
	4 Wire Flush M	62
	4 Wire Surface M	62
	RECHARG. BATTERIES	
	12V 1.9A	7.06
	EXTERNAL SOUNDERS	
	712 Ext. Siren 116dB	5.75
	1010 Ext. Siren 116dB	5.96
	Dinablast 127dB	18.14
	PIEZO SOUNDERS	
	SB1 (140dB)	3.37
	SB2 (111dB)	5.17
	PZ28 (105dB)	4.61
	BUZZERS	
	HB722	60
	TAMPER SWITCHES	
	2½ Tamper	50
	TRUNKING	
	Fused Spur	2.58
	XENON FLASHER	
	128 PCL	6.75
	121 PCL	6.90
	JUNCTION BOXES	
	6 Way	21
	8 way	39
	CABLE CLIPS	
	3.5m 100	98
	4.5m 100	1.08

CASSETTE DRIVE BELTS

35mm	35	46mm	37
57mm	37	66mm	39
71mm	43	90mm	43
101mm	59		

VIDEO PINCH ROLLERS

PANASONIC	NV7000	4.35
SANYO	VTC9300/VBS7000	4.35
SONY	C7/J7/SL17	4.35
JVC	TCE3V00/01/06/16/ 23/24	
JVC	HR2200/3320/3330/ 3660/1100/7700	
AKAI	VS9700	4.35
HITACHI	VT5000	4.35
SHARP	VC6300/6500	4.35

VIDEO BELT KITS

VEKIT 1 AKAI	VS9300/VS9500/VS9800	
JVC HR3300/HR3320/ **HR3330/HR3360**		
TCE	8903/3V00/3V16/3V22	3.50
VEKIT 2 PANASONIC	NV7000B/NV7200B	3.00
VEKIT 3 SONY	SLC5/7	3.75
VEKIT 4 SONY	SL8000/8500/8600	4.50
VEKIT 5 SONY	SL3000UB	4.00
VEKIT 6 PANASONIC	NV3000B	3.00
VEKIT 7 SANYO	9300P	4.25
VEKIT 8 PANASONIC	NV2000B	3.75
VEKIT 9 PANASONIC	NV8600B/8610/V011	4.25
VEKIT 10 TOSHIBA	V8600	3.00
VEKIT 11 SHARP	VC7300	3.50
VEKIT 12 SHARP	VC6300/6600	4.00
VEKIT 13 SANYO	VTC5000	1.95
VEKIT 14 SANYO	VTC5300	2.50
VEKIT 15 JVC	HR7650	2.50
VEKIT 17 SHARP	8300	1.76
VEKIT 18 SHARP	9300	1.47
VEKIT 19 HITACHI	VT8000	1.12
VEKIT 20 HITACHI	VT11/33	2.15
VEKIT 21 HITACHI	9500	1.12

VIDEO IDLER TYRES

	O.Dia	I.Dia	Width	
SONY	23.7	17.4	4.9	50p
SONY	24.2	18	5.1	50p
HITACHI	31.8	25	4.9	50p
HITACHI	39.5	30	4.2	52p
PANASONIC	37	27	3.9	52p
PANASONIC	34.5	27	3.1	50p
AKAI	26	20	3.9	50p
JVC	32.8	3.4	3.9	56p
JVC	23.9	4.8	4	56p

VIDEO HEADS

Thorn New Life Heads (exchange)	21.45
3HSS	30.00
4HSS	31.00
PS3B Sony/Beta	35.00
Philips V2000	64.00
Philips 1700	64.00
Sanyo 9300/9455/9500	53.00
Sanyo 5000/5300/5400	53.00
Toshiba 9600 Upper Ass.	12.50
Toshiba 9600 (Rep. type only)	37.00
Sharp 2300	58.00
Sharp 6300	58.00
Sharp 7300/7700/7750	58.00
Sharp 8300	58.00
Sharp 3300/9700	56.00
Sharp 3HSS (S.P.)	42.00
Hitachi HIVI	35.62
Hitachi VT33E/GEC 4004	35.62
Hitachi VT11/GEC 4100	35.62

VIDEO TAPES

SKC	E60	2.50
	E120	2.88
	E180	2.80
	E240	3.78
	L500	2.90
	L750	3.40
Scotch	E30	3.66
	E60	4.00
	E120	3.24
	E180	3.86
	L750	5.22
	VCC360	6.33
	VCC480	7.23
Philips	LVC 1700 120	17.50

VIDEO SUNDRIES

VHS Drum Motor	25.50
VHS Capstan Motor	25.50
Sanyo 5000 Reel Motor	12.95
Sharp Reel Motor	19.50
Take up idler Ass./Clutch Ass.	
VHS (general purpose) Thorn/JVC etc.	5.95
Sharp 381/383/386/9100 9300/9500	2.48
Sanyo	6.95
Hitachi F.F. Idler VT11E/VT33E	2.90
Video Lamps	
Nat. Pan. Bulb VHS	1.00
General Purpose VHS	1.41
3V23 with plug VHS	1.95
Video Care	
Care Kit Deluxe	5.00
Care Kit	3.50
Universal Copy Kit	5.50
Head Cleaner	90
Beta Eccentricity Gauge	55.00

TURNTABLE DRIVE BELTS (suitable most types listed)

TB42 Thorens	1.20
TB23 Philips	1.20
TB50 Garrard	1.20
TB70 Hitachi	1.20
TB60 Sanyo	1.20
TB01 Pan., Sony, Pioneer, Technics, Sansui	1.20
TB03 BSR	1.20

REMOTE HANDSETS

PHILIPS

IR8331 KT3/K30 Mon. Text IR	15.85
IR8420 KT3/K30 Text IR	16.70
IR8435 G11 8 Way Text IR	20.85
OS8263 G11 Mon Text US	19.50
TP8431 G11 Mon Text US	19.50
US8518 G11 2 Function US	18.75
691, 17181 G11 31 Button US	27.00
Philips Remote 218, 20578 KT3 K30 K35 KT4 KT40 (Non Text or Text)	25.00

DECCA

VS8513 101 Mon. Text US	20.85
OS8511 80/100 3 Func. US	19.50

J.V.C.

RTP843 Text IR	13.50
Remote Control Tester	29.94

THORN

T723 (TMMA, 824, 004) TX10 Mon. Text Gen. Thorn	38.60
T723 IR8442 TX10 Mon. Text Rep. Type	19.50
T725 (TMMA, 860, 004) TX9 Mon. Text	19.40
T725 IR8688 TX9 Mon. Text Rep. Type	23.00
T731 (TMMA, 904, 004) TX9/10/100 Text Ster. Gen. Thorn	20.01
T736 (TMMA, 486, 004) TX9/10/100 Text Gen. Thorn	31.60
T736 IR8864 TX9/10/100 Text Rep. Type	23.85

GRUNDIG

RTP20 Telepilot 12	13.50
RTP05 Telepilot 8	13.50
RTP06 Telepilot 160	13.50
RTP07 Telepilot 300	13.50

REPAIR KITS INC. FOIL/BUTTON MATRIX/ INSTRUCTIONS

Philips KT3/30 1. without Text	8.95
2. with Text	8.95

VARICAP TUNERS

ELC1043-05	8.40
ELC104305 Mullard	12.50
ELC1043-06	8.40
ELC2003	19.50
Philips G8/G9	10.50
Philips G11 (U321)	9.90
U322	7.20
U341	9.50
U342	8.50

PUSH BUTTON ASS.

Hitachi 4 way	12.36
Philips G8 (early)	17.82
Philips G8 (late)	18.97
Philips G11 Tip Switch unit	26.50
Philips KT3	16.67
Philips KT30	13.22
Pye 6 way (207/715)	18.40
Pye 697 repair kit	10.35
Pye 725-735 (also Red Mk.1)	12.60
Pye 725-735 tuning head with PCB	12.50
Decca 4 way	7.93
Decca 6 way	9.17
Decca 4/6 way conversion kit	17.50
Decca 7 way piano key rep. kit	15.62
GEC 2110 6 way	10.92
GEC 6 way slim	10.29
GEC/ITT/PYE 7 way	16.67
GEC Conversion kit	16.50
Rank A823	12.36
Rank T20A	11.21
ITT CVC 8/9 (mod)	13.80
ITT 6 way with VCR	8.90
Thorn 8500	6.50
GEC 7 B/P c neons	10.50

SWITCHES/ACCESSORIES

On/off gen. purpose 4A	80
G8 on/off metal or plastic	1.98
G11 on/off	1.58
G11 on/off remote	1.58
Rotary on/off gen. purpose	66
ITT CVC5 on/off	1.24
ITT mains switch wity solenoid	4.50
Rank T20 on-off switch	2.50
Rank mains switch with solenoid	4.50
Thorn TX9/10	2.98
Thorn 9/10	2.Tx 98
GEC 2040 on/off	98
Rank tuner buttons 3 sizes	20
Thorn 3500 A1 beam switch	86
GEC 2110 tuner neons	35
GEC 2110 A1 cont. R/B/G	58

POTENTIOMETERS

Midget controls, Insulated Spindle. Length 44mm Log. or Lin. Without Switch. 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M 54

DPST Switched log. 5K, 10K, 25K, 50K, 100K, 250K, 500K, 1M, 2M 1.26

Dual Gang Controls 1.25

16mm Rotary Controls 10K, 22K, 100K, 1M 1.25

Convergence Pots. 60

3W Stand

5R, 6R8, 10R, 20R, 50R, 100R, 200R, 500R

Metric/Philips Type 60

5R, 10R, 15R, 20R, 50R

Skeleton Presets 16

Stand. or miniature. Horiz. or Vert 100R-2M2

Slider Potentiometers Lin. or Log. 75

1K, 2K2, 10K, 47K, 470K, 100K, 4K7 Log.

Multiturn Pots 65

GEC/TCE 100K, Philips G8, Decca/Rank

Thermal Cut Out Switches

Thorn 3000 2A Metal	2.68
GEC 2040 Metal	2.50

CAPACITORS

Main Replacement Electrolytic

Pye 169 (200/200/100/32)	3.74
Pye 691/7 (200/300/350V)	2.97
Philips G8 (600/300V)	2.53
Philips G9 (600/300V)	2.44
Philips G11 (470/250V)	3.19
Philips G11 (7n5 1500V)	1.40
Philips 320 (400/400/200V)	3.02
Decca 30 (400/400/350V)	3.74
Decca 80 (400/350V)	4.37
RBM A823 (2500/2500/30V)	1.83
RBM A823 (600/300V)	3.12
RR1 T20A (220/400V)	2.20
ITT CVC 5/9 (200/200/75/25)	3.28
ITT CVC 20 (220/400V)	2.20
GEC (200/200/150/150	2.91
Thorn 1500V (150/150/100/300V)	2.42
Thorn 1500V (12/300V)	35
Thorn 1591/1691 4700/25V	1.32
Thorn 3500 (400/40V)	33
Thorn 3500 (175/100/100/400/350V)	3.06
Thorn 3500 (1000/63V)	95
Thorn 3500 (1000/70V)	95
Thorn 8000/8500 (2500/2500/63V)	3.72
Thorn 8000/8500 (700/250V)	2.55
Thorn 8000/8500 (400/350V)	2.82
Thorn 9000 (400/400V)	3.61

LINE OUTPUT TRANS.

Philips 210/300 Mono	10.00
Philips G8	8.75
Philips G9	9.50
Philips KT3	10.06
Philips K30	17.94
Philips TX2	13.39
Philips TX3	14.41
Philips G11	15.58
Pye 713/715	10.00
Pye 725 90°	10.50
Pye 169	10.00
Pye 741	8.20
Bang & Olufson (2000.3000)	14.69
DECCA 80	8.58
Decca 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
ITT CVC 45	8.60
R.B.M. T20	13.95
R.B.M. BUSHRANGER T16A	10.00
R.B.M. BUSHRANGER T18A	10.00
Thorn 3000 EHT	9.95
Thorn 3000 SCAN	7.95
Thorn 8500	17.50
Thorn 3000/3500 Mains	10.00
Thorn 1615	12.50
Thorn 1691	9.68
Thorn TX9	23.85
Thorn 9600	21.79

RECTIFIER TRAYS

Thorn 1500 3 Stick	5.20
Thorn 1500 5 Stick	5.99
Thorn 3500	7.98
Thorn 8000	6.95
Thorn 8500/8800	7.15
Thorn 9000	8.70
Decca 1730/1830	5.48
Decca 30	6.76
Decca 80	7.12
Decca 100	7.50
Decca/Tatung 120/130	6.50
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 (pre or post Jan '77)	7.00
Philips G8 Short Focus Lead	7.12
Philips G8 Long Focus 550	7.12
Philips G9	6.37
Pye/Philips KT3	12.50
Pye 691/3	7.58
Pye 713 4 Lead	8.79
Pye 713 5 Lead	8.79
Pye 731/25	8.75
R.B.M. A823 plug in	8.75
Rank T20/22	7.12
ITT CVC5/9	7.50
ITT CVC20/25/30 (Mullard)	7.12
ITT CVC45	8.65
Universal	6.00
TV 11 Stick	90
TV 13	1.26
TV 14	1.29
TV 18	1.10
TV 20	1.43

FUSES

Quick Blow 1.25"

100ma	73
250ma-500ma-750ma-1A	60
1.5A-2A-2.5A-3A-5A	60

Quick Blow 20mm

100ma, 250ma, 315ma, 500ma, 630ma, 800ma	90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A	60

Mains Fuses

2A, 3A, 5A, 10A, 13A	1.00

Antisurge 1.25"

250ma, 500ma, 630ma, 750ma, 850ma	1.70
1A, 1.25A, 1.5A, 2A	1.70
2.5A, 3A, 5A	2.70

Antisurge 20mm

80ma	4.80
100ma	2.50
160ma, 200ma	2.20
315ma, 500ma, 630ma, 800ma	1.30
1A, 1.25A, 1.6A, 2A	1.30
400ma, 2.5A, 3.15A, 4A, 5A	1.90

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T.T.L. 74LS SERIES

				74LS92	65	74LS160	90	74LS251	65
74LS00	1.12	74LS37	35	74LS93	60	74LS161	85	74LS253	95
74LS02	58	74LS38	35	74LS107	80	74LS162	4.04	74LS257	1.20
74LS03	58	74LS40	35	74LS109	58	74LS163	85	74LS258	95
74LS04	58	74LS42	80	74LS112	50	74LS164	85	74LS259	1.70
74LS05	58	74LS47	85	74LS113	44	74LS165	1.50	74LS273	1.90
74LS08	58	74LS48	83	74LS114	70	74LS173	1.32	74LS283	1.30
74LS10	58	74LS49	33	74LS122	96	74LS174	85	74LS293	1.20
74LS11	58	74LS51	33	74LS123	80	74LS175	85	74LS352	1.40
74LS13	37	74LS54	43	74LS125	85	74LS191	1.02	74LS353	1.40
74LS14	46	74LS55	60	74LS126	60	74LS192	1.30	74LS365	65
74LS15	33	74LS73	60	74LS132	63	74LS193	1.30	74LS366	82
74LS20	35	74LS74	65	74LS138	83	74LS194	75	74LS367	1.67
74LS21	35	74LS75	65	74LS139	65	74LS197	95	74LS368	65
74LS22	35	74LS76	65	74LS151	85	74LS240	2.20	74LS373	1.40
74LS26	44	74LS78	65	74LS153	85	74LS241	2.20	74LS374	1.55
74LS27	35	74LS83	89	74LS155	65	74LS242	2.20	74LS393	1.20
74LS30	35	74LS85	98	74LS156	1.02	74LS243	2.20	74LS670	1.78
74LS32	90	74LS86	39	74LS157	78	74LS244	2.20		
		74LS90	1.22	74LS158	65	74LS245	2.30		

CMOS 4000B Series

		4026	1.99	4068	22	4510	76	4539	77
		4027	39	4069	22	4512	72	4541	96
4001	21	4028	64	4070	22	4513	1.68	4543	1.12
4002	21	4029	90	4071	40	4514	1.88	4551	96
4008	72	4032	1.04	4072	22	4515	1.88	4553	2.40
4011	31	4035	80	4073	22	4516	76	4554	1.20
4012	21	4038	99	4075	22	4518	76	4556	48
4013	30	4040	72	4076	80	4519	64	4560	1.76
4014	74	4042	58	4077	22	4520	75	4561	74
4015	76	4043	71	4078	22	4521	1.68	4566	1.20
4016	42	4044	71	4081	22	4522	88	4580	3.60
4017	66	4046	96	4093	49	4526	88	4581	1.84
4018	72	4047	70	4094	1.56	4527	1.20	4582	80
4010	70	4049	32	4099	1.20	4528	88	4583	1.00
4020	76	4050	32	4160	72	4529	1.04	4584	40
4021	70	4051	72	4161	72	4530	62	4585	88
4022	70	4052	72	4162	72	4531	72	4597	1.84
4023	21	4053	72	4163	72	4532	1.00	4598	2.40
4024	50	4060	96	4502	72	4536	2.64	4599	2.00
4025	21	4066	43	4505	1.88	4538	1.04		

VALVES CONT'D

30FL2	1.70
DY802	98
DY86/7	66
ECC81	1.08
ECC82	98
ECC83	1.07
ECC84	80
ECC85	98
ECC88	1.35
ECF80	1.30
ECF82	88
ECH81	1.60
ECH84	1.66
ECL80	84
ECL82	1.30
ECL86	1.99
EF80	95
EF86	2.20
EF183	99
EF184	1.09
EL90	1.75
EL34	3.50
EL84	1.05
EY86/7	68
EY500A	2.25
EZ80/81	56
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GZ34	3.50
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KT77	8.50
KT88 (alt type)	12.00
PC92	4.50
PC97	1.65
PCC85	85
PCC805	1.40
PCF80	1.00
PCF200	1.35
PCF800	1.38
PCF801	1.13
PCF802	1.12
PCF805	1.80
PCF808	1.63
PCH200	1.45
PCL82	1.20
PCL84	1.20
PCL805	1.09
PCL86	92
PFL200	1.86
PL36	1.87
PL81	94
PL95	2.25
6L6GT	2.30
12HG7	3.20
12BH7A	2.75
PL504	1.65
PL508	2.90
PL509/19	5.30
PY88	81
PY500A	2.30
PY800/1	69
UCH81	2.25
UCL83	1.82
UY85	1.35
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17DW4A	4.50
3AT2B	5.00
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EQUIPMENT

Testlead Set (AVO Type)	2.20
Degaussing Coil Stick	19.00
Signal Injector	4.00
Electric Circuit Tester	1.50
Probes (x10) or (x1)	10.90
Philips Switchable Probes	13.25
Automatic Wire Strippers	6.95
I.C. Inserters	1.18
Micro Pliers	4.20
Micro Cutters	5.00
Trim Tools Metal Ended	30
Side Cutters sm.	1.20
Long Nose Pliers	1.20
Sm. Neon Screwdriver	40
Quick Set Adhesive (Superglue)	75
Dynascan Tube Reju./testers	
467 model inc. bases	399.00
470 model inc. bases	299.00
available without bases for 50.00 less	

Tube Bases For Dynascan

No. 1 9.09		No. 14	16.63
No. 3 9.50		No. 15	16.44
No. 5 9.09		No. 18	10.83
No. 6 11.08		No. 19	10.83
No. 7 9.09		No. 21	14.40
No. 8 10.08		No. 23	13.86
No. 9 9.09		No. 24	27.07
No. 13 11.11		No. 25	12.57

Avo Meters Factory Recon.	119.00
Avo Battery	2.09
Solder Sucker Antistat min.	4.50
Solder Sucker Antistat std.	5.40
Solder Sucker Antistat lge.	6.20
Solder 500g	7.00
D.I.Y. Solder Small Pack	45
Solder Sucker Nozzles	81
Solda Mop Stnd.	74
For sold. irons see Antex/Weller Under Specific Spares	
Choc Bloc 5A	30
Fuse Wire 5A, 15A, 30A	05
Fluorescent Starter 4-80W)	15
Battery Press Studs min.	11
Battery Press Studs std.	15
Vero Board	2.59
Double Sided Adhesive Tape	5.75
Tinned Copper Wire	
18S WG 45 Amp	1.86
14SWG 100 Amp	1.86
17SWG 60 Amp	1.86
19SWG 45 Amp	1.86
20SWG	2.75
22SWG	1.86
Insulated Copper Wire	9.11
Cable Ties ALT1 per 100 (small)	84
Cable Ties ALT21 per 100 (large)	1.69
Power Adapter (12v)	5.95
Reg. 88 Power Adap.	5.50
Reg. 650 Power Adap.	6.50

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Drill Kit	25.99
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CM7261 Power Unit 12V	11.80
CM7262 Power Unit 12V	12.86
CM7065 VHF/UHF W/B 12V	15.05
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CM7253 Behind Set (Mains)	14.34
CM7243 Second Set Amp.	13.66
CM7093 Three Set Amp	16.83
CM7063 Dist. Amp. VHF/UHF	24.54
CM7108 8+1 Dist. Amp.	43.26
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CM9003 Flush Sing. Outlet	1.95
CM9010 Flush Twin Outlet	2.14
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CM7042 TV Games Combiner	3.09
CM9009 Flush TV/FM Outlet	3.36
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CM7057 Televerta Down UHF to VHF	43.06
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EXPORT ORDERS WELCOME

AERIAL EQUIPMENT

Chimney Kits	86
6" pressed bkt.	55
6" bkt. with kit	1.75
9" welded bracket	1.35
9" bkt. with kit	2.90
Double bkts.	2.39
Double bkts. witha kit	4.75
13.5" Cradle bkt.	2.25
13.5" Cradle with kit	4.25
Std repair pack	1.10
Double repair pack(2)	2.39
Wall Brackets	
6" welded	1.30
12" T&K	3.30
9" welded	1.87
Gutter Brackets	1.00
Clamps	
1" × 1"	68
2" × 2"	1.25
Universal No. 1	1.02
1" u bolts	19
J bolts	20
1.25" u Bolts	20
2" u bolts	28
UHF TV Aerial	
10 element	1.62
18 element	2.63
UHF TV Aerial	
3 element	5.68
4 element	6.50
Masts	
3ft crank 7/s shape	1.00
6ft 1"	1.60
10ft 1.5"	5.25
12ft 1.5"	6.00
16ft 2"	9.00
High Gain Aerials	
Antiference X68	17.10
Antiference XG14	27.10
Set Top Aerials	
Mercury Olympic 11	2.30
Antiference Super Set Top	5.56
Antiference Carratemna	6.80
Antiference Caravan Kit	11.00
Loop Aerial	1.00
Corner Plates	7
Lashing Wire	75
Lead Wall Nails (100)	4.95
Rawbolts	60
Caple Clips (100)	75
Coax Plugs	18
Line Connectors	12
Attenuators	1.80
Tape	76
Wood Screws	7
Mast couplers	8.92
27Mhz filter	2.10
Outlet Boxes	
Surface Single	80
Surface Twin	1.10
Y Splitter	85
Flush Single	95
Flush Twin	1.20
TV/FM Flush	1.35
Antiference	
SB11 Splitter	2.37
CS200 Comb/Split	3.94
COB11 Outlet	96
CS1000 Com/Split	4.77
PV1240 power	11.65
UP1300 MHA	9.09
XS2 xtraset	14.46
XS04 4wayDA	22.50
XS4/6	43.13
Diplexers	68
Match Trans	2.83
Back Boxes	
Metal Single	45
Metal Double	80
Plastic Single	61
Plastic Double	1.09
Budget Range	
Outdoor Splitter	6.50
Mast Head amp.	6.50
Power Unit	6.50

MULTIMETERS

Amprobe Digital Meter AM7	45.00
Amprobe Digital Meter AM9	55.00
Amprobe Volt/Ameter/Ohmeter RF3	68.00
Philips Meter 2000 R. per V.	20.71

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THERE IS VAT ON P+P!

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ADD 87p per order P+P (U.K.). Heavier parcels e.g. cable, service aids, degausing coils please allow £1.50 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. Bulkier items will be sent by carrier £6.00 + VAT up to 20K (except tubes).

BOOKS AND MANUALS ARE ZERO V.A.T.

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. In some cases we may have to supply an equivalent.

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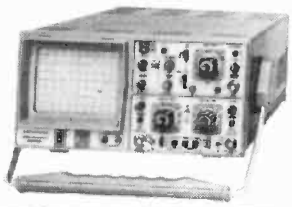
HAMEG are Europe's top selling **DUAL TRACE OSCILLOSCOPES.** Select from four superb models. All incorporate a useful **COMPONENT TESTER.** Size – all models – 285mm x 145mm x 380mm. Clear display 8 x 10cms. Mains supply 110/125/220/240V AC 50/60Hz. **2 YEAR WARRANTY**

HM203-6 20MHz Standard

FREE Securicor Delivery



SPECIFICATION
- Bandwidth DC-20MHz
- Sens. Ch1, Ch2. 2mV/cm
- Time Base 0·2s/cm – 20ns/cm
- Trigger DC-40MHz AC, DC, HF, LF, (TV Frame) Active TV Sinc. Sep.
- Invert both channels
- Variable hold-off 10:1
- Calibrator
- Plus many more features

Price £298.00 + £44.70 V.A.T.
Including two probes

HM204-2 20MHz Multi-function

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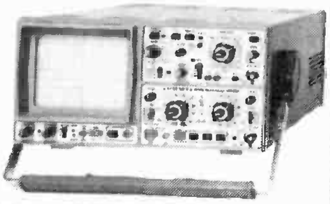
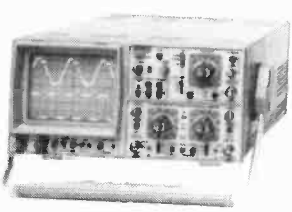


SPECIFICATION
- Bandwidth DC-20MHz
- Sens. Ch1, Ch2. 1mV/cm
- Delay Line
- Time Base 1·25s/cm – 10ns/cm
- Delayed Sweep 100ns – 0·1s
- Trigger DC-50MHz AC, DC, HF, LF, (TV Frame)
- Variable hold-off 10:1
- Overscan LED indicators
- Calibrator
- Plus many more features

Price £402.00 + £60.30 V.A.T.

HM205 20MHz Digital Storage

FREE Securicor Delivery

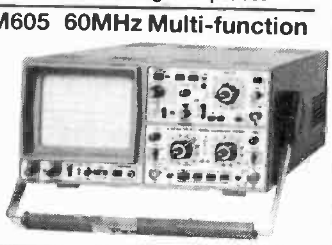


SPECIFICATION
- Digital Storage
- Analogue Real Time (Same as 203-6)
- Bandwidth DC-20MHz
- Sens. Ch1, Ch2. 2mV/cm
- Trigger DC-40MHz AC, DC, HP, LF, (TV Frame). Active TV Sinc. Sep.
- 100KHz Sample Rate
- 2 x 1K Storage
- Storage Range. 1ms-5s/cm
- Variable hold-off 10:1
- Calibrator
- Plus many more features

Price £498.00 + £74.70 V.A.T.
Including two probes

HM605 60MHz Multi-function

FREE Securicor Delivery



SPECIFICATION
- Bandwidth DC-60MHz
- Sens. Ch1, Ch2. 1mV/cm
- Delay Line
- Delayed Sweep 100ns – 0·1s
- Trigger DC-80MHz AC, DC, HF, LF, (TV Frame)
- Variable hold-off 10:1
- Switchable Calibrator
- Overscan LED indicators
- Plus many more features

Price £567.00 + £85.05 V.A.T.

LEADER LCT910-A CRT TESTER REJUVENATOR

Our top selling instrument is designed to readily test the various characteristics and rejuvenation of both colour and B/W CRT's.
- Tests for shorts and leakage between electrodes.
- Tests cathode emission characteristics.
- Separately checks condition of guns.
- Removal of shorts and leakage between electrodes.
- Checks heater warm-up characteristics.
- Rejuvenation of low emission cathodes with automatic timing.
- Super rejuvenation with manual control.
- Complete with tube base adaptors.
- Size H230mm W330mm D120mm.

Price £317.00 + £47.55 V.A.T.

SADELTA FIELD STRENGTH METER TC-402

THE SADELTA FIELD STRENGTH METER TC-402 has been designed to measure the signal levels delivered by the antenna to a TV or FM receiver, in order to test the performance of the antenna and evaluate the best conditions during installation etc. To facilitate measurements, the tuning frequency readout is shown on a digital display.

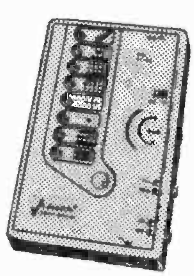
FEATURES

- Covering FM and all TV bands (UHF/VHF) including CATV freq.
- Digital tuning display (3 digits) for direct frequency readout.
- Accurate 10 turn tuning potentiometer.
- Built-in loudspeaker enables monitoring of sound in AM/FM.
- Meter measurement in voltage and dB from 20μV (26dB/μV).
- Continuity tester 0-500 ohms.
- Fully portable (battery).
- Sturdy carry case.

Price £249.00 + £37.35 V.A.T.

SADELTA COLOUR PATTERN GENERATORS

THE SADELTA RANGE OF HAND HELD COLOUR PATTERN GENERATORS is intended for use in production, installation and service of both colour and monochrome TV sets, video and computer monitors. In order to control and adjust the various parameters eight switchable patterns are provided. The technician has ready access to Laboratory, workshop and field use as the Generator has been designed using the latest micro-technology to achieve truly pocket size instruments. Internal re-chargeable Ni-Cd's. Supplied with 9V power supply charger. Size 131mm x 81mm x 23mm.



T.V. PATTERN GENERATOR PAL MC11B UK
- Band IV (21-34)
- Band III (5-12)
- PAL I.
- O/Put 10mV into 75ohms
- Sound output

Price £124.95 + £18.74 V.A.T.

PAL VIDEO COMPOSITE GENERATOR
- PAL B.G.I.
- O/Put 1V p.p. @ 75ohms
- Audio O/Put 10mV

Price £124.95 + £18.74 V.A.T.

SECAM VIDEO COMPOSITE GENERATOR
- SECAM B.G.D.K.L.
- O/Put 1V p.p. @ 75ohms
- Audio O/Put 10mV

Price £124.95 + £18.74 V.A.T.

R.G.B. PATTERN GENERATOR
- O/Put sigs. Pos.RGB Neg. Composite
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- Blank Pulse etc. CCIR

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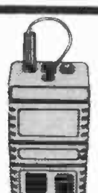
B.K.'s CRT TESTER-REJUVENATOR



Tests and rejuvenates blue, green & red guns separately. Fitted with delta and P.I.L. sockets. Compact size 120×65×60 mm. Supply 240V AC

Price £32.00 + £4.80 V.A.T.

B.K.'s REVOLUTIONARY DYNAMIC 'LOPT' TESTER

Revolutionary L.O.P.T. tester. Operates in dynamic mode which actually tests the L.O.P.T. under high voltage conditions without de-soldering or removal. Size 75×100×40 mm. Supply 240V AC

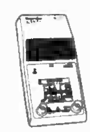
Price £25.99 + £3.90 V.A.T.

DIGITAL THERMOMETER

- Pocket Size
- –50°C to +750°C
- 1°C Resolution
- 0.5" LCD
- Supplied with thermocouple

Price £59.50 + £8.92 V.A.T.

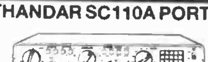
200MHz DIG. FREQ. METER



- Pocket Size
- 8 Dig. LED Display
- Freq. Range 20Hz to 200MHz
- Resolution 0.1Hz
- Sensitivity 10mV

Price £75.50 + £11.32 V.A.T.

THANDAR SC110A PORTABLE OSCILLOSCOPE



- Only 2¼" thick
- Fits in a brief case
- Sens. 10mV
- Bandwidth 10MHz
- Full trig. fac. inc. TV frame etc.
- Battery or mains adaptor
- Size 255mm x 148mm x 50mm

ACCESSORIES
Carry Case £6.25 + £0.93 V.A.T.
Probe £7.50 + £1.30 V.A.T.
Mains Adaptor £7.30 + £1.09 V.A.T.

Price £175.00 + £26.25 V.A.T.

LEADER HIGH VOLTAGE METERED EHT PROBE

LEADER High Voltage Metered **EHT PROBE.** Measures up to 40KV DC with safety. Built in meter. Accuracy ±3%

Price £45.00 + £6.75 V.A.T.

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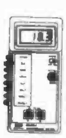


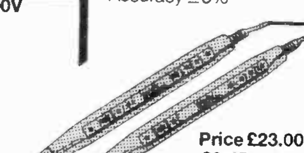
- High Accuracy
- 0·1pf – 2,000μf
- LCD display
- 8 Ranges
- Accuracy ±0·5%
- Full scale ±1 digit

Price £55.00 + £8.25 V.A.T.

INSULATION TESTER 500V

- Electronic battery operated
- Measuring Voltage 500V DC
- Measuring Range 0-100Mohm
- Centre scale 2Mohm

Price £65.00 + £9.75 V.A.T.



The **THANDAR TP1 LOGIC PROBE** and **TP2 LOGIC PULSER** are effective and economical tools for checking both TTL and CMOS circuits. TP1 can show 14 different circuit conditions and can detect pulses down to typically 10ns. TP2 can inject a signal directly into a circuit without damaging sensitive components. Together they can stimulate and monitor responses of components 'in circuit', greatly aiding fault finding.

Price £23.00 + £3.45 V.A.T. each

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AN7116	2.10
AN7145M	2.95
AN7168	2.95
HA1339A	2.95
HA1366W	1.85
HA1366WR	1.85
HA1374	2.45
HA1377	2.95
HA1392	2.95
HA1397	3.95
LA1201	1.25
LA1230	2.95
LA1365	2.45
LA4440	2.75
LA4445	2.45
LA4460	2.45
LA4461	2.45
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SAA1250	3.85
SAA1251	4.95
SAA3027	3.95
SAA5010	4.95
SAA5012	4.95
SAF1032P	3.25
SAF1039P	2.75
SAS560S	2.45
SAS570S	2.45
SAS580S	2.65
SAS590S	2.65
SL470	2.95
SL471DP	2.95
SL480	2.85
SL490	2.50
SL1430	1.95
SL1432	1.75
SN76660N	.65
STK0039	6.45
STK0040	5.95
STK077	6.95
STK078	6.95
STK2129	8.50
STK433	5.95
STK4332	5.95

TYPE	PRICE (£)
STK435	5.95
STK437	6.95
STK439	7.50
STK459	8.55
STK461	8.95
STK463	9.95
STK465	9.95
TA7193P	4.45
TA7204P	1.90
TA7205AP	1.45
TA7222P	1.85
TA7227P	2.95
TBA120AS	.95
TBA120T	1.25
TBA120U	.95
TBA520	1.00
TBA530	1.25
TBA560	1.45
TBA720A	2.95
TBA800	.75
TBA810S	1.25
TBA820	1.10
TBA890	3.25
TBA920S	1.95
TBA950/2X	2.25
TBA1440G	2.95
TBA2800	2.50
TCA270S	1.55
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TDA440	2.95
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TDA1037	1.95
TDA1044	2.95
TDA1170S	1.80
TDA1180P	2.65
TDA1190Z	2.85
TDA1470	3.25
TDA1506	4.35
TDA1510	3.80
TDA1512	3.35
TDA1515	4.50
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TDA1870	6.50
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TDA2005	3.20
TDA2006	1.95
TDA2020	3.20
TDA2030	1.80
TDA2170	2.95
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TYPE	PRICE (£)
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TDA2525	3.20
TDA2530	2.00
TDA2532	2.10
TDA2540	1.95
TDA2541	2.70
TDA2545	3.55
TDA2546	4.95
TDA2560	2.40
TDA2571A	4.95
TDA2576A	3.30
TDA2577	3.50
TDA2578A	2.95
TDA2581	2.00
TDA2582	1.95
TDA2591	2.30
TDA2593	2.30
TDA2594	2.95
TDA2600	6.35
TDA2611A	1.50
TDA2653A	3.55
TDA2654	4.30
TDA2655A	5.95
TDA3190	3.95
TDA3540	3.70
TDA3541	3.70
TDA3560	4.95
TDA3561A	4.95
TDA3562A	6.50
TDA3650A	4.75
TDA3651	2.70
TDA3651AQ	3.80
TDA3652	3.35
TDA4427	4.80
TDA4500	3.95
TDA4600/2	2.85
TDA4600/2D	3.30
TDA4610	3.50
TDA4700A	6.50
TDA5700	3.95
TDA8170	3.35
TDA8180	4.50
TDA8190	2.80
TDA9503	2.95
TDA9513	3.20
UPC1031H	2.60
UPC1181H	1.70
UPC1182H	1.70
UPC1185H	2.50

TYPE	PRICE (£)
UPC1230H	4.35
UPC1363C	3.95
UPC1365C	4.20

TRANSISTORS

TYPE	PRICE
BC107	.14
BC147	.10
BC148	.10
BC327	.11
BC328	.12
BC337	.11
BC338	.12
BC548	.10
BC547	.10
BC558	.10
BC637	.30
BC638	.25
BC639	.25
BD124M	.60
BD131	.33
BD132	.33
BD160	.50
BD201	.80
BD203	.90
BD222	.50
BD225	.50
BD237	.40
BD238	.40
BD438	.70
BD439	.70
BD677	.65
BD701	.95
BD707	.95
BF337	.28
BF338	.30
BF458	.35
BF757	.70
BF758	.70
BF871	.80
BF960	1.25
BR103	.75
BR303	1.95
BT116	1.30
BU126	1.50
BU205	1.40
BU208A	1.45
BU208/02	1.00
BU208D	1.95
BU326A	1.45
BU500	1.95
BU508A	1.75
BU508D	1.95
BU526	2.20
BU807	1.30
BUW81A	3.50

TYPE	PRICE (£)
BUX84	.90
R2008B	.70
R2540	2.35
TIP31C	.45
TIP32C	.45
TIP33	.90
TIP41C	.45
TIP42C	.45
15/80H	2.45
15/85R	2.45
2SB618	2.20
2SC867A	3.20
2SC1034	2.40
2SC1114	5.95
2SC1124	1.00
2SC1413A	3.95
2SC1942	2.90
2SC3156	2.50
2SD588	2.20
2SD725	7.95
2SD870	6.50
2S0880	1.25
2S01398	2.35

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TYPE	PRICE
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BY164	.45
BY179	.65
BY223	1.25
BY227M	.20
BY299/600	.95
BY299/800	.25
BYX10	.20
BYX55/600	.30
SKE5F3/10	1.45
1N4001-7	.07
1N5401-8	.18

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PCF802	.95
PCF802	1.10
PCL82	1.05
PCL85/805	1.00
PCL86	1.05
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PL504	1.60
PL508	3.00
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PHILIPS KT3	7.95
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THORN 8500/8800	7.20
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Dual PTC	2.85
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Tuner	15.95
Service Manual	10.95

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Service Manual	10.95
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Tuner	15.95

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Capstan Motor	31.90
Idler F.F./Rew	1.85
Pilot Lamp	.65
Pinch Roller	4.95
Play Idler	3.95
Service Manual	6.30
Video Head	34.95

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Capstan Motor	30.95
Idler F.F./Rew	1.80
Play Idler	4.30
Pinch Roller	5.50
Pulley F.F./Rew	.40
R.F. Converter	28.95
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Service Manual (9500)	8.50
Video Head	34.95

V4100H/VT11E

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Pinch Roller	5.50
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Service Manual	6.50
Video Head	32.95

V4004H/TV33E

Video Head	34.95

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NV2000 Idler	1.30
NV3000 Idler	1.25
NV7000 Idler	1.20
NV2000 Load. Gear	1.60
NV7000 Load. Gear	1.60
NV333 Pinch Roller	4.95
NV7000 Pinch Roller	4.95

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F. Load Motor	14.10
Loading Motor	12.95
Service Manual	7.50
Take-up Reel	5.30
Tuner	13.95
Video Head	59.95

VCR 6462/00

Capstan Motor	38.95
Control Motor	9.95
Erase Head	11.75
Modulator	35.95
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Video Head	39.95

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Audio Head	26.50
F/Load Motor	14.10
Idler Unit	8.25
Loading Motor	12.95
Service Manual	7.50
Take-up Reel	5.60
Video Head	59.95

VCR 6560/00/05

Capstan Motor	44.70
Control Motor	8.50
Modulator	48.60
Video Head	32.95

VCR 6660

Capstan Motor	36.95
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Capstan Motor	32.95
Gear Idler	6.95
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Reel Motor	8.95
Reel Pulley	6.70

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Limiter Assy	3.15
Motor (BHF1100D)	39.95
Pinch Roller	1.30
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Service Manual C7	9.40
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C6

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Service Manual (C6MKII)	9.40
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C9

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Sharp 7300	2.60
Sharp 8300	2.45
Sharp 9300	2.45
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Sony C6	2.45
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Thorn 3V29	1.80

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National NV2000	1.00
Sharp 8300	1.00
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3V00/16/22

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Take-up Idler	1.40
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3V35/36

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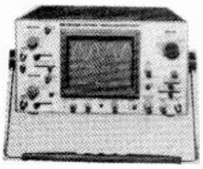

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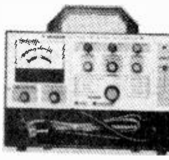

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AN203	£2.20	AN7154	£1.90	HA1306W	£1.80	LA1140	£2.20	M5134P	£3.25	STK5720	£6.80	TA7640AP	£1.75	2SA103	£0.60
AN210	£1.75	AN7156N	£2.50	HA1319	£2.50	LA1201	£0.85	M5155P	£1.85	STK5730	£4.25	TA7641BP	£1.95	2SA329	£0.40
AN211A	£2.30	AN7158N	£3.25	HA1339A	£1.85	LA1222	£1.00	M51102L	£3.95	STK7308	£5.95	TA7658P	£1.75	2SA350	£0.60
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AN234	£5.95	AN7178	£2.95	HA1368	£1.90	LA1365	£1.50	M51516L	£2.80	STR2012	£7.20	UPC20C	£2.50	2SA643	£0.70
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AN239Q	£4.20	AN7223	£3.95	HA1372	£3.50	LA1387	£3.60	M51518L	£2.20	STR6020	£7.20	UPC41C	£2.30	2SA768	£0.95
AN240P	£1.50	AN7273	£3.95	HA1374	£2.50	LA1460	£2.50	M51521AL	£1.90	TA7050P	£1.80	UPC561C	£2.50	2SA899	£0.75
AN241P	£1.50	AN7310	£1.20	HA1377	£2.20	LA2100	£2.95	MB3705	£1.80	TA7051P	£1.80	UPC566H	£0.75	2SA952	£0.40
AN247P	£2.50	AN7311	£1.20	HA1388	£3.50	LA3160	£1.50	MB3712	£1.50	TA7054P	£2.20	UPC573C	£2.50	2SA1015	£0.35
AN259	£2.75	BA301	£0.80	HA1389	£2.20	LA3161	£2.50	MB3713	£1.60	TA7066P	£1.50	UPC574J	£0.65	2SA1102	£2.20
AN260P	£2.20	BA311	£0.95	HA1389R	£2.20	LA3201	£0.95	MB3722	£3.50	TA7070P	£1.75	UPC575C	£1.00	2SA1103	£2.20
AN262	£1.60	BA313	£0.80	HA1392	£2.50	LA3210	£0.75	MB3730	£2.50	TA7074P	£1.95	UPC576H	£2.20	2SA1104	£2.50
AN271A	£2.50	BA318	£1.50	HA1394	£2.95	LA3300	£1.65	MB3731	£3.50	TA7104P	£2.50	UPC587C	£1.30	2SA1105	£2.75
AN274	£2.75	BA401	£0.80	HA1397	£2.75	LA3301	£1.30	MB3756	£2.60	TA7108P	£1.50	UPC592H	£0.95	2SA1106	£2.75
AN295	£3.60	BA402	£0.80	HA1398	£2.75	LA3350	£1.30	MB8719	£3.85	TA7109AP	£2.50	UPC595C	£2.20	2SB54	£0.70
AN301	£3.50	BA403	£1.95	HA1457W	£1.75	LA3361	£1.20	S 40W	£10.50	TA7120P	£0.75	UPC1001H	£2.20	2SB75	£0.60
AN302	£3.30	BA511A	£1.80	HA1112W	£3.75	LA3370	£2.80	SI-1125H	£7.50	TA7122AP	£0.90	UPC1009C	£2.20	2SB341V	£2.75
AN303	£2.75	BA514	£1.90	HA11211	£2.30	LA4030P	£2.00	STK011	£3.95	TA7130P	£1.00	UPC1018C	£1.95	2SB405	£0.80
AN305	£3.50	BA521	£1.80	HA11215A	£4.35	LA4031P	£1.95	STK013	£7.25	TA7136P	£1.00	UPC1025H	£2.30	2SB426	£2.95
AN313U	£2.95	BA526	£3.50	HA11219	£3.25	LA4032P	£1.90	STK014	£7.25	TA7137P	£1.00	UPC1026C	£1.00	2SB471	£3.50
AN315	£2.30	BA527	£1.60	HA11221	£2.75	LA4051P	£2.20	STK015	£5.20	TA7139P	£2.50	UPC1028H	£0.90	2SB492	£0.75
AN316	£3.75	BA532	£1.60	HA11223W	£3.80	LA4100	£1.20	STK020	£5.75	TA7140P	£1.75	UPC1031H	£1.95	2SB509D	£1.95
AN318	£4.95	BA536	£2.40	HA11225	£1.95	LA4101	£1.00	STK022	£5.30	TA7142P	£2.95	UPC1032H	£0.60	2SB536	£0.95
AN331	£2.95	BA547	£2.50	HA11226	£4.50	LA4102	£1.40	STK025	£7.50	TA7145P	£2.50	UPC1035C	£1.95	2SB546	£1.50
AN340P	£1.50	BA612	£1.80	HA11227	£2.20	LA4110	£1.75	STK040	£8.70	TA7150P	£2.75	UPC1037H	£1.25	2SB561	£0.35
AN360	£1.30	BA631	£5.75	HA11235	£2.30	LA4112	£1.75	STK043	£10.50	TA7152P	£2.50	UPC1156H	£2.95	2SB698	£0.40
AN362L	£1.60	BA656	£4.50	HA11244	£4.60	LA4120	£2.95	STK077	£6.50	TA7157P	£1.65	UPC1158H	£0.95	2SB755	£3.50
AN366P	£1.70	BA843	£4.50	HA11401	£2.80	LA4125	£2.20	STK078	£6.75	TA7176P	£2.75	UPC1165C	£1.30	2SC372	£0.35
AN374P	£2.20	BA847	£3.75	HA11423	£4.75	LA4126	£2.60	STK080	£7.50	TA7193P	£4.00	UPC1168C	£1.30	2SC380	£0.35
AN377	£2.00	BA853	£7.50	HA11440A	£3.95	LA4140	£0.80	STK082G	£7.75	TA7202P	£4.50	UPC1170H	£1.60	2SC458	£0.30
AN610P	£1.80	BA1310F	£1.75	HA11701	£3.50	LA4160	£2.40	STK086	£9.50	TA7203P	£1.90	UPC1171C	£1.50	2SC460	£0.35
AN612	£1.80	BA1320	£1.25	HA11703	£4.50	LA4170	£3.50	STK430	£5.50	TA7204P	£1.75	UPC1176C	£1.75	2SC461	£0.35
AN5033	£5.25	BA1330	£1.75	HA11704	£5.20	LA4182	£2.10	STK431	£5.95	TA7205AP	£1.00	UPC1177H	£1.60	2SC503Y	£0.70
AN5265	£3.20	BA1360	£1.80	HA11705	£6.95	LA4192	£1.95	STK433	£5.25	TA7207P	£1.75	UPC1181H	£1.10	2SC536	£0.35
AN5510	£2.75	BA5102A	£2.75	HA11706	£4.75	LA4200	£1.50	STK435	£5.50	TA7208P	£1.75	UPC1182H	£1.10	2SC537	£0.35
AN5620X	£3.50	BA5406	£3.20	HA11710	£3.75	LA4201	£1.60	STK436	£5.25	TA7210P	£2.50	UPC1183H	£2.20	2SC710	£0.35
AN5701	£1.80	BA6137	£2.75	HA11711	£9.50	LA4220	£1.50	STK437	£6.50	TA7214P	£2.60	UPC1185H	£2.50	2SC732	£0.35
AN5722	£1.60	BA6209	£3.75	HA11713	£6.50	LA4230	£2.25	STK439	£5.95	TA7215P	£2.30	UPC1186H	£0.90	2SC733	£0.35
AN5730	£1.85	BA6304	£2.20	HA11714	£5.95	LA4250	£2.75	STK441	£7.95	TA7217AP	£1.60	UPC1187V	£1.75	2SC828	£0.30
AN5732	£1.85	CX0642	£8.50	HA11715	£6.25	LA4420	£1.60	STK443	£7.95	TA7220P	£2.50	UPC1215V	£1.35	2SC840	£1.50
AN5753	£1.95	CX065B	£2.95	HA11716	£4.75	LA4422	£1.40	STK457	£6.50	TA7222AP	£1.30	UPC1223C	£2.20	2SC900	£0.35
AN6250	£2.30	CX075B	£2.75	HA11717	£5.75	LA4430	£1.40	STK459	£6.75	TA7223P	£2.30	UPC1225H	£2.00	2SC929D	£0.35
AN6310	£6.25	CX095C	£2.85	HA11718	£4.75	LA4440	£2.50	STK461	£7.50	TA7225P	£3.25	UPC1230H	£2.50	2SC930D	£0.35
AN6341N	£4.00	CX100D	£6.75	HA11727	£9.50	LA4445	£2.75	STK463	£8.40	TA7226P	£3.20	UPC1263C	£2.50	2SC1034	£4.75
AN6344	£4.75	CX101G	£7.75	HA11745	£9.00	LA4460	£1.80	STK465	£8.50	TA7227P	£2.20	UPC1277H	£2.75	2SC1061	£1.20
AN6350	£7.50	CX130	£4.75	HA11747	£9.50	LA4461	£1.80	STK501	£6.25	TA7229P	£3.25	UPC1278H	£2.75	2SC1096	£0.70
AN6356N	£3.85	CX136A	£7.50	HA11747ANT	£9.50	LA4500	£2.60	STK0025	£4.95	TA7230P	£1.95	UPC1350C	£1.20	2SC1364	£0.35
AN6360	£4.50	CX143A	£7.50	HA11749	£4.75	LA4505	£2.80	STK0029	£4.75	TA7232P	£2.95	UPC1353C	£1.95	2SC1815Y	£0.45
AN6362	£5.50	CX157	£4.25	HA11750	£5.00	LA4507	£4.25	STK0039	£4.75	TA7240AP	£2.95	UPC1356C	£2.00	2SC1875	£2.95
AN6363	£7.50	CX158	£3.75	HA11751NT	£8.50	LA4520	£2.50	STK0040	£6.25	TA7241AP	£2.95	UPC1363C	£2.20	2SC1942	£3.25
AN6387	£5.95	CX160	£3.50	HA11753NT	£8.50	LA5112	£1.85	STK0049	£6.50	TA7270P	£2.75	UPC1378H	£2.40	2SC1957	£0.80
AN6610	£1.80	CX161A	£3.50	HA11758NT	£8.50	LA6458D	£1.20	STK0059	£7.00	TA7310P	£1.85	UPC1382C	£1.10	2SC1969	£1.75
AN6677	£6.30	CX162	£3.95	HA11768	£4.50	LA7016	£2.75	STK0080	£7.75	TA7312P	£1.50	UPC1384C	£2.85	2SC2078	£0.95
AN6811	£1.60	CX170	£6.75	HA11788	£4.50	LA7215	£2.75	STK2028	£7.50	TA7313AP	£1.50	UPC1387C	£2.50	2SC2166	£0.95
AN6873	£4.50	CX181	£8.75	HA11816NT	£6.50	LA7751	£4.75	STK2029	£5.75	TA7314P	£2.50	UPC1391H	£1.50	2SC2335	£1.50
AN6884	£2.75	HA1124A	£2.75	HA11828NT	£9.50	LA7755	£3.20	STK2129	£6.75	TA7315AP	£2.35	UPC1403CA	£5.75	2SC2577	£1.95
AN7105	£2.30	HA1125	£1.75	HA12001W	£6.50	LA7800	£1.95	STK2230	£6.50	TA7317P	£2.75	UPC1420CA	£6.50	2SC2578	£2.75
AN7110	£1.50	HA1137W	£1.75	HA12002	£2.95	LA7801	£2.95	STK3042	£6.50	TA7324P	£2.50	UPC1458C	£0.95	2SC2579	£2.75
AN7111	£1.50	HA1144	£4.25	HA12017	£2.75	LA7806	£2.75	STK4060	£6.50	TA7325P	£1.00	UPC1533HA	£2.75	2SC2580	£2.75
AN7114E	£1.75	HA1151	£2.50	HA12035	£9.50	LA7808	£2.95	STK4141II	£7.50	TA7328AP	£2.20	UPC4557C	£1.50	TDA1515	£4.50
AN7115E	£1.60	HA1156W	£1.20	HA12038	£6.75	LB1287	£2.75	STK4191II	£8.95	TA7331P	£2.20	UPC4558C	£0.90	TDA2002	£0.80
AN7116	£1.50	HA1167	£3.75	HA12413	£2.75	LB1405	£2.20	STK4332	£5.75	TA7343P	£2.95	UPD1514C	£5.75	TDA2003	£0.90
AN7120	£1.50	HA1196	£1.75	HA13001	£2.95	LC4066B	£2.95	STK4392	£7.50	TA7607AP	£2.95	UPD4514BC	£3.50	TDA2004	£2.20
AN7130	£1.30			HA13402	£4.95	LC7120	£3.50	STK5211	£6.75	TA7608CP	£3.95	X0042CE	£2.20	TDA2005	£2.75
AN7145M	£1.95			HA13403	£7.50	LC7130	£3.50	STK5421	£6.50	TA7609P	£2.70	X0077GE	£9.95	TDA2006	£1.50
				HA13430A	£4.50	LC7131	£3.75	STK5422	£6.75	TA7611AP	£3.20	X0092CE	£5.60	TDA2020	£1.40
						LC7136	£2.75			TA7614AP	£2.75			TDA2030	£1.40
						LC7137	£2.75			TA7617AP	£2.50			TDA3562A	£5.50

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JVC HR7700 (3)	£1.70
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AN5430	£2.95
AN7140	£2.20
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UPC1394C	£1.95
SAA1059	£1.95
SAA1250	£3.25
SAA1251	£4.95
SAA1272C	£3.25
SAA5000	£1.50
SAA5010	£4.50
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SAA5030	£6.50
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TDA2653A	£5.20
TDA3505	£4.75
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TDA3651	£2.95
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JVC 3HSS	£28.75
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6-9-12-13 2 Volts £2.95

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TELE-PART

Telegen-1

PRICE £18.35 (Inc. VAT)

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

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

Telegen-2

PRICE £34.45 (Inc. VAT)

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

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

Power Supply

A switchable power supply ideally suited to both Telegen 1 and Telegen 2.

PRICE £4.55 (Inc. VAT)

ALL ITEMS POST AND PACKING £1.44 (Inc. VAT)

All goods should be delivered within 4 working days.

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Price per pack is **£1.00.*** Order 12 you may choose another free. Items marked (sh) are not new but guaranteed ok.

1. 5 – 13 amp ring main junction boxes
2. 5 – 13 amp ring main spur boxes
4. 5 – surface mounting light switches
5. 3 – electrical switches intermediate type, will also replace 1 or 2 way switches, white flush mounting
7. 4 – in flex line switches with neons
9. 2 – mains transformers with 6V 1A secondaries
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31. 1 – key switch with key
33. 2 – aerosol cans of ICI Dry Lubricant
34. 48 – 2 metre lengths colour-coded connecting wire
39. 1 – long and medium wave tuner kit
41. 8 – rocker switch 10 amp mains SPST
45. 1 – 24 hour time switch mains operated
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51. 1 – 12V 2 CO miniature relay very sensitive
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55. 1 – locking mechanism with 2 keys
56. 1 – miniature uniselector with circuit for electric jigsaw puzzle
60. 5 – ferrite rods 4" × 5/16" diameter aerials
61. 1 – Mullard thyristor trigger module
66. 1 – magnetic brake – stops rotation instantly
67. 1 – low pressure 3 level switch can be mouth operated
69. 2 – 25 watt pots 8 ohm
70. 2 – 25 watt pots 1000 ohm
71. 4 – wire wound pots – 18, 33, 50 and 100 ohm your choice
77. 1 – time reminder adjustable 1-60 mins clockwork
85. 1 – mains shaped pole motor ¾" stack – ¼ shaft
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
96. 1 – thermostat for fridge
98. 1 – motorised stud switch (s.h.)
101. 1 – 2½ hours delay switch
102. mains PSU 9V
103. 1 – mains power supply unit – 6V DC
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107. 1 – 5" speaker size radio cabinet with handle
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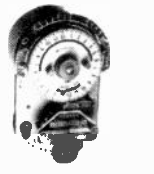
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118. 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
121. 4 – push push switches for table lamps etc.
122. 10 – mtrs twin screened flex white p.v.c. outer
124. 25 – clear plastic lenses 1¾ diameter
127. 4 – pilot bulb lamp metal clip on type
128. 10 – very fine drills for pcbs etc.
129. 4 – extra thin screw drivers for instruments
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
134. 10 – model aircraft motor – require no on/off switch, just spin to start
142. 10 – 4BA spanners 1 end open, other end closed
145. 2 – 4 reed relay kits 3V coil normally open or c/o if magnets added
146. 20 – pilot bulbs 6.5V 3A Philips
154. 1 – 12V drip proof relay – ideal for car jobs
155. 3 – varicap push button tuners with knobs
169. 4 – short wave air spaced trimmers 2-30f
172. 10 – 12V 6W bulbs Philips m.e.s.
178. 3 – oblong amber indicators with liliputs 12V
180. 6 – round amber indicators with neons 240V
181. 100 – p.v.c. grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
184. 1 – three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45mm
193. 6 – 5 amp 3 pin flush sockets brown
195. 5 – B.C. lampholders brown bakelite threaded entry
196. 1 – in flex simmerstat for electric blanket soldering iron etc.
197. 2 – thermostats, spindle setting – adjustable range for ovens etc.
199. 1 – mains operated solenoid with plunger 1" travel
200. 1 – 10 digit switch pad for telephones etc.
201. 8 – computer keyboard switches with knobs, pcb or vero mounting
211. 1 – electric clock mains driven, always right time – not cased
216. 1 – stereo pre-amp Mullard EP9001
232. 2 – 12V solenoids, small with plunger
236. 1 – mains transformer 9V 1 amp secondary C core construction
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
241. 2 – speakers 6" × 4" 4 ohm 5 watt made for Radiomobile
243. 2 – speakers 6" × 4" 16 ohm 5 watt made for Radiomobile
244. 1 – mains motor with gear-box very small, toothed output 1 rpm
245. 4 – standard size pots, ½ meg with dp switch
249. 1 – 13A switched socket on double plate with fused spur for water heater etc.
266. 2 – mains transformers 9V ½A secondary split primary so ok also for 115V
267. 1 – mains transformers 15V 1A secondary p.c.b. mounting
291. 1 – ten turns 3 watt pot ¼ spindle 100 ohm
296. 3 – car cigar lighter socket plugs
298. 2 – 15 amp round pin plugs brown bakelite
300. 1 – mains solenoid with plunger compact type
301. 10 – ceramic magnets Mullard 1" × 3/8 × 5/16
303. 1 – 12 pole 3 way ceramic wave charge switch
304. 1 – stereo amp 2W per channel
305. 1 – tubular dynamic microphone with desk rest
308. 1 – T.V. turret tune (black & white T.V.)
310. 2 – oven thermostats
313. 5 – sub miniature micro switches
316. 1 – round pin kettle plug with moulded on lead

MULLARD UNILEX AMPLIFIERS

We are probably the only firm in the country with these now in stock. Although only four watts per channel, these give superb reproduction. We now offer the 4 Mullard modules – i.e. Mains power unit (EP9002) Pre amp module (EP9001) and two amplifier modules (EP9000) all for **£6.00** plus £2 postage. For prices of modules bought separately see TWO POUNDERS.

CAR STARTER/CHARGER KIT

Flat Battery! Don't worry you will start your car in a few minutes with this unit – 250 watt transformer 20 amp rectifiers, all parts with data £15 case £4 p&p £2.

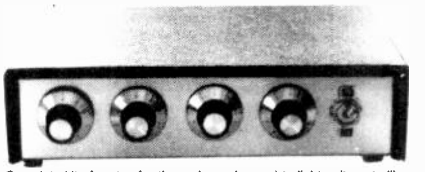


Ex-Electricity Board. Guaranteed 12 months.

VENNER TIME SWITCH

Mains operated with 20 amp switch. One on and one off per 24 hrs. repeats daily automatically correcting for the lengthening or shortening day. An expensive time switch but you can have it for only **£2.95** without case, metal case – **£2.95**, adaptor kit to convert this into a normal 24hr. time switch but with the added advantage of up to 12 on/offs per 24hrs. This makes an ideal controller for the immersion heater. Price of adaptor kit is **£2.30.**

SOUND TO LIGHT UNIT

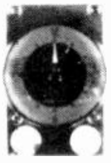


Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is **£14.95** in kit form.

12 volt MOTOR BY SMITHS

Made for use in cars, etc. these are very powerful and easily reversible. Size 3½" long by 3" dia. They have a good length of ¼" spindle –
1/10 hp **£3.45**
1/8 hp **£5.75.** 1/6 hp **£7.50**

25A ELECTRICAL PROGRAMMER



Learn in your sleep. Have radio playing and kettle boiling as you wake – switch on lights to ward off intruders – have a warm house to come home to. You can do all these and more. By a famous maker with 25 amp on/off switch. A beautiful unit at **£2.50**

THIS MONTH'S SNIP

400 Watt Mains Isolation Transformer 230 volts in 230 volts out. Supplementary 10 volt winding for voltage adjustments. Torroidal construction makes it most compact. Regular price £40. Our price **only £10.00** + £2 post.

MAKING SUNBEDS?

CHOKE AND STARTER for 6' 100uva tube **£2**, post £1 for 1 or 50p each in quantity.
TUBE HOLDERS Canopy type spring loaded, 4 pairs for **£1**, 100 pairs **£20**, 1,000 pairs **£150**, post paid.

TANGENTIAL HEATERS

We again have very good stocks of these quiet running instant heat units. They require only a simply case, or could easily be fitted into the bottom of a kitchen unit or book case etc. At present we have stocks of 1.2kw, 2kw, 2.5kw, and 3kw. Prices are **£5** each for the first 3, and **£6.95** for the 3k. Add post £1.50 per heater if not collecting.
CONTROL SWITCH enabling full heat, half heat or cold blow, with connection diagram, 50p for 2kw, 75p for 3kw.

FANS & BLOWERS

Woods extractors
5" **£5** + £1.25 post. 6" **£6** + £1.50 post
4" × 4" Muffin equipment cooling fan 115V **£2.00**
4" × 4" Muffin equipment cooling fan 230/240V **£5**
5" Plannair extractor **£5.50**
9" Extractor or blower 115V supplied with 230 to 115V adaptor **£9.50** + £2 post.
All above are ex computers but guaranteed 12 months.
10" × 3" Tangential Blower. New. Very quiet – supplied with 230 to 115V adaptor on use two in series to give long blow **£2.00** + £1.50 post or **£4.00** + £2.00 post for two.

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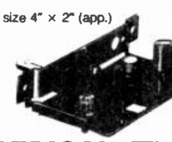
MINI MONO AMP on p.c.b. size 4" × 2" (app.)



Fitted volume control and a hole for a tone control should you require it. The amplifier has three transistors and we estimate the output to be 3W rms. More technical data will be included with the amp. Brand new, perfect condition, offered at the very low price of **£1.50 each, or 13 for £12.00**

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- 2P27 – Goodmans Speaker 6 inch round 8 ohm 12 watt
- 2P28 – Drill Pump – always useful couples to any make portable drill
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- 2P72 – 1 115v Muffin fan 4" × 4" approx. ex computer
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- 2P82 – 9v-0-9v 2 amp mains transformer
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- 2P98 – 20m 4 core telephone cable, white outer
- 2P99 – 500 hardened pin type staples for telephone cable
- 2P101 – mains transformer 15v 4A upright mounting
- 2P105 – capillary type thermostat adjustable for air temperatures with 10A c/o switch
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- 2P108 – mains motor with gear box giving 110rpm
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- 2P113 – 9 volt 200MA Voltage regulated PSU for 13 amp socket
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- 2P116 – FM front end with tuning capacitor and F.M. circuitry
- 2P118 – 30rpm mains motor with gearbox
- 2P119 – Under carpet switch mat for burglar alarm etc.

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- 5P6 12V alarm bell with heavy 6" gong, suitable for outside if protected from direct rainfall. Ex GPO but in perfect order and guaranteed.
- 5P15 Uniselector 5 pole 25 way 50 volt coil
- 5P18 motor driven water pump as fitted to many washing machines
- 5P20 2 kits, matchbox size, surveillance transmitter and FM receiver
- 5P23 miniature (appr. 2½" wide) tangential blow heater, 1.2kw
- 5P24 ¼hp motor, ex computer, 230v, mains operation 1450rpm. If not collected add £3 post
- 5P25 special effects lighting switch. Up to 6 channels of lamps can be on or off for varying time periods
- 5P27 cartridge player 12v, has high quality stereo amplifier
- 5P28 gear pump, mains motor driven with inlet and outlet pipe connectors
- 5P32 large mains operated push or pull solenoid. Heavy so add £1.50 post
- 5P34 24v 5A toroidal mains transformer
- 5P35 modem board from telephone auto dialler, complete with keypad and all ICs
- 5P37 24 hour time switch, 2 on/offs and clockwork reserve, ex. Elec. Board loading up to 50A. Add £1 post
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- 5P45 pack of 6 cooker clock switches
- 5P48 telephone extension bell in black case, ex-GPO
- 5P50 box of 20 infra red quartz glass enclosed 360w heating elements
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- 5P52 mains transformer 26v 10A upright mounting, add £2 post
- 5P54 mains motor with gear box, final speed 5rpm
- 5P58 Amstrad stereo tuner FM and LM and S. AM
- 5P60 DC Muffin type fan 18w to 27v, only 3w
- 5P61 drill pump mounted on frame, coupled to mains motor
- 5P62 2½kw tangential blow heater, add £1.50 post if not collecting
- FP69 Fluorescent light box for viewing PCB's or can be used for shop window sign

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LM380N8-P	1.15
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M51513L	1.90
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MC1327P	1.50
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ML237B	2.30
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STK015	6.20
STK032	13.00
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TA7203P	2.50
TA7204P	2.50
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TA7222P	2.32
TAA550	0.50
TAA611A12	4.50
TAA621AX1	4.50
TAD100	2.90
TDA120A	1.20
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TDA120B	1.30
SA/SQ/UQ	1.30
TBA520	1.50
TBA530	1.20
TBA540	1.64
TDA560C	1.50
TBA810S	1.20
TBA950/2A	3.05
TCA270SA	4.02
TDA1003A	5.50
TDA1006A	2.45
TDA1035S	4.50
TDA1170S	1.99
TDA1352A	1.80
TDA2002	1.80
TDA2020	4.00
TDA2030	1.90
TDA2140	2.90
TDA2160	2.50
TDA2522	2.75
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
UPC57562	1.45
UPC1350C	4.05
UPC1156H	2.75
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7818	0.45
7824	0.45
7905	0.50
7912	0.50
7915	0.50
7918	0.50
7924	0.50
78H05	5.60
78H12	6.40
LM305H	1.48
LM317K	2.40
LM317T	1.25
LM723	0.65

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AC128	0.30
AC128K	0.34
AC141	0.58
AC141K	0.38
AC142	0.56
AC142K	0.38
AC151	0.45
AC152	0.45
AC153	0.57
AC153K	0.46
AC176	0.30
AC176K	0.38
AC187	0.28
AC187K	0.38
AC188	0.28
AC188K	0.38
ACY22	1.50
AD142	0.88
AD143	1.10
AD149	0.72
AD161/162	1.20
AD162	0.52
AF114	1.20
AF115	2.10
AF116	2.10
AF121	0.56
AF124	0.42
AF125	0.58
AF126	0.58
AF127	0.38
AF139	0.40
AF178	2.28
AF239	0.50
AF279S	1.40
ASY80	5.20
ASZ17	2.00
AU110	2.80
AY102	4.40
B40C200	1.03
BA110	0.68
BA115	0.14
BA121	0.40
BA129	0.38
BA148	0.16
BA155	0.12
BA157	0.28
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12
BC108	0.10
A,B or C	0.13
BC109	0.10
A,B or C	0.14
BC115	0.12
BC116	0.12
BC117	0.22

Type	Price (£)
BC118	0.16
BC119	0.28
BC125	14
BC140	0.27
BC141	0.24
BC142	0.24
BC143	0.26
BC147	0.18
BC147B	0.14
BC148	0.10
BC148B	0.12
BC149	0.10
BC149C	0.14
BC157	0.10
BC158	0.12
BC159	0.12
B/C	0.14
BC160	0.30
BC161	0.30
BC168B	0.20
BC169C	0.12
BC170/A/B/C	0.16
BC171/A/B	0.10
BC172/B/C	0.12
BC177/A/B/C	0.24
BC182/A/B/C	0.10
BC182L	0.12
LA LD LC	0.10
BC183/A/B/C	0.10
BC183L	0.10
LA LB LC	0.10
BC184	0.10
A B CL LC LB	0.10
BC207	0.15
BC212/A/B/C	0.10
BC212L	0.09
LA LB	0.10
BC213/A/B/C	0.10
BC213L	0.10
LA LB LC	0.10
BC237	0.11
BC238	0.12
BC251/A/B	0.14
BC262	0.20
A B	0.28
BC301	0.30
BC302	0.30
BC303	0.30
BC307A	0.18
BC317A	0.12
BC323	0.90
BC327	0.16
BC328	0.16
BC337	0.12
BC338	0.12
BC350A	0.24
BC351	0.16
BC440	0.36
BC441	0.40
BC461	0.58
BC478	0.24

Type	Price (£)
BC516	0.48
BC547	0.12
A or B	0.10
BC548	0.12
A B or C	0.10
BC549	0.10
A or B	0.10
BC550	0.10
A or B	0.10
BC557	0.10
BC558A	0.10
BCY70	0.16
BCZ10	3.21
BCZ11	2.60
BD124P	0.70
BD129	0.90
BD130Y	0.68
BD131	0.36
BD132	0.36
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.28
BD142	1.26
BD145	1.82
BD150A	0.72
BD160	1.58
BD165	0.45
BD183	0.70
BD201	0.52
BD202	0.57
BD204	0.50
BD222	0.80
BD225	0.40
BD232	0.45
BD234	0.30
BD235	0.80
BD236	0.38
BD237	0.38
BD410	0.76
BD434	0.58
BD438	0.58
BD439	0.85
BD441	1.00
BD507	1.05
BD520	1.20
BD687	0.88
BD707	0.88
BDX18	1.00
BDX32	1.48
BF115	0.32
BF117	0.50
BF119	0.82
BF120	0.38
BF125	0.42
BF127	0.41
BF154	0.14
BF157	0.46
BF160	0.23
BF167	0.32
BF177	0.42

Type	Price (£)
BF178	0.26
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.30
BF185	0.28
BF194A	0.15
BF195	0.12
BF224J	0.20
BF240	0.30
BF241	0.30
BF244A	0.30
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF294	0.46
BF336	0.32
BF337	0.28
BF338	0.28
BF355	0.37
BF371	0.27
BF450	0.38
BF457	0.36
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.86
BFY50	0.22
BFY51	0.22
BFY52	0.22
BFY90	0.80
BFY90S	1.34
BR100	0.25
BR101	0.40
BR103	0.50
BR303	2.75
BRY39	0.50
BRY56	0.42
BSX20	0.30
BSY52	0.35
BSY95A	0.25
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT116	1.20
BT119	3.30
BT138/600	1.30
BT151/560R	0.90
BTY79/400R	2.80
BU104	1.80
BU105	1.20
BU108	1.75
BU124AE	0.98

Type	Price (£)
BU126	1.40
BU133	1.90
BU204	1.30
BU205	1.30
BU206	1.50
BU208A	1.40
BU326S	1.75
BU407	1.10
BUX80	3.70
BUY20	2.75
BUY69A	2.60
BUY69B	1.98
BY100	0.80
BY103	0.50
BY122	0.60
BY126	0.10
BY127	0.08
BY133	0.06
BY135	0.35
BY164	0.45
BY179	0.56
BY182	0.80
BY184	0.38
BY187	0.65
BY189	6.75
BY198	0.64
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/600	0.24
BY210/800	0.28
BY227	0.22
BY228	0.46
BY238	0.65
BYX10	0.20
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX36/600	0.30
BYX71/600	1.18
C106D (400V)	0.48
E1222	0.30
E5024	0.30
MCR106/5	1.20
ME0413	0.70
ME6002	0.26
MEU21	0.62
MJ400	0.45
MJ2955	1.00
MJ3000	1.80
MJE340	0.46
MJE520	0.44
MJE2955	1.60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSLO1	0.34
MPSUO5	1.05
MPSUO6	1.18
MR502	0.40
MR854	0.88
OA91	0.07

Type	Price (£)
ORP12	0.95
R2008B	1.20
R2010B	1.20
R2540	2.71
TIP30A	0.32
TIP31C	0.39
TIP32	0.35
TIP33A	0.55
TIP34A	0.70
TIP41C	0.42
TIP42	0.44
TIP47	0.42
TIP121	0.63
TIP2955	0.70
TIP3055	0.58
TIS88	0.50
TIS90	0.27
Y728	0.14
Y969	2.80
IN4001	0.04
IN4003	0.05
IN4004	0.05
IN4006/7	0.07
IN4148	0.04
IN5400	0.12
IN5402	0.13
IN5405	0.16
IN5406	0.17
IN5408	0.19
2N2122A	0.34
2N2222	0.30
2N2904A	0.48
2N2926G	0.14
2N3053	0.30
2N3054	0.60
2N3055	0.65
2N3703	0.10
2N3773	2.80
2SB337	1.80
2SC1098	0.84
2SC1172Y	1.70
2SC1173Y	0.88
2SC1279	0.50
2SC1306	0.92
2SC1413A	2.70
2AC1449	0.60
2SC1507	0.60
2SC1678	1.00
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC21953	0.70
2SC1957	0.70
2SC1969	2.80
2SC2028	0.73
2SC2029	2.70
2SC2078	1.05
2SC2091	0.70
2SC2098	2.90
2SC2122A	3.20
2SC2314	0.80
2SC2335	1.50

VALVES

Enquiries are welcomed for any other valve not listed here.

Type	Price (£)
AZ31	4.50
AZ41	1.98
DAF96	1.00
DF96	0.75
DK96	2.65
DM71	2.95
DY86/87	0.66
DY802	0.95
CV850	2.50
CV4015	2.80
E180F	6.50
EABC80	0.98
EAF42	1.50
EB91	1.30
EBC41	2.00
EBF80	0.75
ECC81	1.00
ECC82	0.90
ECC83	1.00
ECC84	0.80
ECC85	0.95
ECC88	1.25
ECC189	0.85
ECF80	1.20
ECF82	0.85
ECF83	1.90
ECH35	3.75
ECH81	1.40
ECH84	1.50
ECL85	0.75
ECL86	1.75
EF80	0.75
EF86	1.80
EF91	2.00
EF95	1.68
EF183	0.90
EF184	1.00
EH90	0.98
EL34	3.25
EL36	2.25
EL81	6.95
EL84	1.00
EL85	4.75
EL86	0.90
EL509	7.85
EL519	7.95
EM80	0.85
EM84	1.75
EM87	2.55
EY51	0.90
EY86/87	0.65
EY88	0.75
EY500A	2.50
EZ41	2.80
EZ81	0.80
GY501	1.40
GZ32	1.20
KT66(G.E.C.)	18.00
KT77	11.50
KT88(G.E.C.)	19.00
PC88	1.40

PC92	3.00
PC900	1.40
PCC88	0.80
PCC89	0.75
PCC189	0.85
PCF80	0.95
PCF82	0.95
PCF84	0.75
PCF86	1.25
PCF87	0.50
PCF200	1.95
PCF201	1.95
PCF800	1.20
PCF801	1.05
PCF802	1.05
PCF805	2.00
PCF806	1.20
PCF808	1.60
PCL82	1.00
PCL83	2.50
PCL84	1.00
PCL86	0.90
PCL88	2.50
PCL805	1.05
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COVER PHOTO

This month's cover photograph shows the remote control and microcomputer PCB (PC1544) used with the Ferguson TX100 chassis. The MAB8440P microcomputer chip is at the top, with the SAB3035 CITAC chip below it and the SAA1061 display driver to the right. See article on page 320.

Right place, right time

The death of Sir David Robinson on January 10th, aged 82, founder of Robinson Rentals, serves to remind us that it has been possible at various times in the past to make a fortune in the TV field in the UK. Sir David's knighthood came in 1985, for gifts to charity estimated to have been over £26m, including £17m to found the Cambridge college that bears his name. Sir David left school at fifteen to work in his father's bicycle shop. He started his own business, as a car dealer, in Bedford in the early thirties, and by 1937 the firm had moved into radio, electrical and cycle retailing. TV rentals came after the war and expanded with the first TV boom that started with the coronation in 1953. By 1962 Robinson Rentals (Holdings) was making a profit of some £1·5m a year. Sir David sold the business to Granada in 1968, for some £9m. Thereafter his interests turned to the turf – in the early seventies he was the UK's largest racehorse owner. In the decade after 1968 his jockeys rode nearly a thousand winners.

It is in no way to belittle the achievements of Sir David in the TV field to point out that he had the good fortune to be in the right place at the right time – or rather to have done the right thing at a favourable time. In addition to hard work and having a good idea, an element of luck is required for success in business. Others who made their fortunes in the TV field during the period included Sir Michael Sobell and Sir Jules Thorn. Interesting that both should have been noted for their philanthropic work and an interest in horses.

TV (and VCR) rental remains a considerable, if declining, industry to this day. Its heyday came during the fifties and sixties, when TV sets were relatively expensive and none too reliable. It made sense for the public to rent their sets, transferring the problem of maintenance to the rental company. From the business point of view, set rental had certain advantages over retailing in those days. It was the period of stop-go demand management, when the chancellor of the day would hoist or slash purchase tax with successive budgets (and often in between). The retailer could be caught with a shopful of sets no one wanted, or a stock shortage when demand boomed. The rental companies could sit back and relax as the payments on their sets came in week by week. There were also tax advantages. The rental company's sets were its trade stock, so no purchase tax was involved. Rental made sense all round, and the public took to the habit enthusiastically. It was given a final, and considerable, boost when the colour boom period came in the early seventies.

The advantages of rental have waned as set reliability has increased and the tax situation has changed. One wonders whether demand management could have worked if implemented with greater skill. The basic idea, after all, was to maintain production and employment. Unfortunately, all too often a boost was given to spending just as industry was recovering from a period of recession and vice versa. So it became boom or bust. The problem is in gathering accurate statistics and taking appropriate action at the right time to have the desired effect. It didn't work too well, though one has to admit that the present system doesn't either: one lot of problems have been swapped for another.

Rental firms managed to sail through the boom and gloom periods relatively unscathed. Sir David made his money, so did Sir Jules. Sir Michael's contribution to TV came in a different area, in manufacturing. He produced rational sets in a rational way – Sobell designs did much to end the vintage era of quirky circuits, with engineers experimenting as they went along. The sets used simple but effective chassis, were reliable and value for money. They were the first to break various price barriers as the price of sets began to fall with mass production (the first 21in. set at under £100 for example, if I recall correctly). Sir Michael was again fortunate in being in a position to seize the opportunity when it arose – to produce simple, inexpensive sets at a time when the mass TV market was rapidly developing. He eventually, again at the right time, sold out to GEC. Many others, from Baird onwards, have striven hard in the TV field but failed to make much out of their efforts.

It's interesting to look back on these success stories in this profitless time for the TV industry in the UK. We can design and make good sets, but profit has become an elusive thing. The fierce competition from Japanese and, more recently, Korean manufacturers has been the major factor in cutting profit margins to the bone. But industry in other countries has had certain advantages. The Japanese ensured, until recently, that the yen remained relatively undervalued. The government in Japan supported industry – in fact to some extent government and industry have been the same thing in Japan. The famed Ministry of Trade and Industry provided strategic planning and encouragement. It all worked very well. Until recently. No one's luck, it seems, lasts for ever. The value of the yen eventually had to rise. It rose from 240 to the dollar to 160 to the dollar during 1986, with a devastating effect on the profitability of Japanese manufacturers. Figures recently released by the Electronics Industry Association of Japan reveal that while production declined only slightly during 1986 (production of consumer electronics goods fell by 8·7 per cent) profitability fell substantially. Companies have been reporting profit declines of around sixty per cent. As in other places and times, lucky the person or firm who's on the spot when opportunity presents itself. More seriously however one has to ask whether it's wise that so much should be left to chance. Governments are there to ease conditions in a changing world. They haven't been making a very good job of it, and leaving it all to "the market", the current economic fad, has hardly been a success.

Faults in CCTV Systems

Part 1

Peter Graves

Closed-circuit television systems have their own particular types of faults. Some are easily recognisable by looking at the monitor screen while others are more subtle. This short series will look at some of the less common problems found during field and bench servicing: the faults described are all genuine, though some of the system descriptions have been simplified to cut out irrelevant details.

Installation Fault

Our first case concerns an external camera overlooking a large car park. It was mounted in a weatherproof housing on a pan and tilt unit at the top of a steel pole (see Fig. 1). The control and mains cables were combined in the form of a single multicore cable that ran up the centre of the hollow pole, along with the video coaxial cable. At the base of the pole the cables passed via an underground duct to an equipment cubicle about 3m away. The cubicle contained a mains distribution panel, the telemetry receiver and its relay unit.

The equipment had been installed some years previously. Maintenance had recently become the responsibility of another company, and enginers from this firm had arrived on site to carry out routine system checks. There had been no complaints of any problems, and the camera appeared to be working normally. While the camera control settings were being checked, working from a lift truck, the system suddenly started to behave erratically. The mains supply kept going on and off and the lens, pan and tilt functions would appear and disappear intermittently. There was no obvious explanation, and nothing that was done at the camera head or in the equipment cubicle seemed to affect the situation which deteriorated until the mains fuse blew, cutting everything off.

We had no circuit diagrams and could make no sense of the control cable wiring. You would normally expect one core for each remote control function, such as pan left, iris open and so on. Some of the cores in this cable appeared to be open-circuit while some were shorted to others: there was no discernible pattern.

Inspection revealed that the multicore cable had suffered a major burn up inside the cable duct between the pole and the equipment cubicle. When we assessed the facts we came to the conclusion that during installation the cable had been pulled tight through the duct and up the pole. As the pole moved in the wind the cable had been pulled backwards and forwards across the rough surface of the duct until it had worn through. Shorts between the cores had caused substantial damage to the cable.

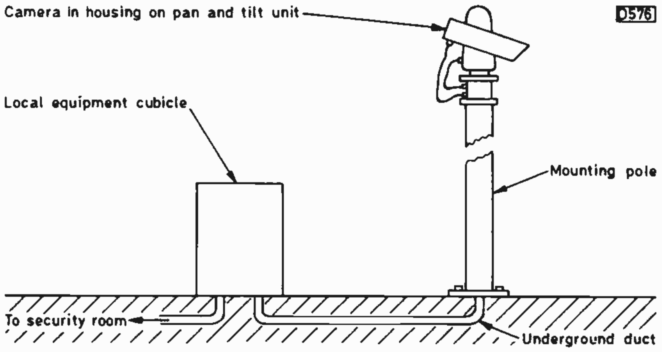

Fig. 1: Car park equipment layout.

The multicore cable was replaced completely, allowing some slack this time. Only one question remained. The cable must have been wearing away for some time before it finally failed. It could have done so at any time, so why did it wait until the first visit from a new maintenance group?!

Intruders

The complaint in our second case was that the picture from one of two cameras mounted below the canopy of a garage to watch the pumps was deteriorating and was particularly poor at night.

The engineer arrived during the day and found that both pictures were satisfactory, though the one complained about was slightly duller. Access was gained to the camera and the housing was opened for inspection. We found that the cable gland at the rear of the housing was larger than the cable and had been left unsealed. A spider had got in through the hole and had spun a web across the inside of the housing faceplate, cutting down the amount of light reaching the camera. It had also raised a large family whose members were scuttling about all over the camera: what they all found to eat was a mystery.

The intruders were evicted, the glass cleaned and the hole round the cable was sealed with insulating tape. No further problems were experienced.

Switcher Problem

Our third case takes us to a clothing shop where a two-way switcher failed twice for no obvious reason. The type of switcher fitted had a three-position switch and a variable control on the front panel. Two switch positions allowed either of the two cameras to be viewed continuously on the monitor. In the third position the pictures from the two cameras were alternately switched to the monitor at a rate set by the variable control.

On the first occasion that the switcher failed we found that the power rails were correct but the CMOS i.c.s used were not allowing the signals through. As no circuit diagrams were available and the chips are cheap they were all changed without an attempt to look for any specific cause of the fault. This action restored correct operation of the switch which was consequently reinstalled.

Some months later the switch failed again, and this time we looked at it more carefully. The switching logic was partly controlled by a CD4011 quad two-input NAND gate i.c. Measurement of the voltages at its inputs and outputs showed that it had failed. While we were making these checks we noticed that the printed circuit tracks around the CD4011 didn't look right. The unused gates in

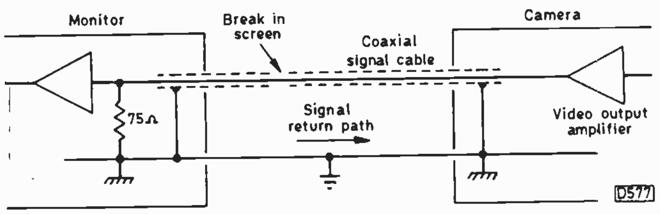

Fig. 2: A severed coaxial cable screen resulted in the signal return path being via the mains earth.

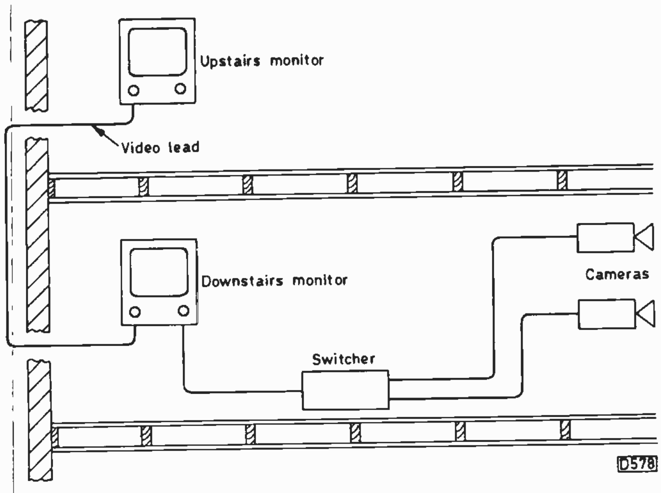

Fig. 3: Equipment layout at a two-story shop.

the package had been left open-circuit by the designer of the switch. Bearing in mind the warnings in CMOS literature about leaving unused gate inputs floating we connected them all to the nearest power rail.

After replacing the CD4011 the unit worked correctly and was reinstalled. It's too early to be able to report that a permanent solution has been found. We feel it's curious that the switcher in this one shop should have failed twice while identical switchers elsewhere have given us no trouble. Does the movement of modern synthetic clothing generate enough static electricity to affect the open-circuit gates of the switcher, or is there an unsuspected fault waiting to happen again?

Defective Cabling

Three cameras mounted in weatherproof housings on pan and tilt heads were used at a large industrial site. Each camera had its own monitor and remote control unit. During a routine maintenance visit we checked and set up the three cameras which worked correctly with a local monitor connected directly to the video output sockets. Back at the control room however the pictures from only two of the cameras were satisfactory. The third produced a picture that was weak, noisy, locked badly and had echoes – black ghost images following a bright white object and vice versa.

The monitor concerned was tried with another camera which proved that it was working correctly. An oscilloscope check then revealed that the signal input to the monitor was of low level with distorted sync pulses. Temporary removal of the monitor's mains earth resulted in loss of picture, indicating that the signal return was coming back through the mains earth instead of the screen of the coaxial cable (see Fig. 2). The resulting severe cable mismatch would cause the symptoms described, but where was the break?

The cable run to this camera was approximately 200m, the final 100m to the camera being inaccessible without a lift truck. Fortunately we found that there was a junction box at the 100m point. Two of the camera cables went through the junction box and comparative measurements back to the monitors (by lifting off both cables and shorting them) showed that the faulty cable had an open-circuit screen in this length, most of which could be reached.

Without special measuring equipment, such as a reflectometer which sends a pulse down the cable and measures how long it takes for the reflection from the fault to return, there was no way of predicting where the problem lay. The cable ran along a high ledge that could be reached only with a ladder, making visual inspection of the entire length difficult. No obvious problems could be seen. The faulty cable was cut at about the 50m point and measurements were again made to determine which half of the cable contained the fault. The cable was then again cut halfway between the ends of the faulty section, until the fault was eventually isolated to a short section which could be given a careful visual inspection.

A telephone cable had been run alongside the bundle of television coaxial and remote control cables. At some time in the past the telephone cable had been cut and part of it removed. Whoever had done this had also nicked one of the coaxial cables, cutting through the sheath, part of the screen and some of the inner insulation. The weather had done the rest by entering the cable through the break and corroding the screen's copper strands until they parted, giving an open-circuit screen.

We cut out the faulty section of coaxial cable plus a short length on either side in case water had penetrated along the cable. A new section was then fitted and the cuts made in the cable to find the fault were repaired with crimps covered heavily with insulating tape. The slight mismatch caused was not visible on the picture produced. After refitting the cables in the junction box normal results were restored.

Mains Wiring Trouble

Two cameras, a video switcher and a monitor were installed on the lower floor of a shop. A slave monitor was mounted in an upstairs office, powered from the office mains supply and fed with the video signal from the downstairs monitor via a length of coaxial cable that ran up an outside wall (see Fig. 3).

The system worked well when first installed, but shortly after commissioning it the customer complained that the pictures displayed by the upstairs monitor had become "poor and wavy". On arrival at the site we found that the pictures on the downstairs monitor were satisfactory but the upstairs monitor had a low-amplitude hum bar on the screen and poor line lock, causing intermittent sideways movement of parts of the picture plus some line break-up. As this was a new installation and we'd had some reliability problems with the type of monitor used we changed it for another new one. To be fair we'd not had hum problems previously with any of the faulty monitors, but changing it seemed to cure the fault.

A few days later, before the monitor we'd removed from the site had been looked at in the workshop, the customer rang to say that the original fault had reappeared on the new monitor.

On the second visit we investigated the whole system much more thoroughly. An oscilloscope check showed that the video signals downstairs were clean and of the correct amplitude. Upstairs, a check with the same scope revealed severe hum on the video signal coming up the coaxial cable. On unplugging the cable from the monitor and making a voltage check between the screen of the coaxial cable and the monitor's chassis we obtained a reading of 15V a.c.!

The fault lay in the building's mains wiring. Faulty cabling resulted in a potential difference between the earths upstairs and downstairs. This superimposed hum on the video signal, causing the hum bar and triggering problems with the upstairs monitor.

The problem could have been cured by running a mains cable from the downstairs mains supply to the upstairs monitor, but such a large voltage between the mains earths pointed to possibly lethal faults in the building's wiring. The customer was warned about this and we advised that the wiring be checked as a matter of urgency. The fault did not reappear after this had been done.

Opto-isolated RGB Interfacing

P. J. Dinning, B.Sc.

In the August 1986 issue of *Television* Brian Webb described an excellent, simple RGB interfacing circuit for use between a microcomputer and a modified TV set. To reduce the cost by avoiding the use of an isolating transformer, and to improve the isolation level and reduce the feedthrough capacitance, I decided to see whether opto-isolation could be employed. It may not be realised that there are a few hundred picofarads of interwinding capacitance in an isolating transformer. This, coupled with a fast transient on the mains supply, can easily corrupt data due to capacitive transfer between windings on the isolating transformer.

A check on the RS Components catalogue revealed that a suitable digital opto-isolator, with a bandwidth of 20MHz, is available at £4·32 (order number 304-273). A slower and cheaper isolator (order number 308-613) can be used for the sync feed. These devices provide 2·5kV r.m.s. isolation with a feedthrough capacitance of approximately 1pF.

Circuit Details

The circuit adopted is shown in Fig. 1. The part to the left of the broken line represents a typical RGB output port (BBC Model B). The output from this port consists of high-speed TTL signals, so for optimum results the leads must be correctly terminated. Twisted pair wire gives good results over several metres. Resistor R1 serves to terminate the line while C1 is a speed-up capacitor. The reverse-connected LEDs (LED1 etc., RS type 586-475), serve to balance the line in the forward and reverse directions. To give adequate decoupling, capacitor C2 (0·22μF) *must* be connected directly across the opto-isolator chip. When used with the original Brian Webb circuit (Fig. 1, page 641, August 1986) the 470Ω resistor in series with the sync gate, i.e. to pin 17 of the 74LS240 chip, can be omitted.

If the unit is being built on a PCB an earthed track should be run down the middle of the solder pads for the i.c.s.

The second section of the sync coupler can be used to give automatic switchover from TV to monitor use within the set by means of relays. The drive in this case consists of the 5V supply usually present at an RGB output socket.

Results

The circuit described has been in use for some time, with both an old Philips and a modern Japanese set. It gives exceptionally crisp and clear characters and graphics, even when the computer is in the 80 column mode. I believe that this circuit is considerably cheaper than an arrangement using an isolation transformer, especially when one considers that a 500W or larger transformer is usually required for sets with switch-mode power supplies because of the non-symmetrical current waveforms.

Component Availability

RS Components products can be obtained from components stockists or by mail order from Electromail, PO Box 33, Corby, Northants NN17 9EL (0536 204 555) – terms are cash with order.

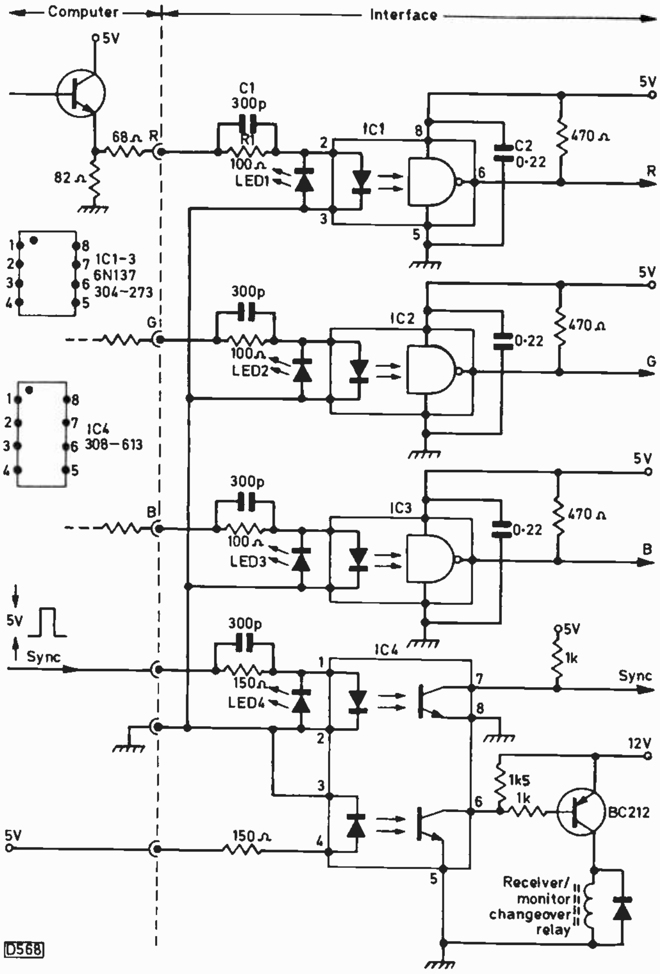

Fig. 1: Opto-isolator interfacing circuit.

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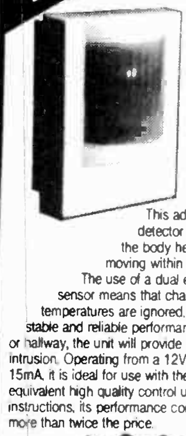
"PASSIVE INFRA-RED INTRUDER DETECTOR RP33"



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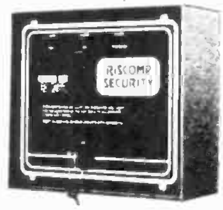
This advanced new intrusion detector operates by detecting the body heat of an intruder moving within the detection field. The use of a dual element pyroelectric sensor means that changes in ambient temperatures are ignored, thus providing a stable and reliable performance. Easily installed in a room or hallway, the unit will provide effective detection of any intrusion. Operating from a 12V supply and consuming only 15mA, it is ideal for use with the CA 1382, CA 1250 or any equivalent high quality control unit. Supplied with full instructions, its performance compares with detectors costing more than twice the price.

ONLY £23.95 + V.A.T.

CA 1382
An advanced control unit with automatic loop testing.



- Fully automatic siren re-set.
- Audible entry/exit warning.
- Alarm Sounded memory.
- 2 separate loop inputs + 24hr circuits.
- Built-in electronic siren.
- Easily installed, full instructions supplied.

This latest control panel provides effective and reliable control for all types of security installations. Its advanced circuitry checks the loop circuits every time it is switched on, preventing incorrect operation. Using a simple 'on/off' key switch, it is easily operated by all members of the family, in addition it provides 24 hr. personal attack protection. Housed in a steel case, it is supplied with full operating instructions.

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- 12V operation

This advanced module uses digital signal processing to provide the highest level of sensitivity whilst discriminating against potential false alarm conditions.

Individual Enclosure SC 5063
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Suitable metal enclosure for housing the ultrasonic module type US 5063. Supplied with the necessary mounting pillars and screws etc.

Control Unit CA 1250
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- Built-in electronic siren drives 2 loud speakers
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- Stabilised output voltage
- 2 operating modes full alarm anti-tamper and panic facility
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- Test loop facility

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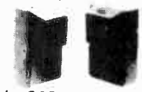
This versatile module provides timed switching of loads up to 3A for pre set times between 10 secs and 5 mins, the timed period being triggered by the opening or closing of an external loop or switch. The built in 12V 250mA power supply is available for operating external sensors. Priced only £13.95 + VAT. Suitable plastic enclosure £2.85 + VAT

HW 1250 – Enclosure & fixings for CA 1250
only £9.50 + VAT

This attractive case is designed to house the control unit CA 1250, together with the appropriate LED indicators and key switch. Supplied with the necessary mounting pillars and punched front panel, the unit is given a professional appearance by an adhesive silk screened label. Size 200 × 180 × 70mm.

Infra-red System IR 1470



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Consisting of separate transmitter and receiver both of which are housed in attractive moulded cases, the system provides an invisible modulated beam over distances of up to 50ft operating a relay when the beam is broken. Intended for use in security systems, but also ideal for photographic and measurement applications. Size 80 × 50 × 35mm.

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Further details from:

LONDON ELECTRONICS COLLEGE (VC Dept.)
20 Penywern Road, Earls Court, London SW5 9SU
Tel: 01-373 8721

Dealing with Liquid Spillage in Videocassette Recorders

Derek Snelling

Judging by what passes through our workshops liquid spillage into VCRs is a relatively common occurrence – certainly more so than with TV sets. During the eight years I spent servicing TV sets I encountered only one case of spillage, but with VCRs we seem to get at least one case a month on average – and once had four cases in a week.

Causes

The causes vary but the most common are children's drinks followed by pets, tea/coffee, plant pots etc. The worst of these has to be pets, not just because the liquid is more corrosive but because of the smell, especially when resoldering suspect joints (even after washing). The corrosion that manifests itself in the form of green or white deposits on wires and print occurs not so much because of the corrosive nature of the fluid itself but because of the electrolytic action that takes place when voltage is applied to the affected circuit.

Effects

The trouble with a spillage is that the faults usually don't show up until the corrosion is well advanced. What tends to happen is that the customer lets the VCR dry out then switches on. If the machine has been left long enough it will then probably work, but the residue left behind by the drying liquid will, with the aid of the various voltages, begin to eat into the wires and soldered joints. Eventually, perhaps after a few weeks, a wire will be eaten through or sufficient leakage will have developed between two adjacent points to cause a breakdown. Sometimes, especially when a pet abuses the machine during the night or morning, the customer may be unaware that anything untoward has happened. Just occasionally the spillage occurs when the machine is in use, in which case you will usually get to do the repair before the corrosion sets in, particularly as one or more of the fuses may have blown.

Steps to Take

When confronted with a spillage job, what's the best way to go about repair? The first rule is to ignore the faults. They will usually be obscure, illogical and untraceable using normal fault-finding techniques. First examine the top of the cabinet and try to establish the path taken by the fluid. This will enable you to determine which panels to check for corrosion. If at all possible, each affected panel should be removed from the machine for attention in turn. In the area affected by the spillage, remove all electrolytics, i.c.s, sockets, transistors and diodes that are mounted hard against the print. Put the panel in the sink and wash it with Servisol Foam Cleanser 30, rubbing this in with a short-haired paint brush. Do both the component and the print sides of the board. Wash under the tap, then with methylated spirits or isopropyl alcohol. Finally, dry with a kitchen towel followed by a blow from a vacuum cleaner or high-powered hairdryer (don't use the hot setting however). Be particularly careful to get the cleanser from under the various components.

Next carefully examine the area of the spillage for any signs of corrosion. Remake any doubtful joints with fresh solder. If a component's leg looks as if it's suspect, move the component. If the leg doesn't break it's probably all right. Clean the i.c.s, transistors and sockets removed from the panel in the same way, being particularly careful to clean between the legs of the i.c.s. As before, if in doubt bend a leg to see if it breaks. Refit the i.c.s, transistors and sockets on the board. Replace all the electrolytics and diodes removed from the board with new ones – they aren't expensive and it will save you a lot of fault-finding and intermittent problems later as these seem to be the components most prone to the effects of spillage.

Before reconnecting it, leave the board in a warm place for twenty-four hours to ensure that it's dry. Repeat this procedure with each affected board. Finally check the plugs to the boards in the affected areas. The leads in these plugs are usually just crimped to the pins, and if liquid gets into them they soon become intermittent. To check the plugs, remove the pins from the moulding one at a time by pressing on the exposed side of the pin with the blade of a trimming tool while pulling the attached wire. If the connection looks to be doubtful, solder the wire to the pin. Be careful not to let the solder flow down and block the pin up. In bad cases it may be necessary to bypass the plug altogether and solder the wire(s) to the board directly. In addition, in bad cases the liquid may have been drawn up the wire by capillary action: it may be necessary to strip the wire back by half an inch or so to reach clean wire.

Testing

When all this has been done, reassemble the VCR and switch on. If the machine was not in use at the time of the accident it will problably work. If it doesn't, switch off and check again for further signs of spillage – and don't be tempted to take short cuts with the cleaning. If the machine was in use at the time of the accident you'll probably have some fault finding to do, but at least it should now succumb to normal fault-finding techniques. If you find yourself presented with a fault that doesn't appear to make sense this is a sure sign that there's still some spillage effect somewhere in the machine.

The Mechanics

Finally a word about the effects of spillage on a machine's mechanics. It's usually best to replace any rubber components such as the pinch roller, belts or tyres that show any signs of contamination. Also clean and lubricate any sliding parts. Most importantly, clean the tape path thoroughly whether it appears to be affected or not, as it can result in repeated dirtying of the heads as the residue from the spillage is carried around by the tape.

Teletopics

FERGUSON FASTEXT

The first sets to use the new fastext teletext feature will be available from Ferguson in late March/early April. Fastext provides an enhanced teletext service by allowing faster and easier access to teletext pages. It has been a joint development by the broadcasting organisations and the setmakers and has taken some years to bring to fruition. Now that the BBC and the IBA have started to use fastext for their Ceefax and Oracle services it's likely that a number of overseas countries will adopt the system. It should be emphasised that fastext is an addition to the current teletext specification and in no way makes existing teletext decoders obsolete – a standard teletext decoder merely ignores the fastext feature.

It was recognised some years ago that two characteristics of standard teletext impede its acceptance by the general public: the slowness of page acquisition and the difficulties that some users experience in finding their way round the pages of information available to them via teletext. Various technical solutions to these problems have been investigated and some have been implemented. These include reducing the number of different pages available so that transmission rates can be increased, using multipage sequences to speed up transmission times, and adding memory capability in the receiver to store pages. The most effective approach, fastext, comes from co-operation between the broadcaster and setmaker: extra signals are transmitted in spare parts of the teletext signal so that best use can be made of additional memory capability in the receiver.

The fastext specification was agreed between the various parties involved around the middle of last year. Its purpose is to minimise the two user problems previously mentioned by adopting a system of linked pages that are stored in the decoder's memory. At any time the decoder can store four pages which are then available for instant display. For any particular page of teletext, the broadcaster transmits additional information that links it with up to four other pages. This information on additional, linked page numbers is understood by the fastext decoder which puts three pages in addition to the one selected into its stores. An additional line at the bottom of the teletext page being displayed indicates to the user the extra pages that have been stored. These indications, or prompts as they are called, are colour coded (red, green, yellow, blue). Corresponding colour-coded buttons on the remote control handset enable the user to select any of the stored extra pages almost instantaneously.

This procedure makes it possible for the user to move around the pages being transmitted much more rapidly, with little reference needed to the actual page numbers. Provided the user knows the subjects he's interested in, relevant pages should be accessible much more quickly than before – it has been estimated that the system enables the user to scan through a number of pages five to ten times faster using fastext instead of the normal teletext procedure. Ferguson has made a major contribution in developing the software required for fastext.

The first Ferguson model to incorporate fastext will be the 59H5, a top of the range receiver fitted with a 59cm FS tube, stereo sound capability and other features. Included within the fastext implementation are the following features: the teletext automatically comes up on the index page – or another page nominated by the broadcaster, such as Newsflash; a previous page facility – pressing the appropriate button restores the previously viewed page to the screen; an index facility – pressing this key brings the next level index page up on the screen; and automatic receiver switch off. The set is expected to sell for around £620 – the basic cost of adding the fastext feature is roughly £20. In addition to the extra memory in the decoder (standard memory chips are used) extra text acquisition circuitry is required so that the relevant pages can be rapidly captured for storage. During the course of 1987 Ferguson will be moving over to fastext – by late autumn it's anticipated that all Ferguson teletext production will be fastext. There are firm plans to start a fastext service in Ireland later this year.

COMPLETION OF CHANNEL 4/S4C COVERAGE

The IBA's £50m engineering project to make the fourth programme channel available from over 850 transmitting sites will be completed later this year. Full parity will then be achieved with the ITV/TV-am coverage which extends to over 99 per cent of the UK population. Details of Channel 4/S4C relay transmitters due to open are available in each region on the Oracle teletext page 297.

NEW VHS SYSTEM

JVC has developed and demonstrated in Japan yet another version of the VHS system, called S-VHS. It's been designed to provide much improved pictures – the horizontal resolution has been increased from the 240 lines of the present systems to 430 lines, giving pictures that are said to show no degradation from those provided by broadcast signals. Machines using the new system are expected to become available in Japan this summer at a price some 30 per cent above that of present top of the range models.

SATELLITE TV

Longreach Marketing Ltd., the satellite TV distribution company based in Bath, has introduced a satellite TV dish alignment meter called the "Pico-Peaker". The peaker, Model PP1450, can be used for aerial orientation, feedhorn focusing and polarity alignment. It's available for £99·95 plus VAT from Longreach Marketing Ltd., Riverside Business Park, Lower Bristol Road, Bath BA2 3DW (telephone 0225 316 257) and comes with leather case and neck strap.

Which? has been taking a look at satellite TV receiving systems – and what's available by way of programming. It's not too enthusiastic, concluding "we're not convinced that the programmes available at the moment justify the expense of going for satellite TV". It recommends a fully-automated system and suggests avoiding systems that require manual tuning: rental, at about £50 a month, should be considered. The report, along with a survey of currently available large-screen colour receivers (nine models were tested), is published in the January edition of *Which?*

NEW PLANTS

NEC, one of the leading Japanese electronics manufacturers, is to build a multi-purpose factory at Telford, Shropshire. The plant, which will be on a 48 acre site and represents an investment of some £36m, will eventually produce communications equipment, computers, electronic components and domestic electronics products. Production of VCRs is expected to start this July, followed by colour TV receivers, mobile telephones, fax machines and radio pagers. VCR production is expected to reach 240,000 units a year by 1990, when employment at the plant should reach 900. The plant will be owned by a new subsidiary, NEC Technologies UK, and will constitute a European manufacturing headquarters for NEC.

Meanwhile Samsung has threatened to stop plans to establish a plant at Billingham, Cleveland (see Teletopics December 1986). Samsung's concern is over fears that the EEC may impose tariffs on imported components. The plant was to be established in an ex-Rediffusion TV factory to produce microwave ovens initially with VCRs and CTVs later. Samsung is awaiting clarification of EEC intentions.

THE EURO-ELECTRONIC HOME

Six major European electronics groups – Thorn-EMI, GEC, Mullard/Philips, Siemens, Electrolux and Thomson – are taking part in a £12m programme to establish a common European standard for computer-controlled domestic electrical/electronic installations. Most of these manufacturers have already developed integrated systems to enable all domestic electrical/electronic equipment to be controlled from a central home computer: the aim of the project, which is being run as part of the Eureka programme for European technological collaboration, is to establish compatibility between European products from different manufacturers.

MARKETING MOVES

Thorn EMI Ferguson is to reintroduce a range of goods under the Ultra brand name. The aim is to market a range of products that will appeal to young new homemakers. Initially there will be two large-screen colour sets, Models U2001 (20in.) and U2201 (22in.), which are expected to sell at around £229 and £269 respectively. The Ultra formula will be to offer a limited range of value-for-money products, designed to appeal in a market sector where style and reliability on a limited budget are the prime considerations in purchasing decisions.

The Electronic Rentals Group (Visionhire), which acquired the Connect chain of outlets when it took over Telefusion in October 1985, has decided to drop the name Connect in mainland UK. The Connect outlets will be integrated with the Visionhire chain – though the 15 stores in N. Ireland will continue to use the Connect logo. ERG report difficult trading conditions, with interim profits down from £7·74m to £7·27m. The decrease is attributed largely to problems with Connect, other sections of the company reporting increased profitability.

SERVISCOPE SPARES SERVICE

The Serviscope depot at Farnham, Surrey, mentioned in our TV/VCR Guide (published with the April 1986 issue), has been closed. Spares are now held at the Preston main branch – telephone number 0772 651 551.

An up-dated VCR/TV Spares Guide will be included with our next issue.

LOW-COST STANDARDS CONVERTER

CEL Electronics Ltd. (Chroma House, Shire Hill, Saffron Walden, Essex CB11 3AQ – telephone 0799 23 817) has introduced an all-digital TV standards converter, Model P156-2, at £4,995 plus VAT (UK retail price). The converter is aimed at the industrial, commercial, educational and corporate video markets, its use avoiding the need to book time on a full-specification standards converter. Designed as a stand-alone unit the P156-2 employs a multi-standard decoder (PAL, SECAM or NTSC 3·58/4·43MHz) which can be manually or automatically selected, allowing conversion from 625- to 525-line standards and vice-versa.

A transversal filter optimises the luminance response, improving the transients and ensuring high-quality, instantly viewable pictures. Also included is a special two-line interpolator which corrects the geometry of the picture sizes. The device can also be used as a timebase corrector/synchroniser and in this mode the burst output provides a genlock reference. Inputs from almost any source are acceptable, including both high and low band U-matic and VHS recorders. Other features include freeze frame, freeze field one or two and a multi-line dropout compensator. Frames are stored at a luminance capacity of 385kbytes, and a chrominance capacity of 256kbytes. YUV component inputs are supplied as standard and PAL M is available as an option. The unit fits a standard 19in. rack.

HIGH-PERFORMANCE PAL/NTSC DECODERS

Vistek Electronics' new Varicomb range of PAL and NTSC decoders achieves a luminance channel chroma suppression level of greater than 45dB. The improved performance is obtained by using unique two-dimensional variable spatial filters for colour component separation.

PUBLICATIONS

Sony has published a group of three fault-finding guides for service engineers, Vol. 1 Video (part no. S-796-202-01), Vol. 2 TV and Home Computers (part no. S-796-000-01) and Vol. 3 Audio (part no. S-795-100-01). The books are available at £4·95 each from Sony (UK) Ltd., Service Department, Thatcham, Newbury. It's understood that the fault advice contained in these books is based on Sony's computer records for spares.

Newnes Television and Video Engineer's Pocket Book is available at a special introductory offer price for a limited period from Paul Richards Books, 28 Boscobel Road North, St. Leonards-on-Sea, East Sussex TN38 0NZ (see advertisement on page 367).

World Satellite Update is being published as a monthly supplement to the *World Satellite Almanac* by MLE Inc., PO Box 159, Winter Beach, Florida, USA 32971. A year's subscription costs $225 for overseas orders ($200 in the USA). It should be an essential service for those who have to keep abreast of the world satellite scene.

IN BRIEF

JVC has introduced a 3¼-hour video tape (standard playing time) which is expected to sell for around £4·50. The cassette is known as the Dynarec E195HR . . . The S. Korean manufacturer Goldstar is to take over from Matsushita the supply of colour TV sets on an OEM basis for sale by GE in the USA. Matsushita had wanted price increases due to the cost of components imported from Japan for use in its US assembled sets . . . The 1987 Las Vegas SBCA/STTI satellite TV trade show is to be held on March 2nd-4th . . . Grundig is now offering a complete TVRO system in the UK, priced at around £1,800. It includes the company's established STR200 receiver and a 1·5m polar-mounted aluminium dish.

TV Fault Finding

Reports from Alan Shaw, Alfred Damp, J. R. Armagh, Hugh MacMullen and Philip Blundell, Eng. Tech.

Ferguson TX100 Chassis

We've had several cases of line output transistor failure in these excellent sets. A replacement may last for hours or even days and then fail again for no apparent reason. We had one set on soak test for the problem. Suddenly the line went off speed, and shortly afterwards there was another short-circuit line output transistor. Replacing the TDA2578A line generator chip IC4 cured the fault. It's advisable to use a genuine Philips/Mullard BU508A line output transistor – some far eastern types are not very reliable. **A.S.**

Rank T20/T22 Chassis

We must have repaired scores of these sets over the years. The other day however one came in with an unusual fault we'd not come across before. The set would switch on from cold all right but if switched off and then on again within five minutes the power supply would fail to start up. The cause of the problem was that 7C10, which provides a start-up pulse for the chopper transistor, remained charged when the set was switched off because 7R12 (1MΩ) was open-circuit. **A.S.**

Philips KT3 Chassis

Under very sudden bright picture content change conditions, such as a camera flash firing, the power supply would momentarily trip out. This is not the easiest of faults to deal with but is simple to rectify once you know the cure. Remove the cabinet back and increase the tension of the phosphor-bronze earth clip attached to the left-hand side of the chassis – it contacts with an Aquadag coating on the inside of the cabinet back. **A.S.**

Cathay CTV3000

If the mains fuse has blown and the 2SC1875 chopper transistor is short-circuit, examine the line output transformer for a bulge in the winding insulation caused by breakdown of one of the rectifier diodes. **A.S.**

Philips K30 Chassis

The symptoms with this set were low brightness when first switched on, line shading and flyback lines. We found that the 155V HT3 line, which is derived from the line output transformer, was initially low and increased slowly. Replacing the 47μF reservoir capacitor C1583 restored normal operation. **A.S.**

Hitachi NP84CQ Chassis

There were odd symptoms with this set – holes appeared in the picture and the screen would turn bright blue. The number and size of these holes depended on the beam current: the holes were non-existent at low beam current. Inspection of the holes proved that the c.r.t. was being blanked off. A scope check on the field pulse output from the TDA4503 chip revealed that there was noise between the pulses. This noise exceeded the field pulses in amplitude and coincided with the holes in the picture. A lot of time was spent checking the blanking circuit and sandcastle pulse generator. The TDA4503 and TDA3562 chips were replaced. All to no avail. The supply lines were all correct except under the fault condition when the h.t. line dropped by about 5V. The h.t. smoothing capacitor C905 (100μF) was open-circuit. **A.D.**

Samsung CI338

We've had a few cases of line output transistor failure in this set. It's a little difficult to check some types of line output transistors with a multimeter due to the device having built-in diodes and resistors. If in doubt, try a replacement. **A.S.**

ITT CVC1200 Chassis with Remote Control

With remote control versions of the CVC1200 and derived chassis a relay is used to switch supplies when in the standby mode. Sometimes you'll find the standby LED lit but the set otherwise dead. The problem is that the primary winding of the mains transformer in the control unit goes open-circuit. Here's a tip. If you don't have the transformer in stock, shorting out the two large relay pins will enable the set to work perfectly with the exception of the standby mode. **A.S.**

Hitachi CBP260 (NP9A Chassis)

This set was a trade-in, with intermittent dead and start-up problems. After much heartbreak we replaced the HA11235 timebase generator chip and module CP701 in the power supply. The set now ran happily on four channels, but they were ghosty because they weren't our local ones. So I tuned to the channels of our local workshop distribution system – or tried to! No way would the set stop for our stations, nor even the other ghosty but strong channels. It would just flash up briefly a screenful of unsynchronised lines then tear on madly to the next channel.

I decided to try with the remote control handset and got the four original, ghosty pictures, locked and remembered. I couldn't even erase them by pressing the store button. A check was made on the sync and flyback pulses that go to PL9-1 and PL10-3 on panel PC895 to see if both were there to tell the scan chip it had found coincidence and was time to stop and look around. Hooking on the scope and turning on the signal generator, which happened to be set for a very low output, I was able to lock the search and stuff the channel in the memory, wiping out the stored wrong station. So far so good: when both traces were used to check the shape, size and coincidence of the pulses I found that the leading edges were very close. But when the strong workshop signal was applied we were back to butts again.

Was the trouble to do with the a.g.c.? Maybe with the gain running high between channels there was no time for the signal to be hauled down to let a proper sync pulse through before the scan took it all away? But o.k. with weak signals. It seemed a good idea to see whether pulse coincidence could be achieved before messing about with the a.g.c. system, so a nervous hand was placed on the line hold control (remember the new HA11235). Bingo, we'd got it: perfect overlay of the pulse edges, with search and memory normal. **J.R.A.**

Hitachi CPT2260

Pressing "search" gave only a snowy raster, no signals. There are two manuals for this model, dated June 1984 and April 1985. It's a good idea to have both of them handy. To save time and money, start on this fault by hanging an Avo 8 on pin 9 of connector base C1 on the main chassis, print side. This is the 0-29V tuning line from the control panel and should read 29V when the set is first switched on. Now press "search" and watch for the voltage scanning across the tuning range. If there's no 29V at switch on, check for 110V at pin 5 of C1, then through ICC7. If the voltage is o.k. and scanning, look to the tuner and i.f. section, for all is well at the complicated end.

If the voltage doesn't scan, get a screwdriver with a wide blade, say quarter of an inch, and connect an earth lead to it. Now touch it momentarily to leads Y and Z to start the scan. These are easily found by hinging down the main chassis, going to the upper edge of the control panel, and finding pins 11 and 12 of connector C1. If you don't find connector C where the manual shows it, try the other manual. If the scan now happens and signals appear, chip ICC5 and its peripherals are o.k. and the trouble lies on the front control panel – its diodes, or fouling on the touch contacts, or other open-circuits. We've had dry-joints here: it's best to solder the whole lot – and clean the touch pads.

If the screwdriver check doesn't produce results, then and only then should ICC5 be replaced. The front panel can catch you out however – there's no reason for others to be caught in this way! **J.R.A.**

Hitachi CPT1454 (NP84CQ Chassis)

The top half of the field scan filled the screen. So did the bottom half, which was superimposed on the top half. The sawtooth waveform at pin 1 of the TDA4503 chip IC203 was found to have a cycle of approximately 10msec instead of nearer 20msec. After checking all obvious time-constant components associated with the field hold the fault was found to be due to C613 (0·1μF). **A.D.**

Philips CF1 Chassis

The trouble with this set was poor contrast. Pin 7 of the TDA3560 colour decoder chip IC7192 was found to be at 1·8V instead of 3·5V because R3600 (18kΩ) was open-circuit. This component does appear to be somewhat underrated. **A.D.**

Thorn 9600 Chassis

I'm rather a novice when it comes to this chassis and the fault led me a merry dance. The set would work for a few seconds, emitting an arcing noise when it did, and would then go dead. My colleague Steve had one working in the workshop at the time, so he was able to prove that the line output, chopper control and timebase generator panels were o.k. The chopper transformer's secondary supplies were disconnected one by one and the transformer itself was changed, but the fault persisted. A scope check showed that the chopper drive waveform was jumping around, but the waveform steadied when the chopper transistor's collector was disconnected. Replacing the diodes in the collector circuit made no difference. Suspicion next fell on C521 (1,200pF, 8kV) which turned out to be arcing internally. **P.B.**

ITT CVC30 Chassis

Tripping can be a difficult problem to trace on these sets. The usual causes are the tripler, the line output transformer, the mains rectifier reservoir capacitor C35, the 35V supply rectifier D26 or the line hold control. As usual I turned down the h.t. and disconnected the tripler. In went a new tripler but the tripping continued. Was it the tube? No – it was C61 (2,200pF, 2kV) at the earthy end of the e.h.t. overwinding leaky. **P.B.**

Thorn TX10 Chassis

The report on this set was sound but no picture. There was e.h.t. but no vision. This turned out to be due to more than I expected. Two of the three BF460 RGB output transistors were short-circuit base-to-emitter and the 10Ω resistor (R666) which provides the 12V supply for the bases of these transistors was 200Ω. When all this had been put right and the set was soak tested R728 (10Ω) in the 205V supply went open-circuit. Fitting a decent one solved that. **H.MacM.**

Mitsubishi CT181B

The complaint with this set was intermittent field collapse, but only after working normally for some considerable time. We eventually discovered that L580 (0·47μH) was going high-resistance, reducing the 20V supply to the field timebase. Having put this to rights I was horrified to see an erratic field scan again, together with the luminance varying in quality. This turned out to be due to the 2SC711 video blanking transistor Q204 going short-circuit intermittently. It's a notoriously unreliable transistor, usually due to bad terminals. **H.MacM.**

Panasonic TC2205 (U2 Chassis)

The symptoms were unstable line hold and a varying pattern in the centre, with or without picture modulation being present. The usual blue electrolytics with their ends off was not the cause this time. The 195V supply smoothing capacitor C856 (10μF, 250V) was partially open-circuit, or should I say of very low capacitance. **H.MacM.**

Thorn TX9 Chassis

The report said that every now and then the set didn't work. No, it wasn't the on-off switch, which is usual. The cause was an intermittent total open-circuit of the lead and socket from the switch to the chassis, on the neutral side – a very dangerous state of affairs which made the entire set live to full mains voltage. The pinched socket connections were soldered as a precaution. **H.MacM.**

Philips K30 Chassis

The lower half of the picture was the wrong colour. The ususal cause is part of the degaussing circuit open-circuit, but this time the lower coil was short-circuit due to e.h.t. welding. **H.MacM.**

Microcomputers in TV Sets

Peter Marlow, B.Sc.(Hons.), C.Eng.

Silicon integrated circuits first started to be employed in TV sets in the early seventies. They were initially used to perform analogue functions such as colour signal decoding and sound processing. With the advent of ultrasonic and then infra-red remote control, also teletext, digital chips started to appear in TV receivers. They were at first specifically designed to perform one function or group of functions in a TV set, but before long microprocessor based systems began to appear. The reason for this was mainly economic. Whole systems could be arranged on one chip at low cost and with high yield, giving enormous flexibility – the same basic chip could be made to perform many different tasks simply by changing the software inside. This in turn led to new possibilities in TV design, for example digital tuning, enhanced teletext with page storage and intelligent selection, computer controlled setting up, and signal processing in digital form (e.g. the ITT Digivision system).

Terminology

First a note on terms. The basic difference between a microprocessor chip and a microcomputer chip relates to the internal memory facilities. A microprocessor chip has built-in ROM only, being designed to work with other chips to provide a microcomputer system. A microcomputer chip contains both ROM and RAM and on its own provides a simple microcomputer. The single chip microcomputer is often referred to as a microcontroller, since it's basically intended as a computerised control system for such applications as car engine and VCR control. Its instruction set is designed to handle small quantities of data very fast, often in the form of single binary bits rather than bytes. It looks like a custom designed chip from the outside since it requires minimal support hardware.

Microcomputer Types

A large variety of microcomputer/microcontroller chips are available from various manufacturers. They employ the same basic operating principles, the differences lying in memory size, instruction set, operating speed, numbers of inputs and outputs and word length (whether four, eight or 16 bit). Additional peripherals can be added on chip, such as analogue-to-digital converters and serial communication interfaces. Some chips are customised for specific end users. These are generally referred to as ASICs (application specific integrated circuits). Almost all microcontroller chips are mask programmed – the software required is put into the program memory during manufacture and cannot be changed later. Some microcontroller chips with an internal EPROM are available however. These are suitable for low-volume jobs and home use (see later).

Most TV microcontroller chips are descended from the 8048 family. The 8048 is in fact fast becoming the industry standard, with many "second sources". Mullard use it in their MAB8400 series and ITT in their CCU2000 family. Other microcontroller chips that have been used in TV sets include the Texas Instruments TMS1000 and the Motorola 6805. There are also of course a number of Japanese devices, whose origin is not easy to trace. In this article we'll concentrate on the 8048.

Internal Arrangements

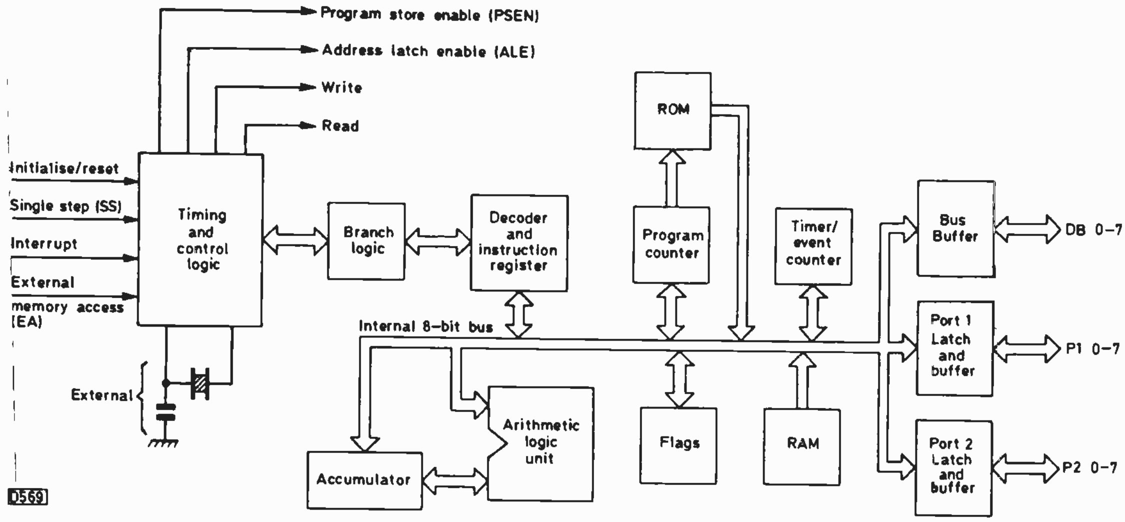
A microcontroller chip contains a central processor unit (CPU), program and data memories, input/output lines that are known as ports, and on-chip peripherals. It's not necessary to know in detail how the CPU works in order to understand or use a microcontroller chip. We'll adopt a "black box" approach therefore, concentrating on what the chip does with its data rather than how it goes about doing this. Fig. 1 shows the internal arrangements of an 8048 microcontroller in block diagram form.

The 8048 is an eight-bit device, i.e. it manipulates data in bytes (eight bits) at a time. It has a repertoire of some ninety-six instructions, in many ways similar to those of the well-known 8080 and F8 microprocessors – this is not surprising in view of the fact that it was Intel (spawned from Fairchild) who designed the 8048 shortly after the 8080. The instruction set is designed for ease of use and to be memory efficient. It can handle both binary and BCD (0 to 9) arithmetic and in addition single bits for control operations. The ROM has a capacity of 1K (1024 bytes). As mentioned above the program is put into the 8048 during manufacture and cannot be changed. An EPROM version called the 8748 is available however: this allows memory erasure with ultra-violet light and programming with a desk-top programmer. The data memory (RAM) has a capacity of 64 bytes. The 24 input and output lines are organised as three eight-bit ports. Two, P1 and P2, can handle a mixture of inputs and outputs. The other, DB, can handle either all inputs or all outputs or be used as a data bus for communication with other chips. The outputs can be latched and will drive one standard TTL load (1·4mA). All the inputs are TTL compatible, i.e. they can be driven by TTL logic chips.

The 8048 has three other inputs which are called T0, T1 and /INT. These can be used as single-bit ports, for example to monitor switch inputs. But they do have other uses. T0 can be used as a clock output at one-third of the 8048's crystal oscillator frequency while T1 can work in conjunction with the internal eight-bit timer/counter as an event counter input – every time a falling edge occurs at T1 the counter increments by one. /INT can be used as an interrupt input to make the program jump to execute a different routine (for example to refresh a display). The uses of the three inputs are specified in the software at the beginning of the program (see later).

The eight-bit timer/counter can be loaded, read, started and stopped by software. Unlike most microprocessor peripherals it counts upwards. When it "overflows", moving from count 225 to 0, it can interrupt the main program. This feature is used to prompt the processor to do something at a specific time (called a "watchdog").

There are also a number of pins for general processor operation: XTAL1 and XTAL2 for the crystal oscillator; PROG to enable the EPROM version (8748) to be programmed or to drive an output expansion peripheral (8243); /RESET to initialise the processor; /SS to allow



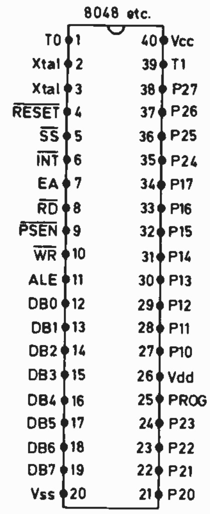


Fig. 1 (left): Basic block diagram for a 48 series microcomputer/microcontroller chip.

Fig. 2 (right): Pin connections for the 8048, 8049, 8748, 8035 and 8039.

single-stepping of the programs for debugging. The Vcc and Vdd pins are connected to a 5V rail while Vss is the chassis pin. There's access to peripheral chips via the data bus, with /RD the read pulse output and /WR the write/strobe output. /PSEN allows external or additional program storage. ALE stands for address latch enable, which gives the 8048 a proper address bus in conjunction with an eight-bit latch (74LS373) or a 1/15 crystal frequency clock. Some versions of the 8048 have a standby mode for low-power consumption: this is initiated by a software command and terminated by a hardware reset.

Fig. 2 shows the 8048's pinning.

The 8048 Family

There are three main members of the 8048 family – the 8048, 8049 and 8050. In each case the program and data memory capacity is doubled (1K, 2K and 4K of ROM and 64, 128 and 256 bytes of RAM). ROM-less versions of the first two devices are available – the 8035 and 8039. With these an external EPROM is connected via the data bus port (DB) and port 2 (P2) to provide the program memory. The advantages of this arrangement, in terms of ease of programming, are unfortunately outweighed by the loss of input and output lines. The EPROM versions of the 8048 and 8049 are the 8748 and 8749. They provide easy programming and ultra-violet erasure whilst maintaining the full complement of inputs and outputs. These two chips were originally intended as software prototyping aids for the ROM versions, enabling prototypes with programmed software to be tested before commitment to manufacture, thus preventing costly mistakes. When first introduced they were quite expensive (£120). They are now mass-produced at around £7 each (NEC version), making their use in many new products very attractive. Another variant is the "one time programmable" version with an EPROM for laboratory programming but no erasure facility. The advantages of this approach are that the simpler packaging makes the chips cheaper while the mask charge for factory programming is avoided. Future developments will include an EEPROM in place of the EPROM. An EEPROM is an electrically erasable programmable ROM, its use allowing non-volatile data to be changed without the need for ultra-violet radiation.

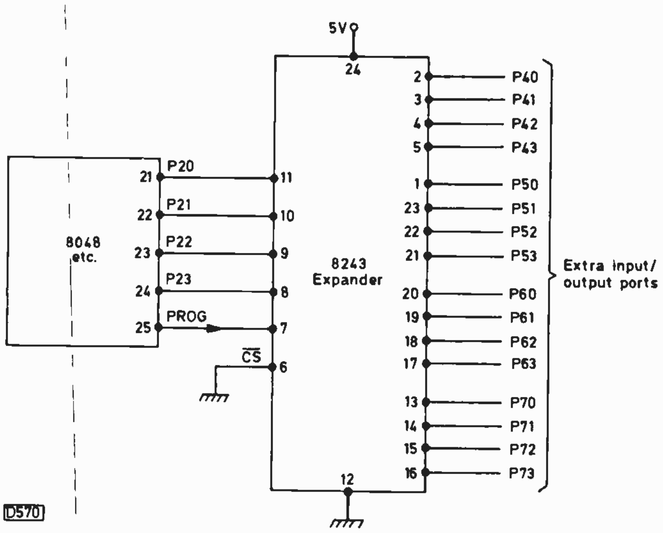


Fig. 3: Adding an input/output expander chip.

Manufacture and Packs

The 8048 series is manufactured in NMOS or HMOS versions, the latter being faster and consuming less power. CMOS versions are also available for lower power applications – the C is placed in the middle of the type number, e.g. 80C48. To date there are no CMOS versions of the 8748 and 8749. The 8048 family generally live in 40-pin DIL plastic packs, but the 8748 and 8749 have ceramic packs with quartz windows for the ultra-violet erasing light.

I/O Expansion

For serial interfacing the input/output capacity of the 8048 can be increased by attaching peripherals like the 8255 and 8251, but there's a custom chip made for the purpose – the 8243 I/O expander (see Fig. 3). This is a 24-pin chip which connects to the four lower bits of port P2 and the PROG line. It adds another 16 bits of I/O in the form of four four-bit ports, addressed as P4 to P7. P2 0-3 are lost however. Each port can be used as a latched output or an input – it's not possible to assign individual bits. The 8243 can drive fairly large loads, like LEDs, at up to 80mA. The main 8048 can support more than one 8243 – to address a particular chip the chip select line (/CS) is taken low. I've not seen this particular chip used in TV circuits yet, but in view of its usefulness this could well happen.

Mullard MAB Series

Mullard make all the members of the 8048 family (MAB8048H etc.) except the EPROM devices. A modified 8048 is used in their MAB8400 series of microcontroller chips which are to be found in sets produced by Thorn, GEC, Panasonic and others. The MAB family offers several memory options: up to 6K bytes of mask program and 128 bytes of data. A "bond-out" chip with connections for an EPROM can be supplied for software development but its availability is limited. With the MAB8400 the number of pins is reduced to 28 by cutting out the parallel peripheral interface circuitry. It can drive a multiplexed LED display direct from port P1. It also has a zero-crossing detector for slow-moving a.c. signals applied to pin T1. The main addition is a serial interface for communication with other chips and microcontrollers – the inter-i.c. bus, or I^{2}C for short.

Serial Buses

The I^{2}C bus is a more recent development in a generation of serial buses used in TV circuits to connect remote control receivers to tuner units and teletext boards, the most widespread being IBUS. The use of a serial bus reduces the amount of wiring required and hence the cost of implementing a control system. IBUS has a 6·25kHz clock line called DLIM and a seven-bit serial data line called /DATA. Thirty-two instructions can be sent, with two bits for TV/teletext or viewdata. The DLIM clock operates at twice the speed of the data, which is valid on the second rising edge.

I^{2}C bus timings are shown in Fig. 4. I^{2}C was developed from IBUS as a multimaster bus for use with microcontroller chips and intelligent peripherals. Like IBUS it uses two connections, serial clock (SCL) and serial data (SDA), but in this case the signals can originate from several different points along the bus – both lines are bidirectional. The clock operates only when data is being sent or received: its speed is variable so that it can work fast or slow. The data is distributed in bytes, with an address (of the device being written to or read from) followed by any amount of data. After each byte the receiving device sends back an acknowledgement bit to show that all is well. An arbitration system ensures that two sources don't use the bus at the same time. The maximum data rate is 100kbits/second.

Mullard have available a number of peripheral chips for I^{2}C use in TV sets, for example the PCF8570/1 256-byte CMOS RAM, the PCF8572 128-byte EEPROM, the PCF8573 clock/calendar for providing real-time information, and the SAB3035 CITAC (computer interface for tuning and analogue control) chip. The RAM and EEPROM are particularly useful for storing factory alignment and user data.

ITT Version

ITT use an 8048 as the basis of the CCU2000 family of microcontrollers. There are two versions, the CCU2000 and CCU2030, with a program size up to 6·5K bytes and a data memory of 120 bytes. Fig. 5 shows a block diagram. The microcontroller is housed in a 40-pin plastic pack which also includes a remote control decoder and a serial

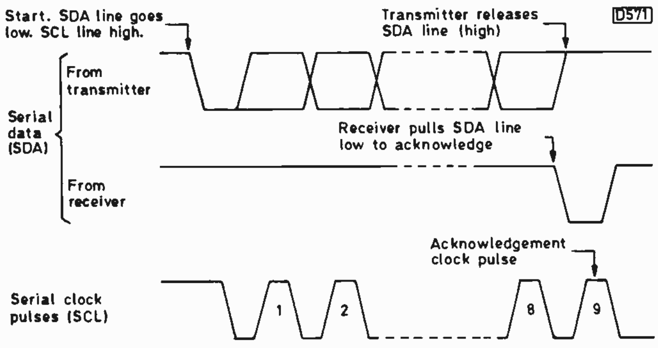


Fig 4: Pulse timing with an I^{2}C bus.

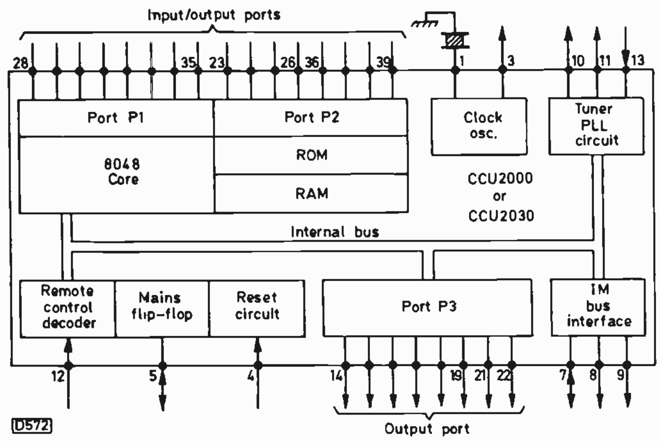


Fig. 5: Block diagram for an ITT CCU2000/2030 microcomputer chip – an 8048 with extra items added.

communications interface to what ITT refer to as the IM bus (Intermetall bus). Both these functions could be done using software but this would take up a great deal of code and execution time. Other items incorporated in the package are a tuner phase-lock loop, a mains flip-flop for standby operation, and a high-power port (P3) for driving an LED display direct.

The IM bus has three lines, ident (I), clock (C) and data (D). I and C are unidirectional between the microcontroller and peripheral devices while D is bidirectional. Data transmission originates from one place only along the bus. At the beginning of a transmission, I goes low to indicate a start condition. An eight-bit address is then sent along the D line serially, with eight clock pulses being issued – D is valid on the rising edge of C (see Fig. 6). I then goes low for the duration of an eight- or 16-bit data word travelling along D. Completion of the bus transaction is signalled by a short pulse on line I. The maximum clock speed is 170kHz.

Various peripheral devices have been developed by ITT for operation with the IM bus, for example the MDA2061 128-byte EEPROM, the MEA2050 eight-way digital-to-analogue converter and the MEA2901 tuner interface.

Memory Map

To understand software operation it's necessary to take a look at the memory map for the 8048/9 (see Fig. 7). The data memory is arranged as three blocks plus the RAM. There are two register banks, R0 to R7 and R0′ to R7′. These are directly addressable by instruction, but it's first necessary to select the required register bank (RB) – RB0 for R0 to R7, RB1 for R0′ to R7′. A further block comprises an eight-level "stack" which stores return addresses generated by subroutine calls and interrupts. The rest of the memory is uncommitted – free for use as a general-purpose RAM.

The program consists of a list of instructions, stored sequentially as one or two bytes in program memory, starting at 0. Instructions from memory are executed in sequence unless there's a branch instruction (jump, call or return), or one of three hardware conditions: a low on the /RST line produces a reset, restarting the program at 0; a low on the /INT line causes an interrupt, with the program sent to location three and the previous address stored in the stack; and finally a timer overflow interrupt tells the program to go to location seven – the address, where the program had got to before the interrupt, is stored in the stack as before.

Other Registers

The 8048 contains a number of other registers to help it do its work. The most important of these are the accumulator (A), the carry flag (C), and flags F0 and F1. These flags are just single bits that can be set or reset by software operations. Almost all processor instructions however act on data held in the eight-bit accumulator – to move it in or out of the microcontroller, perform mathematical functions or just store the data for later.

8-bit Operation

Being an eight-bit machine the 8048's instructions and data are stored as bytes, or eight binary digits. A convenient way of expressing bytes is to use the hexadecimal or hex notation. This splits the byte into two four-bit chunks (known as nibbles) and converts them to the decimal numbers 0 to 9 plus A, B, C, D, E and F for the remaining possibilities (16). Thus 01010001 in binary is 51 in hex, which is somewhat easier to handle. As another example, 11000100B is 0C4H. Note that a zero is placed in front of the C to indicate that it's a number. The suffixes B and H signify binary and hexadecimal notation respectively.

Program Instructions

As mentioned above, for memory efficiency the instructions consist of only one or two bytes. They are represented by letter or mnemonic to make it easier to construct and write a program. It's a bit like Basic programming, although each line does far less (it's called assembly language). There's not sufficient space here to go through the entire 8048 instruction set, but I'll highlight the important areas and give a few examples.

(1) Control instructions: These allow the program to control interrupts, select register banks and control the internal clock output. Here are some examples:

EN I	enable interrupt.
DIS I	disable interrupt.
ENTO	clock output on T0 at one third crystal frequency.
SEL RB0	select register bank 0 (i.e. R0 to R7).
SEL RB1	select register bank 1 (i.e. R0′ to R7′).

(2) Data move instructions: These control the movement of data within the microcontroller. Registers R0 to R7 can be addressed directly but other data memory locations

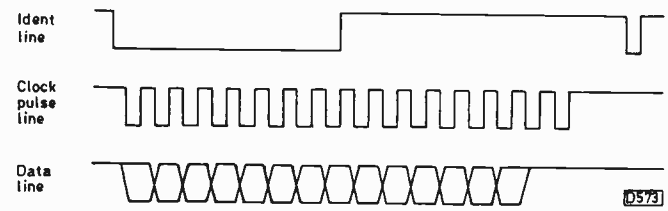


Fig. 6: Pulse timing with an IM bus.

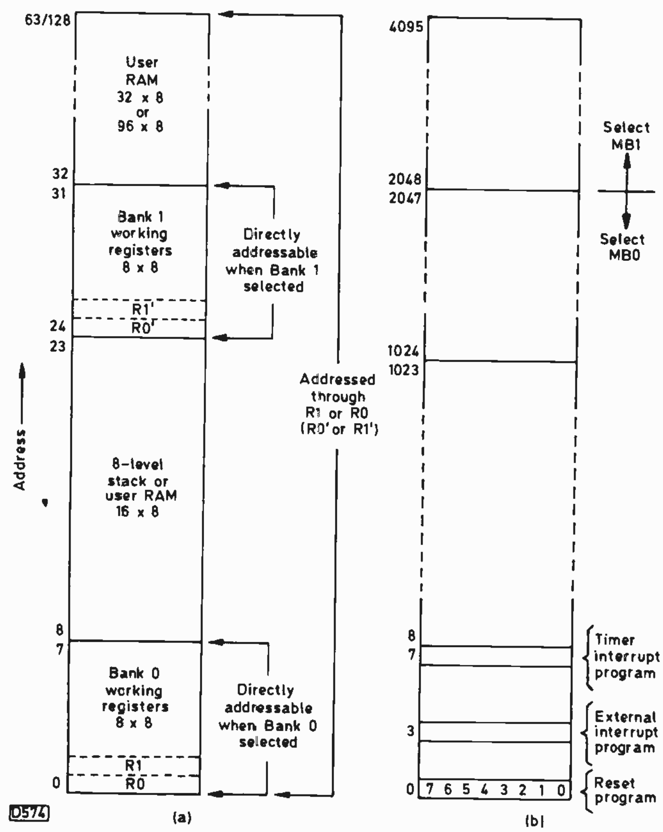


Fig. 7: Memory maps for a 48 series chip, (a) data memory, (b) program memory.

must be addressed indirectly using the contents of R0 or R1 as the address. Examples:

MOV A,R6	move the contents of R6 (or R6′ if register bank 1 is selected) to the accumulator.
MOV A,@R1	move the contents of the data store addressed by R1 to the accumulator.
MOV R5,#6	put the number six into R5.

(3) Timer/counter instructions: These start, stop, read and write to and from the eight-bit timer. Examples:

MOV T,A	move the contents of the accumulator (A) to the timer (T).
STRT T	start the timer (internal clock).
STRT CNT	start the timer – event count through the T1 input pin.
STOP TCNT	stop the timer.

(4) Accumulator instructions: These perform mathematical and logical functions. Examples:

INC A	increment (add 1) to the accumulator.

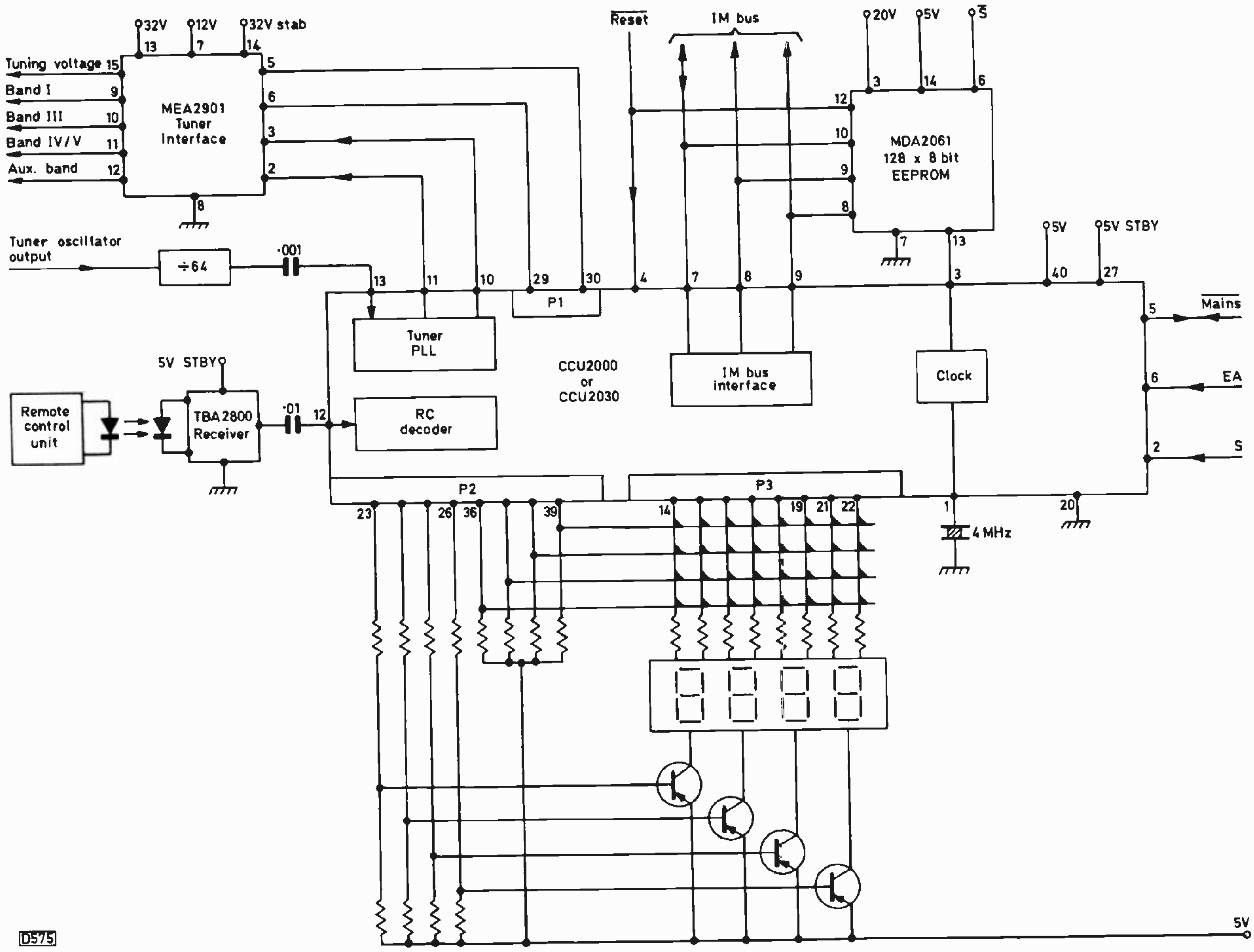


Fig. 8: Method of using a CCU2000/2030 central control unit in a TV set.

ADD A,R3	add the contents of R3 to the accumulator.
ANL A,#01H	logic AND the contents of the accumulator with 01H.

(5) Branch and subroutine instructions: These allow jumps to any part of the memory, either conditional or otherwise, and calls to subroutines. Examples:

JMP 100H	go to location 100H.
JC 20H	jump if the carry flag is set to address 20H.
JT0 30H	jump if input T0 is at one.
DJNZ R6,50H	decrement register R6, and jump to 50H if not zero.
CALL 100H	go to address 100H, but put a return address in the stack.

(6) Input/output instructions: Enable data from ports P1, P2 and BUS to be read into the accumulator. These ports can also be used as latched outputs. Port BUS can be driven in a non-latched mode if required. The bits at P1 and P2 are made into inputs by writing a one to them in the first few lines of the program. Examples:

OUTL P1,A	P1 has as output the contents of the accumulator.
ANL P2,#0FEH	zero bit 0 at port 2, leave the other bits as they are.
ORL BUS,#01H	set bit 0 on the BUS, leave the other bits as before.
IN A,P1	read the data at port P1 into the accumulator.

(7) Miscellaneous: There are various other instructions to do such things as setting flags. There's no HALT instruction – the program is expected to continue to loop.

Not all instructions are allowable. For example it's not possible to move data directly between registers without going through the accumulator. What is and isn't allowed doesn't seem to follow a logical pattern. So prospective programmers must acquaint themselves with the instruction set more closely. Further details are available in the data books published by Intel (Microcontroller Handbook) or National Semiconductors (48-series Data Book).

Writing Programs

It's possible to write very effective programs that are quite short for the 8048. These can be hand-assembled, i.e. the bytes corresponding to the mnemonics are looked up in a table and entered into the program memory. This is a tedious process for long programs, so a computer can be used to enter the program in mnemonics and assemble it. 8048 assemblers are available with the IBM PC (and its clones) and the BBC microcomputer. The program is put into the 8048 mask in the factory, or into the 8748 EPROM version using a desk-top programmer (optionally attached to a computer).

Applications

So what can the 8048 actually do with its elaborate software and hardware? It can simulate blocks of logic by reading inputs and providing outputs according to Boolean logic. But what it's best at is reading keyboards, feeding displays and transmitting serial data. This is well illustrated by the control system shown in Fig. 8. Here a CCU2000/CCU2030 microcontroller drives a four-digit multiplexed LED display and scans a keyboard via port P3. Port P2 selects the display with its lower half and reads the keyboard output with its upper four bits. An EEPROM is attached via the IM bus. A remote control input is handled as well as TV tuning.

In a future article we'll explore hardware design using 8048s in more detail and include a simple 8748/9 programmer design for home or laboratory use. Software development will be illustrated by going through the program I used for the IBUS controller in the low-cost teletext decoder project (December 1986 and January 1987 issues of *Television*). From the above, those more concerned with VCRs should be able to appreciate how microcomputer/microcontroller chips are used in syscon/mechacon arrangements.

Review: SSMU1 Signal-strength Meter

Roger Bunney

A signal-strength meter should be essential equipment for the aerial engineer. With it he can check that a satisfactory set of channel readings is obtained on completion of an installation. All too often cowboys rapidly erect a "rigger-quality" aerial and dismiss the poor results as being due to local conditions. Such operators do the trade a great deal of harm.

Unfortunately many signal-strength meters are rather expensive though Manor Supplies and Fringe Electronics offer modestly priced meters. HRS Electronics Ltd. have recently introduced a meter, Model SSMU1, at a "budget price". This firm sells only direct to the trade, but the meter is available retail from firms such as Aerial Techniques which advertises regularly in *Television*. I've recently been trying one out.

The meter is of attractive appearance, being housed in an RS Components cream case measuring 6⅛in. wide, 2½in. high and 6¼in. deep (excluding the knobs). It weighs 1lb 10oz, the black leatherette case with shoulder strap adding a further 7oz – the strap has no adjustment. The meter is a firm fit inside its cover and is retained by a large "popper" stud. The meter movement is small, about 1 7/16in. wide by 13/16in., and is calibrated 0-4mV (upper scale) and ±12dB relative to 1mV (lower scale). A battery check is incorporated.

Two large, centrally positioned knobs are used for channel tuning. The left-hand knob is a rotary one with six click positions (positions 7-10 are unused). Position one is the battery check while positions 2-6 are for channel groups in sections of ten channels per click position. The adjacent knob is a rotary potentiometer, calibrated 1-10, to tune in the individual channels. As an example, if channel 43 is required the click control is set to 4 and the rotary potentiometer to 3. An unusual arrangement, but tuning is simple with practice.

The standard Belling-Lee surface mounted aerial input socket is on the right-hand side. There are three slide-switch controls across the bottom of the anodised front panel. From left to right these are "off-on-light" (switches the meter on and adds an optional light behind the movement), "audio off-on" (there's a low-level audio output from a small surface-mounted transducer under the top of the case), and "gain". The latter is a three-position switch giving ÷10, ×1 or ×10, i.e. a meter f.s.d. of 0·4mV, 4mV or 40mV (±20dB relative to the centre setting).

The case has to be dismantled (two screws) for battery replacement (eight AA/HP7 pen cells), though a rear socket for a charger input is provided for use with ni-cad batteries. Inside there's a high-quality PCB on which are mounted a Mullard U321 u.h.f. tuner, two signal i.c.s, a voltage-stabiliser i.c. and four transistors. The surface transducer is stuck to the underside of the plastic case and plugs via a sub-miniature socket to the main PCB.

Evaluation

So much for description. How does it perform? I found the two channel tuning knob arrangement a little inconvenient at first (having previously used meters with continuous tuning) but one soon gets used to it. No operating instructions are provided, though it's all fairly straightforward. I felt that some paperwork should however be included. Aerial Techniques inserts a photocopy of the HRS catalogue description, giving the basic technical features.

The readings always seemed to be on the high side when measured with a 75Ω source – up 4dB in comparison with the readings obtained with a known, calibrated meter. This applied throughout the range. There's probably a simple adjustment inside but this would require return of the meter to the manufacturer. The technical leaflet specifies an accuracy of ±4dB, so maybe my findings were within tolerance. When used indoors (leatherette case removed) the output from the internal transducer is hardly sufficient: when packed up for use outdoors the level is too low for sensible operation. It would have been much better to include provision for headphone monitoring. The audio level varies with the setting of the slider gain switch.

The coverage is ch. E21-E69 and the ranges are 20μV-400μV, 200μV-4mV and 2mV-40mV. Current consumption is typically 50-55mA, the quoted cell life being 36 hours (AA cells) or 500mAh at 9 hours per charge with ni-cad batteries.

To sum up, this is a useful field strength meter at an attractive price. The scale accuracy error noted should be rectified by better quality control. Audio monitoring is poor and all but useless outdoors. In use it's a comfortable, light-weight unit. The leatherette case seems to be strong and gives excellent weather protection to the meter facia. Service engineers and u.h.f. TV-DXers could well find it of great help in their activities. The retail price is approximately £150 including VAT.

Servicing Mechanical VCRs

Part 1

Mike Phelan

There must be many hundreds of the early mechanical VHS machines on the second-hand market nowadays. Because they contain many moving parts, and possibly because the principles of operation may not have been fully understood by some of those through whose hands they've passed, their condition can vary a lot. The majority of these machines are of JVC manufacture. They come under various guises however, among them Akai, Ferguson and the names used by the various rental companies. To avoid confusion we'll use the Ferguson model numbers in these articles.

To go back to basics for a moment, the term "mechanical" is generally used to refer to the first generation of VCRs in which all the tape transport functions were directly controlled by piano-type keys that activated the mechanism. In later models these functions are carried out by motors and solenoids that are under the control of a microcomputer chip; all the user has to do is to press buttons that send the appropriate input to the micro.

Model Sequence

The first Ferguson VCR to appear in the UK was the 3292. It had a 24-hour timer and a mechanical pause control. Next came the 3V00, with a seven-day timer, a much brighter LED display (thankfully) than its predecessor, solenoid-operated pause, and a remote control unit that simply consisted of a switch to operate the pause solenoid and a length of cable. At more or less the same time the 3V16 appeared, with many new features. The pause became a freeze frame; the timer, though still of the single-shot, seven-day type, now had a repeat facility, and best of all the remote control, though still wired, was a multi-function type. By using it you can select double-speed operation, freeze frame, normal or slow motion. The speed of the latter is variable, by means of a slider control. During the production of this model an improved version of the 3V00, known as the 3V22, appeared. The only difference apparent to the user is that the remote pause control is no longer an optional extra, but many changes took place in the circuitry and mechanism.

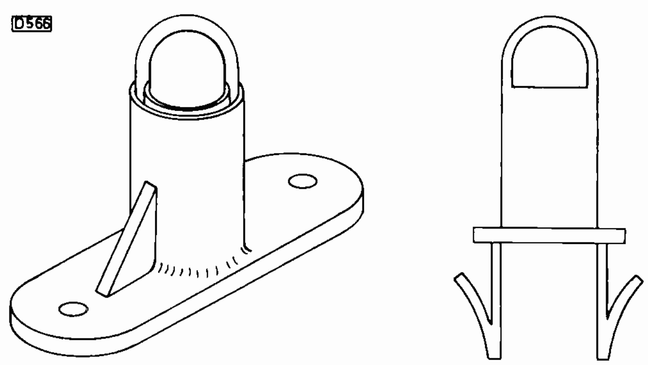


Fig. 1: Different types of cassette lamp holder. Left, Mk. I and II, right, Mk. III.

When working well these machines give a very good account of themselves. They are inherently very robust. The picture quality possibly falls short only of that provided by the latest machines with noise-reduction circuitry, but as there should be no problem in picking one up for two figures who's going to worry?

The tape transport mechanism is the thing we'll be concentrating on in these articles. It underwent many changes during production but there were basically only three main types. Following Ferguson, we'll refer to these as the Mark I, II and III versions. The Mk. I was used only in the 3292. The Mk. II was used in the 3V00 and, with minor modifications, the early 3V16. This machine has a different type of fast-acting capstan servo, necessary because of the "trick modes" introduced with this model, and some changes had to be made to the way in which the take-up reel clutch is driven in order to give better flutter performance. These changes were also incorporated in the 3V22.

What to Look for

If shopping for a mechanical VCR, probably the best bet is a late 3V16. But how can the various models be identified? Bearing in mind the fact that many presentational parts are interchangeable, and that the model number shown on the label and the type of timer fitted may not be the correct ones, the following information should help.

With the 3292 the timer has two toggle switches and no push-buttons. There are three toggle switches below the channel buttons. The slide switch on the rear recessed panel doesn't have a "test" position to aid tuning the TV receiver. The pause key has a very heavy feel to it.

The 3V00 and the 3V22 are superficially very similar – you need to identify the deck mechanism to tell the difference. To do this, eject the cassette lift and peer through at the cassette lamp holder. The two types are shown in Fig. 1. The machine may have been converted to LED use of course – the bulbs are expensive and have a rather high mortality rate. All the seven-day timers have six push-buttons. There are only two toggle switches on

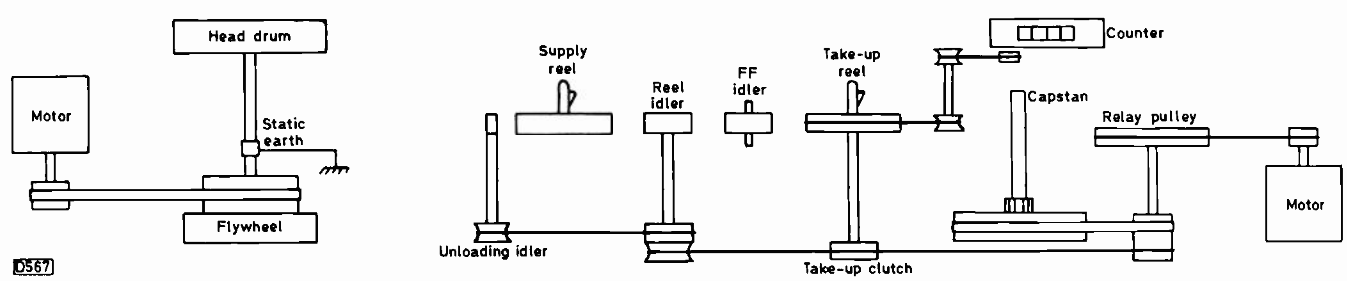


Fig 2: Drive train schematic (not to scale).

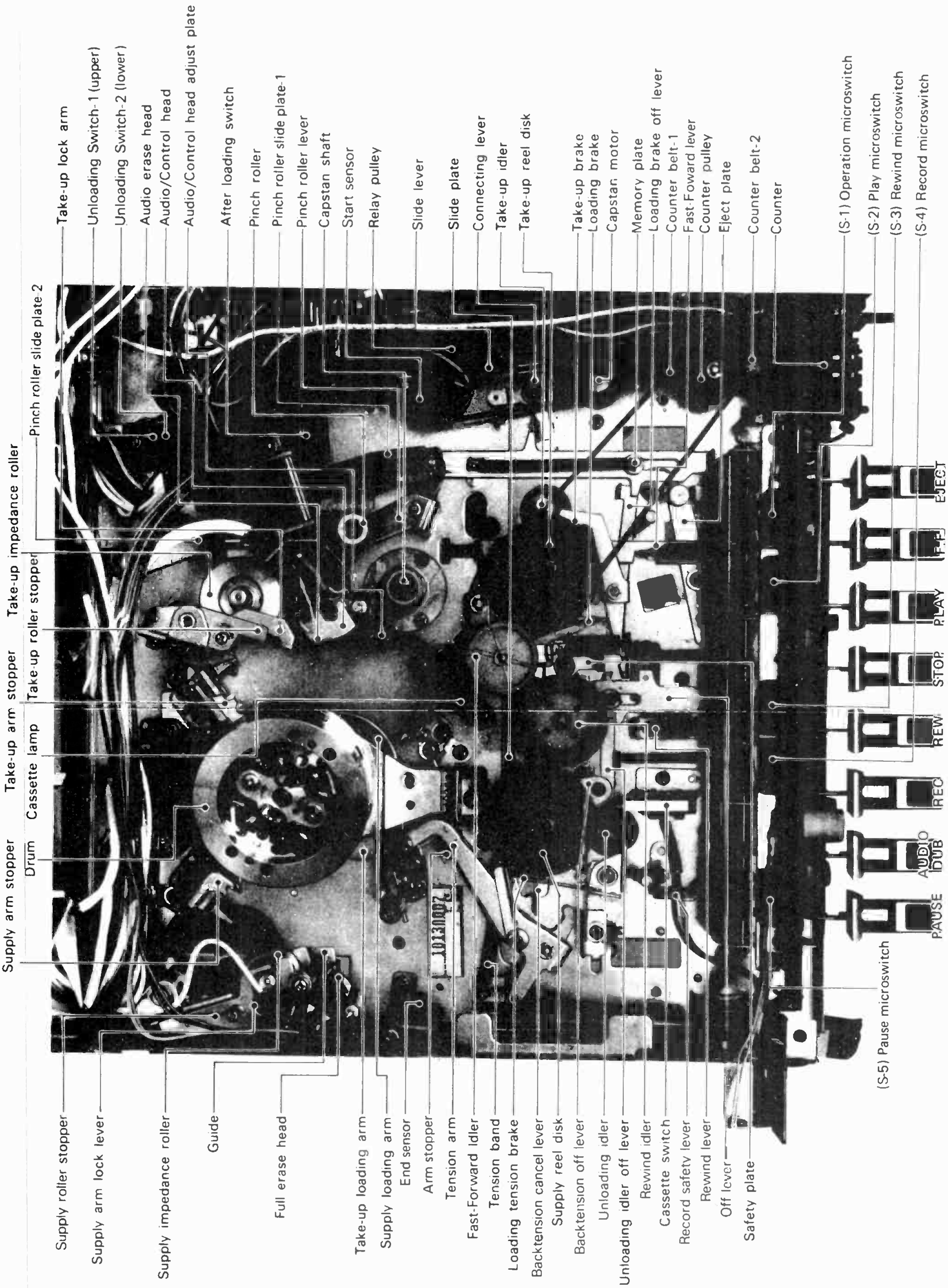


Fig. 3: Top view of the Mk. II deck.

the right and the cabinet back is plastic, not metal.

The 3V16 has a DIN socket for remote control and a timer repeat switch. These items are both located on the front, next to the tracking knob. In addition the rear panel is much deeper to accommodate the extra servo panel, now mounted at the rear, piggy-back fashion.

A good point to check when considering the purchase of a machine is whether the various screws that hold the cabinet panels seem to be the original ones – and that they've not been chewed up too much. If so, and the machine seems to be fairly unmarked, it should be a reasonable buy. One thing to look for is any signs of liquid

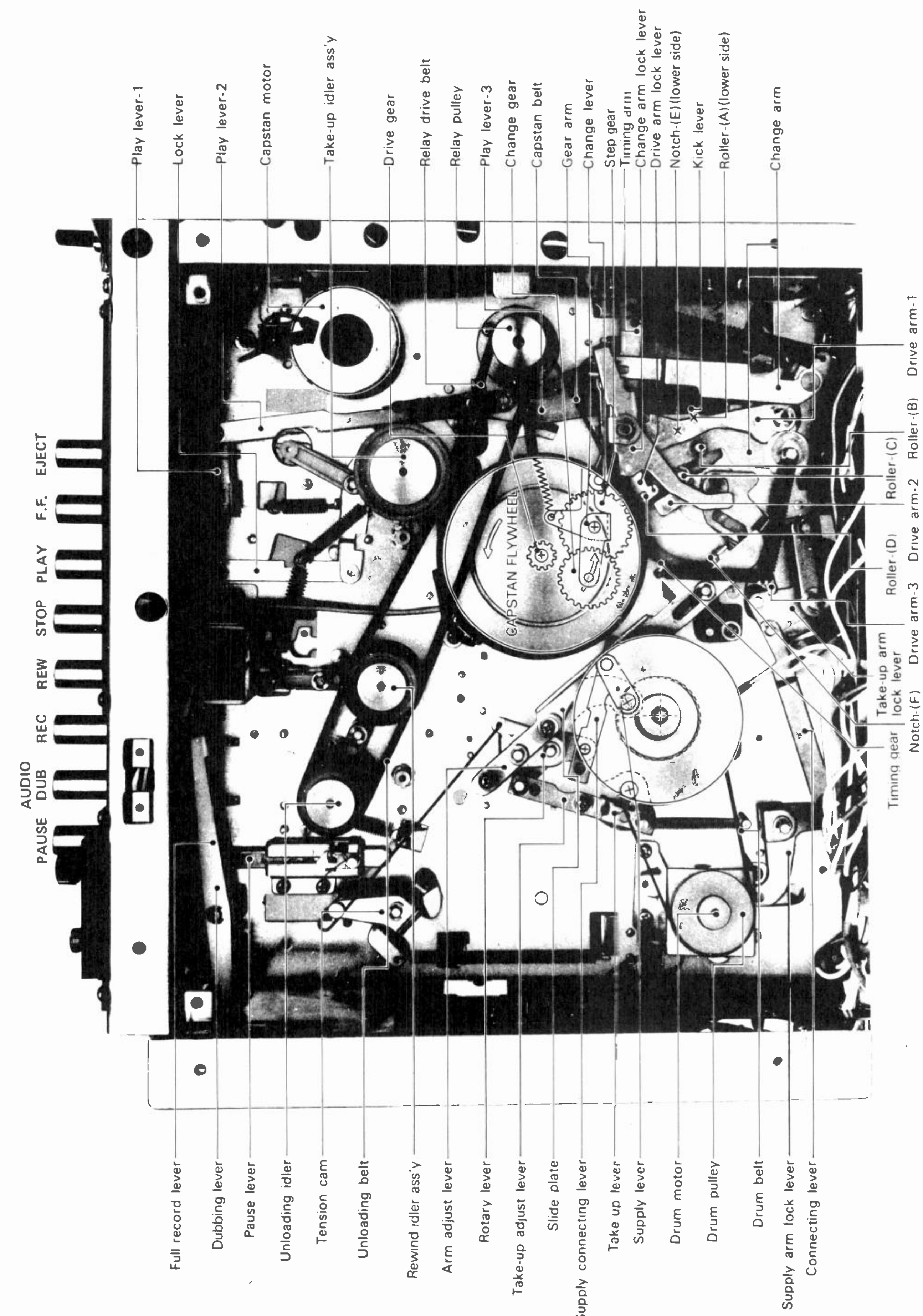


Fig. 4: Bottom view of the Mk. II deck.

spillage. If there's tell-tale evidence of this under the tuner flap, or around the ventilation holes in the bottom, avoid the machine like the plague!

Deck Details

Unless otherwise stated, from here on we'll assume that we're talking about the Mk. II tape transport system. The general layout can be seen from Figs. 3 and 4. The mechanism employs two motors and two solenoids (there's only one solenoid in the Mk. I version). One of the motors is used exclusively to drive the head drum, via a belt. The other one primarily drives the capstan: it also drives the reels and the loading mechanism. Fig. 2 shows the drive train in schematic form (not to scale). One solenoid moves the pinch wheel into contact with the capstan. The other one releases the keys when either the end of the tape is reached, the machine is switched off or to standby, or when a fault occurs.

The mechanism falls into a number of clearly defined but interdependent sections. We'll cover them individually, discussing their operation, stock faults and appropriate preventive maintenance. These sections are as follows:

(1) The head drum assembly with motor and earthing brush.
(2) The capstan relay pulley and motor.
(3) The timing gear drive and drive arm.
(4) The loading arms and linkage.
(5) The key assembly.
(6) The reel drives and brakes.

The tape transport system is mounted on a steel pressing which provides a very rigid assembly. This and most of the mechanical parts are made of steel with a passivated nickel finish. Some parts are made of alloy or plastics.

Tools

While it's true to say that life is easier with all the special jigs and tools available from the manufacturer, life is not impossible without them. Essential however are magnetic screwdrivers with nos. 0, 1 and 2 crosspoint bits and a pair of long-nosed pliers and tweezers. If you must obtain special tools, the most useful is probably a back-tension gauge.

Access

Access is gained by removing the cabinet top (two screws) and base (four screws). The Y/C board can then be hinged out (two screws, not the one in the centre). If much work is to be carried out it's best to remove this board completely to avoid damaging it. To do so, unscrew the two earth leads and pull out all the plugs. This will reveal the above and below parts of the mechanism in all their glory. It may be necessary to remove the cassette lift (four short screws) for additional access. You'll have difficulty replacing these screws without a magnetic screwdriver!

What Next?

Next month we'll start with the head drum and associated parts.

Dog Watch

Les Lawry-Johns

Most of you naval types will recognise the name Dog Watch. There are two Dog Watches, from 16 hundred to 18 hundred hours in the afternoon and from 18 hundred hours to 20 hundred hours. These are the only two-hour watches, the others – middle, morning, forenoon, etc. – all being four-hour watches which can seem an awful long time apassing. You don't like naval terms? Well what about Gunscrew – Guns Screw not Guns Crew. It's true, or was true.

What's this all about? Well, I've come to the conclusion that we need a Dog Watch here (and there). You see just before Christmas Honey Bunch bought, amongst other things, a nice three-pound gammon steak. After boiling it she put it on the table to cool off, then popped into the shop next door to natter to Dianne and get some cigarettes, dog food, etc. I said natter to explain why she was away a while. I was working on a set at the time and was fully occupied. When she came back and went into the kitchen I heard her say "where did I put it?". It wasn't in the fridge and it wasn't in the cooker, but the dogs were licking their lips – or rather clearing their teeth. When we realised who the culprits were we had a good laugh at the thought of how thirsty they were going to be. They were, and drank gallons during the afternoon watch. When H.B. told Dianne she said we were lucky: her dogs had eaten the turkey. Subsequently our lot pinched a one-pound cheddar cheese. So Dog Watch it's going to have to be.

Back to Work

Now to the TVs. We've had a lot in lately. Lots of nice easy ones like G11s and T20s, but some have been a pain in the neck – mainly TX10s. One in particular got me down, and I do mean down. It was a late version, with the plastic chassis wrap – PC1560 main panel. When switched on it tripped for about ten seconds or so then went dead. During the tripping I could see the tube's heaters lighting up and going out, and the sound came on in sympathy. This seemed to rule out the focus unit, which is the most common failing with this chassis, but I disconnected it anyway. The tripping continued. I replaced R813 (121kΩ) which is another common cause of tripping but this wasn't at fault either. I then earthed pin 8 (error input) of the TDA2582 chopper control chip IC801. The tripping continued, at a subdued rate. Changing IC801 made no difference so I followed the "pull out plugs" routine. This didn't make any difference either. I remain confused.

The Fidelity CTV140

This portable also got me going. We sold quite a lot of these so I took on the repair without a second thought. It seemed to be dead when I plugged it in so I thought the power supply was at fault. It wasn't. When I plugged in an aerial the sound came out loud and clear and I realised that this model has the advanced noise suppression which the earlier models didn't have.

I checked the tube base voltages and found that the first anode voltage was low. On this model it's derived from the line output transformer which has two knobs sticking out, the upper one for focus adjustment and the lower for the first anode supply. The tube's heaters also appeared to be underrun. I suspected the transformer, as the e.h.t. and focus supplies were correct but the other supplies derived from it were all low. The line output stage itself seemed to be working all right, so without further ado I removed the transformer and fitted a new one. The same conditions continued and I could see that with the station tuned in the screen was not completely blank. I turned up the presets on the tube base and obtained an acceptable picture, though somewhat lacking in attack. So the whole thing seemed to revolve around the low first anode supply. The *RC* network on the tube base was in order but the heaters were also definitely low and I just couldn't find a common cause.

I shorted out the 1·8Ω resistor in series with the heaters and this improved things a bit. The owner returned and said it was the best picture he'd ever seen on the set, but I was left feeling guilty and inadequate. I'm getting too old to think straight. The doctor says it's vertigo and suggests that I stop trying to do complicated things, but I hate the thought of giving up and I can't afford to anyway. Plod on.

In fact the set came back within the hour, the picture having faded right out. This time there was no first anode voltage and the previously checked decoupling capacitor (C201, 0·01μF) on the tube's base panel was found to have a heavy leak. Removing it restored high brightness and the base panel presets could be returned to their original settings. My guilt vanished, to be replaced by shame. To be fooled by a stupid capacitor, just because it didn't record a leak. Wait a minute, what about the tube heaters? Oh well, the picture was good.

The Fidelity CTV14

I'm sorry to keep on about this model but if you haven't had much to do with it the chances are that you will. These sets are giving a lot of trouble and the more you hear and remember the better equipped you'll be. The original CTV14R is particularly likely to give you heartache because of the oft repeated chain reaction. Here's an example.

The set came in because the line output transformer had been shorting. In addition to the transformer, one must expect quite a few other things to have suffered. We found that the line output transistor was short-circuit and the 10Ω h.t. smoothing resistor R828 was open-circuit. This is a very common occurrence and we've mentioned it before. Replacing these items was only the start however. First the chopper transistor TR13 (BUX84 or BUV46) was short-circuit. When we switched the set on after fitting a replacement it coughed and spluttered and through it all we saw that there was no field scan. A new TDA1170 field timebase chip was required, and fitting this took a bit of patience. When it was installed the tripping continued but we could now see a full scan trying to appear.

Careful adjustment of the h.t. preset stopped the tripping and a bright blue raster appeared. We tried resetting the blue gain and background controls but this made little difference. The voltage at the base of the BF460 blue output transistor TR10 on the tube base panel was 6V while the bases of the red and green output transistors were at the correct 2V. We felt really fed up because this meant that the 28-pin TDA1365 colour decoder chip was faulty.

This chain of events is not unusual and we often find that the rectifier diodes fed from the line output transformer are also short- or open-circuit. Quite often the customer is not prepared to meet the estimate and doesn't believe that all this can be caused by a faulty transformer. It's true though, it's true. I wonder what else we could do for a living?

Letters

THE FERGUSON 3787 AGAIN

Here's a further note on trouble we've had with the Ferguson 3787/NordMende 8180. Random tripping and failure to start up can sometimes be caused by dry-joints on the combi coil UA01 and/or the line output transformer UA02. Resoldering the PCB is not enough: it's necessary to remove these components from the board and also to resolder the wires at the tops of the pins.

A point about my article on these sets as it appeared in the October 1986 issue. In the section on fault finding the comments on the line output transformer's top core section were edited to say that the result of it being missing is low voltages from the transformer. This is not the case. Without a complete core the set will either not work at all or fast tripping will occur. Even a wider than normal gap between the core sections results in no-go or tripping.

Colin Boggis,
Woking, Surrey.

SONY SLC30

In the January VCR Clinic Martin Pomeroy commented on the problem of beat patterning experienced with the Sony SLC30. His suggestion of adding a resistor in the UN12V line merely masks the fault however. The cause of the fault lies in the power supply. We've had this problem on several occasions and have each time found that the cause is C319 on board PS23. This capacitor decouples the UN12V line.

R.E. Foster,
Nottingham.

SOFT-START – AND REMINISCENCES

Whilst browsing through some back numbers I spotted D.R. Bracknell's suggestion in the September 1985 issue for adding soft-start to the Philips G8 chassis. Having two of these sets (22 and 26in.) I made a couple of these circuits up. One set sprang to life but the other didn't – it was necessary to add several components to the power panel to make the circuit compatible (there were several versions of the G8 power supply – editor). The h.t. still rose rather too quickly for my liking however. The rise was made more sluggish by changing the value of C2 to 4·7μF instead of 1μF. This appears to work well.

I've also noticed a few letters recently on the "old days". This has prompted me to recall my own early experiences – perhaps they will stir the memories of a few others.

In March 1952 my late father drew my attention to an advertisement for the then *Practical Television* in a daily paper. It said "Build a TV set for under £20". This referred to the Argus, a 21-valve set using an ex-government VCR97 radar tube which gave a green and black picture measuring about 4 × 3in. I'd always been interested in electrical things, but at fifteen the only previous project I'd attempted to build had been a 4W amplifier described in *Hobbies Weekly*. My attempt to solder it together was done with a small fire-heated iron, so I think it must have been my father's apparent confidence that led me to send for my first *Practical Television*, which contained a free blueprint, then to build the set.

My father owned a car repair garage and I constructed the set on an unused bench. As far as I know there weren't any kits for this sort of project and the Argos was built on five separate chassis that were bolted together. I purchased aluminium sheet, bending, drilling and hand cutting/filing all the valveholder positions etc. I doubt if it would have gained many points for neatness. Not surprisingly in view of my lack of experience the set didn't leap into life for some months (it may have been years). Many of the valves and components were not new and the EF50 valves had short pins that made poor contact. The hand-made H aerial was also blamed – two strong men were needed to erect it. Quite honestly I hadn't a clue about what to expect and which knob did what as we didn't own a TV set. I'd also hand-wound the coils. I eventually bought a set of ready-wound coils and rebuilt some of the chassis using new components including some much posher "Red Sylvania" EF50s. This produced quite good results. I never did make a case, and the set sat on a table around which the family watched. It was occasionally necessary to twiddle a coil former with a knitting needle when the sound wandered.

The mains transformer was a big beast giving 425-0-425V at 200mA. The e.h.t. transformer was also deadly, giving 2·5kV at 5mA. I still have a lot of the constructional data, the blueprint, the transformers, valves and the e.h.t. smoothing capacitors.

In that same year, 1952, there were details of a £9 televisor using an ex-type 62 indicator unit. In 1953 came the "PT Supervisor" and in 1954 a 13-valve set called the "Simplex". The latter could be built for less than £16. In May 1954 there was mention of the TV licence fee having risen from £2 to £3 . . .

John F.J. Kendall,
Herne Bay, Kent.

INTERFERENCE AND VCRs

In the December issue J. LeJeune commented on interference problems with VCRs. During the six-seven years I've been working with VCRs the only problems of this sort I've had have been striations down the screen on playback and herring-bone type interference. If the VCR is mounted beneath the set the first problem can be cured by fitting a sheet of aluminium cooking foil beneath the TV set, i.e. under the top shelf of the TV plus VCR cabinet. This has worked in every case we've had. In our area the second problem is caused by co-channel interference – the main transmitter here (Caradon Hill) uses channels close to the one used by most VCR modulators. The interference can thus be cured by adjusting the VCR modulator. These two simple methods of dealing with interference problems don't require removal of the top, bottom or sides of the VCR.

A.R. Lloyd,
Plymouth, Devon.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

15/80H	3.30
15/85R	3.30
16039	0.79
16181	1.04
16182	1.04
16334	0.98
16335	0.94
16446	0.98
16600	1.38
16802	1.27
17052	5.61
17053	5.61
17074	9.30
17089	5.35
17127	3.51
17376	1.58
17523	1.95
17524	1.32
1N4001	0.06
1N4002	0.06
1N4003	0.06
1N4004	0.06
1N4005	0.08
1N4006	0.08
1N4007	0.07
1N4148	0.06
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.35
1N914	0.04
IR3403	5.00
1S1555	0.20
1S44	0.10
1S5012A	0.81
1S921	0.10
2N1303	0.38
2N2219A	0.40
2N2222	0.38
2N2646	0.80
2N2904	0.36
2N2905	0.43
2N2906	0.38
2N2926	0.15
2N3053	0.27
2N3054	0.99
2N3055	0.61
2N3442	1.56
2N3702	0.14
2N3703	0.14
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.71
2N3773	2.29
2N3819	0.42
2N3823	1.17
2N3904	0.62
2N3908	0.62
2N4101	1.73
2N4240	3.30
2N4444	1.73
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N5771	1.18
2N6109	1.58
2N6130	0.72
2N6133	1.25
2N6180	0.95
2N6292	1.65
2N696	0.43
2N698	0.43
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.89
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SD1391RL	3.95
2SA1095	4.10
2SA1103	6.55
2SA329	0.40
2SA351	1.17
2SA489	1.17
2SA490	2.25
2SA493	2.25
2SA562	0.57
2SA564	0.75
2SA614	4.88
2SA628	1.14
2SA639S	1.75
2SA659	0.49
2SA673	1.27
2SA684	1.61
2SA697	0.82
2SA699	1.75
2SA715	0.95
2SA747	8.26
2SA748	1.36
2SA817	0.65
2SA818	1.82
2SA835	2.50
2SA836	0.89
2SA844	0.65
2SA872	0.70
2SA884	2.15
2SA937R	0.97

2SA940	1.81
2SA940-2	2.14
2SA950	0.72
2SA951	1.26
2SA966-Y	1.16
2SA999	1.36
2SB774	1.15
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB407	3.24
2SB449B	6.98
2SB511	2.50
2SB54	1.39
2SB546	3.75
2SB56	2.80
2SB618A	2.22
2SB631	3.25
2SB643	0.61
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB75	1.04
2SB774	0.72
2SB819	0.89
2SC1034	6.75
2SC1050	5.06
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	6.75
2SC1116	4.95
2SC1124	1.26
2SC1129	0.34
2SC1131	0.64
2SC1158	3.33
2SC1162	1.05
2SC1172	2.22
2SC1195	5.80
2SC1212A	1.97
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1316	10.25
2SC1317	0.87
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.94
2SC1413A	3.05
2SC1446	1.25
2SC1447	2.07
2SC1475	0.37
2SC1505	1.00
2SC1514	1.41
2SC1573Q	1.25
2SC1578	8.74
2SC1583	1.17
2SC1617	3.89
2SC675	1.41
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.66
2SC1826	0.65
2SC1829	3.34
2SC1875	5.85
2SC1881K	2.98
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	1.07
2SC1929	2.25
2SC1942	4.20
2SC1945	7.99
2SC1959	0.45
2SC1957	1.09
2SC1953	1.93
2SC1962	1.93
2SC1969	3.10
2SC1983	8.35
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	0.95
2SC2073	2.25
2SC2085-Q	1.40
2SC2091	1.30
2SC2141	1.86
2SC2166	1.98
2SC2216	0.69
2SC2233	2.20
2SC2236	1.65
2SC2278	1.69
2SC2314	2.17
2SC2335-KI	10.41
2SC2551	1.26
2SC2565	4.14
2SC2570	1.85
2SC2577	3.58
2SC2578	6.75
2SC2671	1.99
2SC2826	2.07
2SC288A	1.85
2SC3153	5.26
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC403C	0.60
2SC41	2.19
2SC458	0.39
2SC495	0.92
2SC515A	2.85

2SC535	0.79
2SC536	0.41
2SC537	0.54
2SC605L	1.16
2SC620	1.46
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	0.69
2SC711A	0.50
2SC717	1.28
2SC734	1.43
2SC761-Y	0.95
2SC783	3.98
2SC790Y	1.64
2SC828	0.28
2SC867A	3.85
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC936	8.66
2SC940	4.68
2SD1128	2.90
2SD1138	0.84
2SD1273	1.25
2SD1453	4.50
2SD152K	2.64
2SD198	3.87
2SD234	0.49
2SD235	0.60
2SD24	2.29
2SD257	2.94
2SD292	2.59
2SD313	2.59
2SD325D	1.95
2SD348	16.13
2SD350	5.20
2SD350A	2.80
2SD353	7.50
2SD389	2.41
2SD401	1.55
2SD414	1.98
2SD471	2.13
2SD560	2.95
2SD588A	2.36
2SD600	3.25
2SD601R	0.65
2SD613	1.03
2SD621	12.85
2SD636	0.55
2SD639-R	0.85
2SD655	0.98
2SD657	3.50
2SD661A	0.80
2SD731	2.45
2SD773	0.33
2SD811	5.54
2SD823	1.98
2SD837	1.56
2SD841	3.65
2SD856	2.25
2SD857Q	1.84
2SD882	1.50
2SD894	1.50
2SD898	5.45
2SK105H	2.15
2SK152	2.95
2SK34	0.76
2SK41	1.07
2SK79	2.98
40408	0.50
40594	1.53
40636	1.43
4EX581	0.80
741	0.30
7805-T022	0.63
7806	0.73
7808	0.85
7812-T022	1.16
7815	0.64
7818	0.92
7824	0.64
7905	0.80
9368	10.70
AA133	0.12
AC133	0.12
AC123K	0.43
AC127	0.27
AC128	0.34
AC138	0.24
AC141	0.29
AC142K	0.44
AC151	0.28
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
AC187K	0.43
AC188	0.49
AC188-01	0.49
AC188K	0.43
AC193K	0.65
AC194K	0.65
AD140	1.06
AD143	1.41
AD145	1.60
AD161	0.56
AD162	0.45
AD262	1.25
AF114	2.47
AF115	1.24
AF118	1.20
AF127	0.50
AF139	0.53
AF178	1.45
AF179	0.55

AF180	0.55
AF181	0.53
AF186	0.53
AF239	0.43
AF279	0.88
AL113	1.36
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN211	3.25
AN214Q	2.75
AN231	14.65
AN234	5.92
AN236	3.78
AN239	6.95
AN240P	1.52
AN241	1.71
AN245	4.49
AN253	2.97
AN260	3.85
AN262	1.98
AN272	7.92
AN281	6.65
AN295	5.52
AN301	3.60
AN302	3.99
AN303	4.39
AN305	11.51
AN315	2.46
AN316	5.53
AN318	6.27
AN320	5.47
AN321	2.25
AN322	5.85
AN331	4.59
AN337	5.37
AN340P	1.17
AN355	5.98
AN362	1.75
AN370	3.95
AN5010	5.70
AN5111	2.92
AN5120N	4.50
AN5132	4.39
AN5250	3.98
AN5435	3.08
AN5610	2.85
AN5612	4.25
AN5613	4.63
AN5630	3.95
AN5701N	1.66
AN6250	2.95
AN6300	7.00
AN6310	8.74
AN6320N	4.28
AN6340	11.00
AN6341	5.98
AN6342	1.61
AN6363	16.00
AN6371	9.24
AN6387	10.65
AN6531	1.95
AN6551	1.35
AN6552	0.68
AN6610	2.40
AN6677	8.95
AN7111	1.45
AN7114E	8.54
AN7115	3.38
AN7120	4.65
AN7145	2.80
AN7146	4.35
AN7151	2.26
AN7156	2.85
AN7158	6.75
AN7218	1.64
AN7223	4.25
AU107	3.50
AU110	2.25
AU113	5.25
AY105K	2.08
AY106	1.09
BA524	8.21
B250	2.65
B40	1.55
BA130	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.33
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.15
BA182	0.24
BA222	1.66
BA302	1.24
BA311	1.32
BA312	0.97
BA313	0.76
BA317	0.08
BA318	0.09
BA328	4.77
BA333	1.37
BA335	6.27
BA5102A	2.86
BA511	2.92
BA514	2.20
BA521	2.52
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.56
BA536	2.95
BA6209	4.75

BA656	8.99
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.21
BAV19	0.11
BAV20	0.31
BAV21	0.34
BAW62	0.19
BAX12	0.44
BAX13	0.11
BAX16	0.11
BC107	0.13
BC107A	0.11
BC107B	0.18
BC108	0.15
BC108B	0.15
BC109	0.12
BC109B	0.15
BC109C	0.12
BC113	0.14
BC119	0.36
BC126	0.23
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC140	0.45
BC141	0.34
BC142	0.34
BC143	0.33
BC147	0.08
BC148A	0.10
BC148B	0.13
BC148C	0.11
BC149	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.36
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172	0.13
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.20
BC178	0.26
BC179	0.26
BC182	0.09
BC182L	0.10
BC182LB	0.14
BC183L	0.11
BC183LB	0.26
BC184	0.13
BC184L	0.14
BC184LB	0.26
BC186	0.27
BC187	0.28
BC204	0.16
BC207	0.14
BC212	0.11
BC212B	0.26
BC213L	0.10
BC213LB	0.15
BC214	0.10
BC214LB	0.26
BC225	0.40
BC237	0.10
BC237BJ	0.12
BC238	0.10
BC238A	0.13
BC238B	0.13
BC239	0.12
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.35
BC301	0.45
BC302	0.53
BC303	1.04
BC307	0.18
BC307A	0.14
BC308	0.18
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.11
BC337	0.09
BC338	0.34
BC368	0.24
BC440	1.09
BC441	0.44
BC454	0.36
BC460	0.42
BC461	0.47
BC462	1.15
BC463	0.64
BC477	0.37
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.17
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.10
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC559B	0.11

BC560C	0.14
BC635	0.36
BC636	0.42
BC637	0.24
BC639	0.20
BC640	0.24
BC879	0.39
BC880	0.31
BCX34	0.40
BCY70	0.30
BCY71	0.21
BCY72	0.20
BD115	0.46
BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.54
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.26
BD137	0.36
BD138	0.46
BD139	0.34
BD140	0.37
BD144	1.70
BD150	1.25
BD157	0.67
BD160	1.60
BD163	0.71
BD165	0.62
BD166	0.42
BD168	0.73
BD175	0.60
BD179	0.49
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.53
BD202	0.60
BD203	0.50
BD204	0.61
BD207	1.79
BD208	0.34
BD222	0.49
BD225	0.49
BD228	0.63
BD229	1.05
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.39
BD239	0.45
BD240	0.37
BD241	0.39
BD242	0.39
BD243A	0.37
BD243C	0.79
BD244	0.51
BD244C	0.79
BD245C	0.99
BD246C	1.25
BD253	1.05
BD278A	0.80
BD317	2.60
BD318	2.85
BD375	0.42
BD380	0.76
BD410	0.52
BD433	0.47
BD434	0.49
BD435	0.49
BD436	0.60
BD437	0.49
BD438	0.40
BD441	1.42
BD442	1.41
BD509	1.42
BD510	1.07
BD519	1.50
BD529	1.32
BD530	1.18
BD533	0.67
BD534	0.53
BD535	0.79
BD536	0.61
BD537	0.74
BD538	1.45
BD544B	0.83
BD598	1.25
BD677	0.56
BD679	0.57
BD680	0.76
BD681	1.48
BD696	2.47
BD699	3.49
BD700	3.70
BD707	1.06
BD709	1.12
BD710	0.80
BD809	0.85
BD810	0.69
BD879	0.74
BD880	0.79
BD895	2.31
BD899	2.48
BD901	0.79
BD902	0.84
BDW83C	1.56
BDW84C	1.56
BDX32	1.75
BDX53A	4.93
BDX53B	3.35
BDX54B	2.16
BDX62A	2.15

BDX63A	1.96
BDY20	1.21
BDY81	1.18
BF115	0.40
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.21
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.18
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.17
BF241	0.17
BF245	0.50
BF245A	0.52
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.28
BF256LB	0.42
BF256LC	0.42
BF257	0.34
BF258	0.36
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.35
BF336	0.33
BF337	0.40
BF338	0.44
BF355	0.49
BF362	0.66
BF363	0.60
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.29
BF423	0.52
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.39
BF459	0.52
BF460	1.56
BF469	0.31
BF470	0.55
BF471	0.31
BF472	0.33
BF479	0.61
BF480	1.38
BF491	1.99
BF495	0.64
BF506	0.43
BF509	0.41
BF523	0.24
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.75
BF869	0.47
BF870	0.30
BF959	0.42
BF960	0.69
BF970	0.69
BFR39	0.44
BFR61	0.50
BFR62	0.50
BFR79	0.29
BFR81	1.65
BFR86	1.08
BFR89	1.63
BFR90A	1.30
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.32
BFY51	0.50

BFY52	0.27
BFY79	0.49
BFY90	0.61
BLY49	2.20
BR00	0.22
BR01	0.75
BR03	0.75
BR03	1.26
BRC116	0.67
BRC300	2.01
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.53
BRY39	0.69
BSS38	0.87
BSTBD140G	5.25
BSTC0246	7.25
BSTC0233	7.25
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.49
BSW68	0.60
BSX19	1.29
BSX20	0.34
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT106	1.55
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
TBA970	3.06
BT151-800R	1.15
BTT6018	2.42
BTT8124	4.89
BU106	2.48
BU108	1.50
BU109	2.65
BU110	5.69
BU111Y	4.16
BU125	2.48
BU126	1.55
BU137	6.53
BU205	1.08
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.93
BU226	2.95
BU326	2.00
BU326A	2.20
BU326S	2.20
BU406	1.49
BU406D	1.79
BU407	0.82
BU407D	1.09
BU412	9.15
BU426A	1.67
BU500	1.95
BU508A	1.75
BU536	5.80
BU608	2.65
BU705	4.07
BU806	1.79
BU807	0.80
BU826A	2.15
BUW84	1.39
BUX84	1.00
BUX85	1.10
BUY69A	2.04
BY126	0.13
BY127	0.08
BY133	0.11
BY164	0.47
BY176	0.52
BY179	0.62
BY182	1.05
BY184	0.47
BY187	0.77
BY189	1.79
BY198	1.62
BY201/2	1.50
BY203/20	0.59
BY207	0.22
BY208	0.46
BY210-400	0.19
BY210-600	0.27
BY210-800	0.34
BY218	1.64
BY223	1.23
BY224-600	1.88
BY225-100	1.13
BY226	0.25
BY227	0.49
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.69
BY295-600	1.03
BY298	0.20
BY299	0.45
BY407	0.90
BY409	1.49
BY448	0.69
BY713	1.10
BYW19/1000	0.69
BYW56	0.34
BYX10	0.29
BYX55-600	0.19
BYX71-600	1.25

BYX71-350	1.40
BYX94	0.16
BYY56	1.20
BZY93C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.46
C106M	0.76
C1129	0.58
CA3046	2.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	3.12
CBF16848N-071	1.56
CD4001	0.38
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.47
CD4016	0.46
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.85
CD4047	1.06
CD4049	0.46
CD4052	0.75
CD4066	0.38
CD4069	0.29
CD4070	0.66
CD4081	0.35
CD4093	0.72
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.55
CV12E	4.09
CX095D	3.14
CX104	9.64
CX108	10.50
CX109	7.86
CX130	8.76
CX134	11.04
CX136	11.49
CX139	11.83
CX157	4.84
CX158	4.10
CX177	6.75
CX187	5.26
CX755	12.95
CX885A	6.85
DEC1	2.20
DEC2	2.20
DS3486N	4.33
DS3487N	4.33
E1222	0.40
E5024	0.28
E5386	0.25
E9003	0.46
E9005	0.50
ESM310BP	4.15
FND500	5.78
GC374	1.65
GD243	4.95
GF758	0.84
GH3F	1.82
HA11215	4.50
HA11211	2.53
HA11225	4.29
HA11226	8.71
HA11229	2.88
HA11235	2.48
HA11124	5.25
HA11244	2.82
HA11251	4.47
HA1125	4.29
HA1137W	2.87
HA1138	5.03
HA11414	5.65
HA1144	7.87
HA1156	1.16
HA1160	4.78
HA1166	5.25
HA1166X	5.36
HA1167	5.36
HA11706	9.50
HA11705	8.00
HA11703	4.95
HA11701	4.56
HA11710	9.50
HA11713	8.13
HA11711	20.16
HA11715	3.25
HA11714	7.76
HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	8.90
HA1180	5.15
HA1196	7.43
HA13001	2.25
HA1306	2.26
HA1338	7.50
HA1339	2.33
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.86
HA1367	4.32
HA1368R	2.45
HA1368	2.07
HA1370	3.71

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

TEL 0902 712083 TELEX 338490

HA1374	4.80
HA1377	4.98
HA1389R	2.05
HA1389	2.39
HA1392	3.90
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HBF4030AF	2.48
HD14538	2.07
HD38702-A2	7.45
HD38750A53	8.95
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	18.25
HEF4001BP	0.67
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	8.89
HM6251	5.70
HM7103	4.85
HM9032	3.22
HM9012	3.22
HM9015	3.24
HT4207	17.16
HT4208	18.25
IN5401	0.11
IR2403	4.25
IR2C05	4.25
IR3P06	2.25
IR3P08	4.95
IR94558	6.25
IS751	2.85
ITT425	0.18
IZ0003GE	5.37
IZ0020GE	5.93
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	5.54
L200CV	1.69
LA1201	1.02
LA1210	1.56
LA1230	2.87
LA1320	2.87
LA1352	1.75
LA1357N	11.07
LA1363	7.25
LA1364	3.02
LA1365J	3.44
LA1385	1.94
LA1387	7.60
LA3155	1.25
LA3301	1.65
LA3350	1.43
LA3361	1.23
LA3365	3.98
LA3390	4.25
LA4030P	4.20
LA4031P	3.20
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	1.56
LA4125	2.25
LA4138	3.45
LA4140	1.15
LA4192	4.29
LA4220	1.62
LA4250	6.75
LA4400	3.92
LA4420	1.72
LA4422	1.72
LA4430	1.56
LA4440	2.95
LA4445	7.25
LA4460	2.32
LA4461	2.95
LA4505	7.25
LA5112N	2.98
LA7020	7.33
LA7025	10.21
LA7027	10.92
LA7040	9.20
LA7042	4.25
LA7800	2.65
LA7801	1.92
LB1274	3.08
LC7800	9.20
LD3120	1.13
LD3150	2.25
LM1017N	4.29
LM1877	10.92
LM224	1.75
LM2808	6.25
LM2877	5.25
LM317CKC	1.38
LM324N	0.75
LM339N	0.80
LM340K	11.85
LM342P	1.62
LM342P	1.62
LM342P	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	1.82
LM8360	3.87
LM8361	3.57
LR2612	11.95

LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	14.95
LU03112	12.37
M193	12.75
M21C	1.00
M23C	0.83
M293	9.15
M51102L	6.35
M5115P	5.24
M51203L	3.15
M51231P	3.04
M5134-9341	4.13
M51353P	5.25
M51381P	4.50
M51393AP	7.78
M51394P	11.97
M5142P	5.49
M5144P	4.25
M51513L	2.55
M51515BL	3.23
M51517L	3.71
M5192	2.20
M5194AP	5.74
M5231L	1.95
M53274P	1.33
M54532P	2.15
M54544L	4.75
M58478P	6.75
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MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	3.25
MC13002	3.60
MC1310P	2.25
MC1327P	1.33
MC1330P	2.88
MC1350P	1.61
MC1351P	3.96
MC1352P	2.50
MC1357P	2.15
MC1358P	1.55
MC14001	2.40
MC14013	0.41
MC14493P	11.95
MC14494P	2.15
MC14497	3.65
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.70
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MC7818C	2.18
MCR100/7	1.65
MCR106-5/6	0.95
MCR220/7	2.28
ME0402	0.17
ME0404/2	0.47
ME0411	0.28
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.76
MJ481	1.53
MJ802	5.45
MJE2955	1.89
MJE3055	1.65
MJE340	0.49
MJE520	0.49
ML231	3.33
ML232B	3.65
ML237B	2.51
ML238	5.77
ML923	3.35
ML926	3.98
MM5314N	4.02
MM5316N	4.25
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	6.20
MM5841N	6.64
MN1400VL	13.65
MN1405	12.95
MN1435VX	11.48
MN6016A	20.56
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.49
MPSU05	0.86
MPSU10	1.56
MPSU56	0.78
MPSU60	1.98
MR818	0.33
MR854	0.72
MR914	1.20
MSM5816RS	17.35
MSM5840H	9.25
MVS460-02	0.61
NE542	2.50
NE545B	4.86
NE555	0.38
NE556	0.95

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NE645BN	3.35
NP1106	8.60
OA202	0.11
OA47	0.14
OA91	0.09
OA95	0.12
OC28	2.95
OC29	2.15
OC36	1.28
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.98
R1038	2.19
R1039	2.19
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R2009	1.98
R2010B	1.33
R2029	1.33
R2030	1.33
R2257	3.71
R2265	1.49
R2305	1.18
R2322	0.59
R2323	0.76
R2354A	2.01
R2354B	2.01
R2443	0.88
R2461	1.50
R2540	2.31
R2540X	3.30
R2615	0.67
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RCA17376	1.58
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RCA17523	0.83
RCA2060	2.00
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RT402	1.58
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SAB3210	3.49
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SAF1039	3.35
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SAS560S	2.26
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SAS570T	5.42
SAS570S	2.61
SAS580	2.85
SAS5600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	1.93
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	18.95
SDA2112/2	12.85
SG264A	6.45
SG613	8.87
SG629	8.27
SG6533	11.96
SI-1020H	10.89
SI-1125HD	17.63
SI1125H	7.50
SI1225HD	19.27
SI1630HD	21.98
SI6900	12.00
SKE1/02	1.85
SKE2F1/04	1.39
SKE2G3/04	1.05
SKE4F1/06	0.73

SKE4F2/08	1.24
SKE4F2/06	0.85
SKE4F2/10	1.24
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	1.98
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SN7410N	0.27
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SN7413N	0.37
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SN74151AN	1.51
SN74154N	1.27
SN74190	2.00
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SN7440N	0.27
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SN7474N	0.44
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SN74LS26N	0.53
SN76001N	1.65
SN76013ND	7.50
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SN76023ND	3.96
SN76033N	4.15
SN76110N	0.90
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SN76226DN	1.98
SN76228N	3.27
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SN76532N	2.95
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SN76549	2.59
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
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SN76708	4.86
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SN76707N	5.11
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SN76730	5.36
SN76810N	0.60
SN76832N	3.25
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SN94042	5.54
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STA471C	7.56
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STR6020	8.31
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TA7074P	1.98
TA7076P	7.80
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TA7092P	8.65
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.92
TA7124P	2.34
TA7129P	1.50
TA7130P	1.27
TA7136AP	1.27
TA7137P	0.98
TA7141AP	3.87
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TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7152P	1.91
TA7153P	7.47
TA7161P	5.45
TA7162P	3.25
TA7169	9.54
TA7172P	1.41
TA7176P	2.48
TA7193AP	6.67
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TA7201P	2.71
TA7203P	2.18
TA7204P	2.16
TA7205P	1.38
TA7206P	6.35
TA7207P	3.34
TA7208P	2.15
TA7210P	3.58
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	3.57
TA7227P	2.81
TA7229P	4.45
TA7230P	4.98
TA7232P	6.60
TA7233P	6.95
TA7240AP	7.83
TA7245P	5.53
TA7270	7.50
TA7310P	2.15

TA7312P	2.45
TA7313AP	1.50
TA7314	5.94
TA7323P	3.15
TA7325P	1.15
TA7339P	1.75
TA7340P	5.06
TA7607AP	13.90
TA7609	3.28
TA7611AP	4.80
TA7616P	5.25
TA7622AP	8.94
TA7628P	5.98
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TA7640AP	1.55
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TC4081BP	3.25
TC40H000	1.98
TC4514BP	5.44
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TCA440	2.25
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TCA640	7.36
TCA650	2.04
TCA660B	3.30
TCA730	3.81
TCA750	2.25
TCA800Q	6.95
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TCA890	5.44
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TD3F800R	3.92
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UPC566H	2.95
UPC574	3.25
UPC575C2	2.40
UPC576H	2.58
UPC577H	1.25
UPC578C	8.70
UPC580C	4.13
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	8.95
UPD2819C	4.98
UPD4013B	4.00
UPD4066B	4.95
UPD553-164	19.25
UPD8049C-1	10.85
X0007TA	4.68
X0022CE	5.75
X0029CE	7.09
X0031CE	4.95
X0035TA	5.98
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	6.25
X0057GE	6.00
X0062CE	6.52
X0065CE	6.25
X0074GE	10.00
X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	5.98
X0109CE	11.25
X0113CE	2.07
X0195CE	7.50
X0204CE	8.74
X0261CE	8.75
X1222AF	3.63
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VCR Clinic

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

New Models

A word about three new machines we've had in recently, all of the HQ type, the Toshiba V81B, Panasonic NVG7 and Mitsubishi HS337. The Toshiba machine has infra-red remote control, one-touch recording, a four-event timer, still with frame advance, a picture sharp/soft control, a counter memory and an auto-play facility whereby if you press rewind and play together it will automatically go into play after rewinding the tape. This is the first true Toshiba VHS machine we've had – the V65B was a badged version of the Ferguson 3V45. The influence of the V65B is obvious however, with a similar panel layout. The Panasonic machine has a similar specification but with a delayed one-touch record facility where the start as well as the finish time of the OTR feature can be set. It doesn't have an auto-play facility. The Mitsubishi machine is similar to the Panasonic one but has a seven-event timer and stepped type slow-motion. It's fitted with a SCART socket at the back.

Having had a chance to compare the three machines I must say that the Mitsubishi machine stands head and shoulders above the other two, which can only be described as average, even for a non-HQ machine. The Mitsubishi machine's still and slow functions are almost perfect, which for a two-head machine is very good. How they improve them on the dearer three-head machine I don't know.

D.S.

Mitsubishi HS306

Here's a problem that occurs regularly with the Mitsubishi HS306. The complaint is a noisy picture and the cause is that the tracking control is a thumb-wheel type positioned along the bottom edge of the front of the machine. If a duster is run along the shelf in front of the machine the back of the hand brushes against the control, rotating it to the end of its track. As with most modern VCRs it's so seldom necessary to use the tracking control that most users don't even know it's there.

D.S.

Finlux VR1010/Philips VR6462

This machine was reported to be dead, including the clock. There was just a red LED on next to the infra-red receiver, presumably because it thought the machine was receiving infra-red instructions. The power supplies are the obvious place to start with a fault of this sort. Early checks revealed that a 17V rail was at 25V. Some time was wasted before we realised that while the rail has overload protection it's not stabilised and was high due to lack of a load. Further checks led us to the 30V zener diode D6103 which was short-circuit. A replacement put matters right.

D.S.

Philips VR6462 and Clones

Nearly half of our customers who have a Philips VR6462 or one of its clones have trouble with the timer. They usually complain about recording the wrong channel or of a blank screen. The problem is that the number used to indicate channel number during normal use is not the one used during timer setting up. This is further aggravated by the fact that when you come to set the channel in the timer the number to watch is in front of the word programme, not the number following it as you would expect, and is in fact the same number that's used to indicate the day in the previous operation.

A minor problem with these Philips machines is that some time during the first couple of weeks' use one of the channels tends to go off tune, usually tuning itself to the next channel along the band. Retuning results in no further calls and at first I thought that customers were pressing the search and store buttons by mistake, perhaps when setting the timer. It's now happened too often however for this to be feasible. I can only conclude that some settling down in the self-tuning and memory circuits takes place.

D.S.

GEC V4005/Hitachi VT63

We've had the following fault several times with the GEC V4005. It can also occur with the Hitachi equivalent (VT63) – in fact a technical bulletin from Hitachi helped us to cure the GEC machines. The symptoms are failure to accept a tape properly or to eject correctly, often with the mechanism bent or out of "sync". The cause is usually the end sensors. These are mounted on the front loading mechanism and should be replaced as a pair. Unfortunately the mechanism is often damaged to the point where it must be replaced as well.

The problem occurs because the machine uses the end sensors to detect whether a tape has been inserted. When the sensors go faulty the machine may attempt to load up without a tape in. Unfortunately the physical presence of a tape is required to release the latches at either side of the mechanism, so it attempts to load up with the latches locked, resulting in damage to the mechanism unless the fault is rectified fairly quickly.

D.S.

Sony SLC6

We've had several cases of intermittent stopping or failure to unthread. The main problem is belt wear. Look inside the cassette compartment, from the right-hand side, to see if the relay pulley is running. If it is, replace all the belts. If the problem is very intermittent, for example if the threading fails after a period of standing, say overnight, carry out the following modifications. Replace the small relay pulley, the large relay pulley, and the phosphor-bronze bearing through the chassis between the two relay pulleys. Part numbers are as follows: small relay pulley, top deck (508) 3-671-171-02; large relay pulley, below deck (519) X-367-100-50; phosphor-bronze bearing, 3-671-122-01. In some cases an arm to the right of the small relay pulley may have to be changed due to the extended skirt on the new pulley.

S.B.

Akai VS2

The problem with this machine was intermittent shutdown when starting to record or play back after a rewind. Our customer told us that the machine was overheating, which threw us completely – with this model, once a function has shut down it won't repower for some minutes. The cause of the trouble was found to be the loading belt – the tape loading was intermittently incomplete. **S.B.**

Panasonic NV7000

In the event of an incorrect clock display at switch on from the mains, consisting of the top row of dots and a bottom row of numbers, IC7505 is being held in reset. Check zener diode D7540. **S.B.**

Sharp VC8300

You will sometimes find that the output from the loading motor chip I805 (STA401) doesn't change state with change of input. If the i.c. has failed, check the motor changeover switch. It can fail, placing a short across the motor drive output – this will destroy a replacement chip if it's not put right first (part no. QSW-I 0002GE). **S.B.**

Grundig VS200 Series

Take-up motors with date codes prior to 04/84 can tighten on their bearings. This and any other factors, such as poor quality tapes, that cause increased tape tension around the drum can lead to displacement of one or both video head tips. As the machine's high performance can mask the problem to some extent the clues to look for are poor reverse search performance and tracking errors at the top of the screen. Care is required and the urge to twiddle the tape guides must be resisted. Note that an unsecured cassette exit guide, next to the cassette's tape output, can also cause tracking errors at the top of the screen. If this guide becomes loose and a tape has been jammed in the machine the tape tension arm can be bent out of true.

Failure to take up the tape can be due to incorrect tape tension. During initial threading up the microcomputer chip checks the position of the tension arm via the opto-tension sensor. Reduced tape tension will result in the arm "bouncing" out of the opto-sensor slot during initial threading up. Check and set the tension: follow the instructions given in the manual but use the new value of 23-25N (gm/cm). **S.B.**

JVC GRC2 Camcorder

An inexpert customer brought this camcorder back to us several times during the guarantee period, each time with red-herring symptoms of one sort or another. It finally came back with a self-recorded tape that proved the sound to be intermittent in the record mode. The fault didn't show up during a long test in the workshop and couldn't be provoked. We finally resorted to a blanket job, replacing the microphone, the BA5112LS sound chip and all the surface-mounted tantalum electrolytic capacitors in the sound section – this type of capacitor is proving to be somewhat unreliable in JVC and JVC-derived recorders. We didn't hear any more, so one of the handful of replaced suspects was faulty. Subsequent testing proved it to be the microphone. **E.T.**

Panasonic NV810

The customer had had this machine for just two days when he rang to tell us that the sound from its left hi-fi channel was louder than that from its right hi-fi channel during playback – also on record unless he offset the slider audio level controls. While he was convinced that the sound balance was wrong workshop tests showed that the signal levels in the two channels were within half a decibel of each other at the crucial 0dB level. What was wrong was the factory setting of the meter balance and sensitivity controls VR6201 and VR6202 on the operation circuit board. Incidentally these are incorrectly referred to as VR6501 and VR6502 in the setting-up instructions given in the service manual. Strange that the recording level control offset which satisfied the meters and the owner was actually introducing imbalance. We've since lined up one or two more of these machines for critical customers. **E.T.**

Ferguson 3V23

This model and its JVC equivalent, the HR7700, were somewhat ahead of their time and had a very high component count compared with later full-function machines. The fault with this one was that some of the remote-control functions didn't work – those concerned with channel changing and clock setting. Remote control of the deck functions worked well. It took us longer than it should have done to track this down to a faulty data select chip (TA1, type TA57) on the tuner-timer control board. We had dallied far too long in the remote control receiver and serial-to-parallel converter sections of the mechacon circuit. **E.T.**

Sony SLC6

Snowy pictures via the video was the complaint with this machine. Playback of a known good tape was fine, but looped-through signals to the TV set were very weak. Since its supply voltage was present and correct the r.f. booster was clearly in trouble. The manual gives no circuit diagram for the expensive combined r.f. modulator/booster module however – it's presented as a "black box". In view of the high cost of this item we decided to have a go amongst the four 2SC3037 npn transistors in the booster section. Once we'd worked out their pinning it didn't take long to find one whose base was 3V positive with respect to its emitter. It was Q3, and had an open-circuit base-emitter junction. No alternative we tried would work in this position so another 2SC3037 was acquired and fitted. Much cheaper than a replacement module. **E.T.**

ITT VR3916

No power-on light was the symptom with this machine, the cause being loss of the switched 5V and 12V supplies. The 3·9V zener diode D3 was short-circuit and Q3 was leaky. **P.B.**

GEC V4005/Hitachi VT63

This machine often produces a squeaking noise in fast forward or rewind. The cure is to remove the bar at the base of the capstan and put a dab of grease where the flywheel touches it. If the bar is badly worn a modified type with a nylon bearing is available. **P.B.**

Toshiba V65B/Ferguson 3V45

There was no clock display as there was no 5V supply to the display driver IC301. The supply comes from Q401 on the timer PCB: this transistor was open-circuit between its base and emitter. **P.B.**

Vintage Mains Supplies

Chas E. Miller

The domestic mains power supply in the UK has been standardised at 240V, 50Hz a.c. for so long now that most younger engineers will be unaware that there was ever anything different – very different! In the vintage television years the mains supplies varied widely and wildly, not just over the country as a whole but very often between districts of the same town – indeed sometimes between adjoining houses!

The reason for this disparity was the way in which the electricity industry grew up. In its infancy, every undertaking was a purely local affair which selected its equipment from the range on offer from the manufacturers of the day. Thus the voltage, its type (a.c. or d.c.), and if a.c. the frequency, were determined by what appealed most to the local engineer-in-chief. Generally speaking it was the pioneering undertakings that had the oddest selection of supplies, as they were themselves working out what in practice best suited their customers' needs. Although the coming of the grid system paved the way for the standardisation of supplies, even well into the vintage years there were no fewer than 600 local supply undertakings, and with the others there was still no firmly decided norm.

Early Power Requirements

From the outset there was brisk competition between a.c. and d.c. as the favourite type of supply. D.C. had undeniable attractions as it could be employed without difficulty to power the arc lamps that were used for early street and factory lighting. The ease of transmission associated with a.c. was not of such importance with local power stations. Nor would the majority of consumers have any need to transform voltages up and down in the long pre-radio and TV era. D.C. motors could be easily controlled and were widely employed in tramway systems. Towns having trams would be likely to have d.c. mains as well, to simplify the generating plants. When a.c. was used for traction purposes the frequency was likely to be less than 50Hz – down to 25Hz or even less. This again was of no moment to the domestic user of the time, though it would have been when mains-powered radio sets came on the scene. Usually the listener unfortunate enough to have a sub-standard a.c. mains supply had to pay over the odds for a set that could be used with low-frequency a.c. At least he could use a television receiver without too much bother when these became available: the person with d.c. mains had no other recourse but to use a d.c.-a.c. converter, either rotary or vibratory (we are talking about the days when all TV sets were fed via a mains transformer). Let us consider therefore the lot of the bloke in the front line, the poor old radio engineer who just over fifty years ago was poised on the brink of becoming a radio/TV engineer.

Some London Choices

This hapless individual, we'll suppose, has a list as long as his arm of customers all over London desperate to have a TV set installed in time for the grand opening of the service in November 1936. His employer has supplied him with a handbook that shows him the mains voltage and type of supply for virtually every district in the kingdom, so he feels the usual TV engineer's false sense of security that comes just before a gigantic pratfall.

Actually, the first call in Battersea isn't going to be too much of a problem if he finds himself in the 230V a.c. area, but a bind if the house is in the alternative 230V d.c. locale. Maybe there were not too many potential viewers in Bermondsey, which is just as well since there's a splendid choice of five supplies – 205V a.c., 205V d.c., 220V a.c., 230V a.c. and 240V d.c. Camberwell is much less complicated with only three supplies, 205V a.c., 205V d.c. and 230V a.c. Chelsea manages with only two, 200V d.c. and 230V a.c., as does Finsbury with its 230V a.c. and rather dotty 104V d.c. So far our friend has had six chances in fourteen of dropping in on a d.c. mains district.

He may breathe a little more easily in Fulham and Greenwich, which both have a civilised 200V a.c., but the problems commence again in Hackney, part of which enjoys 230V a.c. and the other 240V d.c. Hammersmith offers 110V a.c. or 230V a.c., which he supposes is not too bad, nor is Hampstead with its choice of 105V or 210V a.c. supplies. Kensington means either 100V a.c., 230V d.c. or 230V a.c. St. Marylebone offers a straight choice between 240V a.c. or d.c. With Poplar it's 230V d.c. or nothing. In Shoreditch you get 240V, again d.c. only. Southwark provides 205V, 215V and 220V d.c. in some areas, 205V or 230V a.c. in others. Stepney sticks to 240V d.c. which is also favoured by Stoke Newington where some fortunate people get the choice of 230V a.c. Wandsworth plumps for a.c. only at 205V or 230V while Westminster rings the changes with either 230V a.c. or 200V d.c. If our hero penetrates Woolwich he'll find 220V a.c., thus completing a check list of virtually every combination of voltage and current then available. No wonder television and radio sets in the vintage years had comprehensive mains tapping panels!

If you tot up the examples quoted, you'll find that the twenty districts mentioned (and there are many more in London) boasted no fewer than 43 voltage/current variations. But at least, our engineer friend might have reflected, if he armed himself with a supply of step-up autotransformers and d.c.-a.c. converters for approximately 110V to 230V he couldn't possibly go wrong. He had covered every probable eventuality. Wouldn't it be just his luck to get a call to go to that part of Leyton that enjoyed 150V d.c.?

Vibrator Converters

Vibrator converters were commonly used to deal with the problem of a d.c. mains supply when the receiver required an a.c. input. The basic principle is shown in Fig. 1. Spring switch S consists of a springy metal reed which is fixed at one end and carries a piece of soft iron. D.C. passing through coil L at switch-on attracts the piece of soft iron to its magnetised core, breaking contacts A and

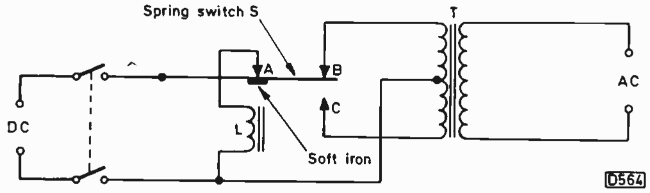


Fig. 1: Principle of the vibrator d.c.-a.c. converter.

B and making contact C. L is then demagnetised and S springs back. The process is repetitive: with each movement of S, the current flowing through transformer T's centre-tapped primary winding reverses. An a.c. output is thus generated across T's secondary winding. In practice a vibrator d.c.-a.c. converter would include overload protection and filtering to suppress the interference generated by the switching action.

Market Place

Eugene Trundle

Part of my job is to buy spares and to select and purchase test equipment for a medium-sized (but growing!) service department. In the course of this I sometimes come across items that seem worthy of drawing to the attention of fellow readers of the magazine. Here then is a round up of a few bits and bobs that don't individually justify a full-blown review but have become available recently and have been found to be very useful.

IR Detector

First the Magic Mirror from Philips Service, catalogue number 395 37198. It's made by Banner in the USA and takes the form of a plastic card, similar to a business or visiting card. In the centre there's a postage-stamp sized infra-red detector pad. When an active infra-red remote control handset is shone at this from a range of an inch or so an orange glow is reflected to indicate the presence of IR radiation. It's most clearly seen when shielded from ambient light, and may be steady or pulsating depending on the handset. Being a passive device this tester is maintenance free and has no need of the batteries or mains power upon which other types of detector depend.

This little device very quickly settles the question "is it the trasmitter unit or the receiver?", and with experience one can gauge the strength of the IR radiation. We've found it invaluable in the workshop, field and in the showroom. It's well worth the £6·95 plus VAT price tag: progressively higher discounts are offered for orders of three, six or twelve.

Wire Stripper

Another useful gadget is the automatic wire stripper available from PV Tubes of Accrington, Lancashire, at £6·95 plus VAT. This beefy and rugged tool is in fact manufactured by Philips though it's not mentioned in the Philips Service UK catalogue. In appearance it's similar to a pair of pliers with the jaws turned through 90°. Below them are sidecutter blades for use on the wire before and after the stripping operation.

The wire (single or flat-twin) to be stripped is inserted in the main jaws and the handles are then squeezed. In a single stroke the outer sleeve is gripped and held and the insulating layer is stripped off and withdrawn. A graduated scale permits a choice of strip length and a knurled knob caters for wire diameters between $0{\cdot}2mm^2$ and $6mm^2$. I found it effective and useful.

TV/VCR Covers

Now for something completely different. If our company is at all typical – and I suspect it is! – the cost of damaged cabinets and screens over a year is staggering. In the rush and bustle of field service collections and deliveries it's all too easy for these to be damaged: a bend taken too fast, a suicidal dog, an extra TV squeezed into the van – all these things happen to us, and it's very difficult to deal with deep scratches and abrasions on the glass, metal and pseudo-wood outer surfaces of modern TV sets and VCRs.

A good way of insuring against such disasters is to use protective covers. I've been trying some from NFPC of 3 Fenham Hall Drive, Newcastle-upon-Tyne NE4 9UT (telephone 091-272 4646). These "tea-cosy" type covers are shaped to fit TV sets and come in two sizes: standard, fitting over sets with screens up to 22in., also some 26in. models; and large, to fit 28in. models and the bulkier 26in. models. There's also a "universal" VCR cover which is suitable for all "homebase" video models except for early monsters like the Sanyo VTC9300. The VCR covers have a Velcro-fastened flap, thus completely enveloping the machine for transit and avoiding those dangling mains cables etc.

These covers are all made from quilted anorak-type material. Though not as heavy and thick as some covers I saw several years ago, they come at a much more affordable price and are quite adequate for their purpose. They also offer protection from rain and snow between the vehicle and the house or workshop door, and completely conceal the gear in sensitive situations such as repossessions!

The prices are £6·50 per VCR cover, £7·50 per standard TV cover and £8 per large TV cover, all inclusive of post and packing. Various package prices and discount schemes are available. To promote business and create a professional image every cover supplied is customised with the buyer's trading name. A good investment in my opinion.

Degaussing Wand

Finally a degaussing wand! Degaussers were in plentiful supply twenty years ago and generally came in the form of a large and rather clumsy disc. Although the need to degauss a colour TV tube arises much less often than of yore, it's still sometimes required – when setting up a newly-fitted tube for example, or when there's a magnetised object near a TV set or monitor. Very few suppliers seem to list degaussers these days but I have a new one on the desk in front of me. It was supplied by PV Tubes of Accrington (0254 36521).

Like all such degaussers it's intermittently rated, on a thirty-second basis. During that period it generates a very strong alternating field that's suitable for use with delta-gun tubes and for demagnetising steel radiators etc. – in addition to the less-demanding in-line gun types of picture tube. Its wand shape (4·3cm diameter, 29cm long) makes it very amenable to storage in the toolbox or to stashing away in some corner of the service van or car. Its price, at £19 plus £1·50 post and packing plus VAT, may seem to be a little on the high side but is well justified when you consider that it consists of lots of expensive copper wire and steel laminations. This one is UK made and, like the seaside rock it resembles, it comes from Blackpool! An essential accessory to have around even though it's not something you'll be using every day.

Long-distance Television

Roger Bunney

December was relatively quiet following the excellent though short-lived tropospheric opening at the end of November. The main activity occurred during the middle of the month when there was a period of intense Sporadic E propagation. Unfortunately both the Gemininds and the Ursids meteor showers proved to be rather quiet, while the indifferent weather in the UK was inimical to trophospheric propagation. The following SpE log for the period reflects the overall quiet conditions:

4/12/86 TSS (USSR) chs. R1, 2.
5/12/86 RAI (Italy) ch. IA.
13/12/86 TVE-2 (Spain) ch. E2; RTP (Portugal) E3; TVP (Poland) R1, 2.
14/12/86 SR (Sweden) E2; NRK (Norway) E2; TSS R1; RAI IA, B; DR (Denmark) E2; RUV (Iceland) E4; TDF-Canal Plus (France) L3.
25/12/86 ARD (W. Germany) E2; SR E3.
26/12/86 RAI IA.

Auroral reception was noted in Scotland on December 16th while slightly improved tropospheric conditions on the 25th produced Band III signals from RTE (Eire) in Wales. The tropospheric opening on November 29/30th was unusual in that very strong System M (525-line) signals from the American Forces TV station at Soesterberg, Holland (ch. E70/A80) were received throughout the south/south east. John Tellick, who was staying at Lancing (Sussex), even received the signals via a set-top aerial. The transmitter runs at only 20kW e.r.p.

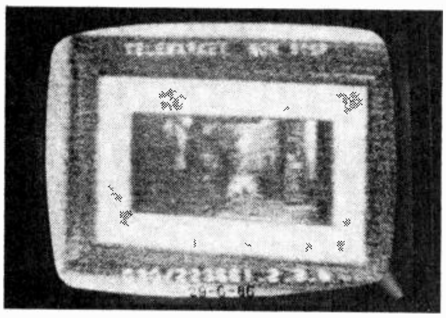
My thanks to the following for sending in reception reports during the month: Ray Davies (Norwich), Simon Hamer (Powys), Len Smith (Havant), and Iain Menzies (Aberdeen). At long last the building work here has been completed and my revised receiving system has been brought into operation – some ten weeks without aerials or receivers!

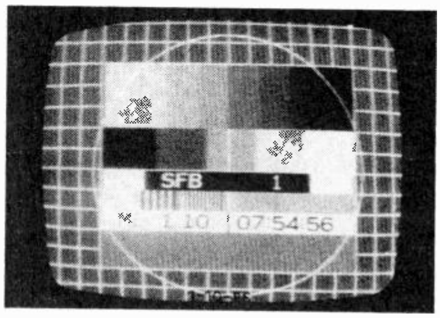
Some time ago in these pages Harold Peters (Lowestoft) reported the theft of an outside 4GHz dish assembly. Recently a colleague of mine living in Kent spent several days in Southampton. On his return he found that his complete Luxor 11GHz TVRO system had been stolen. Since the amount of satellite receiving equipment installed is likely to increase sharply over the next couple of years it's time to consider ways of preventing/deterring theft. Any ideas that readers may have would be welcome.

Sunshine Radio, which is well known in the Shropshire/Herefordshire area for pirate radio transmissions, announced plans for an afternoon TV programme on Boxing Day. Transmissions were to be on ch. 34 from a circling Cessna aircraft. Air space was refused by air traffic control and the project had to be abandoned! My thanks to Network 21, the ch. 21 community TV station covering Brixton on Friday nights from 2345, for their Christmas party invitation. Wish I could have made it!

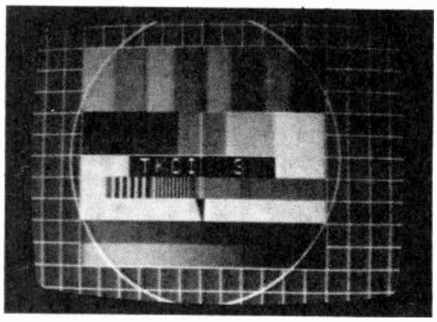
News Items

France: Apparently Canal Plus is shortly to start transmitting the CBS (Canadian Broadcasting System) late news at approximately 0700-0730 French time, unscrambled





Left: A mystery SpE signal, "Televerket Non Stop", received in Holland at 1040-1145GMT on ch. E2. Centre: End of news caption from Poland TVP-2 on ch. R38 – tropospheric signal. Right: FUBK pattern from Sender Freies Berlin with new date/time information – another tropospheric signal. All three photographs from Ryn Muntjewerff, Beemster, Holland.



Left: Programme exchange between Italy and the USA for groups of Italians living in the New York area. Centre: News exchange from Iran through NHK, Tokyo. Right: FUBK pattern following a news exchange from OIRT, Prague. Can anyone identify the source? All three photographs are of reception by Frank Lumen in Denver via Satcom 1, transponder F11.

and with the original sound plus French subtitles. The French ATAFELD DX Club reports that Sony has introduced a new tuner/i.f. strip capable of handling PAL, SECAM and NTSC colour in systems B/G, D, H, L, I, M and K, with stereo sound capability and channel/standard memory options to thirty programmes.

UK: There are indications that Band III is now being used for PMR/industrial communications. Dave Lauder (Hertfordshire) has noted a strong carrier at approximately 181·5MHz, at times unmodulated and at other times with an f.m. tone. A recorded announcement "Cleanfeed Studio E Lime Grove to TS2", also the south-east news at 2125 local time, indicate that the BBC is now active in Band III. Any other reports of Band III activity would be appreciated, with the frequency if known.

India: The Indian TV service is planning to start breakfast-time transmissions this autumn. Weekday programmes would start at 0700.

W. Germany: For many years RIAS (Radio in the American Sector) has transmitted radio programming to East Germany, funded by the US Information Agency and the Bonn government. Plans are being formulated for an RIAS-TV station which would cover Berlin and the surrounding area, again aimed at an E. German audience. Transmissions are likely to start next year, on ch. E25, with an e.r.p. of 250kW.

50 Years of Television

The latest edition of the European Broadcasting Union Technical Review is a special issue devoted to the history of television over the last fifty or so years (No. 220, dated December 1986). It covers not only fifty years of BBC TV but also the early days of TV broadcasting in other European countries – France has also recently for example been celebrating fifty years of TV broadcasting.

French TV has an interesting early history. Thirty-line transmissions first took place in September 1929, with public demonstrations in April and November 1931. The first official TV broadcast was made on April 26th, 1935. In November 1935 a TV centre was established at the Champ de Mars, with a v.h.f. transmitter (6·52m vision, 7·14m sound) atop the Eiffel Tower. For political reasons the system was closed down in 1936. In 1937/8 a 455-line system was demonstrated, with transmissions from the Eiffel Tower: elsewhere in France a 180-line system was being demonstrated. The 455-line standard was adopted from July 1st, with daily broadcasts – the Eiffel Tower transmitter remained in operation until 1956. Transmitter power was 30kW peak white. The outbreak of war in September 1939 saw the close-down of the service. It's interesting that reception at up to 80km was being achieved using amateur receivers.

Research continued during the war, with 800- and 1,200-line scanning and a view to the resumption of a TV service at the end of hostilities. TV transmissions were resumed with the liberation of Paris in October 1944 – with a 441-line system. The 819-line system was adopted in December 1949, with both systems being transmitted from the Eiffel Tower. The 441-line service ended in January 1956, when the transmitter burnt out. France used the 819-line system only (System E) until late 1963, when the current 625-line System L was introduced. The 819-line standard was dropped in the early 80s.

A German TV service was started on March 22nd, 1935, using a 180-line, 25-frame standard. Much earlier considerable research had been done on mechanical systems – Telefunken produced a remarkable "mirror-wheel" 96-line receiver as early as 1928. A great advance came in 1932 when a 16kW transmitter was installed atop the Berlin Radio tower, operating at 42·8MHz with a 90-line system. An all-electronic system came into use in 1936 to give coverage of the Olympics from Berlin and via cable to regional centres. Subsequently the 441-line standard was adopted, and a public service started on September 1st 1939. Broadcasting was limited during the war but the Berlin service continued until 1943 when the station was destroyed by bombing. Test transmissions started in Hamburg in July 1950, using the 625-line standard, initially with 250W in Band II and 1kW in Band III.

This issue of the EBU Technical Review contains much technical and historical detail, both on the progress and development of TV in Europe and the equipment used by the broadcasters. I can recommend it to readers. To obtain a copy, send 220 Belgian Francs (this includes postage) to the European Broadcasting Union, Technical Centre, 32 Avenue Albert Lancaster, B-1180, Bruxelles, Belgium – ask for the "Fifty Years of Television" December 1986 issue, English language version.

ATV Repeaters

A repeater consists of a high-quality receiver with facilities to retransmit an incoming signal on another frequency. Several 1·3GHz band ATV repeaters are in operation in the UK. The advantage of using a repeater is that it can be sited in a good position, e.g. atop a hill, giving coverage over a large area.

ATV repeaters are well established in Australasia – there are several in Australia and two have been commis-

Table 1: Australian ATV Repeaters.

Area	Callsign	Input – MHz		Output – MHz	
		Vision	Sound	Vision	Sound
Canberra	VK1RTV	426·25	431·75	579·25	584·75
Wagga	VK2RTW	444·25	449·75	579·25	584·75
Bendigo	VK3RMZ	426·25	431·75	579·25	584·75
Melbourne	VK3RTV	444·25	449·75	579·25	584·75
Townsville	VK4RAT	444·25	449·75	579·25	584·75
Brisbane	VK4RTV	426·25	431·75	579·25	584·75
Central North	VK5RCN	426·25	431·75	444·25	449·75
Central North	VK5RCN	579·25	584·75	444·25	449·75
Adelaide	VK5RTV	426·25	431·75	579·25	584·75
Adelaide	VK5RTV	444·25	449·75	579·25	584·75
Perth	VK6ROD	426·25	431·75	579·25	584·75
Perth	VK6RUF	426·25	431·75	579·25	584·75
Devonport	VK7RAE	444·25	449·75	579·25	584·75
North West	VK7RTV	444·25	449·75	426·25	431·75

sioned in New Zealand, all operating in the accepted u.h.f. TV bands. As a result it's common for ATV enthusiasts there to provide basic programming in the knowledge that this will be viewed by the general public. Since we've a number of readers down under, the Australian ATV repeaters are listed in Table 1. The New Zealand repeaters are at Gisborne, Kaiti Hill (input 1,251·25MHz, output 443·25MHz) and Belmont (input 443·25MHz, output 614·25MHz). Our thanks to Robert Copeman for providing this information.

From our Correspondents . . .

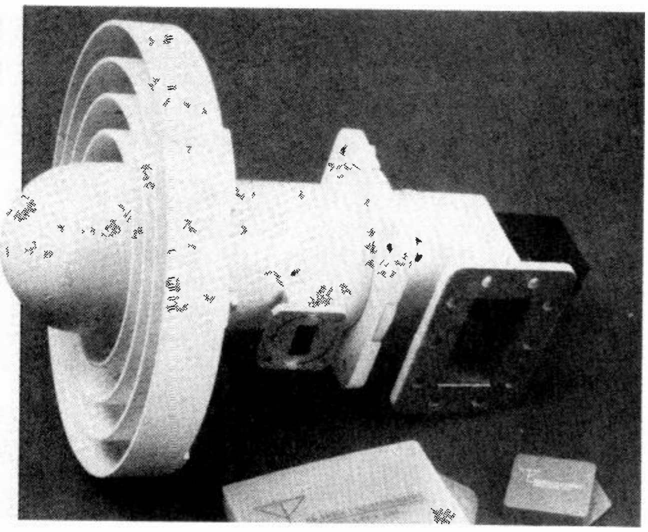
An interesting letter from Roderick Ballardie of Timperley, Cheshire takes up the historical theme again. Roderick joined the TV trade in 1954 when he was apprenticed to the Glasgow Pye service department. One morning whilst working on a Pye VT17 prior to Kirk o'Shotts (ch. B3) coming on air signals appeared on chs. 1 and 2 – from France (819-line standard). During this period the same test card was received on the 441-line standard – it became a regular and persistent signal, though weak. At the time standard ch. B3 H aerials were used, mounted at some 140ft a.g.l. Kirk o'Shotts used the pre-war Test Card A in those days. Roderick comments that the French 441-line signal was always weaker than the 819-line signal and had "a sort of coarseness" to it, the line lock being just off the 405-line setting. During the record peak sunspot activity in 1957/8 Roderick experienced much v.h.f. reception via F2 propagation. In 1959 he moved to the Pye agents in Bermuda where the Hamilton ZBM station transmitted on ch. A10 (System M). An American Forces station (ZBK-TV) at St. George's Base, Kindley also used ch. A10: problems arose when ZBM came on air and ZBK had forgotten to switch off – the interference was "incredible"! Whilst in Bermuda Roderick received many DX signals from North America, also from Puerto Rico, Cuba and Panama. Daytona Beach ch. A2 was most often received. During a good opening signals would arrive from as far as Canada (Toronto, Montreal) and by mid-day signals would be in from the New York area. The later afternoon period would produce signals from the Mid-West at considerable distances. Roderick returned to the UK in 1961, where he continued servicing and some DX-TV on the side, using a Bush TV125 receiver.

George Gaskin (Gibraltar) writes that there's no ch. E4 transmitter at present on the Rock – The only Band I activity is a 50MHz amateur beacon. He comments that he's receiving TVE-1 on ch. E2 but not from Madrid (the only listed ch. E2 TVE-1 station) and suspects that a new relay is in operation – he mentions Andalusian regional programming. A TVE teletext service is expected later this year.

Jean Louis Bubler (Seoul, S. Korea) mentions problems with the Korean dual-sound transmissions, which have been in operation for some months. The trouble is interference from the main sound channel on the secondary one. Jean is shortly to visit Thailand, Bali, Singapore and Hong Kong: we look forward to his on-the-spot observations.

405-line Corner

Two more readers have offered single-standard 405-line TV receivers, all at least 25 years old and working when stored. David Graebe of Chant Stream Cottage, Kent Street, Sedlescombe, Battle, E. Sussex TN33 0SG has available a 17in. Ekco console set with v.h.f. radio: the walnut cabinet is in excellent condition and the set features spot-wobble. G.V. Panton of Dale View, Thorpe Fen, Skegness, Lincs. PE24 4LD has the following sets for disposal: Pye FV1C, V4 and 17F, Ekco T310, Marconiphone 4618, Bush TUG34, TV24A, TV24 and an Invicta set (model unknown). All these receivers are free to good homes but must be collected: please write first, enclosing a stamped, addressed envelope.



Seavey Engineering Associates (USA) C/Ku band common axis feedhorn assembly type ESR124H.

Service Bureau

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

RANK T20 CHASSIS

The problem is no sound or picture. The voltage at the collector of the line driver transistor 5VT3 was found to be high, at 200V, indicating lack of drive. The kick-start was shunted but the result of this was that 5VT3's collector feed resistor 5R3 went up in smoke. 5VT3 has been checked and there are no shorts in this area.

While the problem could be due to short-circuit turns on the line driver transformer 5T1 (look for signs of overheating) it's more likely that 5TV3 is receiving a heavy turn-on bias. This puts suspicion on the TBA950 line generator chip 4SIC1 which could have developed internal leakage. With the correct value resistor shunting the kick-start capacitor 4C9 and 5R3 open-circuit you should see a squarewave at pin 2 of 4SIC1.

FERGUSON 3V00

At random intervals in the playback mode picture synchronisation is lost. On turning down the sound you can hear the drum motor speeding up as the picture breaks up. The drum drive belt has been cleaned and doesn't slip when tested by hand. Do you suspect the drum servo or the motor?

The drum motor is suspect in these early machines for the fault described. We suggest you first try setting up the drum free-speed potentiometer in accordance with the instructions given in the manual. If this is not successful a new motor is likely to be required.

TELEFUNKEN 711 CHASSIS

The problem is tuning drift. All the channels have to be tuned in at switch on and it's necessary to keep on readjusting the tuning until the set has thoroughly warmed up. The tuning is then all right.

In the cases of tuning drift we've come across with this chassis the tuner unit has always been responsible. Before condemning it, check D104 (ZTK33B) and R106 (18kΩ) by substitution.

SANYO VTC5000

There are two problems with this machine. First, when a cassette is removed there's often a loop of tape outside. This usually occurs after a full rewind. Inching the tape forward by pressing the standby and power-on buttons before ejecting the cassette often prevents the looping. Secondly there are at times during replay a lot of white dots all over the screen. A sharp tap or two on the cassette holder usually removes this interference.

A loop of tape hanging from the front of the cassette is usually due to shiny brake-pad surfaces. They can be buffed with fine glasspaper. The usual cause of the interference described is poor earthing of the vision preamplifier screening can. A braided earthing lead from the adjacent bracket to the metal can should clear the problem. If necessary check the head drum earthing brush beneath the deck.

SONY KV2000UB

The picture would flicker in slightly towards the centre of the screen, though the effect was not always apparent. This slight movement was from both sides at the same time, the centre of the picture remaining unchanged. The picture then started to break up horizontally, rapidly becoming a series of lines from the top to bottom of the screen. A normal picture is restored if the set is switched off for a while, but within a few minutes of switching on again the picture degenerates to a series of broad lines.

A very common cause of this symptom is failure of one or more of the electrolytic capacitors in the chopper circuit. Start by checking C612 (3·3μF), preferably by substitution, then if necessary go on to check C620 (33μF) and C626 (100μF). If all these prove to be o.k. check C532 (4·7μF) etc. associated with the CX158 line generator chip.

RANK T22 CHASSIS

The picture narrowed towards the centre, then the receiver appeared to switch off briefly before coming on again set to channel 1. This got progressively worse until the fusible resistor 5R3 in the feed to the line driver stage eventually opened. A new line driver transistor has been tried and the trip circuit seems to be working correctly, but the fault remains.

We've known 5C3 (100pF), between the collector and base of the line driver transistor, to cause this problem by becoming leaky. Replace it then check, preferably by substitution, the line driver transformer damping network 5C2 (2·7nF) and 5R4 (5·6kΩ), also 5R8 (1Ω) in the line output transistor's base circuit. If necessary check the EW modulator diodes 5D6/7 and ensure that the connections to the line driver transformer are not dry-jointed. On very rare occasions short-circuit turns in the driver transformer result in 5R3 going open-circuit – but check first that 5R3 itself isn't faulty.

AKAI VS5

We have two of these machines. One will play and record used tapes despite imperfections brought about by various incidents (including video engineers). The other machine is very sensitive to these imperfections, cutting out on record or play (with no rewind) so that reliable operation is possible only when a new tape is used.

The fact that the cut-out phase is followed by inability to rewind the tape indicates that the machine thinks the tape is in the start position, due to a false message from

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the tape-start sensor at the right-hand rear corner of the cassette. Check first that no one has fitted the wrong cassette bulb. If this point is o.k. check the start-sensor photodiode by monitoring the voltage at pin 10 of IC303 on the syscon board.

TOSHIBA C2000B WITH VCR

When this colour set is used with a VCR there's a nasty buzz on sound. The buzz can be eliminated only by defeating the a.f.c., but the tuning then drifts. The problem is present even with a Toshiba VCR.

We suggest you adjust T171 on the a.f.c. panel for best results from the VCR, with the tuning door shut. Although the set is quite old it should work happily enough with a VCR signal. Check C602 and C617 on the sound panel, preferably by substitution. If necessary back off the a.g.c. control R151 – the signal from the VCR could be overloading the set. If these steps prove unsuccessful, try a very small adjustment of the co-sound traps T103 and T108, returning the cores to their original positions if there's no improvement.

TEST CASE

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

By all accounts the technology (both electronic and mechanical) used in the latest consumer video equipment is some way ahead of that embodied in much ENG and broadcasting gear. The design aims, performance and cost of the two classes of goods are quite different however. So far as servicing is concerned, maybe the consumer category is the more difficult to tackle!

An example of very high technology in a relatively inexpensive form is the Sony Video-8 format camcorder, Model CCD-V8AF. These units are very popular here and are selling well – they offer several advantages over the conventional VHS and Beta types. A recent sale of one to a rather meticulous customer gave us some headaches however.

After taking it home and playing with it at length Mr. X started to experiment. The culmination of this was the videotaping of a beautiful picture of a vase of flowers of delicate and varied hues. The tape was then rewound and replayed via the TV set, with the input to its aerial socket. The original picture of the flowers was propped up on top of the set for purposes of comparison! Various discrepancies were noted by Mr. X. With a detailed list of them he rang Service Department and assailed the ears of a brown-coated innocent who was at that moment struggling to get a reel idler out of a Fisher 615 – no mean task!

The main theme of Mr. X's monologue was that he'd been robbed of over a thousand pounds. He was asked, gently, whether he'd set the white balance before shooting the picture. He had. The patient and helpful technician asked him to try again, using a large sheet of white paper over the picture during auto-white balance, then without changing anything to shoot more footage of the flower picture. If the results were still bad, he was told, bring the little treasure in for service with a concise description of the hue errors.

Next day, in it came. Pinks were slightly purple, oranges dull, greens tended towards turquoise. The brown backdrop curtain had come out puce. Puce?

Now the setting-up procedure for the chroma and encoding circuits of a camera – even a CCD camera like this one – is no joke. It's not proposed to reveal here to rubbernecking *Television* readers whether or not the Test Case workshop boasts a vectorscope. Suffice it to say that the chroma, encoding, burst and auto-white circuits were carefully checked and adjusted. None were very far out, a tribute to the beautiful slant-eyed girl who (we like to imagine) sets them up. She should have had the flowers. A wild and far-fetched suggestion by a bright Technical Spark involved scanning the light box colour bars, genlocking the camera to a colour-bar generator, and twiddling to unify the two halves of a split-field display. He didn't even have a small enough screwdriver to fit the potentiometers however . . .

When Mr. X got his camcorder back he found the results to be just as before and roundly condemned Sony, the workshop and all their works. It was hastily arranged to deliver to him another new machine by way of exchange. On the assigned morning the cause of all the problems became clear, as we'll describe in the next issue!

ANSWER TO TEST CASE 290
– page 271 last month –

The hassle involved in repairing the Ferguson TX9 described last month was due more to the technician than to the set. You'll recall that the problem was random failure of the 1.6A anti-surge mains fuse, and that no fewer than ten components had been replaced on a trial-and-error basis.

The repairman made the fundamental mistake of not checking the h.t. voltage. Had he done so (or even carefully examined a test card on the screen) he would have seen that the h.t. voltage was dangerously high – in fact the potential across smoothing capacitor C148 was hovering at around the 136V level, and wandering somewhat, instead of being a stable 115V. From time to time it would reach the breakdown voltage of the over-voltage sensing zener diode D85: this of course fired the crowbar thyristor CSR2, rupturing the fuse.

Once this fact was realised it didn't take long to find the faulty component. It was R184 in the "set 115V" potential divider network. The correct value of this item is 220kΩ, but it measured nearer 260kΩ on test and its resistance value varied with temperature. Watch out for this fault, which is by no means uncommon in TX9 receivers using panels PC1001 and PC1040.

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2919	T9000 OVER VOLT THICK FILM	3.95
4555	T9000 T701 CHOPPER TX	13.75
4982	T9600 0.33 2KV CAP	2.35
2914	T9600 CHOPPER TX T512	8.11
2916	T9600 FOCUS UNIT	2.95
2913	T9600 SWITCH MODE TX T511	9.98
2917	T9800 FOCUS UNIT	5.93
4429	T9800 MAINS CHOKE	11.03
4437	TX10 .0022 2KV	0.25
4658	TX10 100K TUNING POT	0.64
2938	TX10 CHOPPER DRIVER TX	3.27
5427	TX10 SW NONREM CONT.	2.32
2922	TX10 TUNER DRAWER ASSY	1.95
4859	TX9 4" RND 15R SPEAKER	6.95
2937	TX9 INPUT CHOKE L65	12.05
2936	TX9 L64 BILIFAR CHOKE	4.25

DECCA SPARES

4616	DECCA 100 0.01 2KV CAP	0.98
2933	DECCA 100 BEDIGE TX	2.35
2932	DECCA 100 FOCUS CONTROL	2.77
4615	DECCA 100 LINE DRIVE TX	2.25
2928	DECCA 10SER 470K SH+VOL	2.15
4603	DECCA 2230 10R FUSIBLE	0.70
2930	DECCA 2233 PSH PSH SH	5.14
2931	DECCA 2263 PSH PSH SH	4.20
2926	DECCA 30 SER 3R9 RESIS.	0.50
2924	DECCA 30 SER MAINS TX	12.35
2929	OECCA 30 SER 47K SH+VOL	2.45
2939	DECCA 80 470R SH+VOL	2.45

RESISTORS

CARBON

STANDARD RANGES

1/4 WATT X 10	0.29
1/2 WATT X 10	0.29
1 WATT X 10	0.45
2 WATT X 10	0.60

SAFETY CERAMIC

STANDARD RANGES

5 WATT X 5	0.90
7 WATT X 5	0.74
11 WATT X 5	0.89
17 WATT X 5	1.15

OTHER RESISTORS

3279	2M2 H/V FOCUS RESISTOR	0.46
3280	22M H/V FOCUS RESISTOR	1.50
3281	33M H/V FOCUS RESISTOR	1.50
3282	47M H/V FOCUS RESISTOR	1.50
3283	56M H/V FOCUS RESISTOR	1.50

MAINS DROPPERS

3025	MAINS DROPPER RANK A640	1.20
3013	MAINS DROPPER OECCA 80/100	1.60
3016	MAINS DROPPER GEC 2010	0.90
3031	MAINS DROPPER THORN 3600	0.98
3030	MAINS DROPPER THORN 1600	1.78
4910	MAINS DROPPER OECCA 100 2R5	0.82
3034	MAINS DROPPER THORN 9800	1.60
3027	MAINS DROPPER THORN 1400	1.50
3026	MAINS DROPPER RANK A823	1.10
3028	MAINS DROPPER THORN 1300	1.60
3029	MAINS DROPPER THORN 1500	1.75
3018	MAINS DROPPER PHILIPS G8	0.99
3022	MAINS DROPPER PYE 725/731	1.40
3017	MAINS DROPPER PHILIPS 210	0.98
3019	MAINS DROPPER PHILIPS G8 47R	0.65
3033	MAINS DROPPER THORN 8500/8800	0.98
5385	MAINS DROPPER DECCA 80	2.97
5386	MAINS DROPPER DECCA 100	2.11
5533	PYE CT200 PHILIPS 579 DROPPER	3.45

UNIVERSAL CONVERGENCE POTS

5R, 10R, 22R, 20R, 25R, 50R, 75R, 100R, 200R, 250R, 500R	0.40

FIDELITY SPARES

2940	CHOPPER TX FIDELITY CTV14R	4.50
2942	DRIVER TX FIDELITY CTV14R	8.65
2941	FOCUS UNIT FIDELITY CTV14R	0.50
5408	MAINS INPUT CHOKE ZX2000	3.45
5504	MAINS FILTER TX CTV14R	2.95
5505	DRIVER TX ZX3000 404387	8.95
6162	ON/OFF SH FIDELITY CTV14R	2.25
6163	ON/OFF SH FIDELITY CTV14S	1.65

GEC SPARES

2965	GEC 1401 CHOPPER TX	16.56
2964	GEC 1401 INPUT CHOKE	9.63
5531	GEC 1501 MAINS TX	5.25
4758	GEC 2100 3R FUSIBLE RES	1.45
4759	GEC 2110 SH2 2KV CAPS	2.39
2959	GEC 2100 ETC FOCUS VDR	1.60
2958	GEC 2100 THERMAL CUT OUT	0.97
4760	GEC 2110 FOCUS CONTROL	5.98
4771	GEC 2110 LUM. DELAY LINE	1.83
4728	GEC 2110 MAINS CHOKE	10.50
4996	GEC 2110 NEONS	0.20
4751	GEC 2114 VOL+SWITCH CONT	1.98
4656	GEC 22K MULTI TURN PDT	0.98

GRUNDIG SPARES

2949	GRUNDIG 5010 FOCUS VDR	3.35
4633	GRUNDIG 5010 CONTROL TX	4.76
2948	GRUNDIG 5010 FOCUS UNIT	3.75
4865	GRUNDIG 5010 L515 CHOKE	1.63
4744	GRUNDIG 5010/6010 LID	2.62
4745	GRUNDIG 5011 LID	2.59
4637	GRUNDIG 5011 SH+SLIDERS	11.69
2952	GRUNDIG 6010 MIXIE MOD	22.50
4630	GRUNDIG 6011 MAINS SH	3.60
4631	GRUNDIG 6110 MAINS SH	4.86
2947	GRUNDIG A6400 MAINS SH	4.95

REMOTE CONTROL UNITS

PLEASE STATE MODEL NUMBER

4311	DECCA 100 NONTEXT RCU	21.50
4314	DECCA 100 (TEST+PREST) RCU	22.28
4310	DECCA 80/100 SERIES RCU	21.76
4315	DECCA 90/100 N/TXT RCU	20.78
4324	GEC 2 FUNCTION RCU	20.25
4325	GEC C2057H/2067H RCU	21.43
4326	GEC TELEMASTER 12 RCU	20.03
4327	GEC TELEMASTER 16 RCU	20.03
4328	GEC TELEMASTER 8 RCU	23.98
4332	GRUNDIG TELEPILOT 12 RCU	30.03
4333	GRUNDIG TELEPILOT 16 RCU	25.05
2955	GRUNDIG TELEPILOT 7	24.95
4334	GRUNDIG TELEPILOT 8 RCU	20.03
4357	KORTING 12 CHANNEL RCU	22.13
4358	KORTING 16 CHANNEL RCU	24.05
4380	PHILIPS G11 NONTEXT RCU	22.52
4378	PHILIPS G11 T/TEXT 8CH RCU	20.78
5409	PHILIPS G11 T/TEXT U/SONIC	25.16
5453	PHILIPS KT3 REMOTE RC4001	16.00
4379	PHILIPS/PYE G11 2 FUNC RCU	18.90
4359	PHILIPS/PYE KT3/KT30	16.13
4385	RBM 16CH NONTEXT RCU	24.10
4386	RBM 8CH NONTEXT RCU	23.40
4387	RBM TEXT&V/DATA RCU	20.78
2980	REMOTE CTRL UNIT PHILIPS G9	9.85
4390	TCE 9000CHAS 2 FUNC RCU	19.20
4398	TCE TX10(9653)+TEXT RCU	24.78
4400	TCE TX10(9670)+PREST RCU	21.78
4397	TCE TX9/TX10	19.20

PUSH BUTTON UNITS

2870	4 WAY DECCA ETC	8.25
2871	6 WAY DECCA	12.37
2873	4 WAY HITACHI ETC	5.50
2875	4 WAY PHILIPS/TCE	10.87
2877	6 WAY GEC 2110	11.25
2878	7 WAY GEC 2112	10.95
2879	6 WAY T3500	2.75
2880	6 WAY PYE 713	15.75
2881	6 WAY T9000	7.25
2882	4 WAY BUSH A823	10.93
2884	6 WAY MOD CVC9	12.85
2885	6 WAY 520 PHILIPS	19.30
2886	6 WAY PHILIPS 550	14.75
2887	T1P SWITCH UNIT PHILIPS G11	27.50
2888	6 WAY PYE G11	11.25
2889	PIANO KEY MOD DECCA 2631	22.48
4935	7 WAY ITT CVC5	12.90
5278	GEC 2136 TAPERED	12.62
5279	ITT 6 WAY +VCR	10.70
5280	6 WAY BUSH T20	13.82

ITT SPARES

2972	ITT CP340 PB ASSY	22.98
4501	ITT CP340 SLIDER ASSY	7.58
4683	ITT CVC40 FOCUS UNIT	1.95
5543	ITT CVC20 LINE DRIVE TX	3.05
4571	ITT CVC20 MAINS SWITCH	1.36
4787	ITT CVC25 6N2 2KV CAP	1.35
4786	ITT CVC25 8N2 2KV CAPS	2.15
2970	ITT CVC25 BRIDGE COIL	4.30
4789	ITT CVC25 E/W LOAD COIL	1.92
4567	ITT CVC25/30 MAINS SW.	6.89
2969	ITT CVC32 DRIVER TX	2.56
4568	ITT CVC32 REMOTE MAIN SH	7.67
2971	ITT CVC32 SH MODE TX	5.00
4795	ITT CVC45 ON/OFF SWITCH	2.09
3286	ITT CVC5 1MFD 250V CAP	0.40
4569	ITT CVC5 MAINS SWITCH	1.58
4781	ITT CVC5 SHIFT POT 25R	1.82
4780	ITT CVC5 SLIDER BANK	7.41
2967	ITT CVC5-9 MAINS TX	8.48
4570	ITT CVC9 MAINS SWITCH	5.61

FUSES

STANDARD RANGES

20MM O/B FUSE X 10	0.66
20MM A/S FUSE X 10	
63MA - 160MA	1.80
200MA - 5A	1.20
1.25" O/B FUSE X10	
250MA - 800MA	0.95
1A - 5A	0.70
1.25" A/S FUSE X 10	
250MA - 2A	1.50
2.5A - 5A	2.30
PLUG TO P FUSE X 10	
2, 3, 5, 7, 10, 13A	0.95

SERVICE MANUALS

5011	DECCA 101/100	6.00
5047	OECCA 80 CHASIS	6.00
5442	DECCA/TATUNG 120	7.00
5022	GEC C2055H-C2255H	6.00
5023	GEC C2065H-C2265H	4.95
5026	GEC C2110-C2149	6.00
5068	HITACHI CPT2024	5.00
5074	HITACHI CPT2234	5.00
5094	ITT CVC20	4.00
5095	ITT CVC25+30	9.00
5096	ITT CVC40	9.00
5097	ITT CVC45/1	5.00
5513	ITT CVC800/801	5.00
5093	ITT CVC9	4.00
5123	MITSUBISHI CT200B	5.00
5527	PANASONIC TC2205	9.00
5116	PANASONIC TX2234	5.00
5127	PHILIPS G11 CHASSIS	4.00
4515	PHILIPS KT3 SERV.	5.00
5135	PHILIPS T8-E	2.00
5136	PHILIPS TX	2.00
5143	PYE 725 731 SER	5.00
5145	REDIFFUSION MK1	3.00
5146	REDIFFUSIDN MK3	3.00
5147	REDIFFUSIDN MK4	5.00
5148	REDIFFUSION MK5	4.00
5167	THDRN 1500	1.00
5168	THORN 1600	1.50
5171	THORN 1615	3.00
5172	THORN 1690-1691	5.00
5184	THORN 38030	2.00
5187	THORN 3V01	12.00
5188	THORN 3V16	12.00
5178	THORN 9000	6.00
5182	THDRN 9800	10.00

RANK RADIO SPARES

4650	RRI T20 SPEAKER	2.36
5524	RRI T24E DN/OFF + VDL SH	2.35
4842	RRI 1122 SH+VOL 22K PULL	3.10
4843	RRI A823 100K TUNER POT	1.78
4847	RRI A823 FOCUS ASSEMBLY	6.03
2998	RRI A823 PLASTIC CAM	0.35
5300	RRI A823ETC RING SPK GAP	0.55
4988	RRI T20 (TYPE) FOCUS ASY	0.60
3001	RRI T20 3K3 SH+VOL CTRL	2.67
4852	RRI T20 9N1 2KV CAP.	1.98
4853	RRI T20 CONTRAST+AFC POT	3.23
3003	RRI T20 E/W CORR. COIL	3.29
3000	RRI T20 FOCUS ASSY	3.50
3004	RRI T20 SH MODE TX	11.20
4849	RRI 2718 3K3 SH+VOLUME	3.36

PHILIPS PYE SPARES

4969	PHILIPS 128711 4K7 VOL+SH	4.45
3288	PHILIPS 300 470L VOL+SWITCH	3.25
4449	PHILIPS 570/713 IF MODULE	7.00
5425	PHILIPS CTX-S EHT LEAD	10.11
5418	PHILIPS CTX-S FOCUS UNIT	5.50
4655	PHILIPS G11 100K TUNER POT	0.66
2983	PHILIPS G11 CVC32 B/COIL	1.95
2984	PHILIPS G11 E/W CORR COIL	2.64
2985	PHILIPS G11 FILTER COIL	12.80
2986	PHILIPS G11 FOCUS UNIT	9.15
2987	PHILIPS G11 G2 CONTROL ASSY	7.98
4575	PHILIPS G11 RND SHAFT SH.	2.32
4576	PHILIPS G11 SQ SHAFT SWITCH	2.32
4645	PHILIPS G11 TDA2600 HDLDER	0.65
5284	PHILIPS G8 100K TUN P/SET	0.84
2977	PHILIPS G8 10K COLOUR CTRL	0.98
4525	PHILIPS G8 10K CON POT (550)	0.87
4524	PHILIPS G8 15R CON POT (550)	1.07
2975	PHILIPS G8 2K2 BRIGHT CONTL	2.11
4526	PHILIPS G8 2H A1 POT (550)	3.80
4522	PHILIPS G8 5N1 1500V CAP.	1.88
4523	PHILIPS G8 5R CONV POT (550)	0.64
4858	PHILIPS G8 6×4" 70R SPKR	5.98
2979	PHILIPS G8 EQUALIS. COIL	3.20
4503	PHILIPS G8 METAL SH	1.72
2978	PHILIPS G8 RED/GRW SYM COIL	5.01
4504	PHILIPS G8/G11 NON REM SH	1.72
5307	PHILIPS K12 THICK FILM UNIT	16.35
4649	PHILIPS KT3 4X4 SPEAKER	2.85
4566	PHILIPS KT3 MAINS SWITCH	7.32
4907	PHILIPS KT4 THICK FILM UNIT	10.29
4564	PHILIPS T173 MAINS SWITCH	3.45
4648	PHILIPS G11 6X4 SPEAKER	3.85
2992	PYE 169 LINE OSC COIL	3.46
4839	PYE 731 3R3 50W RESISTOR	1.98
4535	PYE 731 47K VOL SWITCH	5.25
2992	PYE 731 FOCUS UNIT	3.45
5545	PYE 731 L/H 3X 100K PSET	3.20
5546	PYE 731 R/H 3X 100K PSET	3.20
2994	PYE 731 THICK FILM ASSY	1.55
4938	PYE KT2 FOCUS UNIT	2.85
4864	PYE T194/6 SPEAKER	5.05
5556	PHILIPS G11 SHORT SHAFT SH	2.01

THORN VIDEO SPARES (OVER 450 PARTS)

QUOTE THORN PART NUMBER IF POSSIBLE

5561	T3292 BOOSTER	44.62
5562	T3292 CAPSTAN BELT	3.48
5563	T3292 CAPSTAN MOTOR	51.16
5568	T3292 CASSETTE LAMP	1.80
5569	T3292 COUNTER BELT1	0.60
5571	T3292 COUNTER BELT2	0.60
5575	T3292 DRUM MOTOR	47.70
5577	T3292 F/F IDLER	2.02
5582	T3292 GUIDE ROLL ASSY	11.40
5585	T3292 LOWER DRUM ASY	80.48
5587	T3292 PINCH ROLL ASSY	11.45
5591	T3292 REWIND IDLER ASSY	7.04
5592	T3292 REWIND RUBBER TYRE	0.60
5621	T3292 UNLOADING BELT	0.78
5622	T3292 UNLOADING IDL ASSY	6.43
5624	T3292 UPP/DRUM KIT+MOD	35.94
5629	T3V00 CAPS. MOTOR BELT	0.60
5635	T3V00 COUNTER BELT 1	0.60
5637	T3V00 ORUM MOTOR	49.39
5646	T3V00 PINCH ROLLER ASSY.	7.31
5648	T3V00 RECORDING LAMP	2.34
5650	T3V00 SERVICE MANUAL	17.57
5655	T3V00 T/U IDLER ASSY	6.35
5657	T3V00 UPPER DRUM+MOD KIT	35.94
5663	T3V16 PINCH ROLLER ASSY	7.31
5666	T3V00 CAPSTAN MOTOR	51.16
5688	T3V00 TENSION BAND	2.16
5689	T3V00 TIMING GEAR	4.12
5692	T3V00 UNLOADING IDLER ASSY	6.43
5710	T3V01 TENSION BAND	2.16
5716	T3V16 CAPSTAN BENT	3.85
5720	T3V16 CASSETTE LAMP	1.80
5721	T3V16 CHANGE GEAR	0.86
5726	T3V16 DIODE STACK	3.41
5727	T3V16 DRIVE ARM ASSY	4.50
5750	T3V16 SERVICE MANUAL	26.24
5758	T3V16 T/U IDLER ASSY	6.25
5759	T3V16 T/U IDLER ASSY (LA)	8.95
5765	T3V16 UNLOADING IDLER	6.43
5772	T3V22 CAPSTAN MOTOR	51.16
5773	T3V22 CAPSTAN MOTOR BAND	0.60
5774	T3V22 CAPSTAN BELT	3.86
5790	T3V22 F/F IDLER	1.74
5803	T3V22 GUIDE RDLLER ASSY	8.39
5807	T3V22 MICRO SWITCH	4.25
5809	T3V22 PINCH ROLLER ASSY	7.31
5814	T3V22 REWINO IDLER ASSY	7.04
5822	T3V22 SUPP SPOOL CARRIER	4.00
5824	T3V22 TAKE UP IDLER SMALL	6.25
5825	T3V22 TAKE UP IDLER LARGE	8.95
5828	T3V22 TENSION BAND	2.16
5834	T3V22 UPPER DRUM ASSY	35.94
5840	T3V23 BOOSTER	24.71
5844	T3V23 CAPSTAN MOTOR	55.83
5852	T3V23 CONNECT GEAR ASSY	6.56
5856	T3V23 GUIOE ROLLER TYRE	0.60
5862	T3V23 PINCH ROLLER ARM AS	4.10
5868	T3V23 REEL IDLER ASSY	2.87
5869	T3V23 REEL MOTDR ASSY	32.81
5879	T3V23 T/U REEL DISK ASSY	5.17
5880	T3V23 TAKE UP REEL ASSY	2.58
5882	T3V23 UPPER DRUM ASSY	35.94
5885	T3V23 WORM GEAR SPINDLE	5.95
5886	T3V23 WORM GEAR SPROCKET	1.63
5888	T3V24 BRAKE SHOE	0.60
5896	T3V24 CASSETTE LAMP	1.80
5899	T3V24 DEW SENSDR ASSY	9.05
5902	T3V24 F/ERASE HEAD ASSY	10.41
5908	T3V24 LDADING GEAR ASSY	28.91
5909	T3V24 LDADING MOTOR	10.25
5912	T3V24 PINCH RLR LVR ASSY	0.62
5920	T3V24 SERVICE MANUAL	28.50
5945	T3V29/30 BOOSTER	24.71
5946	T3V29/30 BRAKE SHOE	0.67
5951	T3V29/30 CAPSTAN BELT	1.95
5952	T3V29/30 CAPSTAN MOTOR ASSY	36.88
5957	T3V29/30 CASSETTE LAMP	1.65
5962	T3V29/30 EJECT LCK ARM	0.60
5974	T3V29/30 LDADING MOTOR	10.25
5976	T3V29/30 LOHR DRUM ASSY	78.72
5980	T3V29/30 PINCH RLLR ASSY	10.06
5981	T3V29/30 PINCH RLLR SLND	10.15
5985	T3V29/30 REEL MTR ASSY	34.66
5990	T3V29 SERVICE MANUAL	25.85
5991	T3V30 SERVICE MANUAL	15.75
5998	T3V29/30 TAKE UP CLUTCH	0.60
5999	T3V29/30 T/U CLUTCH ASSY	2.78
6001	T3V29/30 T/U LDG RING ASSY	2.73
6003	T3V29/30 T/U SPL IDLER	2.64
6012	T3V31 BOOSTER	32.37
6016	T3V31 CAPSTAN BELT	1.95
6017	T3V31 CASSETTE LAMP	1.71
6027	T3V31 LOADING GEAR ASSY	6.60
6028	T3V31 LONG TRIMMING TOOL	0.93
6030	T3V31 PINCH ROLLER ASSY	8.66
6033	T3V31 SERVICE MANUAL	27.31
6034	T3V31 SERVO TEST JIG	49.94
6038	T3V31 TAKE UP CLUTCH ASSY	2.75
6039	T3V31 T/U LOAD/RING ASSY	2.73
6042	T3V31 UPPER DRUM ASSY	35.94
6044	T3V32 BOOSTER	32.37
6048	T3V32 CAPSTAN BELT	1.95
6053	T3V32 CASS MOTOR ASSY	10.39
6066	T3V32 LOADING GEAR ASSY	6.60
6068	T3V32 PINCH ROLLER ASSY	8.66
6071	T3V32 SERVICE MANUAL	18.65
6072	T3V32 SUPP/LDG RING ASSY	2.58
6081	T3V32 UPPER DRUM ASSY	35.94
6085	T3V35/6 BRAKE PAD X2	0.67
6086	T3V35/6 BRAKE SHOE	0.67
6087	T3V35/6 BRUSH ASSY	2.07
6090	T3V35/6 CAPSTAN MOTOR	23.91
6091	T3V35/6 CASSETTE MOTOR	8.10
6103	T3V35/6 PINCH ROLLER	9.84
6105	T3V35 REMOTE CONTROL	19.43
6107	T3V35/6 SERVICE MANUAL	25.08
6117	T3V35/6 TENSION BRAKE	0.60
6118	T3V35/6 UPPER DRUM ASSY	35.94
6119	T3V40 SERVICE MANUAL	15.00
6158	T3V29/30 UPPER DRM ASSY	35.94

SONY VIDEO

6133	SONY 8000UB FORWARD BELT	1.20
6136	SONY C6UB THREADING BELT	1.20
6138	SONY C6UB CAPSTAN BELT	2.19
6145	SONY C7UB BRAKE ASSEMBLY	1.77
6150	SONY C5UB CAPSTAN MOTOR	45.00
6152	SONY C6UB MK2 REEL MTR	23.00
6154	SONY C7 DC MTR (BHF/1100)	38.75
6155	SONY C7UB REMOTE CONTROL	43.75
6156	SONY C5UB REMOTE CONTROL	20.63
6157	SONY C6UB REMOTE CONTROL	18.13
4953	SONY C5/7 REWIND KIT	5.40
4954	SONY C6 REWIND KIT	5.40
4948	SONY SL-7/SL-T7 BELT KIT	4.00
4944	SONY SLC7/SLJ7 BELT KIT	5.50
4949	SONY SLT 9ME/J9 BELT KIT	4.50

GEC

6173	V4000H UPPER CYLINDER	40.50
6174	V4000H RELAY	4.12
6175	V4000H PINCH ROLLER	7.44
6178	V4000H CAPSTAN MOTOR	38.78
6181	V4000H TAPE SENSOR LAMP	0.79
6185	V4001H PINCH ROLLER	5.81
6192	V4002H UPPER CYLINDER	40.50
6204	V4004 CLUTCH ASSY	11.18
6212	V4100 AUDIO CDNTROL	28.13
6253	V4000H SERVICE MANUAL	10.50
6254	V4001H SERVICE MANUAL	8.31
6255	V4002H SERVICE MANUAL	11.08
6256	V4004 SERVICE MANUAL	11.50
6257	V4100 SERVICE MANUAL	8.31

HITACHI VIDEO SPARES

6214	8000 UPPER CYLINDER	38.99
6218	8000 AUOIO CONTROL	23.85
6220	8000 F/FWD REWINO ASSY	0.68
6224	9300E RELAY	3.30
6230	9300E TAPE SENSOR LAMP	0.95
6231	9300E TUNER	18.21
6240	VT33E UPPER CYLINDER	38.99
6244	VT33E CAPSTAN MOTOR	27.72
6249	VT11E F/FWD REWIND ARM	4.85
6252	VT11E CAPSTAN MDTOR	23.63

VIDEO HEADS

SEE FULL LIST FOR COMPARISON CHART

6258	BETA - A VIDEO HEAD	40.50
6259	BETA - B VIDEO HEAD	40.50
6265	VHS - A VIDEO HEAD	34.50
6266	VHS - B VIDEO HEAD	34.50
6274	PHILIPS H1500 VIDEO HEAD	50.95
6275	PHILIPS H1700/2 VIDEO HEAD	66.20
6276	PHILIPS 2020/2 VIDEO HEAD	57.95
6277	PHILIPS 2030 VIDEO HEAO	53.98

GENERAL SPARES

4999	ANTEX BIT 1/8" DIAMETER	1.45
5000	ANTEX BIT 3/16" DIAMETER	1.45
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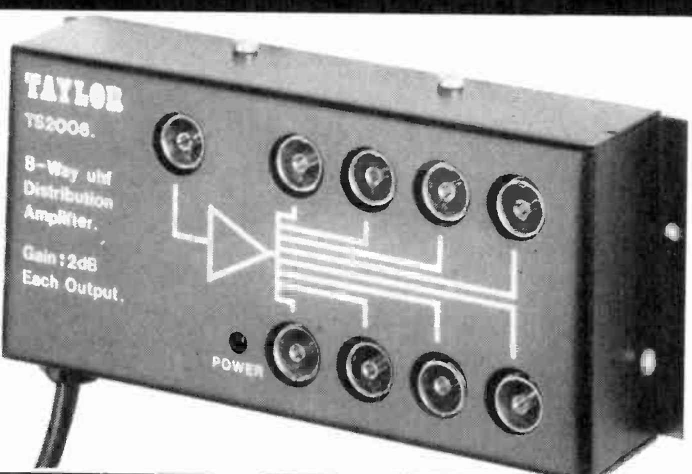

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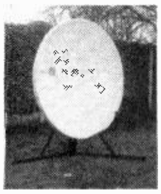

£178

1·0M *DIA*	£58
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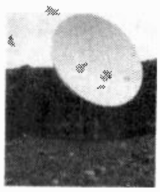

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SANYO, SONY, TOSHIBA, etc.

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PHILIPS 550, G11, KT3
BUSH T20, T22, T24, T26
THORN 8.8K, 9K, 9.6K, TX
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T26	X	16	20	17	X

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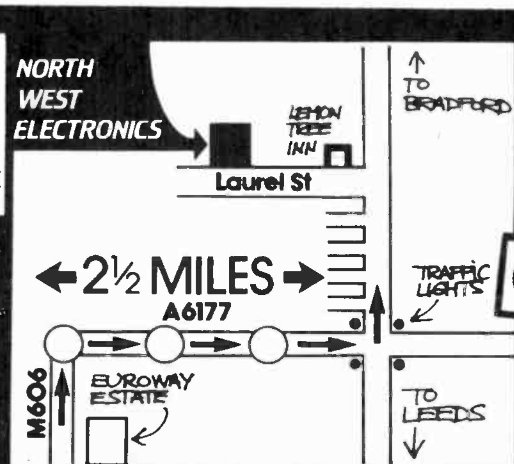

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KT3 £50
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OFF THE PILE PRICES

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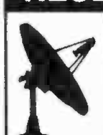

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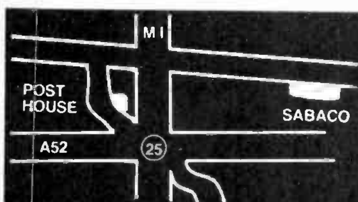

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GEC or Hitachi 6 push button unit 2110 Conversion	£8
GEC 2110 V/Cap	£5
ELC1043 (Ex Panel)	£3.75
ELC1042 NEW	£5.50
ELC2000 NEW	£4.00
ELC2004 NEW	£8.00
ELC2006 NEW	£6.00
GEC Tuner V/Cap Hitachi After 1979 ET548, ET547, ET541B	£8.00
ASTEC UM1183	£10.00
V314 (VHF) ..	£5.00
V317 (VHF)	£5
V334 (VHF)	£5
U321	£6
U341 UHF	£7.00
U342 (UHF)	£5
U411 UHF	£7.00
U.V. 411 Tuner	£10.00
U.V. 415	£7.00
U.V. 417	£7.00
Small V/Cap Mitsumi UHF ..	£4.00
VHF ..	£3.00
Portable & rotary Tuners Sanyo & Mitsumi UHF	£5.00
NSF-UHF/VHF Varicap (old type)	£8.00
Mosfit UHF/VHF (new type)	£8.00
UE2-B31 Fidelity V/Cap T/Unit	£6
UHF-VHF V/Caps on panel	£3.00
HITACHI 20 Turn Pot	40p
U321 on panel	£6.00
Tuner unit VHS Sylvania GTR Videon MTS 900	£2.50
Mullard Video Modulator. Application. video tape recorders, TV cameras, video games, closed circuit T/V, C.C.T.R. system. Data supplied.	£10.00
UHF Tuner GTR Sylvania F4714A	£2
VHF Tuner GTR Sylvania F3720B	£2

Sylvania UHF F4720B	£6.00
Sylvania VHF 900	£6.00
Small Tuner DX 175-220MHz	
Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00
THORN 1400 4P.B. Mech. Tuner	
THORN 1500 4P.B. Mech. Tuner	
THORN 1590 4P.B. Mech. Tuner	
THORN 3500 4P.B. Mech. Tuner	
All new & boxed.	£4.00 each
Delay Lines	
DL20A 80p DL600	£1.00
G8 (Old Type)	£1
DL600	£1.00
DL700	£1.00
UDL11	30p
KT 3 Luminence	75p
Luminance Delay Line (CVC 45)	
Co-Ax Joint	15p
Co-Ax Belling Lee Plug	12p
Co-Ax Splitter	£1.00
UHF Modulator CCIR	£3.00
Infra Red Emitting Diode	20p
NE286H Small Neon Lamps GEC & Philips	5p
Mullard 5 Watt Amps. LP1162 New	75p

T.V. Tubes

12"/110° 31/510 with coils Post £2.50	£5
12" A31/300 Hitachi	£10
Philips C60 Metal Tapes	85p

Integrated Circuits

AM25LS23PC	10p
BAV40	40p

BF694	10p	2SD180 TO3 80v/6A	15p	BC455	10p
BF758	30p	2SD200	£2.00	BC456	10p
BF760	30p	2SD787	30p	BC460	25p
BFT34	15p	2SD811	£2.00	BC462	10p
BFT43	10p	2SD868	75p	BC463	10p
BFT84	8p	2SD880	30p	BC478	10p
BFW11	20p	2SD1576	£1.00	BC527	10p
BFX29	30p	2SK30A	10p	BC532	10p
BFX84	25p	BC107	10p	BC546	10p
BFY50	15p	BC108	10p	BC547	10p
BFY52	20p	BC109	5p	BC548	10p
BFY90	25p	BC113	10p	BC556	10p
BLY49	25p	BC114	10p	BC557	10p
BPW41	25p	BC115	10p	BC558	10p
BRC116	25p	BC116	10p	BC559	10p
BRX43	15p	BC117	20p	BC635	10p
BRX48X	10p	BC119	20p	BCX31	25p
BRY56	30p	BC125	10p	BCX32/36 Pair	75p
BSS68	10p	BC126	10p	BCX32	25p
BSY79	10p	BC139	10p	BD116	25p
BSY95a	10p	BC140	30p	BD124	30p
BTY80	20p	BC141	25p	BD124 (metal)	30p
BSX19	17p	BC143	25p	BD130Y	25p
BSX20	17p	BC147	10p	BD131	30p
FT3055	30p	BC148	10p	BD132/238	30p
TCE82	30p	BC149	10p	BD135	25p
2N930	5p	BC153	10p	BD136	30p
2N2221	8p	BC154	10p	BD138	30p
2N2222	8p	BC157a	10p	BD140	30p
2N2906	10p	BC158	10p	BD176	25p
2N3055	40p	BC159	10p	BD182	£1.00
2N3566	10p	BC160/16	25p	BD183	70p
2N3702	10p	BC171	10p	BD202	60p
2N3711	10p	BC172	10p	BD204	60p
2N3583	50p	BC173	10p	BD207	60p
2N3904	15p	BC174	10p	BD221	20p
2N4355	10p	BC183	10p	BD222	30p
2N4442	£1.00	BC184	10p	BD228	30p
2N4444	£1.00	BC204	10p	BD226	20p
2N5296	40p	BC207	10p	BD233	30p
2N5983	30p	BC212	10p	BD235	30p
2N6099	40p	BC213	10p	BD238	30p
2N6109	40p	BC214	10p	BD239	15p
2N6130	50p	BC237	10p	BD240	50p
2N6133	20p	BC238	8p	BD243c	30p
2N6348	20p	BC239	10p	BD244	50p
2N6399	10p	BC250	8p	BD250a	30p
2X 2N6099 on heat sink	50p	BC251	10p	BD252	20p
2SA437	20p	BC252	10p	BD253B	50p
2SC643A	£1.00	BC262	10p	BD331	20p
2SA992	10p	BC263b	20p	BD373b	20p
2SB407 Sanyo TO3	10p	BC294	30p	BD416	25p
2SB474	30p	BC298	10p	BD433	25p
2SB566	10p	BC300	30p	BD437	25p
2SC772	20p	BC301	30p	BD438	30p
2SC381	10p	BC303	10p	BD439	50p
2SC458	50p	BC307	7p	BD544	40p
2SC732	10p	BC308	7p	BD650	50p
2SC733	10p	BC309	10p	BD678	30p
2SC940	£1.00	BC327	10p	BD681	30p
2SC1030	£1.00	BC328	10p	BD682	30p
2SC1162 C/18	30p	BC328/338 pair	15p	BD507	50p
2SC1520	20p	BC337	10p	BD509	50p
2SC1546	20p	BC338	10p	BD510	30p
2SC1617	£1.00	BC347	10p	BD517	30p
2SC1725	20p	BC349b	20p	BD519	30p
2SC1740	20p	BC350	10p	BD534	30p
2SC1942	£1.00	BC368	10p	BD535	30p
2SC2068	20p	BC384	10p	BD544D	30p
2SC2073	8p	BC394	10p	BD562	30p
2SC2122A	£1.00	BC413	10p	BD610	30p
2SC2229	15p	BC414	10p	BD646	50p
2SC2688	20p	BC416	10p	BD676A	30p
2SC3795	30p	BC440	30p	BD807	20p
2SC7350	15p	BC454	10p	BD826	50p
				BD948	30p
				BDX75	20p

BDX32	£1.25
BDU64B	50p
BF761	30p
BF769	30p
BF788	20p
BF819A	30p
BF858	30p
BF871	30p
BFR39	15p
BFR52	7p
BFR79	15p
BFR81	15p
BFR87	10p
BFS60	10p
BFT42	20p
BFT57	20p
BSD215	50p
MR1366	20p
BRC-M-200	40p
BRC-M-300	50p
BRC 3064	£1.00
BTT822	£1.00
BTT6016	£1.20
BTT6018/ML237B	£1.50
BTT6218	£1.50
BTT8124	£1.00
BTT8224	£1.00
BUP22A	£1.00
CA270AE	50p
CA270CW	50p
CA270CE	50p
CA920AE	£1.00
CA1310	50p
CA3046	50p
CA3065Q	50p
CA3094AE	50p
CA3123	40p
CA3146	£1.00
CA3189	40p
CBF16848	50p
CD4510	30p
DM7492	50p
HA1196	40p
HA1370	£2.00
HA11223	40p
HEF4001	10p
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HEF4053B	30p
HEF4066	20p
HEF4528	20p
HD3890C	£3.00
K5731D 1001012	£1.00
LA3220	50p
LA4102	£1.00
LM1011N	£1.00
LM1017N	25p
LM8361	£3.00
M913	£2.00
M1024=SAA	£2.00
M1025=SAA	£2.00
MC476p	£1.00
MC1307	75p
MC1312	
MC1349	50p
MC1352	£1.00
MC1358	£1.00
MC1496	50p
MC14002	15p
MC14013	25p
MC14016	25p
MC14066	30p
MC14514	50p
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MEM4956	£1.00
ML231	£2.50
FTT6016	£2.00
ML232	£2.00
ML236E	£1.00
ML237B	£1.00
ML238B	£4.00
ML239	£2.00
ML926	£1.00
MM5387	£1.00
MM5611	£1.00
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MM53108N	£4
MR1366	20p
N64100	£1.00
NE555P	60p
NE555	60p
HD38980C	£3.00
IL-1	20p
OPT600	20p
OPT601	20p
SAA611	£1.00
SAA661	£1.75
SAA1020	£4.00

Thyristors

IR106A	30p
BT151/800R	80p
BT106 Plastic	30p
BT106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
GI1 Thyristor	60p
Decca 80-100	60p
2N4444	£1.00
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OT112	£1.00
IT320M	£1.00
HC8441	£2.00
17052	£2.00
17088H	£2.00
17089R	£2.00
17053R	£2.00
SP2M	50p
MCR72/6	50p

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G8 Degausing	35p
Philip type VA1104	70p
ITTP236312	15p
PTH451 AOR	15p
PT37P Fits Pye & PT34	20p
Degausing Thermistor (fits most sets)	20p
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SAA1021	£4.00
SAA1024	£2.50
SAA1025	£2.50
SAA1073	£3.00
SAA1074	£3.00
SAA1075	£3.00
SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
SAA1176	£2.00
SAA1250	£3.00
SAA1251	£4.00
SAA1272	£3.00
SAA1274	£3.00
SAA1276	£3.00
SAA3027P	£4.00
SAA5000A	£1.50
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SAB3210	£2.00
SAB4209	£2.00
TBO0124	£1.00
SAA5000A	£1.50
SAA5010	£2.20
SAA5012A	£5.00
SAA5020	£3.50
SAA5030	£4.50
SAA5040	£3.50
SAA5040A	£3.00
SAA5043	£4.00
SAA5050	£4.50
SAF1032p	£2.50
SAF1039	£2.00
SAS560	£2.00
SAS560T	£1.00
SAS570T	75p
SAS660	£1.00
SAS670	£1.00
SAS580	75p
SAS590	75p
SAS3210	£2.00
SL437F	£4.00
SL901B	£4.50
SL918	£4.50
SL1430	£1.00
TA7122	£1.15
TAA320A	50p
TAA470	£1.50
TAA570	75p
TAA611B	£1.00
TAA621	£2.00
TAA661	£1.00
TAA641	£1.50
TA7108P	£1.00
TA7117	50p
TA7120P	50p
TA7315AP	50p
TA7137P	50p
TA7607AP	40p
TA7609P	50p
TBA120A	40p
TBA120AS	50p
TBA120SA	40p
TBA120B	40p
TBA120SB	40p
TBA120T	50p
TBA120SQ	£1.00
TBA120U	75p
TBA120Q	30p
TBA120C	40p
TBA1441	£1.00
TBA231	75p
TBA395Q	50p
TBA396Q	£1.00
TBA396	75p
TBA440P	£1.00
TBA1440C	£1.00
TBA480Q	£1.00
TBA520	£2.00
TBA530	£2.00
TBA540	£1.00
TBA550Q	£1.75
TBA560CQ	£1.00
TBA570	£1.50
TBA625	50p
TBA641	£2.00
TBA651	£2.00
TBA673	£1.00
TBA720A	£1.50
TBA750Q	£1.50
TBA780	£1.50
TBA800	50p
TBA810AP	60p
TBA810S	60p
TBA820	60p
TBA820M	25p
TBA890	£1.00
TBA920	£1.50
TBA920Q	£1.50
TBA950	£1.50
TBA990Q	£1.00
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TMS1943 N2L (clockchip)	£1.00
TMS9980	£4.00
TMS9901	£1.00
TMS2708JG45	45p
TMS2716JL	£1.00
TMS3529	£1.00
TMS3720ANS	£3.00
TMS4014	70p
TX-012	£1.00
TMS9902	£1.20
ULN2216	75p
UPC566H	£1.00
UPC585C	£1.00
UPC1031H	£2.00
UPC1353C	£1.00
UPC1363C	£2.75
UPC1366C	£1.00
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UPD8049HC	£2
SN29848	50p
SN29770BN	£1.00
SN29771BN	£1.00
SN29772BN	£1.00
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SN7472N	£1
SN74107	£1.00
SN74167	70p
SN7472N	20p
SN75108AN	£1.00
SN76001	£1.00
SN76003	£1.00
SN76013ND	£2.00
SN76018	£1.00
SN76008	£1.00
SN76023N	£1.50
SN76110N	£1
SN76115AN	50p
SN76131	50p
SN76141N	£1.00
SN76226	£1.00
SN76227N	£1.00p
SN76228N	£1.00
SN76270	£1.00
SN76532N	£1.00
SN76544N	£2.00
SN76546	£1.00
SN76550	30p
SN76552	30p
SN76570	£1.00
SN76620	50p
SN76650	50p
SN76660N	40p
SN76620AN	50p
SN76666	£1.00
SN76705N	£2
SN76707N	75p
SN76708AN	75p
SN76720	£1.00
SN76709N	£2.00
UA783P3C	40p
BT100A/02	40p
BT138/10A	70p
BT146	30p
TBA540Q	£1.50
TCA270	£1.00
TCA270Q	£1.00
TCA640	£1.00
TCA660	£1.00
TCA270S	£1.00
TCA270SQ	£1.00
TCA740	£1.00
TCA800	£5.00
TCA830	£1.00
TCA940	£1.00
TCEP100	£2.25
TCE120CQ	£1.00
TDA440Q	50p
TDA1003A	£1.00
TDA1010	£1.00
TDA1012	£1.00
TDA1060A	£1.50
TDA1035T	£1.00
TDA1035SB	£1.00
TDA1072	£1
TDA1151	30p
TDA1170	£1.00
TDA1190	£1.00
TDA1200	75p
TDA1270	£1.50
TDA1327A	69p
TDA1365	£3.00
TDA1512	£2.00
TDA1908A	£1.00
TDA2002	£1.00
TDA2003	£1.50
TDA2004	£2.00
TDA2008	£2.00
TDA2010	£1.00
TDA2020	£1.00
TDA2030	£2.00
TDA2140	£3.50
TDA2160	£1.00
TDA2320	50p
TDA2525	£1.00
TDA2545A	£1.00
TDA2600	£5.20
TDA2640	£2.00
TDA2522	£1.00
TDA2530	£1.50
TDA2532	£1.00
TDA2540	80p
TDA2541	£1.00
TDA2542	£1.00
TDA2546	£3.00
TDA2560	75p
TDA2575A	£1.00
TDA2577	£2.00
TDA2579	£2.00
TDA2581	£2.00
TDA2590	£1.00
TDA2591	£1.00
TDA2560	50p
TDA2611A	£1.00
TDA2611AQ	£1.00
TDA3651A	£1.00
TDA3652	£2.50
TDA2653	£4.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3560	£4.00
TDA3561	£3.00
TDA3571A	£2.75
TDA3590	£3.00
TDA3591	£1.00
TDA3650	£3.50

TDA3651	£3.00
TDA3651AQ	£3.50
TDA3654Q	£2.00
TDA3710	£3.50
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TDA4420	£2.00
TDA4600	£1.00
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SIL4516	50p
SN16861NG	50p
SN16862AN	£1.00
SN16964AN	50p
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UA721	40p
UA7300	40p
MPS43A	25p
MJ13005	30p
MJE51T	25p
MJE340	28p
MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p
Sanikron Diode	30p

Philips Cartridges

GP412	£6.00
GP412/11	£6.00
GP406	£6.00

Transistors

A1222	25p
A1223	25p
AC106	25p
AC121	25p
AC124	25p
AC128	25p
AC137	25p
AC151	25p
AC131	25p
AC138	25p
AC152	25p
AC153K	25p
AC142K	25p
AC169	25p
AC176	25p
AC176K	25p
AC178K	25p
AC179	25p
AC186	25p
AC188	25p
AC188K	25p
ACY21	25p
AD143	50p
AD149	50p
AD161 162	pair 40p
AF17A	25p
AF139	25p
AF181	£1.00
AF239	25p
AF367	25p
AL102	£1.75
AU110	£1.50
BLY49	50p
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF255	20p
BF256	20p
BF257	20p
BF258	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF422	15p
BF423	15p
BF448	30p
BF450	20p
BF458	30p
BF459	30p
BF460	30p
BF468	30p
BF469	30p
BF470	20p
BF480	50p
BF494	30p
BF594	10p
BF597	10p
BF760	30p
BF788	30p
BF819A	20p
BF858	30p
BF871	30p
BF869	30p

Filters

5-5MHz	15p
6MHz	30p
SFD460B	15p
CSB455A	15p

TV Crystals

4MHz	
4 433-619	
6MHz	
8.867238	
11 059 000	30p
Large or small	50p each
Antistatic Isolators Disc Type Black	10p
RCA 1693	£1.00

PHILIPS SBC 1730 SOLAR SCIENTIFIC CALCULATOR
77 Functions
39 Keys
£12.00

I.C. Holders

DIL – DIL		DIL – QIL	
40 Pin × 4	£1.00	16 Pin × 10	£1.00
42 Pin × 5	£1.00	18 Pin × 10	£1.00
28 Pin × 5	80p	28 Pin × 4	£1.00
16 Pin × 10	70p	AB Mains Switch	
24 Pin × 5	75p	u.v	30p
14 Pin × 10	70p	**Philips** Electrodynamic	
18 Pin × 10	80p	Stereo Headphones N6315	£10