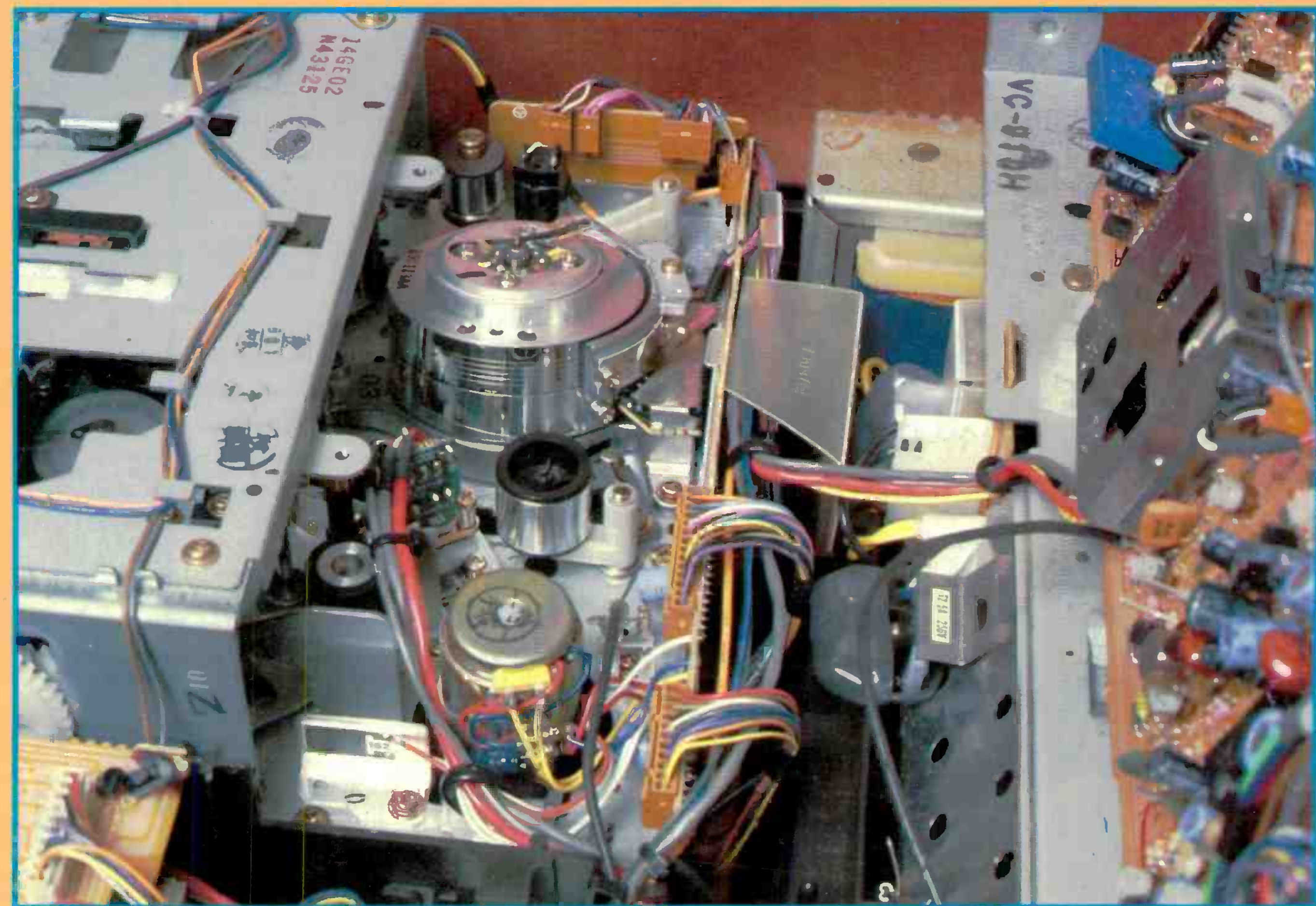
MAY 1987

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

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Servicing the Sharp VC9300

Surface-mounted Technology

Rapid TV Fault Diagnosis

Video 8 Signal Processing

Test Report • VCR Clinic

TV Fault Finding • DX-TV

TELEVISION

May 1987 **Vol. 37, No. 7 Issue 439**

On sale April 15th

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 £16 in the UK, £19 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
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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 JUNE WILL BE PUBLISHED ON MAY 20

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. **£21.45.**

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		3.90

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 Rechargeablę	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 6 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.
Multitum 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	9.90
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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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		

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		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

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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
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PY500A	2.30
PY800/1	69
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UCL83	1.82
UY85	1.35
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467 model inc. bases	399.00
470 model inc. bases	299.00
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Tube Bases For Dynascan

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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

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Solder Sucker Antistat lge.	6.20
Solder 500g	7.00
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Solder Sucker Nozzles	81
Solda Mop Stnd.	74
For sold. irons see Antex/Weller Under Specific Spares	
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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	
185 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
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Cable Ties ALT21 per 100 (large)	1.69
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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
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13.5" Cradle with kit	4.25
Std repair pack	1.10
Double repair pack(2)	2.39

Please note: We cannot supply aerials or masts via mail order. Available by collection only.

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9" welded	1.87
Gutter Brackets	1.00

Clamps

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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

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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

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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
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Corner Plates	7
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Lead Wall Nails (100)	4.95
Rawbolts	60
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Attenuators	1.80
Tape	76
Wood Screws	7
Mast couplers	8.92
27Mhz filter	2.10

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Surface Single	80
Surface Twin	1.10
Y Splitter	85
Flush Single	95
Flush Twin	1.20

Antiference

SB11 Splitter	2.37
CS200 Comb/Split	3.94
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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

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Amprobe Digital Meter AM9	55.00
Amprobe Volt/Ameter/Ohmeter RF3	66.00
Philips Meter 2000 R. per V.	20.71

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• Delayed Sweep 100ns – 0·1s
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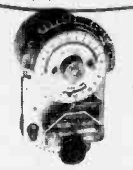
178. 3 – oblong amber indicators with liliputs 12V
180. 6 – round amber indicators with neons 240V
181. 100 – p.v.c. grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
184. 1 – three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
188. 1 – 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.

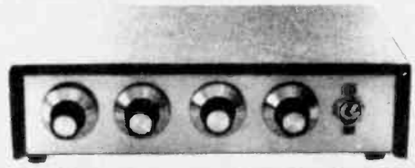


Ex-Electricity Board. Guaranteed 12 months.

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

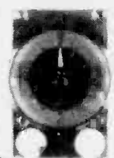


Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input 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.

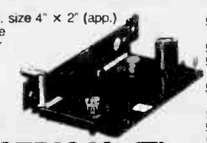
IONISER KIT

Refresh your home, office, shop, work room etc. with a negative ION generator. Makes you feel better and work harder – a complete mains operated kit, case included. £11.95 plus £2.00 post.

TELEPHONE BITS

Master sockets (has surge arrestor – ringing condenser etc) and takes B.T. plug £3.95
Extension socket £2.95
Dual adaptors (2 from one socket) £3.95
Cord terminating with B.T. plug 3 metres £2.95
Kit for converting old entry terminal box to new B.T. master socket, complete with 4 core cable, cable clips and 2 BT extension sockets £11.50

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**

J & N BULL ELECTRICAL (T)

250 PORTLAND ROAD, HOVE, BRIGHTON, SUSSEX BN3 5QT

MAIL ORDER TERMS: Cash, P.O. or cheque with order. Orders under £20 add £1 service charge. Monthly account orders accepted from schools and public companies. Acces & B/card orders accepted. Brighton 0273 734648. **Bulk orders:** write for quote.

OVER 400 GIFTS YOU CAN CHOOSE FROM

There is a total of over 400 packs in our Baker's dozen range and you become entitled to a large free gift with each dozen pounds you spend on these packs. A classified list of these packs and our latest "News Letter" will be enclosed with your goods, and you will automatically receive our next news letter.

£2 POUNDERS*

- 2P2 – Wall mounting thermostat, high precision with mercury switch and thermometer
- 2P3 – Variable and reversible 8-12V psu for model control
- 2P4 – 24 volt psu with separate channels for stereo made for Mullard UNILEX
- 2P6 – 100W mains to 115V auto-transformer with voltage tappings
- 2P8 – Mains motor with gear box and variable speed selector. Series wound so suitable for further speed control
- 2P9 – Time and set switch. Boxed, glass fronted and with knobs. Controls up to 15 amps. Ideal to program electric heaters
- 2P10 – 12 volt 5 amp mains transformer – low volt winding on separate bobbin and easy to remove to convert to lower voltages for higher currents
- 2P12 – Disc or Tape precision motor – has balanced rotor and is reversible 230V mains operator 1500 rpm
- 2P14 – Mug Stop kit – when thrown emits piercing swawk
- 2P15 – Interrupted Beam kit for burglar alarms, counters, etc.
- 2P17 – 2 rev pr minute mains driven motor with gear box, ideal to operate mirror ball
- 2P18 – Liquid/gas shut off valve mains solenoid operated
- 2P19 – Disco switch-motor drives 6 or more 10 amp change over micro switches supplied ready for mains operation
- 2P20 – 20 metres extension lead, 2 core – ideal most Black and Decker garden tools etc.
- 2P21 – 10 watt amplifier, Mullard module reference 1173
- 2P22 – Motor driven switch 20 secs on or off after push
- 2P24 – Clockwork operated 12 hour switch 15A 250V with clutch
- 2P26 – Counter resettable mains operated 3 digit
- 2P27 – Goodmans Speaker 6 inch round 8 ohm 12 watt
- 2P28 – Drill Pump – always useful couples to any make portable drill
- 2P31 – 4 metres 98 way interconnecting wire easy to strip
- 2P32 – Hot Wire amp meter – 4½ round surface mounting 0-10A – old but working and definitely a bit of history
- 2P34 – Solenoid Air Valve mains operated
- 2P38 – 200 R.P.M. Geared Mains Motor 1" stack quite powerful, definitely large enough to drive a rotating aerial or a tumbler for polishing stones etc.
- 2P43 – Small type blower or extractor fan, motor inset so very compact, 230V
- 2P46 – Our famous drill control kit complete and with prepared case
- 2P47 – Telephone ringing unit reduces mains to 50 volts and changes frequency from 50 hz to 25 hz to give right ringing tone
- 2P49 – Fire Alarm break glass switch in heavy cast case
- 2P51 – Stereo Headphone amplifier, with pre-amp
- 2P55 – Mains motor, extra powerful has 1½" stack and good length of spindle
- 2P62 – 1 pair Goodmans 15 ohm speakers for Unilox
- 2P64 – 1 five bladed fan 6½" with mains motor
- 2P66 – 1 2kw tangential heater 115v easily convertible for 230V
- 2P67 – 1 12v-0-12v 2 amp mains transformer
- 2P68 – 1 15v-0-15v 2 amp mains transformer
- 2P69 – 1 250v-0-250v 60 mA & 6.3v 5A mains transformer + £1 post
- 2P70 – 1 E.M.I. tape motor two speed and reversible
- 2P72 – 1 115v Muffin fan 4" × 4" approx. ex computer
- 2P75 – 1 2 hour timer, plugs into 13A socket
- 2P82 – 9v-0-9v 2 amp mains transformer
- 2P84 – Modern board with press keys for telephone redialler
- 2P85 – 20v-0-20v ½A Mains transformer
- 2P88 – Sangamo 24 hr time switch 20 amp S.H.
- 2P89 – 120 min. time switch with knob
- 2P90 – 90 min. time switch with edgewise engraved controller
- 2P95 – 13A socket on satin chrome plate very superior G.E.C.
- 2P97 – mains transformer 24v 2A upright mounting
- 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
- 2P107 – membrane keyboard, telephone type superior plug in type
- 2P108 – mains motor with gear box giving 110rpm
- 2P109 – 5" wide black adhesive pvc tape 33m, add £1 post if not collecting
- 2P111 – ITT line output unit
- 2P112 – 6 volt 200MA Voltage regulated PSU for 13 amp socket
- 2P113 – 9 volt 200MA Voltage regulated PSU for 13 amp socket
- 2P114 – 12 volt 200MA Voltage regulated PSU for 13 amp socket
- 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.

LIGHT CHASER KIT

Motor driven switch bank with connection diagram, used in connection with 4 sets of X-mas lights makes a very eye catching display for home, shop or disco, **only** £5 ref 5P56.

£5 POUNDERS*

- 5P1 12 volt submersible pump complete with a tap which when brought over the basin switches on the pump and when pushed back switches off, an ideal caravan unit.
- 5P2 Sound to light kit complete in case suitable for up to 750 watts.
- 5P3 Silent sentinel ultra sonic transmitter and receive kit, complete
- 5P5 250 watt isolating transformer to make your service bench safe, has voltage adj. taps, also as it has a 115v tapping it can be used to safely operate American or other 115v equipment which is often only insulated to 115V. Please add £3 postage if you can't collect as this is a heavy item.
- 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 collect 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 modern 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
- 5P41 5" extractor fan, very quiet runner sh, gntd 12 mths.
- 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
- 5P51 200w auto transformer 230v to 115v toroidal
- 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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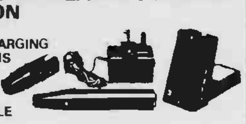
DRAPER RECHARGEABLE CORDLESS SOLDERING IRON

LENGTH: 210MM
COMPLETE WITH RECHARGING STAND, 13A-240V MAINS ADAPTOR, WORKPIECE ILLUMINATION PROTECTION CAP, 2 × 1.2V RECHARGEABLE BATTERIES



£15.99 + 75p P&P + 15% VAT

BOOKS

DATA VOLUME 1 – Trans. data & drawings A-BUY	£9.99
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UNIVERSAL BATTERY CHARGER

To charge AA, C, D and PP3 Ni-Cads
Price £4.50

Rechargeable Batteries

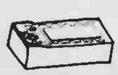
AA (HP7)	95p	10/ 85p each
C (HP11)	£2.14	10/£1.98 each
D (HP2)	£2.30	10/£2.10 each
PP3	£3.75	10/£3.65 each

Full range of Battery Holders

12V RECHARGEABLE UNIT

10 × 4Ah D size Ni-Cads encapsulated in a Black Plastic Case. Fuse Holder. Gives 12V output charged. 245 × 75 × 75mm.

EX EQUIPMENT – FULLY GUARANTEED
Price £5.99
+ P&P £1.85



SOLDER: 60% TIN 40% ALLOY

18 g. Non-corrosive Multi-core Solder.

500gm Reel	£5.25 each
10 Reels	£3.75 each

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NE555	0.25
SAA1025	6.00
SN76226DN	2.30
SN76227N	1.10
SN76533N	1.70
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STK032	13.00
STK078	13.00
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TA7204P	2.50
TA7205AP	1.80
TA7222P	2.32
TAA550	0.50
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TAD100	2.90
TDA120A	1.20
AS/S/SB/T/U	0.80
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
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TDA2020	4.00
TDA2030	1.90
TDA2140	2.90
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TDA2522	2.75
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
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7805	0.45
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7812	0.45
7815	0.45
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

TRANSISTORS + DIODES

Type	Price (£)	Type	Price (£)	Type	Price (£)
AC127	0.28	BC118	0.16	BC516	0.48
AC128	0.30	BC119	0.28	BC547	0.12
AC128K	0.34	BC125	14	A or B	0.10
AC141	0.58	BC140	0.27	BC548	0.12
AC141K	0.38	BC141	0.24	A B or C	0.10
AC142	0.56	BC142	0.24	BC549	0.10
AC142K	0.38	BC143	0.26	A or B	0.10
AC151	0.45	BC147	0.18	BC550	0.10
AC152	0.45	BC147B	0.14	A or B	0.10
AC153	0.57	BC148	0.10	BC557	0.10
AC153K	0.46	BC148B	0.12	BC558A	0.10
AC176	0.30	BC149	0.10	BCY70	0.16
AC176K	0.38	BC149C	0.14	BCZ10	3.21
AC187	0.28	BC157	0.10	BCZ11	2.60
AC187K	0.38	BC158	0.12	BD124P	0.70
AC188	0.28	BC159	0.12	BD129	0.90
AC188K	0.38	B/C	0.14	BD130Y	0.68
ACY22	1.50	BC160	0.30	BD131	0.36
AD142	0.88	BC161	0.30	BD132	0.36
AD143	1.10	BC168B	0.20	BD135	0.26
AD149	0.72	BC169C	0.12	BD136	0.26
AD161/162	1.20	BC170A/B/C	0.16	BD137	0.28
AD162	0.52	BC171A/B	0.10	BD138	0.30
AF114	1.20	BC172B/C	0.10	BD139	0.30
AF115	2.10	BC177A/B/C	0.24	BD140	0.28
AF116	2.10	BC182A/B/C	0.10	BD142	1.26
AF121	0.56	BC182L	0.12	BD145	1.82
AF124	0.42	LA LD LC	0.10	BD150A	0.72
AF125	0.58	BC183A/B/C	0.10	BD160	1.58
AF126	0.58	BC183L	0.10	BD165	0.45
AF127	0.38	LA LB LC	0.10	BD183	0.70
AF139	0.40	BC184	0.10	BD201	0.52
AF178	2.28	A B CL LC LB	0.10	BD202	0.57
AF239	0.50	BC207	0.15	BD204	0.50
AF279S	1.40	BC212A/B/C	0.10	BD222	0.80
ASY80	5.20	BC212L	0.09	BD225	0.40
ASZ17	2.00	LA LB	0.10	BD232	0.45
AU110	2.80	BC213A/B/C	0.10	BD234	0.30
AY102	4.40	BC213L	0.10	BD235	0.30
B40C200	1.03	LA LB LC	0.10	BD236	0.38
BA110	0.68	BC237	0.11	BD237	0.38
BA115	0.14	BC238	0.12	BD410	0.76
BA121	0.40	BC251A/B	0.14	BD434	0.58
BA129	0.38	BC262	0.20	BD438	0.58
BA148	0.16	A B	0.28	BD439	0.85
BA155	0.12	BC301	0.30	BD441	1.00
BA157	0.28	BC302	0.30	BD507	1.05
BB105B	0.30	BC303	0.30	BD520	1.20
BB105G	0.48	BC307A	0.18	BD687	0.88
BB110B	0.42	BC317A	0.12	BD707	0.88
BC107	0.10	BC323	0.90	BDX18	1.00
A or B	0.12	BC327	0.16	BDX32	1.48
BC108	0.10	BC328	0.16	BF115	0.32
A,B or C	0.13	BC337	0.12	BF117	0.50
BC109	0.10	BC338	0.12	BF119	0.82
A,B or C	0.14	BC350A	0.24	BF120	0.38
BC115	0.12	BC351	0.16	BF125	0.42
BC116	0.12	BC440	0.36	BF127	0.41
BC117	0.22	BC441	0.40	BF154	0.14
		BC461	0.58	BF157	0.46
		BC478	0.24	BF160	0.23
				BF167	0.32
				BF177	0.42

Type	Price (£)	Type	Price (£)	Type	Price (£)
BF178	0.26	BU126	1.40	ORP12	0.95
BF180	0.27	BU133	1.90	R2008B	1.20
BF181	0.27	BU204	1.30	R2010B	1.20
BF182	0.32	BU205	1.30	R2540	2.71
BF183	0.32	BU206	1.50	TIP30A	0.32
BF184	0.30	BU208A	1.40	TIP31C	0.39
BF185	0.28	BU326S	1.75	TIP32	0.35
BF194A	0.15	BU407	1.10	TIP33A	0.55
BF195	0.12	BUX80	3.70	TIP34A	0.70
BF224J	0.20	BUY20	2.75	TIP41C	0.42
BF240	0.30	BUY69A	2.60	TIP42	0.44
BF241	0.30	BUY69B	1.98	TIP47	0.42
BF244A	0.30	BY100	0.80	TIP121	0.63
BF257	0.22	BY103	0.50	TIP2955	0.70
BF258	0.26	BY122	0.60	TIP3055	0.58
BF259	0.30	BY126	0.10	TIS88	0.50
BF262	0.34	BY127	0.08	TIS90	0.27
BF263	0.38	BY133	0.06	Y728	0.14
BF270	0.30	BY135	0.35	Y969	2.80
BF271	0.28	BY164	0.45	IN4001	0.04
BF273	0.22	BY179	0.56	IN4003	0.05
BF274	0.34	BY182	0.80	IN4004	0.05
BF294	0.46	BY184	0.38	IN4006/7	0.07
BF336	0.32	BY187	0.65	IN4148	0.04
BF337	0.28	BY189	6.75	IN5400	0.12
BF338	0.28	BY198	0.64	IN5402	0.13
BF355	0.37	BY199	0.72	IN5405	0.16
BF371	0.27	BY206	0.14	IN5406	0.17
BF450	0.38	BY207	0.16	IN5408	0.19
BF457	0.36	BY210/400	0.21	2N2122A	0.34
BFR51	0.36	BY210/600	0.24	2N2222	0.30
BFR61	0.32	BY210/800	0.28	2N2904A	0.48
BFR90	0.86	BY227	0.22	2N2926G	0.14
BFT41	0.68	BY228	0.46	2N3053	0.30
BFT43	0.86	BY238	0.65	2N3054	0.60
BFY50	0.22	BYX10	0.20	2N3055	0.65
BFY51	0.22	BYX36/150	0.40	2N3703	0.10
BFY52	0.22	BYX36/600	0.48	2N3773	2.80
BFY90	0.80	BYX48/300	0.70	2SB337	1.80
BFY90S	1.34	BYX55/600	0.30	2SC1098	0.84
BR100	0.25	BYX71/600	1.18	2SC1172Y	1.70
BR101	0.40	C106D (400V)	0.48	2SC1173Y	0.88
BR103	0.50	E1222	0.30	2SC1279	0.50
BR303	2.75	E5024	0.30	2SC1306	0.92
BRY39	0.50	MCR106/5	1.20	2SC1413A	2.70
BRY56	0.42	ME0413	0.70	2AC1449	0.60
BSX20	0.30	ME6002	0.26	2SC1507	0.60
BSY52	0.35	MEU21	0.62	2SC1678	1.00
BSY95A	0.25	MJ400	0.45	2SC1758	0.68
BT100A/02	0.90	MJ2955	1.00	2SC1909	1.20
BT101/300	2.75	MJ3000	1.80	2SC1923	0.30
BT101/500	3.25	MJE340	0.46	2SC21953	0.70
BT102/300	3.60	MJE520	0.44	2SC1957	0.70
BT106	1.15	MJE2955	1.60	2SC1969	2.80
BT116	1.20	MJE3055	1.40	2SC2028	0.73
BT119	3.30	MPSA05	0.30	2SC2029	2.70
BT138/600	1.30	MPSA12	0.30	2SC2078	1.05
BT151/560R	0.90	MPSL01	0.34	2SC2091	0.70
BTY79/400R	2.80	MPSU05	1.05	2SC2098	2.90
BU104	1.80	MPSU06	1.18	2SC2122A	3.20
BU105	1.20	MR502	0.40	2SC2314	0.80
BU108	1.75	MR854	0.88	2SC2335	1.50
BU124AE	0.98	OA91	0.07		

VALVES

Enquiries are welcomed for any other valve not listed here.

Type	Price (£)	Type	Price (£)
AZ31	4.50	PC92	3.00
AZ41	1.98	PC900	1.40
DAF96	1.00	PCC88	0.80
DF96	0.75	PCC89	0.75
DK96	2.65	PCC189	0.85
DM71	2.95	PCF80	0.95
DY86/87	0.66	PCF82	0.95
DY802	0.95	PCF84	0.75
CV850	2.50	PCF86	1.25
CV4015	2.80	PCF87	0.50
E180F	6.50	PCF200	1.95
EABC80	0.98	PCF201	1.95
EAF42	1.50	PCF800	1.20
EB91	1.30	PCF801	1.05
EBC41	2.00	PCF802	1.05
EBF80	0.75	PCF805	2.00
ECC81	1.00	PCF806	1.20
ECC82	0.90	PCF808	1.60
ECC83	1.00	PCL82	1.00
ECC84	0.80	PCL83	2.50
ECC85	0.95	PCL84	1.00
ECC88	1.25	PCL86	0.90
ECC189	0.85	PCL88	2.50
ECF80	1.20	PCL805	1.05
ECF82	0.85	PD500	2.90
ECF83	1.90	PFL200	1.85
ECH35	3.75	PL33	1.50
ECH81	1.40	PL36	1.75
ECH84	1.50	PL82	0.75
ECL85	0.75	PL95	2.00
ECL86	1.75	PL504	1.50
EF80	0.75	PL508	2.70
EF86	1.80	PL519/509	5.25
EF91	2.00	PL802	5.50
EF95	1.68	PY81/800	1.10
EF183	0.90	PY82	1.75
EF184	1.00	PY88	0.80
EH90	0.98	PY500A	2.20
EL34	3.25	PY801	0.68
EL36	2.25	UABC80	0.85
EL81	6.95	UAF42	1.25
EL84	1.00	UBC41	3.00
EL85	4.75	UBC81	1.50
EL86	0.90	UCC85	0.75
EL509	7.85	UCF80	1.20
EL519	7.95	UCH42	2.50
EM80	0.85	UCH81	2.00
EM84	1.75	UCL82	1.80
EM87	2.55	UCL83	1.80
EY51	0.90	UF41	1.25
EY86/87	0.65	UF89	2.50
EY88	0.75	UL84	1.25
EY500A	2.50	UY85	1.15
EZ41	2.80	2D21	1.60
EZ81	0.80	6AT6	1.25
GY501	1.40	6AU6	1.00
GZ32	1.20	6C4	1.00
KT66(G.E.C.)	18.00	6GH8A	1.20
KT77	11.50	6J5GT	2.50
KT88(G.E.C.)	19.00	6K7G	2.00
PC88	1.40	6K8G	2.75
		6KD6	6.50
		6X4	1.50
		30FL2	1.70
		30FL12	1.60

MULTISECTION ELECTROLYTICS

THORN	850	100+300+100+16/300V	5.50
	1400	150+100+100+100+150/320V	3.96
	1500	150+150+100/300V	2.40
	3000	1000/63V	0.90
	3500	175/400V+100+100/350V	2.00
	8000	400/350V	2.65
	8000/8500	2500+2500/63V	2.25
	8000	700/250V	1.50
		1000/70V	0.90
	9000	400/400V	3.50
Timer Amp		4700/25V	1.15
DECCA 10/30		400+400/350V	3.70
	1700	200+200+400/350V	4.90
GEC	2047	2048 2083 2084 2104	
		200+200+150+50/300V	2.90
		600/250V	2.40
ITT/KB		200+200+75+25/350V	3.00
		220/400V 3 tag	2.10
PHILIPS	G8	600/300V 2 tag	2.50
	G8 G9	600/250V	2.40
	G11	470/250V	3.10
	G9	2200/63V	1.35
EKCO 691		200+300/350V	4.50
	Series	600/300V	3.50
RANK		300+300/300V	3.75
	A823	2500+2500/30V	1.65
		220/400V	2.20
		600/300V	3.10

FULL RANGE IN CATALOGUE

REPLACEMENT TV MAINS DROPPERS

GEC2010	8R + 15R + 17R + 70R + 63R + 188R	0.95
GEC 2018	10R + 15R + 19R + 70R + 188R	1.15
Philips G8	2.2R + 68 R	1.00
Philips 70	6R + 124R + 84R	0.68
Philips 300	118R + 148R (with link)	1.35
RRI A640	250R + 14R + 156R 50W	1.05
RRI A816	302R + 70R + 6.2R	0.78
Thorn 1500	350R + 20R + 148R + 1.5K + 317R	1.34
Thorn 3000/3500	6R + 1R + 100R Fused	1.05
Thorn 8000	56R + 1K + 47R + 12R	0.95
Thorn 8500	1K5 + 40R + 50R	1.28

Plus Many More. Please enquire.

RESISTORS – CARBON FILM 5%

1/4W 1RO to 10M (E12 Range)	2p each. 15p/10. 75p/100
1/2W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	7p each. 65p/10. 6.00/100
2W 10R to 2M2 (E6 Range)	8p each. 70p/10. 6.00/100

RESISTOR KITS – each value individually packed

1/4W pack 10 each value E12 – 10R to 1M 610 pieces	5.75
1/4W pack 5 each value E12 – 10R to 1M 305 pieces	3.35
1/2W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.95
1/2W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.75
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.25
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.50

RESISTORS – WIREWOUND. Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.15
4W – 1R0 to 10K – Available in preferred values	0.18
7W – 0.47R to 22K – Available in preferred values	0.15
11W – 1R0 to 22K – Available in preferred values	0.18
17W –1R0 to 22K – Available in preferred values	0.24

SOLARTRON 15MHz DUAL BEAM OSCILLOSCOPES

SECOND HAND. Fully working complete with manual. Strictly subject to availability. Price: £99.00 + £10.00 carriage.

ZENER DIODES

400mW	Plastic 3V-75V	8p each. 10/75p.	
1.3W	Plastic 3V-200V	15p each. 10/£1.40	
1.5W	Flange 4.7-47V	£1.26 each*	
2.5W	Plastic 7.5-75V	64p each*	
20W	Stud 7.5-75V	£1.35 each*	

*Only available while stocks last

ZENER DIODE KIT 400 M/W 5 ea value – 55 Z/Diodes £3.50

CERAMIC KIT 50 VOLT 5 ea value – 125 Caps £4.75

LABGEAR

CM6021	7.50
CM7253	13.66
CM7243	12.72
CM7093	16.03
CM9700	4.45
CM7122/RA	36.20
CM7042	3.09
CM9006	3.78

SERVICE AIDS

Switch Cleaner	1.15
Circuit Freezer	1.41
Foam Cleanser	1.25
Aero Klene	1.13
Plastic Seal	1.35
Excel Polish	1.19
Antistat Spray	1.25
Aero Duster	1.49
Super 40	1.88
Video Head Cleaner	1.10
Fire Extinguisher	3.35
Silicone Grease Aero	1.51
Silicone Grease Tube	1.80
Heat Sink Compound	1.18
SoldaMop 0.12mm	0.76
SoldaMop 0.08mm	0.78
SoldaMop Industrial Reel 10m 0.12m	2.96

FUSES Prices per 10

20mm Quick Blow. 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. 45p. 20mm Time Delay. 100, 125, 160, 200mA, 250, 315, 400, 500, 630, 800mA. 90p. 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A 70p. 1" Mains. 2, 3, 5, 7, 10, 13A 90p.

VIDEO BELT KITS

NAT/PANASONIC	VDB01	2.05
JVC HR 7700	VDB02	.40
HITACHI VT 5000E	VDB03	1.50
JVC HR 3360/HR3660	VDB04	4.10
SONY SLC7	VDB05	3.75
JVC HR3300/HR3320/HR3330/HR3600	VDB06	4.65
SONY SL8000	VDB07	6.75
NAT/PANASONIC NV8600	VDB08	1.55
SONY SLT-7ME	VDB10	.98
SONY SLT-9ME	VDB11	.98
TOSHIBA V5470	VDB12	1.45
TOSHIBA V5475	VDB13	1.56
TOSHIBA V8600	VDB14	4.50
NAT/PANASONIC NV300	VDB15	2.05
SANYO 5500	SANYO-012	2.05
SANYO 9300	SANYO-013	2.05
SHARP VC381	SHARP-020	3.15
SHARP C6300	SHARP-021	6.00
SHARP VC7300	SHARP-023	3.90
SHARP VC9300	SHARP-024	3.30
SHARP VC9700	SHARP-025	2.65

IDLER KITS/ASSEMBLIES

SHARP NIDL-0005 GE ZZ	SHARP-0012	3.05
0006	SHARP-0013	3.05
SONY SLC5/7UB	IK-01	5.85
SONY SLC6UB	IK-02	4.70

VIDEO HEADS

AKAI	ALL	39.44
HITACHI	VT5000E	37.99
JVC	ALL	39.44
NAT/PANASONIC	ALL VE/ and NV	39.44
SANYO	ALL	46.22
SHARP	VC7300/7700/7750/8300/2300	57.75
	VC6300/387/3300/9700/381/383/386/388/482/9100/9300/9500	53.50
SONY	LLC 9UB	46.65
	SLC 20/30/40	40.44
	SLC 5/6/7UB	39.11
	SL8000UB	48.40
TOSHIBA	ALL	48.66

SERVICE MANUALS

FIDELITY CTV 145/CTV140/R/CTV 2022	ALL	1.85
SONY HMK3000		2.45
SONY KV1810UB Mk.1/KV1400UB	ALL	8.15
SONY KV2000/KV1820/KV2204	ALL	8.35
SONY KV2212/KV2705/KV2252	ALL	5.85
SONY SLC5UB/SLC6UB/SLC7UB/SLC9UB	ALL	9.20

TELEPHONE EQUIPMENT

BT App Telephone Plug + 3m Lead	£1.25
BT App Master Socket inc Wiring instrns	£2.85
BT App Secondary Socket	£1.95
4-way plug	30p each
BT 4-Core Cable per metre	15p/m
	£12.00/100m
Cable clips for above	100/75p

TV TX9	33.00
TV TX10	45.80
TCE 1690/1681	3.75
TCE 1790	1.25
TCE 9600	11.40
TCE 9800	8.65
VCR 3V00	19.90
VCR 3V01	23.75
VCR 3V16	26.50
VCR 3V23	30.60
VCR 3V24	28.40
VCR 3V25/26	18.65
VCR 3V29	29.00

REMOTE CONTROLS

Decca	All	£27.95
G.E.C.	From	£27.35
Grundig	From	£27.35
Hitachi	From	£29.65
I.T.T.	From	£27.33
Korting	From	£27.33
Philips/Pye	From	£14.76
RRI	From	£10.50
Sony	From	£38.05
Thorn	From	£11.60

QUALITY DESOLDER PUMP
Price £4.50

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	74.95
XS25 W iron kit/complete with steel & plug attached	11.00
CS 18W, as above	10.90
Antex 15W iron	5.75
Antex 18W iron	5.95
Antex 25W iron	6.20
Antex elements	3.20
Antex bits	0.99
Antex stands	2.20
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

CERAMIC KIT

50 VOLT 5 ea value – 125 Caps £4.75

MULTITESTER

20kΩ/V HM102BZ

Tester with handle/stand & 19 rangs including 10 Adc. Battery/Checker/Buzzer/Audio output test. Leads with 4mm Plugs, battery & inst. Manual supplied. Mirrored scale. Fuse protection.

AC volts	0-50-250-1kV ± 5%
DC volts	0-2.5-10-50-250-1kV ±4%
DC current	0-5m-50m-500m-10A ±5%
Resistance	10K-100k-10MΩ ± 4%
Battery Check	1.5V/75Ω,9V/450Ω
Decibels	–20 to +62dB
Audio Power	–8 to +22dB
Protection	Fuse and Diodes
Dims:	135 × 89 × 40mm
PRICE:	£11.76 each

EAST CORNWALL COMPONENTS
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TELEVISION

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Value Added

What do you do when profits begin to slide – sharply? It's a question that will have been exercising the mangement of all those well-known and seemingly invincible Japanese electronics goods (and other products) manufacturers over the last year or so since the value of the yen started to rise sharply in relation to the dollar. One answer of course is increased off-shore production. We mentioned Aiwa's move to Singapore on this page last month. Other Japanese consumer electronics manufacturers have been taking similar, if not quite such drastic, steps recently. One likely beneficiary is the UK. Sony for example has just announced a £30m investment programme for its Bridgend plant. When the programme has been completed in 1990 production capacity will be more than doubled to over half a million sets a year, including for the first time small-screen colour sets. So what's bad news in Japan could be good news elsewhere. Major Japanese consumer goods manufacturers long ago adopted a policy of establishing off-shore production facilities close to large markets, amongst other things as a form of insurance against the adoption of protectionist policies by major importing countries. Hence the fact that all major Japanese consumer electronics manufacturers have plants in N. America: they will doubtless have been increasing their investment in such plants recently. The same policy has been adopted by the S. Koreans, which is relevant to Samsung's decision to go ahead with the development of a microwave oven/VCR/TV plant on Teesside.

There's been some criticism of the practice of Far Eastern manufacturers setting up assembly lines in Europe and N. America. It's been termed screwdriver investment, since the technical know-how and research and development remain back at headquarters. While some concern over this is justified it's nevertheless better to have such plants than nothing at all, and one has to bear in mind that most of what they produce has been developed in Japan anyway. One solution to this conundrum is the joint venture concept, where European/N. American/Japanese firms link in joint investment projects to develop and manufacture goods.

Apart from off-shore production, what other courses of action are available to Japanese manufacturers? One policy is the value-added approach – to develop, manufacture and sell more sophisticated products that provide a better profit margin. We are already seeing the implementation of this policy as more sophisticated models begin to appear on the market. There have for example been several announcements recently of VCRs incorporating new and more advanced features. They include Toshiba's machine with a field store memory to provide off-air as well as off-tape still pictures; an Hitachi machine that incorporates picture-in-picture, the monitor displaying a second, smaller picture from a second channel or video source in addition to the main one; and Panasonic's announcement of a VCR with bar-code programming. In due course such things will doubtless come to be regarded as standard features in the way that we now expect freeze frame, slow motion, forward and reverse search etc. as a matter of course.

It's not only a matter of more sophisticated versions of existing products however, but also of new systems. The digital audio tape system has already been launched in Japan, with models from Aiwa, JVC, Matsushita, Sharp and Sony now on sale there. Models are likely to appear in the N. American and European markets before long. The only thing that's held DAT back of course has been controversy over the implications of duplicating material from compact discs. Various approaches to this problem have been suggested, and in the nature of things some compromise will doubtless be adopted before long.

Another system that's put in an appearance recently is the compact video disc. This is a rather curious concept: why should anyone want a brief video programme? It seems however that the main emphasis here will be on the pop music market. The CD-V discs that have been demonstrated so far have contained programme material consisting of twenty minutes of audio and a five minute vision/sound "clip". The discs themselves present no problems since similar CD and LaserVision discs are already in production: players able to handle various types of audio/video discs are already either available (not in the UK at present) or under development. A major push is expected at the Chicago Consumer Electronics Exhibition later this year. It will be interesting to see whether the idea catches on.

We can, then, expect to see an increasing flow of new products offering new features and possibilities. The technology is already there – chips, digital signal processing, more advanced tapes and so on. It's now more a matter of exploiting this technology to provide new production and marketing opportunities.

CORRECTIONS

We've been having trouble with part numbers recently. The correct part number for the timer panel ceramic filter in the Ferguson 3V23 VCR is 01X0-033-926. The part number quoted in Service Bureau, December 1986, is for the complete panel. The correct part number for the Philips Magic Mirror (Market Place, March 1987) is 395 37209, not 395 37198 which is for a headband mirror. In the article on Sony KV1810 GCS conversion, February 1987, the knee of the line output transistor's collector waveform was referred to in the text as the turn-on instead of the turn-off area (page 254, line below Fig. 9). Our apologies for these slips.

COVER PHOTO
This month's cover photograph shows the innards of the Sharp VC9300 videocassette recorder – well some of them anyway. See article on page 466.

OBSCURE BRANDS
Readers have asked about two more obscure 14in. colour portables, the Harwood and the Lincoln 35C. Does anyone know of a source of service data and/or spares?

WIZARD-SONY
Wizard Distributors were quoted in our TV/VCR Spares Guide (April issue) as being official distributors of Sony spares. We have been asked by Wizard and Sony to point out that this is incorrect. Wizard do stock and sell Sony parts, but these are sold on from official Sony distributors.

Long-distance Television

Roger Bunney

Following the very active tropospheric opening during end January/early February the rest of the month provided very little by way of DX-TV signals. Meteor scatter propagation produced some short signal pings, tropospheric propagation ceased altogether, there was less auroral activity than usual and only a few Sporadic E signals provided some brighter moments in an otherwise bleak month. The approach of April should see an increasing incidence of SpE propagation. Hopefully by the end of the month there will have been at least one good opening – we used to consider such an opening as a good omen for the coming season, from mid-May onwards. The February SpE log from the few reports received at the time of writing is as follows:

6/2/87	NRK (Norway) ch. E2, 4; SR (Sweden) E4; TVE (Spain) E4.
8/2/87	TSS (USSR) R1.
12/2/87	TVP (Poland) R1; RUV (Iceland) E4.
15/2/87	NRK E3.
16/2/87	CST (Czechoslovakia) R1.
17/2/87	ORF (Austria) E2a.
19/2/87	TVP R1.
20/2/87	SR E2.

Meanwhile in Australia the SpE season has been slowly decaying, though there have been some excellent catches. Anthony Mann for example has received confirmation of his reception of Quezon City, Philippines ch. A2 (system M) in Perth, Western Australia on September 14th last: the transmitter has an output of 40kW which, fed to a 10dB gain aerial, produces an e.r.p. of 400kW. We also hear that Malaysian ch. E2 TV sound (53·75MHz) has been monitored in New Zealand at a distance of some 5,000 miles – on December 12th last. Other signals received by Anthony Mann have included Indonesia ch. E4 and Samoa ch. A2. His reception of the Philippines ch. A2 coincided with reception of Malaya ch. E2 in Sydney.

Several letters have been received from overseas about the BBC proposal for a "TV World Service". No decision has been made so far on this proposal. The service would be intended for cable networks and would depend on the availability of satellite transponders. The idea is to provide half-hour programmes consisting of news and topical interest items on a five days a week basis.

News Items

Low Countries: A third service, NOS-3, is to start in Holland on April 1st 1988. The name of the Belgian BRT (Flemish) network is to be changed to VRT. Two commercial TV networks are to be set up in Belgium, one serving the French-speaking south of the country and the other the Dutch-speaking north. This would end the present state monopoly in TV broadcasting.

Norway: The first local TV stations have now come into operation. Details are as follows: Bergen ch. E45 50W; Smors ch. E48 10W; Geitanuken ch. E51 10W.

Finland: The Swedish first programme is now being transmitted from Aland on ch. E28 with 600kW e.r.p.

Satellite TV: We understand that the Premiere, Lifestyle, Arts, Sports and Children's Channels will be transmitted using the MAC system from the end of the year. TV5 is now being transmitted using PAL entirely. Comex Systems, Comet House, Unit 4, Bath Lane, Leicester LE3 5BF have introduced a sync processor unit for use with satellite TV receivers (and also for baseband video use in DX applications). It's apparently suitable for use with the Filmnet service that employs a degree of scrambling. Retail cost of the unit is £143·75 including VAT.

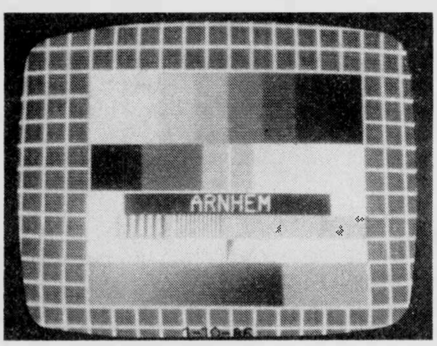
Amateur TV

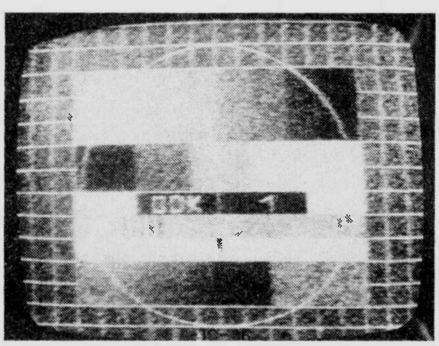
Certain items previously supplied by Solent Scientific, which is not at present trading, are now being supplied by the Worthing and District Video Repeater Group, Toftwood, Mill Lane, High Salvington, Worthing, Sussex BN13 3DF. The range at present consists of a 23cm (1·3GHz) ATV receiver-converter kit, a 1W f.m. TV transmitter, a 16in. diameter dish and a CCIR pre-/de-emphasis kit. The plan is to extend the range. Please send a stamped, s.a.e. with any enquiries.

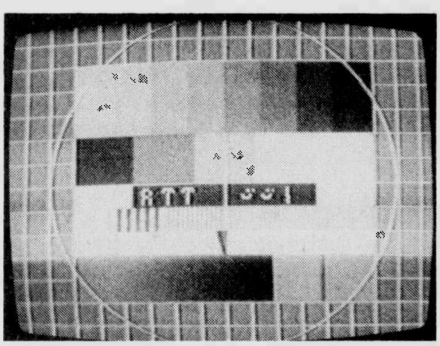
The Bristol FM-TV Group, 15 Witney Close, Saltford, Bristol BS18 3DX has introduced an 18-element Yagi aerial that provides a gain of around 10dBd in the 23-24cm band. The price is £12·50 if the aerial is collected, £14·75 by post in the UK. The array is 0·92m long and has a rear stub mast mounting.

Europe now has its own international ATV organisation EATWG (European Amateur Television Working Group). It has been formed to "promote and protect the interests of ATVers" and to represent the ATV case to such organisations as the IARU.

We commented recently on ATV activity within the Australian u.h.f. TV broadcasting spectrum. As a result of the move of Australian Band II TV stations to u.h.f.







Variations on a theme. Left: The NOS (Holland) FUBK pattern with identification. Centre: Czechoslovakian "DDK 1" FUBK pattern received in Holland on ch. R36 during last October's tropospheric opening. Photos from Ryn Muntjewerff. Right: RTM (Morocco) FUBK test pattern received in France on ch. E4 by M. Dubernat.

the Department of Communications has indicated that the 580MHz ATV repeaters may lose their licence.

New EBU Listings

W. Germany: Quartier Napoleon (Berlin) ch. E31. This 85kW/17·8kW (horizontal) transmitter is operated by the French Forces (GMFB). It uses System G SECAM, i.e. with 5·5MHz f.m. sound, the same as in East Germany. **France:** Troyes ch. E29 200kW e.r.p. horizontal (TV6); Rennes-Saint-Pern ch. E31 100kW e.r.p. horizontal (TV6); Rennes-Saint-Pern ch. E34 100kW e.r.p. (TV5). **Poland:** A report from another source mentions that the Warsaw ch. E27 TVP-2 transmitter is now operating at 10kW e.r.p. A co-sited ch. E51 transmitter operating at 2kW is broadcasting the TSS-1 service (USSR first programme) for the local Soviet Forces.

Tandy VHF Radios

Though an increasing number of DX-TV enthusiasts are now purchasing multi-standard TV sets, and hence enjoying both sound and vision reception during appropriate conditions, it's possible to retain the advantages of narrow-bandwidth vision operation and still receive good quality sound – by employing a radio receiver covering the appropriate frequency ranges. This of course calls for rather more physical dexterity. We recently received a copy of the 1987 Tandy US catalogue which lists four portable radio receivers that cover Bands I/III (their chs. A2-6 and A7-13). One of them also covers the u.h.f. chs. A14-83. If you happen to be visiting the USA, or have friends there wanting to send you a present, the following are worth considering:

Model 12-613. Covers the two v.h.f. TV bands. Hand/pocket portable set operated from a 9V battery. $30.

Model 12-648. Covers m.w., 88-108MHz f.m. plus Bands I/III. Large portable operated from a 6V battery. $40.

Model 12-780. Covers 54-88MHz, 88-108MHz, 108-175MHz and 175-230MHz. Large portable (case 11in. long) operated from a 6V battery. Known as the Portavision 50. $60.

Model 12-781. Covers Band I, Band III and the u.h.f. TV bands. Large portable for 6V battery operation. $70.

Apart from the pocket portable these sets can all be operated from a 117V a.c. supply as well. I've personally owned a Portavision 50. As a general all-round v.h.f. receiver and for SpE Band I reception (its System M coverage includes the OIRT Band II) I found it to be an excellent unit. Tuning is via a slide rule (similar to the UK Realistic DX65). Tandy even feature a stereo tuner/amplifier for Band I/III/u.h.f., at $140. They're also into TVRO at 4GHz, with a 10ft diameter dish, LNBs, etc. The address is Tandy/Radio Shack, Export Department, 500 One Tandy Centre, Fort Worth, Texas 76102, USA.

High-Pass CB Filter

R.F. interference is a continual problem for those of us interested in receiving low-level v.h.f./u.h.f. signals. Unfortunately these weak signals fall outside the DTI's terms of reference, which means that the DXer has either to tolerate the problem or adopt his own methods of minimising it. There are many sources of interference, and the use of high-gain, wideband head amplifiers makes matters worse. When the CB fad started in the early 1980s it soon became obvious that many operators were using illegal imported a.m. rigs from the USA, generally employing a.m. or s.s.b. The subsequent UK CB regula-

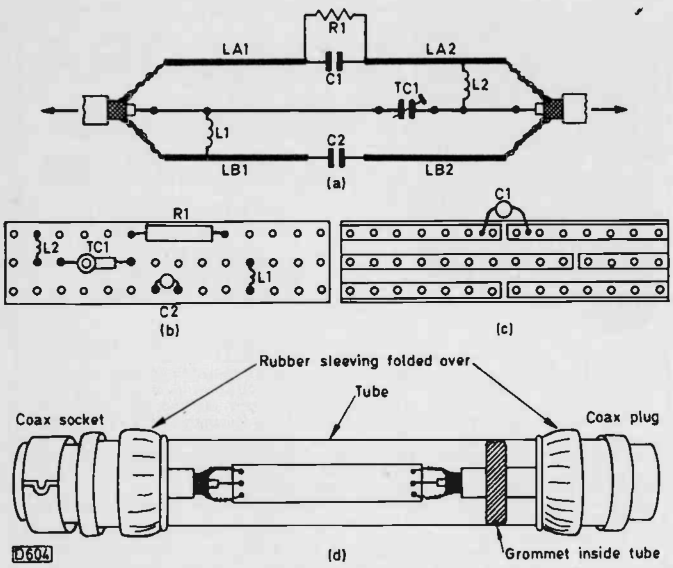


Fig. 1: CB filter devised by Len Smith. (a) Circuit, (b) component side of board, (c) track side, (d) filter housing. The filter is built on a 14-hole, 3-strip piece of Veroboard with 0·1 matrix and is housed in a 3in. long, 0·5in. inside diameter soft-drawn aluminium tube. Six inches of low-loss coaxial cable and a one inch length of 0·5in. rubber sleeving are required – also an 0·5in. grommet. Terminate with a 75Ω coaxial plug at one end and a 75Ω coaxial socket/plug at the other. Stripline inductors LA and LB consist of part of the Vero copper tracks covered with solder. L1 and L2 consist of six turns of 26 s.w.g. e.c. wire wound on an ⅛in. drill. C1 is 10pF, C2 5·6pF, TC1 2-10pF and R1 either 120kΩ or 150kΩ.

tions laid down stringent conditions on transceiver design and harmonic radiation but those imported a.m./s.s.b. rigs are pretty poor when it comes to harmonic radiation. As a result we get interference at 54MHz (2 × 27MHz), often made worse by the use of wideband linear amplifiers ("burners") that lift the signal from typically 10W to some 30-50W. Highly illegal, but equally highly popular. The PO Radio Service could often be induced to take enforcement action in cases of direct harmonic radiation, or alternatively direct negotiation with the operator might ease matters (assuming that the operator is known).

Such radiation was reduced to very low levels with the advent of legal CB. Even so the combination of a Band I aerial, a high-gain wideband amplifier and a local CB operator can cause problems. The amplifier can be driven into non-linearity/overloading, the saturated amplifier then spreading the CB signal over a very wide bandwidth. This is one reason why masthead amplifiers should be avoided in Band I: if problems arise after installation it's difficult to add filtering prior to the amplifier's input.

There are several CB filters on the market. Most tend to be u.h.f. pass, braid-break types giving high attenuation of Band I frequencies. AKD, well known in amateur radio circles, make a range of filters, including those for DTI use. The PO high-pass filter type FS38A gives high attenuation (30dB) below 40MHz and a rapid changeover to minimal loss in Band I. It can be obtained at times from aerial suppliers.

Len Smith of Waterlooville, South Hampshire has some fourteen CB operators living within four roads of his home. Interference in Band I and upwards can affect all DX-TV signals at his location. Details of the filter he designed to deal with the problem are given in Fig. 1. Though we've not ourselves had a chance to try it out Len tells us that he now has a clean Band I and upwards TV spectrum. The filter is housed within an isolated (isolated from the screen of the coaxial cabling, i.e. floating) tube and makes use of a piece of Veroboard to form stripline inductors. Trimmer TC1 is adjusted for minimal CB breakthrough – and that completes the filter!

We'd be interested to hear from other filter designers, and about interference problems and solutions generally.

From our Correspondents . . .

Cyril Willis took the opportunity to test a newly acquired 2in. Casio v.h.f./u.h.f. TV set while flying back from a recent holiday in the Canary Islands. The flight reached 42,000ft. French Band III/u.h.f. TV was visible soon after take off and most channels were full of signals throughout the whole flight, though on programme apart from four TV de Galicia u.h.f. channels. UK signals were visible some 800 miles out.

Robert Copeman (Victoria, Australia) has received a pirate TV station on ch. A3 radiating the call sign "NBC-3 Nunawading Broadcasting Commission" with colour bars and electronically generated identifications. Pirate f.m. activity on an irregular "amateur" basis is apparently very popular there. NBC-3 was logged on January 30th: programmes started at 2000 local time.

Fraser Lees has kindly identified the "Televerket" caption shown in the March column. It's in fact "Telemarket" and originates, on ch. E2, from a private Italian station operating in the Rimini area (the telephone number gives this away). Many low-budget Italian stations transmit such marketing programmes to fill up time, often selling single second-hand items offered by viewers. With RAI now closing down many of its v.h.f. relays the channels are quickly snapped up by private broadcasters which once on air will rarely switch off their transmissions – during non-programme periods a test pattern/computer graphic is left on to maintain occupation of the channel! There are also many f.m. radio links now operational in the 50MHz band. Due to the general chaos TV-DXing at v.h.f. can be difficult if not impossible in Italy.

The "TKCI 3" test pattern shown in the March column has been identified by John Tellick as originating from the Intervision switching centre at Prague, Czechoslovakia. The initials stand for Technical Co-ordination Centre for Intervision.

Can anyone help Nicholas Brown of 30 Cymbeline Way, Rugby, Warks CV22 6JY who is seeking the loan of a recorded BBC-2 programmed called "Window on the World – The Story of Europe's TV", broadcast on October 30th 1986. Either a VHS or Beta tape would do. Please write to Nick directly.

Gareth Foster has recently returned from a holiday in Malaysia and has kindly forwarded a locally recorded VHS tape of signal activity in Singapore. I was surprised by the high level of teletext, both information and advertising. The PM5544 test pattern is of course all too popular. Three local programmes in Singapore use chs. E5, 8 and 12. The ch. E8 programmes feature Mandarin Chinese speech, the others being primarily in English. The three services are RTM1, RTM2 (both v.h.f.) and TV3 (Band III/u.h.f.). There are three programme services generally available in Malaysia. Speech is mostly Malay though English, Chinese and Tamil language programmes are broadcast from time to time. Gareth returned with a "DX Antenna Co." wideband Band I/II/III aerial with a gain claimed to be within 3·5-7·5dBd and a front-back ratio from 8-19dB. The cost was only £19. It will soon be gracing the Twickenham skyline!

The Return of Madame Martine

Les Lawry-Johns

Some while back I wrote about a seaside fortune teller who warned me about the blue tant. I mentioned that a while later I delivered a new set to a customer who was a friend of mine. As we were watching the golf the colour faded out – Bob didn't notice this as his hero was in a bunker. I related that I'd traced the fault on the decoder panel and that it turned out to be due to a blue tant. Time passes, and alas poor Bob has passed on. But the memory remains. Last Saturday as I was working on a set on the bench an old girl came in. She looked at me and I had this feeling I'd seen her before.

Good fortune is coming

"You've a lucky face. Good fortune is coming to you."

"It's about time" I commented.

"Be patient" she said, "good things are worth waiting for."

"I've been waiting for years dear, and I'm still scratching a living mending these things."

"Give me your hand and put a five pound note on it. I will reveal all."

I looked at her hard. "I have to work to earn five pounds. Often for a bloody long time. You want five pounds for a couple of minutes' waffle?"

"It's not waffle: it's the truth and you'll see later on."

It dawned on me whom I was talking to. The blue tant lady. Oh dear. I whipped a five pound note from the till. She whipped it from my hand like lightning. She then grabbed my hand and traced lines down it to my wrist.

"You've a long life and a happy one. It wasn't always so. You were unhappy some years ago but that's behind you. You're happy now and good fortune is coming to you soon."

"As soon as it came to you?" I queried.

She gave me an impatient look. "Now screw thirty pounds up and put it on your hand. I'll put the crystal ball on it."

I scraped around until I had found thirty pounds and screwed it up as I was told. She stroked my hand.

"Now you wouldn't begrudge me that small amount, would you?"

"Oh yes I would" I snapped. "You've already conned me for a fiver. Make do with that."

Her attitude changed immediately. "You're mean, that's what you are. Begrudging an old woman an honest living. You'll regret it."

Just then Phil came in and she started on him. He too parted with a fiver and she told him he'd marry a girl with an M and an L in her name. Phil's loved one is called Sarah. Oh well. How easily we part with our hard earned cash. Seeing that she wasn't going to get any more she departed, saying as she went "beware the white cap".

The next witch on the scene was Honey Bunch.

"You dozy oafs, parting with a fiver each to that old hag. She can't tell fortunes but she seems to be able to grab them off fools like you two. I can tell fortunes better than she can any day of the week."

She can too. Sometimes when she holds something of mine she can say what's going to happen next, and she's always right. But I don't want any of you lot calling here to have your fortunes told. If you do I'll be the one to tell them.

Universal triplers

Do you remember me telling you about Keith from Pompey who called to bring me some scan coils I didn't need after all? While he was here I sold this chap a universal tripler to fit to his CVC30 and told him to join the diode and earth leads together to the earthy side of the focus control. The right and proper thing to do . . . with the ITT set. Keith had commented that the tripler wouldn't last long connected that way and I'd wondered why.

Well the other day I had a call-out to fix a G8. It needed a tripler and I didn't have the G8 one with me, so I dug out a universal tripler and trimmed the leads, soldered the cap on, etc. I joined the diode and earth leads together and soldered them to the clip. On switching on there was a humming noise and very little e.h.t. The new tripler was getting hot. I switched off and clipped through the diode lead. Everything then came on fine and I felt daft. You see I'd always fitted the original Philips type tripler in a G8, never having had to use a universal one before.

When I got back to the shop I looked up the leaflet and it clearly tells you to trim off the diode lead and insulate. Connecting the diode and earth leads together on the G8 had meant that the clipper diode had no load. Sorry Keith, I was right about the ITT, but wrong about some of the others. I didn't know the G8 was amongst them. I'm amazed at the things I don't know. And a little bit ashamed.

Washers

A set fitted with the Philips CTX chassis came in the other day – I think it was the E version. The chopper transistor was faulty so I fitted another without trouble and checked around to see whether there was a cause for the chopper's demise. There was. The line output transistor was short-circuit. I decided to use a BU508A but found that the original transistor didn't use an insulating washer, being solid plastic. So I had to fit a washer in order to use the BU508A. Why's this worth mentioning? Restricted space, that's why. I had to use a pair of tweezers to fit the transistor and washer in position – the gap between the line output transformer and the side wall is about half an inch. The chopper needed the same treatment, but in this case there was plenty of room.

Talking about washers, the rubber ones used in the Ferguson TX100 chassis are beginning to give trouble. Apparently they tend to puncture, probably due to slight irregularities in the surface of the transistor or the heatsink. I thought I'd pass this on to you in case you have one of these sets and are puzzled by the transistor being all right but an obvious short being present.

The white cap

I know you thought the white cap would probably be an 0·47μF, 1kV type living in a CVC5 or something like that. Well you were wrong. It lived on the head of a pretty girl who, believe it or not, popped into the shop to tell me I'd a lucky face and would live a long time and would have good fortune. She looked at Phil and asked him to go away. She then said in a low voice "don't trust that man, he's after your business."

I called Phil back and we had a bit of a laugh. Phil said to the girl "you don't happen to know Madame Martine by any chance?"

The girl looked sort of funny and replied "she's my grandmother and told me this gentleman was generous. You are dear, aren't you?"

"Sorry dear but this drain on my hard earned cash is getting a bit much. Would you take a couple of quid and clear off like a nice girl now?"

"That won't help me. I need folding money."

"Well you'll have to clear off without then and leave me to earn my dishonest living."

"It's only he who stopped you giving me a tenner. I know. I'll see you again."

And she went, white cap and all, leaving me a little uncertain and a little bit angry at the way some people expect to be able to make a living. I suppose I'll have a lot of bad luck now . . .

Servicing Mechanical VCRs

Part 3

Mike Phelan

In conjunction with the pinch roller the capstan drives the tape along the tape path at a constant speed. It forms part of the drive train, and a rather important part at that. Due to the critical mechanical tolerances it can give a lot of trouble.

Capstan Drive System

Fig. 1 shows the capstan drive system in detail. The motor is mounted in an inverted position below the deck, with the pulley protruding above. A short flat belt goes from this pulley to the relay pulley, which runs in ballraces. The lower part of this pulley drives the capstan flywheel via a flat belt: it also provides the power for the reel idlers, via a square section belt. We'll deal with the latter part of the mechanism in a later article.

The capstan itself consists of a hardened, ground steel spindle which is pressed into an alloy flywheel – see Fig. 2. The spindle runs in a sintered bronze bush and to form a lower bearing there's a polypropylene plug in the retaining strap on which the rounded lower end of the spindle runs. A plastic oil fence is pushed on to the spindle above the bearing to prevent oil from the bearing creeping up the capstan spindle and getting on to the tape.

There are one or two slight differences here between models. The original 3292 capstan ran in ballraces and had no lower bearing. In the 3V16 the lower bearing is in the form of a plate rather than a strap, to carry the PCB with the capstan servo tacho printed coil. This is why the other models appear to have a few spare pillars on the deck. With the exception of the 3V16 the machines have two magnets in the flywheel rim and a pickup head on the deck chassis, the servo being a simple speed control system which compares the capstan speed with a crystal frequency (Models 3V00/3V22) or a tuning fork (Model 3292).

Solenoid Operation

It may be worth mentioning that the portable Model 3V01 (an excellent though heavy machine) employed a very similar deck mechanism, the main difference being the way in which the stop solenoid operates. On the mains models the stop solenoid and the pinch solenoid (except for the 3292) have two windings. One consists of a few turns of thick wire and is supplied with a short, heavy current pulse to pull in the armature. The other winding consists of many turns of fine wire and is subsequently energised to hold in the solenoid. This arrangement avoids the need to pass a heavy current through the solenoid for any length of time. Even this system would not be really suitable for a portable machine however, as the power required to operate the stop solenoid under stop-start conditions would load the battery excessively.

The solution adopted with the 3V01 is to have a small solenoid with one winding and allow the inertia of the flywheel to do the work! The flywheel rim is castellated, and when the stop solenoid operates the pivoted armature engages with the castellations. The flywheel rotation moves the armature at right-angles to its original direction of travel and operates the stop mechanism. Similar in fact to the autostop arrangement on many audio tape decks. Later portables use a permanent magnet as a hold for the solenoids.

The Pinch Roller

The pinch roller is another very important part. It consists of a rubber covered brass tube with a tiny ballrace within. The circumference is ground to extremely fine tolerances. Fig. 3 shows the way in which the pinch roller is attached to a steel pin mounted on the pinch roller lever. The loading mechanism moves this lever almost into position, the final movement being provided by the solenoid. Except, that is, for the 3292: this model has no pinch roller solenoid, the roller being moved fully into position by the mechanism, the pause key pulling it back against a spring.

Routine Maintenance

Most of the components mentioned here form part of the regular maintenance schedule. All the belts should be removed and cleaned and if necessary replaced. Clean the pinch roller (it's safer to remove it first). Don't use any downward pressure when removing or replacing the pinch roller screw – the lever is easily bent and this can give rise to all sorts of problems. Clean all the pulley surfaces, paying special attention to the brass part of the relay pulley – this seems to have a greater affinity for belt material! To remove the capstan belt it will of course have been necessary to remove the lower bearing strap or plate. This will enable you to remove the capstan assembly – take care that the oil fence doesn't get mislaid.

Clean the capstan spindle and apply *one* drop of oil near the bottom. You'll have to clean it again after replacing it, in case any oil has been picked up during its passage through the bearing. On the 3V16 you'll also have

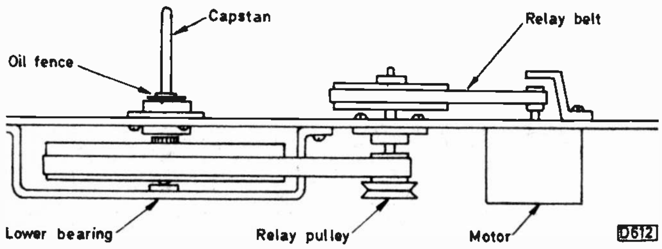


Fig. 1: The capstan drive system.

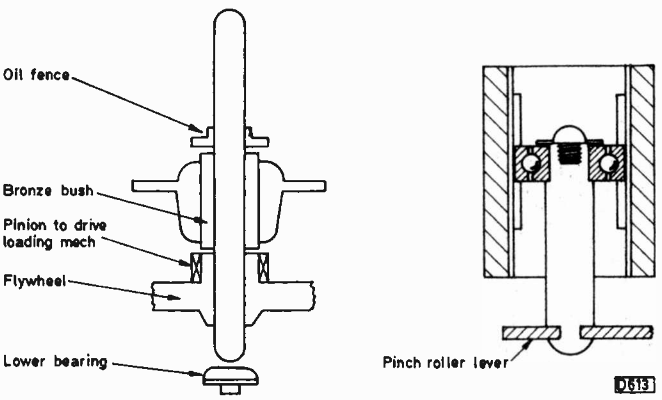


Fig. 2 (left): The capstan (Model 3292 differs).
Fig. 3 (right): The pinch roller.

Fig. 4: Different relay pulleys.

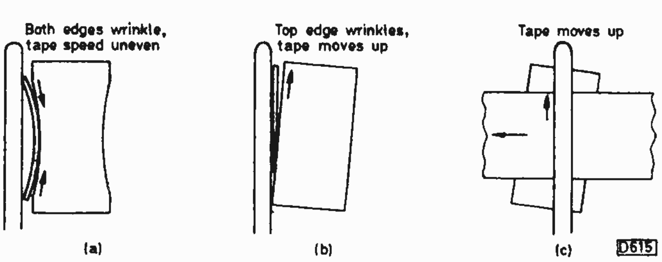


Fig. 5: Pinch roller problems (exaggerated).

to centre the tacho PCB. There's a special tool for this, but if you align it visually with the recess in the flywheel you won't be far out.

Don't oil the relay pulley or pinch roller: as the races are sealed, this would be a complete waste of time.

Problems

The capstan motor will need replacement at some time during the life of the machine. This is less critical on the non-freeze frame models, but as the upper bearing is exposed it has a tendency to gather dust and become noisy or seize up. This can usually be repaired – see our previous series on electric motors. The correct motor must be fitted on the 3V16 – some motors that appear to be identical physically will give poor performance in the slow-motion and still modes. This can be a baffling fault: it's due to the motor armature being too heavy. The still and slow modes rely upon the tape being moved in several increments until a control pulse reaches a set position, the drive being determined by the pulse. The wrong motor makes it impossible to achieve this.

One curious fault is caused by the oil fence not being pushed right down. If it's high enough to contact the tape the servos will go berserk! When refurbishing a second-hand machine search for this little part if it's not in place – it can end up in some unlikely spots to cause trouble.

The relay pulley can be forgotten unless the bearings become noisy – in this event replacement is the only cure. There are two types of relay pulley (see Fig. 4) as the belt arrangement in the Mk. III deck is different.

The capstan can be bent as a result of rough handling. Observation while running will show this up. A more common result of dropping the machine is that the lower bearing strap is bent by the weight of the flywheel. As a result the pulses from the pickup head will be intermittent or absent. Don't forget that these heads can develop an intermittent open-circuit.

The capstan bearing occasionally becomes dry, causing tape flutter.

Pinch Roller Troubles

The worst part of this show is the pinch roller, though it's only fair to say that the problems are generally due to mishandling. These problems are of three types: misalignment in either the plane of tape travel or at right angles to it, and wear.

We'll consider wear first. The tape wears the roller which eventually develops a cotton-reel shape – see Fig. 5(a). As a result the edges of the tape are pushed together, causing wrinkling of the edges. This in turn modulates the control pulses with the "wrinkle frequency", typically about 0·5Hz, giving horizontal movement of the picture. Diagnosis is by laying the roller on a flat, opaque surface, or better still a mirror. No daylight should show through. Once again replacement is the only cure.

Fig. 5(b) and (c) show what happens when the pinch wheel lever gets bent. The 3292 doesn't suffer much in this respect as the lever is cast rather than being a steel pressing. Both planes of bending have a similar effect and make the tape travel up or downhill. The condition shown in Fig. 5(b) can be checked by pushing the roller towards the capstan and looking for daylight when they are in light contact. Straighten the lever carefully by hand. This type of misalignment tends to wrinkle the tape by attempting to drive one edge faster than the other. If the pinch roller leans in the direction of tape travel – Fig. 5(c) – the tape will tend to move up or down. This effect is obvious when the back tension pole is pulled back, relieving the back tension – this is the pole on the left of the deck, attached to a lever with a brake band at its end. With no back tension there should be no perceptible movement of the tape up or downwards for say ten seconds.

The Pinch Solenoid

The pinch solenoid is relatively trouble free. Don't oil it as this will eventually cause sticking, as will any spillage that penetrates the mechanism here. The long lever that moves the solenoid is especially prone to this due to its great area of contact with the baseplate. Sluggish solenoid action (a pause before it engages) can sometimes be traced to an intermittent after-loading switch. This is the rearmost of the two microswitches near the solenoid.

Next month we'll be looking at the loading mechanism.

Letters

VINTAGE RENTALS

I must correct an error in your March leader. You state "the rental company's sets were its trade stock so no purchase tax was involved". This was not so. I was in the TV rental business and we had to pay P.T. when we bought the sets.

Northampton was a fringe area, and the cheap Sobell and similar sets were insensitive, lacked good flywheel sync and a.g.c. and were pretty poor performers. They were also not very reliable, proving once again that you get what you pay for!

Rental certainly made good sense for most people – we had 81 12in. GEC sets out on rent in 1953 and had to change 140 tubes in the first eighteen months. We then converted to Mullard tubes and had no further c.r.t. trouble.

When colour came along the most unreliable sets we had were the Bush ones which had an average fault rate of 16 times per annum, mainly due to faulty i.c.s. The KB sets were about the most reliable of the UK produced ones.

A big difference with the present day is the fact that in the fifties and early sixties one in every four sets we purchased had to be repaired before sale – we even had one set with a wire missing. Today's sets, which can be taken straight out of the box and plugged in without repair or adjustment, were then just a dream.

R.S. Turner,
Northampton.

INTERFERENCE TO VCRs

Many thanks to A.R. Lloyd of Plymouth for his observations on interference to VCRs. The main consideration in my article was with the more difficult to eradicate kinds of interference that emanate from r.f. sources such as radio amateurs, emergency services and broadcast transmitters. Radiation from TV receivers can indeed be removed by the simple expedient of placing an aluminium foil sheet beneath the set. Close off-air channel patterning can also be easily cured by shifting the r.f. converter's frequency – removal of the aerial lead from the VCR will provide a good clue.

These are fairly simple things to sort out and form the most common types of disturbance to the picture. When these basic and often effective cures fail to produce results more clues have to be sought and the covers have to come off. Interference to VCRs from radio transmitters is more common than many people realise – ask anyone who lives near Daventry, Brookman's Park, Droitwich or Moorside Edge! Field strengths of 60V/m are common within 500 yards of the masts.

Recent VCRs with metal bottom and top covers that overlap a good deal are much less affected by interference pick-up. I'm currently testing an RS Components RFI/EMI paint spray on earlier plastic-cased machines: the results have been very encouraging.

J. LeJeune,
Nottingham.

I think that A.R. Lloyd has been very lucky not to have had interference problems of the type described by J. LeJeune. I've a Ferguson 3V29 and an Hitachi TV set. The receiver can easily handle adjacent signals, e.g. Dover ch. 50 and Sudbury ch. 51. The nearest signal I have here to the VCR's output is Sudbury ch. 41, so I've no trouble with co-channel interference. Everything normally works well but I sometimes have interference on the picture in the playback mode. It looks rather like the s.w. interference we used to have in the fifties on sets with low i.f.s. Removing the aerial from the VCR usually stops the trouble. Connecting an earth to the VCR's metal base plate makes the trouble much worse.

Alex Clapton, B.Sc.,
Ipswich, Suffolk.

RECYCLING COMPONENTS

Many of your readers will like myself have rescued scrap logic boards full of 74Ls and linear chips. Removing these chips for reuse by conventional means, i.e. desoldering bolt and pump or desoldering braid, is well nigh impossible without damage or destruction of the items you're trying to save. Anyone with a hot-air type of paint-stripping gun might like to try the following method however. It works well even with double-sided boards. A word of warning though: before you start, make sure you're wearing a pair of safety spectacles – solder splashes are a real hazard.

Mount the scrap board vertically in a vice so that you have access to both sides – a "Workmate" type bench is ideal for this. Grip the chip by its ends with a pair of vice grips or similar and heat the print side of the board with the gun. Don't put too hard a grip on the i.c., and give the heat time to melt the solder. Gently rock the grips: when the solder has melted the chip will come away from the board with very little effort. The first chip will take an interminable time to come free, but if the next one you decide to remove has received some of the heat used on the previous one the time taken will be considerably reduced.

After a few chips have been removed the "something for nothing" urge will take over and you won't be content until you're faced with a bare board. Use a low-wattage soldering iron to remove any bits of PCB tracks left on the chips, and straighten up the legs.

The heat from the gun doesn't seem to affect the chips adversely. I've found that over ninety per cent of the devices removed in this way have been o.k. The other ten per cent are usually damaged physically by over-zealous application of the vice grips.

Happy junking!

Alastair J. Downs,
Edinburgh.

MAINS ISOLATION FOR MONITORS

In your March issue P.J. Dinning contributed an article on using opto-isolators to overcome the problems of mains isolation when converting a commercial CTV set to a cheap RGB data monitor. The article was a follow-up to my earlier one in the August 1986 issue.

I'm in full agreement with P.J. Dinning that picofarads are present between the primary and secondary windings of a mains transformer and that data corruption can occur when fast transients are present on the mains supply. When considering what form of mains isolation to adopt, i.e. opto or inductive, I gave careful thought to the physical fixing arrangements and the need to maintain a high standard of wiring, bearing in mind that many commercial CTV chassis use a bridge rectifier across the mains input and are at half-mains potential with a very low input impedance. The use of a suitably rated transformer for isolation, with correct earthing to ground physical, must be regarded as an extremely safe method and good practice.

C.R.T. flashover would be less likely to cause data corruption if a low-impedance discharge path is correctly wired to ground physical.

Regarding expense, I've seen suitable transformers advertised recently in the magazine for less than £20 – approximately the equivalent of four suitable opto-isolators and discrete components. Whether a 500VA rated transformer is necessary depends on the power supply used in the chassis to be modified. When a switch-mode circuit is used it may not be necessary to use additional mains isolation. This would have to be looked at very carefully.

I'm pleased to see your readers being given several options for modifying older types of chassis – all methods have their pros and cons.

Brian Webb,
Havant, Hants.

EXCLUSIVE AGENCIES

I thought the bad old days of exclusive agencies were over – but I was wrong. Needing a special component for a CVC801 I sent my order on headed notepaper with a cheque to ITT Consumer Products Ltd. Back it came with a letter to say that they could supply spares only to agency accounts and invited me to order through my nearest agent ten miles away. I've obtained spares without any problems from almost every other TV manufacturer – British, German and Japanese. If they can all do it, I wonder what makes ITT different? The irony is that the firm I was asked to order from now employs no qualified TV engineers – it puts its repair work out to independent engineers like me!

L.P. Watkinson,
Telesonic Services, Holsworthy, Devon.

SONY FAULT FINDING GUIDES

In your reference to the Sony Fault Finding Guides in the March issue (Teletopics) you say that the books have been based on our spares computer records. This is incorrect and I feel could be misleading to any engineer considering the purchase of these guides. The information has been amassed from service repair data gathered from our Service Centres throughout the UK and Europe. As a result we've found that the information presented gives a very high statistical probability of correct fault location. Finally the guides are available from our Spare Parts department at Thatcham, not the Service Department.

Mike Nicholls, Technical Publications,
Sony (UK) Ltd., National Operations Centre,
Pipers Way, Thatcham, Newbury, Berks RG13 4LZ.

THE FIDELITY CTV14

Having just read Les Lawry-Johns' comments on the Fidelity CTV14 in your March issue I feel compelled to write in. I've encountered Fidelity sets on only three occasions, my experiences being briefly as follows.

In the first set the line output transformer and chopper transistor were short-circuit. When these were replaced the result was an e.h.t. flashover to the scan coils via a pinhole in the glass beneath the coils. The tube had obviously caused the fault which had by now blown several expensive chips, transistors, etc. Set written off.

Defective line output transformer insulation in the second set caused corona discharge and tripping. The customer decided to buy a new set as he was unwilling to pay for a new transformer.

In the third set the line output stage tuning capacitor was open-circuit (split open). The result was excessive e.h.t. and flashover to the scan coils, as a result of which the following went short-circuit: the line output transistor, the chopper transistor, the field, sound and i.f. chips . . . etc. The set was just out of guarantee and was written off.

A sorry tale of woe.

M.J. Darby,
Coventry.

VINTAGE MAINS SUPPLIES

Chas E. Miller's article on vintage mains supplies (March issue) took me back to the thirties era of radio. Major setmakers supplied models for odd supplies, with 25 and 100Hz transformers. I believe some went to places where collieries supplied the power. Most d.c. supplies seemed to be of the three-wire type – the third wire gave half voltage. I worked in Aldershot, Hants where we had a 220V d.c. supply for lighting, but our rotary converter for accumulator charging had a 415V d.c. input, 7·5V d.c. output. A.C. sets were run on d.c. to a.c. converters. These were motor-generators, a popular version being the electro-dynamic type. This was a portable, rubber-mounted, steel-cased unit. It was quiet and efficient.

A stock fault with mixed supplied was a burnt out mains transformer due to d.c. being applied. My home town, Windsor, was also d.c. then. This reminds me of an occasion in the Castle's furniture stores. A large radiogram owned by the late Duke was abused in this way by workmen hoping to get the racing results.

Younger readers may think that a live chassis is peculiar to TV sets. Not so. It was found with a.c./d.c. radio sets in the UK in the mid-thirties. The sets of the day were unfused, had single-pole mains switches and were fed from bi-pin plugs. It was usual for an earth and an outside aerial to be connected – no ferrite rods then. The earth sockets on these sets were a hazard on a.c. supplies. Isolated by means of an 0·1μF capacitor they could pack a punch. I once took a junior out on a call and remember him saying "this earth's no good" as he withdrew the rod from the soil. His yells as the a.c. shook him belied his comment. Even then we suffered from the Wally, with earth leads being taken to meat skewers in flower pots.

Other ancients will remember the Ferranti chassis with i.f. trimmer screws at the rear, irresistable to handymen. Later on came the radio with a heater ballast mains lead which would be shortened by smart-arse types, thus destroying the valve chain.

My experience with vibrators was only in early car radios, where the hash could drown out weak signals. But just before McMichael became Sobell I had the chore of minimising hash in a radio for the technical director's yacht. I learnt a little about earth loops.

William Harrison,
Windsor, Berks.

PUSH-BUTTON TUNER WANTED

Can any reader supply me with a push-button tuner in good condition for a GEC 2040/2041 colour TV set?

Mike Mills, 34 Garton Road,
Sydenham, London SE26 5HD.

Rapid TV Fault Diagnosis

George Wilding

Three factors contribute to rapid TV fault diagnosis. First, an assessment of the probable cause prior to making any tests. Secondly, meter tests designed to pinpoint the faulty stage. Thirdly, checks to eliminate as quickly as possible all likely defective components.

Transistor Defects

So far as transistors are concerned line and RGB output types exhibit by far the greatest incidence of complete junction breakdown. With RGB output transistors tube flashover is the most common cause of failure, giving the loss of one colour symptom. Largely due to the lower working and flyback voltages involved, field output transistors have a much better service record. After some years of service the high-voltage and/or high-current transistors used as series regulators or electronic filters can develop increased collector-base leakage, the result being a hum bar. When there's no output from a discrete transistor i.f. strip the first thing to do is to check whether a gated a.g.c. amplifier transistor is used and if so to test this item. Such transistors have a much higher incidence of breakdown than those used for signal amplification: the usual result when they break down is that the controlled transistors are driven to saturation.

Resistor Troubles

Resistors which have values in the Megohm range and are used to pass a constant current tend to increase in value after some years of service. Those particularly at risk are ones used in the tube's first anode and focus supply circuits. Low to medium value resistors can rapidly fall in value, especially when subjected to even a short-term overload. They will continue to fall in value after the overload has been removed, so if you are at all suspicious check the resistance value.

Lack of Brightness

Inability to obtain normal, full brightness, assuming that the beam limiter is not misadjusted of faulty, is commonly the result of an increased value resistor in the feed to the tube's first anode(s). Where the brightness control range is restricted in either direction or the brightness varies spasmodically it pays first to check any zener diode used to set the d.c. brightness level.

No EHT

Now for an example of rapid fault diagnosis, taking that most common of complaints no line output/e.h.t. If all the power rails are intact, no fuses have blown and no trip has operated, the cause is either a non-operational line output transistor or loss of line drive. The great majority of sets today use an i.c. to generate the line drive, followed by a driver transistor which is transformer coupled to the line output transistor. Thus barring print disconnections or socket troubles, and the very rare incidence of line driver transformer breakdown, the cause of the fault is likely to be either an inoperative chip, a defective line driver transistor or an output transistor with an open-circuit junction or a short-circuit base-emitter junction – a collector-base or collector-emitter short-circuit would have blown a fuse of course.

The output transistor is the main probability, but as checking it could involve removal of an e.h.t. cage before unsoldering either the base or emitter connection it's generally quicker to eliminate the other suspects. To check the i.c. implies reference to the service manual for relevant pin connections and voltages, while a check of the driver transistor can consist of either voltage measurements or resistance checks across the junctions. All three procedures are time consuming. It's much better to go for direct evidence of line drive, i.e. dynamic testing. In this respect a digital multimeter is particularly useful since most have a.c. voltage ranges that extend to approaching line frequency with only a relatively small fall-off in reading. Being calibrated for sineware r.m.s. values their response to what is essentially a rectangular pulse waveform will naturally be greatly reduced. But all we want is firm evidence of the presence of a waveform – instances of low drive amplitude are rare.

Test probe application to the collector of the driver transistor is naturally the first step to take. If the drive is found to be present, removing the e.h.t. cage and delving into the line output stage will not be a waste of time and effort. If there's no drive at the collector but there's drive at the base then clearly the driver stage is at fault. If there's no base drive there's either no output from the line oscillator chip or a short-circuit across the driver transistor's input, the most likely cause of the latter being a base-emitter short-circuit in the transistor itself.

In total then two or three quick tests should localise the cause of the fault.

Field Collapse

Another very common TV fault is no field scan. In many sets most of the field timebase circuitry is contained in a single i.c. The majority however use a multi-stage discrete circuit, which means that the first essential is to pinpoint the defective stage. Now while digital multimeters tend to have greater sensitivity and always have a much higher input impedance, moving-coil types can be almost equally useful for showing that a sawtooth waveform is present, though once again the values recorded will be only a fraction of the actual peak-peak amplitudes. The point however is that by using meter tests to identify the faulty stage the usual voltage and resistance tests are reduced to a minimum. Dynamic testing is particularly useful in view of the d.c. coupling frequently used in discrete field timebase circuits.

Other Field Faults

Severe field non-linearity, especially towards the bottom of the scan and tending to get worse as the temperature rises, is commonly caused by excessive collector-base leakage in the output transistors. If the non-linearity is fairly static and has increased gradually over a period of time a partially dried up coupling or decoupling capacitor could well be the cause. Large capacitance loss in a coupling capacitor can be detected with a meter by noting the wide disparity between the input/output waveform amplitudes. In the case of a decoupling capacitor loss of value will be revealed by the excessive amount of signal developed across the capacitor.

Even slight leakage in a base coupling electrolytic capacitor can have a major effect on the d.c. biasing of the driven transistor, again producing severe non-linearity.

Though erratic variations in height and/or linearity are often caused by presets with dirty tracks or poor slider contact, ageing electrolytics can cause similar symptoms. Excessive height with bad linearily is invariably due to an open-circuit component or a disconnection in a negative feedback loop. Should panel tapping have no effect it pays to turn the linearity presets from end to end to show up possible hairline cracks and indicate the defective feedback loop.

Weak or non-existent field sync with a well locked line oscillator may well imply a fault in the field sync circuitry: it's often due to a high-value resistor used to bias the base of the sync separator however.

Using the Eurodecoder Panel

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

The *Television* low-cost teletext decoder project published in the December 1986 and January 1987 issues used a Mullard VM6101 module because of its low cost and ready availability. Another suitable module has since become available, the Eurodecoder panel used in the Philips KT3 and K30 chassis. You may be able to obtain this even more cheaply than the VM6101 (from Sendz Components and Manor Supplies). Its size is similar to that of the VM6101 and it fits in the box suggested for use with the low-cost teletext decoder project.

As with the VM6101 module, some preparation work has to be carried out on the KT3/K30 board before it can be used in the project. The modifications required are shown in Figs. 1 and 2. They are summarised below:

(1) Remove connector blocks V2, V3 and V4 to allow direct soldering to the PCB (unless you can get some connectors!).
(2) Reverse the polarity of C2002.
(3) Remove R3002.
(4) Short out or link our resistors R3021 and R3022.
(5) Connect the video input to connector V3 pins 1 and 2.
(6) Apply the power supplies required to connector V2, 12V to pin 1, 5V to pin 3 and chassis to pin 5.
(7) Wire the data control lines to connector V4 – DLIM to pin 4, /DATA to pin 3 and the chassis connection to pin 2.
(8) Using a scalpel, cut the tracks leading to pins 22, 23 and 24 of IC7043 (SAA5050). Solder flying leads directly to these pins to form the colour outputs. These are red to pin 24, green to pin 23 and blue to pin 22.
(9) Connect a flying lead to pin 5 of IC7041 (SAA5020).

This is the /AHS output.

The only other change required when a KT3/K30 panel is used instead of a VM6101 module is to the 8748 microcontroller chip's software (IC1 on the interface panel). The IBUS instructions are different, requiring changes to the look-up table inside the chip. This part is available, programmed, from VIP Ltd., 32 Charlton Lane, Cheltenham, Gloucestershire GL53 9DX – to order it, ask for an 8748/KT3 chip. The other items required for the project are also available from VIP Ltd. (for details see page 112 of the December 1986 issue).

The KT3/K30 teletext decoder boards come ready aligned (as does the VM6101). The two boards I've tried both worked without adjustment, although one was advertised as untested and required a new SAA5042 chip. An important point is that if the teletext decoder project doesn't work when first assembled don't start fault finding by making alignment adjustments on the decoder panel – it's almost certainly something else that's wrong.

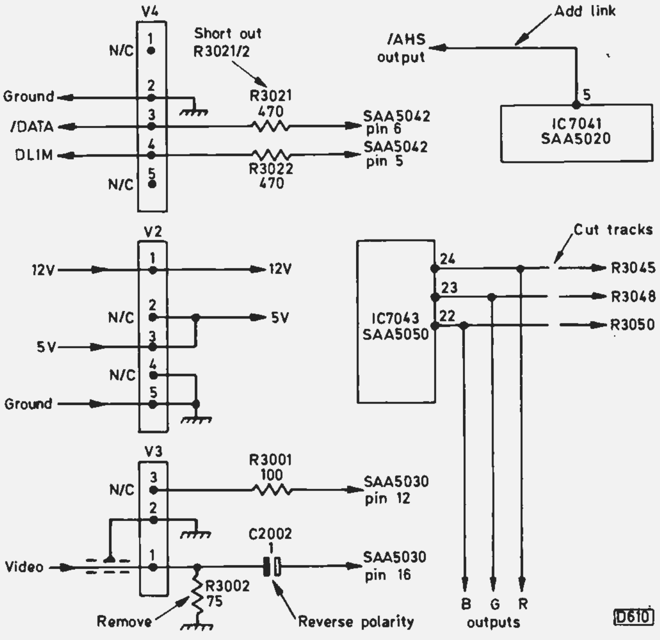


Fig. 1: Modifications to the Eurodecoder circuit.

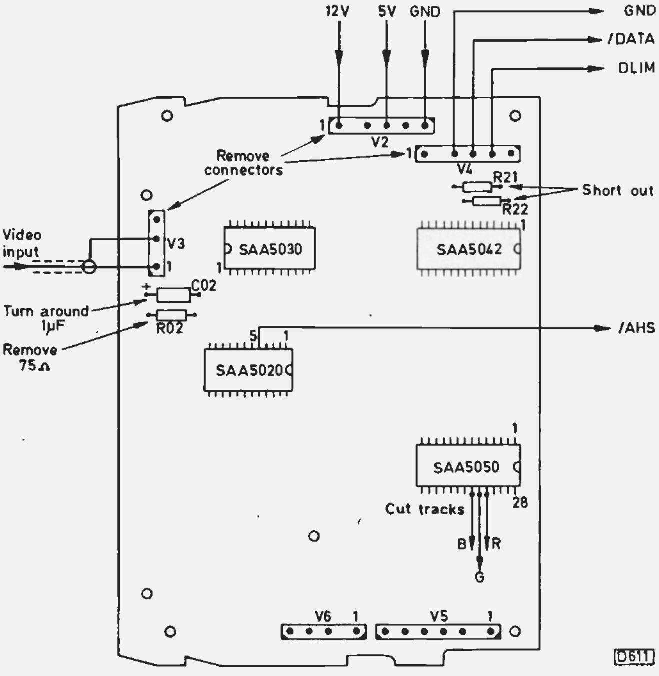


Fig. 2: Eurodecoder panel layout, showing modifications.

Servicing the Sharp VC9300

David Botto

The Sharp VC9300 VCR is a front-loading VHS machine with a wired four-function remote control unit. It was on sale during the 1982-3 video boom period and proved to be a best-seller. We've found it to be quite reliable.

A digital multimeter is essential for voltage measurements and a logic probe and component tester (see the June 1984 and November 1985 issues of *Television*) will save you a lot of stress and time – some oscilloscopes incorporate a component tester.

Access

Begin by removing the three screws at the back of the top cover and the one under the little panel that fits over the TV channel tuning controls. The top cover can then be lifted away to reveal the interior. A magnetic screwdriver will help to avoid the frustration that arises when searching the interior of the machine or the floor for dropped screws.

Looking into the machine you'll see the flat-mounted PWB-C Y/C PCB that handles the colour and luminance signals. After removing the two screws at the lower left and releasing the clip at the lower right the board can be lifted backwards on its hinges. A metal cover over the video heads is held by the same two screws. It's easy to forget to replace this cover: you may then experience problems with patterning.

At the front right, also laid flat, you'll find PCB PWB-U which contains the preset tuning controls. Beneath this panel there are two small PCBs which house the audio circuitry (PWB-B).

PWB-I which holds the tuner and i.f. amplifier is at the front right, mounted upright. The upright PWB-D panel behind it contains the mechanical switch circuitry.

The bottom metal cover plate comes away easily after removing three screws. The front panel can be taken off after unscrewing three more screws that hold the three lugs at the top of the front panel and releasing the clips at the bottom. Be careful not to lose the two felt pieces on the front slider switches: they tend to drop off, never to be seen again.

With the front panel removed you'll see to the right the PWB-T PCB which contains the clock circuitry and display, the tuner selector switches and LED indicators. It's held in place by a single gold-coloured screw and a top plastic clip – be careful, this clip breaks easily. The PWB-H operations circuit board is on the left.

The large PWB-A board at the bottom of the machine contains the mechanism control and servo circuitry. It can be released by removing the two gold screws near the front and two side plastic clips. After pulling out plug HA2 at the front of the board it will swing out by about 45°, allowing sufficient access for most purposes. The less you disturb the PCBs in this machine the better.

The Power Supply

It's not particularly easy to get at power supply board PBW-P. This board is enclosed in a metal box at the top rear of the machine, under a metal support bar that runs the length of the machine and to which the two plastic hinges that carry board PWB-C are fixed.

To gain access, first remove the little black screw above mains on-off switch S901, whilst viewing the VCR from the rear. Next unscrew the black screw just above the moulded indicator arrow to the left of the aerial (antenna) input socket. Finally unscrew the two big gold screws at the top of the metal support bar. The bar support and PCB can then be lifted away and the metal box undone so that PBW-P is revealed.

The power supply circuit is shown in Fig. 1. Most of it, anyway: there's an oscillator/rectifier circuit on board PWB-A to produce some additional voltage lines and the 13V line crowbar protection circuit is also on this board.

The mains supply is fed to connection points OB1 (neutral input) and OB3 (live input) on board PWB-O, then via fuse F901 and points K908/9 to connection points K902/3 on panel PWB-Z. K902/3 connect to the mains power switch S901, then to points K901/4. The Mylar mains filter capacitor C901 is connected across K901/4. Also on this board is a special 12MΩ carbon resistor, R901. The mains supply leaves board PWB-Z at K901/4, returning to board PWB-O at K910 and K907. After passing through the filter choke L901 the supply goes via OA4/6 to the primary winding of mains transformer T901.

T901's secondary winding supplies the chopper regulator board PWB-P at connections K9002 and K9012. One side of the supply is taken to the off-board fuse F9001 via K9011 and K9001. The supply is then fed to the bridge rectifier D9001 (part no. RHDX0008GEZZ) which develops about 34V across its reservoir capacitor C9003. The positive side of this d.c. supply goes to the emitter of chopper transistor Q9001. You'll recognise this as a standard series chopper circuit, with L9002 the inductive reservoir and D9003 the efficiency diode. The output from the choke is filtered by C9007/L9003/C9008. A regulated 13V supply is obtained at K9006.

IC9001 (μPC393C) contains two operational amplifiers. OP1 and the associated external components act as a 30kHz oscillator whose output, developed across C9912, is taken to the inverting input of OP2. This second operational amplifier acts as a pulse-width modulator, its non-inverting input (pin 3) being fed from the collector of the error detector transistor Q9004 which senses the chopper output voltage via zener diode D9006 and the potential divider network R9016/7/8. A variable mark-space ratio output whose on/off times depend on the voltage across C9007 thus appears at pin 1 of IC9001. This drives the base of the chopper transistor via Q9003 and Q9002.

At switch-on diode D9004 charges capacitors C9009/9010 to provide a start-up supply for the chopper control circuitry. Once the chopper gets going this part of the circuit is supplied via D9005.

Panel PWB-P also contains a conventional series regulator circuit which produces a stabilised 12V supply at K9008. Q9006 is the series regulator transistor and Q9007 the error amplifier. The circuit is switched on and off by Q9005/Q9008. The base of Q9008 is taken via K9004 to connector AE3 on the mechanism control panel PWB-A, where it goes to pin 33 of the 64-pin microcomputer chip IC801. When the on switch is pressed pin 33 of this i.c. goes high and the 12V line appears. During cassette unloading pin 33 goes low, switching off the 12V line. In the timer mode pin 33 goes high when the VCR begins to

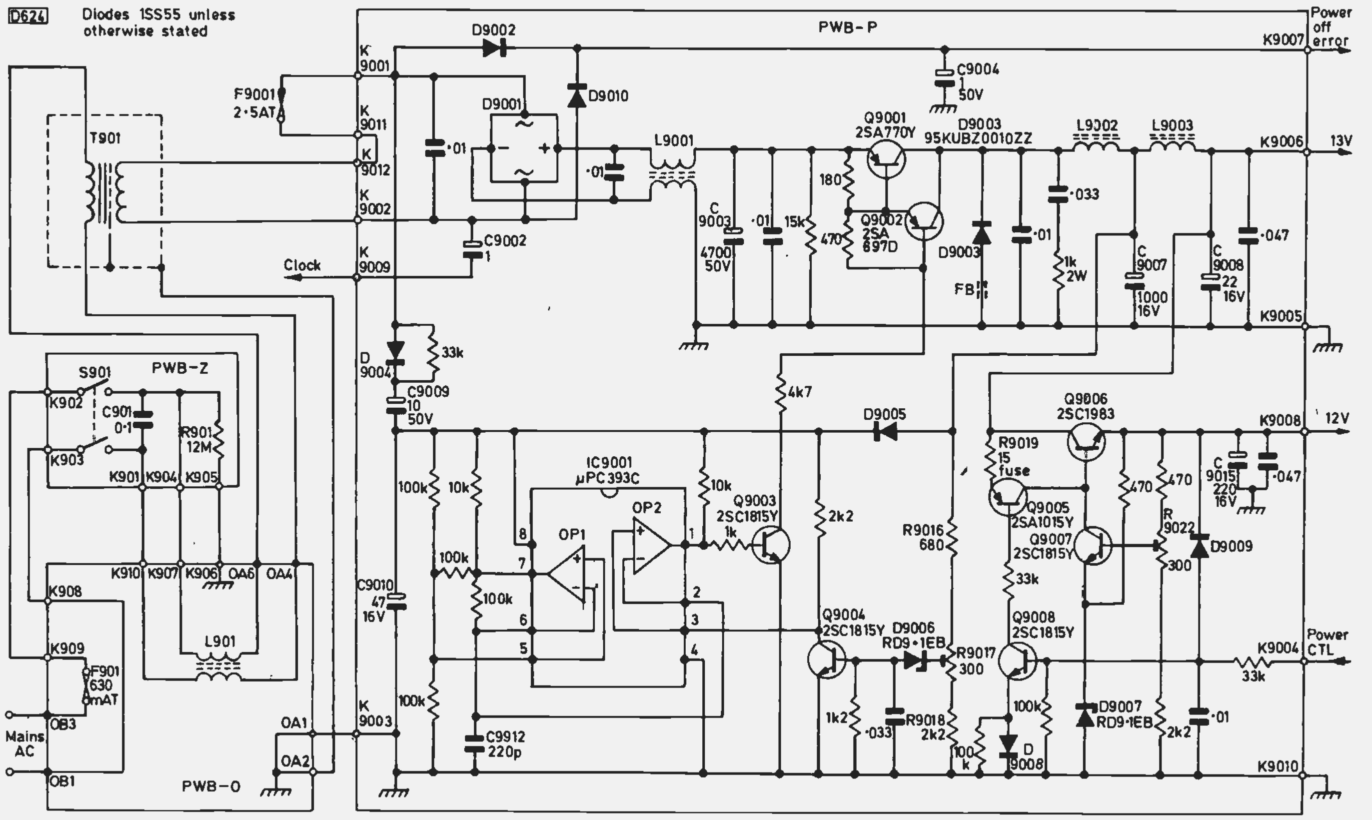


Fig. 1: The power supply circuit. A converter stage and a crowbar protection circuit are mounted on the mechacon panel.

record, establishing the 12V supply.

Diodes D9002 and D9010 develop across C9004 a positive d.c. voltage that goes via K9007 to connector AE5 on board PWB-A, providing a power-off error voltage.

C9002 feeds a 50Hz signal to K9009 to synchronise the timer clock with the a.c. mains supply. This signal goes to AE4 on the mechacon board and then follows a rather roundabout route before finally arriving at pin 3 of the timer microcomputer chip IC5001 on timer board PWB-T.

Power Supply Faults

The first step to take with a machine that shows no signs of life is to check fuses F901 and F9001. If one of these fuses has failed and it's not a nasty black colour the failure may simply be due to old age. If so, give the machine a four-hour test before returning it to the customer. If F9001 again blows after an hour or so, the machine functioning correctly after replacement of F9001, suspect an overload on the 13V line. The cause is probably a defective component in the power supply circuitry on panel PWB-A. Use your component tester to check, in the following order, zener diode D901 (RHEX0019GEZZ), thyristor Q903 (3P1M), C915 (2·2μF), C903 (4·7μF) and zener diode D902 (RHEX0045TAZZ). The two electrolytics can dry out and corrode.

The PWB-P power supply board is very reliable, which is just as well considering how difficult it is to get at it. But you can get problems. The best place to measure the output voltages from panel PWB-P is at pins 1-6 of connector AE. This connector is located at the rear of panel PWB-A (the mechacon board), next to fuse F902. Check for 13V at pin 1 and 12V at pin 2, using your digital voltmeter.

If the 13V supply is present but the 12V supply is missing, before you start to remove board PWB-P connect the positive supply clip of your logic probe to pin 1 of connector AE and the negative supply clip to pin 6, then check the logic level at pin 3. This should be high when the front panel "standby-on" control is pressed.

When you've established that there's a fault in the PWB-P board circuitry remove the board from its metal cover and place some insulating material between the board and the machine's chassis to prevent the print touching the chassis with the mains supply switched on. If fuse F9001 blows and turns black, start by checking the bridge rectifier D9001 for shorts.

Check the waveform at the collector of Q9003 (see Fig. 2) with a 10:1 probe. If it's missing, check transistors Q9003/4 and Q9001/2 in that order, then zener diode D9006 and diode D9005. If all seems to be in order but the oscillator circuit won't start up suspect the start-up capacitors C9009/C9010. One or other may have dried up. So far we've had no problems with IC9001.

Once you've dismantled board PWB-P and got it working it's a good idea to check the eight electrolytics for loss of capacitance and the few diodes and transistors for the slightest leakage. This takes only minutes with a component tester and could save you the frustration of having to dismantle the PWB-P board again within a week or two.

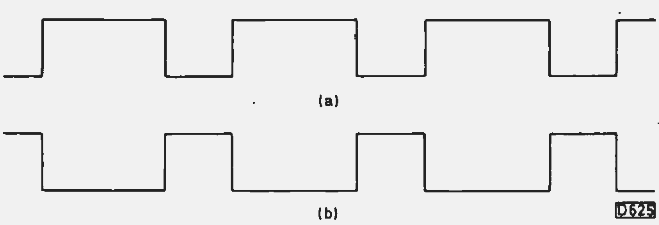


Fig. 2: Waveform at pin 1 of IC9001 (a) and at the collector of transistor Q9003 (b).

Before replacing board PWB-P in its metal box, first carefully set up the 13V line (R9017), then the 12V line (R9022), with the machine in the record mode. Recheck the voltages when the machine has been running for half an hour.

The Luminance/chroma Panel

Fortunately few faults seem to occur on the luminance/chroma panel PWB-C. The adjustments don't seem to drift, so don't disturb them unless it's absolutely essential. Before looking for obscure faults examine the printed circuit carefully for cracks or dry-joints where it's joined to the various socket connectors. Damage can occur when the panel is opened and swung back too quickly. Be sure to clean the video heads and the audio/control and full erase heads with a proper video head cleaning kit before making further tests.

A quick check is to play a colour-bar test tape with a scope connected, via a 10:1 probe of course, to test point TP308. Adjust the scope's timebase so that you can see the head 1 and 2 signals separately.

The signal at TP308 is fed via Q305 (2SC945), filter FL302 and the emitter-follower Q306 (2SC945) to pin 18 of IC501 (AN6360). This device can give trouble, either failing to function at all or causing various strange effects to appear on the picture. It has been used in VCRs of various makes. Before replacing it, make sure that its 11·6V supply is present at pin 5. If this supply is missing check L502 (220μH) for continuity or dry-joints.

If all is well with IC501 the luminance output will be present at pin 7. It passes to pin 15 of IC402 (HA11703) where it's combined with the chroma signal. You should see the complete video signal in the record, playback or E-to-E modes at TP402.

If you think that the a.p.c. adjustment (C517) is out don't be in a hurry to adjust it. First connect a 39kΩ resistor and an 0·01μF capacitor in parallel between TP503 (pin 13 of IC502, AN6371) and chassis and an 18kΩ resistor between TP501 (pin 9 of IC502) and chassis (TP504 and TP506 are convenient chassis points). Select the record mode, feed a colour-bar signal to the VCR and connect an accurate digital counter via a 10:1 probe between TP502 (junction of C521/R523) and chassis (TP504). The reading should be 4·433619MHz. If it's incorrect, adjust C517 gently to obtain the correct frequency.

As with most VCRs, problems occur due to small electrolytics on the board drying out and losing capacitance. A poor signal at TP402, yet with a good signal output from the r.f. output socket to the TV set, can be due to C431 (1,000μF, 16V) becoming almost open-circuit. The reverse occurs if C439 (100μF, 10V) dries out and fails and C431 is in order.

If a signal fed to the video input socket at the rear of the machine seems weak check C201 (100μF, 10V) for low capacitance and/or leakage. Before condemning IC501, check C509 (47μF, 16V) and C502 (1μF, 50V).

These small electrolytics on board PWB-C are less liable to dry out than on earlier TV sets and VCRs. But if you've a puzzling fault on this board it takes only minutes to check all the small electrolytics with a component tester.

Table 1: IC801 logic level checks

Pin	*Function*	*Condition*				
		Tape stopped	*Play*	*Record*	*FF*	*Reverse*
1	Supply brake strong	L	L	L	L	L
2	Supply brake medium	L	L	L	L	L
3	Supply brake weak	L	L	L	H	L
4	Take-up brake strong	L	L	L	L	L
5	Take-up brake medium	L	L	L	L	L
6	Take-up brake weak	L	L	L	L	H
10	Fast forward LED	L	L	L	H	L
11	Rewind LED	L	L	L	L	H
12	Dub LED	L	L	L	L	L
13	Record LED	L	L	H	L	L
14	Playback LED	L	H	L	L	L
15	Pause LED (high in pause)	L	L	L	L	L
16/7	End/start sensors	L + P in all above modes				
18	Sensor stop input	H	L	L	L	L
19	Dew sensor input	L in all modes with no moisture				
20	Timer rec. indicator input	L in all modes when not on timer				
21	Timer CTL input	L in all modes when not on timer				
22	Timer rec. output	L in all modes when not on timer				
23	AL output	L	H	H	L	L
29	Oscillator	H + P on all functions				
33	Power CTL	H	H	H	H	H
34	Dew indicator output	L when normal				
35	AV mute output	L	H	L	–	L
36	DM mute	H	L	L	–	H
37	Drum rotation sensor	H	*	*	H	H
38	Reel sensor input	H	†	H	*	*
44	Sleep input	L	L	L	L	L
45	Camera remote control input	L	L	L	L	L
54	Reel motor UL/swing	L	L	L	L	L
55	Reel motor play/rec.	L	H	H	L	L
59	Reel motor VS	L	L	L	L	L
60	Reel motor FF/rew.	L	‡	‡	H	H
61	Motor reverse	L	L	L	L	H
62	LDM CTL	L	L	H	L	L
63	Cap mute	H	L	L	H	H
64	Cass. M.CTL	L	L	L	L	L

* H + P + L
† H + P + L very slow
‡ L + P momentary
Pins 24, 26, 27 and 28 are connected to chassis.
Pins 31 and 32 are at 10V.
Pins 42, 43, 46-49 are the AD0-5 lines, L + P in all modes.
Pins 50-53 are the KE0-3 inputs, L + P in all modes.
Pins 7-9, 25, 30, 39-41 and 56-58 not connected.

Function Faults

A dirty or faulty reel idler assembly (part no. NIDL0005GEZZ) and/or reel motor (part no. RMOTV1008GEZZ) can cause the following problems: no or poor rewind or fast forward; the machine going into the stop mode intermittently; the tape not going back into the cassette when stop is selected; tape spilling out during playback.

To clean or replace the reel idler assembly and if necessary replace the reel motor the cassette housing has to be removed. Remove the four little red-gold screws at the sides of the housing and the two larger black screws in front, gently unplug the connector at the left and lift the housing clear. Clean the reel idler assembly and the entire tape path mechanism. If this doesn't provide a cure you may need to fit a new idler assembly or the fault may be due to the reel motor sticking or having a dead spot. It's sensible to replace the reel idler assembly when fitting a new motor.

To fit a new reel motor remove the cassette down switch and holder – two metal screws only – to reveal a little metal bracket and the two small screws that hold the reel motor (see Fig. 3). A small coiled spring has to be unhooked: it easily flies off into the unknown, so be careful not to lose it! Swing back the PWB-A mechacon panel and the reel motor can be replaced. Note that the fault can sometimes be due to the plastic sleeve on the motor shaft riding up.

All sorts of strange and apparently complex function faults, such as tape stopping and starting or some functions not working properly or at all, can be caused by the cassette down switch (part no. QSWK0008GEZZ) and/or the little slide switch (part no. QSWS0032GEZZ) sticking or making no or poor contact. It's good sense to clean and check these switches whenever you've a function fault or a machine comes in for service. They've even been known to break in half. This could save you hours of time and worry as you try in vain to find a fault in the circuitry!

Other faults such as fast forward or rewind slow or no rewind at all can be due to relay RY7751 (part no. RRLYZ0016GEZZ) sticking or failing. The associated transistor Q7754 (2SD882) likes to leak or go open-circuit, sometimes intermittently, giving similar symptoms. These two components are on the PWB-A mechacon panel.

The trip counter can be responsible for intermittent stopping due to a worn gear – the take-up reel drives the motion detector via a belt, with a further belt driving the counter from the detector. As a check, reset the counter then test the machine. If it always stops at a certain number the trip counter is responsible – as a further check remove the counter belt.

The Converter Stage

As previously mentioned there's a converter stage on the mechacon panel (PWB-A). This consists of an oscillator and several rectifier diodes. The transformer T902 (part no. RTRNH0015GEZZ) provides anti-phase 2V a.c. outputs and feeds three rectifiers. D903 (1SS81) develops −20V across C907 (47μF, 150V). This supply is fed via connector AD7 to connector TB3 on timer/channel selector board PWB-T. D904 (1SS81) develops 10V across C908 (220μF, 25V) which goes via AD8 to TB4 on board PWB-T and via AF3 to MA9 on the cassette unit. This supply is also used on the PWB-A board itself, including pin 32 of the microcomputer chip IC801 (RHIX0074GEZZ). D905's (DX0126CE) output is developed across C909 (47μF, 100V) and fed via R908 (2·7kΩ, 2W safety) to connection AC1 where 50V should be recorded. This supply goes to UC2 on board PWB-U. The 2V a.c. feeds go via AD3 and AD4 to TB1/2 on board PWB-T, finally arriving at pins 20 and 38 of the clock display. When choke L902 (100μH) goes open-circuit, as it sometimes does, all these voltages disappear. The reservoir capacitors C907/8/9 can dry out and lose capacitance. The rest of the circuitry around transformer T902 has so far proved to be extremely reliable.

System Control Checks

The easiest way to check the system control circuitry is to use a logic probe. First ensure that all the d.c. supply voltages are present then, with the mains supply disconnected, carefully solder two half-inch lengths of bare wire to pins 32 (Vss +) and 28 (Vdd) of IC801. Connect the probe's positive supply lead to pin 32 and the negative supply lead to pin 28.

First check that an H + P logic signal is present at pin 29 (oscillator) of IC801. Then monitor the various pin levels (see Table 1). If no indication whatever is obtained at a pin that should show a logic level the connection within IC801 has failed. Should this occur, heating and freezing may sometimes temporarily restore IC801 to a working

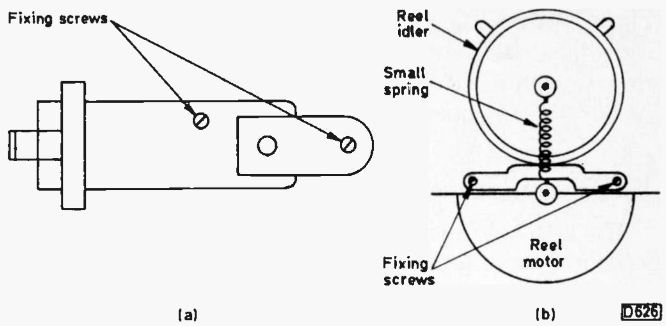


Fig. 3: Sketch of the cassette down switch, viewed from the top, (a). Sketch of the reel idler and motor viewed from the top with the cassette carriage removed (b).

condition. A connection like this can be the cause of intermittent results. When you're reasonably sure that IC801 is defective, carefully desolder and remove it, trying not to damage the device. Now fit a 64-pin i.c. socket. This gives you two advantages. If the original i.c. proves not to be faulty after all you can put it back again, and if the new one fails some time it's easily replaced.

IC803 (STA401), IC802 (IR3403) and IC804 (IR2403) are logic inverter i.c.s that can, on rare occasions, fail. Usually one output only goes open-circuit. If this happens just one function may cease or the whole system may stop. These chips are simple to check – the logic level output from each inverter should be opposite to that at its input. Don't forget to transfer the positive supply clip of your logic probe to the positive line supplying these inverter chips. If you suspect an overload in the circuitry desolder the output pins of each inverter temporarily.

We've had not problems with any of the other chips on board PWB-A.

The cassette lamp should be replaced if it has seen a fair amount of service. If you don't it's sure to fail shortly afterwards, preventing the machine from functioning.

The adjustments on board PWB-A usually don't drift. If you have any suspicions, check the small electrolytics on the board for leakage and loss of capacitance and examine the board carefully for dry-joints before wielding your small trimmer tool.

Other Boards

The PWB-T board and the associated PWB-U board contain the clock display, timer, channel selector and tuning circuitry.

If the clock circuitry functions incorrectly or not at all, the first thing to check is that the voltages at connector TB are present and correct. These include the 2V a.c. supplies at TB1/2 which feed connections 20 and 38 of the clock display. If this a.c. supply is missing look for a dry-joint around one of the connecting sockets en route from board PWB-A. Don't overlook the 50Hz synchronising signal at TB7 – if all is well the digital multimeter reading here should be about 14·17V a.c. If it's not, suspect C9002 on board PWB-P. IC5001 (MP2812S) seldom gives trouble: before condemning it check the three transistors on the board – Q5001/3 (both 2SA733) and Q5002 (2SC945).

The channel selector switches sometimes become noisy and unreliable. The only satisfactory cure is replacement.

If the VCR doesn't erase previous recordings properly or at all in the record mode carry out a scope check, via your 10:1 probe, at TP601 (pin 8 of connector BB) on the PWB-B-1 audio board. A nice sinewave should be present here. If not, check R626 (10Ω fusible), L602 (1mH) and

Q604 (2SC496) in that order.

Perhaps we've been fortunate, but we've never had trouble with the PWB-D fine still/mechanical switch board or the PWB-H operation circuit board.

In Conclusion

If a new belt is required it's best to fit a complete set of belts to ensure future reliability. Avoid unnecessary complications by using the correct Sharp spares and recommended transistors which are readily available from Willow Vale Electronics Ltd. (11 Arkwright Road, Reading, Berks RG2 0LU, telephone 0734 876 444). They can also supply service manuals.

Before finally assembling the machine ensure that all the connecting leads are neatly tucked into their correct positions and that you've not forgotten to replace any of the small screws you may have removed during servicing.

You may come across a version known as Model VC9300E, which persons unknown sometimes bring into this country. It operates on a wide range of a.c. voltages from 95V to 250V and has an entirely different switch-mode power supply to the one described earlier. At the front there's a PAL/SECAM switch. The machine is not designed for use in the UK but it's possible, if you like a challenge, to remove the crystal filters in the sound i.f. circuit (board PBW-I) and replace them with the correct UK types. You'll then have to retune the circuitry a little.

Faults in CCTV Systems

Part 3

Peter Graves

This is the concluding instalment in a three-part series that deals with some of the less common faults you might find with closed-circuit TV systems.

Flats' Surveillance System

Two cameras were installed at a block of flats, one in a weatherproof housing to look at the door entry panel with the bell buttons and entry phone for each flat, the other inside to look at the lift area. The video signals from the cameras were fed to modulators feeding the communal aerial distribution system. The residents could tune in to either picture on their domestic sets to see who was calling them from the door or to look for trouble taking place in the lift area. Both cameras were reported to be faulty, with no picture from either of them.

The engineer looked at the outside camera first. It had a separate power supply which was installed in a cupboard on the third floor: this power supply was connected to the rest of the camera in the external housing via a multicore cable. When the cupboard door was opened it was found that the power supply had been switched off. Switching it on produced a satisfactory picture on a local monitor. The camera in the lift lobby was self-contained, so the engineer went downstairs to look at it. This was an even easier "fault" to find – the camera had been stolen!

Misleading Voltage

The report on an unfamiliar, low-voltage camera was that it produced "no picture". When the engineer arrived on site he found that the monitor was showing a blank, unlocked raster. The camera cable – a thin multicore containing two coaxial links, one for video and one for sound, plus two cores for power – plugged into the rear of the monitor. As a first step the cable connector's shell was removed: 12V d.c. was measured across the power pins at the monitor end.

The camera was mounted some distance away. When it was removed from its housing the 12V supply at the end of the cable was found to be missing. The continuity of the vision coaxial link was checked by measuring the resistance across it. This was about 85Ω, i.e. the 75Ω terminating resistor in the monitor plus the resistance of the cable in series with it. So it seemed that the cable hadn't been cut. The screens of the coaxial links and the power common lead were found to be joined together at both ends of the cable.

From the engineer's point of view the system appeared to be as shown in Fig. 1, with the fault an open-circuit power lead. It was impractical to replace the whole cable: it was inspected visually as far as possible but no damage was found. The engineer decided to remove the unused audio lead from the existing pins and connect the inner core and the screen together at the power pin to replace the "broken" power lead. Fortunately he measured between the power supply and the common lead at the monitor end before switching the system on again. There was now a short-circuit between the power and common leads even though both ends of the cable were still disconnected. This short-circuit was of such a low resistance that it had to be near the monitor end of the cable.

The cable was carefully followed back. A few feet away, concealed behind some other equipment, the engineer found an auxiliary power supply which was in line with the camera cable. Fig. 2 shows the actual arrangement. This auxiliary power unit supplied the camera, the 12V at the monitor plug being a red herring – it didn't go anywhere. Only the video coaxial cable was being used between the monitor and the power supply, the rest of the cores being redundant. The screens of the video and audio coaxial links were commoned within the auxiliary power supply.

The engineer found to his horror that the auxiliary power supply had been switched off, which completely explained the original fault. The sound links were reconnected to their original pins and when the auxiliary supply was switched on the picture was immediately restored. Three hours had been spent looking for a "fault" caused by someone accidentally switching the auxiliary power supply off. It shows how easily one can be misled when details of the installation are not available.

Furnace Installation

Each furnace in a coal-fired power station was split into two sections vertically. Each half had a furnace-viewing camera, in an air-and-water cooled housing, to look at the burners on the opposite wall. The cameras were of the separate head type, i.e. the camera head contained the lens, scan coils, head amplifier and part of the scan circuit, the rest of the camera circuitry being rack-mounted under

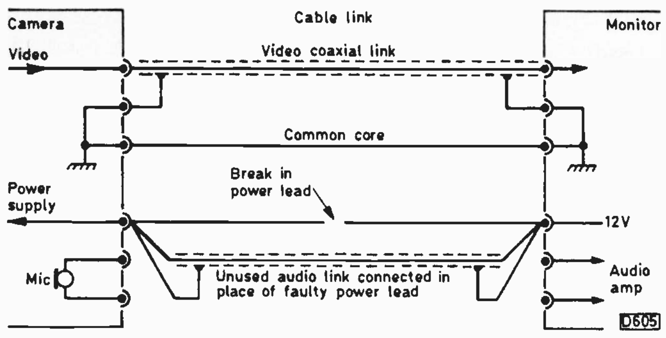


Fig. 1: How the system appeared to be connected.

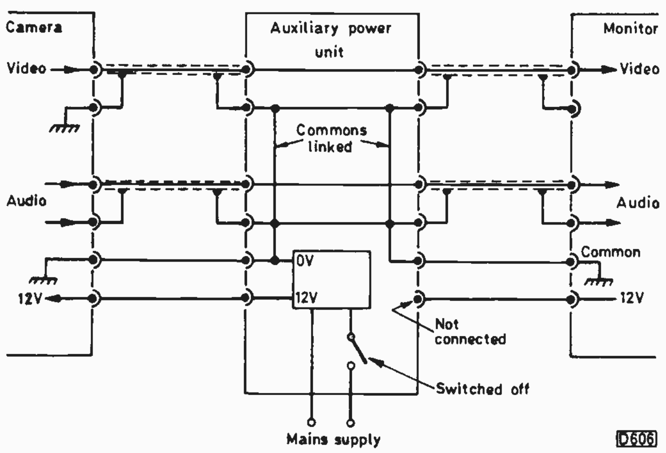


Fig. 2: The actual connections.

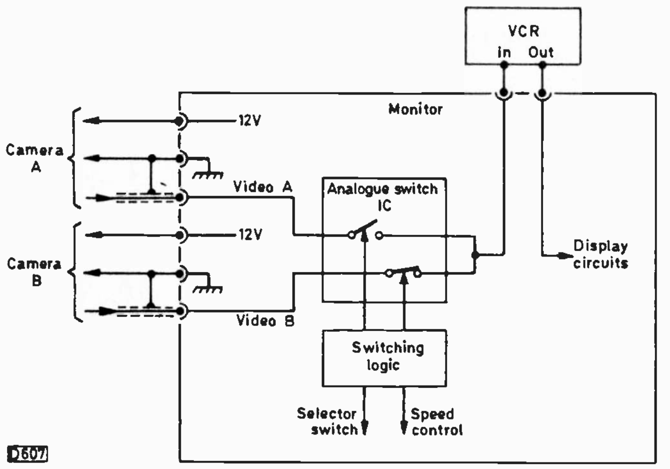


Fig. 3: The modified monitor

the control room and connected to the camera heads by a multiway cable. The video outputs from the rack were fed to monitors in the control room.

During an early stage of a new maintenance contract an engineer was checking at the rack with a test monitor that could be connected to any of the video output leads by a selector switch. All pictures from the furnaces were satisfactory at the rack, but on walking upstairs to the control room he found that there were no pictures on either of the monitors for one furnace, just blank, locked rasters. It was unlikely that both cameras or both monitors had simultaneously failed in the same way but instead of keeping quiet and going back to check at the rack the engineer offered to see if he could "get some pictures on those monitors". This was greeted with howls of laughter from the control room operators and comments like "let us know if you find any". The furnace had been shut down in the few minutes it had taken him to walk from one floor to the next.

Adding a VCR

A 9in. monitor was supplied, fitted with a two-way switcher for use with two cameras that plugged into the rear panel sockets and took their power from the monitor's d.c. rail. Multiway cables containing coaxial and power leads connected the cameras to the monitor. Two of the positions of a three-position toggle switch on the monitor's front panel selected the output from camera A or camera B all the time. In the third position ("auto") the two pictures were displayed alternately at a rate that could be varied. Switching was carried out by an analogue switch i.c. driven by some simple logic selected by the front panel switch. The logic was driven by a variable-frequency oscillator whose output was set by a potentiometer accessible through the front panel.

After delivery the monitor was modified to include a VCR in the system. The arrangement adopted is shown in Fig. 3. The lead between the switching circuit and the rest of the monitor circuitry was broken and taken to and from the VCR via two u.h.f. connectors on the monitor's back panel. With the VCR in the record or standby mode the signal from its input socket passed via internal amplifiers to its output socket. When playback was selected the tape playback signal appeared at the output socket to provide the display on the monitor. Thus no extra switching was required in the monitor, the VCR's controls automatically selecting the correct circuit arrangement.

The cameras, monitor and VCR were connected together – but the system didn't work. The monitor displayed just a blank, unlocked raster in all VCR switch positions. The problem caused some consternation. If the VCR's sockets were linked across the monitor would work with the cameras. The VCR was checked in both record and playback with a separate camera and monitor: no problems were found in either the record, standby or playback modes. The video cables between the monitor and the VCR were also tested.

The problem was caused by a combination of circumstances. Since the monitor was designed for the cheaper end of the market the switcher circuit was simple and had no buffer amplifier at its output. Normally this didn't matter because the input impedance of the following monitor circuitry was high enough not to load the switcher output. When the VCR was linked to the switcher the 75Ω terminating resistor at its input and the "on" resistance of the analogue switcher (typically between 80Ω and 300Ω depending on the type used and its operating voltage) formed a potential divider that drastically reduced the signal level at the output of the switcher.

Within the VCR the input signal was monitored by a circuit which cut off the output if the input level was too low. The potential divider effect reduced the signal level below this circuit's threshold – as far as the VCR was concerned it had no input. No input meant no output.

As the equipment was needed urgently the terminating resistor at the VCR's input was disconnected. This was not a very satisfactory solution as the VCR was rendered non-standard and would have to be restored to normal in the event of it being sent away for repair, but since the leads to the VCR were only about a metre long the slight mismatch could be tolerated. In later installations of this type a simple buffer amplifier was fitted within the monitor, between the switcher output and the input to the VCR.

Low-light Camera

Many underwater cameras use a SIT (silicon intensifier target) low-light tube. Use of a sensitive camera means that little additional lighting, which may be difficult to provide underwater, is needed. In addition the problem of light back-scatter into the camera from debris floating in the water is minimised. A customer of a company that made underwater cameras rang up insisting that an engineer be sent out to a site to fix a camera "because it was not sensitive enough".

The camera was on a gas rig in the North Sea and the engineer was flown out, on an urgent basis, with his test equipment and spares. On arrival he found that the "faulty" camera worked as well as the new spare he had taken with him. When this was pointed out to the customer he shut the camera in a completely dark room and demanded to know why he couldn't see anything. It took some time to explain the difference between a "low-light camera" and a "no-light camera"! The non-technical customer had been casually told something like "these cameras can see in the dark" by the salesman. The phrase had been taken literally and the customer's diving crew were trying to use the camera, without additional lighting, to inspect the sea bed under a rig on a November evening.

Strapping a diving torch to the camera enabled reasonable pictures to be obtained, getting both the customer and the camera supplier off the hook.

In Conclusion

The faults that have been described in these articles are all based on practical experience. Some general lessons can be drawn from them.

First, reliability starts at the system design and specification stage: it's a false economy to cut corners, particularly with respect to cables and connectors. Quality pays.

Secondly, those who design and install CCTV systems should be aware of the fact that their systems will require servicing at some stage – far too many are designed and installed by people who've never had to do field servicing. External cameras in particular call for a means of access and a local power supply should be available for test equipment.

Thirdly, detailed documentation which is kept up-to-date is vital in all but the simplest installations.

Finally, you can't plan for everything. Surprises will always occur. If everything worked perfectly most of us would be out of a job.

TV Fault Finding

Reports from R.T. Rees, Les Grogan Christopher Holland, Martin Pomeroy, Steve Leatherbarrow, Roger Burchett, Michael Dranfield and Philip Blundell, Eng. Tech.

Panasonic TC2205 (U2 Chassis)

The picture was bright and looked as though the line hold control was off frequency. The 195V supply smoothing capacitor C856 (10μF) was found to be open circuit. **R.T.R.**

Sanyo 80P Chassis

This set would take a long time to come on and the start-up was intermittent when the set was hot. C312 (10μF) which develops the supply for the error detector transistor was found to be almost open-circuit. It's also worth checking the chopper transistor's base bias/start-up resistor R302 (470kΩ) and for a dry-joint at the collector of the chopper transistor (Q304) on these sets.

The problem with another of these sets (Model CTP7132) was no/poor line sync: the line hold had to be adjusted when changing channels. The sync separator and line oscillator are in IC401 (LA7800) which, being a plug-in i.c., is easy to check by substitution. On this occasion the chip was o.k. A check at pin 16 revealed that the line feedback signal was missing due to a collector-base short in Q421 (2SC536). **R.T.R.**

NordMende F11B Chassis

A puzzling problem we've had recently with some of these sets has been very intermittent failure of either the BU806 chopper transistor or the BU508 line output transistor. Replace the offending component and the set will work again for anything from a few days to a few months before the transistor fails again.

The problem is due to the preset adjuster PP01 in the power supply. The suspect type is square-shaped and what happens is that intermittent wiper contact allows the 124V line to rise sharply. Note also that if the line output transistor fails it will take with it the feed resistor RP14. This is shown on the circuit diagram as R39, which means 0·39Ω not 39Ω. Fit the latter value by mistake and it will go up in smoke at switch-on. **C.H.**

Samsung CI338

Several of these 14in colour sets have been returned to us recently in the "set dead" condition, the cause being an open-circuit mains fuse. Failure is due to the current drawn by the degaussing circuit at switch-on being more than the 800mA fuse can cope with. The factory approved answer is to use a 1A anti-surge fuse as a replacement. **C.H.**

Sony KV1810

Sporadic failure of the line driver transistor Q509 can be due to C538 (an 0·47μF electrolytic) going low in value. I suspect that this can also contribute to failure of the line output gate-controlled switch (Q510) and always replace it as a matter of course, using a polyester type. **M.P.**

Philips KT3 Chassis

It was all 4s and 7s with this set due to that nice 4·7Ω resistor R291 in the power supply. No sound was traced to R413 (4·7Ω) in the feed to the sound panel being open-circuit.

Another of these sets had an unusual fault. Everything was fine at switch-on, but as the set warmed up bending of the verticals developed at the top of the picture. The effect was similar to the bending that occurs on some sets that are not video compatible when playing VHS tapes. As the set continued to warm up however the bending got worse and moved down the screen to the half-way point. A replacement sync panel was tried as a check (easy!) but failed to cure the problem. Some discolouration of the print was then noticed around D567 (BY228) in the EW diode modulator circuit. The diode was swapped over with one from a donor set. Hey presto!, the fault swapped with it. **S.L.**

Grundig CUC41KT Chassis

The sync gradually drifted off. It proved to be an elusive fault which was eventually traced to C738 (0·22μF) on the sync/line oscillator panel.

A case of tripping at switch on, with the set eventually settling down, was cured by replacing C662 (470μF) in the power supply – it was found to be completely open-circuit. **S.L.**

Philips KT4 Chassis

We've had quite a few of these nice sets in with the dead or more usually intermittently dead symptom. The cause has in every case been dry-joints around the line output transformer connections. **S.L.**

Rediffusion Mk. IV Chassis

The power supply gave a very low output and very rarely worked normally. If the set was left on for any time while testing the chopper transistor would be ruined. We found that the chopper driver transistor 4TR2 had a reverse base-emitter leak (several hundred kΩs). **S.L.**

Ferguson TX100 Chassis

The symptom with this set was line tearing which varied with the settings of the brightness and contrast controls. The cause of the trouble was traced to R143 in the feed to the line driver transistor – it had increased in value from 15Ω to 250Ω. **L.G.**

Panasonic TX2284 (U3W Chassis)

EW distortion in this set was due to the EW diode modulator driver transistor Q753 being open-circuit base-to-collector. Note that this transistor is mounted on the same heatsink as the field output transistors. **L.G.**

Decca/Tatung 140/150 Chassis

The picture was very dark even with the contrast and brightness controls turned up fully. Q205 on the tube base was found to be open-circuit. This transistor forms part of a circuit that's used to hold the emitters of the lower transistors in the RGB output stages at a constant 2·6V and also provides beam limiting. **L.G.**

Panasonic TC2203 (U1 Chassis)

The symptom was sound but no picture, though the e.h.t. was present. A check at the collectors of the RGB output transistors revealed that these were all at about 175V and thus cut-off. Moving back to the TDA2530 matrixing/drive chip IC301 we discovered that the supply pin (9) was high at 15V. This took us to the 12V regulator transistor which was o.k., the trouble being due to one of the associated series-connected 6V zener diodes which was open-circuit. Replacing this restored the correct 12V supply and a good picture. **M.D.**

Thorn 9000 Chassis

The problem with this set was a short across the l.t. rail. The relevant fuse (F4, 1·6A) had blown. It was necessary to lift components one by one to find the short, which was eventually traced to C171 (6·8μF) on the signals panel. This is a small, red tantalum looking capacitor and has since been found to be the cause of the same fault in sets fitted with the 8500-8800 series chassis – the signals panels are very similar.

Another 9000 displayed a good picture apart from the fact that the whole screen was covered with large coloured dots. The cause of this was traced to internal arcing in the focus control. **M.D.**

Panasonic TC2213 (U3W Chassis)

This set incorporates automatic channel search and the trouble was with the tuning action. The sweep would start when the auto button was pressed but it wouldn't stop at any of the channels. Extensive checks were carried out on the control panel but nothing amiss could be found. So the set was put aside to await the arrival of another one.

Panel swapping when a second set came along revealed that the fault was in the main chassis. We then found that gross mistuning of the a.f.c. detector coil L151 would stop the sweep on channel. Replacing the AN5132 vision i.f. chip IC101 made no difference but a new coil cured the fault. Presumably the internal tuning capacitor had gone open-circuit. **M.D.**

Rediffusion Mk. I and III Chassis

Ex-Rediffusion sets dumped by Granada continue to pour in. One Mk. I colour set confused me though the fault was simple. The mains fuse had blown and replacing it produced the sound but no raster symptom, with the PY500A glowing. There was no thermal trip action. After checking the boost capacitor and the valves I disconnected the tripler which turned out to be faulty. This is the first time I've encountered tripler failure in the Mk. I chassis. The thermal trip senses the line output valve's cathode current so it didn't react. This is something of a design fault, but considering the age of these sets they are very reliable. Personally I think Granada were mad to close down the Rediffusion setmaking operation.

A few days later I encountered my first faulty tripler in a Mk. III chassis. Although it was a number of years old this set had hardly been used, so presumably damp played a part here. **R.B.**

Network NW1210

Very poor/non-existent field sync was traced to the sync separator transistor's bias resistor R409 (1·2MΩ) going high in value. **R.B.**

Finlux 1000 Series

The symptom with this set was no picture – just a plain raster. As usual with a TDA3562A decoder chip I started by making d.c. checks around the auto black level feedback loop, where transistor Tb1 turned out to be short-circuit between its base and emitter. **P.B.**

Test Report: Thurlby/RS Bench Power Supply

Eugene Trundle

As our portable video equipment workload increased we started to find it inconvenient to chase up every customer for his mains unit or to rely on batteries whose charge level is in our experience usually low or zero. A 12V mains power supply salvaged from a scrap HR2200 was initially used. It proved to be somewhat inflexible and eventually blew up. It was of no use for the new breed of camcorders anyway: these work from a 9·6V supply. The cheap, low-capacity bench power supply next pressed into service thoroughly misled us: it was unable to supply the short-term surge current required by many portable equipments in such situations as going from stop to record, when the camera, VCR and loading motor are all on at once – the supply voltage would dip below the cut-out threshold and the machine would promptly cut out. So we decided to dip into the test-gear budget (what's that?) for a "proper" power supply unit. The choice fell on the Thurlby PL series 15V , 4A unit available from RS Components (stock no. 611-420).

This beefy unit is a mains-operated bench power supply that provides a variable stabilised d.c. output voltage of up to 15V with a current capability of up to 4A. The output voltage is set by coarse and fine rotary controls, the latter enabling the required voltage to be set to within 10mV. A third rotary control enables a current limit to be set – from a few milliamps to the unit's full 4A capability. Two front-panel mounted digital meters, each of 3¾ digit (4,000 count) capacity with 0·5in. LED numerals, provide simultaneous and continuous monitoring of the voltage and current levels. Where the current consumption varies rapidly on load a damping mechanism can be invoked to reduce the milliammeter count rate, thus reducing the "boggle factor". A full specification for the instrument is given in Table 1. Other versions are available – 5V and 0-30V types, also dual and triple supplies.

Hook Up

The output voltage appears across two 4mm sockets. Our first action was to make up connecting leads with terminations appropriate to the portable video equipment we service – mainly the JVC/Ferguson camcorder range and Sony/Pioneer 8mm camcorders. A third lead with shrouded mini-croc-clips caters for most other requirements. Thus kitted up we were able to devote all our mental resources (such as they are) to diagnosing and repairing faults rather than having to worry about keeping the wheels turning . . .

In Action

This power supply proved its worth from the moment it was installed. We'd be lost without it now. Its effective output impedance of 5MΩ enables it to sustain all the transient demands of the mechanics of portable video decks and camcorders. It also provides some very useful aids to fault diagnosis and to setting up procedures: one quickly gets accustomed to the current demand made by each type of machine in its various modes, and the continuous current monitoring provides a useful indication of the health of the patient on the bench. The ability to set the output voltage finely facilitates easy checking and adjustment of the user low-battery warning indicators and the under-voltage cutout point – items that are incorrectly set at the factory suprisingly often.

When it's not in use for repair work the unit can be put to work as a battery charger – for video batteries or any other lead-acid or nicad types. Charging can be done in the constant-voltage or constant-current mode as required. It will also charge car batteries – as ours did between-times during the snowy mid-January period!

Nor was use with "outdoor" gear the only video application we found for this power supply. With a suitably low output voltage it can be used to wind tapes and cassettes out of – or in to – dead VCRs, also to test for "jamming" and to test newly-repaired front-loading mechanisms out of the machine. Similarly, the loading or mode motors in modern decks can be "pulsed" to check the operation of the mechanics and mode switches, while the instrument's milliammeter gives an accurate indication of the mechanical load being imposed and the condition of a motor. The action of the servo disc-braking coil in oldie machines like the Philips N1500, Sanyo VTC9300 and Sony SL8000 can be checked by direct application of a variable current from this instrument.

It's very often necessary to estimate for the repair of a VCR with a power supply fault. Without restoring correct operation of the power supply there's no way of telling the

Table 1: Specification

Line voltage: 110, 120, 220, 240V a.c. ± 10% at 48-63Hz.
Output: 0-15·5V nominal; 0-3·98A nominal.
Output terminations: 4mm terminals with 19mm (0·75in.) spacing. D.C. output switch.
Sensing: Remote via 4mm terminals or direct via shorting links (provided).
Line stability: <0·01% of maximum output for 10% line change.
Load regulation: <0·01% of maximum output for 90% load change.
Protection: Full short-circuit and overload protection.
Ripple and noise: Typically <1mV.
Output impedance: <5MΩ at 1kHz.
Temperature coefficient: Typically <0·01%/°C.
Transient response: <20µsec at <50mV of setting for 100% load change.
Constant-current output impedance: Typically 50kΩ with voltage limit at maximum.
Voltage controls: Continuously variable coarse and fine controls.
Current limit: Continuously variable from 0-99% of maximum current rating. Automatic indication of constant-current operation.
Meters: Dual 3¾ digit (4,000 count) with 12·5mm (0·5in.) LEDs. Reading rate 4 per second.
Meter resolution: Voltage 0·01V over entire range. Current 0·001A over entire range.
Meter accuracy: Voltage 0·1% of reading ± 0·05% full scale. Current 0·3% of reading ± 0·2% full scale. At 20-25°C.
Current meter damping: Normally 20msec, switchable to 2 seconds for averaging rapidly varying loads.
Operating temperature range: 0-45°C.
Electrical safety: Designed and manufactured to comply with IEC 348.

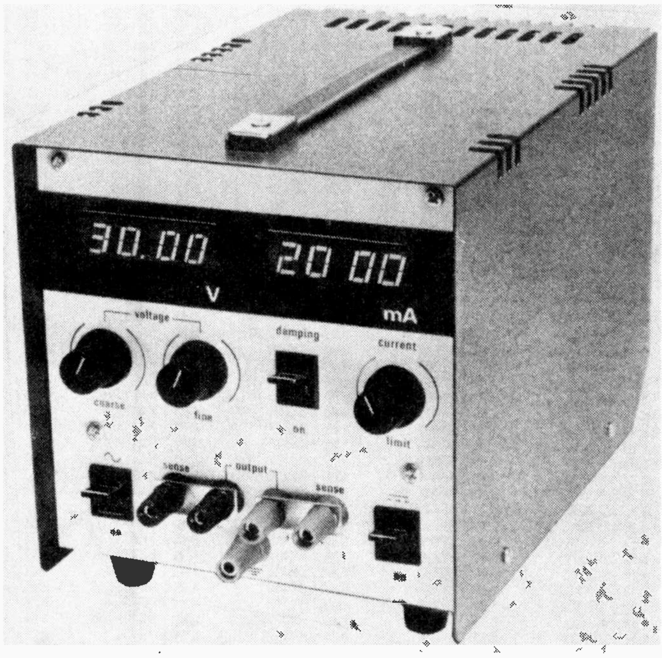
condition of the heads, motors, etc. whose cost, if faulty, will be greater than that of the power supply job. This power supply can in many cases be used to energise a machine before the soldering iron is disturbed or much time is spent, so that the overall situation is known at the outset.

At the other end of the current scale the availability of a variable, closely stabilised voltage source can provide diagnostic short-cuts. Examples include the injection of a high logic level at an i.c. pin (current limit set low); the testing of servo units where the effect of a steady "error" voltage on motor speed and the feedback signal can be studied; the manipulation of a.g.c. voltages in i.f. amplifiers, and particularly tuners, to ascertain cause or effect; the provision of a control potential for voltage-controlled attenuators or amplifiers as used in camcorders, sound i.f. chips and so on. The latter application is relevant to TV sets where the brightness, contrast and saturation levels are nowadays set by d.c. control lines.

TV and Other Applications

In fact there are many time and trouble saving roles for the variable power supply in TV servicing. A.G.C. and tuner gain tests have already been mentioned. When servicing TV power supplies it's often helpful to be able to run up the control and pulse-generating sections in the absence of mains power, or with a reduced primary a.c. supply, in order to prevent fireworks if a fault is present: the Thurlby unit's output terminals are isolated from mains ground and the instrument's case, and it's safe to superimpose up to 300V on this.

In the same way that a mains variac is often used to soft-start a TV set under investigation this unit can be used to run up gradually the power applied to a newly repaired or newly designed circuit, for example a field timebase or audio amplifier, while keeping an eye on the unit's ammeter. This procedure of increasing the voltage while watching the current is also useful for testing zener diodes, and for the bizarre purpose of "softly" killing semiconductors, fuses and low-value resistors. To what end? To imperceptibly introduce faults for diagnostic training exercises! Indeed this unit is ideal for training purposes: its inbuilt current-limiting and constant-voltage/current characteristics are useful for demonstrations and, more to the point, make it impossible for the student to blow up the power supply.



The Thurlby PL series bench power supply which is available from RS Components/Electromail.

Computers and their peripherals can also be powered by this unit of course, and it will (in time of need) run little Willie's Scalextric or train set far better than the power unit supplied. When the previously mentioned January snows melted, our ill-sited workshop promptly flooded. It was rapidly pumped out by a 12V bilge pump powered by you-know-what!

Some time after we acquired the instrument, while it was fulfilling its normal role on the bench, we discovered quite by accident that it would also act as a high-impedance digital voltmeter with an accuracy of 0·1 per cent if the output voltage was set to zero and the unknown voltage was applied to the output terminals. A check with the handbook confirmed that this is permissible provided the applied voltage doesn't exceed 50V.

Conclusion

Since the day of its arrival we've found this instrument to be indispensible. So far as I am concerned its only drawback is that everyone in the service department continually wants to borrow it. I consider is to be excellent value for money at £159 plus VAT. Those who don't hold an account with RS Components can obtain it from the RS subsidiary Electromail (PO Box 33, Corby, Northants NN17 9EL – telephone 0536 204 555) at an inclusive price of £185·15. Since it can be reasonably expected to last for say fifteen years I'd look upon it as an investment.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

15/80H	2.40
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
2N3906	0.62
2N4101	1.73
2N4240	3.30
2N4444	1.73
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.58
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	0.46
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SD1391RL	3.95
2SA1095	3.74
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	1.50
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
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	3.82
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	3.92
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	1.73
2SC828	0.28
2SC867A	3.84
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	5.39
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	2.26
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	0.77
2SD655	0.98
2SD657	3.50
2SD661A	0.80
2SD731	2.46
2SD773	0.33
2SD811	7.65
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	5.44
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	0.25
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	5.52

BA656	7.95
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	2.85
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	0.60
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	1.20
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
BR100	0.22
BR101	0.65
BR103	0.75
BR303	1.23
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
BSTB0140G	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	1.91
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	0.95
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	1.35
BY713	1.10
BYW19/1000	0.69
BYW56	0.34
BYX10	0.29
BYX55-600	0.19
BYX71-600	0.90

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	0.34
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	0.76
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	9.75
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	1.05
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	3.46
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	13.06
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.58
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	5.09
M51393AP	9.35
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
M58485P	13.65
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.94
MC13002	3.69
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	9.16
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

NE565N	1.33
NE645BN	3.35
NP1106	8.60
OA202	0.11
OA47	0.16
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
R2008B	1.33
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
RCA16029	2.01
RCA16600	1.38
RCA16802	1.08
RCA17074	6.60
RCA17376	1.58
RCA17524	0.83
RCA17523	0.83
RCA2060	2.00
RGP01-15	0.70
RGP10	0.50
RGP30M	0.59
RT402	1.58
RT905A	2.38
S1299	7.98
S175	31.48
S2062D	2.07
S2800D	5.54
S2802	3.47
S2818	4.05
S3702S	6.15
S40W	16.68
S6080B	8.80
SA8063	5.17
SAA1006	1.75
SAA1020	4.76
SAA1025	4.40
SAA1024	2.81
SAA1075	6.25
SAA1121	7.44
SAA1124	3.25
SAA1130	4.99
SAA1174	7.77
SAA1250	4.25
SAA1251	5.85
SAA11351	4.95
SAA3027P	10.03
SAA5000	2.95
SAA5010	5.39
SAA5012	5.20
SAA5020	5.78
SAA5030	8.25
SAA5050	7.74
SAB1009B	5.98
SAB3011	7.34
SAB3013	5.61
SAB3021	7.90
SAB3024	6.36
SAB3209	5.82
SAB3210	3.49
SAF1032P	5.50
SAF1039	3.35
SAS5010	8.39
SAS560S	2.26
SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
SAS580	2.85
SAS6600	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	2.32
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	4.78
SL480	3.98
SL490	2.44
SL901B	6.95
SL918A	6.98
SN16861ANO	4.95
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	7.65
SN29764AN	1.38
SN29767	4.98
SN29770BN	3.84
SN29772BN	4.91
SN29771BN	3.25
SN29791	2.98
SN29798N	5.56
SN2709	0.44
SN7400N	0.34
SN7401N	0.36
SN7402N	0.65
SN7404N	0.24
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.37
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	2.00
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.93
SN74LS26N	0.53
SN76001N	1.65
SN76013ND	7.50
SN76023N	5.15
SN76023ND	3.96
SN76033N	4.15
SN76110N	0.90
SN76115AN	1.61
SN76131	1.92
SN76227N	1.33
SN76226DN	1.98
SN76228N	3.27
SN76242	8.95
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SN76396	2.90
SN76533N	2.47
SN76532N	2.95
SN76545	4.87
SN76546N	3.47
SN76549	2.59
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.41
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SN76709N	25.54
SN76707N	5.11
SN76705N	1.34
SN76730	5.36
SN76810N	0.60
SN76832N	3.25
SN94041	5.54
SN94042	5.54
SP8385	0.55
SPS5384	1.98
ST1702L	0.99
STA401	6.76
STA441C	2.75
STA471C	7.56
STK0029	5.54
STK0039	5.11
STK0040	12.78
STK0050	7.72
STK0080	9.16
STK011	5.08
STK013	9.25
STK014	9.80
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STK1039	5.75
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STK2145	16.25
STK2230	7.70
STK2240	14.40
STK2250	18.95

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STK3044	5.75
STK4019	4.50
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STK435	5.94
STK4352	12.25
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STK437	7.80
STK4372	3.85
STK439	8.31
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STK457	13.45
STK460	6.95
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STK4833	16.95
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STK502	5.74
STK5314	12.32
STK5730	3.95
STK7216	14.50
STK772	6.95
STR1096	5.45
STR4090	11.98
STR440	7.85
STR441	6.50
STR451	4.95
STR453	8.16
STR454	7.50
STR6020	8.31
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T6035V	0.73
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T6037	2.11
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T6059	2.77
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T9013V	7.96
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TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
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TA7227P	2.81
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TA7270	7.50
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TA7314	5.94
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TMS3720ANS	19.50
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X0056CE	6.25
X0057GE	6.00
X0062CE	6.52
X0065CE	6.25
X0074GE	10.00
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X0092CE	4.95
X0096CE	5.98
X0109CE	11.25
X0113CE	2.07
X0195CE	7.50
X0204CE	8.74
X0261CE	8.75
X1222AF	3.63
IX0111CE	2.95
Y969	0.82
TDA3310	2.15
ZPY120	3.25
ZTK33	0.43

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The 8mm Video System

Part 2

Eugene Trundle

In Part 1 last month we covered the basic specification and characteristics of the Video 8 system, including the cassette, the track and deck layout and finally the recorded signal spectrum. This time we're going to consider the chroma and luminance signal processing.

Chroma Record System

The chroma signal processing system is conventional, though there are several points of interest. The basic arrangement used in the record mode is shown in Fig. 9.

The 4·43MHz chroma subcarrier is filtered from the composite video signal and then fed to an amplifier whose gain is regulated to maintain a constant burst (and hence chroma) amplitude – this is the a.c.c. action (automatic chrominance control). Two reservoir capacitors are used, with switching at field sequential rate: this gives separate gain control to compensate for any difference in the characteristics of the two video heads.

The next stage is chroma emphasis whose main purpose is to reduce chroma noise, particularly with low-level signals. The outermost chroma sideband signals are weakest and most susceptible to noise: these are boosted by a filter that has a bell-shaped response, similar to that used in a SECAM decoder. A complementary filter restores the signal balance during playback, reducing the chroma noise in the process. A further stage of emphasis operates when gated on by a suitably timed pulse, doubling the amplitude of the burst to make it less susceptible to tape noise and increase the accuracy of the playback chroma-correction processes. It partly compensates for the fact that the Video 8 system doesn't use the Betamax system's excellent pilot-burst system. This 6dB burst emphasis system is also used in US-standard VHS machines (NTSC colour system).

The chroma down-converter works in the subtractive mode, with a "local-oscillator" input at 5·16MHz. To facilitate crosstalk correction during playback the 732kHz output from the down-converter has a phase advance of 90° per TV line for application to head A (ch. 1) and a non-changed phase for head B (Ch. 2). To remove timing jitter during playback the relationship between the 4·43MHz subcarrier frequency and the line frequency (fH) has to be strictly maintained. The arrangement used to generate the 5·16MHz local-oscillator signal takes care of these factors.

Fig. 10 shows the arrangement in block diagram form. Line sync pulses from the signal to be recorded are used

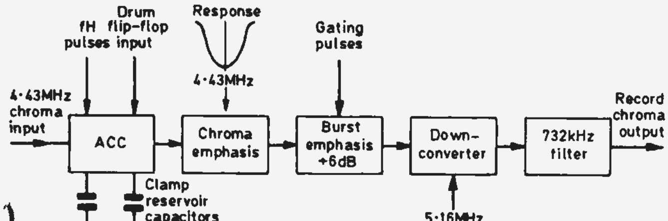

Fig. 9: Block diagram showing the chroma signal processing in the record mode. Separate a.c.c. reservoir capacitors provide for differences between head characteristics.

to lock a 375fH (5·86MHz) voltage-controlled oscillator (VCO) whose output is fed to a divide-by-eight circuit which is programmable, coming under the influence of line-rate pulses from a second VCO that's locked to the incoming line sync signal by means of a phase-locked loop. The output from the divide-by-eight counter is at 732kHz, with a 90° per line phase-stepped characteristic when used with head A. For use with head B the phase-shift system is muted by the head-switch flip-flop signal (a 25Hz squarewave) that's also applied to the programmable counter.

The 732kHz signal is fed to an additive mixer (carrier converter) whose second input is a stable 4·43MHz c.w. signal derived from a crystal oscillator locked at 90° to the burst signal: 4·43MHz + 732kHz gives 5·16MHz for application to the down-converter. The record chroma signal that emerges from the down-converter has the required head A 90° per line phase-stepping characteristic, and after filtering it's added to the luminance f.m. record signal. The carrier inverter shown in Fig. 10 is immobilised during record: it's used for trick-mode playback, as we shall shortly see.

Chroma Playback

As is always the case the chroma playback arrangement is more complex than the record system – due to the need for dejittering and crosstalk cancellation. An outline of the system is shown in Fig. 11 – many of the stages are common with those used for recording.

The 732kHz off-tape signal is controlled by the a.c.c. stage before being applied to an up-converting mixer. The output from this, at 4·43MHz, enters a comb filter for crosstalk removal before de-emphasis is applied by a bell filter with a characteristic which complements that used during the record process. In the normal playback modes the chroma signal is now ready to be added to the luminance signal to form a composite (CVBS) video output. Derivation of the 5·16MHz "local oscillator" signal is the key to correct phase restoration and dejittering of the chroma playback signal.

As before the 5·16MHz c.w. signal is generated by a mixer whose inputs are at 4·43MHz and 732kHz. The source of the 4·43MHz input is a crystal (the same as that used in the record mode) but the oscillator is now "free-running", i.e. it's not within a control loop: it acts as a master oscillator for the chroma playback system.

The a.p.c. detector has two inputs, a gated sample (burst) of the up-converted subcarrier and a 90° phase-shifted signal derived from the 4·43MHz crystal oscillator. The phase detector's error voltage output acts on a 5·86MHz (375fH) VCO whose output passes through the programmable divide-by-eight counter to produce the required 732kHz signal for the carrier converter. Once again the counter/phase-shift circuit is programmed by the head-switching flip-flop squarewave to produce the appropriate phase-stepping characteristic for head A's signal and a constant-phase output for head B's signal. This cancels the phase shifting introduced during the record process: it's used in the comb filter circuit where crosstalk is cancelled.

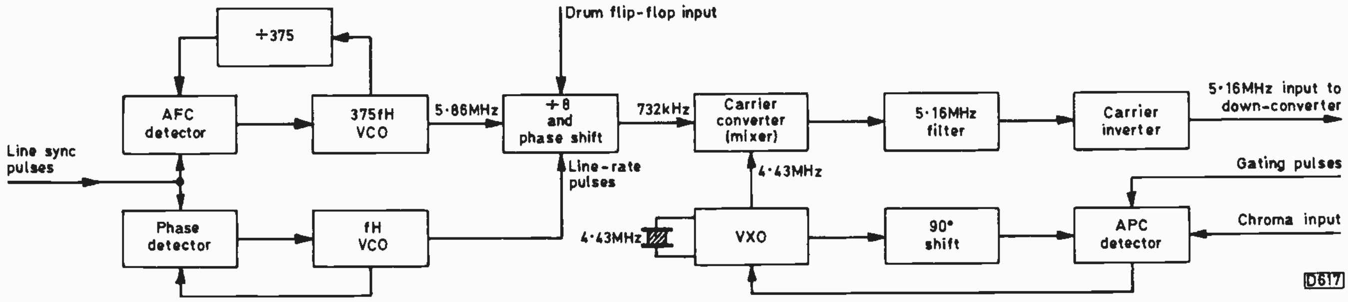

Fig. 10: Generating the 5·16MHz "local oscillator" signal for the down-converter in Fig. 9.

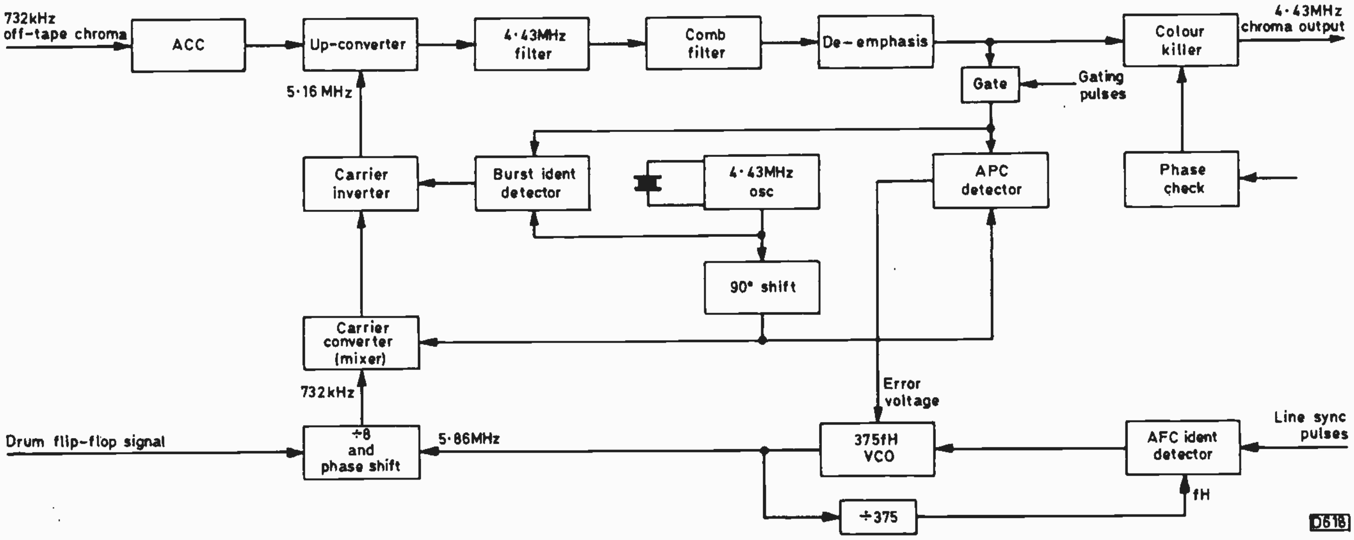

Fig. 11: Chroma playback up-conversion and carrier generation.

The phase detector's control range is limited – it can work over a range of only 180°. To prevent the phase detector "running out of road" the burst ident detector compares the phase of the playback chroma burst with the local 4·43MHz c.w. signal from the crystal oscillator. If a phase error is detected a reset signal is passed to the carrier inverter in the 5·16MHz feed to the up-converter. This has the effect of inverting the chroma output signal so that the correct operating range for the a.p.c. detector is maintained.

During normal playback then the dejittering agent is the 5·86MHz VCO which acts in a phase-control loop to maintain the correct phase (and hence colour) by slaving the chroma signal to the 4·43MHz reference signal. The subcarrier frequency control normally provided in chroma playback systems is not required here, though the facility does exist – the a.f.c. ident detector shown at the bottom in Fig. 11. This steers the 5·86MHz VCO on a line-by-line basis, producing an error output voltage which is derived from a comparison of the off-tape line sync pulse and an fH pulse counted down by the ÷375 circuit. The VCO is thus locked at 375fH. This arrangement is normally operative only in the jog (trick) playback modes, which call for the use of several other artifices.

Jog Chroma Correction

In any mode other than normal playback at SP or LP speeds the linear tape speed differs from that used during record. As a result the path of the heads crosses the tape tracks instead of being centred on them. Because the track correlation is 1H and 2H (SP and LP respectively) these track crossings – typically in the search modes – cause no problems with the luminance signal (unlike VHS-LP, where an 0·5H jump pulse generator and a 32μsec signal delay are required) but can give rise to a disordered PAL chroma signal.

As head A (Ch. 1) for example crosses from one of its tracks to an adjacent track in the search mode (cue or review) it may well leave on a +(R – Y) line and move to another line with +(R – Y) instead of the expected –(R – Y), destroying the PAL sequence. This cannot be prevented but can be masked by using the additional circuitry shown in Fig. 12. Here the chroma signal is checked for correct burst phase sequence by comparing it – in the sequence detector – with an artificial burst generated within a special chip. When an incorrect sequence is detected a logic circuit comes into action, operating a

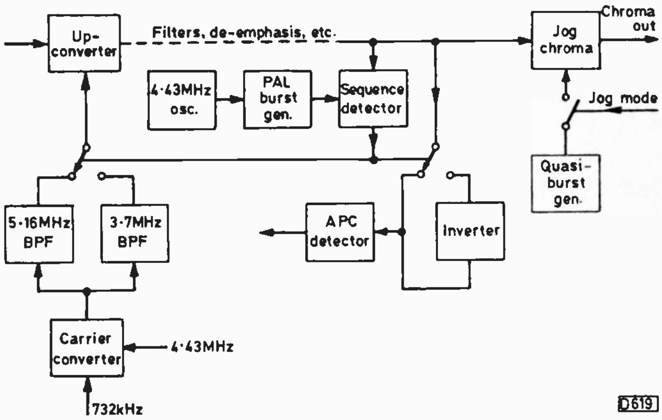

Fig. 12: Chroma correction arrangements used in the trick playback modes.

changeover switch in the 5·16MHz path to the up-converter. Its effect is to invert the phase of the chroma signal, burst and all, about the B – Y axis, restoring the normal PAL continuity at the chroma output.

The way in which this is done is unusual. The carrier converter's two inputs, 4·43MHz and 732kHz, produce both sum (5·16MHz) and difference (3·7MHz) outputs which can be selected by means of bandpass filters. Either can be used as the "local oscillator" input to the up-converter, whose output will in both cases be at 4·43MHz. When 5·16MHz is being used the carrier converter is working in the additive mode and the up-converter in the subtractive mode: when 3·7MHz is being used the carrier converter subtracts and the up-converter adds. The point is that in the additive mode the up-converter inverts the phase of the R – Y chroma without upsetting the head A phase-stepping sequence.

Alteration of the chroma phase on such a rapid basis would ordinarily cause instability in the a.p.c. detector circuit, which has a relatively long time-constant. To prevent this a compensation link is provided between the sequence detector and the a.p.c. detector.

Further compensation techniques used in the jog chroma playback mode include a high-speed a.c.c. circuit to minimise the effects of mistracking, a facility to correct the speed of the 5·86MHz VCO by applying off-tape line sync pulses to the a.f.c. ident detector, and a quasi-burst insertion circuit in which a locally-generated PAL burst signal is substituted for the off-tape one – the latter could be corrupted by mistracking noise or timing errors. In Sony's own and derived machines all these jog chroma circuits are incorporated in a specially designed chip, type CX20117.

Chroma Crosstalk Compensation

The effect of the line-rate phase advance given to the chroma signal recorded by head A (Ch. 1) is shown in the top row (a) in Fig. 13 – this assumes that the signal consists of a plain red raster. The constant-phase red signal recorded in the adjacent tracks by head B (Ch. 2) is shown in row (b). When the tracking during playback is correct head A will read mainly its own tracks, but crosstalk will give rise to a small signal from the Ch. 2 tracks, as shown in row (c). The TV-line correlation between adjacent tracks ensures that the crosstalk signal is coherent. In restoring the phase of the Ch. 1 playback signal the crosstalk signal is rotated clockwise by 90° per line as shown in row (d). Row (e) is the result of delaying previous row (d) by two TV lines, i.e. 128μsec. When the signal components from rows (d) and (e) are added (electrically) the crosstalk signals (black arrows), being equal and opposite, will be cancelled while the wanted in-phase signals will add and will thus be reinforced.

Although Fig. 13 shows only a red hue and takes no account of the PAL alternations of the signal the crosstalk cancellation system works for all hues and for PAL, as a laborious redrawing of Fig. 13 for different signal conditions would show. In fact the only time when the system breaks down is when the colours on adjacent lines are markedly different.

Though not actually part of the format, V8 machines incorporate a correlation detector and switch to prevent hue distortion at the upper and lower edges of coloured objects in the picture. Fig. 14 shows its operation. A feedback loop is used to feed back 2H delayed chroma to a subtractor in the chroma signal path. The correlation

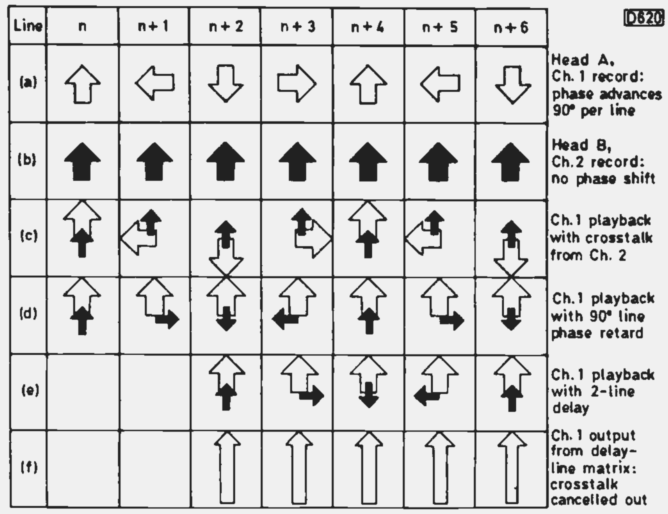

Fig. 13: Chroma crosstalk cancellation achieved by the two-line delay line and add matrix.

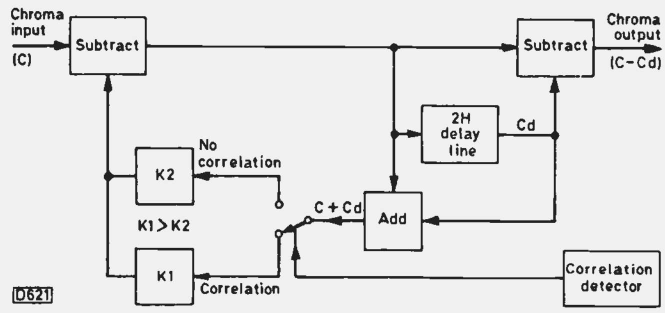

Fig. 14: Operation of the correlation detector in the chroma crosstalk cancellation circuit – this prevents colour distortion at sharp horizontal edges in the picture.

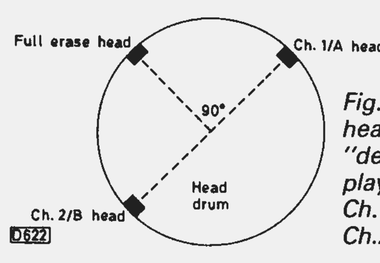

Fig. 15: Positions of the heads around the drum. In "deck" models a trick-playback head designated Ch.1' is incorporated in the Ch.2/B head chip.

detector allows a high degree of feedback when the chroma correlation is high: when low or no correlation is present however an alternative feedback path is switched in to cancel the effect of the crosstalk-compensation delay line.

The Flying Erase Head

An important feature of the Video 8 format is the head-drum mounted flying erase head. Its width covers approximately two tracks and it's mounted at 90° to the line on which the record/playback heads are situated, as Fig. 15 shows. The main advantage of the flying erase head is in editing situations where a clean cut between the old and the new video material is achieved. Because of the physical separation between the stationary full-erase head and the video-head drum in other formats the old tracks must be overwritten by the normal (or a specially increased) luminance recording action of the rotating heads during the first few moments of a new recording. This provides adequate erasure of the previous luminance signal but leaves remnants of the original chroma signal:

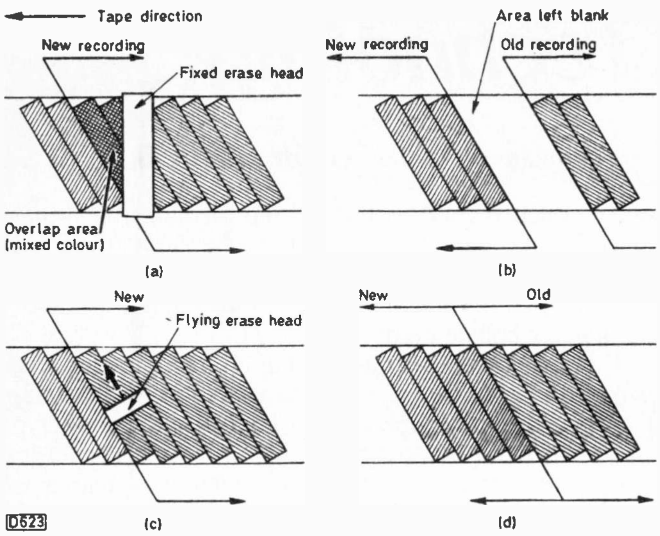

Fig. 16: The advantage of the flying erase head. The start of a new recording in a fixed erase head machine is shown at (a). The portion of the tape between the fixed erase head and the video head drum will produce chroma patterning during playback. At the end of the recording a blank section of the tape is present before reversion to the original recording. This is shown at (b). In (c), representing a record start with a flying erase head, an instant and complete transition is achieved between the old and new recorded material. A slick changeover again takes place at the end of an insert recording, as shown at (d).

the result is colour stains at the transition point during playback – the severity of the stains depends on the colour saturation and content of the old and new pictures. The flying-erase system has long been used on professional video equipment. Fig. 16 shows the way in which these unsightly colour glitches are avoided: it also shows how a "noisy gap" is avoided at the end of an insert recording. The erase head, which needs considerable energy, is driven via a high-power rotary transformer and is switched on and off by the syscon. The process of PCM dubbing involves fast switching of the erase head and will be dealt with later.

Luminance Processing

It is not proposed to describe the luminance circuits in any detail since apart from the use of a high f.m. carrier frequency (see Fig. 8) they follow conventional practice, with non-linear pre- and de-emphasis for noise reduction and a 7·8kHz (half line rate) shift of the f.m. carrier frequency field by field to facilitate crosstalk removal by means of a comb filter during playback.

A feature of the Sony luminance record system is the use of a delay-line comb filter (the same one that's used for noise reduction during playback) in conjunction with a clamp to remove, line by line, any d.c. offset in the recorded luminance signal. This ensures that the field-rate half line frequency differential in the f.m. oscillator is accurately maintained for optimum working of the luminance crosstalk cancellation system.

Current Video 8 machines also use the correlation detection system during playback to prevent signal distortion in the noise-cancelling circuit in situations where the adjacent TV lines are dissimilar. These techniques were described by Steve Beeching in the March 1986 issue (see page 300). The luminance correlation detector used in Sony 8mm machines operates in a similar manner to that in the chroma playback circuit already described.

next month in TELEVISION

● RECENT PHILIPS CHASSIS
We've had little to say about Philips TV chassis since a brief article on the CTX in the January 1983 issue. Time then for an up-date. Harold Peters traces the evolution of Philips sets from the KT3/K30 series through System 4 – with notes on servicing these models – to the current CF1 and 2A chassis. Coverage includes the SOPS (self-oscillating power supply) system, Philips' variation on the old Siemens concept.

● 25kV EHT PROBE
With care it's possible to build an e.h.t. meter at a modest cost: Andrew Heron provides constructional details for a self-contained probe incorporating a moving-coil meter. The probe has been designed to measure voltages up to 25kV and the prototype has provided three years' reliable service.

● LOW-VOLTAGE DC OPERATION
It's holiday time again, which means complaints about the operation of equipment designed for use with low-voltage d.c. supplies. J. LeJeune provides practical guidance on satisfactory operation, particularly on the importance of adequate wiring, on interference problems and on obtaining a 12V supply from a 24V source.

● VIDEO 8: THE ATF SYSTEM
The use of control pulses recorded on a longitudinal track at the edge of the tape, as in the VHS and Beta systems, has served us well. With the Video 8 system's very narrow tracks however a more precise tracking technique is required. The system used is akin to that employed in V2000 VCRs, i.e. automatic track following pulses are laid down during the helical scan. Next month's Video 8 article describes the implementation of the technique in the 8mm format.

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Surface-mounted Technology

Geoff Lewis, B.A., M.Sc.

One of the most significant developments in printed-circuit board technology has been the introduction of surface-mounted components/devices (SMC/D). Use of very short tabs instead of the conventional lead-out wires means that the performance of these components is much closer to the theoretical specification. As a result of the reduced self-resistance, -capacitance and -inductance SMDs have a much better r.f. performance and much higher operating speed.

Surface-mounted components are soldered directly to metallic pads or lands on the PCB. The components are smaller physically and can thus be mounted closer together, resulting in smaller and more compact PCB assemblies. Since there are no through holes the PCB strength is greater, allowing the use of thinner substrates. Although the components themselves are smaller, the relatively larger contact pads provide better heat dissipation with lower resistance connections.

Board Production Techniques

SMD technology is particularly suited to automated production, leading to significant cost reduction. The changes mean that new soldering techniques have had to be developed. What could once be regarded as an acquired practical skill must now be considered as the application of a branch of chemical science. Three basic techniques are employed in the production of PCBs using surface-mounted components: the different methods have a bearing on the way in which a PCB is handled when servicing.

With wave-bath soldering a heat or ultra-violet light curing adhesive is used to attach the components to the PCB solder resist. The board is then preheated and passed, inverted, over a wave-soldering bath. The adhesive is used to keep the components in place whilst the solder joints are being made.

With reflow soldering a solder cream or paste is used instead of the adhesive. The paste is applied to the PCB through a silk screen, the components being positioned and held in place by the paste's viscosity. The assembled board is then passed through a melting furnace or over a hot plate. As a result the solder in the paste reflows to make the joints.

Vapour-phase reflow soldering is a derivative of the reflow method, using the latent heat of vaporisation to melt the solder cream. The assembled PCB is preheated then immersed in an inert vapour of saturated fluorocarbon liquid which is used as the heating medium: the heat is quickly and evenly distributed as the vapour condenses on the cooler PCB. This method has an important safety factor in that the soldering temperature cannot rise above the liquid's boiling point of about 215°C.

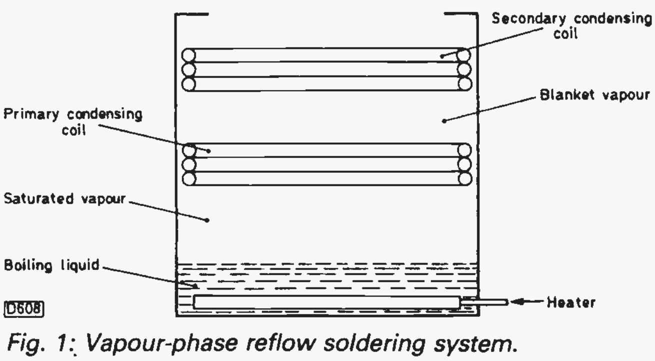

Fig. 1: Vapour-phase reflow soldering system.

This method is illustrated in Fig. 1. The primary liquid is boiled to produce the saturated vapour at the bottom of the chamber. It's trapped by a blanket vapour of, typically, trichlorotrifluoroethane, which has a condensing temperature of about 47°C. This situation is maintained by the condensing coils. PCB preheating is necessary to prevent disturbance of the temperature equilibrium when the chamber is being loaded.

Solders and Fluxes

All electronic components become stressed at high temperatures. The effect is cumulative. Because of this the work temperature during production and servicing must be controlled. The wave-soldering operation for example is normally restricted to a temperature of 260°C maximum for no more than four seconds. Use of low melting-point solders is thus critical to component lifetime. The standard tin/lead (60/40) solder, which has a melting point of 188°C, is not recommended for use with SMDs which often have silver- or gold-plated contacts to minimise joint resistance. Tin/lead alloy solders all cause silver leaching, i.e. the tin absorbs the silver from the component over a period of time, leading to high-resistance connections. The problem is avoided by using a silver-loaded alloy solder such as 62 per cent tin, 36 per cent lead, 2 per cent silver. Its melting point of 179°C makes it particularly suited for use with SMDs. Tin also tends to absorb gold, producing a similar problem which is aggravated by the higher soldering temperatures required. A silver bearing alloy also helps with this problem.

Flux is used in soldering basically as an anti-oxidant. The most effective flux causes an increase in the solder's rate of flow, thus lowering the component heating effect. The type of flux recommended for SMD use is either a natural organic resin compound or one of the new synthetic chemical types which leave less unwanted deposit on the finished board.

Servicing Aspects

A solder rework station could well be cost-effective for a large service department. It could include a small portable vapour-phase soldering unit such as the Multicore Vaporette, which is particularly suitable for small batch work. Much ingenuity is called for in the smaller servicing department when SMDs are first met.

The method used to remove a suspect component depends on the number of connections. For a two or three connection component such as a diode, resistor or transistor a fine soldering iron used in conjunction with solder wick or a solder sucker can be effective. Special tools are available for use with i.c.s. These vary from special collets that can be attached to the soldering iron, or electrical wire strippers, to the use of a controlled hot-air blast. These methods allow all the pins to be heated simulta-

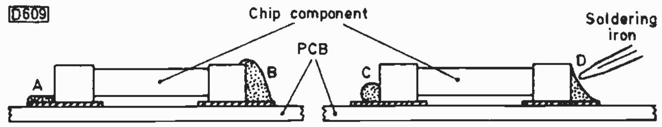

Fig. 2: Good and bad soldered joints. See text.

neously so that the component can be lifted away.

Alternatively the component can be removed by cutting the connections, spills or tabs being removed separately. This is not quite so drastic as it might appear to be. Reuse of a suspected faulty component is not recommended, even though it might turn out to be serviceable – the two heating cycles required to remove and restore the device will greatly add to the component's total heat distress, with the result that it can fail prematurely at a later date.

Removing even a two-contact component can be a double-handed job. It's recommended therefore that any PCB being serviced is held securely in a suitable clamp. Once the solder has been removed there may still be the problem of removing the glued component. Though care should be taken when prizing such a component off the board track damage is unlikely as the adhesive should have been applied to only the solder resist part of the board.

Before a new component is fitted each pad should be lightly tinned using the appropriate solder and flux. Because of the smaller board size the tracks are much closer together than with a conventional board. It's important therefore to position the new component accurately and carefully. In the case of multi-contact components, secure two diagonally opposite connections first. The heat from the soldering iron, which should not be rated in excess of 40W, should be applied to the component via the molten solder as shown at D in Fig. 2. Each joint should be made in a period of about three seconds. D also illustrates how a good joint should look, the solder fillet having a smooth miniscus.

Three faulty joints are also shown in Fig. 2. Joint A has too little solder, resulting in a high-resistance connection. Joint B is the result of using too much solder – this is probably due to the use of excessive heat. Joint C is again an example of using too little solder, once more giving a high-resistance connection.

As a final point, note that some SMDs are too small for the component value to be marked in the normal way. Unmarked components should therefore be stored in their protective packing until they are needed. Otherwise devices that may be difficult to identify will become mixed.

Teletopics

SATELLITE TV LATEST

British Telecom has signed two major agreements, with Eutelsat and the Societe Europeenne des Satellites (SES) of Luxembourg, to distribute TV programmes via satellite to Europe. The agreement with Eutelsat is for up to eight of the transponders on the Eutelsat-2 satellite due for launch in late 1989. The agreement with SES is for up to eleven transponders on the Astra satellite which is due for launch next year. Both these satellites are medium-power types that would give reception in an area bounded by Edinburgh, Stockholm, Milan and Bordeaux using dish aerials as small as 60cm. Under the agreements British Telecom will lease the satellite transponders and sell time to programme suppliers.

A row has broken out over the supply to British Satellite Broadcasting (BSB), which holds the UK DBS franchise, of satellites for the service. The US satellite organisation Comsat has offered BSB two satellites for around £46m with a launch date in 1989, a year earlier than previously envisaged for the start of the service. The satellites were originally intended to provide a US DBS service which was aborted. Modification for European use would take about eighteen months, roughly half the time it would take to build a new satellite. British Aerospace has protested that Comsat's offer amounts to dumping, since the satellites would be supplied at far less than the true manufacturing cost.

The Australian Bond Corporation, which was a member of one of the unsuccessful consortia that applied for the UK DBS franchise, plans to invest £30m in the BSB satellite project. BSB is in talks with various potential investors to raise additional capital for the project.

Home Video Channel and Premiere have merged to form a single feature-film channel. Following the deal British Telecom Vision and the Mirror Group will be 30 per cent shareholders and joint managing partners of the new Premiere service. The remaining shares are held by film companies.

A new version of the MAC satellite TV transmission system, EU-MAC, has been announced by the IBA. The aim is to achieve a common European satellite TV transmission standard – EU-MAC was developed following discussions with the electronics industry throughout Europe. The original MAC-C standard, which has been accepted by the EBU, is not compatible with cable systems. For this reason France and West Germany have preferred a less sophisticated version known as MAC-D2 for use with their DBS satellites, which are due to come into operation during the next twelve months. EU-MAC is compatible with cable operation and can be relatively easily converted to MAC-D2. Lile MAC-C, EU-MAC is suitable for wide aspect ratio/enhanced definition transmission (extended-MAC).

COMPACT VIDEO DISCS

Since the compact audio disc uses similar technology to LaserVision, why not compact video? Matsushita, Philips and Yamaha are jointly developing what is to be known as the CD Video system and will be demonstrating CD Video players at this summer's Chicago Consumer Electronics Show. Sale of the player in the US market may start this autumn. Major software companies have announced their support and commitment to the CD-V system and it's expected that other electronics manufacturers will become involved soon. There are also plans for 8 and 12in. discs using LaserVision technology with digital sound.

GRUNDIG'S SURPRISES

Grundig is to introduce a colour set with a 32in. FS tube during the spring trade show period: the firm has exclusive use of the 32in. tube in Europe for a six-month period.

A flicker-free television receiver, the new-generation multi-system M70, will be available in the UK this October. The set has a 28in. tube and a 100Hz picture frequency – the picture is refreshed 100 times a second instead of the conventional 25 times a second. This has been achieved by incorporating a 4Mbit CCD memory system which gives the added advantage of slide-quality still pictures.

TV AT 14GHz?

Croydon Cable, with the support of other London cable TV operators, has applied to the Department of Trade and Industry for permission to use frequencies in the 14GHz band to provide a local London channel consisting of live news and magazine programmes.

FLAT SATELLITE TV AERIAL

A new flat satellite TV receiving aerial that's said to have many advantages over a parabolic dish has been jointly developed by Comsat and Matsushita. The aerial was on show at the recent Wembly Cable and Satellite '87 exhibition and is expected to be on the market later this year.

The flat design combines Comsat's expertise in satellite aerial technology with Matsushita's printed circuit design and production techniques. Unlike a parabolic dish, which is a reflective device, the flat plate aerial receives the microwave transmissions direct, making alignment less critical. The thin, light-weight design makes installation relatively easy. Portable models are also to be made available.

PLANT EXPANSION

Sony is to increase production of both TV sets and tubes at its South Wales plants. The £30 million TV investment will double the output of sets from 250,000 a year to over 500,000 a year when complete in 1990 and will create 300 extra jobs. Tube production is to be increased from 300,000 last year to 400,000 this year.

Samsung has decided to go ahead with its £17m plant at Billingham, Cleveland. The company had suspended plans pending clarification of the EEC's plans to impose duties on imported components. Production is likely to start late this summer.

Sanyo is to double production of TV sets and VCRs at its Lowestoft plant. Output of colour sets will be increased to 170,000 a year while VCR production will be increased to 150,000 a year.

SOUND BALANCE AND THE HARD OF HEARING

A working group consisting of representatives of the BBC, the IBA, the ITCA, the Royal National Institute for the Deaf and the British Association for the Hard of Hearing has been set up to study the problem of dialogue audibility in some TV programmes. People with hearing difficulties have complained that they find it hard to follow dialogue when the accompanying background sound, such as music, audience response and various effects, is present at a similar level. The working party will organise a series of tests to investigate the way in which sound balance affects dialogue intelligibility – both for the hard of hearing and viewers with normal hearing. It's hoped that the investigation will lead to a clearer understanding of the problem and suggest ways in which the situation can be improved. The aim is to see whether it would be possible to adjust the sound balance without impairing the artistic effect intended by the producer.

IN BRIEF

Full details of a video monitor conversion for the Ferguson TX90 chassis are contained in the March issue (Vol. 21, no. 3) of *Electronic Technology*. The magazine is the journal of the Society of Electronic and Radio Technicians (57-61 Newington Causeway, London SE1 6BL) . . . A VCR offering picture-in-picture capability is to be introduced by Hitachi later this year. The new Model VT250 will enable the viewer to see an off-air and a playback picture simultaneously . . . It seems many, many years since we last saw a TV set bearing the Ambassador brand name. A new range of Ambassador products, including a 14in. TV set and a VCR, is to be launched by Sentra Consumer Products of Wood Street, Brighouse, W. Yorkshire.

VCR Clinic

Reports from Eugene Trundle, Alfred Damp, Roger Burchett, Steve Leatherbarrow and Philip Blundell, Eng. Tech.

Mitsubishi HS318

This newish machine came in with the complaint "no colour". A known good colour-bar tape played back in black and white, but we were relieved to find that a recording made by the machine played back in colour on another machine. A quick scope test revealed that the chroma signal got no farther than transistor Q6B0, the 627kHz playback amplifier, whose base voltage was correct at 1·6V but whose emitter read 0V. A replacement transistor cured the fault, though the base-emitter junction of the faulty one read o.k. on an ohmmeter when tested out of circuit. **E.T.**

JVC HR2200/Ferguson 3V24

"Flashing Lights" said the owner. "It's going into the alarm mode" we told him. When we explained what might be wrong and what that might cost he went into the alarm mode too . . . Sighs of relief all round then when we found that the cassette lamp had failed.

With a new lamp fitted the lights stopped flashing, but when play was selected the head drum roared round at about ten thousand r.p.m. There was no drum FG signal at TP7 in the servo section. None at terminals 111 or 112 on the servo board either. A new drum motor required? No, there was continuity through the FG coil at the motor connector. The trouble was due to dry-joints on the motor drive amplifier board, whose terminals 11, 12/21, 22 pass on the FG signal. **E.T.**

Sanyo VTC9300

These golden oldies were built like battleships and give every sign of outliving all their contemporaries. One arrived in the workshop the other day with a broken belt, and was thus unable to play. A footnote on the job card, in the owner's writing, gave elaborate instructions on how to get the tape to load: hold down the cassette lid with one hand while half-pressing the eject lever with the other and simultaneously pulsing the play lever till it stays down. He'd apparently been going through this procedure for some months before the belt broke to spoil his fun. The problem was that the mains motor was not being energised on receipt of a cassette: the cause was the fact that the loading switch (a great big microswitch bolted to the left-hand side of the deck) had gone open-circuit. Its tags and blade differ from the standard RS Components type lever microswitches in our stores so one had to be ordered from Sanyo. With it and the belt fitted, and the heads cleaned, the machine seemed to be ready for another ten years' use. **E.T.**

Finlux VR1030

The problem here was that the machine would lace up then, when the play key was pressed, it would unlace again – regardless of whether a tape was inserted or not. A second symptom was that the head drum rotated so fast there was a danger of it becoming airborne.

Taking these two symptoms together led us to the head drum tacho pulse generator. This consists of an optocoupler through which a drum-mounted interrupter whizzes. It's conveniently mounted on top of the drum, making it easy to establish that no output pulses were present during the few seconds available before the syscon shut the show down. In fact the phototransistor was o.k., but the LED section had gone open-circuit. A new optocoupler assembly restored order, with the correct 12V peak negative pulse per 40msec at pin 3 of P669. **E.T.**

Hitachi VT33

A weak point that's come to light is where the wires to the supply end sensor (Q141) are soldered into the cassette loading motor board. The wires are pulled tight and eventually break off, giving no rewind or review. **R.B.**

Hitachi VT11

Intermittent stopping/tape snagging was the fault report with this machine. As the fault didn't show up on test a basic deck service was carried out and the pinch roller was replaced. It came back of course, this time with the tape still in the machine. It looked as though the capstan had stopped, so a new capstan motor was fitted (this cured the warbling sound). Back it came a third time. The unit was put to one side with the bottom panel unhinged. It played away merrily for hours. Eventually I caught it. The drive was there for the take-up reel but the clutch assembly that drives it underneath the deck didn't rotate. I removed it (this is easier said than done, as it was almost solid on its shaft) and after lubricating the shaft the trouble had been cured. **S.L.**

Sharp VC9700

Intermittent failure to play was the fault with this machine. When the fault occurred the drum didn't rotate as the motor control voltage at plug ES2 was low (1V). The drum muting transistor Q719 was leaky. **P.B.**

Sanyo VCT5000

For no E-to-E vision check relay RY1001 on board VD1 for dirty contacts. **P.B.**

Sharp VC8300

This machine intermittently blew fuse F903. In the past this has often been due to a faulty drum motor, but not on this occasion. The fuse would usually blow when the tape was unthreading, so a meter was connected in the feed to the threading motor. As there was no overload here we had to work back. The problem was eventually traced to an intermittent short in the forward/reverse switch (part no. QSWF0002GE). It's mounted by the solenoids. **P.B.**

JVC HRD120/Ferguson 3V35

This machine wouldn't accept a cassette. A quick check revealed that there was no supply to the cassette motor drive chip due to the 13V supply protector CP1 on the mechacon panel being open-circuit. **P.B.**

Sharp VCRs with Scotch Tapes

Since the shop down the road started to sell Scotch tapes I've had a number of cases of Sharp machines creasing only this make of tape, usually in the rewind search mode though three machines creased the tape in playback. In all cases the tape folded as it went over the drum exit guide. In most machines the search or playback tension was towards the top of the tolerance range and readjustment provided a cure. New rotating guides were required in the other machines. One wonders why the problem showed up with only this make of tape? **P.B.**

JVC HRD565

Intermittent failure to eject was the complaint with this machine. The problem was to have a meter connected at the right time and in the right place. To start with we connected the meter across the cassette motor. This turned out to be a fortunate move: when the fault did occur the voltage across the motor rose but the motor stood still – a slight touch on the motor wormgear and the motor sprang to life. Replacing the motor restored normal operation. **A.D.**

Mitsubishi HS330

This two-speed machine couldn't detect SP or LP and was constantly switching between speeds. When the VCR did settle the displayed picture suggested that the drum input/output guides were incorrectly set. Readjusting these guides cured the fault. **A.D.**

Sony SLC5

With its own recordings there was no picture except in the pause and picture search modes. The machine worked all right with prerecorded tapes. A check on the f.m. envelope at the head amplifier board showed that one output was rising and falling, indicating a servo fault. Checks on the servo board then revealed that the CTL pulse was missing at TP11. Replacing the audio/control head cured the problem. **A.D.**

Fisher FVHP715

This machine would work intermittently: when it was in the fault condition all the front indicator lights went out but the clock and counter stayed on. When we moved the machine from the soak test rack to the work bench it worked normally. We were unsure whether the trouble was due to a confused microcomputer chip or a dry-joint. When the fault eventually appeared we removed the mains plug, counted to ten and plugged in again. As the fault was still present we looked for a dry-joint. After much tapping we found one at R971 on the power board. **A.D.**

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.

SONY KV2022UB

This set may work normally for weeks on end but on some occasions it won't switch on at all. In the fault condition the 105V h.t. supply is missing. If the set is left off for a while it will return to the normal working condition.

Check by substitution the chopper driver transistor's base bias resistor R624 (120kΩ), the decoupler C609 (3·3μF) and the error detector transistor's reference diode D603 (RD12E-B2). If the start-up resistors R602 and R603 (both 47kΩ, 1W) are cold after a period of non-running, replace both. This assumes that the mains bridge rectifier is producing 360V at the collector of the chopper transistor Q605.

THORN 9000 CHASSIS

The problem is very intermittent height reduction, with the lines carrying teletext information appearing approximately a quarter of an inch below the top of the raster. Scope tests have been carried out in the field timebase but due to the short duration of the fault nothing of significance has been noticed.

Now that these sets are getting on in years dry-joints are a common cause of problems. It's likely that replacing the large electrolytics in the field timebase circuit and resoldering all the joints here will do the trick. If not, use heat from a hairdryer and freezer spray to check the semiconductor devices in the field timebase, particularly VT407, VT408 and W408 in the driver and output circuits.

SANYO VTC5400

When any function other than pause is selected the machine returns to the stop mode after exactly two seconds. In addition the record function can be entered only when the lock button has first been pressed. All chip voltages seem to be correct and the sensors appear to be working correctly.

The fact that pause is the only function which works correctly indicates that the problem lies with the reel sensors. If these have been checked by substitution the only other likely possibility is failure of the BA6135 chip. Rather than change this on spec however it would be better to check the generation and progress of the reel sensor pulses.

TELETON C18BS

The problem with this set is sound distortion after a few hours' use. The speaker seems to be all right and the sound is quite good at other times. The distortion is the same on all channels.

This effect is very often caused by a "soft" loudspeaker that warps and rubs as it warms up – lash in a substitute 16Ω or 15Ω speaker as a check. If the problem remains the fault is most likely to lie amongst the bunch of audio amplifier transistors TR704/5/6/7 – use gentle heat from a hairdryer and freezer to check them. It's possible though unlikely that the TA7073AP sound chip is responsible: test it thermally in the same way.

PANASONIC NV333

When the machine is powered the loading motor continues to run and the machine stays in the loaded condition. The syscon microcomputer chip has been replaced but this hasn't made any difference.

A very common cause of this problem is slippage of loading belt 2. If replacing this doesn't provide a cure, suspect misadjustment of (or a fault in) the mode switch. Its mechanical adjustment is very critical.

SHARP VC7300

The machine will suddenly switch off for no reason, in either the play or record mode. Pressing the relevant button, play or record, restores normal operation. There's no set time for the switch-off: it could be after five minutes or after an hour or so.

Check by inspection whether the take-up spool is stopping. If it is, check the play idler which may need replacement. If the spool doesn't stop, the cassette lamp could just be responsible (intermittently open-circuit) but it's more likely that the take-up rotation sensor optocoupler assembly is faulty.

PYE G11 CHASSIS

The picture is stable at normal brightness but with no signal or a dark scene the raster is smaller.

First check the voltage at the h.t. fust F4037. If the reading is less than 156V the power supply should be checked. If everything is o.k. here the line output transformer is suspect. Before replacing it try resoldering the joints on the underside of the panel. The whole board can be reworked in less than half an hour.

FISHER FVHP615

There's loss of colour and horizontal lines appear across the screen as though the tracking is incorrect, but the tracking control has no effect. I've changed the i.c.s in the servo circuits and made various checks here but have been unable to find any cause of the problem.

It's almost certain that the cause of the problem doesn't lie in the servo section. The common factor between the two symptoms – no colour and incorrect servo action – is that they both depend on the 4·43MHz subcarrier signal. It's likely that this is missing. It comes from X202 and Q232 on the video PCB. A scope will be needed to trace it.

SANYO 80P CHASSIS

The first thing we found was that the 800mA fuse in the chopper circuit had blown. The chopper transistor was then found to be short-circuit. These items were replaced, along with R302 and C314 in the chopper transistor's base circuit. As no short-circuits were apparent 130V was applied via an isolating transformer. This produced a perfect, full-sized picture. When the input was increased to 180V however the fuse blew again and we had another short-circuit chopper transistor.

The bias and coupling components in the chopper transistor's base circuit are the most common culprits, but you've replaced them. We suggest you check by substitution the other components immediately associated with the chopper transistor, C315 (1,500pF), R315 (39Ω) and R318 (0·33Ω), also R313 (2·7Ω) which is in series with the chopper circuit and the two zener diodes D305 and D309 in the control circuit.

TEST CASE

293

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.

As a general rule we don't service TV sets that are more than about seven years old. This is for the following very good reasons: in many cases spares are hard to obtain; future reliability is unlikely to be good, leading to call-backs; and the general condition of many such old soldiers is such that either the set has to be returned in poor shape or the "repair" process can be a very lengthy and expensive one. Individual makes and models vary tremendously of course, so our rule is reasonably flexible. Provided we can get the parts we'll do it if we think that we, the customer and the set will all be friends in a year's time . . .

So what were we doing inside a 1976-vintage ITT hybrid set (CVC9 chassis)? Wallowing in nostalgia! This fugitive from the corporation tip had no colour. It was given to a trainee to deal with, more as a training exercise than because this was necessary. The trainee did very well. He started by carefully tuning the set to an off-air transmission, then waded into the decoder department with an oscilloscope probe. The displays he got with the vision signals were inconclusive, partly because of the varying chroma content and partly because it's difficult to trigger the scope reliably from the burst. A colour-bar generator was substituted for the off-air signal, and a more stable external triggering mode was arranged for the scope.

Thus equipped, our trainee established that chroma signals of reasonably good amplitude were present at the chroma amplifier transistors T27 and T28 and were being fed to the burst gate/amplifier transistor T34 along with the correct gating pulse. A 13V peak-to-peak gated burst output was present at the collector of T34. The next check was for the presence of the ident signal at the collector of T35. Virtually nothing was present here. With the scope flat out (gainwise) a few millivolts of misshapen 7·8kHz signal were discerned – less in fact that were present at the base drive point, the junction of C212 and R296.

The next logical step seemed to be to check the d.c. voltages around T35. The base and collector readings were both rather low at 0·35V and 4·5V respectively. At this point an experienced technician was consulted. His much respected – but completely wrong! – advice was to replace the transistor. The result of doing this was that exactly the same symptoms and readings were present as before.

Our trainee reported these facts and pressed the experienced technician for further words of wisdom. He suggested checking the base bias and collector feed resistors, also the tuning of the ident coil. These measures made no difference and the false prophet soon found himself in the trainee's chair! Muttering to himself he prodded with the voltmeter and probed with the scope, confirming the conditions already outlined. The culmination of his checks was the disconnection of one not previously mentioned component. This action restored a beautiful ident signal at T35's collector. An ohmmeter test on the now-isolated component proved it to be o.k., but an associated component certainly wasn't when checked with the same instrument. What was it? See next month's test case page.

ANSWER TO TEST CASE 292
– page 413 last month –

Our test case story last month concerned one of those maddening intermittent faults that are part of every service technician's burden. The set (Tatung 120 series chassis) would at irregular intervals choose its own programmes. Fruitless investigation of the channel selection system included changing the control chip and several of its peripheral components, all to no avail.

It's a moot point whether the fault would have continued to be present with the chip running from an external power supply. Everything would depend on the way in which the transient was getting into the channel selection system when the focus spark gap flashed over. The cause of the problem was brought to our notice because an ear happened to be close to the back of the set at the vital moment. It would however have been audible in reasonably quiet surroundings, the sound being similar in nature and volume to the snapping of fingers. If only the customer had mentioned the "snicking" noise! We found that it could easily be instigated by gently blowing on the spark gap.

The new component we fitted was of a different (fully enclosed) type, Tatung part no. 2519909, and we don't expect any more problems. Does anyone want to buy an SN76705AN?

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TELEVISION MAY 1987

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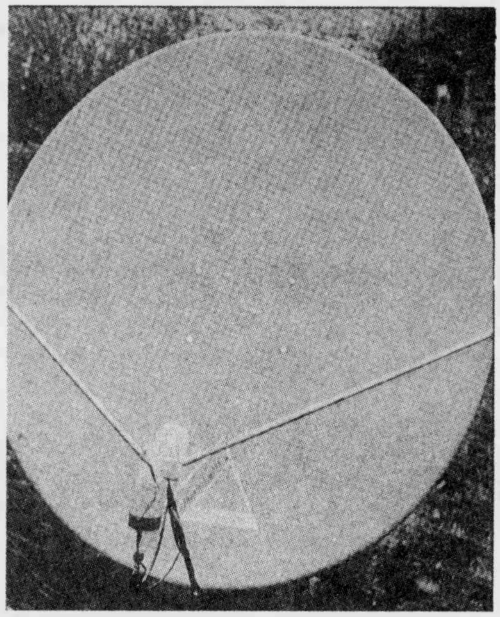

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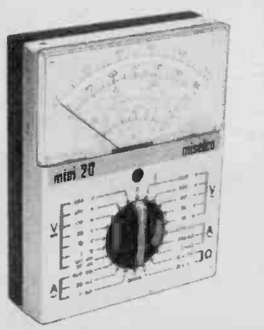

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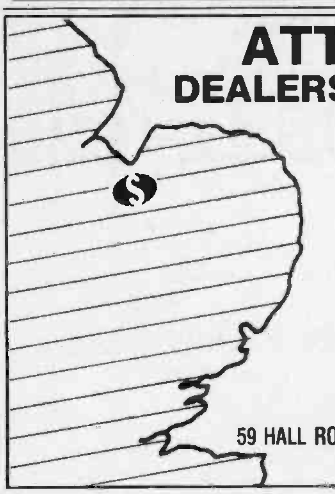

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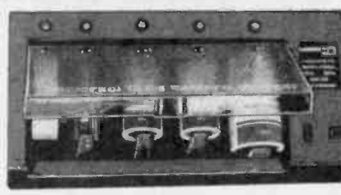

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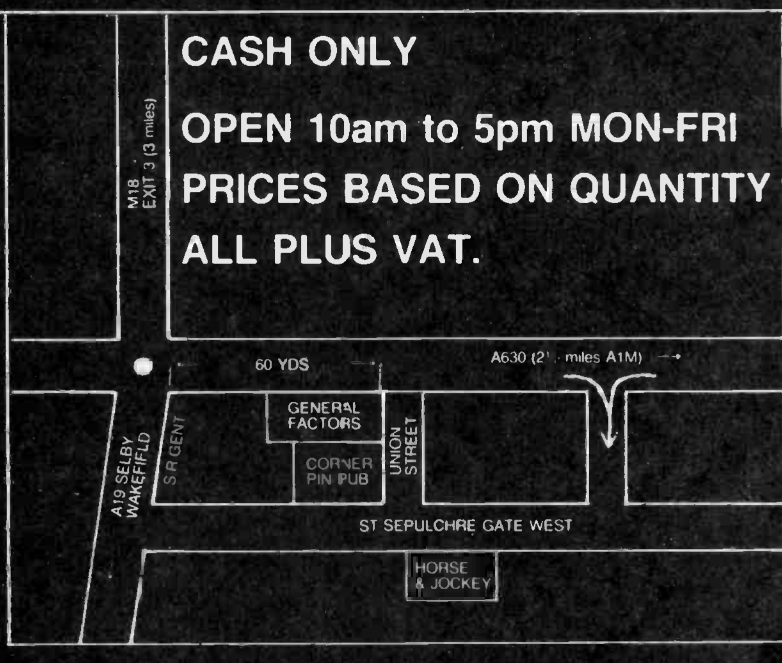

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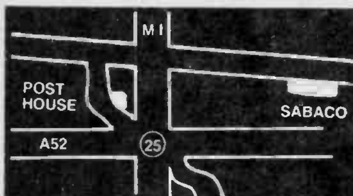

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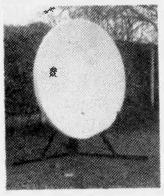

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- LP 1193/63 £4.00
- BG 100/41 £3.25
- ERC Tripler print type with foacs PO7 BG2087 £5
- T/text ultrasonic rec'r panel £14.00
- 12-14V. 20 for £5.00 200 for £25.00
- GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
- G11 E.W. Transformer 50p
- G11 E.W. coils £1.00
- G11 Transient Suppressors 245V 20p
- G11 Scan Coils £5.00
- G11 100K tuner pots 12 for £1
- KT3 IF panel £6.00
- KT3 line OSC transformer £1
- KT3/K30 infra-red receiver head £1
- K30 drawer unit with IC's (home) £10
- K30 drawer unit with IC's (export) £10
- KT3 AE Sockets 50p
- KT3 receiver panel £8
- KT3 line driver transformer 50p
- Pye, K30, GEC, etc. Pre-mains stand-by switch £1
- Decca 80/100 1F panel £5
- NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
- 5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
- Control panel 5 sliders + mains lead £1.50
- G11 8 touch button unit replaces old 6 P.B.U. £24
- G11 6 touch unit replacement with dat £14.00
- Tube base + base unit for 820 Euro chassis £4.00
- GEC Line O/P Trans. & Rec Stick for Portable £3.00
- CVC 20/25/30/35/40 decoder panel £10
- CVC 20/25/30/35/40 decoder panel (untested) £5
- CVC 40/45 IF panel £5
- 40K Transducer 50p
- PHILIPS NE511N £1.20
- LM337M Reg. 30p
- 20 GEC Black Spark Gaps £1.00
- KT3 Front Panel Control Assy. £2.50
- BTW 30/50 50p

TELETEX DECODER

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

- Rank T20 Z136 Panel £6.00
- NEW 1617 THORN Chassis with ICs & AU113 £5.00
- NEW GEC 20AX Power Supply Switch Mode £12.00
- Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI £10.00
- Field + Jungle panel for GEC 3133/3135 £1.50
- GEC 2110 line panel with transformer £7.00
- GEC 2110 tuner unit + IF Panel £12.00
- Pye/Chelsea Line op panel £12.00
- Pye 205 T/unit £3.90
- Pye 205 Line op panel £7.50
- Pye 713 IF panel and tuner £7.00
- Pye 713 Chroma £10.00
- Pye/Chelsea Timebase panel with LOPTI £10.00
- Pye 731 Frame Panel £5.00
- Pye 731 Convergence Panel £5.00
- Pye 731 Chroma £10.00
- Pye 731 IF panel + tuner £10.00
- Pye CDA/205 panel £6.00
- GEC portable chassis + LOPTI 2114 New £4.00
- Thorn 1613/1713 chassis 9.75
- G9 Power Panel £6.00
- Mono RANK Chassis 127A NEW £10.00
- NEW G9 Frame Panel £4.00
- NEW G11 IF Panel £10.00

- G8 Tuner Unit + Panel £4.00
- G8 Power Supply £5.00
- G8 6 Sloping PBU £8.00
- G8 IF & Chroma £6.00
- G8 Chroma £3.00

- G11 IF Detector £3.00
- G11 Selector gain module £3
- Complete CVC 825 Chassis (both panels) £40.00
- AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
- Z714 RANK IF Panels 6MHz 1 I.C.
- SL437F £3.00
- Z909B RANK IF Panels
- Export 5.5MHz 2 I.C.'s
- TBA1205B TCA2705Q £2.50
- K35 IF £6.00
- Z743 RANK IF Panel
- Export 5.5MHz 3 I.C.'s
- TBA750+SC9504P+
- SC9503P £1.50
- Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
- Pye 6 button switch portable £1.00
- GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export) £12.00
- GEC Line O/P PC 659B3 £6.00
- 2110 GEC Power Panel £8.00
- CVC 20 Front panel with sliders + mains input panel £4
- CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots
- 8 and 12 button units £9.00
- CVC9 slider pots panel 50p
- CVC 5 Mains on/off + 5 pots £2
- Universal Focus. Fits Pye, Thorn and Decca Units.
- T147 Rank tube base on panel £1.00
- Z718 Focus Unit £1.50
- T20 Focus Unit £1.00
- Large Type 75p
- Decca Small 75p
- KT3 Focus Unit 75p
- K30 Focus Pot 75p
- K30 Tube base on panel £1.00
- TX10 Focus Units £7.00
- CVC 32 Focus Unit 75p
- Fedility Focus Unit 14R–14S 30p
- 3500 Thorn Focus Unit £1.00
- ITT Small for use with Split
- Z718 Bush Focus £2.00
- Diode 50p
- TV11 50p
- Remo TV12SP 50p
- 1600 Thorn EHT Rec and Lead 50p
- TV13 50p
- TV14 50p
- TV18 60p
- TV20 £1.00
- TV45 50p
- Thorn 14/1500 rec stick 5p

- G11 drawer ASS 3 pots Mains switch and lead £2.00

- K30 Drawer Ass with pots cable forme £1.00

- Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228 £10

PHILIPS BATTERIES
(Small Types) HAND SETS

- SR41 40p
- SR43 40p
- SR44 40p
- SR54 40p
- LR43 40p
- LR44 40p
- LR54 40p
- CR2032 40p

- .22/1000 20p
- .1/250AC 20p
- .1/100 5p
- 1MFD-250AC 25p
- 1/100 × 10 30p
- 22/100 10p
- 4.7M/100 5p
- 470/100 20p
- 2000/100 70p
- 4700/100 75p
- 47/160 10p
- 300 300/300V 80p
- 800/160 50p
- .1/250 Pulse 5p
- 2.2 250v 10p
- 3n3/250 A.C. 10p
- .33/250V 20p
- .39/250V 15p
- 4n7/250 tested 5KV 25p
- 22/250 15p
- 47/250 10p
- 100/250 20p
- G11 470/250V £1.75
- GEC600/250 60p
- 700/250 £1
- 300+300 MFD 350v £1.00
- 800/250 40p
- 32/300 20p
- 4/350 5p
- 8/350 8p
- 4.7M/350v 10p
- 33/350 20p
- 220/350 30p
- 300/350 40p
- 400/350 50p
- 10/375 10p
- 22/375 15p
- 220/385 (ITT) 75p
- 330/385 CVC 820HT 60p
- 0.1/400 15p
- KT3 E/W .39/400 15p
- .56K/400v 20p
- 4700pf/400 10p
- .22/400 10p
- 8/400 15p
- 33/400 20p
- 400/400 40p
- 394K/400V 20p
- 220/450 40p
- .47/500 25p
- 0.1/600 15p
- 0.1/1200V wire end 20p
- 0.1/450 A/C wire end 20p
- .22/1000 20p
- .047/600 15p
- 0.047/1000 10p
- 0.01/1000 10p
- 0.1/1000 10p
- .47/1000v 65p
- .47/250V A.C. 10p
- .001K/1250 10p
- 0.0047/1500 10p
- .005/1500 10p
- .0105/1500 10p
- 1n8/1500 15p
- 2n0/1500 10p
- 2n2/1500 15p
- .01/1600 15p
- G11.8200/2KV 15p
- 0.1/2KV 20p
- 3n9/2KV 15p
- 0.0015/2KV 10p
- 6n2/2KV 15p
- 2n0/2KV 15p
- 2n2/2KV 15p
- 470pf 4KV 10p
- 7500pf/2KV 10p
- 3000PF/3000V 10p
- 4n7/2KV 15p
- 6n8/2KV 10p
- 7n1/1500V 10p
- 8n2/1500V 10p
- 9n1/2000V 10p
- 8n2/2KV 15p
- 0.0082/2500 15p
- 150/3500 10p
- 1800/4KV 5p
- 4.7nf/5KV 10p
- 170/8KV 10p
- 180/8KV 10p
- 210/8KV 10p
- 1000/10KV 10p
- .47/100V 80p

- CVC 20-25-30 Mains Switches 60p
- Infra-Red and Ultrasonic G11 Teletext Decoder Panel £30
- RANK & ITT Mains Remote On-Off Switch (720R) £1.50
- RANK & ITT Mains Remote Switch 2865 ohm £1.50
- RANK & ITT Remote Switch 2800 ohm £1.50
- G11 Mains Switch 50p
- 4 amp Mains Switch 25p
- GEC Mains Switch 4 amp 30p
- KT3 Mainswitch £1.00
- THORN Rotary Mains Switch 50p
- G8 Mains Switch 75p
- G11 Preh Red LED P/Button for C.H. Change 20p
- RANK TOSHIBA Transductors TPC-2011 50p
- Mains Switch ITT Long Type Print 75p
- Mains Switch Philip Long Type TAG 75p
- Mains Switch GEC Long Type TAG 75p
- Thorn 12 or 24 volt battery convertor for portable colour T/V £6.00
- 2000 Chassis Fidelity Mains Switch (4 TAG) 60p
- 250V/4A White Lorlin Mains Switch 60p
- KT3-K30-K35 Full Remote Mains Switch (6 TAG) £1

- Tube Thermpath 167 £1.00
- Rank Secam Decoder Panel UHF & VHF T115A £13.00

Multi-Caps

- 220 MFD Sprague 385V 50p
- 350V 300M + 300M £1.00
- 400V 400M 60p
- 350V 400M 60p
- Thorn 3500
- 175/100/100/350v £1.00
- KT3/200/25/25/385v £1.00
- 200+200+75+25M 325V £1.00
- 300+300+150+100+50MFD
- 350V £2
- G11 CAP 470/250 £2
- 47/220/350v 60p
- 150/150/100/100/100/320v £2.00
- 2500/2500/63v 50p
- 150/200/200/300v 70p
- 300/100/100/16/275v £1.50
- 100/200/325v 40p
- 150/150/100/375v £1.50
- 200/200/75/25M 325V £1
- Thorn TX9 Caps 500+500M 175V £1.75
- 300/300/100/32/32/300v 2.00
- 1500/2000/30v 50p
- 150/150/100/100/320v £2.00
- 100/350 + 300/200/100/16/275v £2.00
- 225+25/380 GEC 70p
- 200/100/100/350v £1.50
- 500/500/25v 50p
- 150/150/100/300v 75p
- 200/150/150/300v 1.00

- ITT 8 and 6 Push Button £1.00
- Pye 725 LOPTs £6.00
- Pye 731 LOPTs £6.00
- Thorn 8500-8800 LOPTs £5.00

- CMC 301 £20.00
- CMC 303 £20.00

- CMD 800 Chassis. No tuner £20.00

- CMD 800 Decoder £8.00
- CMD 800 IF/Tuner £20.00

- UPC 574 30p
- BSS 38 30p

- G11 £1.50
- 1 I.C. Receiver Panel

- 3 I.C. Power Supply G11 Full Remote Receiver Panel £3

- FET Power VN88AF 50p

- PHILIPS SBC 469 Stereo Microphone £23.00
- Meters Hills 520 £17.00
- Meters Hills 420 £15.00
- Hills HD5000 Digital Meter 1000V DC 750AC 10 Amp 20 MRG Rangers £28
- HT100 Multimeter £6.75
- HT300 Multimeter £7.75
- HT500 Multimeter £9.00
- HD1000 Digital £20.00
- HD3000 Digital £25.00
- HD5000 Digital £25.00
- HD6000 Digital £32.00
- HD8000 Digital £37.00

Infra Red
Hanset Tester

Works at 24 feet – Sound repeater.
Works off 9 volt battery £8.00
Fits in top pocket.

Repaired Handsets

- Philips K4-K35, RC5350-RC5300, RC5370, RC5375, repaired same day £10.00
- RC4001 Full Remote KT3 K30 Teletext Handsets exchanged £9.00

- GEC Full Remote Infra-red, 1983 models £15.00

- Timers, 60 mins, small £1.00

TOSHIBA
HAND SETS

- 24 Button CT938 Fulremote £5.00
- 32 Button CT983 Videotext £6.00

- G11 Full Remote Ultrasonic £32
- G11 Touch Unit Full Remote £13
- G11 Ultrasonic Teletext Handset £24.00
- 8 C.H. Ultrasonic GEC Full Remote C2014I1/C2219H £15.00
- New Replacement for G11 Ultrasonic Full Remote £12.00
- Thorn 4000 insert with 7 buttons £5.00
- Decca RC 11 £14.00
- Decca RC 12 £14.00
- G11 Infra-red full teletext £24.00
- Dynatron-Full remote CTV 62, 63, 64 £19.00
- Hitachi infra red handset £18
- Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
- G11, Full remote top button assy. £12.00
- G11, Full remote repair service (exchange unit) £18.00
- G11, Full remote new ultrasonic £32.00
- GEC infra red full remote 8 channel (1.C.SAA1250) £14.00
- Philips infra red full remote 9 channel for 60 CP2605 £6.00
- Philips infra red full remote 12 channel for 60 CP2605 £12.00
- K35
- KT3/K30 T/Text £15.00
- KT3/K30 Full remote £15.00
- KT3 Power supply £4.00
- GEC infra-red 2236-2026 £4.00
- GEC 8 button full remote £14.00
- GEC push pad handset button blobs 10p each
- Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
- **Special Price** £13.00
- RC4001 KT3 and Teletex £14.00
- IT CVC 32 handset repaired £15.00

PHILIPS
UNIVERSAL HAND SET
£20.00
KT3 – K45

We have all parts for Philips Handsets