MARCH 1984 Australia $1.80; New Zealand $2.10; Malaysia $5.50; £1.00

TELEVISION

SERVICING·VIDEO·CONSTRUCTION·DEVELOPMENTS

THE CED VIDEO DISC SYSTEM

SERVICING THE SONY KV1400UB

DX SIGNAL DETECTOR/ALARM

BLACK LEVEL VIDEO GENERATOR

VCR CLINIC

TV FAULT FINDING

TELEVISION

March 1984

Vol. 34, No. 5
Issue 401

this month

OUR NEXT ISSUE DATED APRIL WILL BE PUBLISHED ON MARCH 21

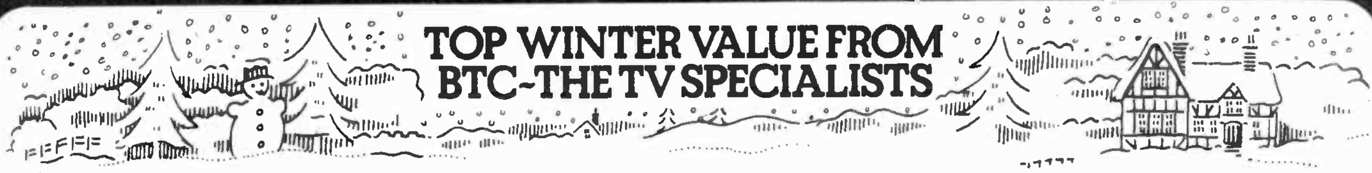
CORRESPONDENCE
All correspondence regarding advertisements should be addressed to the Advertisement Manager, "Television", King's Reach Tower, Stamford Street, London SE1 9LS. Editorial correspondence should be addressed to "Television", IPC Magazines Ltd., King's Reach Tower, Stamford Street, London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

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

BINDERS AND INDEXES
Binders (£4.50) and Indexes (45p) can be supplied by the Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF. Prices include postage and VAT. In the case of overseas orders, add 60p.

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

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



You won't better these BTC bargains!

Top quality sets to set you up for the winter televiewing boom.
Brighten your winter profits with better sets from BTC.

HYBRIDS

COLOUR		UNTESTED		WORKING	
	DECCA BFD 30				
	TELPRO	ONE TO TEN	£20.00	ONE TO TEN	£28.00
	KORTING	ONE TO TEN	£20.00	ONE TO TEN	£28.00
	PYE 697, GEC 2040	OVER TEN	£18.00	OVER TEN	£25.00

SOLID STATES

COLOUR		UNTESTED		WORKING	
	PHILIPS G8's				
	2-CHIP BUSH/MURPHY	ONE TO TEN	£28.00	ONE TO TEN	£45.00
	GEC 2110, 8500	ONE TO TEN	£28.00	ONE TO TEN	£45.00
	3500 VARICAPS	OVER TEN	£25.00	OVER TEN	£40.00
	P/BUTTON HITACHI's	OVER TEN	£25.00	OVER TEN	£40.00
	18″ PHILIPS	ONE TO TEN	£28.00	OVER TEN	£40.00

COLOUR		UNTESTED		WORKING	
	1-CHIP BUSH/MURPHY				
	THORN 3000, THORN 8000	ONE TO TEN	£22.00	ONE TO TEN	£35.00
	18″ PYE's	ONE TO TEN	£22.00	ONE TO TEN	£35.00
	ROTARY JAPS	OVER TENS	£30.00	OVER TENS	£40.00

COLOUR		UNTESTED		WORKING	
	LATER SETS				
	ie. THORN 9000	ONE TO TEN	£45.00	ONE TO TEN	£55.00
	TOUCH TUNE SETS	ONE TO TEN	£45.00	ONE TO TEN	£55.00
	etc.	OVER TENS	£40.00	OVER TENS	£50.00

MONO

SINGLE STANDARD MONO TV's IN BATCHES OF 20 @£4.00 EACH

PLEASE NOTE-15% VAT ON ALL PRICES

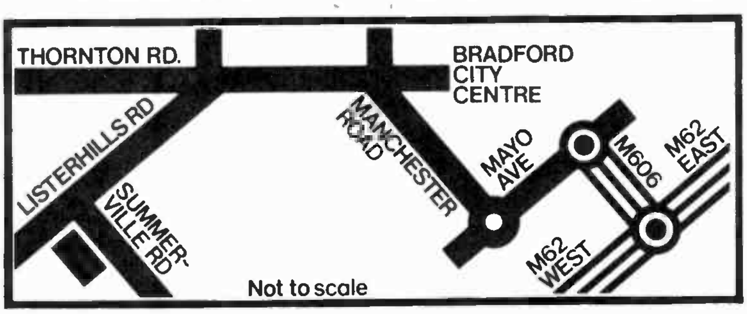
SPARES PANELS, TUNERS, LOPTS, TUBES, STANDS, INDOOR AERIALS.
ALWAYS IN STOCK — NEW OR S/HAND ABOVE SPARES INCLUDE BRITISH & CONTINENTAL TV's.
PLEASE RING OR WRITE FOR QUOTES.

0274-306018

CASH & CARRY SPECIAL SERVICE TO THE TRADE OR ASK ABOUT SPECIAL DELIVERIES ON LARGE QUANTITIES.

OPENING TIMES MON-FRI 9.00-12.00/1.00-5.45 (CLOSE 4.30 SAT)

BRIARWOOD TRADING COMPANY



BTC

BRIARWOOD TRADING COMPANY
LEGRAMS MILL, SUMMERVILLE ROAD,
BRADFORD BD7 1NH

P. V. TUBES

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	3.40
PHILIPS 320 (400/400/200V)	2.07
DECCA 30 (400/400/350V)	3.40
DECCA 80 (400/350V)	3.00
DECCA 100 (800/250V)	3.97
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.30
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.70
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.66
RBM A823 (600/300V)	2.83
RBM Z146 (300/300/350V)	3.55
RR1 T20A (220/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.98
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.20
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.78
THORN 3500 (1000/63V)	86
THORN 3500 (1000/70V)	86
THORN 8000/8500 (2500/2500/63V)	3.38
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.28
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25
THORN 4700 P/C 25V	1.20
PHILIPS 320 400/400/200V	2.74
THORN 1591/1691 4700/25V	1.20

ELECTRONIC TUNERS AND ASSEMBLIES

Mullard ELC1043/05	8.40
Mullard ELC1043/06	8.40
4 P/B DECCA/GEC/ITT	6.88
6 P/B DECCA/GEC/ITT	7.50
4 P/B PYE	9.00
6 P/B PYE	16.00
PHILIPS G8 Tuner	10.50
PHILIPS G8 Ass. (Square/Early)	13.50
PHILIPS G8 Ass. (Sloping/Late)	13.90
PHILIPS G9 Tuner	10.50
PHILIPS G11 Tuner	9.00
ITT/PYE/GEC 7 Button P/B	13.95
GEC 2110 6 way P/B	7.98
U321 UHF Tuner	7.50
THORN 8800 SELECTOR (HMV Model 2725/6 way round button)	7.50
THORN 9000 SELECTOR	13.40
U322	7.20
HITACHI 4 way Chan. Selector (Also Rank A823)	10.75
RR1 T20A 6 way Chan. Selector	9.75
RR1 T20/22/26	11.00
PHILIPS 8 way TIP Switch Unit (suitable for all G11)	23.00
ITT CVC8 (5 wheel modified)	£12
ITT 6 way with VCR (Also Slim GEC)	8.90
PHILIPS KT3	14.50
PHILIPS KT30	10.30
PYE 697 Repair Kits	6.97
ELC 2003	£16.50

SWITCHES

4A Double Pole On/Off Switch General Purpose Push/Push	75
Philips G8 Push On/Off Switch	1.38
4A Double Pole Rotary On/Off	66
A1 Beam Switch (THORN 3500)	70
GEC 2110 A1 Control IM5 (Red, Blue, Green)	58
GEC 2040 On/Off Switch	88
On/Off Switch G11/G12	1.58
On/Off Switch GEC/TCE TX9/10	1.06

FUSES

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

AERIAL ACCESS.

Surface Mount. Splitter	1.70
Surface Mount. Outlets	80
Cable Clips per 100	1.18
Coax Plugs per 10	1.80
P.V.C. Tape	35
F.M. Plugs	25
PL259 Plugs	40
Line Connectors	35
Reducers for PL259	16
T.V. Filter 50db Rejection 27mhz	2.10
Attenuators 6db, 12db, 18db	1.80
Top Tenna Set Top Aerial	2.30
M.H.A/P.U. the pair	18.00
Aerial Isolator Kit	2.08
4m Fly Lead	1.20
2m Fly Lead	90

ANTIFERENCE

SB11 Indoor Splitter	1.91
COB11 Single Outlet	80
TRR/VSP Transformer	2.83
CS200/SP Comb/Splitter	3.03
CS1000 Comb/Splitter	6.15
PU1240 Power Unit	11.10
UP1300 M.H.A. UHF/VHF	8.25
XTRABOOST XS2U	11.63
4 Way Amp UHF/VHF	33.75
6 Way Amp UHF/VHF	42.60
Super Set Top	5.50
XG8 High Gain Aerial A,B,CD or W/B	17.90

LABGEAR

CM7061 Power Unit 12V	10.70
CM7062 Reg. Power Unit 12V	11.67
CM7060 MHA 10db 12V W/B	9.39
CM7065 VHF/UHF MHA W/B 12V	13.86
CM7067 UHF 12V MHA (Specify A-B or C/D)	10.21
CM7068 UHF 12V MHA High Gain (Specify A-B or C/D)	15.19
CM7053 Behind Set UHF Amp. (Mains)	12.13
CM7054 Behind Set UHF Amp. (Battery e.g. Caravans)	9.92
CM7043 Second Set Amp. UHF	11.54
CM7093 Behind Set UHF Amp. 3 Sets	14.54
CM7063 Dist. Amp. VHF/UHF 17db/output 12V	20.10
CM7108 VHF/UHF 8+1 Dist. Amp.	41.20
CM9700 27mhz CB Suppress.	3.86
CM6011 Outdoor Splitter (2 way) W/B	7.46
CM9003 Flush Single Outlet	1.40
CM9010 Flush Twin Outlet	1.86
CM9034 UHF Group Filters with DC Through Pass (state A/B/CD)	6.97
CM6006 6 Way Passive Splitter	10.97
CM7042 TV Games Combin.	2.68
CM9009 Flush TV/FM Outlet	2.90
CM7069 Tri Star Amplified Set Top Aerial W/B	17.50
CM7090 Amplified Caravan Aerial 12V DC W/B	15.52
CM6038 UHF/VHF 625 Pattern Gen.*	50.00
CM6052 UHF/VHF PAL Colour Bar Gen.*	190.00

* While stocks last

RECTIFIER TRAYS

THORN 950 Mk II	4.25
THORN 1400 3 Stick	5.20
THORN 1500 3 Stick	4.55
THORN 1500 5 Stick	5.29
THORN 1600	3.90
THORN 3000/3500	7.98
THORN 8000	5.28
THORN 8500/8800	7.15
THORN 9000	7.93
DECCA 1730/1830	4.48
DECCA 1910/2213 Bradford	5.92
DECCA 30	6.76
DECCA 80	6.60
DECCA 100	7.50
UNIVERSAL ITT or REMO	6.00
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 Pre Jan '77	7.00
GEC 2110 Post Jan '77	7.00
PHILIPS G8 Short Focus Lead	6.75
PHILIPS G8 Long Focus 550	6.75
PHILIPS G9	6.37
Pye/Philips K3 Tripler	6.65
PYE 691/3	6.58
PYE 713/4 Lead	7.00
PYE 713 Doubler 5 Lead	7.50
Philips/Pye KT3	6.67
PYE 731/725	7.60
R.B.M. A823 (plug in) AV	7.60
KORTING (similar to Siemens TVK1)	7.32
ITT KB CVC5/9	6.90
ITT KB CVC20/25/30 (Mullard)	5.95
RRI T20	6.80

DIODES

AA119	9
BA102	17
BA115	13
BA145	17
BA148	17
BA154	6
BA155	14
BA156	15
BA317	26
BAX13	4
BAX16	8
BB105B	30
BB105G	30
BY126	12
BY127	11
BY133	15
BY164	45
BY176	85
BY179	63
BY182	87
BY184	55
BY199	28
BY206	14
BY210/600	28
BY210/800	33
BY223	90
BY227	28
BY298	22
BY299	22
BYX10	20
BYX36/10	30
BYX36/600	35
BYX55/600	30
BYX71/600	90
OA47	9
OA90	10
OA91	10
OA95	6
OA202	11
IN914	4
IN4001	4
IN4002	4
IN4003	4
IN4004	5
IN4005	5
IN4006	5
IN4007	6
IN4148	2
IN4448	10
IN5401	12
IN5402	14
IN5403	12
IN5404	12
IN5405	13
IN5406	16
IN5407	16
IN5408	16
ITT44	4
ITT2002	11
Y969 (30V Thorn 3500)	89
BZY15-24R	1.18
BZY15-12R	1.18

CAPACITORS AXIAL

Volts	Mfd	Price
6V3	33	9
10V	22	10
	47	10
	100	10
	220	15
	470	20
16V	33	11
	68	11
	220	16
	1000	27
3300	53	
25V	10	11
	22	13
	47	15
	100	15
	220	29
	470	30
	1000	55
	2200	51
4700	98	
40V	10	10
	22	10
	400	48
63V	1	12
	2.2	12
	4.7	12
	10	11
	15	12
	22	13
	47	19
	100	23
	220	37
	470	49
	1000	58
	2200	94
100V	10	13
	22	15
	47	20
	100	36
	220	70
450	1	33
	4.7	30
	10	30
	22	65
	33	75
500	10	32
600	1	41

DISC CERAMIC CAPACITORS

8kV (12kV Wlag)
39pF 200pF each
150pF 220pF 40p
180pF 250pF

CERAMIC CAPACITORS

63V A range of pref. values each
22pF-4700pF 6p

SLIDER POTENT

Lin or Log
470R-1K-2K2-44-10K-47K-470K 65

SKELETON PRE-SET POTS

Standard or miniature
Horizontal or Vertical
100R-2M2 16p

CONVERGENCE POTS

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

METRIC CONVERGENCE POTS

PHILIPS G8
5R-10R-20R-50R 60

PANELS + UNITS

AFC UNIT PHILIPS G8	8.82
IF GAIN MODULE (Pye/Philips)	9.00
COA PANEL (Pye/Invicta/Ecko/Dynatron)	20.00
REAR CONVERGENCE PANEL (Philips G8)	23.00

MIDGET CONTROLS

Insulated Spindle Length 44mm

Log or Lin Without Switch
5K-10K-25K-50K-100K-250K-500K-1M 39p
With D.P.S.T. Switch
Log: 5K-10K-25K-50K-100K 250K, 500K, 1M, 2M 81p
Dual gang Controls 1.25
16mm Rotary Controls 10K, 22K, 100K, 1M, 10K 39p

THERMAL CUT OUT

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

MULTITURN POTS

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

THICK FILM RESISTOR NETWORK

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

EAGLE PRODUCTS

Please send large S.A.E. for full EAGLE Catalogue

DF615 Full Range Speaker 6½"		8.95
Multimetres		
KEW 7N	2,000	5.25
KEW 20		14.50
EM5	5,000 opv	9.95
EM10	10,000 opv	11.50
EM50	50,000 opv	19.95
EMC321 Carrying Case for above		2.25
Digital Meter TS1000		44.50
MM20	20,000 O.P.V.	21.95
MM50	50,000 O.P.V.	25.95
MM100	100,000 O.P.V.	36.50
MMT20		16.95
Case for MM100		15.95
T1206 2 Station Intercom		6.95

While stocks last

SPECIAL DIODES

SKE 49	£1.09
SKE 5F	£1.19
Y723	£1.30
Y827	£1.42

MIXED DIELECTRIC CAPS

Volts	D.C.	
250V	0.91mF	84
400V	0.22mF	29
600V	0.1mF	38
1000V	0.01mF	24
	0.047mF	46
	0.033mF	33
	0.1mF	35
	0.22mF	66
	0.47mF	98
1250V	0.1mF	59
	0.91mF	1.15
1500V	0.0022mF	28
	0.0047mF	32
	0.022mF	30
	0.033mF	62
	0.005mF	65
2000V	0.0052mF	1.20

DATA BOOKS (No VAT)

Transistor Equivalent TVT 80 A-Z only	3.75
TVT 80 2N/2S series only	4.00
TVT 80/80 A-Z and 2N/2S together	7.50
LIN IC Books LIN 1	5.95
LIN 2	5.95

SINCLAIR COMPUTER SPARES

We have a full range of components for Sinclair computers.

Please ring and ask for prices.

BATTERIES RECHARGEABLE

RX6 – HP7/NN1500	1.39
RX14 – SP11/HP11/NN1400	2.17
RX20 – SP2/HP2/NN1300	2.34
RX22 – PP3/NN1604	4.69

VIDEO/AUDIO

VHS E30	3.06
VHS E60	4.00
Scotch E120 Video Tape	5.00
Scotch E180 Video Tape	5.13
BETA L500	4.90
BETA L750	5.80
PHILIPS VCC 240	6.20
PHILIPS VCC 360	8.30
PHILIPS VCC 480	10.21
PHILIPS LVC 1700	15.70

VIDEO CASSETTE CASES

Red/Blue/Green/Brown	80
Book Type – Any Format	
Video Heads	
3HSS	38.00
4HSS	38.00
PS3B	42.00
Video Recorder Heads Philips V2000	52.00

ELECTROLUBE PRODUCTS

Electrolube Adhesive	62
Electro-Mech lubricant	1.49
Elect. cleaning solvent	1.62
Freezer	1.49
Foam cleanser	1.12
Heat transfer compound	1.14
Silicone compound	1.94
Special contact fluid (Snorkel)	3.20
Permagard	1.52
Elec. mech. lubricant pen	74

SUNDRY TUNER ACCESS.

RANK Tuner P.B. 1½" × ½"-2" × ½"-2" × ⅜"	35
RANK Drive Cams	10
GEC 2110 Tuner Neons	14

SUNDRIES

Delay Lines DL60, DL700, DL50	2.20
CRT Tube Base	70
EHT Final Anode Cap	53
EHT Cable	25p mtr.
6.3V CRT Boost Trans.	4.35
13A Plug Top box 10	4.80
Quick Set Adhesive	78
Moulded Plastic Hex. 6mm Trim Tools	10
Double End 4mm/8mm Trim Tools	20
Focus Rod	1.25
Focus Holder	2.00
Keynector Safe Block (mains)	7.00
Cassette Drive Belts price each	
35mm	35
46mm	37
57mm	37
66mm	39
71mm	41
76mm	43
90mm	43
110mm	59
Torch (handy for tool box)	42
I.C. Inserter	1.18
SM Neon Screwdriver	40
DIN Plugs 3 pin	22
4 pin	22
180° 5 pin	20
Stnd. 5 pin	20
Phono Plugs	12
Car Aerial Plug	18
2.5mm Jack Plug	14
3.5mm Jack Plug	14
Stnd. Jack Plug	20
Stereo Jack Plug	36
5A Connector Block (12)	40
Fuse Wire 5A-15A-30A	5
Battery Plug Thorn TV's	28
Mains Connector 4 way 13A	5.00

RECTIFIER STICKS

TV11	74	TV18	90
TV13	79	TV20	1.20

MAINS DROPPERS

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

TEST EQUIPMENT

Portable Oscilloscope	155.00
Probes x10	10.90
CRT Tester/Rejuvenator	172.00
KHP30 Measuring Probe (3 okv) EHT	29.95
T120 RF Signal Injector	4.00
Test Lead Set	4.20
Degaussing Coil (stick type)	17.00
Degaussing Coil (disc type)	24.00

SERVICE AIDS

SERVISOL Freeze-It	1.02
SUPER SERVISOL	92
SERVISOL Foam Cleanser	89
SERVISOL Plastics Seal	1.00
SERVISOL Silicone Grease	1.08
SERVISOL Tubes Silicone Grease	1.64
SERVISOL Aero Klene	84
SERVISOL Aero Duster	1.10
SERVISOL Excel Polish	88
SERVISOL Video Head Cleanser	82
Super 40	1.50
Fire Extinguisher 640G	2.50
Heat Sink Compound 25G	1.08
Silicone Rubber Tube 110G	2.98
Solda Mop standard reel	74

ZENER DIODES

BZX61/85 (1.3W) 6V2-7V5-8V2-9V1-10V-11V-12V-13V-15V etc up to 75V.	20
BZY9390, 18V	1.18
BZY88 (400MW) 2V7-3V-3V3-3V6-3V9-4V3-4V7-5V etc. up to 24V.	10

P.V. MICROCOMPUTER CENTRE

Why not pay us a visit and see our range of Micros, Software Books and Peripherals. Please ring for prices.

Spectrum 16K, 48K; Vic 20; Commodore 64; Atari 800; Sharp; Oric; Dragon; Texas; Lynx

We are also authorised dealers for the BBC Micro and accessories

Quantity discounts on application (Trade Only). Minimum of 5.

HOW TO ORDER

ADD 65p per order for Post and Packing (UK). (Export orders will be charged at cost.)
THEN ADD 15% VAT TO TOTAL COST.
Orders which contain aerosols or degaussing coils are very heavy — please add extra 30p per can/coil.
First Class Mail is used whenever possible.
All enquiries S.A.E. please.
VAT invoice on request.

Goods are despatched on the day we receive your order. If for any reason we are out of stock we will try to inform you as quickly as possible.
We try our best to give a speedy, fair and efficient service. As our regular customers know, orders telephoned in before 4 p.m. will be despatched the same day.
Give us a ring — we'll give you service.
Please ask if what you need is not listed — we will try to help.
Prices are subject to change without notice.

INCREASE YOUR PROFITS IMPROVE YOUR SERVICE WITH RELIABLE COST EFFECTIVE TEST EQUIPMENT

ALSO AVAILABLE
Analogue Multimeters
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T.V. Field Strength Meter
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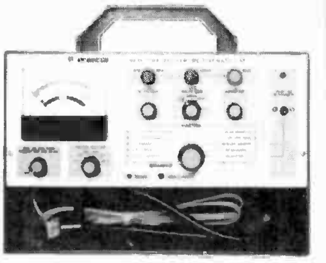
LARGE S.A.E.
FOR COMPLETE LIST.

LEADER LCT-910A C.R.T. TESTER-REJUVENATOR

Our top selling instrument is designed to readily test the various characteristics and rejuvenation of both colour and B/W C.R.T's.

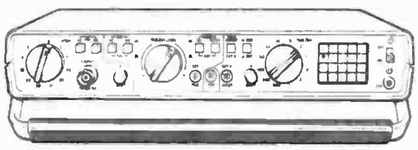
* Tests for shorts and leakage between electrodes.
* Tests cathode emission characteristics.
* Separately checks condition of guns.
* Removal of shorts and leakage between electrodes.
* Checks heater warm-up characteristics.
* Rejuvenation of low emission cathodes with automatic timing.
* Super rejuvenation with manual control.
* Complete with tube base adaptors.

Size: H 230mm W 330mm D 120mm.



PRICE £175 + £26.25 VAT

THE VERY LATEST SC110A LOW POWER, FULLY PORTABLE OSCILLOSCOPE.



The new Thandar SC110A represents a break-through in oscilloscope development. The SC110A is ONLY TWO INCHES thick and weighs under two pounds, yet retains the standard features and controls of a bench oscilloscope. **FITS IN A BRIEFCASE**

Full Sized Performance
* 10 MHz bandwidth.
* 10 mV per division sensitivity.
* Full trigger facilities are provided including TV frame, or TV filtering.
* Runs on 4 to 10V DC via disposable batteries, re-chargeable cells, or AC adaptor.
* Size 255mm x 148mm x 50mm.

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Carry Case £5.95 + £0.89 V.A.T.
x 1 Probe £7.00 + £1.05 V.A.T.
x 10 Probe £8.00 + £1.20 V.A.T.
x1/x10 Switched Probe £9.50 + £1.42 V.A.T.
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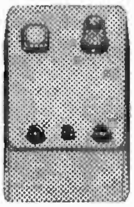
LEADER HIGH VOLTAGE METER EHT PROBE

Measures up to 40 K.V. D.C. with **SAFETY BUILT IN METER**

PRICE £23.50 + £3.45 VAT

✱ FULLY GUARANTEED

LOPT TESTER



BK's REVOLUTIONARY DYNAMIC 'LOPT' TESTER
Revolutionary L.O.P.T. tester. Operates in dynamic mode which actually tests the L.O.P.T. under high voltage conditions without de-soldering or removal.
Size 75×100×40 mm. Supply 240V AC

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CRT TESTER-REJUVENATOR

BK's C.R.T. TESTER-REJUVENATOR
Tests and rejuvenates blue, green & red guns separately. Fitted with delta and P.I.L. sockets. Compact size 120 × 65 × 60 mm. Supply 240V AC

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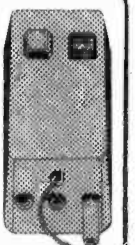
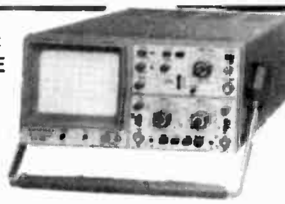


HAMEG HM 203-4 20MHz DUAL TRACE OSCILLOSCOPE



SPECIFICATION:
* BANDWIDTH DC-20MHz
* SENSITIVITY CH1, CH2 2mV-50V/DIV
* TIMEBASE 40nS to 0.2S CM
* TRIGGER DC-40MHz Auto-Normal-TV
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* BUILT IN SEMICONDUCTOR COMP. TESTER
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* SUPPLY 110-125-220-240V AC 50-60Hz

2 YEAR WARRANTY

WITH COMPONENT TESTER

PRICE £264.00 + £39.60 VAT

Optional probes as above

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HIGH TEMPERATURE PUMPED COLOUR TUBES

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Just phone for a quotation. Delivery Manchester area free same day. Two year guarantee. Fitting while you wait or in your home £20.

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400mW Plastic 3V–75V 8p each. 10/75p
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TBA673	2.40
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TBA810P	1.10
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Antex 15W Iron	5.00
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Antex bits	0.95
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Additional P&P on above 30p

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Universal Ni-Cad charger, charges PP3, AA, C, D
Price £5.00
AA Ni-Cads £0.65
10 for £5.00

RESISTORS – CARBON FILM 5%

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

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	4.80
½W pack 5 each value E12 – 10R to 1M 305 pieces	2.75
¼W pack 10 each value E12 – 2R2 to 2M2 730 pieces	5.25
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	3.00
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.00

RESISTORS – WIREWOUND. Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.20
4W – 1R0 to 10K – Available in preferred values	0.21
7W – 0.47R to 22K – Available in preferred values	0.25
11W – 1R0 to 22K – Available in preferred values	0.29
17W –1R0 to 22K – Available in preferred values	0.37

VDRs etc

E295ZZ	
01/	0.28
02/	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E298ZZ	
/05	0.25
/06	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.66
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 564 02221	0.59

PLUGS & SOCKETS / PRESETS

Metal Co-ax Plug	0.18	0.25W Type
Plastic Co-ax Plug	0.14	100R-4m7 V&H
Metal Line Socket	0.50	10p each,
Single Junction Socket	0.80	10/90p
Plastic Phono	0.10	0.1W Type
F.M. Plugs	0.20	100R-1M V&H
PL259 Plugs	0.38	7p each,
Reducer	0.15	10/65p

MULTISECTION ELECTROLYTICS

THORN	850	100+300+100+16/300V	1.80
	1400	150+100+100+100+150/320V	2.70
	1500	150+150+100/300V	1.50
	3000	1000/63V	0.56
	3500	175/400V+100+100/350V	1.70
	8000	400/350V	2.10
	8000/8500	2500+2500/63V	1.35
	8000	700/250V	2.10
		1000/70V	0.58
	9000	400/400V	2.25
Timer Amp		4700/25V	0.70
DECCA0/30		400+400/350V	2.45
	1700	200+200+400/350V	3.52
GEC	2047 2048 2083 2084 2104	200+200+150+50/300V	2.32
		600/250V	1.50
ITT/KB		200+200+75+25/350V	2.15
		220/100V	1.95
PHILIPS	G8	600/300V	1.70
	G8 G9	600/300V	1.50
	G11	470/250V	1.50
	G9	2200/63V	1.26
EKCO	T148	125+200+100+32/275V	2.65
	691 Series	200+300/350V	2.15
		600/300V	1.80
RANK		300+300/300V	2.05
	A823	2500+2500/30V	0.98
		220/400V	1.75
		600/300V	1.78

FUSES Prices per 10

1¼" Quick Blow. 100, 150, 250mA £1.30. 1, 1.25, 1.5, 2, 2.5, 3, 10, 15A 55p. 1¼" Time Delay. 100mA £3.50. 150mA £2.25. 250, 300, 500, 600, 750, 850mA £1.84. 1, 1.25, 1.5, 1.6, 2A £1.84. 2.5A, 3.15, 3, 5A £2.82. 20mm Quick Blow. 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. 40p. 20mm Time Delay. 100, 125, 160, 200mA £1.80. 250, 315, 400, 500, 630, 800mA, £1.00. 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A 85p. 1" Mains. 2, 3, 5, 7, 10, 13A 85p.
Manufacturers please note — we can offer very competitive production quantities of 20 mm Quick Blow & Time Delay range — apply for quotation.

TRANSFORMERS

All 240v Primary. 4.5-0-4.5v 400m/A 50p. 6-0-6 100m/A 58p, 6-0-6 500m/A 65p.
Postage and packing 45p per transformer.
Competitive bulk prices on request.

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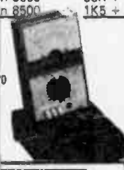
GEC2010	8R + 15R + 17R + 70R + 63R + 188R	0.95
GEC 2018	10R + 15R + 19R + 70R + 188R	1.15
Philips G8	2.2R + 68 R	0.80
Philips 70	6R + 124R + 84R	0.68
Philips 300	118R + 148R (with link)	0.85
Philips 300	30R + 125R + 2.85K	1.08
RRI A640	250R + 14R + 156R 50W	1.05
RRI A816	302R + 70R + 6.2R	0.78
Thorn 1500	350R + 20R + 148R + 1.5K + 317R	1.34
Thorn 3000/3500	6R + 1R + 100R Fused	0.93
Thorn 8000	56R + 1K + 47R + 12R	0.95
Thorn 8500	1K5 + 40R + 50R	1.28



MULTIMETER SPECIAL

Russian type U4324 – (20,000 O.P.V.)
DC Volts: 0.6, 1.2, 3, 12, 30, 60, 600, 1200.
AC Volts: 3, 6, 15, 60, 150, 300, 600, 900.
DC Curr. M/A: 0.06, 0.6, 6, 60, 600, 3000.
AC Curr. M/A: 0.3, 3, 30, 300, 3000.
DC Resistance: 0.2, 5, 50, 500, 5000K.
level dB: –10 to +12.
Supplied with rechargeable batteries.
Price £12.00 incl. of p/p & VAT.

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

MARCH SPECIAL TELEPHONES

GPO ex-rental 70b style, mainly grey & green, some blue – state several choices. We will send nearest – all untested.
£2.75 (p&p £1.50)
10 for £20.00 (p&p £5.50)

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4.7/35V	10/75p, 100/£6.00
2.2/35V	10/60p, 100/£4.75
2N6495	50p

I C SOCKETS

Dil to Dil		
8 pin	0.08	0.70/10
14 pin	0.10	0.95/10
16 pin	0.11	1.00/10
18 pin	0.14	1.60/10
22 pin	0.21	1.95/10
24 pin	0.25	2.25/10
28 pin	0.30	2.75/10
40 pin	0.34	3.10/10
Dil to Quil		
14 pin	0.30	2.75/10
16 pin	0.32	2.90/10
18 pin	0.34	3.10/10
Quil to Quil		
14 pin	0.30	2.75/10
16 pin	0.34	3.10/10

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.30
AC128	0.30
AC128K	0.34
AC132	0.55
AC141	0.26
AC141K	0.40
AC142	0.26
AC142K	0.48
AC151	0.45
AC152	0.45
AC176	0.28
AC176K	0.46
AC187	0.26
AC187K	0.40
AC188	0.28
AC188K	0.40
ACY40	0.88
AD142	1.10
AD143	1.10
AD149	0.96
AD161	0.42
AD162	0.42
AD161/AD162	0.98
AF106	0.48
AF114	2.10
AF115	2.10
AF116	2.10
AF117	2.10
AF118	0.85
AF121	0.62
AF124	0.48
AF125	0.48
AF126	0.48
AF127	0.48
AF139	0.68
AF178	0.68
AF239	0.68
AF279S	0.75
AL100	2.50
AL102	1.88
AL113	2.20
ASY80	1.75
AU110	1.40
AY102	4.32
BA102	0.34
BA110	0.67
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12

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

Type	Price (£)
BC302	0.32
BC303	0.32
BC307	0.10
BC308A	0.10
BC323	0.99
BC327	0.14
BC328	0.14
BC337	0.12
BC338	0.12
BC350	0.14
BC440	0.30
BC441	0.32
BC461	0.32
BC547	0.12
BC548	0.12
BC549	0.12
BC550	0.18
BC550C	0.18
BC557	0.12
BC558	0.12
BCX34	0.27
BCY70	0.15
BCY71	0.17
BCY72	0.18
BCZ10	1.68
BCZ11	1.45
BD124P	0.80
BC130Y	0.68
BD131	0.34
BD132	0.34
BD131/BD132	0.95
BD135	0.32
BD136	0.36
BD137	0.36
BD138	0.38
BD139	0.38
BD140	0.38
BD144	1.60
BD145	1.82
BD150A	0.51
BD159	0.65
BD160	1.65
BD165	0.45
BD175	0.60
BD182	1.00
BD183	1.10
BD184	1.20
BD201	0.72
BD202	0.87
BD204	0.80
BD222	0.80
BD225	0.86
BD232	0.45
BD233	0.60
BD234	0.62
BD235	0.63
BD236	0.63
BD237	0.65
BD238	0.56
BD241	0.60
BD243A	0.80

Type	Price (£)
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.54
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.10
BF115	0.32
BF117	0.54
BF119	0.82
BF120	0.38
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BF160	0.23
BF167	0.30
BF173	0.25
BF177	0.42
BF178	0.30
BF179	0.32
BF180	0.35
BF181	0.35
BF182	0.32
BF163	0.32
BF184	0.32
BF185	0.32
BF194	0.08
BF195	0.10
BF196	0.10
BF197	0.10
BF198	0.14
BF199	0.16
BF200	0.26
BF222	0.48
BF224	0.20
BF224J	0.16
BF240	0.20
BF241	0.20
BF244	0.26
BF244A	0.28
BF244C	0.24
BF245A	0.28
BF254	0.15
BF256	0.40
BF257	0.32

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

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

Type	Price (£)
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ITT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.48
MJE2955	0.99
MJE3055	0.70
MPSLO1	0.28
OA47	0.10
OA90	0.08
OA91	0.09
OA95	0.18
OA200	0.06
OA202	0.15
OC25	2.10
OC26	1.70
OC28	1.50
OC29	2.47
OC35	1.75
OC36	1.75
OC42	0.72
OC42K	1.40
OC44	0.72
OC45	0.58
OC71	0.50
OC72	0.52
OC81	0.68
OC200	2.46
OC202	2.20
ORP12	0.85
R2008B	1.50
R2010B	1.52
SHG1.5	0.40
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70
TIC106A	0.70
TIP30A	0.46
TIP31C	0.54

Type	Price (£)
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72
TIP41C	0.46
TIP42A	0.52
TIP47	0.60
TIP110	0.88
TIP2955	0.60
TIP3055	0.60
TIS43	0.32
TIS88	0.40
TIS90	0.25
TIS91	0.28
ZTX108	0.12
ZTX109	0.12
ZTX212	0.28
IN4001	0.05
IN4003	0.05
IN4004	0.06
IN4006	0.07
IN4007	0.07
IN4148	0.05
IN5400	0.12
IN5402	0.15
IN5405	0.16
IN5406	0.18
IN5408	0.20
IS920	0.08
2N697	0.55
2N706A	0.33
2N2904	0.28
2N2906	0.24
2N2926G	[illegible]
2N3053	0.22
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.16
2N3906	0.16
2N5294	0.48
2N6107	0.71
2N6126	0.68
2SB337	1.60
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
2SC1226	0.84
2SC1279	0.50
2SC1306	0.92
2SC1307	1.40
2SC1413A	2.70
2SC1444	1.45
2AC1449	0.63

Type	Price (£)
2SC1507	0.63
2SC1678	1.06
2SC1768	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74
2SC1957	0.78
2SC1969	2.88
2SC2028	0.73
2SC2029	1.00
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
2SC2166	1.20
2SC2314	0.80
2SC2335	1.50
2SC2749	2.70
2SC2752	0.60
2SD234	0.64
2SD348	3.30
2SD986	0.62
2SK134	3.80
2SK135	1.90
3N126	1.90
3N211	2.52
3SK45	0.76

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22nF 300V AC	32p
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Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.95
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.95
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	2.50
EL84	0.69
EL509	5.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.95
PCF801	1.45
PCF802	0.85
[illegible]	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	0.98
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.90
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60

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TELEVISION

Investment decisions

The Tele-Jector story is an intriguing one. It seems that the directors of a firm called London and Liverpool Trust, whose main operation is the distribution of business equipment (photocopiers, computers, etc.), got this bright idea for making money. A subsidiary, Tele-Jector, would instal projection TV equipment in pubs and clubs and would generate a substantial revenue from hire agreements. The clever bit is that it wouldn't cost anyone anything. The publican would be able to recover the cost of his Tele-Jector through the advertising revenue it would produce, and with enough Tele-Jectors out on lease the whole exercise would soon pay for itself so far as London and Liverpool Trust were concerned. Only it didn't work out like that.

The height of its fame came when Tele-Jector made an £8m bid, just over a year ago, to obtain exclusive rights to show Football League matches on its screens. London and Liverpool shares shot up to a high of 350p. Unfortunately for Tele-Jector the bid fell through – the broadcasting authorities made a successful counterbid, and it transpired that not all League clubs would be prepared to participate. Even if they had, it would have taken some effort to recover the £8m and the cost of the other programme material provided in cassette form and the Tele-Jectors themselves. Looked at in this light the scheme looks rather less clever. It seems even less clever when you consider the underlying assumption – that pubs and clubs would be filled with avid Tele-Jector viewers. One wonders whether the directors of London and Liverpool Trust ever set foot in their local. If they had, they might have discovered that the box, when present, is seldom given much serious attention. At least the publicans appreciated that, and far fewer than were estimated to be necessary to make the venture pay decided to take it on.

At the end of the day London and Liverpool Trust were faced with the cost of providing programme material for an uneconomically small number of Tele-Jectors, and those publicans who had taken it on found that there was negligible advertising revenue. There was also some criticism of the leasing terms. London and Liverpool Trust's shares dropped to a low of 11p, and liabilities of £18m incurred by the project threatened the company's existence. A sad case of things going badly awry.

Is there a lesson to be learnt from this? Well, it could be an example of one of Parkinson's laws at work – that a group of people, in this case the directors, will often take a collective decision that each individually considers to be highly doubtful. It could also be an example of making an investment with a view to generating a quick profit. Of more relevance to television, doesn't it seem analogous to some of the headier notions of bonanzas to be made from developments such as cable and satellite TV? There was indeed a time when ITV was "a licence to print money", but it looks increasingly as if that was a once only state of affairs. The more TV there is, of one sort or another, the greater the competition and the harder the economic climate.

There has been much criticism that those responsible for investment in the UK seek too quick a return on their money. I'm not at all convinced that this is fair. In a highly uncertain world, is it reasonable to lock up funds in long-term projects whose outcome is difficult to foresee? We need industrial investment for sure, but investment in projects that don't turn out is worse than no investment at all.

In an interesting article in *Electrical and Radio Trading,* Erik Arnold argues that, amongst other things, the UK TV industry has reached its present sorry state due to lack of investment in new product technology. Those of us with fairly long memories might question this. For a start, successive governments through the fifties to the mid-seventies engaged in stop-go economic policies. Consumer taxes and credit control provided a simple means of putting such policies into effect, but meant that industries such as TV bore the brunt of the accelerator/brake business. This sort of thing hardly encouraged long-term planning – you can't be expected to undertake expensive investment when wondering how to finance a warehouse full of unsold TV sets awaiting the next "go". Firms nevertheless did invest in research and development, but if I read him right Erik Arnold argues that they didn't go about this in the right way. They left much of the technical research to component suppliers whilst concentrating on assembly. So we don't have integrated firms that can develop and produce their own tubes, i.c.s and systems through to the end product offered to the consumer.

This is largely due to the structure of the industry and is not necessarily a bad thing. It would hardly be sensible for every TV firm to produce its own types of tube – a case of reinventing the wheel time and again – while i.c. development is best left to those with semiconductor technology know-how. This doesn't mean that setmakers simply sit back and make use of whatever's on offer. That way does lead to disaster, in terms of unreliable consumer products. Developing reliable components that will survive in the stressful conditions of a TV set and the knock about home environment is a two way business between the component manufacturer and his customer, while UK setmakers have often taken the initiative in going to component manufacturers with their requirements and jointly working on the solution. Whether it would be better for component manufacturers and setmakers to be part of the same company is something that could be argued about endlessly. Provided they both have technical compentence it shouldn't really matter.

This does leave unanswered the criticism that the UK's industry has failed to come up with new product technology such as the VCR. For this you need a certain vision and confidence that perhaps we lack today. But really successful new products are not everyday occurrences. There is probably no harm in manufacturing under licence rather than undertaking the original research.

PETER GRAVES
Please drop us a line to let us know your new address.

FRONT COVER
Our thanks to Hitachi Sales (UK) Ltd. who provided this month's cover photograph showing the Hitachi Model VIP101P CED video disc player.

Long-distance Television

Roger Bunney

Now that we're into the new year it's possible to summarise the conditions during 1983. They were pretty good! Sporadic E signal propagation continued after its usual ending in late August, and there was a little F2/TE reception as the sunspot cycle dwindled. More encouraging were the good tropospheric openings towards the end of the year – indeed December both started and ended with spells of enhanced tropospheric propagation. There were good tropospheric openings during all months from late August – my own most interesting catch was ORF-1 (Austria) ch. E9 on September 26th, a 20kW transmitter at Bruck near the Hungarian border.

Reports from our Australian friends suggest that they are enjoying a good SpE season, and one must hope that this heralds a good season ahead for us in the UK. With the 405-line transmitter closures, many will be able to enjoy Band I/III relatively clear of local transmissions. This could be the last year of Band I being free from interference, so make the most of it!

What with other activities during December, reports of reception normally slacken off. From the letters received however it seems that the main event was the good tropospheric opening on December 27-29th. Reception was mainly from the E./S.E., with signals from W./E. Germany, the Benelux countries and France. The prevailing high-pressure system first gave a signal lift on the 27th, with strong French u.h.f. signals and W. Germany (just). There was further improvement in Band III and at u.h.f. on the 28th, with a peak on the 29th when signals extended from W. Germany across the UK as far as Wales. Unusually, the emphasis was on W. German Band V signals, reaching as high as ch. E60. The in-vision teletext/scrambled information from Paris ch. 8 was present, but not the mystery ch. 5. RTL (Luxembourg) was widely seen, the PM5534 test pattern carrying the identification "RTL PLUS". We've a report that RTL have been using both PAL and SECAM at their ch. E7 outlet. ATV activity was high during the period. F3YX, to the S.W. of Paris, was seen here at Romsey – a new station for me and a most welcome bonus to see out 1983!

Meteor shower/scatter reception has been remarkably good, with two prime showers during the period. The Geminids produced active conditions over the 10-14th, the peak on the 13th producing signal pings and more sustained bursts throughout Band I, reaching into the lower end of Band III (chs. E5, E6 and R5) on occasions. In early January the Quadrantids again produced MS reception – the peak appeared to be on the evening of the 3rd.

There was little SpE reception over the period. The log is as follows:

23/12/83 NRK (Norway) ch. E3.
30/12/83 Unidentified signals on chs. R1 and R2.
3/1/84 RAI (Italy) IA; unidentified signals on E3, 4.
4/1/84 RTVE (Spain) E2, 3, 4; RTP (Portugal) E2.

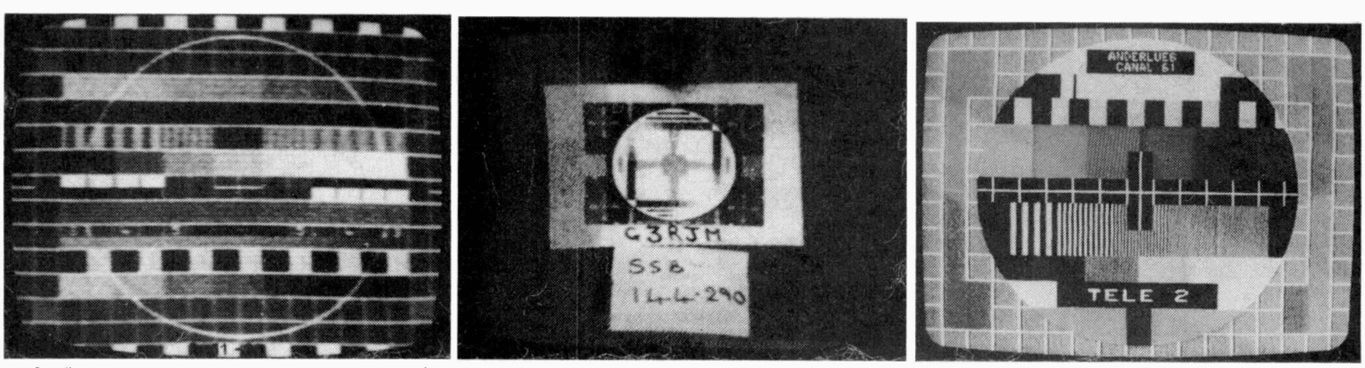
My thanks to Simon Hamer (Powys), Hugh Cocks (E. Sussex), Graeme Wilson (Cleveland), John Tellick (Surrey) and Ryn Muntjewerff (Holland) for reception reports.

Robert Copeman reports that December started off quietly in Australia so far as SpE reception is concerned, though conditions had opened up by the end of the month – with little evidence of double-hop propagation unfortunately. He mentions that the increasing number of Band II f.m. radio stations in operation there is giving greater scope for v.h.f. DXing. The Network 0/28 (cultural service) is to loose most of its ch. 0 outlets with a move to u.h.f. operation only. This should ease DX reception by 1985.

Jim Maden reports a "lousy" season in S. Africa, with no sign of ZTV Gwelo ch. E2. This is most unusual and he wonders whether the transmitter is now off the air. Bulawayo ch. E3 has moved to Band III – due to interference from Europe! Jim views TSS-1 via the Ekran 714MHz downlink, and comments on the flashing diamond caption previously mentioned – at TSS programme closedown. The translation of the Ekran caption reads "don't forget to switch off the television", with the words in red on a white diamond with a blue background. The centre words that flash are "switch off", and there's also an 800Hz tone. During various October/November TE openings Jim received RTVE, RAI and RTP, the highest frequency signal being ch. E3/IA vision. Finally Jim mentions that TSS now use an African lady who speaks fluent Russian for the discussion of African affairs – so watch out for her on ch. R1 during the next SpE season . . .

Radio Receivers

In the January column I mentioned the Lowe Electronics AR2001 scanner, which covers 25-550MHz. Revco Electronics have since told us that the professional version of their SX200n will shortly be available at some £400. It



Left: The new Rumanian test pattern (similar to DFF/GDR), received by Ryn Muntjewerff from Bucharest on ch. R2. Centre: ATV reception in Holland by Ryn Muntjewerff, at 435MHz. G3RJM card (Newcastle) with G8PZF background. Right: Tropospheric reception by John Tellick (Surbiton) from Anderlues, Belgium, during the September opening.

covers 26-520MHz, with the only gap being 88-108MHz. A.M. and f.m. signals are catered for: the sensitivity is 0·5/1μV (f.m./a.m.) at v.h.f., 0·5/2μV (f.m./a.m.) at u.h.f. The image rejection is 50dB at v.h.f., 40dB at u.h.f., with sharp selectivity. The unit will interface with certain NEC computers for outboard control, for example to increase the channel memory and for high-speed reprogramming. Perhaps more interesting is the availability of a prescaler that gives operation at up to 3GHz! More details can be obtained from Garex Electronics, 7 Norvic Road, Marsworth, Tring, Herts HP23 4LS (0296 668684).

Perhaps more down to earth is a range of Tandy (USA) portables for TV sound. Their 1984 catalogue features four receivers, one hand held, with full system M v.h.f. channel coverage – one receiver has full u.h.f. coverage as well. The Portavision 55 covers low and high bands (Bands I/III) and has a 70 channel u.h.f. tuner (click stops plus fine tuning). The price is $79·95. The Portavision 5 has similar v.h.f. TV coverage plus air/PMR at 108-175MHz and is perhaps the best for general v.h.f. coverage at $59·95. The Personal Portavision covers just the low/high TV bands at $44·95. All three models include MW and 88-108MHz, give good sound reproduction and are sensitive (there's a tuned r.f. stage for each band).

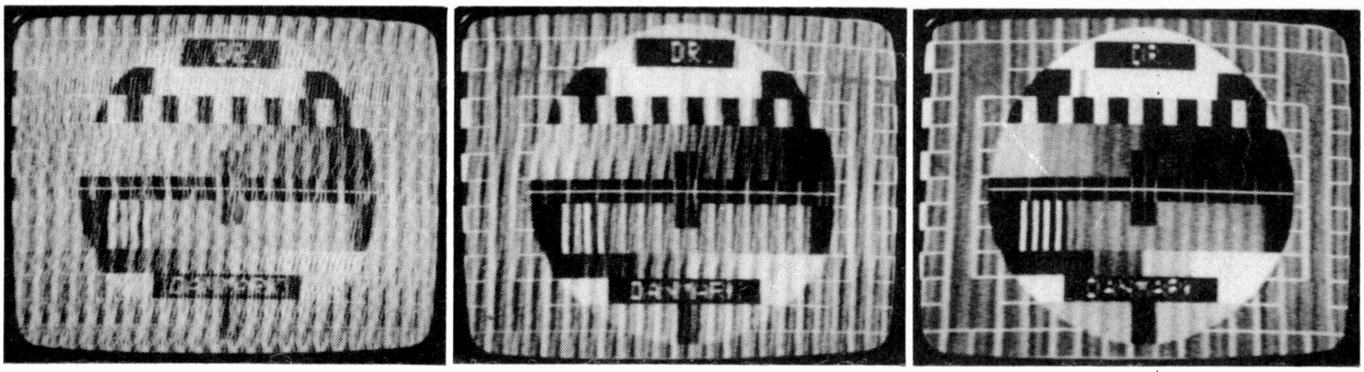
I'm using the Portavision 5, which I've realigned from ch. A2 sound to ch. E2, i.e. from 59·75MHz to 53·75MHz. By shifting the coverage in this way a gap has appeared at the top end of the low band, but ch. R3 (83·75MHz) can still be received. Apart from this gap there's full coverage over 53-220MHz. The radio has proved to be very useful during SpE openings since it will resolve both f.m. sound and the a.m. vision buzz. In addition to the integral whip aerial, there's a Motorola (car radio) socket for an external aerial. You can't obtain these sets from Tandy UK (in part due to the battery/115V a.c. operation) but you can obtain them by mail order from Tandy Corporation, Export Sales, Fort Worth, Texas 76102, USA. Note that you may get involved with import duty/VAT – it may be easier to obtain sets secondhand via a friend.

News Items

Belgium: The French language ECS downlink channel "TV5" (uplink at a French station near Troyes) came into operation on January 2nd, with programmes from 1900-2200 nightly. TDF-A2 is used on Monday and Thursday, SSR on Tuesday, TDF-TF1 on Wednesday and Sunday, TDF-FR3 on Friday and RTBF on Saturday. TV5 will not be scrambled until mid/late summer. The channel is for feeding via 12GHz terminals to cable networks and is also available on ch. E56 (Brussels). There are rumours that BFBS propose to instal transmitters in Belgium.

UK: Mention was made of a pirate station, "Second City Vision", in the June 1983 column, operating in the Birmingham area on ch. 40 after the closedown of the local BBC-2 station. There have been press reports recently of activity over a five mile area, using the name Telstar Television. The authorities have been trying to close down the aspiring broadcaster, whose output includes current feature films etc. No reader has reported reception of the station, whose location appears to be the Edgbaston area. If it's still around, a good time to try would be at Easter – Bank holidays seem to be favourite times for this activity.

Luxembourg: The RTL-Plus channel came into operation on January 2nd. It's intended for W. Germany but is being carried on Belgian cable systems. Start of programmes is



Tropospheric reception from Denmark ch. E8 on December 4th, showing progressive reduction of the bandwidth from 6 to 3 to 2MHz to reduce interference, using the equipment described in the February-April 1982 issues of Television.

1727 local time (1657 Sunday) with closedown at 2230/2300 (2400 Friday/Saturday). The system B PAL transmissions are on ch. E7, the test pattern carrying the identification "KANAL 7" at the top and "RTL PLUS" at the bottom. It's expected that ch. E24 will also shortly be used.

Denmark: The experimental South Jutland service TV Syd will continue until next year. If successful, this could lead to full regional Danish TV. The main transmitter is at Sonderjylland on ch. E7 with 60kW e.r.p.

Satellite News

Luxembourg has applied to the ITU for permission to use four channels at 10·7, 10·95, 12·5 and 12·75GHz. The satellite would be privately funded and able to provide reception using 1m dishes. Norway, Sweden and Finland have reached agreement on the Tele-X satellite project. Ireland is inviting organisations to tender to provide the proposed Irish satellite TV service. It's hoped that this will be on air in 1987, with five channels.

The Indian Insat 1b satellite is apparently giving good results. There will eventually be two TV channels, with direct to community receivers as with the 1975-6 SITE experiment via ATS-6.

The North American conference on satellite services has confirmed eight slots for US DBS use in the 12GHz band, between 61·5° and 175°W. These include spot beam coverage of Alaska and Hawaii. The conference decided on a service area signal strength of -107dBW/m² – the USA had sought -105dBW/m². The USA had also hoped for more slots to cater for time zone variations. STC in the USA plans to commence a five-channel 12GHz service this autumn covering the N.E., and hopes that domestic reception via 2ft dishes will be possible. Due to congestion, domestic 4GHz craft are to use a reduced orbital spacing of 2°. As a result, receiving dish specifications will need to be tightened. Domestic dishes in the USA range from 6-12ft and are usually of the prime focus type, with a comparatively wide beamwidth. Whereas an 8ft dish will work well with the present 4° spacing, with minimal adjacent satellite/channel interference, a 2° spacing could lead to problems, particularly with dishes of less than 8ft diameter.

The US government has approved funds for the VOA-TV service to Europe from the TDRS-1 satellite at 41°W. Transmissions are expected to start this May/June. The Home Box Office company has apparently acquired the use of an ex-US DOMSAT which is being moved to approximately 40°W, with test transmissions expected to be in progress by the time you read this and a service starting in March. The Television Entertainment Group, a consortium consisting of Goldcrest (UK) and four US firms (including HBO), hopes to use this satellite to provide a 24-hour programme of films, sport, pop music etc. The HBO/VOA services would be in the 4GHz band, intended for cable distribution.

From our Correspondents . . .

Bud Lloyd Bennett, now in Bahrain, is using two stacked long Yagi aerials – Dutch Kamco type assembled in Kuwait – and a 40dB head amplifier to receive the 714MHz signals from the Ekran satellite at 99°E. He says that reception is weak, though improvements are being worked on – including a notch filter to remove Bahrain ch. 55 which causes interference.

Nick Harrold has built a 12GHz unit, to the basic Chris Wilson/Grahame Harding design featured in the September 1982 issue, and has received OTS using an 8ft. petal dish (who said a petal wouldn't work at 12GHz?). The Satellite plc programmes are scrambled, but with sync reinsertion a viewable picture can be received. The coded sound is impossible to decipher however. Some days after this reception the channel was transferred to the ECS-1 satellite. TDF-FR3 is still present via OTS, with the cogwheel type scrambling illustrated in the January 1984 issue (page 126) and noisy SECAM. For 4GHz reception Nick is now using a commercial 110° LNA. He reports that AFRTS is received with good colour from the 1°W Intelsat. RTM (Morocco) has moved to the 31°W Intelsat (from 27·5°W) and is much weaker.

We've received another letter from Mel Thurlbourne in the Falklands. He reports that TV signals are now being received, generally from 1800-2100 local time, with the aerial system pointed to the north. They are on chs. A2 and 3, most likely via SpE. Charlie's Angels and Kung Fu have both been seen – in colour and dubbed in Spanish! An Argentinian news programme has also been seen. The reference oscillator in the decoder needed a tweak to obtain correct colour lock, and since then things have been going well. Stanley residents use VCRs, to the UK system I. The Cable and Wireless Intelsat link is now in operation, but for communications only.

Bill Cotterill (Tipton, W. Midlands) received most of Europe, plus Jordan ch. E3, via SpE during the summer months, using the TV-DX system described in the February-April 1982 issues, a Hugh Cocks upconverter/preamplifier, and a wideband Band I aerial (Ian Beckett's design, see June 1976 issue). For u.h.f. he uses a Jaybeam JBX21 array, also a system L-I converter (see February 1983 issue). The early December tropospheric opening produced excellent signals from France, Holland and Belgium.

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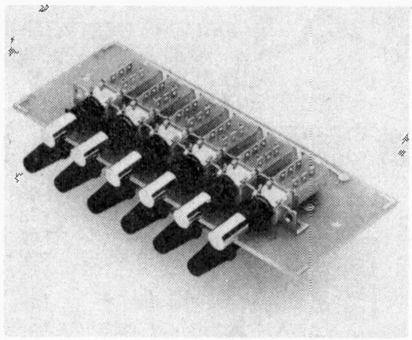

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The CED Video Disc System

Derek Snelling

The RCA CED (capacitance electronic disc) video disc system was launched on the US market on March 22nd, 1981. It was said to have been the biggest product launch in business history, and was the outcome of substantial research and development expenditure by RCA over a period of many years – RCA are reputed to have invested more in their video disc system than in the development of the NTSC colour system (shadowmask tube and all). RCA's work on video disc systems started in the early sixties, and the decision to go ahead with the capacitance system was made in 1978.

Acceptance of video discs in the USA was slow to start with, though greater success has been achieved more recently following price reductions. The CED system was launched on the UK market last October, with discs manufactured by RCA and players produced by Hitachi.

Basic Principles

The information on the CED disc is carried in a V-shaped spiral groove and consists of frequency-modulated capacitance variations. These variations take the form of vertical undulations along the track. Fig. 1 shows the principle. The disc is 12in. in diameter and is housed in a protective plastic caddy. It's removed from the caddy by the player and is never touched or removed from the caddy outside the machine. The caddy contains brushes that clean the record automatically upon insertion and removal.

The disc is conductive and is tracked by a diamond stylus (for durability) to which a metal electrode is attached. Thus the disc forms one capacitive plate and the metal electrode the other, the groove undulations producing capacitance variations of the order of 10^{-4}pF. These undulations are approximately 850Å deep (it's their frequency that varies). The electrode tip is typically 2,500Å thick and the diamond tip straddles several undulations at once – it's important to appreciate that the diamond tip is merely a carrier for the electrode and doesn't "play" the disc in the way that an audio stylus does. The plastic disc is made conductive by adding carbon to the compound from which it's pressed.

The stylus tip electrode is connected to a tuned line resonant at 890MHz. This forms part of what is called the resonator assembly, which also includes an 896MHz oscillator whose output is coupled to the stylus driven line. The circuit is shown in Fig. 2 and the action in Fig. 3. Q101/C105/C106/L105/C108 form the 896MHz oscillator whose output is coupled by L103/4 to L102, the stylus driven line. The capacitance variations at the stylus tip alter the resonant frequency of this line slightly, as a result of which the position of the 896MHz oscillator's signal shifts up and down the trailing slope of the 890MHz response curve. The result of this is amplitude modulation of the 896MHz carrier. Since the depth of the undulations in the groove is constant, the amplitude modulation is constant. But the rate of the amplitude modulation varies, thus producing an f.m. output.

L101 couples this amplitude modulated carrier to the peak detector diodes D101/D102. C103 filters out the carrier and the result, at the base of the buffer transistor Q102, is an f.m. output carrying the information stored in the disc's groove.

This is fed to a preamplifier before being sent for splitting into audio, chroma, luminance and DAXI information – all the signals are f.m. An automatic fine tuning signal is taken from the preamplifier circuit to varicap diode D103 to maintain the average centre frequency, i.e. to ensure that the 896MHz signal remains at the centre of the falling slope of the basic 890MHz response. The detected output from the arm must now be processed.

Processing the Sound Signals

Two subcarriers, 711kHz and 898kHz, are used for the sound signals. A block diagram of the sound processing system is shown in Fig. 4. Filters separate the two signals, the first of which carries mono sound with a mono disc or L+R (the same thing really) with a stereo disc and the second L−R with a stereo disc. On bilingual discs or discs

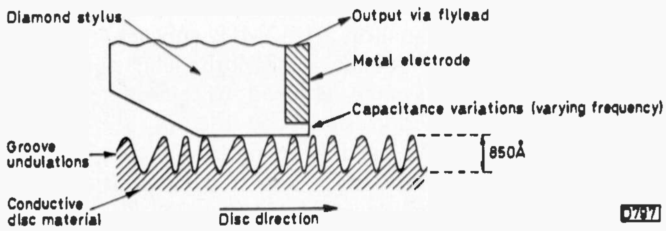

Fig. 1: Cross-section showing the stylus resting on the base of the V-shaped groove. The groove undulations, which cause capacitance variations, vary in frequency.

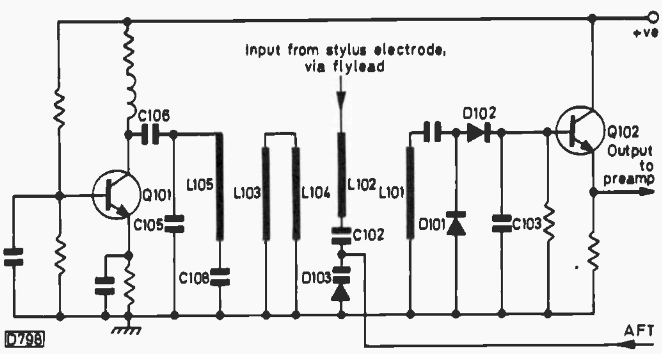

Fig. 2: The resonant circuits and detector used to retrieve the f.m. signal from the disc.

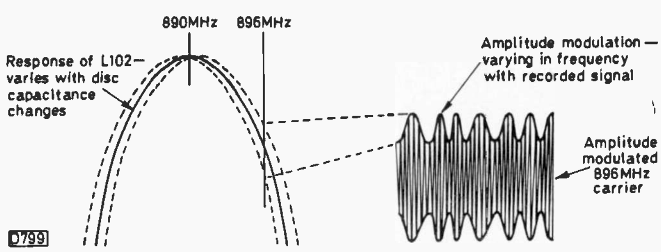

Fig. 3: Principle of signal retrieval. The frequency of the 890MHz resonant circuit varies with the disc capacitance variations, giving rise to an amplitude moduated carrier. The amplitude modulation varies in frequency.

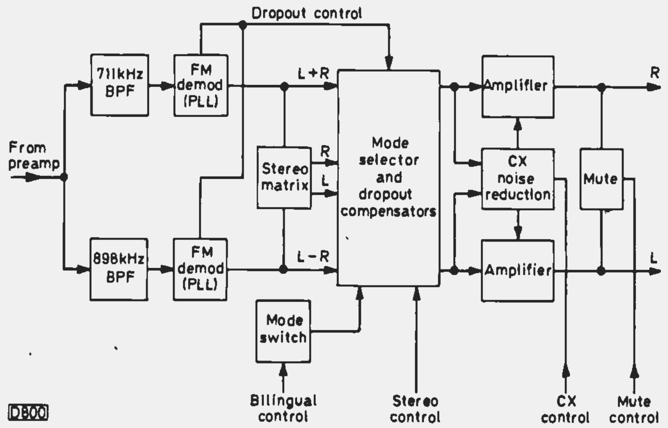

Fig. 4: Block diagram of the sound processing system.

with two sound tracks the main track is at 711kHz and the subsidiary one at 898kHz. The bandwidth is 30-15,000Hz, and the signal-to-noise ratio can be improved by 20dB by the use of CX noise reduction, which is a feature of some discs.

Video Signal Processing

The video signal processing system is shown in block diagram form in Fig. 5. A 1·5-9MHz bandpass filter passes the composite chroma/luminance signal to the video f.m. detector. The bandwidth of the demodulated luminance signal is approximately 3MHz, with the interleaved chroma signal on a 1·52MHz subcarrier – near the centre of the luminance bandwidth. The non-linear aperture correction system is used to eliminate phase modulation of the video signal by the 711kHz sound carrier. The technique used is to filter out the 711kHz component, invert it and then add it back to the video signal to provide cancellation.

The dropout compensation can replace up to three lines before signal degradation becomes noticeable.

A CCD (charge-coupled device) comb filter is used to separate the luminance and chrominance signals – this is the standard PAL delay line technique, though in solid-state form. Because of the wide bandwidth of the CCD filter the chrominance output contains low-frequency luminance information. This is separated by a 1MHz low-pass filter and added to the luminance signal.

The 1·52MHz chroma signal obtained from the 3MHz low-pass filter is mixed with the output from a 5·95MHz voltage-controlled crystal oscillator to obtain a 4·43MHz chroma signal which is then phase altered to the PAL standard and added to the luminance signal for sending to the u.h.f. modulator. This produces an output for feeding to the TV set's aerial input socket.

A 4·43MHz crystal oscillator and phase detector are used to control the 5·95MHz oscillator. The phase detector's output is also used to operate the jitter servo circuit, whose purpose is to maintain a constant stylus-to-groove velocity in order to compensate for such things as warped or eccentric discs or an off centre hole. The result of such defects would otherwise be varying colour or horizontal instability of the picture. In addition, the outputs from the 4·43MHz and 5·95MHz oscillators are mixed to produce a 1·52MHz clock signal for the CCD comb filter i.c.

Another output from the 3MHz chroma low-pass filter is the DAXI (digital auxiliary information) signal, which is recorded on lines 20 and 333 during the field blanking period. This information is used to tell the machine if the stylus is tracking correctly, whether a mono/stereo or bilingual disc is being played and also, by checking the field number, whether the stylus has kicked back one or more grooves or, in visual search, whether the stylus is kicking forwards or backwards correctly.

The Mechanics

The arm is a lateral tracking one driven by a d.c. motor. To ensure that the stylus remains centred in the groove, the position of the output signal coupling flylead is detected: if this moves off centre from the arm, due to the arm being ahead of or behind the stylus, an error signal to

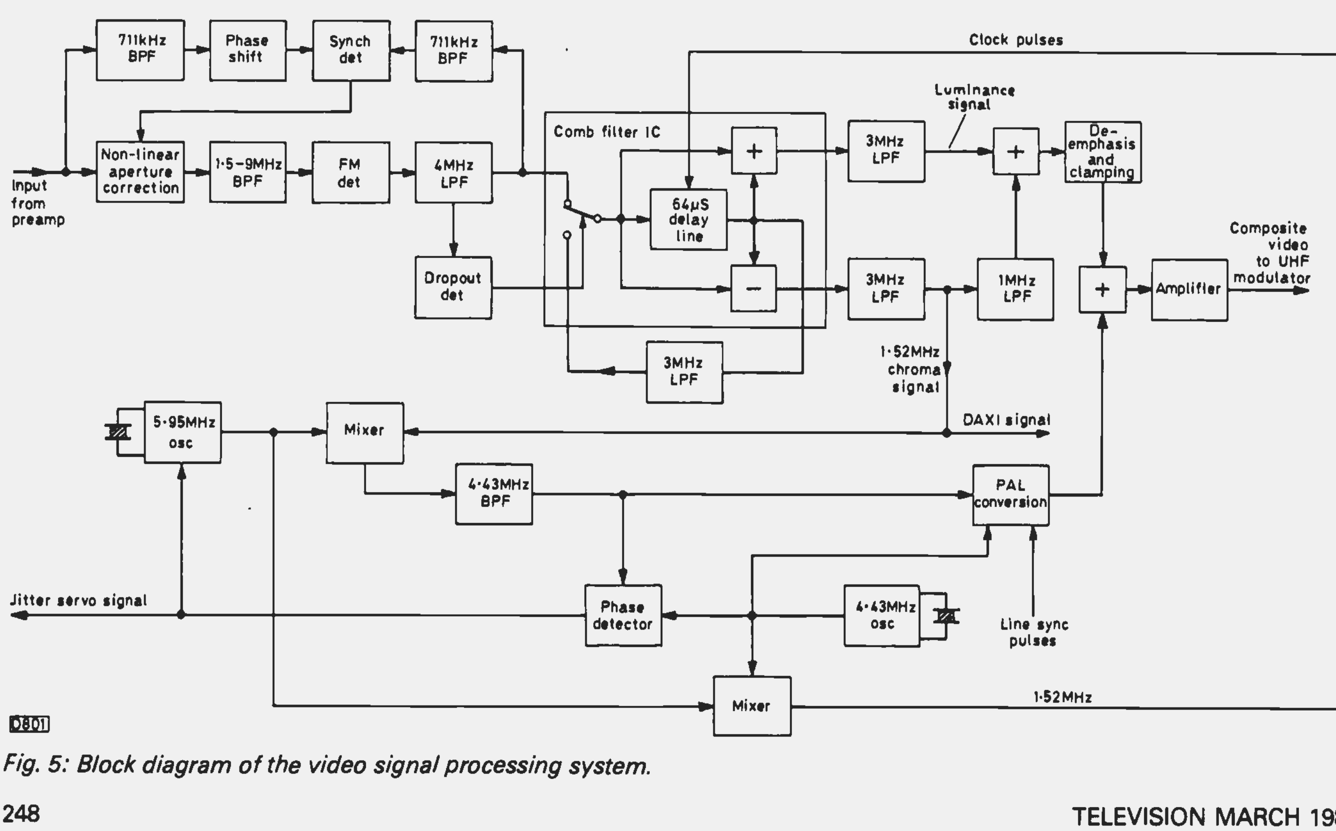

Fig. 5: Block diagram of the video signal processing system.

correct the arm position is generated. Fig. 6 shows the arm servo system.

The disc rotates at 375 r.p.m. on a turntable driven by a three-phase direct-drive d.c. motor containing an eight-pole rotor. The motor does not need to be locked to the mains frequency. Motor rotation is detected by a printed coil which generates a frequency proportional to the motor speed. This is used to control the motor speed – three Hall elements generate the three-phase drive current.

The arm assembly with the cartridge and stylus is interesting. It contains the stylus position sensors and three coils – the kicker, lifter and jitter coils. The kicker coil makes the stylus jump one or more grooves either forwards or backwards. It works by pushing (electromagnetically) on a small permanent magnet mounted near the stylus. It's used during search, pause and to nudge the stylus if it sticks in the groove. The lifter coil is used to lower the stylus on to the disc – only the stylus is lowered on to the record, not the arm assembly, unlike an audio record player. The stylus is also lowered on to a cleaning pad each time a disc is removed from the player. Power is required to lower the stylus: in the event of power failure the stylus rises automatically to prevent possible damage to the stylus or disc. The jitter coil moves the stylus forwards or backwards slightly in the direction of the groove, momentarily altering the relative stylus-to-disc speed to compensate for wow and flutter.

Practical Points

So much for the basic player. Now for a few practical points on the Hitachi range of models. There are three machines, the VIP101P, VIP201P and VIP202P. The VIP101P provides mono sound reproduction only. Features include pause (without picture) and ×16 forward search. The VIP201P and VIP202P provide mono, stereo or bilingual sound reproduction (depending on the disc) with ×120, ×16 and ×4 forwards and backwards search, pause (without picture) and step (a sort of freeze frame). The VIP201P has eleven-function remote control while the VIP202P has an optional wired eleven-function remote control system.

The ×120 visual search is not visual search in the same sense as with a VCR. In this mode the arm travels across the disc rapidly, the stylus being lowered at intervals to sample the picture for a few fields – a sort of peep search.

The position of the arm on the disc is indicated by an LED fitted to the end of the arm. It's viewed through a window along the front of the machine. There's a rough scale in minutes along the window, to give an idea of how much playing time has gone – the maximum playing time is 75 minutes per side. Whether side one or side two of the disc is being played is also shown on the front: this is detected by a microswitch at the rear of the machine and is necessary because the disc can be inserted in the caddy either way up.

Once the machine detects that a disc has been inserted and the caddy removed – by correct sequential operation

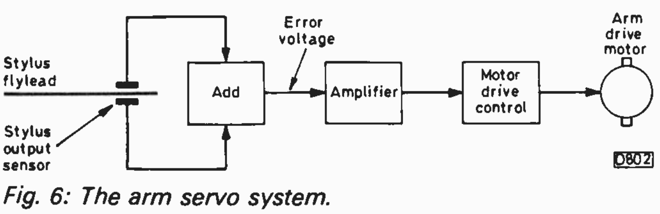

Fig. 6: The arm servo system.

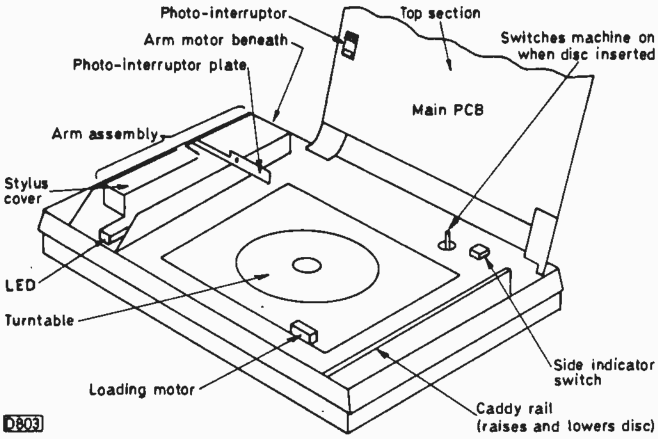

Fig. 7: Some of the mechanical aspects of the player discussed in the text.

of the door flap microswitch and a microswitch at the rear of the machine – the disc is lowered to the playing position and the arm moves across to the start of the disc. A metal plate attached to the arm passes between the two halves of a photo-interruptor: the plate has a hole in it, the position of the hole determining the set-down point. This plate can be adjusted using a test disc.

The cartridge/stylus can easily be changed by removing a small plastic cover on the top left of the machine, unclipping the stylus cover, pulling out the old assembly and dropping in the replacement. Also housed beneath this cover is a transit screw and spacer. These must be fitted whenever the player is transported, and removed prior to its use. The arm assembly complete with coils, tuned line, oscillator and preamplifier is considered by Hitachi to be a non-serviceable item that should be replaced complete.

Apart from these components the rest of the electronics are mounted on a single large panel in the top of the machine – the top can be hinged up and locked in the vertical position for servicing. A word of caution here. If the machine is operated in this position with a disc in place, you could well drop something on the disc, ruining the disc and possibly the stylus. If it's necessary to operate the machine with the top off, remove the cartridge/stylus assembly and trick the machine into loading by operating the two microswitches and the photo-interruptor in the correct sequence.

When you press reset, the arm returns to the rest position and the disc unloads ready for removal. If the disc is not removed, it will be lowered back into the play position and rotated after a few minutes. This is done to prevent the disc warping due to heat in the machine. The disc can be unloaded by pressing reset again.

Sound and Picture Quality

What does all this technology give us by way of picture and sound? Well, the quoted bandwidth is not significantly different from that of a VCR, and having seen the picture quality I'd put it at about equal to the better VHS machines, no sharper but with perhaps slightly better noise performance. The sound is of course vastly superior, though I've not yet heard the new Panasonic machine with hi-fi, helically-recorded sound. Although the price is half that of a VCR, it doesn't of course record. Neither does it have the improvement in picture quality and the extra features available with LaserVision, though you have to pay extra for all that.

Teletopics

8mm VIDEO

The 8mm video system, which has been developed for use in light-weight camcorders, is to be introduced by a number of firms later this year. Several firms have released details of their plans following Kodak's worldwide announcement of its intention to enter the field with the Kodavision series 2000 video system. Kodak have also gone into the video tape market, with a comprehensive range of open-reel and cassette tapes. Kodak's tape is being produced by TDK while the camcorder and its associated equipment will be manufactured by Matsushita.

Matsushita camcorders will also be sold by General Electric (GE) in the USA, where RCA will be selling Hitachi manufactured camcorders. Sanyo have also announced their intention to enter the 8mm camcorder market in the USA and have already exhibited prototypes. In Europe, Philips have brought forward plans to launch their VKR8500 8mm camcorder, with a possible launch date as early as June.

The Kodavision camcorders weigh about 5lb each (there are two models), are easy to carry and use, and share several features including a fast f/1·2 6:1 power zoom lens, a ⅓in. Newvicon pickup tube, and automatic white balance to adjust for colour temperature variations. The two camcorders also feature fast forward and reverse, five times visual search, and an electronic viewfinder – the latter provides a miniature monochrome TV display. The review feature enables the user to replay the last four seconds of the previous recording, and both camcorders incorporate automatic exposure control. Model 2200 features manual focus, two record/playback heads and a still-frame capability. Model 2400 features an autofocus lens with manual override, three heads for jitter-free still frame and frame advance, and provision to "write" the date on the tape as it's being recorded. The 2400 also has push-button fade in/out control and backlight control.

A key item in the Kodavision system is the cradle, which turns the camcorder into an easy to use playback device. To play an 8mm tape, the camcorder is inserted in the cradle which provides standard video and audio outputs. The cradle also serves the function of camcorder storage, and will charge the battery while the camcorder is in situ – the cradle can also be used to charge a separate battery to extend the equipment's recording time. In addition, the cradle is designed to include the optional

The Kodavision camcorder Model 2200.

Kodavision tuner/timer, which has 105 channel capability and offers twelve preset channel positions. The cradle is compatible with existing ½in. VCRs so that the material recorded on 8mm tape can be transferred to ½in. tape and vice versa. Most cradle functions can be controlled by a remote control unit that comes with each cradle.

The Kodavision system is due for release in the USA this summer and in the UK this autumn. UK prices have not been decided, but on a rough conversion of the US prices announced you could expect to pay some £850 for the basic 2200 camcorder, £1,000 for the 2400, £120 for the cradle and £190 for the tuner/timer.

JVC, who have also developed 8mm equipment, maintain that the goal of compactness is easier to achieve using standard ½in. VHS tape. JVC's Video Movie VHS camcorder (not Victor Movie as we called it last December) is now in production and has been launched in Japan. Shipments to the USA are due to start this spring and to Europe during the summer. It uses a VHS-C E30 cassette, an ultra small drum and a new parallel loading system. The pickup tube is a ½in. Saticon.

It seems therefore that home video movie enthusiasts will soon have on offer at least two competing systems – there's also Betamovie, which was first to appear. As regards price and weight, there will probably be little to choose between them.

DBS CO-OPERATION

Last month's leader discussed some of the problems of starting a UK satellite TV service for direct domestic reception. Since then, high level talks have been held at the Department of Trade with representatives from the BBC, the IBA, the Independent Television Companies Association and United Satellites with a view to saving the project from collapse. Senior government officials from both the Home Office and the DTI were present. The BBC has proposed a compromise plan under which the two broadcasting authorities would share the costs of a four-satellite system providing three TV channels. There are both legal and practical problems, which are being discussed by a tripartite working party headed by the managing director of the BBC's DBS operation Bill Cotton, the IBA's director general John Whitney and London Weekend Television's chairman Brian Tesler.

STEREO TV SOUND

The BBC's experimental stereo TV sound transmissions from the Crystal Palace transmitter have been mentioned before in this column. The outcome was that whilst a second f.m. sound carrier, as used in W. Germany, could provide a largely satisfactory stereo sound service with terrestrial TV a digitally modulated second sound carrier might prove to be a more attractive solution. The advantages of the digital approach have since been confirmed by tests carried out at the Wenvoe transmitter – this area was chosen because the nearby mountains can cause severe multipath propagation (ghosting) and it was considered important to establish that digital sound signals can be received satisfactorily under such conditions.

These tests have given very encouraging results. The effect of multipath reflections was found to be very small, the digital signal providing excellent stereo quality even in areas of extremely low signal strength where the picture was badly impaired by noise. It was also found that the additional signal passed satisfactorily through the five-station relay chain used to feed one of the remote valleys. The conclusion is that the BBC's digital system is fully viable. It uses a bit rate of about 700 kbit/s (sufficient for two high-quality sound signals), the phase modulated carrier being set at about −20dB with a sound-vision carrier separation of about 6·55MHz.

A further full scale trial from Crystal Palace on BBC-2 is planned to ensure that the system will not give rise to compatibility problems with the very wide range of monophonic TV sets in use. Discussions are being held with industry, the IBA and the Home Office to achieve an agreed UK standard, but it seems that regular stereo TV sound transmissions in the UK could be some four years away.

SKY CHANNEL

Subscribers to Radio Rentals' cable TV network at Swindon are now able to receive five hours a night of programmes from Satellite Television plc broadcast via the ECS satellite. The transmissions can be received on a 10ft dish and the cable network operators pay Satellite Television ten pence a month per subscriber. It's expected that the service, which at present consists of mainly American programmes, will shortly be available via other pay-TV cable networks. Satellite Television's main source of income comes from advertisements carried on the transmissions, which are also taken by cable networks in Norway, Finland, Switzerland and Malta. The uplink is from the PO tower in London.

NAMES

Morphy-Richards is a well enough known brand name that's never before appeared on a TV set. There are now two Morphy-Richards 12in. monochrome portables however, the T730 and T739. The latter in addition incorporates an LED clock with 59-minute sleep feature. Some more brand names that might turn up on the service bench in the future. Saisho, sold by Dixons, uses Panasonic chassis; Triumph, sold by Currys, uses Toshiba chassis; Solarvox, sold by Comet, uses ITT chassis.

TRADE RESULTS

Figures for the third quarter of 1983 show CTV deliveries ahead of 1982 by 6·5 per cent. For the first time there was a fall in VCR deliveries, of 5·2 per cent, possibly reflecting the effects of the Japanese-EEC import limitation agreement. Monochrome portable deliveries increased by 23 per cent and an even greater increase in deliveries of teletext equipped sets occurred.

During the first nine months of 1983 CTV deliveries increasd by 20 per cent, with imports increasing from 31 to 35 per cent. It appears that there was a surge in imports towards the end of the year, consisting mainly of Grundig and ITT sets from W. Germany. There's been a change in the market, with imports accounting for a greater proportion of large-screen CTV deliveries than previously.

VCR NEWS

The VHS system has been given a significant boost with the announcement that leading US TV manufacturer Zenith Radio will in future be marketing VHS instead of Beta machines. Until now the VHS system has held 75 per cent of the US market.

Two keenly priced V2000 system VCRs have been released by Grundig. The 1600 is a basic, simple to operate top-loader with a suggested price of £369. The two-speed Model 2080 is able to provide up to 16 hours' recording/playback time in the half-speed mode. Features include instant record (single button operation), a go-to facility, freeze frame with manual or auto advance, and an eight-programme capacity which can be set up to a year in advance. The suggested price is £479.

Heron Electronics have introduced a playback only VHS machine. It's manufactured by Funai and will be sold under the Ingersoll brand name at a suggested retail price of just under £300. Heron's managing director Ron Sulkin comments that with the large amount of prerecorded material now available there's a need for an inexpensive player-only machine.

The latest addition to the Ferguson range is the 3V38, a slim front-loader with a suggested price of £429. The specification is similar to the 3V35 (£489) but without remote control. ITT's latest Model VR3605 also retails at £429. Panasonic's latest models are the NV370 (£516·50) and the two-speed NV688 (£633·50).

SCOPEX BACK IN PRODUCTION

Production of the Scopex Model 14D15 double-beam oscilloscope and the 14D10 model with TV delay system for line selection is now in full swing again, only a few weeks after the acquisition of Scopex assets by Bridage Scientific Instruments and the formation of the new company Scopex Electronics Ltd. Enquiries should be sent to Scopex Electronics Ltd., 63-65 High Street, Skipton, North Yorkshire BD23 1EF (0756 69511).

EXPANSION IN WALES

Matsushita (Panasonic) have announced a £1m investment plan for their Cardiff TV factory, where CTV production is being increased from 600 to 1,000 sets a day. About twenty per cent of the plant's output, which includes radio tuners marketed under the Technics brand name, is exported.

GEC-Hitachi are to start production of 14 and 16in. colour sets at their Hirwaun plant. Two new production lines will be installed to produce the small-screen models. At present about a third of the UK CTV market of 3·1 million sets a year consists of the smaller screen models, a high proportion of which are imported.

EAST CORNWALL CATALOGUE

A new mail order/trade catalogue is available from East Cornwall Components. In addition to the usual items there's a comprehensive listing of i.c.s, multisection capacitors, test equipment and tools. A retail shop is also in operation at the mail order address – 119 High Street, Wem, Shropshire SY4 5TT (0939 32689).

HEAD CLEANING

A new head cleaning cassette for use with VHS machines has been introduced by Bib. It can be used wet or dry and incorporates a new non-abrasive spun-bonded polyester cleaning tape made to Bib's specification. The cleaning time is ten seconds and the cassette provides 35 cleanings, i.e. about four years' average use. Bib recommend regular head cleaning after 40-50 hours' playing time to remove dust and oxide particules. The new cleaner has a recommended retail price of £9·98 including VAT.

Issue 9 (December 1983) of *Ferguson Feedback* contains a detailed article on head cleaning. Thorn recommend cleaning by hand, using chamois leather and either isopropyl alcohol (IPA) or Isceon (MMV3601). The chamois leather should be wrapped tightly around a finger and moistened with the cleaning fluid. Then clean the heads and surrounding area by rubbing backwards and forwards across each head six or seven times (don't clean in the vertical direction or with the heads in motion). Apply sufficient pressure for the head profile to be felt through the leather. Finally rub backwards and forwards six or seven times with dry chamois leather. Thorn comment that the main cause of poor head cleaning is the application of insufficient pressure to the head face.

MOVE TO REAR PROJECTION TV

Mitsubishi have added a 40in., rear-projection set, Model VS400R, to their range of projection sets on sale in the USA. The set features a wide viewing angle (120°), high picture brightness (180 foot lamberts) and a 139-channel frequency-synthesis tuning system. A six-element glass lens is used instead of the conventional three-element plastic one. Mitsubishi officials are convinced that there will be a significant move from front-projection TV sets to rear-projection types.

Sanyo have launched a 46in. rear projection set, Model CVP9110T, in the UK. The set features a stereo sound system delivering up to 10W per channel and uses three 7in. tubes each with its own lens. A suggested price of £2,700 is quoted.

ITT RECEIVER-MONITORS

ITT have launched two new 14in. colour receiver-monitors to meet the increasing demand from microcomputer users. The basic RL2301/1 has RGBS inputs while the RL2301/M also has provision for a PAL composite video input and loop-through facilities. Both sets are equipped for off-air reception. ITT comment that the use of RGBS (RGB plus sync) inputs provides superior colour graphic displays since the video input does not have to be decoded.

DIGITAL TV TRANSMISSION

The BBC's Engineering Research Department has been carrying out tests on methods of reducing the information rate required for digital television. It is generally assumed that a basic information rate of 216 million bits per second (216 Mbit/s) is required for a TV signal consisting of separate brightness and colour components. The BBC has recently carried out a field trial using a system that reduces this rate to less 140 Mbit/s – the component signals were passed through the British Telecom 140 Mbit/s digital circuit between London and Birmingham. Two high quality stereo sound signals, using the BBC's NICAM-3 digital coding system, were also transmitted over the circuit. There was negligible loss of picture quality. During earlier experiments composite PAL signals were passed through a digital London to Birmingham circuit. The BBC's next target is a further bit rate reduction to 53 Mbit/s, the eventual target being a bit rate less than 34 Mbit/s.

Vintage TV: The Ferguson 841T

Vivian Capel

Thorn have for many years been the UK's leading indigenous TV manufacturer. The firm did not enter the TV field at the outset however, and the earliest model appears to have been the post-war Ferguson 841T. There were two versions, with 9in. (MW22-7) and 12in. (MW31-7) tubes – the e.h.t.s were 5 and 6kV respectively. They were single-channel, t.r.f. sets for reception of the Alexandra Palace transmissions. The design seems to have owed something to radar practice, with lots of EF50 valves (eleven) and a transitron oscillator as the field generator.

This was one of those models that had to be treated with respect by the service engineer, the e.h.t. being mains derived. Though the voltage was low by modern standards, it packed a hefty punch and could be lethal because of the high current that could be passed. The chassis was mains isolated however, by a single transformer that supplied all the chassis' power requirements. This had a centre-tapped h.t. secondary winding (see Fig. 1) which fed an FW4-500 full-wave rectifier. There was a 4V filament winding for this and a separate 6V winding for

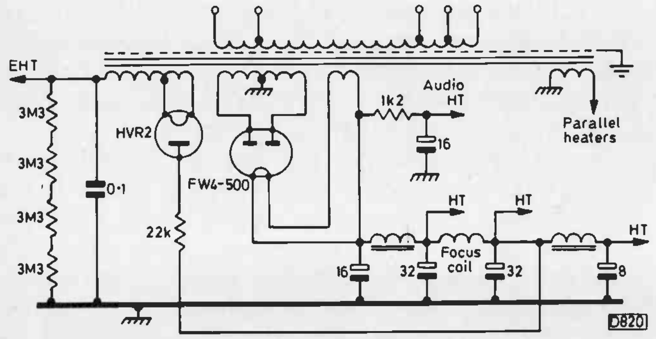

Fig. 1: The Ferguson 841T's power supply circuit.

the parallel connected valve (plus c.r.t.) heaters. Then there was the e.h.t. winding, plus a bit for the HVR2 rectifier's filament. The arrangement of the e.h.t. rectifier circuit was a bit unusual. The rectifier was connected to the low-voltage end of the winding, with its anode returned to the h.t. line. Thus the h.t. voltage was added to that obtained from the e.h.t. winding. A string of 3·3MΩ resistors was connected across the e.h.t. supply, providing a constant load to improve the e.h.t. regulation and also serving to discharge the 0·1μF e.h.t. reservoir capacitor.

One of the reasons for the comparatively large valve complement (twenty plus c.r.t.) was the use of EF50s in the r.f. sections. These all-metal envelope valves did not have as much gain as the later r.f. pentodes that took their place. No fewer than five were used in the vision r.f. stages, the first two being common to the sound channel. A further two were used in the sound only r.f. circuits. In cases of low gain it was often necessary to replace most if not all the EF50s. They tended to suffer from loss of emission, and replacing one or two would make only marginal improvement. Another problem often encountered with this type of valve was noisy and intermittent pin contact. Fortunately in the 841T the five vision r.f. pentodes were mounted in a row along the rear edge of the chassis, and were thus easily replaced.

An EA50 was used for vision demodulation, driving another EF50 that acted as the video amplifier (see Fig. 2). Since the c.r.t. was grid modulated, the video output at the anode of V11 was positive-going. The vision interference limiter circuit operated on a time-constant basis: large positive-going spikes caused the diode across R74 to conduct, thus short-circuiting the output. The diode used was part of an EBC33 whose triode section served as the line blocking oscillator.

An unusual feature was the use of d.c. restoration in both the video feeds, to the tube and to the sync separator. D.C. restoration in the latter path was required because the sync separator had to operate with negative-going sync pulses. This complicated the design of the sync separator quite a bit – it had to be saturated during the video part of the signal, then driven to cut-off by the sync pulses, thus producing positive-going pulses at its anode.

A.C. coupling without d.c. restoration means that the signal's d.c. conditions vary with the content of the video signal – a line with a predominantly white content will have a different mean level than one that's mainly dark, due to the different proportions of the negative- and positive-going portions of the waveform. Hence the brightness level will float and the sync pulses will move up and down. Another problem is the fact that the video amplifier must be able to accommodate larger signal excursions and be able to deliver about twice the output required with a stable d.c. level. With an EF50 used as the video amplifier, there was little gain to spare.

The use of a.c. coupling to the c.r.t.'s grid avoids the problem of tube damage in the event of failure of the video output pentode, and the inclusion of a d.c. restorer maintains the correct d.c. conditions at the grid. Many devotees in the early days maintained that grid rather than cathode modulation gave superior results, but the complications, both in the tube drive and sync separator circuits, led to the general adoption of cathode drive.

The sync separator stage used an EF50 and this was followed by a further EF50 which was used to amplify, invert and integrate the field sync pulses. Yet another EF50 was employed as the field oscillator. This was

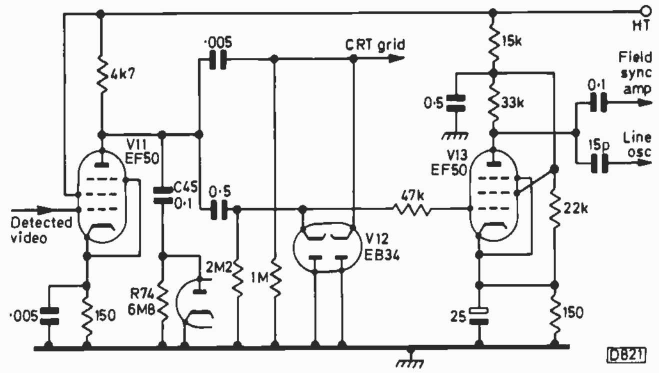

Fig. 2: The video amplifier and sync separator circuits, with d.c. restoration in both feeds.

arranged as a transitron, with feedback between the anode and control grid and also between the screen and suppressor grids. The operation has been described before in this series. The EL33 field output valve was *RC* coupled to a transformer driving the scan coils.

The line timebase was simple indeed in those pre-flyback e.h.t. days. The blocking oscillator's output drove an EL38 output pentode that operated as an amplifier rather than a switch, with simple transformer coupling to the scan coils.

The audio circuit was conventional, using an EBC33 and EL33 output pentode, but the negative feedback loop incorporated a tone control. Sound was considered important in those days!

One wonders whether there's anyone left at Thorn who can recall the 841T. It's a far cry from the TX series!

VCR Clinic

Reports from Steve Beeching, T.Eng. (C.E.I.), Derek Snelling, Mike Phelan, Les Harris and Mick Dutton

JVC HR7700/Ferguson 3V23

The problem was no clock display. If the clock crystals on the tuner/timer board are red ones, the first step is to change them to blue ones. Other minor capacitor changes have been suggested but are not essential. In this case however these changes did no good despite the fact that the timer microcomputer i.c. was deprived of clock oscillations. The culprit was in fact the microcomputer i.c. itself. **S.B.**

Sharp VC8300

It's not often that we get bounce backs, to adopt a phrase from the world of TV repair. A certain Sharp machine (VC8300) with a servo fault caused some concern however. The initial report was of a tracking fault after the machine had been in operation for a couple of hours. So it was soak tested, with the scope tied to the capstan servo. A small servo adjustment seemed to cure the problem, a fact that seemed to be confirmed by making a double check from cold the following day.

Some days later it was back with us again, this time with the complaint that the fault occurred just after switching on. Again we gave it a lengthy soak test, with the scope monitoring the capstan servo ramp and sample pulses at TP711 and TP712. This proved that long-term drift was present. The sample pulses started off high up the ramp, then slowly moved down over a period of three-four hours. Further checks for capacitor or other component value drift proved inconclusive, so we came to the conclusion that the trouble was due to the capstan motor. A month or two later, when the customer was getting really upset, a replacement motor arrived. A further soak test confirmed that our diagnosis was correct. **S.B.**

JVC HR7200/Ferguson 3V29

I'm not sure whether this one has been covered before, but to avid VCR fault collectors, here's a beaut! This JVC HR7200 (Ferguson 3V29) machine had a replay colour fault: the colours were in horizontal bands, so they were obviously not phase locked. I did puzzle initially why the colour-killer didn't operate, then discovered that there isn't one fitted – pin 10 of IC403 is left open-circuit. The colour phase-locked loop is in IC403, which was soon eliminated. So was the 4·435571MHz crystal as it measured correctly in the record mode. With the scope connected to certain points the colours would lock, giving normal playback colour bars. This proved that the a.p.c. loop could be locked. The question remained as to why it wouldn't do so.

There are two phase detectors in IC403, the a.p.c. and ident detectors. Both are fed with gated burst, at pins 14 and 13 respectively. The only difference is that the input to pin 14 goes via a 90° phase shift network. A scope comparison showed that the phase shift was correct, and the only discrepancy we could detect was in certain voltage readings. Pin 1 was at 5·9V instead of 5·6V while pin 14 was at 6·04V instead of 6·4V. These could be put down to tolerances. We eventually found that C462 (15pF), part of the 90° phase shift network in the feed to pin 14, was resistive, though of the correct capacitance value – it measured a few hundred kΩ on the AVO.

Note that the circuitry around pins 13 and 14 of IC403 is high-impedance. Thus readings here will be valid only if a × 10 scope probe or a high-impedance digital voltmeter is used. **S.B.**

JVC HR2650

The complaint was that when editing by either insert or audio dub the original sound was erased. Before starting on any repair work we had to make sure that the customer was doing the right thing. On this machine the camera records sound on ch. 1 or if stereo chs. 1 and 2. The tuner records on both channels. Now when audio dubbing or insert editing it's possible to select to over record both channels or ch. 2 only. The customer complained that with the switch in the ch. 2 dub only position and then insert editing a title on to his tape all the original sound was erased, whereas the original sound on ch. 1 should have been left alone. A cross check with a stock machine confirmed that this should be so, the ch. 1 sound remaining untouched. In the customer's machine it was erased.

A tuner recording was made and a further check carried out using the audio dub facility. Ch. 2 was over recorded and ch. 1 fully erased – but a small amount of the original sound could still be heard on ch. 2! The fault? Well, the ch. 1 and ch. 2 audio erase heads had been reverse wired in production! As a result, when an audio dub was performed ch. 2 erase went to the ch. 1 erase head, thus wiping ch. 1, and the ch. 2 record head erased and over recorded, thus explaining the residual sound that was left on ch. 2. **S.B.**

Defeat!

There are occasions when circumstances dictate a course other than investigative repair. Such an occasion arose just before Christmas. A local dealer sent around a Sony SLF1 portable which wouldn't thread up after inserting a cassette. Three microcomputer i.c.s control this function. One in particular scans the cassette detector switch and has an output for threading drive. Whilst it scanned the switch input, it didn't activate the threading output. Sony technical agreed that a replacement for this i.c. and/or one of the other two was in order, and after replacing two of them to no avail it became obvious that without any technical information on the starting routines a great deal of time would be required to sort the fault out. The dealer was not prepared to pay for this and I believe the machine went back to Sony. If any Sony engineer has sorted it out, I'd be glad to hear from him . . . **S.B.**

Toshiba V8600 with a Hangover

Being Christmas, I suppose it had to happen. Andy did say the customer suspected that someone had spilt white wine into the machine. The whole area around IC604 and IC602 was badly corroded. Most components had to be removed for cleaning and the wire links had to be replaced. After a good clean up the machine was tried. The pinch solenoid didn't operate. This was traced to Q642 not providing IC602 with clock pulses (derived from the PG circuits). I wonder whether Andy reordered the foaming cleanser? **S.B.**

VCR Supply Lines

The fault with a Mitsubishi HS700 (the portable machine with the built-in tuner) was that it wouldn't record. A check showed that it was working correctly so far as the E-to-E mode was concerned, but attempting a recording produced no results – not even erasure of the previous sound or picture. A point here – when dealing with a no record fault, always use a tape with a previous recording on it in order to check whether the erase circuits are working or not. This can aid diagnosis.

The fact that so much was defective, i.e. no recording, no erasure and both the sound and vision affected, led me to suspect that a voltage rail was missing – in this case the REC 9V rail. A check showed that it started off at 9V but over a few seconds fell to 7·8V. Shorting across to the permanent 9V rail brought the voltage up to the correct level but didn't affect the problem in the slightest. The manual is not very well set out, as a result of which we had to spend some time trying to find the record voltage rail to the erase oscillator. Eventually a line labelled DREC 9V was found. This was at 0·2V instead of 9V. The problem was traced to IC2H1, which processes the sound, a replacement curing the fault. A DREC 9V line is not found in many machines – it stands for delayed record 9V, the purpose being to allow noise-free transitions between recordings. The sequence after record is selected is as follows:

(1) The machine laces up and REC 9V appears.
(2) The machine winds tape back for a short period.
(3) The machine goes into the combined record/playback mode. During this time the E-to-E mode is maintained, i.e. the machine doesn't playback the tape, the idea being to use the previously recorded control pulses while synchronising the motor speed to the incoming sync signals.
(4) The DREC 9V line appears and the machine goes into the full record mode. With the heads synchronised to the previous picture, a noise-free transition occurs.

This fault prompted me to make a list of the various voltages found in VCRs and their purposes to help with fault diagnosis. I've used 9V as the nominal voltage, but the rails may be at 12V – the principle remains the same.

The basic lines are usually 18V, 15V, 12V and 9V. These are present all the time once the machine has been plugged in and the operate switch is on. They power such things as the clock, timer, microcomputer (usually a 5V feed derived from one of the other rails), aerial amplifier and, in some models, the infra-red remote control receiver.

The not-PB 9V line is present all the time during operation except during playback. It powers the tuner and i.f. strip plus associated changes to provide the E-to-E mode.

The PB 9V line is present only during playback. It switches the signal processing circuits and the servos to the playback mode.

The REC 9V line is present only during record. In addition to switching the signal processing and servo circuits to the record mode it switches on the bias oscillator/erase circuits.

The DREC 9V line is present on record only, after a few seconds delay. Used for noise-free transitions between recordings.

Thus failure of the not-PB 9V line would give normal playback but no sound or picture in the E-to-E mode, and record via the video and audio input sockets only. Failure of the PB 9V line would give normal operation except for no playback. This assumes that the relevant voltage disappears, but as regular readers will know this seldom happens. What usually occurs is that the voltage drops sufficiently to affect some parts of the circuit but not others, or enough to cause intermittent operation. Worst of all is a switching transistor that leaks, causing part of the voltage to be present all the time. This can give rise to some very obscure faults – as the machine tries to record and playback at the same time for example. **D.S.**

Grundig 2×4 Super

A Grundig 2 × 4 Super arrived with the complaint that it chewed tapes. The machine worked all right on rewind and fast forward, though it was a bit sluggish. On record and playback however the take-up reel failed to rotate. This created a loop of tape, as a result of which the machine entered the alarm mode. We investigated without a tape in and discovered that the reel motors were deprived of power – there was only about 4V at the emitters of the drive transistors instead of 12V. A check back to the power supply revealed that the 2V zener diode at the top centre was dry-jointed!

The power supply in this machine is liberally sprinkled with small safety resistors that tend to go open-circuit at the drop of a hat – R443, R453 and R485 are the favourites. With R443 (390Ω) open-circuit the machine will not switch on – the clock displays 8s and the relay doesn't energise. This resistor is in the base circuit of transistor T443 that bypasses the relay contacts to power up the microcomputer i.c. so that the latter can give a "relay on" signal. R435 and R485 (both 100Ω) are in the 150V and −150V dynamic track following output stage supplies respectively – R435 will also remove the 33V tuning supply when open-circuit. Lack of dynamic track following shows up as noise bars in fast search (like a VHS machine). Also the voltage at the brushes above the head will be ±60-80V instead of approximately zero volts ±15V. **M.P.**

Akai VS2

Failure to load was the problem. The tape would half load then retract, with the "breakdown" signal showing. We found that the brakes were not being released from either the take-up or the supply reel. The brakes are operated by a pin which is engaged in a fork on the underside of the mechanism, but the pin had disappeared – when the bottom cover was removed it dropped out of the bottom PCB. We had no further trouble after glueing it back in place. **M.D.**

Sony SLC6

A customer phoned to say that his new VCR had already chewed up three tapes. We called and found a tape jammed inside the machine. After removing this we inserted our own tape and found that the machine laced up correctly. When play was selected however the tape went slack and the slack sensor operated. Also the machine wouldn't go into fast forward, and in rewind the tape became very taught.

This suggested a problem with the take-up spool brake, so the machine was taken to the workshop for further examination. With the machine on the bench we inserted our dummy cassette so that we could see what was happening to the take-up wheel. There was plenty of take-up torque in play, and the brake was released correctly in rewind. Removing the cassette carriage enabled us to see what the problem was. There's a "cassette in" microswitch at the base of the cassette tray, and the wiring to this should be routed via plastic clips around the edge of the metalwork. This wire was not properly in place, and was getting trapped between the take-up wheel and the reel inside the cassette when the latter was in position. The problem didn't show with our dummy cassette because this doesn't contain tape reels. **M.D.**

Ferguson 3V23

The problem was intermittent failure to eject the cassette. When the button was pressed you could hear the motor running, but there was no movement. We found that the middle cog wheel on the side of the cassette housing was quite sloppy. On removing the cassette housing we noticed that the screw which holds the spindle on which this cog wheel is mounted had worked loose: tightening the screw removed the cog wheel play and cured the eject problem. **M.D.**

Sharp VC7300

The complaint was that the machine was stuck in play. Removal of the top cover revealed that the tape was loaded. When the machine was powered the tape unloaded. Play was selected, then stop: the machine remained loaded and the loading motor made a complaining noise – it was turning the wrong way, i.e. to load. I next noticed that the main solenoid did not release when the stop button was pressed. Pulling out the plunger enabled the machine to unload.

A switch which is activated by the main solenoid via a lever changes the polarity of the supply across the loading motor. Because the solenoid plunger had stuck, the switch was applying the wrong polarity supply to the loading motor. Lubricating the plunger solved the problem. This also solves the mystery about the VC8300H (VCR Clinic, November) with its thermal fuse open-circuit. Because the solenoid wouldn't pull in, the loading switch would be in the wrong position with the loading motor running in reverse. **L.H.**

Bulbs

When checking ex-rental Ferguson 3V29/30 series machines in the workshop we've noticed that the cassette lamp seems to fail rather a lot. We eventually realised that it seems to happen if the machine is switched on at the mains with the operate switch in the on position. With the operate switch kept in the off position, the bulb failure rate was cut dramatically. A similar thing happens with the clock bulbs in the Toshiba V5470B. If the machine is unplugged for the first time in a couple of years to go into the workshop, the clock bulbs almost always fail: unfortunately there's no way to prevent this. **D.S.**

Letters

THORN TX9 CHASSIS

In the January issue TV Fault Finding feature there was mention (page 145) of chopper transistor (TR62) failure in the latest version of the Thorn TX9 chassis. My experience has been that when TR62 goes short-circuit the reason is that R165 (300kΩ) has gone high in value. This resistor forms part of a sawtooth generating network connected to pin 4 of the TDA4600 chopper control i.c., the sawtooth in turn affecting the drive to the chopper transistor. The result of R165 going high in value can also be intermittent blowing of TR62.
Brian Francis, Tech. (C.E.I.),
Plympton, Plymouth.

POOR AERIAL DESIGN

It's a sad fact that the majority of u.h.f. TV aerials installed are of the cheap (some would say cheap and nasty) variety. The average customer does not seem to be prepared to pay for the good quality aerials produced by the better known manufacturers, and I doubt whether this situation will change in the foreseeable future. There's one little thing that could be changed however, at very little cost to anyone. It would enormously improve the performance of many of these cheap aerials.

For some reason the smaller aerial manufacturers tend to make their group A arrays with a reflector that's too short and too close to the dipole. The length tends to be 260-270mm when it should be 345mm: the reflector-dipole spacing is usually 70-80mm when it should be 100mm. A reflector of this sort is literally worse than useless, as it acts as a director on the lower channels.

The performance of some of these aerials at the bottom end of the channel group is disastrous. On channel 21 the polar diagram looks like a starfish: the gain drops to about 4dB and the front-to-back ratio is 1:1! For vertical polarisation some aerial riggers throw the reflector away and mount the array about 200mm from the top of the mast, thus using the mast itself as a reflector.

This situation is becoming acute as so many Channel Four transmitters use channel 21. Surely the offending manufacturers would find it in their own interests to make a small and cheap modification that would greatly diminish the quality gap between themselves and the "big boys"?
W. Wright, Wright's Aerials,
Micklebring, Nr. Rotherham.

TV FAULT REPORT

The following recent fault experiences may help some other readers. The first concerns an Hitachi P27FM 12in. monochrome portable – the one with the f.m. radio – the complaint being field roll when the set was first switched on. This could be corrected by adjusting the rear mounted hold control, but further drift would occur some minutes later. Eventually the end of the control's range would be reached. Well, field oscillator circuits are usually simple and easy to repair, so I gave the owner a ridiculously reasonable quote. On removing the set's case however I discovered that the entire field timebase is contained within a KC531C i.c. A spray with the freezer confirmed that it was at fault, replacement curing the trouble. Unfortunately the repair was more expensive than originally envisaged. Ouch!

The Philips G8 chassis has been around for many years and rarely do I find anything that surprises me. This particular one came in for tube replacement plus a general service and set up. After carrying out the work, the h.t. control was set to minimum and the set was switched on. To my surprise the h.t. voltage at the two fuses on the power supply panel was 210V. Increasing the control's setting increased the voltage, its stability indicating that the circuit was regulating – but at the wrong point. This sort of thing is usually caused by R1368 (470kΩ), which is in series with the h.t. preset, or the feedback resistor R1372 (390kΩ), but both were perfect.

The panel was removed and appeared to be an early version (the set itself was the later 550 series/BEAB/VCR compatible version), but not quite. The panel contained aspects of both versions – the panel went through several modifications. I decided to bring it up to the later standard. The h.t. preset was changed to 22kΩ, with 5·6kΩ in parallel, and the chassis return resistor was changed to 10kΩ. R1384 was changed to 4·7kΩ and a diode was added in parallel with the charging capacitor C1376 – I used a BY207, with the anode to chassis. Some components were of the later values while others had the original values, and it seemed that the combination wouldn't do the job. Switching on with the later values fitted and the preset at minimum produced a regulated 150V supply, with the correct 205V when the control had been advanced to approximately mid-way.

Intermittently changing colours was the fault reported on an old GEC hybrid colour set. These receivers are now nearing the end of their useful life, but I occasionally still come across a good example. This was one such, in excellent condition throughout, with a crisp tube and polished, unmarked cabinet. The purity was appalling, but resetting this along with the convergence and grey-scale tracking produced a good picture. I switched off and on to check the operation of the degaussing circuit, and as everything appeared to be all right I left it at that. The owner had moved before the fault appeared, so I put the fault down to this.

A week later I was back. This time I switched off the blue and green guns and watched in red. This showed that the purity was continuously varying, drifting out and then back in. I've never seen a set do this before, but the circuit is simple enough, with a couple of thermistors – the usual VA8650 and a strange three-legged one with two sections. The VA8650 fell to pieces when I touched it, so I replaced it with confidence that the fault was now cured. All connections were checked, and the double thermistor had been replaced recently. Purity and convergence adjustment produced a good picture, and the red raster no longer varied.

After another week I was back again and, on removing the rear cover, saw it immediately. The double thermistor had a tiny hairline crack through the small end section. Replacing it put an end to my visits. Apparently the crack had been too small to see on previous visits, repeated thermal cycling eventually widening it.

A Philips TX 12in. monochrome portable (Model 12B711) gave croaky sound, reminiscent of crossover distortion, at low levels. At normal listening and high volume levels the output was normal and undistorted. Speaker replacement made no difference, and no transistor leakage could be measured. The TBA120AS was replaced to make sure, but this didn't seem to have much effect. There's a modification to cure the condition, which is present with some of these portables. Change R300 from 27kΩ to 18kΩ, R311 from 33Ω to 56Ω, R312 from 2·7kΩ to 3·3kΩ and R315 from 180kΩ to 120kΩ. The modification increases the output stage quiescent current and provided a complete cure. My thanks to Philips Service for their advice.

Another common trouble with these sets is cracks in the print around the brightness/volume/contrast control potentiometers. They are usually very hard to see, but are easily found with an ohmmeter.

Stephen Leatherbarrow,
Middleton, Manchester.

KEEP AN EYE ON THE ROOF

Some four years ago I reported in these columns on some of the unexpected things that can happen during the course of servicing. One case I mentioned concerned a customer who'd installed his own u.h.f./v.h.f. aerial on the roof of the block of flats in which he lived. His reception gradually deteriorated over a period of time, and when he eventually went up on to the roof to try to discover why he found that no less than six other aerials had been fitted to his mast, all in extremely close proximity. They'd all been installed by bona fide aerial companies, but not one of them had asked for permission to install an aerial on his property. He had them all removed a bit sharpish!

The saga of this gentleman and his aerials is by no means over however. Some three months ago he decided that some streamlining of his array was due. Since the old v.h.f. aerials were no longer in use they were to be scrapped and, at the same time, it was decided to replace the existing mast with a sturdier one (a scaffold pole to be exact). Suitable reinforcement was carried out and the single u.h.f. array was mounted at the top of the pole, the space below being left clear for the future installation of a CB aerial and a v.h.f. stereo radio aerial. He then painted the complete pole with red and white stripes (barber shop style) to deter (he said) anyone from fitting anything to it in the interim period.

Eventually he gets his other aerials and up he goes to fit them. What does he see? Two lovely u.h.f. arrays smack in the middle of his mast! He traced one to a particular flat and, after speaking to the tenants, got the name of the firm who'd installed it. A fitter from the firm came round and said he'd resite it. That was on a Friday. On the following Monday our customer went up to trace the owner of the remaining aerial. He managed this and found it had been installed by the same firm. He also found that the first aerial had been resited on a lightning conductor, complete with a large lump of baton in the U of the clamp bolt to act as a spacer!

Now I'd expect this sort of thing from a cowboy outfit, but the firm concerned is a prominent member of the National Federation of Aerial Contractors . . . If a customer is given a quote for an aerial installation this will include all the fittings. If the aerial is then attached to someone else's mast this means that the bracket, pole, lashing wire etc. which have been paid for have not been used. In my previous communication I suggested that managers should take a greater interest in the way their firm's work is carried out. It seems that this suggestion has not been heeded.

Steve Knowles,
London N4.

Servicing the Sony Model KV1400UB

David Botto

We've handled quite a few of these receivers, which are reliable, well designed and give excellent picture and sound. Just the same, you can get puzzling faults.

As with many modern sets, failure in either the power supply or the line timebase results in the dead set symptom. As the first logical step in this event is to determine in which section of the receiver the fault lies, we'll start by considering the operation of the power supply. We'll use the Sony board lettering identification system to identify sections of the chassis.

The Power Supply

The switch-mode power supply consists of a series chopper arrangement – though Sony choose to call it a choke-coupled flyback converter. The circuit is shown in Fig. 1. It's on board D, along with the line and field timebases.

The a.c. mains input is fed via the on/off switch S901, fuse F601 (3·15AT), choke T601 and the surge limiting resistor R601 (3·9Ω, 10W) to a bridge rectifier consisting of two ERC04-06SU2 double diodes. The fuse sometimes goes open-circuit for no apparent reason, a new one restoring picture and sound. Before fitting a replacement, check whether the old one is blackened. If so, then the bridge rectifier is suspect. Note that D602's two anodes are returned to the h.t. line rather than chassis.

Q605 (2SC1942) is the chopper transistor and Q604 (2SC2230A) the driver. Q602/3 (both 2SC633A) form an astable multivibrator circuit which if left to run on its own operates at about 10kHz. When the set is running normally, the multivibrator is triggered by pulses from the line output transformer. The frequency is thus 15·625kHz. L603 is the reservoir inductor and C621 the h.t. filter capacitor. When Q605 switches off, the efficiency diode D606 (ERC25-06) conducts to maintain the current flow.

The control action is provided by transistor Q601 (2SA733) which senses the h.t. voltage at its base – D603 provides a stable reference at its emitter. If the h.t. voltage rises, Q601's base voltage will rise and its collector current will fall. Since the collector of Q601 is connected to the junction of R611/2 in the multivibrator circuit, the effect is to shorten the on period of Q602 and thus the on time of Q605 to compensate. The reverse occurs when the h.t. voltage falls.

Excess current protection is provided by transistors Q651/2 (2SA733 and 2SC633A respectively) which are connected together to act as a thyristor. The emitter of Q652 senses the voltage developed across R651. Excessive h.t. current will increase the negative voltage developed at this point with the result that Q651/2 will switch on, removing the drive to Q604. The circuit also provides over-voltage protection. In this event the output from D652, developed across C653, will be sufficient for D653 to conduct. Q651/2 will then switch on as before.

Dealing with a Dead Set

So there's a dead set sitting on your bench. Is the fault due to the power supply or an overload elsewhere? To find out you'll need an 18V d.c. supply – we always use two PP9 batteries in series, guaranteed absolutely ripple free! It's also vital – as with all Sony sets – to have a means of controlling the mains input voltage, i.e. a variac or tapped mains transformer. In addition, a 100W, 240V bulb is required.

Removing the link (see Fig. 2) right next to Q605's heatsink isolates the power supply. Connect the negative end of your 18V supply to chassis and the positive end to the positive side of C609. Don't connect the mains supply at this stage. Connect a meter in series with the 18V supply to measure the current drain – start on a high current range. The reading should be around 25mA. A digital multimeter is best for all tests on the power supply.

With an oscilloscope connected via a 10:1 probe to the collector of Q602, a waveform similar to that shown in Fig. 3(a) should be seen – of about 12V peak-to-peak. This tells you that the multivibrator is working. If the waveform is missing, disconnect the collector of Q651. If the waveform now appears, the fault is in the overload protection circuit. Check Q651/2 and capacitor C654 – examine it for corrosion. Diode D651 (1S1555) can also fail.

If there's still no waveform with the collector of Q651 disconnected, it's possible that there's a fault in the error detector circuit. Check Q601, the zener diodes D607 (RD3·9E) and D603 (RD12E-B2) and capacitors C608 and C622 (also make sure they're not corroded). This leaves only the multivibrator circuit itself. We've found this to be reliable, but if necessary check Q602/3 and diode D604 (1S1555).

If the waveform at the collector of Q651 is correct, connect the scope – still via the 10:1 probe – to the collector of Q604 and the emitter of Q605. The waveforms shown in Fig. 3 (b) and (c) should be seen.

To avoid damage, two quick checks should be made before connecting the mains a.c. supply. First check the waveform at the collector of Q602 again, then momentarily short the anode of D653 to chassis. The waveform should disappear and won't come back until the 18V supply has been disconnected for a minute or so. The second check is to connect the junction of R605/6 to the 18V d.c. supply. As RV601 is adjusted the waveform will vary – in fact at one end of the control the multivibrator will stop. These checks confirm that the overload protection circuit is working and that the error detector circuit is in order.

Note that if Q605 fails, D606, Q651 and Q652 are likely to be faulty. Knowing how this power supply works is useful since similar circuits are used in other Sony sets.

Disconnect the batteries and remove the link from resistors R605/6, then connect the mains supply via the variac or tapped transformer. Monitor the waveform at the emitter of Q605 with the scope, via the 10:1 probe. Increase the a.c. input slowly, watching for smoke or signs of overheating. At about 40V a.c. the scope should show a waveform of some 170-180V peak to peak and the h.t. across C621 should be about 100V. If all is well, switch off the mains input – without altering the a.c. voltage setting – and connect the 100W bulb between the h.t. line and

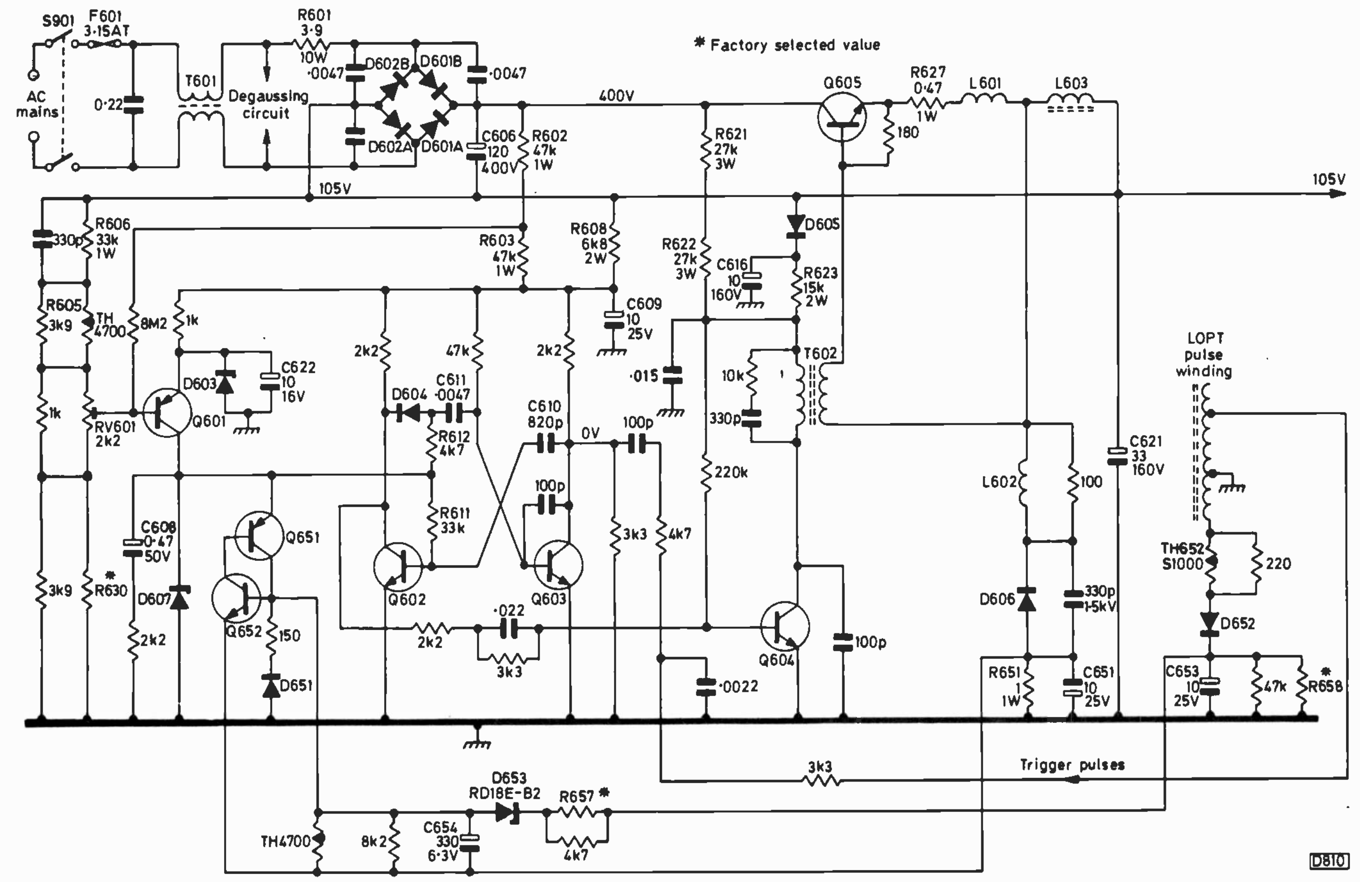

Fig. 1: Circuit diagram of the switch-mode power supply. The multivibrator's main time-constant network comprises R611/C610, the control transistor Q601 adjusting C610's charging time.

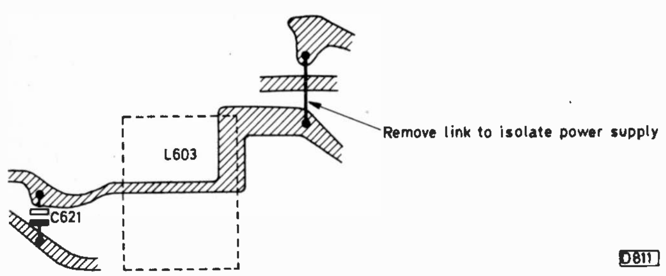

Fig. 2: Location of the power supply isolating link.

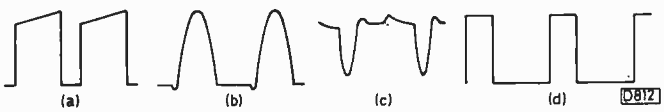

Fig. 3: Power supply check waveforms.

chassis.

Restore the a.c. input and check the waveform at the emitter of Q605 – see Fig. 3(d). As the a.c. input is increased to 150V the h.t. line should reach 95-110V depending on the setting of RV601. Slowly increase the input to the full 240V. The h.t. voltage should remain at 105V. If during these tests any of the waveforms don't seem to be clean, having a lot of "fuzz", replace C609 and check C606. On rare occasions C616 dries out and causes problems.

Switch off, remove the 100W bulb and reconnect the link (Fig. 2). Switch on with the a.c. input at a low setting and gradually increase the input. At 40V a.c. there should be a squarewave at the emitter of Q605 and at 60V a.c. the frequency of this squarewave should increase because pulses should arrive from the line output transformer to trigger the multivibrator. If there's no change in the frequency of the waveform, find out why before increasing the a.c. input further.

Picture and sound should begin to appear when the a.c. input is about 80-90V. With the full 240V a.c. mains input, an 18V peak-to-peak line-frequency waveform should be present at thermistor TH652 and at the anode of D652.

Timebase Troubles

If the line timebase is dead, check the output transistor Q503 (2SC1875) and the efficiency diode D503 (GH1F). If necessary, check the 12V regulator transistor Q811 (2SD471) and the three rectifier diodes fed by the line output transformer T801. These are D811 (V09C), D802 (GH1F) and D801 (HF1), for the 12V, first anode and 170V supplies respectively. If all is well, apply a very low a.c. mains input and monitor the waveform at the collector of the line driver transistor Q502 (2SC2230A) to see whether line drive is present. Check that it's reaching the base of Q503. Switch off as soon as line drive waveforms are seen.

Lack of line drive can be caused by failure of the line oscillator transistor Q501 (2SA677) or Q502, also the feed resistors R514 (4·7kΩ, 2W) and R513 (47kΩ, 1W).

In earlier Sony receivers it was almost unknown for the line output transformer to fail. T801 in the KV1400UB does sometimes fail however. The only reliable test is by substitution. Note that the e.h.t. rectifier is encapsulated within the transformer. First make sure that R811 (1·2Ω, ¼W flammable) and the two diodes (D504/5, type SIB01-02) in the centring circuit are o.k. Also examine all the small electrolytics in the line timebase for excessive leakage or signs of corrosion.

We've not had many problems with the field timebase. If diode D511 (1S1555) fails, field sync is lost. The output transistors are Q553 (2SD669A) and Q554 (2SB649A). They rarely fail. If the sides of the picture are bowed, suspect leakage or failure of the pincushion correction transistor Q581 (2SD571) and/or its emitter resistor R584 (82Ω).

The Signals Side

The audio circuit (board A) also rarely needs attention. If the sound does fail, the first thing to do is to measure the voltage at pin 6 of the intercarrier sound i.c. (IC251, type CX095C). It should be 5·4V. If way off, check the sound mute stages on board M2 – test transistors Q182 (2SC634A) and Q181 (2SC733) for leakage, also diode D181 (1S1555). If the 5·4V reading is correct, check the audio circuit. The output transistors Q252 (2SD669A) and Q253 (2SB649A) can fail. In this event check the emitter resistors R260/1 (both 33Ω, ½W) and the driver transistor Q251 (2SC926A).

There are five i.c.s on the signals panel (board A). In addition to IC251 these are IC281 (M5135P) for a.f.c., the i.f. chip IC201 (CX177B) and the two decoder chips IC301 (CX108) and IC302 (CX109). IC301 contains the luminance amplifier, chrominance processing and reference oscillator stages (there's also an external transistor, Q305, in the oscillator circuit) while IC302 is mainly concerned with colour demodulation and matrixing. IC201 also feeds the intercarrier sound chip of course. These i.c.s are all very reliable.

A difficult fault to trace is intermittent loss of sound and picture with a peak white raster. A number of 0·0047μF capacitors will be seen in the vicinity of IC201-C207, C208, C211, C213 and C216. Replace the lot!

In the event of colour problems, start by connecting the 10:1 scope probe to the junction of C310 (100pF) and R313 (1kΩ). With a colour bar input, chroma bars should be seen. It's handy to know how to disable the colour killer: this is done by applying 4V (use one of your PP9 batteries and a 5kΩ preset) to pin 24 of IC302. If there is still no colour, go straight to the oscillator transistor Q305 (2SC403C) – there should be a 4·43MHz sinewave at its collector. If there isn't, check the transistor and the components in this area.

The colour-difference and luminance outputs from board A can be easily checked with the scope at plug A5. The luminance signal should be present at pin 1, with R – Y, G – Y and B – Y at pins 3, 4 and 5 respectively.

The RGB output transistors Q701-3 (2SC2278) are on c.r.t. base panel C. Predominance or absence of one colour can be caused by leakage or failure of one of these transistors.

If the set is stuck on one channel, first clean the touch contacts then suspect the two i.c.s (IC151/2, both type M51231P) on touch sensor panel M1. This doesn't happen often.

We've not had problems with panel S (18V regulator, a.g.c. amplifier plus i.f. preamplifiers). If the tuner should fail it's best to obtain a new one from Sony rather than trying to repair the old one. If the tuning drifts off after the set has been on for some time, change D172 (μPC574J), the 33V regulator on panel M2.

It's best to obtain all replacement parts from Sony. After carrying out any soldering on the printed boards, spray on a very thin coat of circuit varnish in order to prevent future corrosion.

TV Fault Finding

Reports from Mick Dutton, P. Hardy, M.S. Barakat and John Coombes

Grundig 3402

The customer complained that the set would sometimes not switch on from cold. He mentioned that a faint hum could be heard from the back. This model is fitted with the CUC220 chassis, with full remote control. We made the set go into the fault condition by turning it on and off over a period of hours. The customer was correct in saying that a humming noise could be heard from the back – it was coming from the chopper transformer TR651. Voltage measurements showed that all the outputs derived from this transformer were present and correct, but we noticed that the standby relay hadn't operated. Pin 13 on the tuning panel was shorted to chassis to prove that the fault was not in the remote control circuitry. This still produced no results, so we removed the relay's cover. The problem was now clear – the relay contacts were jammed open. Careful cleaning provided a cure, but to be on the safe side we decided to fit a new relay. **M.D.**

Thorn TX9 Chassis

The problem was that the picture would intermittently flicker. This seemed to be due to a fault in the tuner unit, but was difficult to prove since it was so intermittent. A new tuner unit was fitted and the set given a long soak test. After several days the fault reappeared, but once again it was hard to decide upon a specific cause. Luckily we had another set with the same chassis in the workshop, so we tried swapping over the i.f. modules. This cured the fault on the first set, and after a time it put in an appearance on the second set. Careful examination revealed that one leg of the a.g.c. reservoir capacitor C35 (1μF) was loose. A replacement cleared the fault. **M.D.**

Philips K30 Chassis

The complaint with this K30 series set was that the background colour would change intermittently. On soak test we found that the red level was varying: with the blue and green guns switched off, it was possible to watch the red level gradually drifting up and down. With the use of freezer and a hairdryer the problem was traced to D4255 (BAV21) on the RGB output panel. The diode was going leaky when warm – it's in the red channel d.c. stabilising circuit. **M.D.**

Grundig CUC720 Chassis

Picture jitter was the complaint with this set: a few minutes after switching on, the picture would become very unstable both vertically and horizontally. We suspected the switch-mode power supply, but the output voltages remained stable during the fault condition. We nevertheless tried reducing the output voltage (R647), which made the jitter less prominent. We also noted that the control didn't seem to have much range. When we removed the plastic cover from the print side of the power supply the reason for the fault was obvious. The BU208A chopper transistor's base connection had a white deposit around it, causing a dry-joint. Someone had been very generous with the heatsink compound during manufacture, and this had pushed right through the base pin connection. We had to remove the transistor and file its pins clean before a satisfactory connection could be made. **M.D.**

Rank T22 Chassis

The initial problem with this set was no results. This was soon traced to the 1Ω feed resistor in the BU208 line output transistor's base circuit being open-circuit. A few days later the customer complained that the set had once again gone dead. This time the 1·8kΩ feed resistor 5R3 in the line driver transistor's collector circuit had sprung open. We thought we might have disturbed the soldering on this resistor during the previous repair, and after resoldering it the set seemed to work all right. A few days passed, then the same thing happened again.

This time we resoldered the resistor and left the set running. After several hours the picture went unstable horizontally, giving an effect similar to that produced by tripler breakdown. The problem was traced to pin two of plug 4Z2 having a bad connection. This pin makes the chassis connection between the line output and the scan drive panels. **M.D.**

ITT 1611

This set, fitted with the ITT80 (90°) chassis, would intermittently go dead or fail to switch on from cold. We found that in the fault condition the mains supply was not present at the mains panel. After removing the remote control receiver assembly we found that the mains input was present at the relay-operated on/off switch but one side of this was open-circuit. Stripping the unit down and cleaning the contacts provided a complete cure. **M.D.**

Tatung 120 Series Chassis

Loss of one colour is quite a common fault on these sets. Swapping over the RGB leads at the tube base will eliminate the decoder of suspicion. The RGB output stage transistors on the tube base panel may then need to be checked as appropriate, but the cause of the trouble is more often the feedback resistors R226 (red channel), R244 (green) and R251 (blue). They are 100kΩ metal film resistors with a 2% tolerance rating, but tend to increase in value to something like 2MΩ.

In the event of field collapse, check the supply to the TDA1170 field timebase chip – there should be 23V at pin 2. If this is missing, check rectifier diode D404 (BA159) and the surge limiting resistor R434 (10Ω) in the line output stage. One or other is likely to be open-circuit. If there's a short-circuit in the i.c., R434 will burn and go open-circuit. This resistor is a metal film safety component (fusible) and must be replaced with the same type. **J.C.**

Thorn 1690 Chassis

The complaint with this set was a common enough one – a severe hum bar which also upset the field sync. The l.t. rail was slightly low at 10·5V, and adjustment to 11·3V only made matters worse. The mains rectifier diodes W8/9 were changed, then the reservoir capacitor C70 and the series regulator transistor VT10, but the fault persisted. The error amplifier transistor VT13 appeared to be sensitive to freezer spray so a replacement was fitted. Still no difference. The zener diode W5 was then changed, apparently clearing the fault. The l.t. rail was low at 10V however, and when reset to 11V the hum bar reappeared.

A scope was then used to check the ripple at the emitter of the series regulator transistor. It was higher than expected at about 4V peak-to-peak, and of 20msec duration instead of 10msec. This revealed that the rectifier circuit was operating in the half-wave mode, and a quick check at the anodes of the two rectifier diodes confirmed that one of them was receiving no current from the transformer. A meter then showed that one half of the secondary winding was open-circuit – it had been poorly soldered at a tag. A clean up and some fresh solder restored normal operation. **P.H.**

Bush TV350

This set came in with a faulty picture – going negative. On checking we found that the fault was in the a.g.c. circuit. The set worked o.k. with a weak signal, but with a strong signal overloading was seen. Checks on the transistors, diodes and capacitors in the a.g.c. circuit showed that they were all in order, but there was no gating pulse from the line output transformer. A resistance check showed that the pulse winding was open-circuit. Apparently the transformer is no longer available – from Mastercare anyway – so we decided to add a few turns to the existing transformer. About seven-eight turns of "3000" line oscillator coil wire were used, connected to terminals 2 and 3 of the transformer. As a safety measure, insulating tape was used before and after the winding. When the set was switched on it was found to be working normally. Note that if the winding is in antiphase the field locking is difficult – in this case reverse the connections of the new winding to pins 2 and 3. **M.S.B.**

ITT CVC20 Chassis

In the event of excessive width, check whether C72 (4·7μF) is short-circuit then if necessary check the EW modulator diodes D23 (MR854) and D24 (BYX71-350) by substitution. **J.C.**

Amstrad CTV2000

This set uses a chopper power supply with the control circuit and the chopper transistor in a single chip, IC502 (type STR451). In the event of no sound or picture, check for 103V output at pin 2. If this voltage is present, check the voltage at the collector of the line output transistor Q705 (2SD904). If correct at 102V, check back to the collector of the driver transistor Q704 (2SC1756) where a reading of about 75V should be obtained. If this voltage is absent the feed resistor R726 (1kΩ, 1W) is probably open-circuit. **J.C.**

Thorn 9000 Chassis

In the event of tripping with a loud hum, check for dry-joints or open-circuit print at the mains rectifier's reservoir capacitor C702 (400μF). **J.C.**

VCR Servicing

Part 26 **Mike Phelan**

The 3V24 uses dual-loop servos, like the 3V23, but in this case the phase control loops are both contained in an HA11711 i.c., as in the 3V16 mechanically controlled machine which we discussed earlier in this series. The drum motor is a direct drive, Hall effect type, also as in the 3V23.

Servo System on Record

Fig. 117 shows the basic drum and capstan servo arrangements in the record mode. Briefly, the drum servo is locked to the off-air field sync pulses after division by two. This is done by comparing the phase of the 25Hz pulses with that of a trapezium waveform derived from pulses obtained from a pick-up head associated with the drum motor. The divided-by-two field sync output also provides the feed to the control head. The 1,500Hz FG (frequency gear) signal produced by the drum motor assembly is converted to a control voltage for the speed control loop. The capstan servo is controlled by a 32·768kHz crystal oscillator whose output is divided down to 21Hz and then converted to a trapezium. This is compared to the 126Hz FG signal after division by six. The FG signal also operates the capstan speed control loop.

Servo System on Playback

On playback (see Fig. 118) the crystal oscillator provides a reference signal for the phase-control loops in both servos. It's divided down to 25Hz (not 21Hz this time). In the drum servo it's used to gate the sample trapezoid obtained from the feedback pulses provided by the pick-up head. In the capstan servo the divided-down output from the oscillator is converted to a trapezoid which is gated by the pulse output from the control head. There are also shuttle search, still frame and (by remote control only) slow-motion facilities. The speed control loops operate in the same way in both the playback and the record modes.

The Drum Servo

Fig. 119 shows the drum servo in greater detail. We'll look at the drum motor drive amplifier later. Suffice it to say for now that it has a forward and a reverse input (the latter is used for braking – the head never goes backwards!), also a control input, switched by transistor X6, so that the motor is stopped in fast forward/rewind/stop. As in the 3V23, the forward and reverse inputs are driven by two operational amplifiers so that the phase and speed control voltages can be added. When X6 is on, the two control lines are grounded via the isolating diodes D8 and D9 and the motor stops. Transistor X5 is included to ensure that only one control line goes high at one time – otherwise the motor drive amplifier would be damaged. A similar arrangement was used in the 3V23.

The speed control loop is mostly contained in IC3 (type VC1029). The 1,500Hz FG input is amplified to approximately 1V peak-to-peak. It emerges at pin 3 and is fed back in at pin 4. It's then squared and converted to a sawtooth whose slope is constant, determined by the setting of the drum free-running speed control R13. If the drum speed decreases, the average ramp voltage falls. This is integrated within the i.c. to provide a d.c. voltage, and is also inverted to produce a rising output to speed up the motor. Note that with this type of system if a decrease in speed is called for the forward output to the motor drive amplifier goes low and the reverse output goes high, braking the motor until the correct speed is reached.

The phase control loop is the same as that in the 3V16, so we'll not go into detail. The network connected to pin 10 of IC1 should by now be familiar. R1 is the customer's tracking control which gives ±10msec phase shift (equivalent to a quarter revolution of the head drum) each side of the mean point set by R2 and the linear position of the control head. The latter is adjusted with an alignment tape while R2 is adjusted on the machine's own recording. D1 conducts on record, shorting out R1 and R2. This reduces the monostable multivibrator's time-constant, which is still adjustable by R4 to set the record head switching point. IC1 also contains the capstan servo, which is why the oscillator's output is divided down to 21Hz on record.

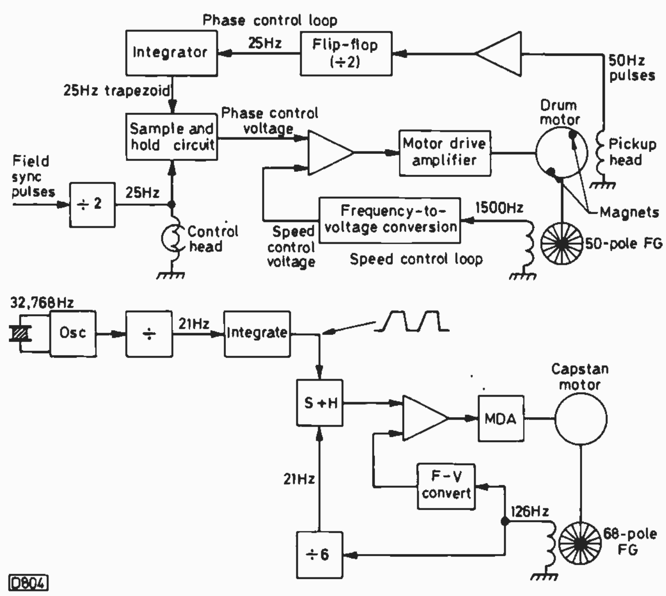

Fig. 117: Block diagram of the record servo system.

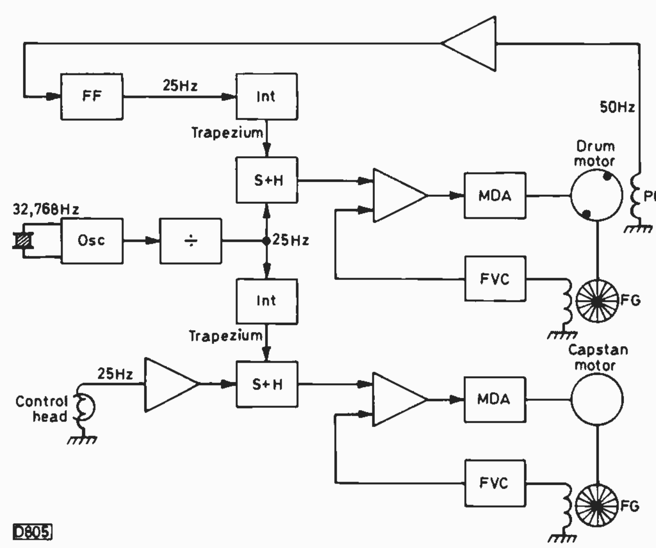

Fig. 118: Block diagram of the playback servo system.

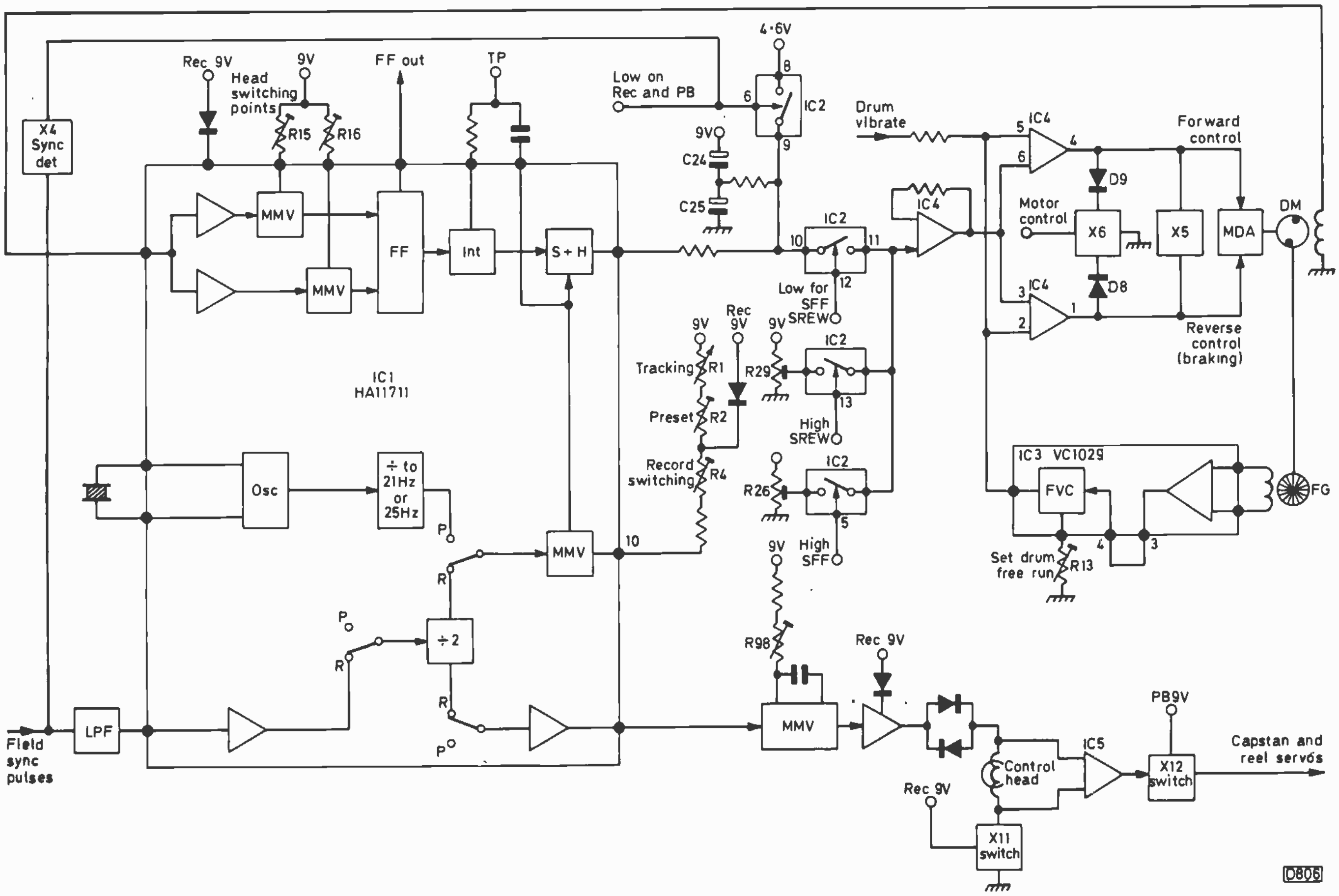

Fig. 119: Main features of the drum servo.

Pin 8 of IC2 is fed with a 4·6V reference voltage, this being approximately the correct value for the drum to free run at the correct speed. C24 and C25 form a time-constant to maintain this voltage against short-term variations. Pin 6 of IC2 is low in record and playback (switch open) while pin 12 is high (switch closed), thus enabling the phase control loop. If the sync pulses are lost during record, sync detector X4 drives pin 6 high to maintain the drum speed and prevent hunting. Pin 12 goes low in shuttle search (search fast forward and search rewind), opening the phase control loop: either pin 5 or pin 13 goes high, connecting the appropriate presets R26/R29. These are set to give the correct drum speeds (1,560 or 1,425 r.p.m.) to maintain the correct number of lines per field in the shuttle search modes. In stop, fast forward and rewind pin 6 goes high so that C24/5 are charged to the reference voltage to give the minimum lock-up time when record or playback is selected.

As in the 3V23, a "drum vibration" signal is fed to pin 5 of IC4 in slow motion to correct the sideways motion of the picture. This is necessary because the different writing speeds when the tape is alternately moving and still would cause a variation which has to be corrected. For this purpose a waveform obtained from the flip-flop in the slow-still i.c. is added to the loop error voltage.

Drum Motor Drive

Fig. 120 shows the drum motor drive amplifier circuit. As mentioned in Part 24, the resistors on this panel are of the chip type to conserve space. The motor has two sets of stator coils and a permanently magnetized rotor. Each coil is driven by a six-transistor bridge circuit. There are two Hall effect sensors (HG1 and HG2) which are switched on

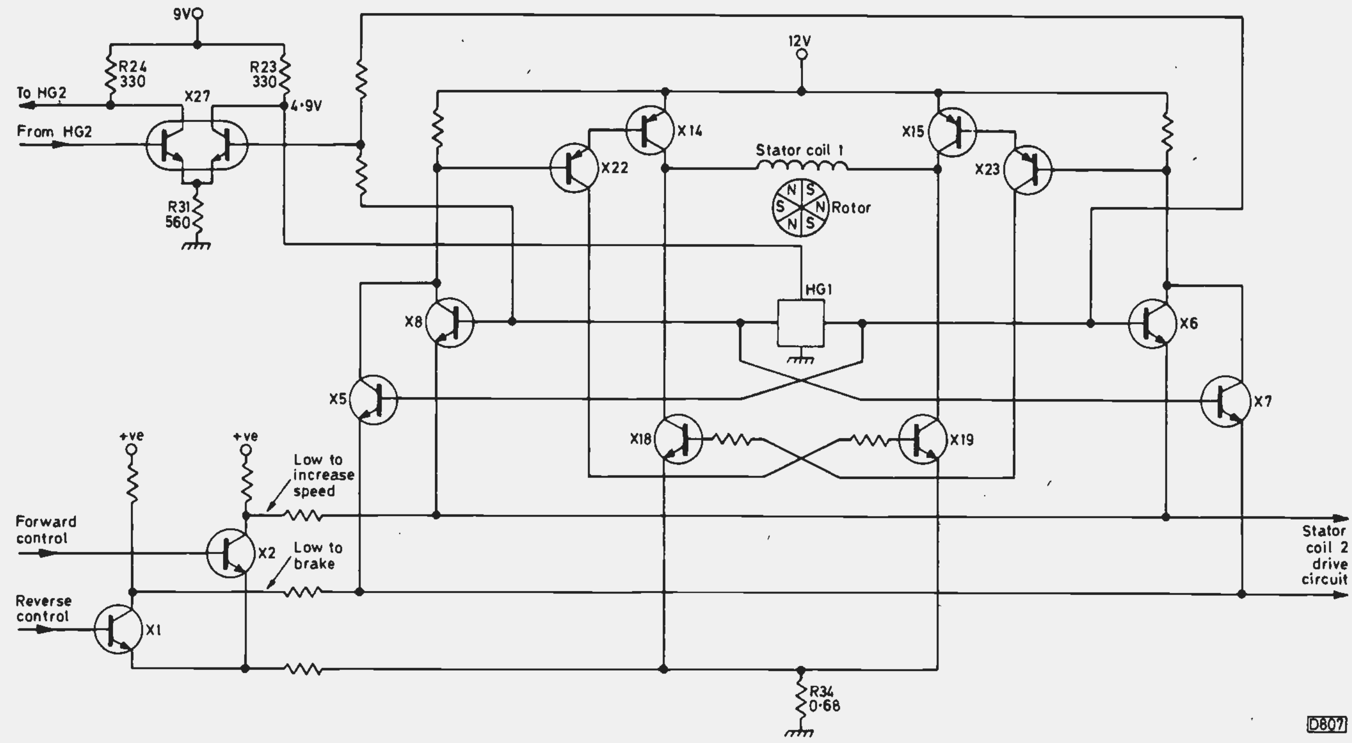

Fig. 120: The drum motor drive amplifier circuit.

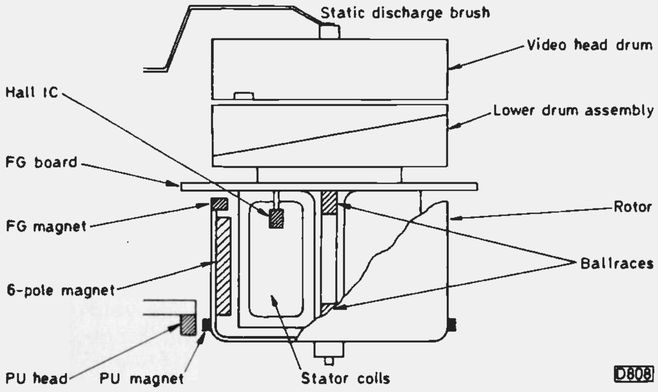

Fig. 121: Basic construction of the drum motor.

by the rotor magnets, also two control amplifiers (X1 and X2) and a balance ciruit (X27). Only one bridge circuit is shown in Fig. 120 – the bridge circuit for stator coil 2 is identical.

As the motor rotates, HG1 produces two antiphase sinewave outputs that switch X6 and X8 on alternately. When X8 is on, X14, X19 and X22 are on: when X6 is on X15, X18 and X23 are on. Thus the current through stator coil 1 is reversed smoothly as the motor rotates.

To increase the motor speed, X2's base current is increased. Its collector voltage falls, thus increasing the conduction of X6 and X8 (and the corresponding transistors in the stator coil 2 circuit). The output transistors X14/15/18/19 in turn conduct more heavily and the motor speeds up. To provide braking, X1 turns on and X2 off. X5 and X7 then turn on. These are connected in the same way as X6 and X8 but with reversed base connections to the Hall effect i.c. As a result, the rotating stator field reverses, and so would the motor if the process continued, but the servo action prevents this – "reverse" is just used to slow the motor.

The 0·68Ω resistor R34 provides a convenient test point for scoping the motor current and also a slight amount of negative feedback as the earth return current for both bridges passes through it.

This leaves the dual transistor X27 with its common emitter connection – it's a long-tailed pair. The Hall effect i.c.s are fed with approximately 5V via R23 and R24, the output sinewaves sitting on about 4V. Because the rotor pole fluxes are not necessarily equal, the two Hall effect i.c.s can give markedly different outputs. This would produce a rhythmic speeding up and slowing down of the head during each rotation – and bent verticals on the picture. To prevent this, the outputs from each Hall i.c. are fed to the bases of X27. As the outputs are in antiphase they cancel, leaving an average d.c. level which is what we need to monitor. If the d.c. tends to rise, the relevant half of X27 will turn on harder, reducing the supply to the i.c. Because of the common emitter resistor R31, an increase in the current flowing through one half of X27 will reduce the current flowing through the other half. This reduces the supply to the other i.c. and increases the output level from it. This balancing system ensures that the outputs remain the same. In practice the correction voltages are in the form of 25Hz sinewaves, most of the errors coming from magnetic imbalance of the rotors.

Before we leave the drum servo, a few words on the construction of the motor (see Fig. 121). The lower drum assembly, including the motor centre, is a finely machined alloy casting containing the two ballraces for the spindle. Under this is the printed FG coil on a printed board which also carries the Hall effect i.c.s, disposed at 90°. The plastic encapsulated stator coils are mounted vertically on this. The assembly is covered by the cylindrical rotor, which is a steel pressing and also acts as a flywheel. The six-pole permanent magnet, of cyclindrical form, is inside the rotor, with the 60-pole annular FG magnet on its upper end. The pick-up magnets (one N pole, one S pole) are mounted externally on the rotor, the pick-up head being mounted on the chassis. A word of warning – the ballraces are preloaded on assembly: don't dismantle the unit, as this preload is difficult to achieve on reassembly.

Next month we'll look at the capstan and reel servos.

The Card Game is Over

Les Lawry-Johns

Some time back I mentioned the card game we played at the Call Girl at lunchtime on Sunday. Honey Bunch's partner was Sean (John). For a long time Sean suffered from a bad heart and a damaged leg. Recently his leg got much worse and he was taken to hospital. He was found to have lung trouble and didn't survive long after an operation. H.B. took it upon herself to arrange the burial and all the other things that have to be done when there are no relatives to handle them. It's now over and done with, but we are left puzzled by the vacuum that Sean left behind him. No papers, no letters, nothing. He didn't talk much, and when he did he talked so softly that few heard all he said. We know that he had been resident in the Waterford or Wexford area and that he had served in the police force there for some ten years. We also know that the magazine has a number of readers in that area. He spoke of his father, brother and dog. Perhaps someone there knows a little more about John Joseph O'Leary? If so, we should like to hear from them. He was well known and liked here.

Testing Ultrasonic Handsets

Someone brought in a remote control handset that wasn't working. I checked it over, resoldered several suspect joints and fitted a new battery. I then realised that I didn't have a suitable set to check it on. All our new sets have infra-red remote control. The cat (Spock) was asleep on top of one of these sets. I pointed the unit at her and pushed the button. Her ears flicked. I waited a while then tried again, with the same result. This world shaking scientific test was carried out several times. We wrote: handset repaired and subjected to repeated tests on suitable receiver.

The Philips G11

The G11 can be a bit of a pain at times. One pained me the other day. A white line across the screen testified that all was not well with the field timebase circuit or the supply to it. Normally the TDA2600 field timebase chip goes short-circuit internally and blows the 800mA fuse on the line output panel. So, finding the fuse blown, I removed the heatsink on the TDA2600 and fitted a new chip. I then checked for shorts and fitted a new fuse. Switch on and pop goes the fuse.

I checked again for shorts. None. So I removed the chip, replaced the fuse and tried again without fitting a TDA2600. The fuse held. Fit another TDA2600. Pop. Conclusion: the i.c. was in order, the short occurring only when it came into operation. I looked at the circuit diagram and tried this, that and the other. It took this idiot some time to find that one of the two parallel-connected 1,000μF output coupling electrolytics was dead short. I should have found it in the first place.

Miss Spray

Miss Spray came in to tell me that her Pye 725 was playing up – the colours were constantly changing. We immediately diagnosed a faulty RGB output stage thick-film resistor unit, and this proved to be correct. However... She had these two little dogs with her and they immediately caught the smell of Ben. They then tried to cover every vestige of such smell as best they could. After telling me her tale of woe she noticed what was going on. "You naughty boys" she snapped, "sorry Lorry".

I smiled weakly. Thank heavens they were small dogs. It took me about an hour to remove all traces of their visit.

Mrs Plunky's G8

Mrs Plunky phoned to say that her Philips TV (G8) had suddenly lost height. As she was on her own she couldn't bring it in. Not wishing to be away too long, I grabbed a G8 timebase panel and the rest of the boxes and sped to her house. I took in only the toolbox and the panel. She showed me the picture, and although the height was indeed lacking there was also a nasty curve inwards at the right-hand side. I decided against the panel and nipped out for the spares box. Removing the rear cover, I held a mirror to the front of the h.t. reservoir capacitor: there was severe deterioration, so out it came. Unfortunately I'd forgotten to put a 600μF, 300V electrolytic in the box. I'd several of the 470μF type for the G11 and one 200+300μF 350V electrolytic can (Pye hybrid type). The latter was too long to fit in the original position, but it stood up nicely and the clip could be fitted to keep it there. The two positive tags were moved together, soldered to the red lead, then black to the negative tag and all was well. A nice picture with full height and width.

"Who's a clever boy then?" I squawked. "Who's the best boy in the world?" Unknown to me however Mrs Plunky had returned and was standing behind me. She was giving me an odd look.

"Do you always sound like a parrot?" she queried.

"Er, well. It's not so much a matter of parrots. My wife is trying to teach this young cockatiel to speak and it's sort of catching."

"She seems to be teaching it to be rather conceited" sniffed Mrs Plunky. "Do I owe you anything for this quick little job?"

Oh dear. No one seems to appreciate me any longer.

Round the Room Four Times

We get our share of strange tales. This young couple struggled in with their Ferguson 9600. The young man started the tale, which was eagerly taken up by the girl.

"The set goes all right for some time and then the picture goes funny" said he. "And we have to unplug it, wheel it round the room four times, then it's all right for the rest of the evening" said she. I looked at the set for some time, then asked the key question. "Clockwise or anticlockwise?"

She was struck dumb for once. "Clockwise" said he after a pause.

I turned the set up and, with the rear cover off, looked for a dry-joint under the centre section. "It curves in at the sides" he said helpfully. So I concentrated on the EW correction circuit and found one of the modulator diodes loose in its solder at one end. A quick dab of the iron with the help of some fresh solder completed the job. When the set was turned the right way up the picture was slightly impure at one side – well, would you like being stood on end?

"Now listen" I said, with as straight a face as I could manage. "When you get back, wheel the set around the room four times anticlockwise. To unwind it, see?"

The girl nodded. The young man got the message but went along with the leg-pull. "Magnetism of the earth" he said.

"Exactly, and good luck to you both."

"When are you going to repair the set?" asked the girl.

"Already done dear. It had a cold and needed warming up . . ."

DX Signal Detector/Alarm

G.R. Exeter

The circuit described in this article is capable of detecting very weak TV signals and providing an audible indication that a signal is present. It was developed primarily for use with rapidly changing sporadic E propagation. The basic idea is shown in Fig. 1. The video signal itself is used to provide the sound, giving an immediate indication of signal-to-noise ratio and interference. The filter section detects the 15,625Hz line frequency component of the signal, producing a switching voltage to control the video feed to the audio amplifier. In use, the channel being monitored must initially be clear of 625-line signals – the presence of some 405-line information will not upset the circuit's operation. Two phase-locked loops are arranged as a narrow-band filter to generate the switching voltage. System M, 525-line signals (line frequency 15,750Hz) are also detected.

Circuit Description

Fig. 2 shows the circuit. For the phase-locked loops, two TDA2591 (alternatives TDA2590 or TDA2593) i.c.s are used. These are fairly complex i.c.s intended for use as the sync separator and line generator sections of a TV receiver. Not all the internal circuitry is used. The sections that are used are shown in block diagram form in Fig. 3. These are the sync separator, oscillator and phase detector, i.e. the phase-locked loop, the coincidence detector whose output varies the gating of one input to the phase detector, and the pulse generator and output stages. Use is also made of the fact that the voltage at pin 4 can be employed to switch off the output at pin 3, while the burst gating/blanking pulse output at pin 7 is used for setting up.

It might at first sight appear that the output from the coincidence detector, at pin 11, could be used to indicate the presence of a signal without any further complication. The output here is similar whether the input consists of noise or a strong locked signal however. Instead, the two TDA2591s are run with slight frequency offsets: when a signal is present, an output is obtained once both circuits have locked in. The principle is shown in Fig. 4.

A negative-going video input should be used, though reduced performance will still be obtained with a positive-going input. The video input is first filtered by R1 and C1 to reduce the noise bandwidth. As there's no need to worry about picture cogging, more filtering than usual is employed. This filtering also means that there's no need to make use of the noise-cancelling circuits within the i.c.s. The video signal is then buffered by Tr1 and fed via C2 and C8 to the sync separators in the i.c.s and via R23 and C16 to a convenient input for the TBA120S i.c.

The external oscillator capacitors are connected to pin 14 of the two TDA2591 i.c.s while pin 15 is used to set the frequency. High quality components should be used here in the interests of long-term frequency stability. The phase detector output at pin 13 is filtered and fed back to pin 15.

The output obtained at pin 3 of IC1 is applied to pin 4 of IC2 so that the latter produces an output only when pin

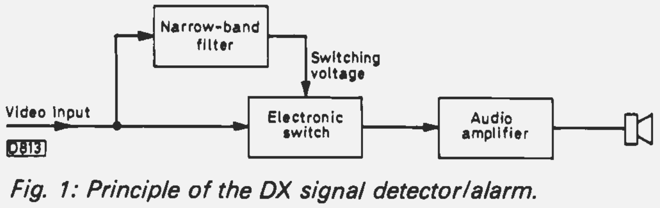

Fig. 1: Principle of the DX signal detector/alarm.

Components List

Resistors:		Capacitors:		
R1	1k	C1	1n5	ceramic
R2	4k7	C2	0·47	polyester
R3	1M8	C3	0·1	polyester
R4	1k2	C4	4·7	63V axial electro.
R5	82k	C5	10n	polyester
R6	12k	C6	4n7	polystyrene
R7	100k	C7	47	25V axial electro.
R8	2k7	C8	0·47	polyester
R9	2k7	C9	0·1	polyester
R10	10Ω	C10	4·7	63V axial electro.
R11	1M8	C11	10n	polyester
R12	1k2	C12	4n7	polystyrene
R13	82k	C13	47	25V axial electro.
R14	12k	C14	47	10V axial electro.
R15	100k	C15	47	25V axial electro.
R16	10Ω	C16	0·1	polyester
R17	1k	C17	1	63V axial electro.
R18	10k	C18	0·1	polyester
R19	2k2	C19	1n	ceramic
R20	100Ω	C20	100	25V axial electro.
R21	1k2	C21	0·1	polyester
R22	820Ω	C22	47	25V axial electro.
R23	100k			
R24	10k			
R25	100k			
R26	10Ω			
R27	10Ω			
All ¼W, 5%				

Miscellaneous:

D1	1N4148
Tr1, 2	BC252B or equivalent
IC1, 2	TDA2591
IC3	TBA120S
IC4	LM380
RV1, 2	47k sub. min. horizontal preset
RV3	10k 15mm min. PCB mounting
Small speaker	

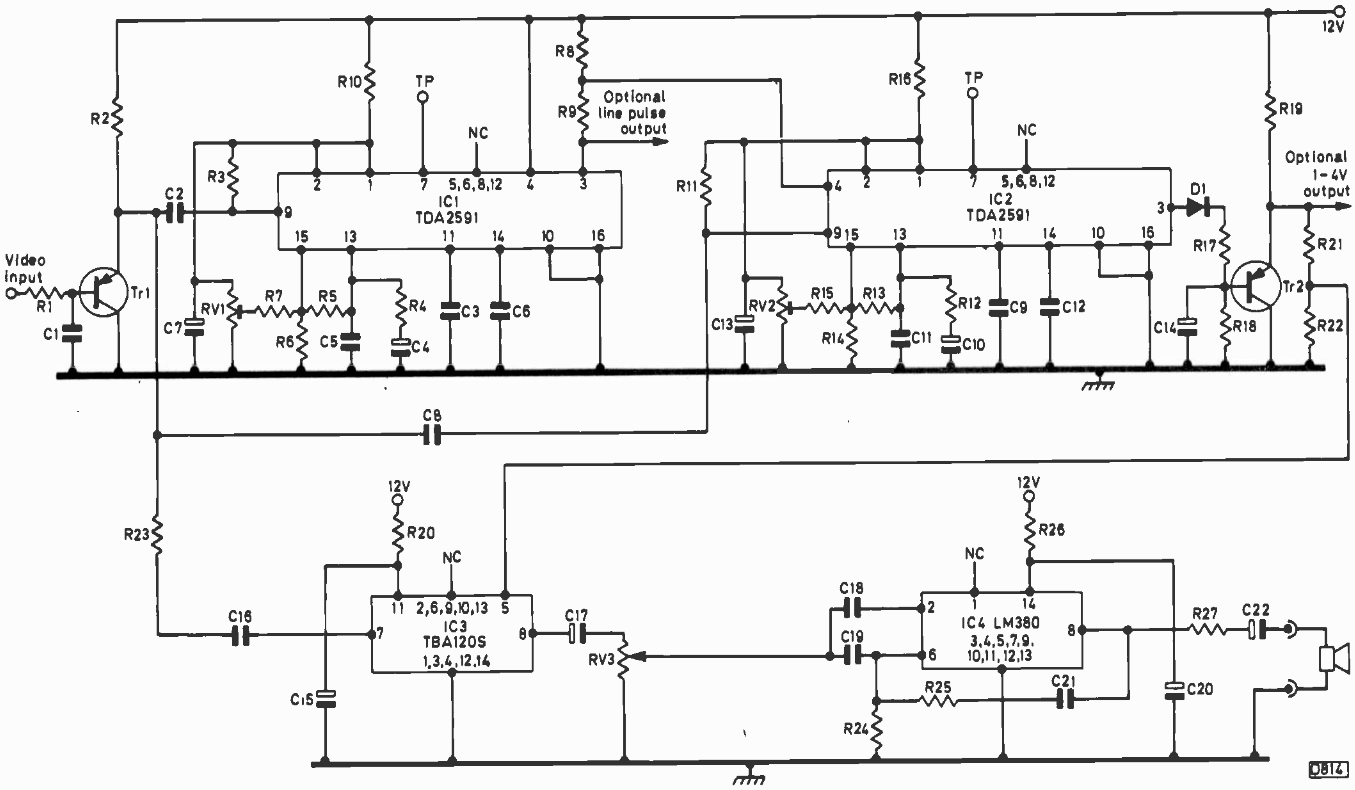

Fig. 2: Circuit diagram.

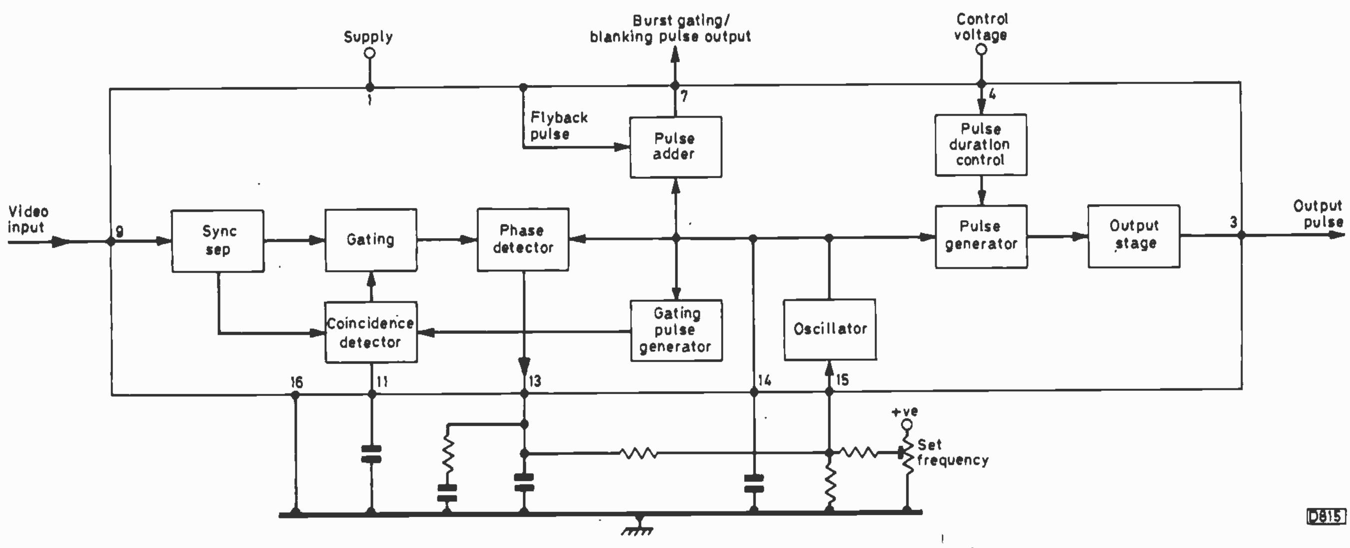

Fig. 3: Block diagram of the sections of the i.c.s used.

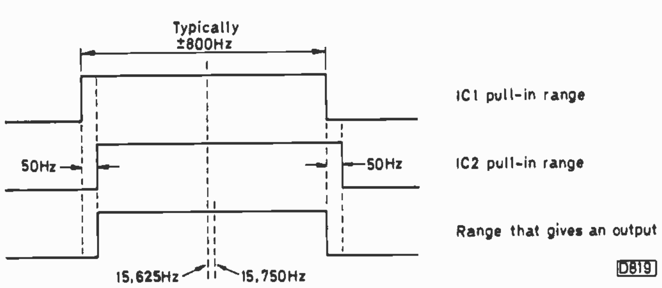

Fig. 4: Principle of the PLL narrow-band filter.

3 of each i.c. is high (with pin 4 at half the supply voltage, there's no output at pin 3). This output is integrated and buffered by Tr2, producing a control voltage which is typically less than 2V with no signal and 3-5V when a signal is present. This is an on/off output, though noise and phase jitter make the control voltage appear to change more linearly.

The TBA120S is used to provide the switching action, the output from Tr2 being fed to pin 5 – in normal use, the d.c. volume control is connected to this pin. The i.c. smooths out the on/off transitions and avoids a jarring crash when a signal is detected. Another advantage of the TBA120S is the 70dB attenuation possible, ensuring that there is no stray low-level output from the speaker.

The switched video output appears at pin 8 of the TBA120S and is then fed via a volume control potentiometer to pin 2 of a simple audio amplifier i.c. This in turn drives the speaker.

Construction

The prototype was constructed on a PCB (see Figs. 5 and 6) and has given satisfactory operation for many months. The following points should be noted however.

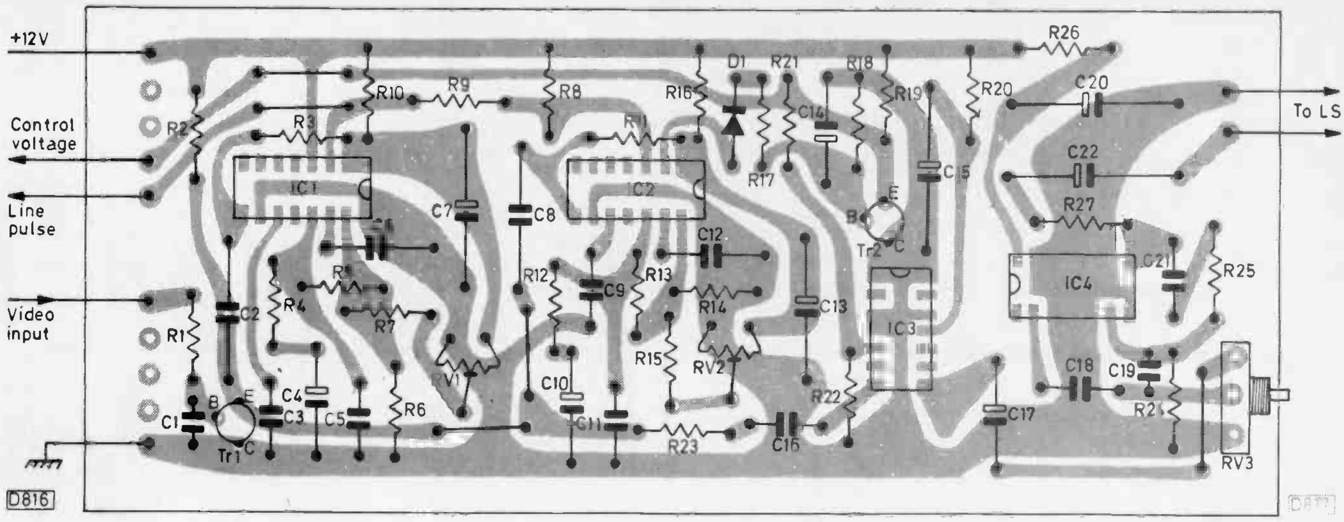

Fig. 5: Component layout.

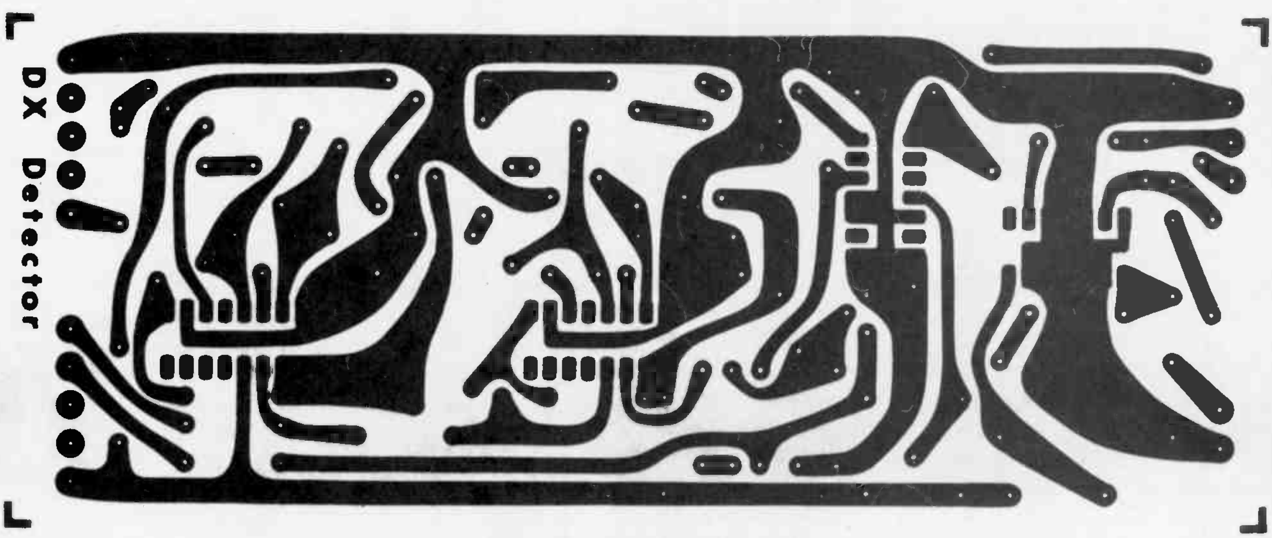

Fig. 6: Track pattern, scale 1:1.

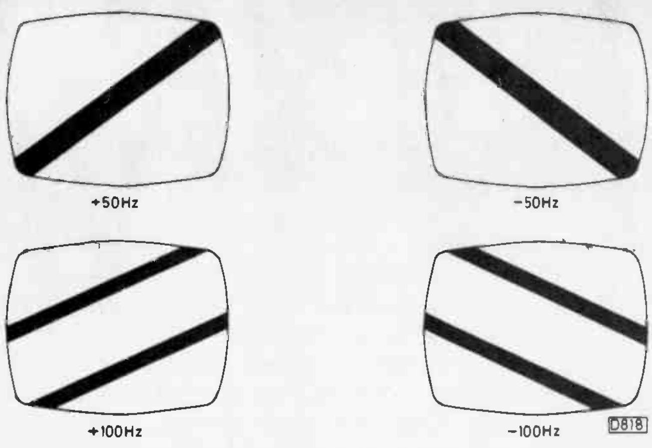

Fig. 7. Adjustment displays.

First, in all systems using two oscillators at the same frequency there's a tendency for them to lock together if the earthing and supply decoupling are inadequate. A small amount of coupling was present with the prototype when the input was grounded, but this was sufficient for only a few Hz of common lock-in range and didn't upset the setting-up procedure.

Secondly the input is very sensitive to 15kHz signals. If it's not connected directly to a low-impedance source of video in the i.f. strip, it should be screened from any nearby timebase radiation. Timebase currents should be kept separate from the receiving system.

Thirdly the TBA120S's volume control characteristic has a fairly wide spread. The values of the pot-down resistors linked to pin 5 may require optimisation therefore. The device used should have internal bias resistors connected to pins 7 and 9. All devices examined, other than ITT ones, appeared to have these: the ITT i.c.s rely on the presence of a quadrature coil to provide d.c. bias at pin 9, a difference that doesn't show when the i.c. is used as an f.m. detector.

A miniature 8Ω speaker was used, with R27 included to restrict the maximum power. Any small speaker can be used. A 12V regulated supply capable of supplying 140mA is required. If not already available in the set, one can be built using any of the popular i.c. regulator circuits.

Alignment, Testing and Use

To set up the system, ground the input and loosely couple pin 7 of IC1 (11V peak-to-peak burst gating/ blanking pulse output) via suitable attenuating resistors to the video channel of a system locked to a standard broadcast signal. Adjust RV1 for an offset of approximately 50Hz (see Fig. 7). This, as shown, can be judged by the slope of the pulse output displayed on the screen. Repeat this step for IC2, setting the offset in the opposite direction. If available, a frequency counter can be used, adjusting for 15,625 ± 50Hz. If the frequency difference is too large, IC1 and/or IC2 may not be able to pull in: if too small there may be false locking problems. The prototype worked well with 50Hz and 100Hz offsets. Pin 7 is used as the setting-up monitoring point rather than pin 3 as there will always be an output at pin 7 of IC2.

The unit should now be working. If there are problems, a further test can be made at the emitter of Tr2 as video signals are applied and removed. The voltage here should vary from below 2V to greater than 3V. The audio control stages can be tested by varying the voltage at the base of Tr2 between 0V and 4V (volume control midway) with an input signal present. The audio output should be present at 4V.

The total supply current with no audio output should be about 100mA, and without IC1 and IC2 about 35mA.

When two strong signals are received simultaneously, it's possible that IC1 may lock to one and IC2 to the other, giving a lock-out condition. Usually however a warning of improving conditions will already have been given, so the condition should not be troublesome.

As it stands the unit is capable of monitoring one channel continuously. To cover more channels, either more receiver systems and detectors are required or alternatively the tuner could be stepped through several preset channels at a rate slow enough for the detector to respond, say three-four seconds per channel. A method of doing this was described in the January issue. The system response time is set by the filtering at pin 3 of IC2, and is sufficiently fast to give a response with the stronger meteor-scatter signals.

Finally, a word of warning. Some Russian transmissions start at 4 a.m. our time. I can testify that SpE reception does occur at this time!

A Question of Black Level

Malcolm Burrell

Black level is quite a useful test signal: it's also useful for video purposes. When making a programme, presentation comes a close second to the actual content. Adding a little black level between programme segments improves the editing, and a minute of black at the start of the tape, where most of the wear occurs, removes picture dropouts here. Thus when the cassette is inserted dropout effects should clear before the programme begins. In addition, rolling noise bars at the start are not seen. Tape noise and dropouts tend to be more easily seen on a plain blank raster, enabling the tape quality to be more easily assessed.

Black level can be obtained in several ways. One source is a camera with the lens capped. Another is a broadcast transmission, though you will be lucky to find a transmitter broadcasting black when you want it – the days are passed when transmitter line-up consisted of perhaps an hour of black-level and tone signal. Yet another source is a workshop pattern generator. Some don't give true black level without modification, so you might have to make do with a red or blue raster with the colour removed – some VCRs have a monochrome/colour switch.

Black Level Generator

In the interests of convenience however I decided to make use of a Ferranti ZNA234 chip mounted in a compact case. This is basically a pattern generator i.e. that also provides fully interlaced sync pulses. It might seem a little wasteful, but only the mixed sync output is used. The 5V supply required is obtained from a battery via a 78M05UC stabilizer – the chip likes about 135mA, which is more than mini-regulators can handle. The prototype uses a 2·5MHz crystal, though this can be replaced with a single fixed capacitor of about 15pF if you're not too concerned about stability.

The mixed sync output from the ZNA234 drives a couple of gates in a TTL chip. The gate outputs are linked together via 27Ω resistors to give a 75Ω output. Connect the signal to the VCR via a short screened lead terminated with a u.h.f., BNC or phono plug as required. You can thus record black level at any desired point by connecting the output to the video input socket and switching the machine to "aux" or "camera".

The unit can be easily constructed on Veroboard and accommodated in a small Vero box near the machine. Battery life will not be very long, but for short periods of use this is not very important. An LED indicator is useful next to the on/off switch.

You can't fade to black of course when using this black-level generator – it's much more of a cut to black level. Suppose however that you wanted to keep a selection of news items. You could judge the point at which the first is faded down, then add your black level for anything from three to ten seconds. You then edit in the next item as it is faded up.

This black-level facility is particularly useful with a VCR that doesn't have back-wind or insert-edit facilities, since most of the disturbance that arises will occur during black and thus be much less objectionable. It also makes a much cleaner distinction between the different items on the tape. The ZNA234 costs about £8·50, so the total cost of construction need not be more than £12 or so. If you want to use the chip's other patterns, refer to the TV pattern generator article in the October 1981 issue.

Overseas readers with 525-line signals can use this chip by connecting pin 2 to chassis instead of to 5V and employing a 2·52MHz crystal.

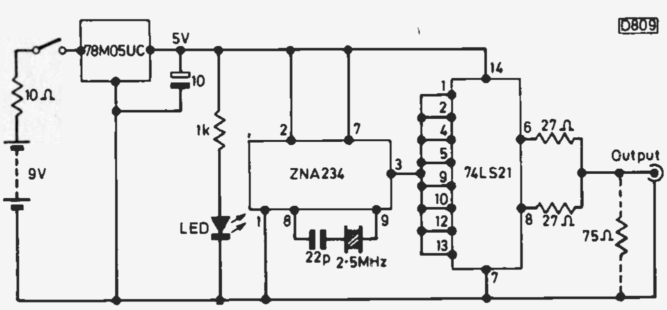

Fig. 1: Black level generator circuit.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·00 postal order (made out to IPC Magazines Ltd.), the query coupon on page 271 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.

FERGUSON 3V00

When playing back a recording the picture continuously moves from left to right by about three eights of an inch. The fault is more noticeable when the picture subject is stationary, and doesn't occur with prerecorded tapes.

It seems that the head speed is varying on record only. If the variation is erratic and random, suspect a dirty record/playback switch. This is the longer one of the two slide switches on the left-hand audio/servo board. Try cleaning it first. If the hunting is rhythmic and regular, the two head servo presets (discriminator and drum sample) probably need adjustment. Failing this the drum motor may be defective – check the ripple as described in the manual.

SABA F CHASSIS

There is slight cramping, about a quarter of an inch deep, across the centre of the picture. It's only apparent when the camera shot is moving up or down and when the credits roll.

This can be an awkward problem and is due to non-linearity in the field oscillator circuit. Check by substitution capacitors C691 (0·1μF), C692 (0·0022μF) and C693 (0·022μF). They go slightly leaky and for some reason cause distortion at the centre of the field sawtooth waveform at pin 1 (triode anode) of the PCL805.

GEC HYBRID COLOUR CHASSIS

The flywheel sync diodes used in this chassis share a common encapsulation, but the FSY41A doesn't seem to be available any more. Any ideas for substitutes?

We've successfully used a pair of 1N914 or ITT2002 diodes in this position. A pair of 1N4148 or BY206 diodes should work just as well.

RANK A823A CHASSIS

The line output transistors have been replaced and I now want to balance the line output stage (6L4/5). It seems however that the balancing network has been removed. How do I monitor the adjustment?

6R6 and 6C5 were omitted in later production. To balance the stage, adjust the coils for minimum picture width: a "null" should be found, and this corresponds with correct balance.

ITT CVC25 CHASSIS

The problem with this set is vision interference – it takes the form of streaking horizontal lines on all channels. Removing the aerial input leaves a snowy raster with mushy sound: the interference remains but is not as bad. The cause could be in the field timebase as there has been lack of height with top foldover on one or two occasions, though it lasted for only two-three seconds.

First check the connections between the printed panel and the mains switch – dry-joints can occur here. Then check the mains filter capacitor: replace this if it's of the cylindrical yellow type, as these are given to internal arcing. If the fault persists and no bad joints can be found around the power supply panel, in particular around the surge limiter resistors R76/7 and the BY133 h.t. rectifiers, concentrate on the field timebase. If the problem lies here it's more likely to be with the output transistor pair T8/9 than in the pluggable module.

THORN 3000 CHASSIS

There's a good, clean monochrome picture but this becomes increasingly noisy as the colour is turned up. At the correct colour control setting the noise gives the impression of a poor level signal from the aerial, but the signal strength here is first class.

If the colour is locked, check transistor VT110 and the a.c.c. smoothing capacitor C173 (2·5μF) on the i.f. panel. If necessary, check the chroma amplifier transistor VT309 and the blanking diodes W316/7 on the decoder panel.

PHILIPS G11 CHASSIS

No sound or raster led to a check on the h.t. fuse which had blown. Tests in the line timebase failed to reveal anything amiss, but the only way of preventing fuse failure is to disconnect the h.t. supply to the line timebase. The h.t. is 180V instead of 153V.

The excessive h.t. is the cause of the problem and is likely to be due to failure of the BD201 active smoothing transistor. The 27V zener diode D4021 usually fails as well. A common cause of this situation is the h.t. reservoir capacitor C4029 which develops loose internal connections at the rivets. Try gentle mains application via a 110V transformer at first to save fuse blowing – a 100W lamp will do if you don't have a transformer.

RANK T22 CHASSIS

There's no colour on this set except when the colour-killer override link is connected. With the set slightly off tune there are colour patches on the screen. Replacing the three decoder i.c.s has made no difference.

We've known electrolytic capacitors cause this sort of thing in the T130A decoder. Check C83 (3·3μF) and C85 (1μF) by substitution and C84 (0·22μF) by replacing it with a polyester type if you find it's a tantalum electrolytic. If necessary check C87 (4·7μF) as well.

THORN 8500 CHASSIS

The problem is vertical black lines, about one eighth to a quarter of an inch wide, at roughly quarter inch intervals right across the screen: they are not straight but curve with the edge lines of objects on the screen. Neither changing channels nor cleaning the tuner contacts improves matters.

Check the condition and adjustment of the set tuner gain control R102. If this is o.k., suspect the tuner – we've known this effect to be caused by a form of tuner instability.

GEC C2110 SERIES

There's poor field linearity, with bottom cramping and a white line that moves rapidly up and down the bottom half of the screen. Field collapse sometimes occurs for a few seconds, then a full, normal picture appears for a while before the linearity faults return.

These sets are prone to problems due to poor earthing of the field timebase panel (at PL28/1). You can check this by using a screwdriver to link the panel's earth print to the metal chassis. If all's well here and capacitors C457/8 (field charging) and C462 (bootstrap) are o.k., the field output transistors are probably faulty.

TEST CASE

255

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

Good service costs money in the TV trade – the cost of service attention by a reputable and well organised firm can be considerable. In our part of the world (and most, we suspect) there are several rather shady operators who offer their services at very low rates and whose attention can be inexpert to say the least. From time to time we encounter the results of their efforts when a set owner, in desperation, brings us a set to sort out. Similar situations have been described in these pages by other contributors: here's one of our botch stories.

The set's owner, a rather shady character himself, brought in a dog-eared and frayed Tandberg 22in. TV set. He then went back to his van and brought out the back cover – always a bad sign. Without removing his hand-rolled cigarette from his mouth, he hissed in a conspiratorial whisper "give us an estimate mate, colour's all wrong". We switched the set on there and then so that if the tube was flat he could take it back with him. A quick check showed that all three colours were present, but the picture looked like a colour snapshot negative! We promised to contact him when we'd got to the bottom of the fault.

On the bench we started by turning the colour right down to check the grey scale tracking. It was reasonable, though marred by a degree of impurity on one side. We made a mental note to deal with that later. The set was then tuned to the local Channel 4 test pattern, and on advancing the colour control setting a strange sight met our eyes! In order, from left to right, the colour bars were magenta, yellow, red, cyan, blue and green. Someone had swapped the drive leads to the tube – but inspection proved otherwise. The leads were correctly positioned on the tube base panel and at the RGB output stages. Tongue in cheek we interchanged the leads – R drive to the green cathode, G drive to blue and B drive to red. This produced reasonably good colour within the tracking and purity constraints previously mentioned. Suspecting some diabolical trickery in the decoder or RGB output stages we carefully examined the panel, but could see nothing amiss on either side.

With full colour bars still displayed, we made an oscilloscope check on the RGB drives. They were correct, with the right R, G and B primary colour waveforms coming from the right amplifiers! Back to the c.r.t. base panel. We could see no modifications or wiring alterations, and to confirm that we were not becoming unhinged we checked at the appropriate tube pins themselves – nos. 2, 6 and 11 for R, G and B respectively with this A56-120X tube. The waveforms were correct.

When the man returned for his set he had a considerable bill to pay, mostly down to time rather than components. It had taken us half an hour to find a means of refitting the set's back cover, and rather longer to sus out the cause of the colour problem. You needn't concern yourselves with the back screws, just the wrong colour effect: answer next month!

ANSWER TO TEST CASE 254
– page 217 last month –

The problem described last month was no field scan in a Doric colour portable fitted with the Rediffusion Mk. 5 chassis and our attempts at diagnosis, having twice convinced ourselves that the field oscillator/driver chip was faulty. The virtually zero d.c. voltage at pin 3 of the chip should have pointed us in the right direction, for if Q502 was not switching on – and it wasn't, without any drive – there should have been a fairly high voltage at its collector and thus at pin 3 of the i.c., due to the conduction of Q501.

Q501 was not conducting however, for the very good reason that its base bias resistor (Q502's load resistor) was open-circuit. It looked all right, but there was 73V at one end and nothing at the other. The design of the field timebase chip is such that with zero feedback at pin 3 it shuts down, which is what was happening. We must confess that we were happier with PCL805s and the like – sometimes you got a dud spot on the height control, or the valve got broken . . .

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Available until 21st March 1984. One coupon, plus a £1·00 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice on page 270.

TELEVISION MARCH 1984

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BC158	0.11
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BC303	0.33
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BC308	0.13
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BC337	0.11
BC338	0.13
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BC462	0.53
BC463	0.53
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BC528	0.13
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TIP33B	0.75
TIP41A	0.46
TIP41C	0.58
TIP42A	0.45
TIP42C	0.68
TIP30A	0.34
TIP31A	0.34
TIP31C	0.48
TIP32A	0.34
TIP32C	0.48
TIP33B	0.75
TIP41A	0.46
TIP41C	0.58
TIP42A	0.45
TIP42C	0.68
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T0220	0.34
T0126	0.34

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Linearity Coil AT4042/02	1.15
Transductor 90°	1.65
110°	1.85

CRYSTALS

4.43MHz	1.80
8.86MHz	1.80
8.86MHz Miniature	1.75

VIDEO THICK FILMS

3500	1.45
Pye 713	1.90
Pye 731	1.90

FILTERS

6MHz	0.78
SW150	2.20
SW154	2.20

SUNDRIES

12 Way Terminal Block 2A	0.20
5A	0.22
Min Insulated Croc Clip Red or Black	0.07
Standard Croc Clip	0.08
GEC Neon	0.15
3500 Cut out	2.00
Focus Spark Gaps	0.15
Rank Tuner Cams	0.08
5yds PVC Tape	0.12

DISCOUNTS

ORDERS OVER £50 IN VALUE 5%

ORDERS OVER £120 IN VALUE 10%

(Order Value not including VAT)

VIDEO HEADS & CRTs EXCLUDED

N. J. ELECTRONICS

SERVISOL

Super Servisol	0.88
Freezer	1.04
Aero Kleen	0.86
Silicone Grease (aerosol)	1.10
Silicone Grease (tubes)	1.70
Foam Cleaner	0.92
Plastic Seal	0.96
Heatsink Compound	1.20
Solda Mop	0.75
Video 40	0.93
Super 40	1.60

Add 30p per can additional post

SOLDER

Mini Pack	0.35
½Kilo 18SWG	7.00
½Kilo 22SWG	7.95

SOLDERING AIDS

Antex 15W Iron	6.25
Antex 25W Iron	6.60
Antex 15W Bit	0.70
Antex 25W Bit	0.75
Desolder Pump	6.00
Nozzle	0.85
Antex Elements 15W & 25W	2.50

MIXED PACKS

Mixed Dust Cores	0.70
Transistor Mount Kit	0.70
10 yds Assorted Wire	0.50
100 Capacitors	1.00
300 Carbon Res	1.00
100 2½ Watt Wirebounds	2.00

REGUN C.R.T.s
(2 year warranty)

A44-271X	32.00
A47-342X	32.00
A47-343X	32.00
A49-192X	32.00
A51-110X	32.00
A56-120X	32.00
A56-140X	33.00
A56-500X	45.00
A66-120X	37.00
A66-140X	38.00
A67-120X	38.00
A50-120WR	14.00
A61-120WR	15.00

Carriage £8.00 per tube + VAT

AERIAL ISOLATORS

40mm×40mm with 500mm Lead	0.60
67mm×65mm with 430mm Lead	0.60
Philips Plastic Moulded Type for KT3 Chassis	0.80

VIDEO HEADS

3HSS Ferg–JVC–Akai	34.00
4HSS Nat Pan	34.00
PS3B Sony–NEC–Toshiba	39.00

BOOKS

A–Z Equivalent Book (Two Parts)	7.50

NB: Zero VAT on Books

PLUGS–SOCKETS

Phono Plug Plastic (red or black)	0.12
Phono Plug Metal	0.22
Phono Line Skt	0.18
Phono Chassis Skt	0.19
DC Plug 2.1mm	0.19
DC Plug 2.5mm	0.19
DC Chassis Skt 2.1mm & 2.5mm	0.19
Coax Plug	0.15
Coax Coupler	0.15
¼" Mono Jack Plug	0.15
¼" Stereo Jack Plug	0.27
3.5 Mono Jack Plug	0.12
3.5 St Jack Plug	0.25
¼" Jack Line Coupler Mono	0.22
¼" Jack Line Coupler Stereo	0.25
¼" Mono Jack Chassis Socket	0.24
¼" Stereo Jack Chassis Socket	0.24
3.5mm Socket	0.10
2.5mm Socket	0.10

D.I.N PLUGS

2 Pin	0.10
3 Pin	0.10
4 Pin	0.14
5 Pin 180°	0.19
5 Pin 240°	0.19
5 Pin 360°	0.19
6 Pin	0.23
7 Pin	0.23

D.I.N. LINE SOCKETS

2 Pin	0.11
3 Pin	0.22
5 Pin 180°	0.22
5 Pin 240°	0.22
6 Pin	0.23
7 Pin	0.23

D.I.N. CHASSIS SOCKETS

2 Pin Switched	0.10
2 Pin Unswitched	0.12
3 Pin 180°	0.22
5 Pin 180°	0.22
5 Pin 240°	0.23
6 Pin	0.23
7 Pin	0.25

D.I.N. PCB SOCKETS

2 Pin Unswitched	0.25
5 Pin 180°	0.24
FM Plug	0.20
FM Socket	0.19
AM Plug	0.20
AM Socket	0.19

BATTERY HOLDERS

HP7 2 per side, end to end	0.28
HP7 2 per side, side by side	0.28
HP11 4 end to end	0.37
HP11 2 rows single sided	0.37
PP9 Press Stud	0.10
PP3 Press Stud	0.10

CRT–VALVE BASES

T20 CRT Base	1.35
Toshiba CRT Base	1.40
B9A EHT Base	0.55
B7G Ceramic	0.55
B9A Ceramic	0.55
B10B Ceramic	0.55

TRIM TOOLS

Twin Bladed Bronze-Phosphor	0.25
Long Plastic, Hex at one end	0.11

FOCUS UNITS

RRI T20	1.80
Thorn 8500	1.90
Focus Rods	1.10

CAPACITORS

MIN PLATE CERAMIC 63V

1.8PF to 12,000PF	0.05
10,000PF to 12,000PF	0.06

POLYSTYRENE 160V

10PF to 820PF	0.07
10,000PF to 15,000PF	0.09

TANTALUM BEAD

.1MF 35V	0.16
.15MF 35V	0.16
.22MF 35V	0.16
.33MF 35V	0.16
.47MF 35V	0.16
.68MF 35V	0.16
1MF 35V	0.16
1.5MF 35V	0.16
2.2MF 35V	0.17
3.3MF 35V	0.18
4.7MF 35V	0.18
6.8MF 35V	0.20
10MF 35V	0.20
22MF 16V	0.24

MIXED DIELECTRIC

.01 1000V	0.24
.01 1500V	0.25
.022 1000V	0.28
.033 1000V	0.28
.1 1000V	0.30
.1 1250V	0.46
.1 2000V	0.75
.22 1000V	0.48
.22 1250V	0.60
.47 1000V	0.79

8KV DISCS

180PF, 210PF, 270PF, 330PF, 500PF	0.30

POLYESTER 250V

.01MF	0.06	.022MF	0.06
.033MF	0.06	.047MF	0.06
.068MF	0.06	.1MF	0.07
.22MF	0.08	.33MF	0.08
.47MF	0.13	.68MF	0.13
1MF	0.16		

MYLAR FILM 100V

.001MF	0.06	.0022MF	0.06
.0047MF	0.07	.01MF	0.07
.022MF	0.07	.033MF	0.08
.047MF	0.08	.068MF	0.09
.1MF	0.09	.22MF	0.13
.47MF	0.22		

DISC CERAMIC 50V

.01MF, .022MF, .047MF, .1MF	0.04

S CORRECTION

.91MF G11	0.55

ELECTROLYTIC 25V

10MF	0.08	22MF	0.08
47MF	0.09	100MF	0.09
220MF	0.15	470MF	0.22
1000MF	0.33	2200MF	0.50

ELECTROLYTIC 40V

470MF	0.30	2200MF	0.70

ELECTROLYTIC 63V

1MF	0.08	2.2MF	0.08
4.7MF	0.08	10MF	0.08
22MF	0.11	47MF	0.12
100MF	0.19	220MF	0.30
470MF	0.42	1000MF	0.65

ELECTROLYTIC 100V

0.47MF	0.10	1MF	0.10
2.2MF	0.10	4.7MF	0.10
10MF	0.12	22MF	0.16
47MF	0.17	100MF	0.26
220MF	0.45	330MF	0.55

ELECTROLYTIC 250V

0.47MF	0.11	1MF	0.14
10MF	0.28	22MF	0.31

ELECTROLYTIC 450V

10MF	0.50

SMOOTHING CAPACITORS

Decca 200/200/400 350V	2.70
Decca 400/400 350V	2.90
Decca 400/800 350V250V	2.90
Philips 600 300V	2.50
Philips 2200 63V	1.55
Philips 470 250V	2.00
Philips (G9) 600 300V	2.80
PYE 200/200/100/32	2.85
PYE 600 300V	2.80
RRI 2500/2500 30V	1.20
RRI 220 400V	2.90
Thorn 150/160/100 300V	1.90
Thorn 4700 25V	0.85
Thorn 1000 70V	0.70
Thorn 200/100/100 350V	2.85
Thorn 175/100/100 400V	2.40
Thorn 400 400V	2.50

PUSH BUTTON UNITS

Decca 30 4 way	6.80
Decca 30 6 way	7.80
GEC 2110	11.00
GEC 2112	12.95
GEC 2136/7	8.90
GEC 2112 Conversion	13.00
Hitachi 190 4 way	8.95
ITT CVC5 7 way	10.00
ITT CVC8/9	12.85
ITT CVC20/30 6 way	8.00
ITT CVC 25 6 way	8.50
Philips 520	11.00
Philips 550	13.55
Philips G11	22.50
PYE 713 4 way	8.70
PYE 715 6 way	13.50
PYE 725 (UHF-VHF)	13.50
RRI 823 4 way	8.75
RRI 823 6 way	9.50
RRI T20 6 way	10.50
RRI Z718 6 way	9.50
Thorn 3500 6 way	2.75
Thorn 8500 6 way	2.75
Thorn 9000 6 way	2.75
Thorn 1615 4 way	8.70
Telpro 4 way	8.50

FUSES

20mm A/S (10 Pack)	
100mA, 160mA, 250mA	1.50
315mA	1.20
500mA, 630mA, 800mA	0.95
1A, 1.25A, 1.6A, 2A	0.95
2.5A, 3.15A, 4A, 6.3A	0.95
20mm Q/B (10 Pack)	
160mA, 250mA, 315mA, 500mA, 630mA, 800mA, 1A, 1.6A, 2A, 3.15A	0.45
1¼" A/S (10 Pack)	
250mA, 500mA, 630mA	1.50
800mA, 1A, 1.25A, 2A	1.50
2.5A, 3A, 5A	2.30
1¼" Q/B (10 Pack)	
250mA, 1A, 1.5A	0.60
2A, 3A, 5A	0.60
Mains Fuse (10 Pack)	
2A, 3A, 5A, 13A	0.90

LOUDSPEAKERS

8 × 5 16 ohm	2.98
6 × 4 16 ohm	2.60
6 × 4 25 ohm	4.30
8 × 3 70 ohm	3.40
5 × 3 50 ohm	3.00
7 × 3½ 16 ohm	3.00
5¼ × 3 80 ohm	2.90
Thorn 1590 large	4.00

TUNERS

1043/05	7.95
1043/06	7.95
U321	7.25
U322	7.25
G8	11.75

RESISTORS (CARBON)

½ Watt IR0 to 10M (10 Pack)	0.18
1 Watt 2R2 to 10M (10 Pack)	0.39
2 Watt 4R7 to 10M (10 Pack)	0.60

RESISTORS (WIREWOUND)

2½W 0R22 to 10R	0.15
5W 0R47 to 6K8	0.15
7W 0R47 to 12K	0.15
11W 0R1 to 18K	0.18
17W IR0 to 6K8	0.24

PRESETS

Horizontal and Vertical Standard and sub mid sizes 100R to 4M7	0.12

MAINS DROPPERS

Decca 20 mono	1.35
Decca 30 3R9	0.60
Philips G8 2R2 + 68R	0.84
Philips G8 47R	0.50
Philips 210 (no link)	1.10
Philips 210 (with link)	0.95
PYE 725 3R3	1.79
UMc B69 BBL + 56R	1.40
PYE 725 + 56R + 3R	1.55
RR1 823 56R + 68R	0.85
Thorn 1500	1.55
Thorn 1600	1.45
Thorn 3500	0.97
Thorn 8000	1.20
Thorn 8500	0.97
Thorn 8800	0.97
Thorn 9800	0.90
GEC 2110	0.85

CONVERGENCE CONTROLS

5R 7R 10R 12R 15R 20R 50R 100R 200R 500R	0.38
G8 Metric 10R 15R 20R	0.50
Thorn 50R 200R	0.50

THERMISTORS

PT34P	0.85
PT37P	0.85
PTH451A	0.75
VA1026	0.50
VA1104	0.60
GEC Dual	1.60
G11Transient VDR	0.42

VALVES

30FL1	1.20
DY86	0.75
DY802	0.75
ECC82	0.75
PCF80	0.85
PCF802	0.95
PCL82	0.85
PCL84	0.85
PCL85	0.95
PCL86	0.95
PFL200	1.20
PL36	1.25
PL504	1.60
PL508	2.30
PL509	5.80
PY800	0.89
PY500A	2.30

EHT TRAYS

Decca 1830	5.90
Decca 2230	6.25
Decca 80	6.25
Decca 100	6.25
GEC 1028	6.25
GEC 2040	6.25
GEC 2110	6.25
GEC 2200	6.25
Grundig 5011	6.25
ITT CVC 5/8	6.25
ITT CVC 20	6.25
ITT CVC 45	6.25
Korting 90°	6.95
Philips 520	6.50
Philips 550	6.50
Philips G9	6.25
Philips 570	6.50
Philips KT3	8.95
PYE 691/697	6.30
PYE 713 5 lead	6.50
PYE 713 4 lead	7.60
PYE 725/731	6.25
RRI 823	7.75
RRI T20	6.50
Tandberg TV2-2	6.50
Thorn 1500 3 stick	4.95
Thorn 1500 5 stick	5.50
Thorn 3000/3500	7.70
Thorn 8000	4.95
Thorn 8500	6.80
Thorn 9000	7.80
Telpro 561	7.00
Seimens Universal	5.50
TV11	0.65
TV13	0.65
TV18	0.70

LINE OUTPUT TRANSFORMERS

Autovox 90°	9.75
Autovox 110°	9.75
Decca 1700 Mono	9.80
Decca 1830	9.80
Decca 2230	8.30
GEC 2110	9.50
GEC 20AX (diode split)	12.00
Grundig 1500 mono	13.70
Grundig 5010	11.50
ITT CVC5/8	10.25
ITT CVC20	10.75
ITT CVC30	8.75
ITT CVC45	9.75
Indesit mono	10.75
Korting 90°	10.75
Korting 110°	12.50
Philips 210	9.90
Philips G8	8.90
Philips G9	8.50
Philips G11	12.95
Philips K30	14.95
Philips KT3	7.95
Philips 570	9.50
PYE 691 P.C.	13.00
PYE 725	8.95
PYE 731	8.95
PYE 169	10.75
RRI 640/793	11.75
RRI 774	12.90
RRI 823	11.90
RRI T20	12.90
SABA	12.50
Skantic	12.50
Thorn 1500 20"	7.00
Thorn 1500 24"	7.00
Thorn 1591	10.50
Thorn 1615	10.00
Thorn 1690/1	8.75
Thorn 9000	10.90
Thorn 9600	10.00

PLEASE ADD 65 PENCE POST/ PACKING TO YOUR ORDER TOTAL AND THEN 15% VAT. GOODS ARE DESPATCHED BY RETURN AND SHOULD BE RECEIVED WITHIN 4 WORKING DAYS.

AA117	0.090
AA119	0.090
AAY32	0.090
AC107	0.280
AC126	0.170
AC127	0.150
AC128	0.150
AC128K	0.230
AC141K	0.230
AC142K	0.220
AC153K	0.230
AC176	0.180
AC176K	0.200
AC187	0.150
AC187K	0.200
AC188	0.170
AC188K	0.230
ACY18	0.480
ACY19	0.480
AD142	0.600
AD149	0.450
AD161	0.220
AD162	0.220
AF124	0.250
AF125	0.250
AF126	0.250
AF127	0.250
AF139	0.220
AF239	0.220
AL112	0.700
AL113	0.800
ASZ15	1.000
ASZ17	1.000
AU106	1.000
AU110	1.100
AY102	1.800
AY106	1.800
BA145	0.100
BA148	0.100
BA154	0.060
BA157	0.120
BB101	0.130
BB103	0.160
BB105B	0.180
BB205B	0.240
BC107	0.070
BC108	0.070
BC109	0.070
BC115	0.100
BC118	0.110
BC140	0.190
BC141	0.190
BC142	0.190
BC143	0.190
BC147	0.055
BC148	0.055
BC149	0.055

BC157	0.055
BC159	0.055
BC182	0.060
BC182L	0.060
BC183	0.060
BC183L	0.060
BC184	0.060
BC184L	0.060
BC212	0.060
BC212L	0.060
BC213	0.060
BC213L	0.060
BC214	0.060
BC214L	0.060
BC237	0.070
BC238	0.070
BC300	0.160
BC301	0.180
BC302	0.180
BC303	0.180
BC327	0.060
BC382	0.060
BC337	0.060
BC328	0.060
BC557	0.060
BCY32	1.500
BCY33	1.500
BCY34	1.500
BCY42	0.200
BCY56	0.160
BCY70	0.160
BCY71	0.160
BCY72	0.160
BD115	0.250
BD124P	0.500
BD124	1.100
BD128	0.350
BD131	0.250
BD132	0.250
BD135	0.200
BD136	0.200
BD137	0.200
BD138	0.200
BD139	0.200
BD140	0.200
BD144	0.900
BD150	0.300
BD157	0.380
BD158	0.380
BD166	0.300
BD175	0.300
BD177	0.300
BD179	0.320
BD181	0.450
BD201	0.330
BD202	0.380
BD203	0.420
BD204	0.420

BD222	0.310
BD225	0.310
BD232	0.310
BD237	0.210
BD238	0.240
BD433	0.280
BD437	0.280
BD535	0.380
BD536	0.380
BD537	0.400
BD538	0.400
BDX32	1.000
BDX65	0.800
BF180	0.160
BF181	0.180
BF183	0.200
BF184	0.200
BF185	0.200
BF194	0.050
BF195	0.050
BF196	0.060
BF199	0.060
BF200	0.160
BF257	0.180
BF258	0.180
BF259	0.180
BF336	0.200
BF337	0.200
BF338	0.200
BF362	0.300
BF422	0.210
BF458	0.190
BF459	0.190
BFX29	0.200
BFX84	0.200
BFX85	0.200
BFX87	0.150
BFX88	0.150
BFY50	0.140
BFY51	0.140
BFY52	0.140
BFY56	0.250
BYF57	0.250
BFY84	0.250
BR100	0.140
BSX19	0.150
BSX20	0.150
BSX21	0.160
BSX26	0.160
BSX29	0.190
BZX76	0.160
BT106	0.900
BT109	0.900
BT116	0.800
BT119	1.000
BT120	1.000
BU104	1.000
BU105	0.800

BU108	1.000
BU110	1.100
BU111	1.400
BU126	0.700
BU204	0.750
BU205	0.700
BU208	0.750
BU208A	0.800
BU208D	1.200
BU326	0.850
BU406	0.850
BU407	0.750
BU408	1.000
BU500	1.100
BU526	0.800
BY126	0.060
BY127	0.080
BY133	0.080
BY164	0.220
BY176	0.850
BY179	0.350
BY182	0.320
BY184	0.320
BY187	0.320
BY196	0.200
BY206	0.110
BY207	0.110
BY223	0.720
BYX10	0.150
CA270	0.400
CA3086	0.250
CA3089	1.500
CA3240	0.900
C106D	0.230
MC1327	0.700
MJ2500	1.000
MJ2501	1.100
MJ2955	0.550
MJ3000	1.150
MJ3001	1.150
MJE29A	0.300
MJE30A	0.300
MJE340	0.250
MJE350	0.800
MJE520	0.300
MJE2955K	0.900
OA47	0.060
OA90	0.040
AO91	0.040
OA200	0.070
OA202	0.070
OC28	1.000
OC29	0.800
OC35	1.000
OC45	0.500
OC71	0.300

OC72	0.500
OC200	1.800
OCP71	1.000
ORP12	1.000
ORP60	1.000
ORP61	1.000
R2008B	0.800
R2010B	0.800
SAS560	1.100
SAS570	1.100
SN76003N	1.400
SN76013N	1.400
SN76023N	1.400
SN76033N	1.500
SN76110N	0.700
SN76115	0.700
SN76226	0.900
SN76227	0.800
T2800D	0.520
TAG06-60	0.420
TAG521-200	0.720
TAG4443	0.760
TAG4444	0.760
TAA550	0.150
TBA120S	0.450
TBA395	0.600
TBA396	0.600
TBA520	0.750
TBA530	0.750
TBA540	0.750
TBA560	0.700
TBA800	0.350
TBA810S	0.600
TBA820	0.750
TBA920	0.800
TBA950	0.800
TBA990	0.800
TCA800	0.800
TCA940	0.850
TDA1170	0.900
TDA1412	0.600
TDA2002	0.800
TDA2003	1.500
TDA2020	1.400
TDA2030	1.400
TDA2522	0.800
TDA2530	0.800
TDA2532	0.750
TDA2540	0.700
TDA2560	0.700
TDA2593	0.800
TDA2640	0.800
TDA2690	0.700
TIP29	0.150
TIP29A	0.220

TIP29C	0.250
TIP30	0.160
TIP31A	0.240
TIP32	0.240
TIP32A	0.240
TIP33	0.500
TIP34	0.500
TIP41A	0.220
TIP41C	0.250
TIP42A	0.220
TIP42C	0.250
TIP47	0.400
TIP48	0.400
TIP49	0.400
TIP110	0.470
TIP112	0.540
TIP115	0.450
TIP117	0.560
TIP120	0.430
TIP121	0.460
TIP122	0.470
TIP125	0.470
TIP126	0.560
TIP127	0.560
TIP2955	0.340
TIP3054	0.380
TIP3055	0.340
TIS61	0.150
TIS90	0.150
TIS91	0.180
2N.2904	0.200
2N.2905	0.200
2N.2906	0.180
2N.2907	0.180
2N.2926	0.080
2N.3019	0.280
2N.3053	0.180
2N.3054	0.350
2N.3055	0.320
2N.3055H	0.380
2N3440	0.580
2N.3442	0.850
2N.3771	0.850
2N.3772	0.900
2N.3773	1.000
2N.4031	0.250
2N.4036	0.250
2N.4037	0.250
2N.4443	0.760
2N.4444	0.760
2N.5061	0.200
2N.6294	0.300
2N.5296	0.300
2N.6106	0.400
2N.6107	0.400
2N.6109	0.400

3N.128	0.550
3N.143	0.650
IN.914	0.020
IN.4001	0.040
IN.4002	0.040
IN.4003	0.040
IN.4004	0.040
IN.4005	0.040
IN.4006	0.040
IN.4007	0.050
IN.4148	0.020
IN.5400	0.090
IN.5401	0.100
IN.5402	0.100
IN.5403	0.110
IN.5404	0.110
IN.5405	0.120
IN.5406	0.130
IN.5407	0.130
IN.5408	0.130
VOLTAGE REGULATORS	
7805	0.350
7812	0.350
7815	0.350
7818	0.350
7824	0.350
7905	0.350
7912	0.400
7915	0.400
7918	0.400
7924	0.400
78L05	0.280
78L12	0.280
78L15	0.280
74L18	0.280
74L24	0.280
LM309K	1.000
LM317K	2.200
LM317T	1.800
LM323K	4.200
LM723	0.320
78HGKC	5.700
78H05KC	5.200
78GU1C	1.900
79GU1C	2.150
79HGKC	6.700
JAPANESE TRANSISTORS	
2SA73	0.300
2SA104	0.320
2SA198	0.220
2SA203	0.300

2SA473	0.370
2SB54	0.250
2SB77	0.320
2SB337	1.200
2SB405	0.220
2SC460	0.210
2SC495	0.600
2SC733	0.400
2SC1161	1.100
2SC1172Y	1.500
2SC1279	0.240
2SC1306	1.000
2SC1307	1.000
2SC1520	0.250
2SC1969	1.300
2SC2029	1.200
2SC2078	1.200
2SC2122A	2.000
2SC2952	0.270
2SD234	0.370
2SK135	4.000
MB3712	1.500
TA7205	1.500
UPC575	1.000
ICS SOCKETS	
8 pin	0.060
14 pin	0.080
16 pin	0.090
18 pin	0.120
20 pin	0.140
22 pin	0.150
24 pin	0.180

28 pin	0.200
40 pin	0.250
VALVES	
DY87	0.530
DY802	0.450
ECC82	0.400
ECC83	0.430
ECC84	0.400
ECC85	0.400
ECH81	0.490
ECH84	0.520
ECL80	0.570
ECL82	0.590
ECL84	0.570
ECL85	0.570
ECL86	0.490
EF80	0.310
EF85	0.340
EF89	0.430
EF183	0.450
EF184	0.530
EL34	1.900
EY86	0.310
EY87	0.310
PC97	1.000
PCC85	0.420
PCF80	0.580
PCF200	1.350
PCF801	1.100
PCF802	0.570
PCF806	1.150
PCH200	1.000
PCL81	0.540

PCL82	0.630
PCL84	0.500
PCL85	0.550
PCL86	0.550
PCL805	0.550
PFL200	0.850
PL36	0.800
PL504	0.950
PL508	1.900
PY81	0.700
PY88	0.480
PY500A	1.600
ZENERS	
400MV BZY88 Range 2V7 to 39V	0.060
1.3W Zeners BZX61 Range 2V7 to 39V	0.120
MEMORIES	
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2716	2.200
2532	2.900
2732	2.900
2764	5.000
4116	0.750
6116	3.000
LM324	0.300
LM380	0.600
LM381	1.000
LM709 Dil	0.300

LM723	0.320
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LM741 Met	0.450
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NE555	0.150
NE556	0.400
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BYX55/600	0.300
BYX55/600	0.300
BYX55/800	0.320
BYX70/500	0.290
BYX70/500	0.310
BYX70/800	0.360
BYX71/600	0.800
LED	
LED 3mm RED	0.050
LED 3mm YELLOW	0.100
LED 3mm GREEN	0.100
LED 5mm RED	0.050

LED 5mm YELLOW	0.100
LED 5mm GREEN	0.100
BRIDGE RECTIFIERS	
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1A/100V	0.180
1A/200V	0.190
1A/400V	0.210
1A/600V	0.230
1A/800V	0.280
2A/100V	0.350
2A/200V	0.380
2A/400V	0.420
2A/600V	0.540
2A/800V	0.580
3A/200V	0.660
3A/400V	0.680
3A/600V	0.780
6A/200V	1.000
6A/400V	0.800
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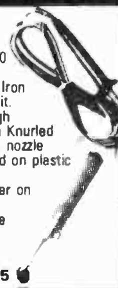

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BC143	.25	BD233	.37	BFY51	.22	TV106/02	1.60
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BC148	.09	BD235	.32	BR101	.32	2N3055	.50
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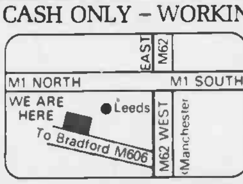

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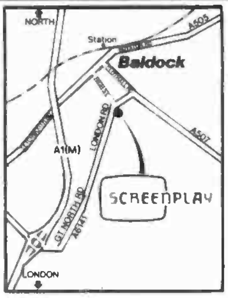

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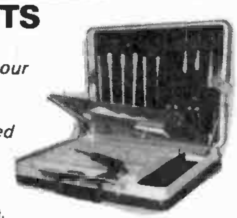

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IN 5235 10p
IN 5254 10p
IN 5392 10p
IN 5393 10p
IN 5928B 10p
IAV 30 10p
IM 72Z55 10p
IR 106a 20p
IR 3051 10p
IS 164 10p
IS 921 10p
IS 3011a 10p
IS 3072a 10p
IS 5024a 50p
IS 5030 50p
ITT 921 10p
ITT 923 10p
ITT 1075 10p
ITT 2001 10p
ITT 2002 10p
ITT 4150 10p
ZE 1.5 10p
ZF 3 10p
ZF 3.3 10p
ZF 4.3 10p
ZF 10 10p
ZF 11 10p
ZF 12 10p
ZF 15 10p
ZF 33 10p
ZF 43 10p
ZF 47 10p
ZF 82 10p
ZPD 3.9 10p
ZPD 4.7 10p
ZPD 5.6 10p
ZPD 10 10p
ZPD 47 10p
ZPY 8v2 10p
ZPY 12 10p
ZPY 16 10p
ZPY 24 10p
ZPY 43 10p
ZPY 47 10p
ZPY 56 10p
ZTE 2 10p
ZTK 22 10p
ZTK 33 10p
ZTK 33a 10p
ZW 13 12p
ZW 27 10p
ZW 4-3 10p
ZW 310 10p
ZY 47 10p
ZY 72 10p
AA 112 10p
AA 113 10p
AA 119 8p
AA 143 10p
AA 144 10p
BA 102c 10p
BA 157 8p
BA 159 8p
BA 173 8p
BA 182 8p
BA 201 8p
BA 202 8p
BA 243 8p
BA 248 8p
BA 316 5p
BAV 10 10p
BAV 21 10p
BAW 21 10p
BB 103 10p
BB 105A×12 £1
BB 105B×12 £1
BB 105G×12 £1
BB 121a 10p
BRC 83c13 10p
BZX 46c22 15p
BZX 61 9-1 6p
BZX 61c110 6p
BZX 61c15 6p
BZX 61c20 10p
BZX 61c30 10p
BZX 61c220 10p
BZX 70c6v2 8p
BZX 70c33 8p
BZX 79c3v9, 4v7, 5v1, 5v6, 6v2, 6v8, 7v5, 11, 12, 30, 47 10p each
BZX 83c4v3 10p
BZX 83c5v6 10p
BZX 83c8v2 10p
BZX 83b12 10p
BZX 83c20 10p
BZX 83c27 10p
BZX 83c33 10p
BZX 84c6v8×10 30p
BZX 85c8v2 10p
BZY 88c0v7 10p
BZY 88c3v9 10p
BZY 884v3 10p
BZY 88 6v2 10p
BZY 88c12 10p
CV 8617 10p
Wire 3300/50 Ends 25p

Min 12 volt Relays 75p
Y 716 10p
Y 730 10p
Y 827 30p
Y 860 30p
Y 933 5p
Y 969 50p
Y 997 30p
R 1038 40p
R 1039 40p
R 2009 80p
R 2010b £1
R 2029 50p
R 2210 60p
R 2257 60p
R 2265 50p
R 2305 50p
R 2306 50p
R 2322/2323 pair 80p
R 2323 15p
R 2396 50p
R 2461 80p
R 2030 50p
R 2443=BD124 40p
R2737 40p
R2738=TIP41 30p
R2775=TIP41c 40p
R3129=TIP47 40p
S 2008b 80p

BU 105/04 80p
BU 108 £1
BU 124 50p
BU 126 80p
BU 180a 65p
BU 204 70p
BU 205 £1
BU 206 £1
BU 207 £1
BU 208 60p
BU 208 on heat sink 70p
BU 208A £1.20
BU 208D 90p
BU 222 £1
BU 326 £1
BU 407 60p
BU 426V 60p
BU 500 £1
BU 526 75p
BUX 84 50p
BUW 84 30p
BUY 71 £1
E 1579 25p
E 1580 25p
E 1611 25p
E 5359 10p
E 5444 10p
E 5577 10p
E 8018 25p
E 9004 10p
E 9005 10p

TIC 106a 30p
TIC 116n/Y 1003 35p
TIC 126N 40p
TIC 206m 30p
TIC 225S 40p
TIC 226E 40p
TIC 226m 30p
TIC 236E 30p
TICV 106D (T092 case 2A/400V) 10p
TIP 29 20p
TIP 29C 25p
TIP 30 35p
TIP 30A 35p
TIP 30B 40p
TIP 30C 45p
TIP 31 30p
TIP 31A/RCA 16334 35p
TIP 32 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34C 50p
TIP 35B 50p
TIP 35C 50p
TIP 35D 70p
TIP 36 50p
TIP 36C 70p
TIP 41B 40p
TIP 41D 70p
TIP 42/BRC 6109 30p
TIP 47 30p
TIP 48 40p
TIP 49 30p
TIP 57 30p
TIP 100 30p
TIP 112 30p
TIP 115 50p
TIP 117 50p
TIP 120 35p
TIP 125 35p
TIP 130 30p
TIP 131 30p
TIP 136 30p
TIP 140 50p
TIP 147 50p
TIP 640 50p
TIP 2955 35p
T 6032 30p
T 6036 40p
T 6040 40p
T 6047 40p
T 6049 40p
T 6051 40p
T 6052 40p
T 9004 40p
T 9005 40p
ZTX 102c 10p
ZTX 107 10p
ZTX 108c 10p
ZTX 109k 5p
ZTX 213 5p
ZTX 341 10p
ZTX 342 10p
ZTX 384 10p
ZTX 451 10p
ZTX 550 10p

VERY SPECIAL OFFER
CVC 25/3 chassis with P.S. Lorit + Tripler (no modules) £15

MJ 2253 60p
MJ 3040 60p
MV 2209 10p
SP 8385 25p

Voltage Regulators
+5V/UA78PO5SC 30p
−5V/LM79MO5CP 25p
−8V/79M08c 30p
+6V/78M06c 30p
LM 337 30p
LM 342/12 30p
−12V/MC 7912 20p
+12V/LM 340T12 25p
+15V/78M15 15p
+18V/MC78M18 20p
+24V/78M24 30p
MC 7724cp 40p

TIS 90 10p
TIS 91 20p
TIS 92 20p
TIS 93 20p

CB Radio transistor
16119 2A/40v.50Meg
5 for £1.

U 14727 15p
U 19885 40p
U 3832 15p
U 3845 15p
MR 508 10p
MR 501 10p
MR 502 10p
BYF 1202 10p
BYF 1204 10p
BYF 3123 40p
BYF 3126 40p
BYF 3214 40p
BYX 10 6p
BYX 36/600 35p
BYX 38/300 25p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYV 95 8p
BYV 96D 10p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v 8p
BZY 93 50p
BZV 15/12 30p
BZV 15/18 30p
BZV 15/30 30p
BZW 70c6v2 10p

Bush thyristor RCA 76122 £1
ITT computer bookset 2020 £2
G8 20 turn 100K pot 35p
Transformer 240v/20v-500Ma 75p
Viewdata torroidals £6
CVC 20 tube base £2
Mitsumi tape motor 75p
Sankyo tape motor 75p

Swiss made 250rpm/240V motor very small 75p

Sharp tape motor 400-040 £1.50
Mono scan coil 110° small neck £1.50

Infra red led LD57CA 15p
Mono scan coil £3
G 8 transductor £1
AT 4041/41 transductor £1
2K5 Lin pot with 40mm spindle 20p
1982 Hitachi Ae isolator 50p
Mullard FM decoder 1401 £1
Philips service pack, flat films, 57 condensers 56nf-2.2uf £2
VHF 3 Transistor rotary tuner DX-TV £1
15K-20 turn pots 20p
Thorn panel 6×100 pot + changeover switch (Irish) 50p
Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £12
Thorn 3500 2A cut out 75p

Stereo GEC amp 20 watt + pre-amp with 4 pots + mains power unit £6

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

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

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

8Ω 4" speakers £1

4700/10v × 10 50p
68/16 × 10 50p
150/16 × 10 50p
47/25 × 10 50p
220/25 × 10 50p
1/250 × 10 50p

8000/30v 50p
470/40v × 10 £1
22/100v × 10 £1
100/350v 70p
400/350v 70p
.47/500v 25p
1/600v 25p
.022/1kv 10p
200/150/150/300v 70p
150/150/100/300v 75p

Philips GP422.4CH (£40 cost) **£6**

Stereo Dynamic Cartridge

12 Volt Aerial Changer over Relays £1

GEC Hitachi
V/Cap tuner, after 1979 Series £13
6 Push Button Unit for GEC 2100 Series Replacement for Touch Button Unit £12

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

Mullard Broadband R.F. power modules

VHF. BGY33 £15
UHF. BGY22E
£5 PT4236C
£5 PT9783

Various Tools and Accessories
G11 Neon Switch £1
GPO 5 way plug 25p
12v screwdriver tester with lead + croclip 25p
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket £3
Sellotape PVC Electric Insulation
25mm × 20M 50p 50mm × 20M 70p
Telescopic aerials (radio) £1
UHF Radio Aerial 50p
Xcelite pliers £3.90
Xcelite snips £5
Xcelite cutters £3.90
GKN Supascrew kits £2.50
VU meter 45p
Pull up large aerial 75p
"V" TV aerial £1
Soldering iron 6v/23w £2.50
Portable TV aerial 75p
Phillips snips £2
2 way baby alarm/intercom with long leads £5
Phillips universal battery tester/charger, fuse/bulb tester £5
Volt/ohm test meters 1000 ohm/volt £5
Eisenmann NICAD CHARGER 5.5V/150 ma £2
12V Nicad pack. "AA" £2.50
Hitachi TP 007 Battery pack 7.2v/1.6A £7
"AA"/1.25V Nicad £1
"C" Nicad £2
"D" Nicad £3
Duracell PP3 60p
⅜" × ⅜" microphone/speaker 50p
Continental 2 pin plug with 5½ft mains lead (black & blue) 5 for £1
7" Ferrite rod with LW/MW coils 50p
Xcekute 5" bent nose plier £3.50
De-solder pump + 2 nozzels £5.20
Plastic box for i.c.s with anti-static pad 6"×3"×⅜" 75p
Can of handy oil 40p
Flat Red LED 12p
500gm 60/40 solder reel £7
Clearweld glue pack 30p
Dual v/u meter−20→ +10db £1
15 service manuals, Thorn 3504 & 3448, etc £2.50
3 × C90 Cassettes 70p
Can Freezer £1.75

75R/25 Watt 25p
18R/11 Watt 25p
120R/17 Watt 20p
Front End Music Center. VHF/MW/LW 13"×3½" £5
Output Stage for music center £5
Both items £9
circuit supplied (as previous ad)
SONY 1400KV Chroma Panel £6
SONY 1400KV Tuner unit £3.50
SONY 1400KV Touch button unit £3.50
3 books, Electronic Systems/Guide to Print Circuits/1st Steps in TV £1.40
Texas Viewdata Decoder VDP 12/80 Issue 3 with all IC's £10.00

15 Bulbs 40p
Video lamps 20 for £5 200 for £25
Antistatic Discloth 5 for £1
100 Diodes £1.50
100 Fuses £2.00
100 W/W Res. £1.50
BF 199 20 for £1
BC 547 100 for £4
10 × 20 Turn 100k pots. Rank £2
Thorn 9 volt power supply regulated £3.00
BF 470 20 for £2
Metal BD 124 10 for £8
20 Slider Knobs 70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

Quantity Reductions
BY204/4 25 for £1.00
BY206 25 for £1.00
BD132/676a 20 for £2
W005 bridge 20 for £2
G11 touch button red 6 for £1
6Meg filter 10 for £2.60
BY210/600 25 for £1.00
BY298 3 amp/fast/R 20 for £1.50
BD239 20 for £2.00
MR856 25 for £1.50
BU126 10 for £6.00
BU205 10 for £8.00
BU105 10 for £6.00
2SC2122A 10 for £8.00
BF458 10 for £1.00
BD136 10 for £1.25
BF224 20 for £1.40
OA90 40 for £1.00
IN4148 40 for £1.00
IN4448 40 for £1.00
BYX10 100 for £4.00
KT3 multicaps 10 for £7.50
50 High voltage ceramic condensers £1.50
Mixed Mounting Kit for Power Transistors 50p
300 Condensers £1.50
300 Resistors £1.50
150 Electrolytics £2.00

Mixed Packs
50 Mixed AC Transistors £4.50
15 Thorn service manuals £3
15 Panel mount rocker switch 250V/10A £1.50
Pack of mixed coloured wire £1.00
25 LED red/yellow/green £1.50
20I/C Holders £1.20
20 Large LED Red £1.00
20 Small LED Red £1.00
10×20 Turn 100K Pots £1.00
100 Transistor £2.50
20 Convergence Pots 80p
100 Sticks £1.00
10 Thermistors 50p
20 Slider Pots £1.00
30 Presets 50p
15 VDR + thermistors, degaussing, HT, etc. £1.00
40 glass reed switch £1
10 press to make switch 70p
40 Pots £1.50
10 Gun Switches 50p
5 Tube Bases £1.00
1,000 Diodes, Condensers, Resistors on Bandolier £3.00
Lucky Dip 600 gram £1.00
Jungle Bag 5Kg £5.00
20 Knobs £1.00
40 Pots, ⅜"+6mm spindles for audio/TV £3

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SENDZ COMPONENTS

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Thorn Spares

9000 tube base and panel	£1.50
9000 Front Panel	£5
9000 Front Panel (remote)	£8
8800/9000 remote unit U705 receiver	£6
9000 Frame panel	£8
9000 Cyclops panel	£1.50
8000/8500 timebase panel	£8
8000/8500/9000 chroma panel	£15
8500 convergence panel	£6
4000 Frame panel	£5
4000 Power supply	£3
1600 Mains lead, switch	
3500 6 push button + cable form	£1.50
T605 1vNPN T066 80v/6A	10p
9000 Sound output panel	£1
3500 Focus unit	£1.50
4000 thick film.	
00S1-012-E002	£1
00S1-012-0108	£1
00S1-018D	£1
3500 2amp thermal cutout	75p
3500 IF panel	£2
3500 Frame panel	£4
3500 Video panel	£5
3500 Line panel	£5
3500 A1 Diode	20p
Export 3500 IF panel	£2
Remote unit, 1 1ic, transformer, relay + 5 volt unit	£2
IC board with set of SN74LS	£1
4000 Tube base	£4
3500 A1 pots	50p
9000 Frame panel	£7
3 Way regulated adaptor 240V 6V/7.5/9V/300mA	£3.50
Rank/Toshiba preh unit 0354	£9.50
2 banks of 3 PB unit. Pye 731	£2
4 Push button unit preh	£1.00
6 Push button VHF/UHF for v/cap. GEC-Decca type	£7.00
7 Push button for CVC5 ITT	£8.00
KT3 12 Push button unit	£2.00
KT3 (Export) 12 P.B.u	£2
6 Push button Unit Thorn	£1.00
6 Push button unit for GEC 2040 and ELC 1043/05	£6.00
6 Push button unit PYE 713	£7.00
7 Lamps for P.B./Unit	10p

Mains Droppers

Pye 731 3+56+27R	50p
3500 Thorn 6/1/100	60p
Thorn 50/17/1K5	£1.00
120/20/20/48/117	£1.00
270/10/6 for Thorn 4000	50p
18/320/70/39	£1.10
Thorn 50-40R-1K5	50p
Ae Socket & Lead GEC, ITT, Philips, Pye	25p each
Rank Toshiba Tube Bases	30p

Speakers

6×4G11	25 ohm	£1.00
5¼×2¼	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
5×3	15 ohm	80p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
5" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
6½" dia	4 ohm	£1.50
6½" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
3" dia	15 ohm	60p

Diodes

BY 127	10p
BY 133	10p
BY 134	10p
BY 176	25p
BY 179	40p
BY 184	25p
BY 187	10p
BY 190	40p
BY 196	30p
BY 198	10p
BY 204/4	8p
BY 206	8p
BY 210/400	5p
BY 210/600	8p
BY 210/800	10p
BY 223	80p
BY 224/600	50p
BY 226	15p
BY 227	15p
BY 228	20p
BY 229/400	30p
BY 234	10p
BY 237	5p
BY 254	10p
BY 255	10p
BY 298	10p
BY 299	10p
BY 406	8p
BY 527	20p
BY 407a	10p
BY 602	10p
F 247	10p
XK 3102	50p
XK 3123	50p
Hitachi 2A/1500V metal case wire end	20p

Line Transformers

G8 Trans. Philips	£7.50
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
CVC40 Split Diode ITT	£10.00
Thorn B/W AD5308F + Stik + Lead	£1.50
GEC 2040	£5.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye mono	£3.00
Rank mono T704A	£3.50
CVC32 ITT	£7.50
GEC Portable Line Trans.	£3.00
EHT Split Diode Leads	£1.00
EHT Cable/Metre	20p

Triplers

11 TEZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
9000 Thorn	£6
9500 Thorn	£4.50
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
G8 Philips	£4.50
Decca 80 100	£4.50
LP1194 Pye 731	£3.50
Grundig TVK 52	£2.50
11TBQ	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
BG 100/61	£3.25
BG 200/43	£3.00
T/text ultrasonic rec'r panel	£14.00
Video cassette lamps on lead. 12-14V.	50p or 3 for £1.00
GEC 8 touch unit assy complete with all I.C.'s + pots	£6.00
G11 E.W. coils	£1.00
G11 6 Button Key Switch	£2.00
G11 Transient Suppressors 245V	10 for £1.00
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 AE Sockets	25p
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.	£20
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans. & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg.	30p
20 GEC Black Spark Gaps	£1.00
G11 Line Driver Transformer	35p

International Rectifier EHT Diodes G770/HV34 6KV	3 for 8p
6A/600V Stud Diodes	20p
6A/1000V Stud Diodes	20p
BTW 30/50	50p
BTW 92/800R	£3
EHT Rectifier wire ends 16Kv	10p
25A473 PNP C/P	10p

GEC portable chassis + LOPT 2114 New	£4
Thorn 1613/1713 chassis	£9.75
Hills 520 multimeter + case. 20,000Ω/volt, fuse diode protected + logic test facility. 10meg/1200 volt	£19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230)	£15.00
Panel 6101	£15.00
Panel 6330	£15.00
G8 T/Unit Panel	£12.00
G8 IF Panel	£12.00
G8 Convergence Panel (late type)	£12.00
G8 Line O/P Panel	£12.00
G8 Power Supply	£12.00
G8 IF & Chroma	£15

G11 IF Detector	£3.00
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F	£3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q	£2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P	£1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead	£5.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£10.00
GEC Power Supply (Export)	£10.00
G11 dynamic correction panel	£6
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots	£14
CVC 5 Mains on/off + 5 pots	£2
GEC Convergence panel	£1
Universal Focus. Fits Pye, Thorn and Decca Units.	
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
CVC 32 Focus Unit	
Focus Rod	25p
G11 focus	£2.00
ITT Small for use with Split Diode	50p
TV11	50p
Remo TV12SP	50p
TV13	50p
TV14	50p
TV18	60p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p
16 Button Key Pad 1 to 0 + * + #+ 4 blank (Cherry)	£3.00

Condensers

470/16	6p
1500/16	20p
3300/16	20p
10000/16	25p
15000/16	50p
3300/18	20p
47/25	5p
470/25	5p
680/25	5p
1000/25 Radial	10p
1500/25	10p
3300/25	20p
4700/25	25p
5000/25	25p
470/35	6p
2200/35	25p
100/40	5p
220/40	5p
400/40	20p
1250/40	20p
1500/40	20p
2500/40	25p
1000/50	20p
1250/50	25p
2000/50	20p
3000/50	25p
3300/50	25p
2.2/63	5p
15/63	5p
47/63 Bipolar	15p
100/63	6p
2200/63	50p

DISPLAYS

4040 Clock	£1
7seg Red LED	50p
4 digit LCD 88:88	£1.00
2 digit LED 8.8	50p
2 digit LED ÷1.8 with panel + MC14511	£1.00
4700/63	£1.50
250/64	10p
3300/70	50p
.1/100	5p
1/100 × 10	30p
4.7M/100	5p
140/100	25p
470/100	20p
2000/100	70p
800/160	50p
.1/250 Pulse	5p
G11 0.47/250	10p
2,2 250v	10p
3n3/250 A.C.	10p
.39/250V	15p
4n7/250 tested 5KV	25p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
500/250	50p
GEC600/250	60p
700/250	£1
800/250	40p
32/300	20p
4/350	5p
8/350	8p
12/300	10p
600/300V	£1.50
4.7M/350v	10p
16/350	25p
33/350	20p
50/350	10p
220/350	30p
300/350	40p
22/375	15p
220/385	75p
330/385 CVC 820HT	60p
0.1/400	15p
KT3 E/W .39/400	20p
.56K/400v	20p
8/400	15p
33/400	20p
400/400	40p
394K/400V	20p
220/450	40p
0.1/600	15p
.047/600	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
.15/1000	20p
.47/250V A.C.	10p
.47/1000	50p
.001K/1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n0/1500	10p
2n2/1500	15p
G11.1 1000/1500	15p
.01/1600	15p
G11.8200/2KV	15p
0.1/2KV	20p
10n/2KV	15p
3n9/2KV	15p
0.0015/2KV	10p
5n2/2KV	10p
6n2/2KV	15p
20n/2KV	15p
2n0/2KV	15p
2n2/2KV	15p
7500pf/2KV	10p
4n7/2KV	15p
8n2/2KV	15p
20n/2KV	15p
0.0082/2500	15p
150/3500	10p
1800/4KV	5p
4.7nf/5KV	10p

Infra Red and Ultrasonic G11 Teletext Decoder Panel	£30
RANK & ITT Mains Remote On-Off Switch (720R)	£1.50
RANK & ITT Mains Remote Switch 2865 ohm	£1.50
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GEC Mains Switch 4 amp	30p
THORN Rotary Mains Switch	50p
G8 Mains Switch	75p
Mains Dropper PYE 3R5+15R+45R	50p
Thyristor 600/4 amp C106/2	24p
G11 Preh Red LED P/Button for C.H. Change	20p
RANK TOSHIBA Transductors TPC-2011	50p
CVC 5 Mains on/off +250K+100K+500K+50K+500K Pot on Panel	£2.00
Thorn 12 or 24 volt battery convertor for portable colour T/V	£12.00 Post £1

170/8KV	10p
180/8KV	10p
210/8KV	10p
1000/10KV	10p
210/12KV	10p
1000/12KV	10p
1200/12KV	10p

Multi-Caps

Thorn 3500	
175/100/100/350v	£1.75
KT3/200/25/25/385v	£1.00
47/220/350v	60p
150/150/100/100/100/320v	£2.00
2500/2500/63v	50p
470/470/250v	50p
150/200/200/300v	70p
400/400/200v	£1.70
300/100/100/16/275v	£1.50
100/200/325v	40p
150/150/100/375v	£1.50
300/300/100/32/32/300v	2.00
1500/2000/30v	50p
400/200/200/350v	
150/150/100/100/320v	£2.00
100/350 + 300/200/100/16/275v	£2.00
300+300/300	£1.00
225+25/380	70p
200/100/100/350v	£1.50

ITT Panels

CMA 10	£2.00
CMA 11	£2.00
CMA 30	£2.00
CMA 40	£1.50
CMC 10/2	£5.00
CMC 16	£4.00
CMC 38	£8.00
CMC 45	£1.50
CMC 47	£1.00
CMC 52	£15
CMC 57	£6.00
CMC 58	£8.00
CMC 59	£8.00
CMC 67	£3.75
CMC 67/2	£4.00
CMC 68	£4.00
CMD 12	£10
CMD 32	£5.00
CMD 33	£5.00
CMD 40	£5.00
CMD 41	£5.00
CMF 25	£2.00
CMF 26	£2.00
CMF 31	£1.50
CMF 40	£2.00
CMH 10	£1.50
CMH 31	£1.00
CMK 12 (untested)	£4.00
CMK 30 (untested)	£4.00
CMN 20	£1.50
CMN 21	£1.50
CMN 40	£1.00
CMN 45	25p
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CMP 11	£2.00
CMP 30	£2.00
CMP 40	£2.00
CMS 11	£2.00
CMS 40	£2.00
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CMU 14	£8.00
CMU 30	£7.00
CMU 40	£7.00
CMU 45	£5.00
CMZ 30	£5.00
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GMC 120	£2.50
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VCA 21	£10.00
VMC 26	£3.00
VMC 34	£5.00
VMC 44 + 45	£4.00
VMC 51	£5.00

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Decca RC 12	£14.00
G11 Infra-red full teletext	£19.00
C11 Ultrasonic full teletext for G26c 674/02 and G22c 66/02	£16.00
Philips, 2 button	£8.00
Rank, Infra-red	£10.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826	£12.00
G11, Full remote top button assy.	£12.00
G11, Full remote repair service (exchange unit)	£12.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
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ELC2006	£10.00
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VHF ,,	£3.00
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SONY 1400KV Tuner unit	£3.50
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Thorn Tuner PANEL with 6×100K pots + cursors NO TUNER	£1.00
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THORN 1590 4P.B. Mech. Tuner
THORN 3500 4P.B. Mech. Tuner
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SAA1124	£2.00
SAA1130	£2.50
SAA1174	£3.00
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TBA530	£1.00
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6MHz
8.867238
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AC138	15p
AC152	15p
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AC142K	15p
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AC176	15p
AC176K	15p
AC178K	15p
AC179	15p
AC186	15p
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AC188	15p
AC188K	15p
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BD507	50p
BD509	30p
BD510	30p
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BD519	30p
BD534	30p
BD535	30p
BD544D	30p
BD562	30p
BD610	40p
BD646	50p
BD676A	30p
BD678	50p
BD681	25p
BD807	20p
BD948	30p
BDX75	20p
BDX32	£1.25
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF256	10p
BF257	20p
BF258	25p
BF259	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF423	15p
BF448	30p
BF450	20p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	20p
BF480	50p
BF594	10p
BF597	10p
BF694	10p
BF758	30p
BF760	30p
BFT34	15p
BFT43	10p
BFT84	8p
BFW11	20p
BFX29	30p
BFX84	25p
BFY50	15p
BFY52	20p
BFY90	25p
BPW41	25p
BRC116	40p
BRX43	15p
BRX48X	10p
BRY56	30p
BSS68	10p
BSY79	10p
BSY95a	10p
BTY80	20p
BSX19	17p
BSX20	17p
FT3055	30p
TCE82	30p
2N930	5p
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2N2222	8p
2N2906	10p
2N3055	40p
2N3566	10p
2N3702	10p
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2SK30A	10p
BC107	10p
BC108	10p
BC109	5p
BC113	10p
BC114	10p
BC115	10p
BC116	10p
BC117	20p
BC119	20p
BC125	10p
BC139	10p
BC141	25p
BC142	25p
BC143	25p
BC147	10p
BC148	10p
BC149	10p
BC153	10p
BC154	10p
BC157a	10p
BC159	10p
BC160	25p
BC171	10p
BC172	10p
BC173	10p
BC174	10p
BC182L	10p
BC183	10p
BC184	10p
BC187	10p
BC204	10p
BC207	10p
BC212	10p
BC213	10p
BC214	10p
BC237	10p
BC238	8p
BC239	10p
BC250	8p
BC251	10p
BC252	10p
BC262	10p
BC263b	20p
BC294	30p
BC298	10p
BC300	30p
BC301	10p
BC303	30p
BC307	7p
BC308	7p
BC309	10p
BC327	10p
BC328	10p
BC328/338 pair	15p
BC337	10p
BC338	10p
BC347	10p
BC349b	10p
BC350	20p
BC365	10p
BC384	10p
BC394	10p
BC413	10p
BC414	10p
BC416	10p
BC440	30p
BC454	10p
BC455	10p
BC456	10p
BC460	25p
BC462	10p
BC463	10p
BC478	10p
BC527	10p
BC532	10p
BC546	10p
BC547	10p
BC548	10p
BC556	10p
BC557	10p
BC558	10p
BC559	10p
BC635	10p
BCX31	25p
BCX32	25p
BCX32/36 pair	50p
BD116	25p
BD124	50p
BD124 (metal)	60p
BD130Y	25p
BD131	30p
BD132/238	30p
BD135	25p
BD136	30p
BD138	30p
BD140	30p
BD175	30p
BD176	25p
BD182	£1.00
BD183	70p
BD202	60p
BD204	60p
BD221	20p
BD222	30p
BD223	40p
BD228	30p
BD226	20p
BD233	30p
BD235	30p
BD238	30p
BD239	15p
BD243c	30p
BD244	50p
BD250a	30p
BD252	20p
BD253B	50p
BD331	20p
BD332	20p
BD373b	20p
BD416	25p
BD433	25p
BD437	25p
BD439	50p
BD501	30p