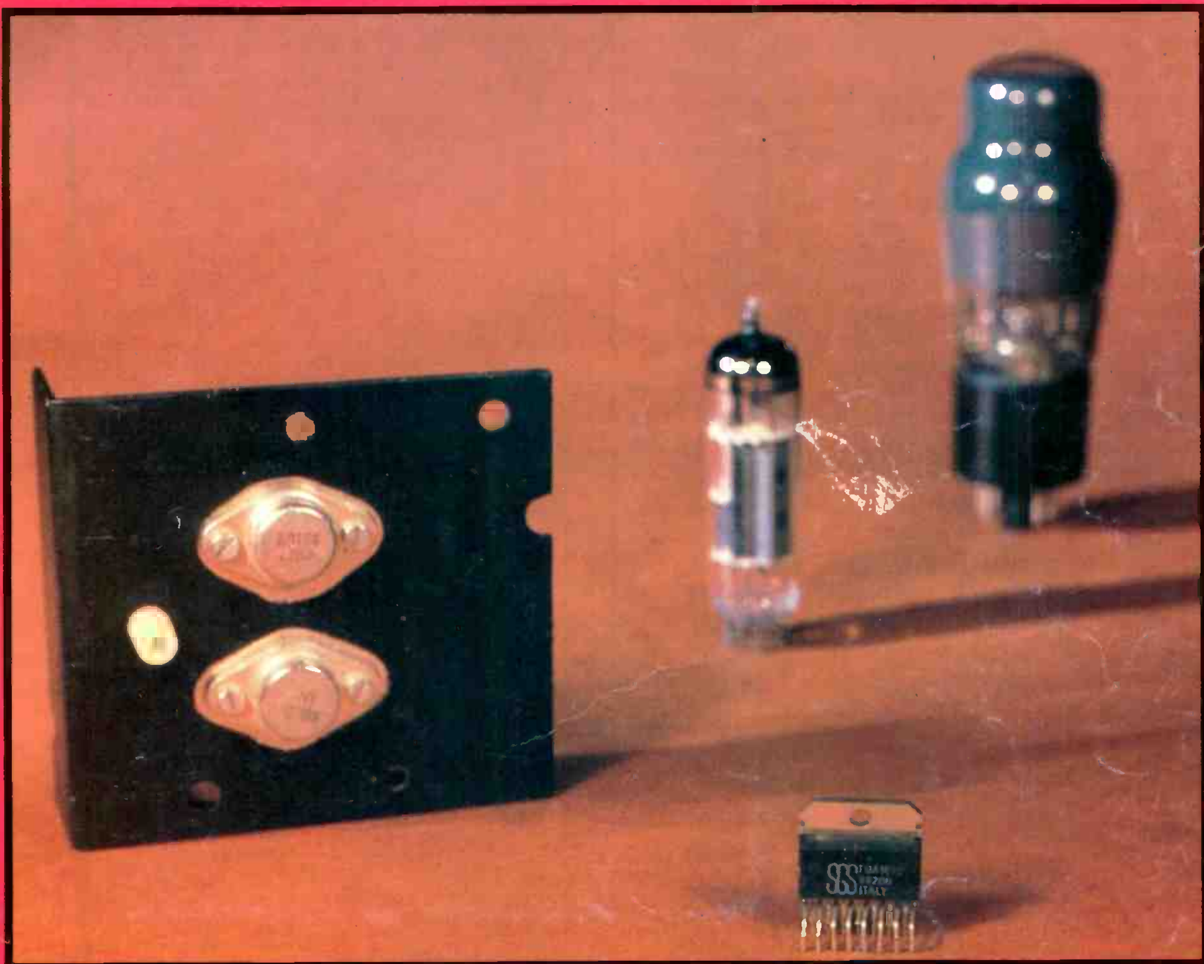
OCTOBER 1985 Australia $1·80, New Zealand $2·20, Malaysia $5·50 £1·10

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS



Field Timebase Circuit Survey
Philips G11 Fault Finding Chart
TV Line Selector Unit
Quick Checks on the Rank A823
VCR Clinic • Test Report
TV Fault Finding • DX-TV

TELEVISION

October 1985

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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 £13 in the UK, £15 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

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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.

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

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

this month

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 16

P. V. TUBES
HAVE MOVED

104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.

Just phone your order through, we do the rest.

Buy with

Telephone: Accrington (0254) 36521
Accrington (0254) 32611
Telex: 635562 Griffin G (For P.V.)

SUPPLIERS OF TELEVISION COMPONENTS

TRADE COUNTER OPEN MON-FRI 9 a.m.–5 p.m. SAT 9.30 a.m.–5 p.m. TRADE COUNTER CLOSED WEDNESDAY p.m.

VARICAP TUNERS

ELC1043-05	8.40
ELC1043-06	8.40
ELC2003	16.50
Philips G8/G9	10.50
Philips G11 (U321)	8.50
U322	7.20
U341	9.50

PUSH BUTTON ASS.

Decca 4 way	6.88
6 way	7.50
GEC 2110 6 way	7.98
GEC Slim 6 way	6.50
GEC/ITT/PYE 7 way	14.50
Pye 4 way (713/15)	9.00
Pye 6 way (207/715)	16.00
Pye 697 repair kit	9.00
Pye 725-735	11.00
Pye 725-735 with tuning head	14.60
Philips G8 (early)	15.50
Philips G8 (late)	13.90
Rank A823	10.75
Rank T20A	9.75
Hitachi 4 way	10.75
Philips G11 unit	26.50
Philips KT3	14.50
Philips KT30	10.30
ITT CVC 8/9 (mod)	12.00
ITT 6 way with VCR	8.90
Thorn 9000 switchback	5.30
Decca 7 way piano key replacement kit	19.50

SERVICE AIDS

SERVISOL Freeze-It	1.14
SUPER SERVISOL	98
SERVISOL Foam Cleanser	96
SERVISOL Plastics Seal	1.08
SERVISOL Silicone Grease	1.20
SERVISOL Tubes Silicone Grease	1.64
SERVISOL Aero Klene	90
SERVISOL Aero Duster	1.20
SERVISOL Excel Polish	92
SERVISOL Video Head Cleanser	86
Super 40	1.62
Fire Extinguisher 640G	2.86
Heat Sink Compound 25G	1.08
Silicone Rubber Tube 110G	2.98
Solda Mop standard reel	74

ELECTROLUBE PRODUCTS

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

VIDEO

Video care kits	3.50
VHS E30 video tape	3.06
VHS E60 video tape	4.00
Scotch E120 video tape	5.00
E180 video tape	4.50
Beta L500 video tape	4.90
Beta L750 video tape	5.80
VCC 240	6.20
VCC 360	8.30
VCC 480	10.21
Philips LVC 1700 1200	15.10
VIDEO HEADS	
3HSS VHS	32.50
4HSS VHS	32.80
PS3B Beta/Sony	42.00
VIDEO RECORDER HEADS	
Philips V2000	57.00
Philips 1700	57.00
Video lamps	1.30
3V23 Cassette Lamp with plug	1.95
VIDEO DRIVE BELT KITS	
JVC HR3330/3600	4.50
JVC HR3360/3660	4.50
JVC HR7650	4.50
Panasonic NV/300	4.50
Panasonic NV/7000	4.50
Sony SLC7/SLJ7	4.50
Sony SL8000/8080	4.50
Toshiba V7540	4.50
Ferguson HR3330/3600	4.50
Video head cleaner	86
Sanyo video motor	20.00

AUDIO HEADS AND MOTORS

Mono record/playback	4.32
Stereo playback	4.79
Stereo record/playback	4.99
Stereo record/playback (Dolby)	6.90
Mono/stereo erase	2.25
Electronic/rotation clockwise motors	
6V MD6515	4.95
9V MD9516	4.95
12V MD12517	4.95

SWITCHES & ACCESS

On/off gen. purpose 4A	75
G8 on/off	1.38
G11 on/off	1.58
G11 on/off remote	1.58
Gen. purpose rotary	66
Thorn Tx 9/10	1.06
GEC 2040	98
Thorn 1591 push on/off	2.90
Rank tuner buttons 1½"×½", 2"×½", 2"×⅜"	35
Rank drive cams	15
GEC 2110 tuner neons	20
Thorn 3500 A1 beam	70
GEC 2110 A1 cont. R/B/G	58
ITT CVC5 on/off	1.24
ITT mains switch + solenoid	4.50
Rank mains switch + solenoid	4.50
Rank T20 on-off switch	1.95

EAGLE MULTIMETERS

KEW 7N	7.50	
KEW 14	9.95	
KEW 20	14.50	
EM5	11.95	
EM10	13.95	
MM50	31.25	Bench
MM100	44.50	Meters
MM150	89.00	
T1206 intercom	8.50	
MMC100	21.95	Case
TS350	25.00	

ANTEX SOLDERING EQUIPMENT

C15W Iron 240V	6.20
C240 Element	2.75
Bits 102	1.10
106	1.10
820	1.10
821	1.10
CS17W Iron 240V	6.40
CS240 Element	2.75
Bits 1100	1.10
1101	1.10
1106	1.10
XS25W Iron 240V	6.50
XS240 Element	2.75
Bits 50	1.10
51	1.10
Temp. Controlled	
30W Iron CSTC	16.95
40W Iron XSTC	16.95
Unit for above TCSU1	68.95
Stand	2.10
MLXS Auto Repair Kit	8.40

WELLER

Heat gun	12.00
Heat gun tips (pair)	57
3/16" Iron tips 25W (MT5)	57

LABGEAR

CM7261 Power Unit 12V	11.24
CM7262 Reg. Power Unit 12V	12.25
CM7060 MHA 10db 12V W/B	9.86
CM7065 VHF/UHF MHA W/B 12V	14.34
CM7066	13.38
CM7067 UHF 12V MHA (Specify A-B or C/D)	10.72
CM7068 UHF 12V MHA High Gain (Specify A-B or C/D)	15.95
CM7053 Behind Set UHF Amp. (Mains)	13.01
CM7054 Behind Set UHF Amp. (Battery e.g. Caravans)	10.42
CM7043 Second Set Amp. UHF	12.12
CM7093 Behind Set UHF Amp. 3 Sets	15.27
CM7063 Dist. Amp. VHF/UHF 17db/output 12V	22.17
CM7108 VHF/UHF 8+1 Dist. Amp.	43.26
CM9700 27mhz CB Suppress.	4.05
CM6011 Outdoor Splitter (2 way) W/B	7.83
CM9003 Flush Single Outlet	1.47
CM9010 Flush Twin Outlet	1.95
CM9034 UHF Group Filters with DC Through Pass (state A/B/CD)	7.69
CM6006 6 Way Passive Splitter	10.97
CM7042 TV Games Combin.	2.95
CM9009 Flush TV/FM Outlet	3.05
CM7091 Col. Bar Gen.	121.80
CM9006 VHF/UHF Diplexer	3.60

STATIONERY

Service Call Pad (100)	1.99
Repair Ticket (100)	3.90
Job Card (100)	2.50
Rental Payment Card (50)	3.50
H.P. Agreements (100)	3.50
Maintenance Agreement (100)	3.50
Rental Agreements (100)	3.95

DID YOU KNOW WE'VE GOT LOTS OF NEW THINGS!

Decca speaker 8R 3.75

B+K tube bases Dynascan

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

L5 7"×3⅝" speaker	4.25
C15 computer cass.	30
C20 computer cass.	33
5¼" floppy disc s/s s/d	1.61
15R fused res. G9	55
G11 line lin coil	2.95
G11 pot G2 R.G.B.	5.30
G11 line scan panel	54.00
G11 power panel	37.50
G11 timebase panel	37.50
G11 bridge trans.	97
G11 EW correc. coil	1.95
G11 final anode lead	1.50
G11 focus unit	5.80
G11 39R 3W resistor	60
G11 RGB 10G diodes	50
Televerta up converta	37.20
G11 47K pot plus switch	65
Dynascan	399

SUNDRY EQUIPMENT

Test Lead Set	4.20
Degaussing Coil Stick	17.00
Signal Injector	4.00
Elect. Circuit Tester	1.50
5A Choc Bloc (12)	40
Fuse Wire 5A, 15A, 30A	05
4-way 13A Mains Conn.	5.00
Safe Block (mains)	8.50
13A Plug Top (box 10)	4.80
Probes (x10)	10.90
Probes (x1)	10.90
Bell Wire (100m)	5.00
Mains Cable (circular 100m)	
(2 core)	10.75
(3 core)	13.25
Factory recon. Avo meters	119.00
Avo Batteries	2.95
Vero Board	2.59
Isolating trans. 500vA 240V	40.00
Solder 500g	7.00
D.I.Y. Solder	45
Solder Sucker	6.50
Nozzles	81
Trim Tools	
Plastic	16
Metal End	30

OFFICIAL ORDERS ACCEPTED FROM SCHOOLS, LOCAL AUTHORITIES ETC.

WE HAVE A FULL RANGE OF AERIALS AND ACCESSORIES FROM TRADE COUNTER

AERIAL EQUIPMENT

Outdoor Splitter	5.50
Plastic Tape	50
F.M. Plugs	25
Set Top Aerial	2.30
Loop Aerial	1.00
Mast Amp/Power Unit WB	18.00
Aerial Isolator Kit	2.08
Attenuator 6dB, 12dB, 18dB	1.80
27MHz Filter 50dB	2.10
Cable Clips 7mm per 100	1.18
Single Outlets	80
Surface Splitter	1.70
A Splitter	70
100M Coax	15.00
Coax Plugs per 10	1.80
1" U Bolts	30
J Bolts	25

ANTIFERENCE

SB11 Splitter	2.37
COB11 Outlet	96
CS1000 Combiner/Splitter	6.15
PU1240 Power Unit	11.65
UP1300 MHA	9.09
XS2U Xtraset	14.56
4 way VHF/UHF Amp	40.71
6 way VHF/UHF Amp	50.68
XG8 High Gain Aerial A-B-CD-WB	17.10

PHILIPS KT3 SPECIFICS

KT3 posistor	1.50
Mains electrolytic 225/25 380V	2.50
Selector unit Mod. 933	13.42
On/off switch Mod. 933	3.20
Tripler	10.65
Luminance chroma panel	24.00
2003 IF module	14.95
U321 IF module	13.50
R.G.B. panel	10.30
Sound panel	8.50
Power panel	10.60
Mains input panel	14.30
Line sync panel	10.20
Mark II chroma panel	16.50
Sound module	8.50
LOPT	9.70
Focus unit	3.50
Infra Red Teletext remote hand set	18.87

K30 SPECIFICS

K30 LOPT	17.50
K30 focus unit	2.90
K30 EHT lead	8.30
Selector unit 1002 (early)	11.20
TMS 1000 panel 1234	13.00
Euro decoder panel 1234	46.00
Power supply 1234	23.50
A1 gun switches	70
On/off switch	2.60
Selector unit 1002 (late)	9.90
Hand set 1201	16.00
Hand set 1234	16.00
Diode ZTX 33B	90
DL 20 delay line	2.20

Solda Mop Stnd.	74
Sidecutters sm.	1.20
Long Nose Pliers	1.20
SM Torch	42
Quick Set Adhesive	75
Sm. Neon Screwdriver	40
Lg. Neon Screwdriver	65
Min. Screwdrivers	15
I.C. Inserters	1.18
Automatic Wire Strippers	5.95
Scart Plugs	2.95
Scart Leads	3.50
TA81 Car Battery Leads/port. TV Thorn 1690/91	4.47
TA51 Car Battery Leads/port. TV Thorn 1613/1615	3.66
Car Battery Leads/port. TV Philips	3.95
Universal Car Accessory Cable	1.99

DATA BOOKS (Zero VAT)

Pair of A-Z/2N2S TVT80	8.50
LIN IC Books (data only not equiv.) LIN1	5.95
2M Fly Lead	70
4M Fly Lead	1.20
10M Fly Lead	1.90
Figure 8 Mains Lead	62
Computer to TV	97
7 pin din to 5 pin din	98
5 pin din to 5 pin din	98

IC equivalent booklet £3.25 and transistor equivalent booklet £3.25

SPECIFIC COMPONENTS

Philips G8 knobs sm/lg	50
90° transductor	2.60
Thorn 1591 speakers sm	6.20
lg	6.20
Thorn 1500 controls	59
390K frame 470K line contrast 1k5	each
Focus control Thorn/GEC	2.95
Thorn 9000 focus unit	5.95
Thorn 8500 focus unit	4.75
Thorn Tx10 focus cont.	9.80
Decca bridge trans.	1.97
Decca 30 width cont.	50
Decca 2M2 HT cont.	25
Pye 731 HF choke	6.50
Delay lines DL20, DL60, DL700, DL50	2.20
CRT tube base	1.40
EHT final anode cap	63
6.3V CRT boost trans.	5.80
Focus rod	1.25
Focus holder	2.00
AFC unit G8	8.82
IF gain module	9.00
C.D.A. panel	20.00
G8 rear conv. panel	23.00
Philips K35 Tuner drawer	10.00

PLUGS AND SOCKETS

5 pin DIN plugs 180°	20
5 pin DIN chassis sockets 180°	28
5 pin DIN line sockets 180°	28
5 pin DIN plugs 360°	20
5 pin DIN chassis sockets 360°	28
5 pin DIN line sockets 360°	28
6 pin DIN plugs	28
6 pin DIN chassis sockets	36
6 pin DIN line sockets	28
7 pin DIN plugs	35
7 pin DIN chassis sockets	36
7 pin DIN line sockets	30
8 pin DIN plugs	56
8 pin DIN chassis sockets	64
8 pin DIN line sockets	55
Phono plugs	12
Phono chassis sockets	10
Phono line sockets	20
2.5mm Jack plugs	11
2.5mm Chassis sockets	14
2.5mm Line sockets	17
3.5mm Jack plugs	15
3.5mm Chassis sockets	24
3.5mm Line sockets	18
3.5mm Stereo jack plugs	35
3.5mm Stereo chassis sockets	18
3.5mm Stereo line sockets	28
6.3mm Stereo jack plugs	36
6.3mm Stereo jack line sockets	25
Standard mono jack plugs	20
Loud speaker plugs 2 pin	10
I.D.C. plugs 36 conn.	5.90
I.D.C. sockets 36 conn.	6.90
BNC plugs	1.15
Coax plugs Each 18p Pack of ten	1.80
Line connectors	16
Double ended female sockets	1.20
Car aerial plugs	18
PL259 with reducer	1.30
Reducers for the PL259	16
FM plugs	25

CASSETTE DRIVE BELTS

35m	35	46mm	37	57m	37
66m	39	110m	59	76m	43
90m	43				

SHEILA'S SURPRISES

SHARP VIDEO HEADS £55
VC2300
VC6300
VC7300/7700/7750
VC8300
VC220/381/383/388/9100/9300/9500
VC3300/9700

SANYO VIDEO HEADS £53
VTC 9300/9500
VTC 5300/5000
VTC 5350
VTC 5500
VTC 9350

We are now stocking a range of Thorn New Life tubes. Please ring for prices and carriage costs.

REMOTE CONTROL HAND UNITS

Decca 100/101 Ultra Sonic Non Teletext	£23.80
Grundig Telepilot 12 Series Infra Red	£13.87
Grundig Telepilot 8 Series Infra Red	£25.10
Grundig Telepilot 160 Series Infra Red	£25.10
Grundig Telepilot 300 Infra Red	£18.87
Philips KT3/K30 Infra Red Non Teletext	£18.87
Philips G11 Ultra Sonic Non Teletext	£22.00
Philips G11 8 Way Infra Red Teletext	£23.80
Philips G11 Ultra Sonic 31 buttons	£27.00
Philips G11 Ultra Sonic 2 function	£21.00
Thorn TX10/JVC Infra Red Teletext	£16.87
Philips KT3 Infra Red Teletext Remote Hand Set	£18.87
KT3/K30 Teletext Remote	£16.00

REMOTE CONTROL TESTER £29.94

TRADE ANNOUNCEMENT

FERGUSON 3V16/3V22 VHS VIDEOS

THORN 8800/9000/9600 COLOUR TV's

MAINLY REMOTE CONTROL
HAND UNITS NOW AVAILABLE

MINIMUM PURCHASE 5 UNITS
LOWEST PRICES IN U.K.

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OTV HOUSE
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LONDON E5 9RB**

Telephone: Bob Munson 01-985 6111

EAST CORNWALL COMPONENTS

☆ ☆ ☆ **85**

NEW 1985 CATALOGUE will be available early September – range of components greatly increased – over 125 pages fully illustrated. Price £1.00 per copy (free upon request with orders over £15). Includes 50p Credit Note, Special Offer Sheets, Order Form and Pre-Paid Envelope. Order your copy now – will be despatched as soon as available.

SERVICE AIDS

Switch Cleaner	1.18
Circuit Freezer	1.24
Foam Cleanser	1.16
Aero Klene	1.10
Plastic Seal	1.28
Excel Polish	1.12
Antistat Spray	1.18
Aero Duster	1.40
Super 40	1.82
Video Head Cleaner	1.06
Fire Extinguisher	3.06
Silicone Grease Aero	1.42
Ditto Tube	1.64
Heat Sink Compound	1.08
Solda Mop 0.12mm	0.74
Ditto 0.06mm	0.76

INTEGRATED CIRCUITS (£) EACH

709	0.35	ML23713	2.30	TDA560C	1.50
741	0.25	NE555	0.25	TDA800	0.80
747	0.70	SAA1025	4.00	TBA810S	1.20
AN214Q	3.80	SAS560	2.50	TBA950/2A	3.05
AN240P	3.42	SAS570	1.85	TCA270SA	4.02
BTT6218	1.98	SAS580	2.85	TDA1003A	5.50
CA301AT	2.88	SN76023N	2.00	TDA1004	4.95
CA358	0.66	SN76033N	2.50	TDA1006A	2.45
CA801CM	1.20	SN76131N	1.99	TDA1035S	2.20
CA3020	2.10	SN76226DN	1.70	TDA1170S	1.99
CA3065	1.60	SN76227N	1.10	TDA1352A	1.80
CA3080E	0.68	SN76660N	0.75	TDA2002	1.80
CA3140	0.45	SN76666NO	1.40	TDA2020	4.00
HA1366W	1.59	STK015	6.20	TDA2030	1.90
LA4422	3.20	TA7146P	4.60	TDA2140	
LC7131	4.90	TA7203P	2.76	TDA2160	
LC7137	5.40	TA7204P	1.50	TDA2522	
LM324N	0.48	TA7205AP	1.30	TDA2530	
LM380N8-P	1.15	TA7222P	2.32	TDA2532	
LM380N14-P	1.80	TAA550	0.50	TDA2560	3.20
LM1011N	3.20	TAA611A12	3.50	TDA2561	4.65
LM1488N	0.98	TAD100	2.90	UPC57562	1.48
LM3900N	0.85	TDA120A	0.80	UPC741G	0.92
M51513L	3.18	AS/S/SB/T/U	0.80	UPC1156H	2.75
M51515L	3.18	TDA120B	1.30	UPC1182H	2.75
MC1307P	1.99	SA/SQ/UQ	1.30	UPC1218H	1.80
MC1327P	1.50	TBA520	1.50	UPC1370C2	2.50
MC1330P	1.60	TBA530	1.20	UPC2002H	2.78
ML23213	2.10	TBA540	1.64	UPC2002V	2.78

FUSES Prices per 10

20mm Quick Blow. 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. **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.

REPLACEMENT TV MAINS OROPPERS

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

RESISTORS – CARBON FILM 5%

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

RESISTOR KITS – each value individually packed

1/4W pack 10 each value E12 – 10R to 1M 610 pieces	5.75
1/4W pack 5 each value E12 – 10R to 1M 305 pieces	3.35
1/2W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.95
1/2W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.75
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.50

RESISTORS – WIREWOUND. Generally 5%

2.5W – 0.22 to 270R – Available in preferred values	0.20
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

PLUGS & SOCKETS

Metal Co-ax Plug	0.18
Plastic Co-ax Plug	0.14
Metal Line Socket	0.50
Single Junc Socket	0.80
Plastic Phono	0.15
F.M. Plugs	0.20
PL259 Plugs	0.38
Reducer	0.15
Low loss splitter 1 in, 2 out	1.00

CHART RECORDER SPECIAL

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

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	2.00
	3000	1000/63V	0.74
	3500	175/400V+100+100/350V	2.56
	8000	400/350V	2.10
	8000/8500	2500+2500/63V	1.99
	8000	700/250V	2.15
		1000/70V	0.80
	9000	400/400V	3.00
Timer Amp		4700/25V	0.95
DECCA 10/30		400+400/350V	3.20
	1700	200+200+400/350V	3.75
GEC	2047	2048 2083 2084 2104	
		200+200+150+50/300V	2.50
		600/250V	1.85
ITT/KB		200+200+75+25/350V	2.90
		220/100V	1.95
PHILIPS	G8	600/300V	2.20
	G8 G9	600/300V	2.10
	G11	470/250V	1.80
	G9	2200/63V	1.25
EKCO	T148	125+200+100+32/275V	2.65
	691 Series	200+300/350V	2.50
		600/300V	2.20
RANK		300+300/300V	1.75
	A823	2500+2500/30V	1.50
		220/400V	1.85
		600/300V	2.25

ZENER DIODES

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

*Only available while stocks last

HV Disc Ceramic (†)
1kV 1.5nF 18p
8kV 10, 47, 56, 82, 100, 120, 150, 180 30p

ZENER DIODE PACK

400mW – 5 each value – 11 values – individually marked and packed – 55 Zener Diodes.
Price £3.50 each.

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which) 49.95
XS25 W Iron kit/ complete with steel & plug attached 10.00
CS 18W, as above 9.90

Antex 15W iron	5.25
Antex 18W iron	5.50
Antex 25W Iron	5.75
Antex elements	2.75
Antex bits	0.90
Antex stands	2.10
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

CAPACITORS

Metallised Paper

2n2F 600V AC	24p
10nF 1000V DC	22p
10nF 500V AC	80p
15nF 300V AC	30p
22nF 300V AC	32p
100nF 1000V DC	46p
470nF1000V DC	60p

I.C. SOCKETS

Dil to Dil

8	pin	0.08	0.70/10
14	pin	0.10	0.90/10
16	pin	0.11	1.00/10
18	pin	0.14	1.30/10
22	pin	0.20	1.80/10
24	pin	0.20	1.90/10
28	pin	0.22	1.95/10
40	pin	0.28	2.00/10

Fuseholders

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

MIXED DIALECTRIC CAPS

.01mf	1000V	30p
.022mf	1000V	20p
.1mf	1000V	48p
.47mf	1000V	78p

DC MOTORS (Min)

6-12V 75p ea. 3.00/5

SCREENED CURLY LEADS

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

SPEAKERS

4" Round 1.6W 4 ohm	£1.50 pair
2¼" Round 1.6W 8 ohm	.85p each
4" Round 1.6W 4 ohm plus mounting bracket	£1.00 each

POTENTIOMETERS

Carbon Track Rotary 0.25W Log & 1 in values. All ¼in Spindle 20ml body dia Shaft 2" long

4K7.2M2 Single Gang Log	.40	10/ 3.50
1K — 2M2 Single Gang Lin	.30	10/ 3.50
5K — 2M2 Single Gang DP Switch Log	1.05	10/ 9.50
5K — 2M2 Double Gang Log & Lin	1.25	10/10.50

TELEPHONE SPECIAL

BT App Telephone Plug + 3m Lead	£1.25
BT App Master Socket inc Wiring instrns	£2.85
BT App Secondary Socket	£1.95
4-way plug	58p each 10/£5.50
BT 4-Core Cable per metre	15p
Cable clips for above	100/75p

NI-CAD CHARGER

Universal Ni-Cad charger, charges PP3, AA, C, D
Price £6.00

Rechargeable Batteries

AA (HP7)	85p	10/ 75p each
C (HP11)	£1.75	10/£1.85 each
D (HP2)	£2.05	10/£1.95 each
PP3	£3.80	10/£3.70 each

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

SONY TV & VIDEO SPARES

Rewind Kits SLC5-SLC7	A-670-634-8A	4.50
SLC6	A-670-639-1A	3.50
Video Heads SLC6-SLC7	A-676-203-8A	48.25
SLC5	A-676-204-4A	45.60
Motor Kit	X-354-931-41	13.45
Idler Assembly	X-365-331-50	0.95
Cap. Film 0.18mf 1.5Kv	1-129-952-11	1.35
Relay	1-515-323-00	5.10
Switch Power	1-516-390-11	2.30
Switch Push Button	1-552-503-11	3.25
Thyristor SG264A	8-726-420-00	4.00
SG6533	8-726-330-00	13.45
Service Manual		20.00

TERMINAL BLOCKS

2 amp 12 way	0.20
5 amp 12 way	0.24
15 amp 12 way	0.42
32 amp 12 way	0.88

DE-LUXE EMERGENCY LITE

Operating from 12V DC comes complete with 4 metres of cable and cigar lighter plug for easy operation. Magnet bas and solid state controlled blinking switch are incorporated 99p

VALVES

Type	Price (£)
DY802	0.95
DY86/87	0.66
ECC81	1.00
ECC82	0.92
ECC83	1.00
ECC84	0.80
ECC85	0.95
ECC88	1.25
ECF80	1.20
ECH81	1.40
ECH84	1.50
ECL82	1.10
ECL86	1.75
EF80	0.75
EF86	1.80
EF183	0.90
EF184	1.00
EH90	0.98
KT66(G.E.C.)	16.00
KT88(G.E.C.)	19.00
EL34	3.25
EL84	1.00
EL509	7.85
EM87	2.55
EY86/87	0.67
EY500A	2.50
PCC84	0.60
PCC85	1.75
PCC89	0.75
PCC189	0.85
PCF80	0.95
PCF86	1.25
PCF200	1.95
PCF801	1.05
PCF802	1.05
PCF806	1.20
PCL82	1.00
PCL83	2.50
PCL84	1.00
PCL86	0.90
PCL805/85	1.05
PD500	2.90
PFL200	1.85
PL33	1.50
PL36	1.75
PL81	0.85
PL82	0.75
PL83	1.20
PL84	0.75
PL95	2.00
PL504	1.40
PL508	2.70
PL509/519	5.25
PY88	1.80
PY500A	2.20
U26	1.90
UCH81	2.00
UCL82	1.80
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.28
AC128	0.30
AC128K	0.34
AC141	0.58
AC141K	0.38
AC142	0.56
AC142K	0.38
AC151	0.45
AC152	0.45
AC153	0.57
AC153K	0.46
AC176	0.30
AC176K	0.38
AC187	0.28
AC187K	0.38
AC188	0.28
AC188K	0.38
ACY22	1.50
AD142	0.88
AD143	1.10
AD149	0.72
AD161/162	1.20
AD162	0.52
AF114	1.20
AF115	2.10
AF116	2.10
AF121	0.56
AF124	0.42
AF125	0.58
AF126	0.58
AF127	0.38
AF139	0.40
AF178	2.28
AF239	0.50
AF279S	1.40
AL100	5.40
AL102	4.40
ASY80	5.20
ASZ17	2.00
AU110	2.80
AY102	4.40
B40C200	1.03
BA110	0.68
BA115	0.14
BA121	0.40
BA129	0.38
BA148	0.16
BA155	0.12
BA157	0.28
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12
BC108	0.10
A,B or C	0.13
BC109	0.10
A,B or C	0.14
BC113	0.42
BC115	0.12
BC116	0.12

Type	Price (£)
BC117	0.22
BC118	0.16
BC119	0.28
BC125	14
BC140	0.27
BC141	0.24
BC142	0.24
BC143	0.26
BC147	0.18
BC147B	0.14
BC148	0.10
BC148B	0.12
BC149	0.10
BC149C	0.14
BC157	0.10
BC158	0.12
BC159	0.12
B/C	0.14
BC160	0.30
BC161	0.30
BC168B	0.20
BC169C	0.12
BC170	0.16
A B or C	0.16
BC171	0.10
A or B	0.10
BC172	0.12
B or C	0.12
BC177	0.24
A B or C	0.24
BC182	0.10
A,B or C	0.10
BC182L	0.12
LA LD LC	0.10
BC183	0.10
A B or C	0.10
BC183L	0.10
LA LB LC	0.10
BC184	0.10
A B CL LC LB	0.10
BC207	0.15
BC212	0.10
A B or C	0.10
BC212L	0.09
LA LB	0.10
BC213	0.10
A B or C	0.10
BC213L	0.10
LA LB LC	0.10
BC237	0.11
BC238	0.12
BC251	0.14
A B	0.14
BC262	0.20
A B	0.28
BC301	0.30
BC302	0.30
BC303	0.30
BC307A	0.18
BC317A	0.12
BC323	0.90

Type	Price (£)
BC327	0.16
BC328	0.16
BC337	0.12
BC338	0.12
BC350A	0.24
BC351	0.16
BC440	0.36
BC441	0.40
BC461	0.58
BC478	0.24
BC516	0.48
BC547	0.12
A or B	0.10
BC548	0.12
A B or C	0.10
BC549	0.10
A or B	0.10
BC550	0.10
A or B	0.10
BC557	0.10
BC558A	0.10
BCY70	0.16
BCZ10	3.21
BCZ11	2.60
BD124P	0.70
BD129	0.90
BD130Y	0.68
BD131	0.36
BD132	0.36
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.28
BD142	1.26
BD145	1.82
BD150A	0.72
BD160	1.58
BD165	0.45
BD183	0.70
BD201	0.52
BD202	0.57
BD204	0.50
BD222	0.80
BD225	0.40
BD232	0.45
BD234	0.30
BD235	0.30
BD236	0.38
BD237	0.38
BD410	0.76
BD434	0.58
BD438	0.58
BD439	0.85
BD441	1.00
BD507	1.05
BD520	1.20
BD687	0.88
BD707	0.88
BDX18	1.00
BDX32	1.48
BF115	0.32

Type	Price (£)
BF117	0.50
BF119	0.82
BF120	0.38
BF125	0.42
BF127	0.41
BF154	0.14
BF157	0.46
BF158	0.30
BF160	0.23
BF167	0.32
BF177	0.42
BF178	0.26
BF180	0.27
BF181	0.27
BF182	0.32
BF183	0.32
BF184	0.30
BF185	0.28
BF194A	0.15
BF195	0.12
BF200	0.30
BF222	0.38
BF224	0.16
BF224J	0.20
BF240	0.30
BF241	0.30
BF244	0.34
BF244A	0.30
BF257	0.22
BF258	0.26
BF259	0.30
BF262	0.34
BF263	0.38
BF270	0.30
BF271	0.28
BF273	0.22
BF274	0.34
BF294	0.46
BF336	0.32
BF337	0.28
BF338	0.28
BF355	0.37
BF363	0.35
BF367	0.24
BF371	0.27
BF422	0.20
BF450	0.38
BF457	0.36
BF458	0.37
BF459	0.35
BFR51	0.36
BFR61	0.32
BFR90	0.86
BFT41	0.68
BFT43	0.86
BFW11	0.84
BFW44	0.88
BFX29	0.28
BFX48	0.78
BFX80	6.46
BFZ85	0.35
BFY50	0.22
BFY51	0.22

Type	Price (£)
BFY52	0.22
BFY90	0.80
BFY90S	1.34
BR100	0.25
BR101	0.40
BR103	0.50
BR303	2.75
BRY39	0.50
BRY56	0.42
BSX19	0.32
BSX20	0.30
BSX59	0.78
BSX76	0.65
BSY52	0.35
BSY95A	0.25
BT100A/02	0.90
BT101/300	2.75
BT101/500	3.25
BT102/300	3.60
BT106	1.15
BT108	1.25
BT109	1.15
BT116	1.20
BT119	3.30
BT120	3.50
BT121	2.99
BT138/600	1.30
BT151/560R	0.90
BTY79/400R	2.80
BU100A	2.30
BU104	1.80
BU105	1.20
BU105/02	1.55
BU108	1.75
BU124AE	0.98
BU126	1.40
BU133	1.90
BU204	1.30
BU205	1.30
BU206	1.50
BU208	1.40
BU208A	1.40
BU208/02	2.05
BU326S	1.75
BU407	1.10
BUX80	3.70
BUY20	2.75
BUY69A	2.60
BUY69B	1.98
BY100	0.80
BY103	0.50
BY122	0.60
BY126	0.10
BY127	0.08
BY133	0.06
BY135	0.35
BY164	0.45
BY179	0.56
BY182	0.80
BY184	0.38
BY187	0.65
BY189	6.75
BY198	0.64

Type	Price (£)
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/600	0.24
BY210/800	0.28
BY227	0.22
BY228	0.46
BY238	0.65
BYX10	0.20
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/600	0.30
BYX71/600	1.18
BYZ12	0.78
C106D (400V)	0.48
C106F (50V)	0.36
D40C1	1.08
D40N1	1.12
E1222	0.30
E5024	0.30
GET872	0.60
GET881	1.70
GET882	1.90
ITT2001	0.18
ITT2003	0.34
MCR106/5	1.20
ME0413	0.70
ME6002	0.26
MEU21	0.62
MJ400	0.45
MJ2955	1.00
MJ3000	1.80
MJE340	0.46
MJE520	0.44
MJE2955	1,60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSLO1	0.34
MPSUO5	1.05
MPSUO6	1.18
MR502	0.40
MR854	0.88
OA91	0.07
OA210	0.66
OC26	2.65
OC35	4.75
OC36	1.75
OC44	0.72
OC72	0.70
OC81	0.68
ORP12	0.85
R2008B	1.20
R2010B	1.20
R2540	2.71
TIC45	0.45
TIC47	0.70
TIC29	0.30
TIP30A	0.32
TIP31C	0.39
TIP32	0.35

Type	Price (£)
TIP33A	0.55
TIP34A	0.70
TIP41C	0.42
TIP42	0.44
TIP47	0.42
TIP121	0.63
TIP2955	0.70
TIP3055	0.58
TIS43	0.88
TIS88	0.50
TIS90	0.27
TIS20	2.45
Y728	0.14
Y969	2.80
ZE75	0.60
ZTX107	0.14
ZTX502	0.22
IN4001	0.04
IN4003	0.05
IN4004	0.05
IN4006	0.07
IN4007	0.07
IN4148	0.04
IN5400	0.12
IN5402	0.13
IN5405	0.16
IN5406	0.17
IN5408	0.19
IS44	0.06
IS920	0.07
2N1306	1.42
2N2122A	0.34
2N2222	0.30
2N2904A	0.48
2N2926G	0.14
2N3053	0.30
2N3054	0.60
2N3055	0.65
2N3703	0.10
2N3773	2.80
2N3904	0.20
2N3906	0.20
2N5294	0.80
2N6107	0.80
2SB337	1.80
2SC1098	0.84
2SC1172Y	1.70
2SC1173Y	0.88
2SC1279	0.50
2SC1306	0.92
2SC1307	1.50
2SC1413A	2.70
2AC1449	0.60
2SC1507	0.60
2SC1678	1.00
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC21953	0.70
2SC1957	0.70
2SC1969	2.80
2SC2028	0.73

Type	Price (£)
2SC2029	2.70
2SC2078	1.05
2SC2091	0.70
2SC2098	2.90
2SC122A	3.20
2SC2314	0.80
2SC2335	1.50
2SK135	3.80
3N211	3.52
3SK88	0.60
3SK88L	0.80
40636	1.65
40673	1.80

74LS

Type	Price (£)
74LS00	0.24
74LS01	0.24
74LS02	0.24
74LS03	0.24
74LS04	0.24
74LS05	0.24
74LS08	0.24
74LS09	0.24
74LS10	0.24
74LS11	0.24
74LS12	0.24
74LS13	0.33
74LS14	0.48
74LS15	0.24
74LS19	0.44
74LS20	0.24
74LS21	0.24
74LS22	0.24
74LS24	0.28
74LS26	0.24
74LS27	0.24
74LS28	0.24
74LS30	0.24
74LS32	0.24
74LS33	0.24
74LS37	0.24
74LS38	0.24
74LS40	0.24
74LS42	0.50
74LS47	0.79
74LS48	0.85
74LS51	0.24
74LS55	0.24
74LS73	0.30
74LS74	0.33
74LS75	0.44
74LS76	0.38
74LS83	0.88
74LS85	0.82
74LS86	0.35
74LS90	0.48
74LS91	0.90
74LS92	0.54
74LS93	0.54
74LS95	0.60
74LS96	1.20
74LS107	0.40
74LS109	0.44

Type	Price (£)
74LS112	0.44
74LS113	0.40
74LS114	0.39
74LS122	0.68
74LS123	1.00
74LS124	1.15
74LS126	0.50
74LS132	0.60
74LS135	0.26
74LS136	0.42
74LS138	0.44
74LS139	0.58
74LS145	0.93
74LS147	1.64
74LS148	1.28
74LS151	0.70
74LS153	0.70
74LS155	0.55
74LS157	0.45
74LS158	0.58
74LS160	0.62
74LS161	0.68
74LS162	0.70
74LS163	0.68
74LS164	0.74
74LS165	1.10
74LS166	1.50
74LS168	1.48
74LS170	1.40
74LS173	0.98
74LS174	0.75
74LS175	0.70
74LS190	0.82
74LS192	0.98
74LS193	0.98
74LS194	0.75
74LS195	0.74
74LS196	0.84
74LS197	0.96
74LS221	0.85
74LS240	0.80
74LS241	0.80
74LS242	0.94
74LS243	0.94
74LS244	0.80
74LS245	1.20
74LS247	1.00
74LS251	0.75
74LS257	0.73
74LS258	0.75
74LS259	1.20
74LS266	0.55
74LS237	1.20
74LS279	0.70
74LS283	0.80
74LS353	1.10
74LS365	0.50
74LS366	0.50
74LS367	0.50
74LS368	0.50
74LS373	1.00
74LS374	1.00
74LS375	0.70

EAST CORNWALL COMPONENTS
119 HIGH STREET
WEM
SHROPSHIRE SY4 5TT TEL: 0939 32689
TELEX: 35565

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Long-term Strategies

It is quite common to hear criticism of city institutions and large firms for failing to take a long-term view of investment. The argument is that when a quick return on investment is the prime aim long-term industrial development will suffer and we shall all end up the poorer. Investment is seen as a good thing that should be encouraged, undertaken with long-term developments in mind and maintained despite market hiccups. Well yes, but one must also acknowledge that long-term investment and research are very difficult things to control and that they require the discipline of constant economic monitoring. Some research programmes can and have in the past got out of control, developing a momentum of their own that has eventually led to the creation of a white elephant – aptly described recently by Karl-Erik Sahlberg (see below) as "a magnificent product that is hopeless to market".

In practice terms like investment and research cover a vast number of very different things. The development of a new aeroplane engine or main-frame computer requires long-term commitment indeed. But few firms are engaged in activities of this sort. At the other end of the scale the practical development of a simple idea can produce a very quick return. Such investment is often into ways of making things rather than in scientific research.

Our own industry highlights the divers results of research and investment. Perhaps the most profound discovery was of the bipolar transistor effect. The extraordinary thing is that it was discovered by accident, which seems to suggest that commitment to long-term research is a wise course on the ground that something is bound to turn up eventually! Well maybe, but spotting a significant discovery and exploiting its potential is the vital thing.

The world of TV displays a more purposeful approach to what research and development can achieve. The famed development of a complete TV system by EMI-Marconi in the early thirties occurred within a very brief span of time. When one looks at the history of the period however one sees that many people worldwide were working along similar lines. The c.r.t. had been in existence in primitive form since the end of the nineteenth century, which also saw the discovery of photosensitive materials. Someone was bound to come up with a working photosensitive electron tube before long. The problem at that time was not so much any lack of ideas so much as sheer shortage of money in a period of acute economic depression. Basic TV, and radar for that matter, are two results of effective research that developed from an idea to its practical realisation very quickly. More recently the development by the Japanese of domestic VCR systems is another example of applied research producing quick results. It can be done: the problem is in getting it done.

The British Association's annual meeting, held recently, had as its main theme putting science to work. Many speakers were concerned with the relationship between commercial firms and the research activities of the educational institutions. GEC's chief scientist Dr Cyril Hilsum stressed the importance of market research in innovation, something at which our Japanese competitors have always been particularly good. One of the factors that has underpinned electronic development has been research into materials. The development of the VCR depended on suitable tape becoming available, and solving that problem took a great deal longer than devising the mechanics and circuit techniques. The problem with early camera tubes was the lack of a suitable target material. Materials technology has of course been vital to semiconductor development, also to such things as producing mechanical parts with the best characteristics. But few firms carry out much research on materials. This area tends to be the preserve of academic research.

Much was made at the BA meeting of problems in this area, of the need to link universities and industries in common innovative objectives (Cyril Hilsum again) and of the need for research to be interdisciplinary (Professor Gareth Roberts, chief scientist of Thorn EMI). These are old problems that still seem to block innovative progress. Gareth Roberts commented on the need to restructure science research funding and on authorities being "too compartmentalised and wedded to a peer review system that's inherently weak at exploiting the interfaces between sciences". The BA's president, Professor Sir Hans Kornberg, spoke of the need for scientists in industry to become involved with research in universities at an early stage and to blur the distinction between "basic" and "strategic" research.

The problem of getting things right, i.e. of short-, medium- and long-term strategies, in research and innovation, lies not only in the provision of funds therefore, i.e. the traditional criticism made of the city. There's the problem of whether industry can make the best use of academic research and how the latter should respond to industry's needs; also the problems of the best use of available funds and how to monitor progress. It's interesting that in a recent interview with the *Financial Times* Karl-Erik Sahlberg, managing director of the Swedish firm Perstorp, reported that his firm had closed down its central research and development unit in 1971, each separate business area instead being responsible for its own R and D work and for keeping its researchers close to its marketing staff.

There's little doubt that the control of research and innovation is a difficult and demanding business. One thing that's certain is that simply pouring more money in, as is so often advocated, is no solution at all. The vital element (Karl-Erik Sahlberg again) is "to find the right people to manage innovation projects". Also, one might add, to keep long-term strategies under continuous review and retain maximum flexibility so that opportunities can be seized as they arise.

COVER PHOTO

Four generations of field output device are shown in our cover photograph this month. Taking us way back is a Cossor 61BT output tetrode with international octal base. Still with us is the PCL805 field timebase triode-pentode. A pair of BD124s, on the heatsink used in the Pye 697 chassis, represents early transistor practice. In the forefront an SGS TDA1670 provides almost a complete field timebase in i.c. form.

HELP!

Can anyone assist with a source of spares/service information on another obscure make of colour portable – Contec? We've received several requests for this information.

CORRECTION

The international video camera market survey published by Euromonitor, mentioned in Teletopics last month, costs £250 not £25.

Quick Checks: Rank A823 and Pye 725 Chassis

S. Simon

We have received comments recently to the effect that we ought to mention more of the older models. After all they're the ones that are more likely to require attention, and the right approach is required to save time and patience. One chassis mentioned is the still popular Bush A823 series (Model CTV1122 etc.), so we'll kick off with this.

RANK A823 SERIES

No Sound or Raster

In the event of no sound or raster one should first appreciate that whilst a conventional thyristor regulated power supply circuit is used to provide the h.t. line most sections of the receiver, including the line driver stage, are operated from l.t. lines derived from the mains transformer at the bottom left-hand side. Hence lack of sound and a picture could well be the result of l.t. supply failure. As a first step, a glance at the rear of the tube will show whether the transformer is being supplied. If the tube's heaters are out, make your first voltage check at the h.t. fuse at the top of the panel (630mA, anti-surge). If 200V is recorded here, you know that the mains supply is intact, including the 3·15A anti-surge (5A on early models) mains fuse at the bottom of the panel. Thus if the tube's heaters are out but h.t. is present either the mains transformer isn't being fed or (very rarely) it's defective. In this event look for a floating line fuse in the feed to the transformer. Most versions don't have this extra fuse but if the tube's heaters are out the chances are that the set does have it. It has a low-current rating – 315mA maximum.

If the tube's heaters are glowing the transformer is functioning and the chances are that the 2A l.t. fuse (anti-surge again) midway on the rear edge of the power board has failed. If this is so, don't replace the fuse until the circuit has been checked for shorts. The usual failure is a faulty bridge rectifier which may consist of a single unit or four separate diodes. In the latter case you may well find that two are short-circuit – BY126 diodes can be fitted. If you find a short-circuit single unit a BY225 can be used as the replacement. There can be many other causes of l.t. fuse failure of course, but the usual one is a shorted bridge.

Sound but no Raster

With the sound present but no raster symptom you know immediately that the transformer is functioning and therefore (you hope) the tube's heaters are glowing. So the fault is probably in the h.t. supply, and this is where most confusion seems to arise. Check for 200V at the top fuse. If there is h.t. at one end only it will be necessary to check for shorts. Before diving into the line output stage – disconnecting the tripler etc. – check under the centre section where you will find that a 47kΩ resistor is wired across the tags of both electrolytics. These resistors are included to render the circuit stable and safe in the event of an open-circuit. They deteriorate with age and heat however and often decrease in value, getting lower until the rush of current completes their demise and blows the h.t. fuse. Check these points. Incidentally, the connections to the tripler are plugs so disconnection is simple indeed – just pull out the rear end plug to leave the line output transformer unloaded. But we digress: back to the power supply.

If the fuse is intact but there's no h.t. present, check that a.c. is reaching the anode of the thyristor (body of the BT106). If 240V a.c. is present here, switch off and check the continuity of the wirewound resistors under the centre section in front of the electrolytics. The left side one (h.t. smoothing) is suspect and should read 68Ω. If this is open-circuit the thyristor will not be triggered and no h.t. will be produced. A replacement resistor must be rated at 20W or more and the contacts must be mechanically sound – a dab with the soldering iron will not do as considerable heat is dissipated.

If there's no a.c. on the body of the thyristor it's highly likely that the VA1104 thermistor, a disc type on the lower part of the panel next to the degaussing thermistor, has deteriorated – perhaps to the point where the disc has parted company with the contact wires and has dropped out. It's common practice in some quarters merely to twist the wires together, thus leaving out the surge limiter. This is not the correct action: a new thermistor should be fitted to preserve the life of other components. If the thermistor is intact, or replacement still leaves the thyristor without a.c., check the continuity of the tracks to and from the thermistor – they could have burnt away, though this should have been seen when the thermistor was replaced.

What if the h.t. supply is in order and there's sound but no raster? Remember what we said about the l.t. supplies. Check the condition of 8R2 at the upper left of the power panel. This 6·8Ω wirewound resistor supplies the line oscillator and driver stages. If it's cold it could be open-circuit and replacing it could restore normal results. If the new resistor runs hot or the original one is found to be running hot suspect the BD131 line driver transistor – on the right side of the timebase board, bottom right. Fit a new one with heatsink washers or a frame to dissipate the heat if a heatsink isn't fitted.

If the line drive is in order, remove the line output stage cover and hold a neon near the transformer. If it lights up, the line output stage is probably in order and the tube base voltages should be checked (if this has not already been done). The first anode voltages on the tube base give a good indication as to whether or not the line output stage is working.

If the neon doesn't light up, first try disconnecting the tripler to see what effect this has. If it makes no difference, check the h.t. voltage on the body of the line output transistors. If h.t. is present on one only, switch off and prepare to remove the timebase panel to gain access to the reverse side of the output transistors (remove small panel). There should be a very low resistance reading between the base and emitter of each transistor due to the presence of the secondary windings on the driver transformer and two low-value resistors. A reading of just below 10Ω suggests that the associated 2·2Ω series resistor is open-circuit – remove and check it.

If you suspect that the set has been tampered with, check the setting of the overvoltage preset on the timebase panel – 5RV1 in the A823 chassis, 5RV5 in the A823A chassis. If in doubt, set this midway.

Rapid fluctuation of the picture size is often due to a faulty item on the power supply panel. The BT106 thyristor is the usual culprit, though the BR100 trigger diac can also be responsible. It cannot be measured: if a replacement is not to hand, removing it and reversing its connections could solve the problem, i.e. try turning it round.

There are many other common faults we could discuss, but the aim here is to outline quick steps to take to deal with basic fault conditions.

No Colour

We will however discuss one other common problem since the following points could save much time and worry. In the event of no colour the tendency is to rush to the decoder panel and accuse the SL917 i.c. (on later panels – earlier ones used discrete circuitry in this area, i.e. just one i.c. instead of two) of causing the trouble. The correct procedure is first to check on the upper left side of the i.f. panel, where the chroma amplifier resides. On the later models there's a small preset control adjacent to the amplifier's screening can. This is often the cause of the trouble – it may need only a clean and adjustment. If the preset is not at fault, remove the screening can and check the three transistors (two BC148s and one BC158) in the usual way. The small round types are more suspect than rectangular ones. If all is well here move over to the decoder panel and check the SL917's voltage supply which comes from the BC148 emitter-follower 3VT2. Check this transistor if necessary. If the voltages are present the SL917 may be suspect, but check the other transistors on the panel first as one or two of these can give trouble and the SL917 is an expensive item compared to say a BC148. Note that in the earlier A823 chassis, which does not have the preset next to the chroma amplifier can, the transistors within the can are two BC148s and a BF197 (no pnp transistor).

PYE 725 CHASSIS

This chassis is used in the Pye Models CT222, CT223 etc. We mentioned it briefly in the first article in this series (July) but only to illustrate a point or two. It's worth making some general points.

Power Supply Faults

Most problems centre around the power supply board on the lower right side. To obtain access, remove the top strap (if still fitted), raise the bottom latch and slide out the vertical panel containing the field output (upper) and power supply (lower) boards. When the panel has been withdrawn a certain way it can be rotated to provide access to both sides. This enables the 3·15A mains fuse F913 to be replaced if necessary, also possibly the mains filter capacitor C915 which often goes short-circuit, leaving the fuse with a distressed appearance (if the glass is left intact that is). Replace the fuse with the normal 3·15A anti-surge type and the capacitor with an 0·22μF type rated at 1kV or 300V a.c.

If there's no sign of life but the mains supply is clearly in order check that a.c. is present at the anode of the mains rectifier thyristor. The input choke L909 often works itself loose on the print, as do the main electrolytics – a check on these points will often pay dividends.

If the a.c. is reaching the thyristor but this is not being fired check the condition of the two 82kΩ charging resistors R898/899. These tend to deteriorate and go open-circuit. If these are in order, switch off and check the conditions of the centre section dropper elements – the 3·3Ω section R978 often goes open-circuit to produce the dead set symptom and your search will often end here.

If the droppers are intact go back to the power supply and carry out a general check on the transistors, resistors, zener diodes etc. The preset controls should also be checked to ensure that they are intact and don't have a dud spot where the wiper contacts the track.

You will often find that the h.t. supply is all right but the h.t. fuse F971, on the centre section, is open-circuit. Remember what we said before, because this can be difficult. Check the 0·1μF, 1·25kV capacitor C563, which lives under the top of the line output section, first. This may save a lot of heartache and unnecessary replacement of the tripler etc. On the other hand it may already have ruined the tripler, the transformer and the BU208.

Thick Film Unit

The other weak spot in this chassis is at the top of the left side signals panel. The thick film unit resides here – it's an angled metal structure which contains the load resistors for the RGB output stages and the feedback resistors. If there's no voltage here check R476 (47Ω) to the left of the unit. This is the h.t. feed resistor and may be found open-circuit. Normally h.t. will be found at the body of the unit. If the voltages at the collectors of the three BF336 transistors are not roughly equal, first check the TBA530Q i.c.'s 39kΩ output load resistors R474/R458/R442. If these are in order, remove and check the thick film unit. The act of removing it may complete its demise, leaving no choice other than replacement.

Grainy Picture

We should also mention the other trouble spot in these sets – the i.f. gain and filter unit. This is the screened unit at right angles to the tuner on the lower part of the left side. The faults that occur tend to throw suspicion on the tuner, producing as they do the grainy, weak reception typical of a faulty tuner. It's a fairly easy matter to unsolder the pins and remove the unit. This done, concentrate on the input end. Carefully resolder the coil ends and remake all the soldered joints, carefully lifting the small capacitors to ensure that the solder is in contact with the leads. The unit can then be refitted with a good chance that all will be well and that the trouble will not recur. On the rare occasions when this does not produce the desired result the tuner may after all be at fault – or a second attack on the gain/filter unit may be required.

The Moral

These various points show that each type of TV chassis calls for a different approach even though the symptoms or the reported faults may appear to be the same. Next month we'll outline the approach required to deal with some of the hybrid CTV chassis, many of which are still in constant use and seem to confuse younger engineers.

Test Report: MiniScope Soldering Iron

Eugene Trundle

Up to now I've known only two basic types of electric soldering iron for radio/TV work: the gun type, in which the bit is part of a loop incorporating the secondary winding of a mains transformer; and the conventional type, which contains a resistive heating element to raise the temperature of the bit. In the latter type, the bit acts as a heat reservoir, interfacing the varying load presented by the soldering job (in terms of duty cycle and thermal suck-out) and the steady heat output from the element, which is typically rated at about 25W.

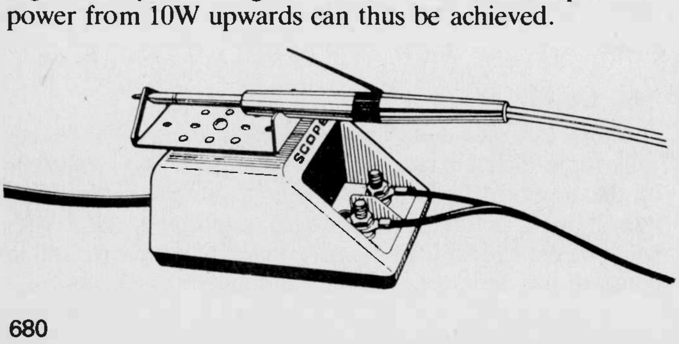
Unless the iron is thermostatically or thermomagnetically controlled, the bit temperature depends very much on circumstances – it stabilises when the heat gained from the element equals the heat lost by radiation and convection from the bit. This is fine for light work, but there can be a tendency to run out of steam as it were during prolonged operation on heat-hungry components such as screening cans.

As a result it's been necessary to have available two or more soldering irons to cater for the variety of work we encounter – typically a small-bit, 15-25W type for PCB and light applications and a 60W gun for use where heatsinks, screening cans and the old-fashioned metal chassis have to be tackled. A thermostatically-controlled iron has a wider range of applications, but again a single type is unlikely to cover all requirements.

Enter the MiniScope

The Australian manufactured Scope iron uses a principle of operation that's totally different from those described above. Instead of storing heat in the bit, this design develops heat energy within a very small bit assembly that's intended purely as a heat conductor. It works as follows. A voltage of around 4V, a.c. or d.c., is applied between the body of the iron (including the copper bit) and an insulated central stem which moves axially along the centre of the barrel. The stem is spring-loaded and has a small plug of carbon at its front end. When the operating lever is depressed this plug is pushed into contact with the rear face of the copper bit. The contact resistance depends on the physical pressure: the current flow can reach 20A, giving a capability of around 70-80W.

As can be imagined, having a dissipation of this order in a bit with a volume roughly equivalent to a matchstick can be dramatic. If the operating lever is held down without any thermal load for the bit you'll have a red hot bit in eight seconds! In practice the effective dissipation is regulated by "dabbing" the control lever. An equivalent power from 10W upwards can thus be achieved.



The iron is supplied with about a one and a half metre length of heavy-duty twin cable with eye terminations. These bolt to the terminals of the mains power supply unit, which consists of a transformer housed in a smart orange case with a metal holder for the iron on top. The transformer provides a "floating" supply of 3·3V r.m.s., 30A intermittent rating.

On the Bench

I used the MiniScope iron exclusively for all TV, video etc. bench work for some weeks. It took three-four seconds to reach the operating temperature, and I was amazed at its thermal capacity – I could use it to solder a large bracket to the body of an ELC1043 tuner and to deal with very heavy copper heatsinks such as those used on sound and field output chips etc. I've no doubt that it would be well able to tackle tinplate, brass and copper assembly work at up to reasonable sizes – s.h.f. plumbers take note!

At the other end of the scale, the tiny pointed bit was equally capable of dealing with i.c. leadouts on PCB assemblies, though it's necessary to maintain a suitable temperature by dabbing the operating lever – I found that with the iron too hot the print tends to lift from the PCB surface rather than component damage occurring.

At one point the gorgeous lady presenter of a children's programme on a soak-testing TV set (Louise H.T. for those who know her) attracted my attention and I went into a daydream with the lever pressed down. This resulted in virtual collapse of the bit. Apart from this episode I got on well with the iron, and it with me . . .

It was difficult in the time I had during the trial to gauge the life of the bit and the carbon-block element. There's no doubt that the latter will need replacement more often than the element in a conventional iron. At 75p plus VAT each however bit and element expenses won't break the bank.

Conclusion

The iron is very versatile and easy to use once the "switch-mode" technique of temperature control has been mastered. I was impressed by the range of jobs it can tackle – a unique feature in my experience. Some colleagues expressed concern at the exposure of the output terminals at the front of the mains unit, not from the point of view of shock hazard but because of the danger of a conductive object accidentally short-circuiting them. I found that the moulded side and centre shields provided adequate protection against this possibility, but perhaps a cover flap would have been a good idea: it's not too difficult to devise a suitable shroud if required.

The price of £21 for the iron and £16·15 for the power supply gives a total of £37·15 plus VAT. Certainly the ensemble would be worth this to most potential users, but I wouldn't be happy about any higher price!

The MiniScope is available from SEME Ltd., Units 2E and 2F, Saxby Road Industrial Estate, Melton Mowbray, Leics LE13 1BS (0664 65392).

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AC131	40	BC177	24	BCX34	11	BF179	32	BFR87	25	OT121	2.08
AC138	40	BC182LB	12	BD115	49	BF180	33	BFR90	1.74	R1038	80
AC141K	39	BC183L	12	BD131	30	BF181	30	BFR91	2.08	R1039	80
AC142K	38	BC184L	13	BD132	46	BF184	30	BFT42	30	R2008B	1.40
AC153	39	BC187	24	BD133	59	BF185	30	BFT43	30	R2010B	1.10
AC176	33	BC204	15	BD139	36	BF194	16	BFX38	40	R2030	70
AC176K/		BC208	9	BD140	38	BF195	16	BFY50	30	R2265	1.30
AC128K	93	BC212L	9	BD144	1.70	BF196	16	BFY51	34	R2305	80
AC188	38	BC213L	12	BD150	50	BF197	15	BFY52	34	R2322	50
AD142	1.18	BC237	12	BD163	98	BF198	19	BRC116	1.50	R2443	25
AD143	1.08	BC238B	8	BD201	74	BF199	15	BRC1693	1.43	RCA16446	30
AD149	98	BC238L	8	BD203	78	BF223	18	BU105	1.00	RCA16599	1.25
AD161	32	BC250A	15	BD204	99	BF224	19	BU126	1.10	RCA16600	1.40
AD162	32	BC251	8	BD222	48	BF238	20	BU207	1.05	RCA16799	1.13
AD263	1.05	BC252A	20	BD225	52	BF240	9	BU208	1.15	RCA16800	1.42
AF127	45	BC294	37	BD232	50	BF241	21	BU208A	1.15	RCA16802	1.38
AF139	38	BC301	32	BD233	60	BF255	10	BU326A	1.30	RCA16815	1.20
AF239	41	BC303	31	BD234	60	BF256LB	38	BU407	1.70	SP8385	2.65
BC107	15	BC307	10	BD237	55	BF256S	20	BU408	2.76	S1299	2.25
BC108	15	BC308	8	BD238	65	BF257	28	BU500	2.30	S28000	1.25
BC109	15	BC309	14	BD241	59	BF259	28	BU526	2.46	T6050V	1.30
BC115	16	BC327	18	BD244	85	BF271	25	BU806	1.80	T6052V	1.30
BC117	21	BC328	18	BD278A	81	BF274	11	BU807	2.94	T9003V	1.25
BC125	26	BC337	17	BD386	68	BF337	29	C1129	9	T9010V	1.45
BC126	23	BC338	17	BD433	71	BF338	34	C1172B	9	T9053V	1.30
BC139	27	BC347	8	BD437	83	BF355	40	E5386	54	T9054V	1.00
BC141	34	BC394	8	BD592	1.20	BF362	50	E9003	28	T9039V	1.10
BC142	30	BC454	8	BD589	1.20	BF391	21	E9005	25	TIC45X	50
BC143	31	BC455	8	BD677G	1.35	BF394	16	ME0404	10	TIC46	48
BC147	12	BC456	10	BD679	1.42	BF422	47	ME0412	10	TIC106C	40
BC148	12	BC460	40	BD701	1.04	BF423	53	ME6002	10	TIP29	42
BC149	12	BC463	22	BD702	1.12	BF450	43	MJ2501	2.36	TIP30	42
BC153	16	BC546	8	BD707	95	BF453	53	MJ3001	2.21	TIP31	35
BC1540R	16	BC547	12	BD708	95	BF458	37	MJE340	50	TIP32	43
BC154YL	16	BC548	12	BD839	1.30	BF459	40	MJE520	50	TIP33	61
BC157	12	BC549	8	BDX10	93	BF461	59	MJE2955	1.40	TIP41	42
BC158	12	BC557	10	BDY20	1.09	BF556B	35	MJE3055	1.50	TIP42	45
BC159	15	BC558	10	BDY82	99	BF596	15	NKT241W	8	TIP110	61
BC171	9	BC559	8	BF137	20	BF694	16	NKT241G	8	TIS91	25
BC172	9	BC595	8	BF153	20	BF757	62	NKT241Y	8	ZTX550	30

INTEGRATED CIRCUITS

				TBA530	1.26	TDA2030	2.10
BRC1330	1.40	SN76013ND	1.80	TBA540	1.00	TDA2522	2.10
BRC3064	1.00	SN76023N	1.80	TBA550Q	1.82	TDA2530	2.61
BRC/M/200	1.00	SN76033N	2.00	TBA560C	1.50	TDA2540	3.50
BRC/M/300	1.00	SN76115	2.00	TBA641	2.05	TDA2560	3.50
CA3060	1.58	SN76131N	1.58	TBA651	2.50	TDA2581	3.00
LM1303P	1.48	SN76226N	1.25	TBA720A	2.49	TDA2591	1.96
ML231B	2.20	SN76227N	1.00	TBA750	2.20	TDA2611A	1.95
ML237B	2.00	SN76530P	1.30	TBA800	1.62	TDA2640	2.90
ML239B	2.86	SN76622N	1.00	TBA810S	1.00	TDA2690A	1.50
MC1327AP	1.25	SN76660N	80p	TBA810AS	1.00	TDA3560	6.00
MC1358P	1.30	SN76666N	75p	TBA920	2.08	TDA4500	5.40
MC1455P	18p	SN76744	1.92	TBA950	2.54	TDA9503	2.90
MC14516BCP	60p	SY153A	2.50	TBA1440	1.92	TCEP100	3.48
SAA1025	7.20	TA7117P	1.00	TCA270SA	1.05	TEA1009	1.95
SAA1124	4.50	TA7109AP	2.80	TCA270C	1.05	MC14426P	4.80
SAA5010	6.00	TAA611	1.40	TCA270CQ	1.05	MC14429P	4.50
SL432A	1.80	TBA120B	1.20	TDA1035T	3.50	MC14514	5.00
SL1430	2.50	TBA120C	1.20	TDA1037	2.72	UA758PC	2.50
SL1432	2.50	TBA120CQ	70p	TDA1170	2.15	UAA1008A	2.66
SN15846N	60p	TBA120S	70p	TDA1170S	1.76	ULN2165	1.30
SN74123N	65p	TBA120U	1.00	TDA1200	2.42	ULN2216A	1.25
SN74154N	1.40	TBA395	1.00	TDA1270	2.76	UPC1365C	5.75
SN76001N	1.40	TBA480Q	1.40	TDA1327	2.53	SC9488P	1.40
SN76110N	1.14	TBA510	1.90	TDA2002	2.80	SC9511P	1.40
						SW153	2.50

Thorn 8/8K5 ex equip panels untested

PSU	2.88
FTB	3.75
Decoder	4.00

Thorn 9K ex equip panels untested

PSU	12.00
Decoder	5.00

Thorn 9K6 ex equip panel untested

Decoder	5.75

Thorn 3/3K5 ex equip panels untested

PSU	3.75
LTB	3.75
Video	2.50
Chroma	2.00
FTB	2.75
IF	1.75
Conv. 3K	3.00
Conv. 3K5	3.75
Autovox Decoder FG/01 new boxed	5.00

Thorn 4000 Convergence panel ex-factory	3.75
Thorn 4000 PSU panel ex-factory	2.50
Thorn 3K5 beam limiter board new	1.75
Thorn 3/3K5. EHT & scan TX + R2008B on alum chassis ex-equip	1.80
Thorn 8/8K5 damaged FTB for spares	1.25
Thorn 8/8K5 damaged decoder for spares	2.25

UHF TV Aerial for portable Indoor Aerial With Reflector to Help Combat Ghosting Problems	2.50
Line Connectors	38p
Coax Plugs	10 for 1.65
Band Change Switch Assy, Pye 725	40p
Coax Cable Low Loss	per Metre 22p
Switched Flush Fitting Aerial Outlet	1.00

Pye 78+161	50p
Pye 147+260	50p
Thorn 56+1K+47+12	1.24
Thorn 50+40+1K5	60p
Thorn 128+16+1K7+116+462+126	50p
Thorn 120+72+300	50p
RBM 250+14+58 (TV161)	63p
Pye 3R5+15+45 (713)	90p
Philips 2R2+682	90p
Philips 47R	52p
Thorn 6+1+100	92p

Thermal Cut-Out

Thorn 3000 Metal	1.45
Thorn 8/8500 Plastic	1.45

EHT TRAYS

Thorn 3000	5.50
Thorn 8000	4.50
Thorn 8500	6.00
Thorn 9000	7.90
Thorn 9600	6.00
Thorn 900/950	1.50
Thorn 1500 3 stick	2.40
Pye 713 4 lead	5.83
Pye 713 5 lead	5.97
Pye 725	6.35
Decca Bradford	5.00
Baird 8750	7.10
Korting AZ9100	7.10
Philips G8 (520)	6.50
Philips G8 (550)	6.50
Universal	5.00

MULTISECTION CAPACITORS

220+47	350V	65p
200+150+50	350V	60p
200+200+100	325V	54p
32+32+16	275V	52p
200+200+100+32	350V	70p
100+50+150	350V	58p
400+400	200V	72p
32+32+16	350V	52p
200+32+300+100	350V	70p
225+25	350V	50p
200+200+100	350V	70p
200+100	325V	65p
200+100+100+50	350V	60p
200+200+100	350V	55p
200+200+75+25	350V	60p
50+50+8	300V	55p
100+50+100	350V	55p
100+150+50	350V	55p
2500+2500 (Thorn 8K)	63V	1.20
150+150+100	300V	1.80
200+47	250V	65p
500+500 175V Thorn TX9		1.00
175+100+100 350V Thorn 3K5		2.25
400 400V Thorn 9K		2.50
470 250V Weldel Type Philips G11		1.71

CAN TYPES

0.2MF 250V	50p	1250MF 40V	50p
2MF 250V	50p	1250MF 50V	50p
22MF 275V	50p	1500MF 100V	1.05
50MF 275V	50p	2000MF 30V	50p
100MF 150V	65p	2200MF 40V Thorn 4K	95p
100MF 250V	70p	2200MF 63V Philips G9	1.25
220MF 450V Thorn 4K	1.30	2500MF 35V	65p
400MF 350V Thorn 8K	1.00	2500MF 40V	65p
400MF 400V Thorn 9K	2.95	3000MF 30V	65p
800MF 250V	70p	3300MF 16V	50p
1000MF 100V Thorn TX90	2.90	3300MF 25V	60p
		4700MF 16V	72p
		4700MF 40V	75p

Thorn/Decca/GEC On/Off Switch. Push to make	75p
Philips G11 On/Off Switch. Push to make	75p
ITT CVC9 On/Off Switch + Relay	90p
Philips G8 On/Off Switch	75p
Thorn 3/3500 A1 Switch	50p
Thorn 4000 A1 Switch	50p
Korting Shift Pot 50Ω	65p
2·5A Push to make on/off switch	15p
Thorn TX90 On/Off Switch	1.85
10K Lin Pot. TX9/TX90	75p

DIODES

AA112	8p	IN4003	4p
AA119	8p	IN4004	5p
AA143	8p	IN4005	5p
BA115	8p	IN4006	5p
BA154	8p	IN4007	6p
BB103	8p	IN4148	2p
BB105B	30	IN4149	6p
BR103	52p	IN4742A	8p
BT106	1.50	IN5254B	8p
BT116	1.00	IN5349	14p
BT119	2.56	IN5400	12p
BT120	2.82	IN5401	12p
BT151 650	1.00	IN5402	14p
BY127	12p	IN5404	12p
BY188	16p	IN5406	16p
BY204	26p	IN5408	16p
BY206	16p	IS025	8p
BY207	16p	IS131	8p
BY208/800	38p	IS1658	8p
BY223	95p	MR854	35p
BY225	1.20	SKE1/02	20p
BY227	28p	MCR106/1	1.00
BY298	22p	MCR406	35p
BYX22/400	30p	2N4444	1.50
BYX55/600	30p	Y827	80p
BYX71/350	80p	Y969	75p
BZV15 C12R	1.16	ZX150	12p
BZV15 C24R	1.16	OA91	5p
IN60	8p	MCR106/7	1.00
IN2070	16p	MCR106/8	1.50
IN4001	4p	BY255	30p
IN4002	4p		

The Lid off Microcomputers

Part 6

Mike Phelan

From the servicing point of view microcomputer faults fall into similar categories to those experienced with other forms of consumer electronics equipment. A goodly proportion result from owner misuse in one way or another. This category includes mechanical damage (including spillage), operating errors, misuse of or faults in peripheral equipment, and defective software.

There's also a "grey area" where the user is trying to make the computer do, via his own software, things it was never intended to do. This may be due to a misunderstanding of the language dialect or maybe because the user is unaware of operating system changes that affect his programs, particulary those written wholly or partially in machine code. Dealing with this type of "fault" requires a fairly good acquaintance with the microcomputer concerned.

Taking mechanical damage first, in addition to obvious things like damaged plugs, sockets and edge connectors the keyboard is susceptible to spillage. The rubber membrane type, as used in the Amstrad CPC464, is fairly waterproof. If liquid gets on to one of the printed boards there can be a lot of trouble, especially if the machine is switched on before it has dried out. Spilt liquids can corrode the printed tracks, i.c. pins and holders, in which case a new board is the only cure. In less severe cases a good wash in warm soapy water, followed by thorough drying, may do the trick.

Peripheral failures can cause many problems. Monitor faults should be easy to diagnose (we'll discuss the Amstrad monitors next month).

Printer Troubles

Printer troubles can be mechanical or electronic. The latter usually show up when one of the bits of the parallel printer code is either missing or stuck at one or zero. Careful comparison between what's been printed and what should have been printed will usually pinpoint this. Don't forget that the cause of this sort of fault can lie in the computer's print latch or buffer – or the lead to the printer.

Cassette Failures

Cassette department failures probably account for more complaints than anything else, especially with first time users of a machine that doesn't have its own cassette recorder. The best way to illustrate what's involved is to list the requirements for the system to work – this application is far more critical than normal audio signal recording. To load and save software successfully we must have:

(1) Correct azimuth setting of the record/playback head.
(2) A clean head, tape transport system and a good h.f. response. Don't use a stereo machine.
(3) An undamaged tape, recorded at correct level on a machine with correct azimuth and a good h.f. response.
(4) The recording must start after the tape starts, otherwise information contained in the header will be lost.
(5) Correct playback level – this often means using the external speaker socket on the recorder rather than the "audio output" which is at a much lower level.

Attention to these points will eliminate most troubles. It's worth bearing in mind that there are recorders whose response has been tailored to make then suitable for computer use – other models can be given a slight h.f. boost by altering the values of feedback or equalisation capacitors. A good way to set the azimuth is to play a good commercial software tape and listen to the audio: the correct azimuth setting should be obvious and fairly critical.

Computer Faults

This leaves us with genuine microcomputer faults. Due to the operating principles, fault finding can be difficult – especially with intermittent faults or those of a thermal nature, since the symptoms may remain even when the fault clears.

Quite often a test ROM and/or test cassette is available from the manufacturer. This carries out a series of tests, maybe selected by the user from a menu. The test ROM takes the place of the normal one so it cannot test this, while a test cassette relies on the cassette interface working correctly.

Obvious faults would be things like malformed characters, e.g. the lower dot missing every time a colon is printed. Finding the cause may not be so simple however. Say the fault is in the ROM. At switch on the character set is loaded into the RAM so that the symptom would remain even if the ROM fault cleared as the machine warmed up. Alternatively the character location in the RAM could be corrupt, giving the same symptom except that in this case the contents could be put right by the user. One of the tests provided by a test ROM or tape is to fill every RAM location with ones and zeros and read these back. Any failure has its address displayed so that the i.c. concerned can be replaced.

CRTC failure affects the screen display, sync or blanking, or there may be failure to scroll or for anything to appear on the screen. With many microcomputers there's a faint, audible breakthrough from the speaker when a programme is running – almost like a repetitive tune. This can prove that the CPU is operating though the screen may be blank.

Failure of the operating system to get the computer going correctly can result in some strange errors that will persist even when the fault clears – until a complete reset is performed. A screen full of garbage could be the result of something like this, or of a missing or malformed system reset pulse at switch on. This type of fault often leaves the keyboard dead.

The Amstrad test ROM includes a very useful test of the cassette interface. It gives a display like a spectrum analyser of two groups of frequencies corresponding to ones and zeros. These should be in two well-defined groups, with not too many "stragglers" between – the latter would mean poor "eyeheight". Don't forget that in most programs there's at least one bit that if changed will cause a system crash (stop): this bit would coincide with a section of missing tape oxide or a crease. The result could be anything from premature finish of a game of Space Invaders to the loss of five years' household accounts.

The most critical part of a BASIC program consists of the byte(s) stored at the beginning of each line to show where the next line starts in the RAM. It needs only one of these links to be corrupt for the program from that point onwards to be lost. To explain this further, say the microcomputer in question fills its RAM with 01010101 at switch on then loads the operating system. All unused RAM will still contain 85 (01010101 binary). Lines of BASIC are stored with a zero to show the end of a line while the first two bytes in each line are the address of the start of the next line (link address). If one of these link addresses is corrupt (usually due to excessive playback level from tape) it will probably point to an unused section of RAM. As this will be taken as the next line, the link address for the following line will be #5555 (85, 85). So will the line number – it will be taken as 21845, i.e. (85 × 256) + 85. The line will be shown as a string of capital zeros (ASCII 85) – pages and pages of them until the micro finds something else! We can sometimes get out of this: if we edit a program the operating system is forced to recalculate all the link addresses from that point on. So if you load a BASIC program that comes out as a few lines of good code followed by 2184500000 etc. add a line then remove it. This should put matters right. Then check the cassette volume.

Next month a slight move towards TV servicing as we look at the Amstrad CTM640 colour monitor.

Letters

ITT CVC20 SERIES

Having serviced many ITT sets I found S. Simon's article on the CVC20 chassis and its derivatives (August issue) interesting. It covered the majority of common faults, though more obscure troubles are beginning to occur as these sets age. I've come across the following faults and hope that these notes will be of help.

The most common cause of a dead set, i.e. no LEDs alight on the CVC30 etc., is the tags on the on/off switch parting company with the PCB. Hand wiring to the spare tags at the top of the switch is more effective.

A fault we've occasionally had on the CVC30 chassis is R28 (820Ω) going open-circuit. The result is a bright, blank unmodulated screen. R28 feeds the flyback pulse from the line output transformer to the TBA560C i.c. in the decoder.

Continuous springing of R101 in the CVC20 chassis with nothing amiss on the EW modulator panel and the driver transistor T17 o.k. is caused by the EW modulator transformer L33/L34 burning up. This burning up can be the result of C72 (4·7μF) going open-circuit.

As mentioned in the article D8 in the CVC20's field output stage can fail, causing field collapse. But this component has a habit of being intermittent: it's the first component to replace when a set with intermittent field collapse comes along. The driver transistor T8 (BC337) can be destroyed during one of D8's tantrums. Demise of the output pair T9/T10 at regular intervals has been traced to C21 (10μF), the reservoir capacitor for the negative supply to T7, drying up – a clue to this is that the anode of D8 is at around 5-6·5V instead of 8V.

C19 (22μF) and C20 (10μF) in T7's base circuit can be responsible for insufficient height with bottom foldover.

If C26 (22μF) and C24 (1μF) – C23 (22μF) in the CVC30 chassis – in the field flyback blanking pulse circuit go open-circuit text/flyback lines are visible at the top of the screen. The print from these capacitors is quite thin as it goes around the aerial socket. We've known this to break on its way to plug L1.

The most common cause of field collapse or lack of height in the CVC30 is the print around the emitter of T9 disconnecting itself from the chassis. Slight field bounce is caused by C2001 (2·2μF) going open-circuit.

C701 (all chassis) on the line oscillator panel drying up (its value is 100μF) results in the set tripping a few times before coming on. It can also cause a slight line squeal. Another electrolytic on this panel, C708 (4·7μF), is responsible for striations extending a few centimetres from the top of the screen.

C45 (4·7μF) – C42 in the CVC30 chassis – drying up can result in intermittent tripping, horizontal black lines and a deafening whistle. This electrolytic is in the power supply.

Low volume has been traced to the audio output coupling capacitor C3 (470μF) – it's C5 in the CVC30.

In the event of a hum bar, with hum on sound and reduced height, check the soldering of the earth tags around the line output transformer. Similar symptoms can be present when the 12V regulator transistor plays about – T14 (BD136) in the CVC30, T15 (BD132) in the CVC20.

Finally, with a tripping set removal of the line oscillator panel tells you whether there's a direct or an indirect short across the h.t. supply.

Ray Dunleavy,
Raphoe, Co. Donegal.

SONY KV1810UB MODIFICATION

I dreaded the fate of my Sony KV1810UB every time my wife Hoovered from the same bank of mains sockets. Last week the inevitable happened, and I decided I wouldn't spend any more money on GCSs. Instead I turned to Bernard Pruden's article in the December 1984 issue (page 82). I want to thank him for that article, because the KV1810UB now works a treat and I no longer have the fear of big expense.

The article was concerned mainly with the Mk. I version of the set but the suggestions worked for my Mk. II. Instead of a BU426A I used a BU326A with further mechanical modification to the original chopper metal plate. I also kept the old line driver transformer: I cleaned its metal fin and put plenty of heat transfer compound between the fin and the main aluminium framework.

Anyone willing to convert their KV1810UB should not hesitate about following the recommendations in the article. The modification really does work.

G. Bakawala,
G.B. Electronics, Coventry.

THORN 1613 CHASSIS

An interesting but simple fault came our way recently on a 12in. Ultra portable fitted with the Thorn 1613 chassis. The basic symptom was a noticeable drop in brightness over several months. The first anode voltage was checked and found to be correct and we then found that a good brightness range could be obtained by adjusting the set video level preset. This produced four or five faint vertical lines however, approximately one third of the way in from the left-hand side. Checks in the line timebase failed to reveal anything amiss and after much head scratching we found that the lines disappeared when the brightness was reduced. We also obtained a clue by doing this – the third of the screen with the lines went dark more quickly than the other two thirds of the screen.

The penny then dropped. The supply for the video output transistor is obtained from a winding on the line output transformer. W14 is the rectifier concerned and C106 (10μF) the reservoir capacitor. When C106 was removed it was found to be open-circuit, a replacement restoring normal results. The same sort of thing happens with the National Panasonic Model TC85G when the reservoir capacitor for the supply to the luminance output transistor dries up, producing a darker display on the left-hand side of the raster.

Michael Dranfield,
Dranfield and Harrop, Buxton, Derbyshire.

BBC MICROCOMPUTER PROGRAM

The following program for the BBC microcomputer Model B will provide an external trigger pulse, coincident with each field, for an oscilloscope. Sync, which can be taken from PB7 at the user port, can use the negative-going transition at the start of each field or the positive-going transition 10,240μsec later, about half-way through the field.

```
 10 MODE 2
 20 ?&FE6B = &80
 30 !&220 = &FFA60074
 40 !&72 = &28A90000
 50 !&76 = &60FE658D
 60 VDU&419; 0; 1023; &419; 0; 0; 5
 70 FOR a% = 7 TO 0 STEP -1
 80 VDU18; a%/2+4*(a%AND1), &5119; 160; 1023; &5119;
    0; -1023;
 90 NEXT a%
100 *FX14, 4
110 IF GET MODE 7
120 *FX13, 4
130 END
```

J. M. Collick,
Westbury-on-Severn, Glos.

SUPPRESSING MAINS TRANSIENTS

In connection with Derek Snelling's article on VCRs and the mains supply in the July issue, Maplin have a component which can be fitted inside the mains plug of these expensive units. It's referred to as a mains transient suppressor, type HW13P (Maplin list number), and is very good. Whilst it looks like and is about the size of an ceramic disc capacitor it's very different, acting like a high-power, bidirectional zener diode. When connected across the live and neutral terminals it conducts when the voltage across them exceeds a certain value, around 600-800V, thus clipping any spikes present. The usual mains filter components within the VCR, microcomputer or whatever then reduce what's left of the spikes further, leaving all those micro chips to get on with their work undisturbed. Note that when an HW13P is used in a mains plug the fuse there should be of 3A maximum, and quick-blow at that.

I think the time will soon come when the manufacturers of VCRs, microcomputers etc. will have to provide at the end of their mains leads a big plug case containing a very good mains filter – if you rock the mains plug of a microcomputer when inserted in the socket a number of nasties can occur in the computer circuits.

R. M. Porter,
Bristol.

SPECTRUM 48K PROGRAM

The following program produces on the 48K Spectrum a crosshatch pattern with the horizontal lines extending into the border at the edge of the screen. Lines 10-50 enter the code into the memory while line 60 tests for the correct check sum. Note that this test is not infallible, so save the program before trying it out. After the screen goes dark, press any key to get the crosshatch: the break key returns to BASIC.

```
 10 LET C = 0
 20 FOR Z = 32802 TO 32975
 30 READ N: POKE Z, N
 40 LET C = C + PEEK Z
 50 NEXT Z
 60 IF C <> 18810 THEN PRINT "ERROR IN PROGRAM":
    STOP
 70 RANDOMIZE USR 32883
 80 DATA 251, 201, 62, 10, 237, 71
 90 DATA 237, 94, 118, 62, 0, 211
100 DATA 254, 227, 227, 134, 134, 0
110 DATA 14, 30, 205, 102, 128, 6
120 DATA 150, 16, 254, 13, 32, 246
130 DATA 62, 127, 219, 254, 31, 48, 2
140 DATA 24, 225, 62, 62, 237, 71
150 DATA 237, 86, 205, 107, 13, 201
160 DATA 80, 82, 79, 71, 82, 65, 77
170 DATA 32, 66, 89, 32, 77, 32, 74
180 DATA 32, 69, 68, 73, 83, 62, 7
190 DATA 211, 254, 6, 16, 16, 254
200 DATA 62, 0, 211, 254, 201, 62, 0
210 DATA 205, 155, 34, 62, 7, 50, 141
220 DATA 92, 205, 107, 13, 62
230 DATA 2, 205, 1, 22, 17, 83, 128, 1
240 DATA 19, 0, 205, 60, 32, 1, 0, 0
250 DATA 205, 61, 31, 205, 107, 13
260 DATA 62, 255, 230, 255, 24, 2
270 DATA 214, 15, 245, 79, 6, 191
280 DATA 197, 175, 120, 205, 176, 34
290 DATA 205, 236, 34, 193, 16, 244
300 DATA 241, 32, 235, 6, 7, 14, 0
310 DATA 197, 175, 120, 205, 176, 34
320 DATA 6, 32, 54, 255, 35, 16, 251
330 DATA 193, 120, 198, 10, 71, 254
340 DATA 191, 56, 234, 205, 36, 128
350 DATA 201
```

M. J. Edis, G4RPT,
Broughton, Northants.

VIDEOTAPE BIASING

In reply to Mr. Catchpole's letter "Videotape Warning" (September), as with audio tape recorders the bias frequency for recording must be chosen for the tape type and the speed of the tape past the heads. The effective tape speed with the V2000 system is different from that of the VHS system, so the tape isn't biased correctly. The "fundamental difference in the composition of the tapes" is thus the tape bias frequency.

Colin McCormick,
Plymouth, Devon.

Teletopics

SATELLITE TV MOVES

While UK efforts to start a DBS service have for the time being fizzled out the French are busy getting their DBS act together. The four-channel French DBS satellite TDF-1 is due to be launched next July. The company running it will be 50 per cent French and 50 per cent foreign owned, with the French government taking a 34 per cent blocking interest. Of the foreign organisations, Robert Maxwell (Pergamon Press/Mirror Group Newspapers) has taken the largest interest, 20 per cent. The Luxembourg financial institutions Sofilec and Marner are expected to share a 17 per cent interest, Silvio Berlusconi who runs Italy's largest private TV network is to take an 8 per cent interest while the remaining 5 per cent interest will be held by Philips. The initial capital will be FFr 30m (£2·5m): this is expected to rise to FFr 600m.

At least 150m W. Europeans will be within the satellite's service area. One of TDF-1's channels is to be devoted to a cultural/educational service for which the French government is to provide funds totalling FFr 700m. Robert Maxwell plans to run a second channel which will provide general entertainment and be financed by advertising. The other two channels may be run by CLT (Compagnie Luxembourgeoise de Telediffusion).

It seems that many financial details remain to be sorted out. CLT for example is unhappy at the suggested charge of FFr 90m (£7,625,000) a year to lease a channel in view of the small initial audience (the charge for leasing a channel on the lower power ECS-1 satellite is FFr 15-20m).

One interesting aspect is the transmission standard to be used. Japanese setmakers would be able to supply receiving equipment very quickly if the signals were transmitted in PAL or SECAM form. The MAC system, developed in the UK for satellite TV use, would provide improved performance and is protected by IBA patents. Considerable investment has gone into MAC decoding chips and the use of this system would give European setmakers an initial advantage. Unfortunately it would make the receivers more expensive and it might well be thought by the TDF-1 authorities that this would be detrimental to getting the service started on an economic basis.

A World Administrative Radio Conference with representatives from some 120 countries is at present being held in Geneva to consider procedures for the allocation of orbital positions and frequencies for geostationary communications satellites. Developing countries have been demanding orbital allocations and have expressed concern that the geostationary orbit is being rapidly filled with satellites. There are already some 120 satellites in this orbit and a further 100 are expected to be launched during the next five years. The USA has called for a simplified procedure for notifying plans for satellite launches to the ITU and a voluntary moratorium on the use by industrial countries of certain frequency bands.

Unisat, the consortium set up by GEC-Marconi, British Aerospace and British Telecom to produce the satellites for the now abandoned UK DBS project, has closed its London office. It will not be shut down completely: a holding operation is to be retained in case of future DBS work coming its way. Unisat invested £50m in the DBS project and whether any of this can be recovered is in doubt.

REDIFFUSION TV PLANTS FOR SALE

A question mark hangs over the future of the Rediffusion setmaking operations. The plants, at Bishop Auckland, Co. Durham, Billingham, Teesside and Rochdale – there is also a design centre at Chessington, Surrey – have a maximum production capacity of 150,000 sets a year. They were originally established to supply sets for the Rediffusion cable and rental operations – the sets have also been sold by Doric Radio, a Rediffusion subsidiary, and under the Murphy brand name. When Granada bought the Rediffusion rental chain from BET in mid-1984 an agreement was reached that Rediffusion would supply Granada with sets until the end of 1985. It seems that Granada, who have at various times bought sets from Salora, GEC, ITT and Tatung, are unwilling to continue to take Rediffusion sets while BET wishes to withdraw from the consumer electronics field completely. BET has been having discussions with overseas companies on the future of Rediffusion Consumer Manufacturing. While BET would prefer to sell RCM a joint venture has not been ruled out. Sharp has provided technical know-how in the past (the Rediffusion Mk. V small-screen TV chassis): since it's the only major Japanese setmaker without production facilities in the UK Sharp might be interested in running the plants.

Tatung (UK) Ltd. has decided to move its Research and Development Department from Bradford, W. Yorkshire to Telford, Shropshire, adjacent to the new Tatung CTV plant.

TED TURNER

Our June leader commented on the attempt by Ted Turner's Atlanta based Turner Broadcasting Systems to take over the USA's premier television network CBS. CBS responded by taking protective measures, including a buy back of shares, but before the crunch came Ted Turner decided to take over MGM/UA instead, offering $29 a share. The deal, which has yet to be finalised (Ted Turner still has to find $1bn), is a complex one which will be partly financed by selling United Artists to the group's main investor Kirk Kerkorian for $470m. The attractions of MGM to Ted Turner include its large film library, world-wide distribution network and production studios. MGM's profit record has been patchy in recent years but Ted Turner evidently feels that the price he is paying – twice the market value before takeover speculation began – will be worthwhile once MGM has been linked up with his cable and satellite TV interests.

SERVICING PROSPECTS

In a recent address to the Television and Radio Industries Club Dr. Jim Maxmin, director of Thorn EMI's home electronics division, had some ominious comments to make on the prospects of the domestic electronics servicing trade. It's possible, he said, "to envisage a situation where service is reduced to virtually nil and when a major fault occurs you simply replace the set". Well, he did say a major fault: those of us dependent on the servicing trade can console ourselves with the thought that mains switches and aerial sockets will continue to break, tuners to drift, transistors to leak, electrolytics to dry up and dry-joints to put in an appearance. With all due respect to Dr. J., we've heard this one before! It's unlikely that the public will ever accept that its treasured tellys have to be scrapped when simple or even not so simple faults occur. The setmakers could be awkward of course and refuse to supply things like LOPTs etc., but past experience has always been that when there's a proven need for such an item some bright spark will produce a suitable replacement type. Odder still was Dr. Jim's remark that dealers will be deprived of the support of their servicing revenue. For all too many dealers the servicing side has traditionally been a pain in the neck!

Perhaps a more interesting development is Sony's decision to sell a 50 per cent interest in its five servicing centres to existing managers and engineering staff. The centres, at Dulwich, Oldbury, Cumbernauld, Leeds and Staines, will continue to trade as Sony Service Centres. Sony's future plans are to reduce its financial interest in the centres further and to set up additional independent service centres. In fact Sony seem to be open to offers right now – provided the proposed location is suitable.

MULLARD WIDEBAND HF AMPLIFIER IC

Mullard have introduced a new four-terminal, fixed-gain, wideband h.f. amplifier, type NE5205, which is designed to provide a non-inverted gain of 20dB from d.c. to 500MHz with low noise – the −3dB bandwidth extends to over 600MHz. A 6V supply at 25mA is required and the noise figures are 4·8dB in a 75Ω system and 6dB in 50Ω applications. It's available in several packages include SO and TO46 – plastic DIL and cerdip packs are to follow. Applications include cable TV decoder circuits, aerial amplifiers etc.

RECORD INDUSTRY IMPROVING

Not a TV matter perhaps but of interest nevertheless to those who watch the trade. It seems that the compact disc is at last catching on: deliveries during the second quarter rose to 542,000 in comparison to 135,000 during the same quarter last year. Sales of records, cassettes and compact discs have all been on the increase and expansion seems to be the present preoccupation in the record industry, with proposals for several large new stores having recently been announced.

VIDEOCONFERENCING EQUIPMENT

GEC McMichael have developed some sophisticated equipment for videoconferencing use – videoconferencing enables groups of people to hold conferences via a video link. The Hilton Hotels Corporation has inaugurated a network in four major US cities (New York, Washington, Chicago and San Francisco) using GEC McMichael video codecs. These transmit only those parts of the TV picture that change between one field and the next, allowing the picture to be transmitted at lower cost without loss of quality. GEC McMichael's new split-screen unit, Model TE561, enables the images from two cameras to be transmitted over a single video link. This allows the number of participants at a table to be increased to at least six when showing their heads and shoulders. The unit exploits the inherently superior linearity and resolution of the centre horizontal portion of the picture. The top and bottom portions of the pictures from two cameras, each viewing three individuals, are eliminated using digital techniques: the resulting half-height pictures are then stacked one above the other and transmitted to the remote conference room. If the remote terminal has TE561 facilities the stacked images can be decoded and viewed on two adjacent screens to recreate the original scene. In the absence of decoding facilities the stacked images can be viewed on a single monitor.

CES DOUBTS

There seem to be doubts as to whether the 1986 Consumer Electronics Show (see Teletopics June) will in fact take place. Twenty two major brown goods manufacturers and suppliers have decided instead to hold the traditional hotel shows and many, including Binatone, Grundig, Hitachi, JVC, Luxor, Mitsubishi, NEC, Network, Panasonic, Salora, Samsung, Sanyo, Sharp, Teleton and Toshiba, have already made bookings. Alan Taylor, organiser of CES, nevertheless reports that out of 10,000 square metres of space available at Earl's Court some 6,300 have already been reserved, about half of which have been actually booked.

BBC MICROCOMPUTER SYSTEM

The BBC has announced that from August 1st the price of the teletext adaptor part of the BBC microcomputer system, required for telesoftware use, has been reduced to £149 including VAT. The adaptors are available by mail order from Vector Marketing, London Road, Wellingborough, Northampton NN8 2RL.

CABLE NEWS

The Cable Authority has announced approval of the second batch of cable franchise applications – final confirmation of the schemes has to come from the DTI. Schemes approved are East London Connections in the London Docklands development area; Bolton Telecable in Bolton, Lancs; British Cable Services (Rediffusion) in W. Surrey/E. Hampshire; Cotswold Cable in Cheltenham and Gloucester; and Shaw Cable in Wandsworth, London. The East London Connections scheme is of particular interest in that it will involve laying two sets of cables, one to provide an entertainment service and the other for voice and data communications. The intention is to offer customers connections to the British Telecom and Mercury telecommunications networks and overseas links. Members of the East London Connections consortium include Mercury Telecommunications, United Telecoms of the USA, Ferranti and various city organisations.

Robert Maxwell's SelecTV company, which runs a number of the older types of cable networks, has reported a reduced loss of £355,570 for the year to end March and is considering a substantial rights issue to enable it to participate in new cable franchise applications. Managing director Alan Morris reported that the number of subscribers had increased during the year.

Greenwich Cable continues to make losses and has reported a continuing and substantial loss of subscribers during the spring and summer months. The company has halved its staff, abandoned its local TV and radio production facilities and is endeavouring to raise further funds.

Rediffusion's Reading cable network has introduced an information and classified advertisement channel called LocalVision. It will carry Shop TV, Littlewoods' home teleshopping service, which is already available on Prestel. The goods on offer will vary from week to week and will initially include electrical and electronic lines: orders are placed by phone and payment is by credit card, with free delivery to the door and a satisfaction or money-back guarantee. Reading LocalVision is the first channel to use a highly automated cable advertising system from Diverse Pictures Systems, specialists in high-resolution quality graphics.

TV PRINTERS

Mitsubishi are to launch two new TV printers, successors to the SCT-P50 digital TV printer that was introduced in October 1983. The new printers, types SCT-P60 and SCT-P70, offer far higher resolution – 630 dots horizontal by 476 dots vertical, more than four times higher than the SCT-P50's resolution. Black-and-white prints are made in 16-shade gradation and the print-out speed has been increased. The new printers incorporate facilities for connection to various types of equipment. Features include duplication for multiple copies of the same picture, negative/positive reversal printing, three-step contrast change, 525/625-line switching and field mode/frame mode switching.

TV SETS

The recently introduced Sony 14in. colour monitor Model KX14CP1 has been designed for microcomputer and video enthusiasts, offering high resolution (a fine aperture grill is used in the Trinitron tube), multi-standard capability (PAL, SECAM and 3·54/4·43 NTSC) and a wide range of input sockets including eight-pin digital RGB, 21-pin SCART (analogue RGB, composite video and audio), composite video via BNC and phono connectors and audio phono, catering for most microcomputer systems.

Ingersoll have introduced a mains/battery portable, Model XK512, comprising a 5·5in. colour TV section and a two-band radio. VCR input and earphone sockets are provided. The suggested price is around £220.

Goodmans Loudspeakers (2 Marples Way, Kingscroft Centre, Havant, Hants.) has been appointed sole distributor for Saba TV and video equipment in the UK and will be honouring all outstanding guarantees. Saba is a subsidiary of Thomson-Brandt.

VIDEO EQUIPMENT

Sanyo's latest Beta VCR, Model VTCNX100, features instant timed recording and has a suggested price of under £300. Panasonic's latest VCR, Model NV230B, switches on and off automatically as a cassette is loaded or unloaded. The suggested price is £430.

Canon is about to introduce an 8mm camcorder, Model 8VM-E1, with a suggested price of around £920. Features include a sophisticated infra-red auto-focusing system. Unlike other mainly photographic firms, Canon manufacture the camcorder themselves. Sanyo is to introduce a Sony-sourced 8mm camcorder.

VCR Clinic

Reports from J. Hopkins, Mick Dutton, Jeff Herbert, William G. Lockitt and Philip Blundell, Eng.Tech.

Sharp VC9300

This Sharp machine came in with a no-go fault. The tape was inside the machine and was badly screwed up. Now it's quite common for the reel motor to have a tight spot on this model and although it's not a two minute job replacement is simple enough. So I set to with a will and having removed what was left of the tape I loaded up and watched the action. Sure enough the reel motor hesitated. So out came the old one and in went a new one. Switch on, insert cassette and select play. Nothing!! Try fast forward and rewind. Again nothing. Faulty motor? Try record and it works . . .

At this moment the missus brought in the tea and asked why I was so distressed. "Is that all?" she said, "probably a dry-joint." I think she must have gone to school with Les's wife. My Sharp manual is not too hot to say the least: no waveforms and a magnifying glass is needed to read the circuit diagrams. Oh well . . .

The only thing common to all functions is a 64-pin microcomputer i.c. The supplies were o.k. and the clock pulses present so it seemed sensible to replace the i.c. Just then John came round. He works for himself so I suppose we are in competition but we don't work on it. "Had that fault yesterday and it was the cassette down switch" he said, "but it wouldn't record. If you haven't lost one of the supply voltages it must be the microcomputer i.c."

A new i.c. left the situation exactly as before of course. Time for a closer look at the circuit. What happens when you push record and what happens when you push play? Well on record waveform AD5 comes into the push-button unit as a row of spikes and goes to diode D8109. On play, fast forward, rewind and stop waveform AD4 does the same thing, passing through four other diodes. That was it then, no waveform AD4. It was present on the main board and at the connector to the small board but not at the diodes, due it turned out to a dry-joint under plug HA13 – under the nice protective paint there was a hair crack too small for my old eyes. Can't tell the missus, she'd never let me live it down. **J.H.**

Sanyo VTC5400

Wow on sound was the complaint. On investigation we found that the problem was actually capstan speed fluctuation: the speed was approximately correct but there was no tracking servo action. We disconnected the output from pin 23 of Q4002 to disconnect the capstan phase servo. The speed could then be set with VR4008 to just run through. Checks were then made on the waveforms around the i.c. When we came to the monostable we found that it had an equal mark-space ratio. The voltages here were correct so we started to check components by substitution. When C4040 (0·47μF) was changed the servo locked in solidly, though we ran through the servo set-up procedure to be on the safe side. **M.D.**

Sharp VC7700

The customer moved house and during this process the machine got knocked. When he came to use it he found that a tape had jammed in the loaded position. We removed the covers, hinged down the bottom panel and found that the loading motor was trying but the loading rings were jammed. These are held in place by three plastic retaining clips, one of which had broken. Fitting the replacement was very difficult and after doing this the loading motor wouldn't rotate – because the thermal cutout in the main solenoid had succumbed. Replacing this restored the machine to working order but the action of the loading motor was still weak. We had to replace Q8091 which controls the loading motor: it's a Darlington type and was not switching hard on, with the result that the loading motor was nor receiving the full supply voltage. It's worth noting that this transistor grounds one side of the loading motor to switch it on. **M.D.**

Ferguson 3V29

The customer complained that this machine kept switching itself off. We found that when a cassette was inserted and play was selected the tape would load up then unload and return to stop. The capstan motor wasn't turning, so with no take-up drive the reel sensor stopped the machine. In playback the voltage across the capstan motor was found to be only 0·2V instead of 9·3V. The circuit says that the motor's d.c. resistance is 70Ω, but it measured only 17Ω. Short-circuit turns perhaps? We measured the d.c. resistance of a new motor and found that it was 17Ω, so we amended the circuit (the machine has the combined mechacon/servo panel) and checked back to the drive transistor Q216 (2SD880).

The problem was loss of base drive. When 10V was applied to the base via the variable bench supply the capstan motor turned. The lack of drive was traced back to IC204 which was producing no output at pin 1. Replacing this i.c. made no difference and to keep the machine running the bench supply was set to 11·1V and connected to pin 1 – otherwise the reel sensor would shut the machine down before any voltage or waveform checks could be made. The next step was to move back to IC1 (VC1029) which contains the capstan speed control circuit (frequency-to-voltage converter). The speed control output voltage at pin 10 was low at 1·2V instead of 2·7V. Applying 2·7V here from the bench power supply got everything working correctly so a new VC1029 was fitted. This time we'd got the right i.c.! Pin 10 of IC1 drives pin 3 of IC204: the voltage at this latter pin had been 5·9V instead of 6·2V, a difference that's easy to miss.

After a soak test in the play mode the machine failed to complete a loading cycle and again went to stop. This time the loading belt was slipping just before the loading rings reached their stops – a new belt cured this trouble. **J.H.**

Hitachi VCRs

Faults that have come our way on Hitachi machines are as follows.

VT8300: (1) Squeaking and distortion on sound. Check the audio/control head. (2) Machine will not work, stop light flashing. Cassette bulb open-circuit.
VT8000: No record, no sound or vision in the E-to-E mode, no channel lights, playback o.k. Check the 12V line on the tuner/i.f. board. Check the not-12V playback voltage. R069 (1·5kΩ, 0·5W) may be open-circuit.
VT9300: Take-up spool stops, tape chewing. Replace the playback idler wheel.
VT9700: Runs slow intermittently. Capstan motor has an internal short.
VT8500: Goes to stop when put in the cue/review mode. Also does this with remote operation. Check the voltage at pins 3 and 4 of the HD44801A05 i.c. (IC901). Should be low. If high suspect the i.c.
VT11: Chews tapes. Replace the playback/rewind/fast forward idler.
VT14: Will not change channels up or down. Check around the programme control chip IC721. If the voltage at pin 13 is low (should be 10V) check C712 (0·01μF). **W.G.L.**

Philips VR2020

We've had the following faults on this model.
Pressure roller doesn't engage after threading up. Suspect T7008 (BD677) or T7007 (BC548) in module U180.
Machine threads up, pressure roller flicks over and back, then the machine unthreads and cuts out. The pressure roller solenoid SK5 is not engaging. Check the voltage at pin 15 of module U220: if low (below 5V) T7002 (BC548) is suspect.
No sound on loop-through, playback and record o.k. Replace IC7051 (RC4559) in module U160.
Video tuning mark on all the time. Check T7005 (BC548) in the U140 sync module. **W.G.L.**

Sharp VCRs

Some faults we've had on Sharp VCRs are as follows.
VC9300: For no rewind, fast forward o.k., check relay R7751 – this relay changes the polarity across the reel motor.
VC8300: Check the drum belt if the cassette ejects after insertion – it may be broken or stretched.
VC2300: Machine dead with tape trapped in the laced-up position – check Q914 (2SA770) on the servo board.
VC9300: Machine plays for three seconds then the capstan and drum motors stop with the tape still threaded: press the play button and the machine works. The after-loading switch is faulty. **W.G.L.**

Sanyo VCRs

We've logged the following faults on Sanyo machines.
VTC5000: No results with the mains fuse F5201 open-circuit, a replacement fuse blowing – suspect the STK7216 switch-mode power supply i.c. (IC5101).
VTC9300: No picture on record, E-to-E and playback o.k. Check Q4 (2SK68A) on board W1.
VTC5150: No playback colour. Check the chroma signal at pin 27 of IC1009 (TP1016), also the voltage at pin 26. If the latter is incorrect check R1297 (12kΩ).
VTC5600: No E-to-E colour, loop-through o.k. Check the pilot burst cleaning pulse: suspect Q177 (2SC536KE). **W.G.L.**

Mitsubishi HS306B

Here's another stock fault on these machines – intermittent tuning drift and a whistling noise on the sound. The cause is a dry-joint on C703 which decouples the tuning voltage. **P.B.**

Grundig 2 × 4GB

The fault with this machine was a negative picture on E-to-E and playback for the first ten minutes. The −22V/R supply to the modulator was found to be low at −14V due to R477 (27kΩ) having gone high-resistance. **P.B.**

Field Timebase Circuit Survey

Part 1

S.W. Amos and E. Trundle

The main emphasis in this series will be on field output stage circuits: we will review practice from the earliest days to the present. The task of the field output stage is to drive the field deflection system, i.e. to supply it with a signal (voltage or current) of waveform and amplitude suitable to give the required vertical deflection of the scanning electron beam. The normal requirement is to deflect the beam downwards linearly with time. With the moderate deflection angles used in early picture tubes the field output stage was called upon to supply a linear sawtooth or ramp signal to drive the deflection system. Such a waveform is shown in idealised form by the solid line in Fig. 1. With the wider deflection angles used in modern flat-faced tubes the scanning beam must slow up at each end of the working stroke to give a truly linear scan on the face of the tube: the dashed part of the waveform in Fig. 1 shows the required wave shape. This alteration to the basic sawtooth waveform is called scan correction. Methods of achieving it will be described later.

Electrostatic Deflection

The chief application for early cathode-ray tubes was in oscilloscopes. So it was natural, when public service television started in late 1936, that the first picture tubes should resemble oscilloscope tubes and use the electrostatic deflection system employed in oscilloscopes. The e.h.t. voltage used for these early tubes was by today's standards modest – around 3-4kV – but even so sawtooth voltages of the order of 1kV peak-to-peak were needed on the deflection plates. Moreover it was desirable to drive each pair of plates in push-pull to get a truly rectangular raster. Fig. 2 shows a simplified circuit of a typical field output stage of that era. Note that an h.t. voltage of 700V was needed to give the required output voltage swing.

The basic sawtooth is generated by the charging circuit C1, R1, with switch S1 (the field oscillator) providing periodic discharge of C1. As C1 charges via R1 the voltage across it increases. This rise in voltage is used as the forward stroke of the field sawtooth output waveform. At the end of the forward stroke S1 closes, short-circuiting C1 to produce the flyback. The next forward stroke commences when S1 opens again.

A variety of field oscillator arrangements have been used over the years. A blocking oscillator or multivibrator is perhaps the most common circuit. Thyratrons were widely used in the pre-war and early post-war periods while the modern equivalent, the silicon controlled switch, was quite common in early solid-state field timebase circuits. The oscillator is synchronised by the field sync signal and provides a once per field period short-circuit path to discharge C1.

The voltage rise across a capacitor that charges from a d.c. source via a resistor is of course exponential, but the early part of such a curve is a good approximation to a linear rise. In this example (Fig. 2) only 20V out of a possible 700V voltage rise is used as the forward stroke: the departure from linearity over such a small proportion of the full potential is negligible. The curvature of the voltage rise can however be used to provide scan correction in the second half of the forward stroke – an example will be described in Part 2.

Since two output stages of the type shown in Fig. 2 were required – the other for line deflection – such timebase systems were rather extravagant in terms of valves and h.t. power. During the years preceding the war it was gradually realised that an electromagnetic deflection system would be more economical on both counts though the design of the coils and the circuit was a more difficult proposition. Moreover as larger-screen tubes requiring large deflection angles and short necks were introduced the superiority of electromagnetic deflection became more obvious: it soon became standard practice in TV receivers.

Coil Current and Voltage Waveforms

The ideal sawtooth waveform shown in Fig. 1 has a linear forward stroke and a linear flyback. With electromagnetic deflection the field output stage has to drive a current with such a waveform through the field deflection coils. Although the output was specified as a current (because it's on the current that the deflection of the beam depends) this doesn't mean that the voltage waveform is unimportant. Consider the shape of the voltage waveform. At the low field frequency the coil windings are predominantly resistive, but there's necessarily an inductive component: the coils can be represented as a resistance and an inductance in series. In flowing through the resistance the sawtooth current generates across it a voltage of the same sawtooth waveform – see Fig. 3(a). In flowing through the inductance the sawtooth current generates across this a voltage proportional to the rate of change of the current, i.e. a pulse waveform – see Fig. 3(b). The voltage across the coils is therefore the sum of these, see Fig. 3(c), and this is the voltage waveform that the field output stage must supply. As we shall see later, this voltage waveform's excursion during the flyback can be large enough to damage valves and transistors so that protective measures may be necessary.

Frequency Response Required

Now consider the frequency range required for a field output stage. A waveform such as that shown in Fig. 1 obviously contains a strong component at the fundamental frequency of 50Hz, but in addition there is a wealth of harmonics extending theoretically to an infinite frequency. In fact Fourier analysis of the waveform shows that the amplitude of the fundamental component is nearly two thirds that of the sawtooth. Odd harmonics predominate, and their amplitudes are inversely proportional to their order, e.g. the third harmonic has one third the amplitude of the fundamental. Thus the 51st harmonic has less than two per cent of the amplitude of the fundamental and in consequence this and the higher harmonics have only a small effect on the shape of the waveform. This means that the effective upper limit to the frequency range need extend to a few kHz only – in fact the overall frequency range is similar to that of an audio amplifier.

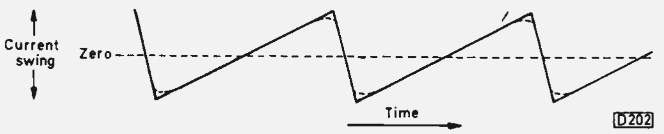

Fig. 1: Ideal sawtooth waveform (solid) with modification for scan correction shown in broken line at top and bottom.

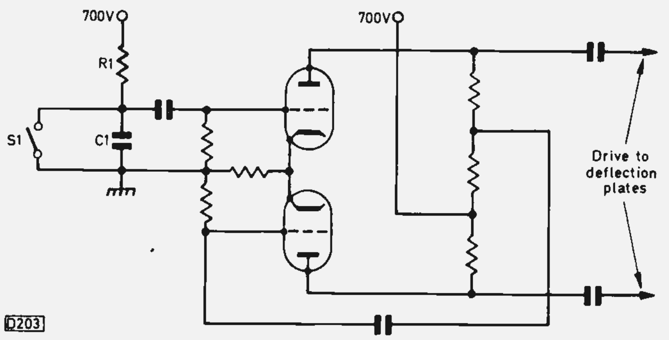

Fig. 2: Field output stage for electrostatic deflection.

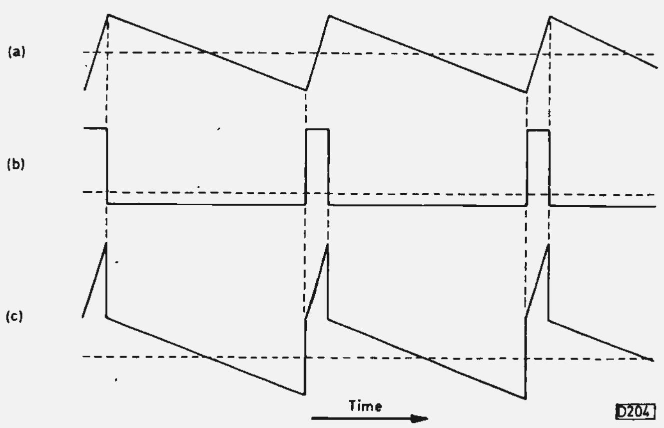

Fig. 3: Voltage across (a) a resistor, (b) an inductor and (c) the sum when a sawtooth is passed through them.

The output power required from a field output stage is usually a few watts, again similar to the requirement with an audio output stage. It's not surprising therefore that many field output stage circuits bear a strong resemblance to those of audio output stages. This analogy with a.f. practice is useful but must not be pushed too far. The signals handled by the two types of output stage are quite different for example: the field output stage handles a repetitive waveform of constant amplitude and frequency whereas the audio output stage handles a complex signal whose components are constantly changing in amplitude and frequency. At times an a.f. signal can have zero amplitude: if this occurred in a field output stage there would be something radically wrong somewhere!

Field Scan Coils

With electromagnetic deflection the angle through which the electron beam is bent is proportional to the magnetic field set up in the tube by the scan coils: this in turn depends on the product of the number of turns on the coils and the current flowing through them – the ampere-turns in fact. Provided the ampere-turns product remains constant there can be considerable variation in the two. For example a low-impedance pair of coils might have 200 turns and require a peak-to-peak current swing of 0·5A for full deflection. This gives an ampere-turn product of 100: such a pair of coils might have a resistance of 15Ω and an inductance of 7mH. At the other extreme a high-impedance pair of coils might have 2,500 turns and require a current swing of only 40mA for full deflection. The resistance is likely to be about 2kΩ and the inductance around 1H.

To give some idea of the practical magnitude of the currents and voltages, consider the low-impedance coils mentioned above. The peak-to-peak current required for full deflection is 0·5A, i.e. +0·25A to −0·25A. By a simple application of Ohm's Law we know that the voltage across the resistance will swing between +3·75V and −3·75V. If, to get an approximate answer, we take the field forward stroke as occupying 19ms and the flyback 1ms, then the voltage across the inductance during the forward stroke is given by *L*.di/dt, i.e. $7 \times 10^{-13} \times 0{\cdot}5/(19 \times 10^{-13}) = 0{\cdot}18$V. During the flyback the voltage is 19 times as great, i.e. 3·5V. The voltage across the coils thus swings between −3·93V during the forward stroke and +7·25V during the flyback, a total swing of 11·18V – 50 per cent greater than for the resistance alone.

If we repeat this calculation for the high-impedance coils with an inductance of 1H, a resistance of 2kΩ and a 40mA peak-to-peak current flow we find that the voltage across the resistance swings between −40V and +40V while that across the inductance swings between 2·1V during the forward stroke and 40V during the flyback. The voltage across the coils thus swings between −42·1V and +80V, a total change of 122·1V – again about 50 per cent greater than for the resistance alone.

Early Valve Circuits

In the early days of television the only active device available for use in field output stages was of course the valve. The obvious way to drive the field deflection coils was to pass the anode current of a class A amplifying stage directly through them, a sawtooth input voltage being applied to the valve. High-impedance coils would clearly be needed to provided the valve with a load approximating to the optimum value, but if direct connection is used the static deflection produced by the d.c. component of the anode current is a nuisance, as also is the considerable dissipation in the scan coils themselves.

These disadvantages can be overcome by using *RC* coupling between the valve and the coils – see Fig. 4(a). This arrangement was used in a number of early TV receivers. The coupling capacitor had to have a value of around 64μF in order to maintain an adequate response at 50Hz. It was sometimes connected on the chassis side of the coils – see Fig. 4(b) – as a result of which the coils were at h.t. potential, say 250V. This arrangement was adopted not so much to catch out unwary service engineers (though there's little doubt that it did do this – see Chas E. Miller, *Television* May 1984, page 374) but because an electrolytic capacitor was used and it was convenient to mount it directly on the metal chassis to provide a connection to its negative terminal. Dissipation in the anode load resistor (commonly between 2-7kΩ) was considerable, necessitating a 5W or 10W component. In some designs this dissipation was reduced by using a choke instead of a resistor but the choice of choke inductance posed a difficult problem which is discussed below.

With 30mA mean anode current the valve, usually a pentode but sometimes a triode, could readily accommodate the ±20mA anode current swings and, with an h.t. supply of 250V, the 112V anode voltage swing needed by the high-impedance coils whose characteristics were quoted above. For input the valve typically required a sawtooth voltage of 10V peak-to-peak which could be readily obtained with good linearity from an *RC* charging circuit connected across the 200-250V h.t. supply. Thus it was common in valve TV sets for the field timebase to consist of a single output valve driven by an *RC* charging circuit controlled by the field oscillator. This was fortunate because it's difficult to design intervalve coupling circuits that give the exceptionally good low-frequency response required to preserve a 50Hz sawtooth. Direct coupling is perhaps the best technique to employ but this isn't easy with valves. As shown in Part 2, transistor field timebases normally have a number of stages – an oscillator, driver and output transistor at least – but transistors, particularly complementary-symmetry pairs, lend themselves readily to direct coupling.

Transformer Coupling

When TV receiver manufacture resumed after the war most makers decided to use low-impedance field scan coils requiring deflection currents of up to 1A, with coupling by means of a matching transformer (sometimes an autotransformer) as shown in Fig. 4(c). The transformer's turns-ratio was chosen to present the valve with a suitable value of load impedance. The coils were more robust than the high-impedance type and the transformer eliminated static beam deflection. This seemed to be an ideal solution though the effective shunt reactance present, due to the transformer magnetising current required, caused difficulties – this applied also with choke-capacitance coupling to high-impedance coils.

Ideally the inductance of the primary winding should be so large that its reactance at the lowest frequency of interest (50Hz) is many times the optimum load of the valve. It then has negligible shunting effect. If the optimum load is 3kΩ, the shunt reactance should not be less than 30kΩ, which at 50Hz calls for an inductance of approximately 100H (with probably 30mA of d.c. flowing in the primary winding). Such a component is large, heavy and expensive, so it's not surprising that setmakers preferred to use smaller transformers and to compensate in some way for the deficiencies in performance resulting from the inadequate primary inductance. For example, if the matching transformer didn't have to carry d.c. it would not require a gapped magnetic core and could thus have greater inductance. Accordingly some setmakers *RC* coupled the transformer to the output pentode as shown in Fig. 4(d). But this again necessitated the use of a high-wattage anode load resistor and a coupling capacitor with a large value. So the standard technique was to pass the anode current directly through the transformer's primary winding. The shunt reactance then causes a bad l.f. loss.

The loss of a dB or so at 50Hz in an audio amplifier might worry the hi-fi fiends but is hardly disastrous because the listening process can effectively restore the attenuated components. In a field output stage however such a loss at the fundamental frequency would introduce obvious errors in the vertical linearity of the display and these could not be corrected subjectively. The low-frequency response of a field output stage must therefore be excellent. To obtain this the loss due to the primary winding's shunt reactance can be offset by introducing a low-frequency boost. This is done by modifying the primary current waveform as shown in Fig. 5, which illustrates the effect of the increased boost needed to maintain a good sawtooth output as the primary winding's inductance is reduced. A significant point is that if the primary inductance is reduced below a certain critical value the primary current waveform must start each forward trace with a negative-going slope. It's difficult to design a network to produce such a waveform, though it's comparatively easy to devise a means of producing waveforms such as OA which have zero initial slope and a positive slope thereafter. Fig. 6 shows the anode current waveform required in practice: the output transformer has the minimum inductance consistent with this waveform and the valve's drive waveform is adjusted to achieve the required output current waveform. The next problem is to provide the required predistortion.

Waveform Shaping

The shape of the curve shown in Fig. 6 is similar to the Ia-Vg characteristic of a triode valve and in some immediate post-war sets this characteristic was used to shape the primary current waveform, the valve being driven by a sawtooth input voltage from the charging circuit. It was also possible to exploit the full length of the charging waveform. Unfortunately the shape of the Ia-Vg characteristic varied from valve to valve of the same type and also changed as the valve aged. A preset control was therefore included in the circuit to provide linearity adjustment as the valve's characteristic changed. This preset was usually part of an *RC* combination – such combinations were and still are widely used to obtain waveform shaping.

By suitable choice of component arrangement and time-constant, *RC* networks can be used to derive from a recurrent waveform any shape between the first derivative and the time integral of the waveform: by combining a controlled amount of the waveform thus obtained with the original waveform it's possible to alter the shape considerably. In this way setmakers were able to obtain an approximation to the waveform shown in Fig. 6, starting with the sawtooth waveform provided by the charging circuit. It's still considered desirable to have at least one preset resistor to give a degree of linearity control.

The *RC* shaping networks required could be included in the valve's control grid coupling circuit, but as valve ageing would still affect the performance it became the general practice to include the networks in a negative-feedback loop, thus making the output stage's performance substantially independent of the valve's characteristic and thus of valve ageing. It must not however be thought that the values of *R* and *C* used in the shaping circuits were arrived at empirically: there were sound theoretical reasons for the choice as the following account shows.

When negative feedback is used to linearise the waveform of the current flowing in the secondary winding the feedback voltage should ideally be directly proportional to this current and should be taken from a low-value resistor in series with the field scan coils. If the coils have a low impedance the value of the series resistor should not exceed about 1Ω in order to minimise waste of scan power. But the voltage generated across such a resistor is unlikely to exceed 1V peak-to-peak, which is too small to be of use as negative feedback for application to the control grid of an output pentode, where the normal input signal is likely to be around 10V peak-to-peak. If there was an earlier stage of amplification the voltage feedback could be applied to its input, but as

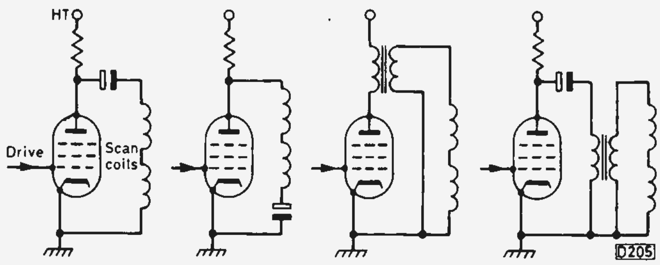

Fig. 4: Field scan coil coupling arrangements.

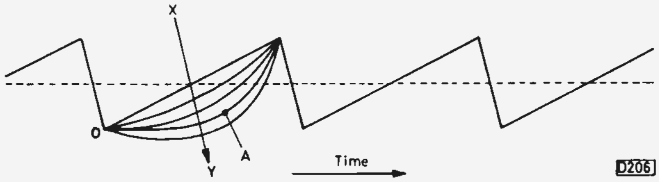

Fig. 5: The effect on the primary current waveform required to produce a sawtooth in the secondary winding as the inductance of the primary winding is reduced. X-Y shows the primary current waveform needed for a sawtooth secondary current as the primary inductance is reduced.

Fig. 6: The primary current waveform used in practice.

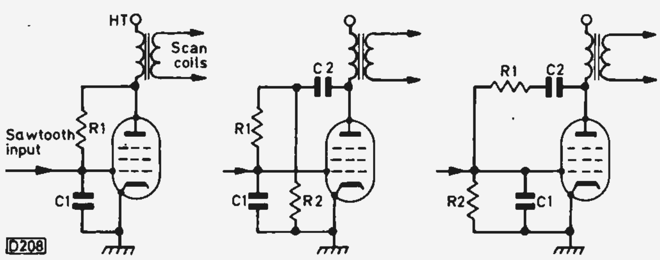

Fig. 7 (left): Feedback circuit to correct for the effects of coil and leakage inductance.
Fig. 8 (centre): Addition of l.f. boost (C2, R2).
Fig. 9 (right): Alternative arrangement to Fig. 8.

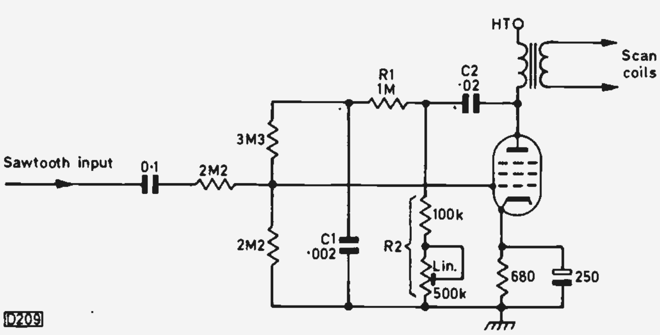

Fig. 10: Field output circuit used in the Pilot TV107.

we've seen with valve field timebases the output stage is driven by the *RC* charging circuit without intervening stages.

The only practical solution to this problem is to take the negative feedback voltage from the output pentode's anode, where there is no lack of signal voltage. Unfortunately the voltage waveform at the anode is not proportional to the current flowing in the scanning coils – due to the effect of the inductance of the coils and of the leakage inductance in the output transformer. There's a simple method of overcoming this difficulty however: as shown in

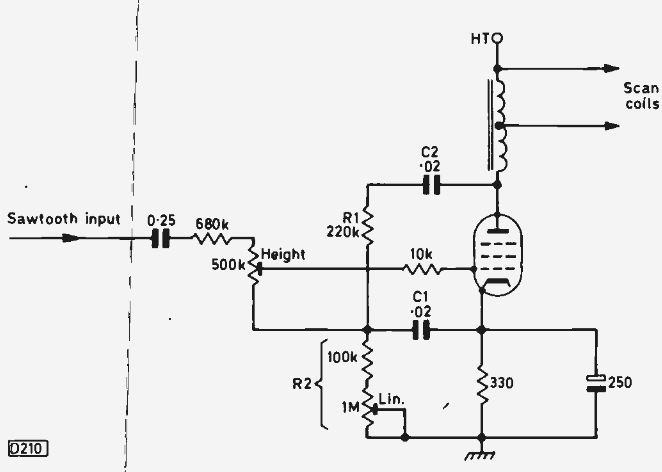

Fig. 11: Field output circuit used in the Cossor 948.

Fig. 7, the anode voltage can be applied to an *RC* circuit with the voltage developed across the capacitor used as the feedback. Provided a suitable time-constant value is used, the voltage across C1 is proportional to the current flowing in the scan coils.

The value of time-constant required is equal to that in the valve's anode circuit, i.e. $(Lc + Ll)/(Rc + Rs)$ where Lc is the inductance of the coils, Ll the transformer's leakage inductance, Rc the resistance of the coils and Rs the resistance of the secondary winding. If for example Lc = 7mH, Ll = 6mH, Rc = 15Ω and Rs = 2Ω, the time-constant required is 760μs. Somewhat greater values were used in practice and the resistor was made preset for linearity adjustment. For example in one chassis the capacitor was 0·05μF and a 50kΩ preset was used, giving a maximum time-constant of 2,500μs.

A second *RC* combination has to be included in the feedback path to provide the l.f. boost necessary to produce the current waveform shown in Fig. 6. C2, R2 in Fig. 8 give the required effect provided a suitable time-constant is used (R1, C1 compensate for the effects of coil and leakage inductance as before). An indication of the order of time-constant required is given by Lp/Rp, where Lp is the inductance and Rp the resistance of the primary winding. Typical practical values are 20H and 500Ω, giving a time-constant of 0·04s. The Alba Model T744 used 0·03μF and 2·2MΩ, giving a time-constant of 0·066s.

The negative feedback due to R1, C1, being concerned with correcting deficiencies due to coil and leakage inductance, is effective chiefly at the upper range of the field-frequency spectrum; that due to R2, C2 is concerned with the other end, being required to provide l.f. boost. It's possible therefore to combine the networks as shown in Fig. 9. At very low frequencies the reactance of C1 is so high that the network is effectively (R1 + R2)C2 – equivalent to R2, C2 in Fig. 8. At very high frequencies R2 is large compared with the reactance of C1 and the network is effectively C1, R1, C2 which is similar to Fig. 7 if we neglect the effect of C2.

Practical Circuits

Most of the field output stage designs of the immediate post-war period and the fifties were based on the principles described above. As illustrations, here are a few examples. The circuit shown in Fig. 10 was used in the Pilot Model TV107 which was introduced in September 1956 – it's the same as that shown in Fig. 8. The circuit shown in Fig. 11 was used in the Cossor Model 948 (August 1958) and is an example of the combined net-

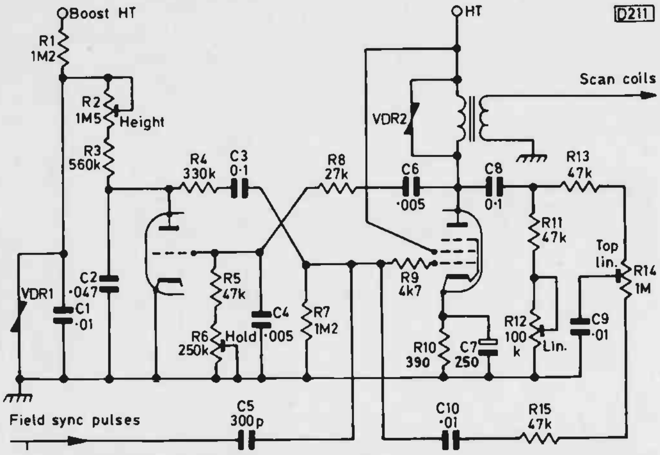

Fig. 12: Triode-pentode field timebase circuit used in many GEC chassis, with the pentode section acting as the output valve and as half the oscillator (multivibrator).

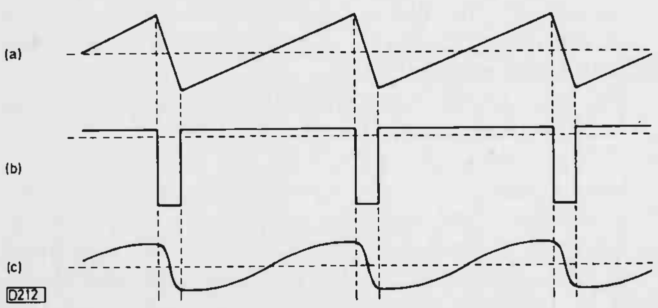

Fig. 13: Sawtooth waveform (a), its first derivative (b) and the waveform obtained (c) when the time-constant is comparable to the period of the input waveform.

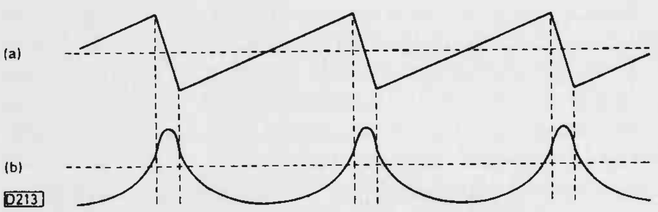

Fig. 14: Sawtooth waveform (a) and its integral (b).

work arrangement (Fig. 9).

Because valves age, die and have to be replaced, one of the aims in designing valved equipment has always been to keep the valve complement to a minimum. Any opportunity to economise in the number of valves used was eagerly seized (paradoxically the aim in modern equipment seems to be the opposite – to use as many active devices as possible: modern i.c.s use them by the thousand!). One way of reducing the valve count was to make one valve do the work of two. This became the practice with valve field timebase circuits where a triode-pentode would provide all that was required: the pentode section often acted as half of a multivibrator circuit in addition to being the output valve – Fig. 12 shows a typical circuit which was used in a number of GEC chassis up to and including the final hybrid monochrome ones.

The triode and pentode are cross-coupled to form an astable multivibrator: the grid circuit time-constants are markedly dissimilar so that the pentode conducts for a much longer period than the triode. During this time the triode is cut off and C2 charges via R2 and R3 to produce the basic sawtooth. Feeding the height control via the potential divider R1/VDR1 provides a stable charging supply: taking this supply from the boost rail helps to give a linear sawtooth. We can ignore the multivibrator action during the forward stroke when the pentode acts as a straightforward output valve. The feedback network follows the lines previously described, with C8, R11, R12 providing l.f. boost and R13, R14, C9 contributing h.f. correction. Negative-going field sync pulses cut off the pentode just prior to the natural oscillatory cycle to initiate the flyback, which is produced by primary current reversal in the output transformer. The VDR across the primary winding reduces the flyback pulse voltage.

RC Networks

Before going on to transistor field timebases in Part 2 it's worth mentioning another way of looking at the waveform correction brought about by R1, C1 and R2, C2 in Fig. 8. Instead of regarding them as h.f. and l.f. correction networks or as correctors for leakage inductance and shunt inductance they can be treated simply as waveform shapers used to get the required signal shape. This is worth considering in more detail.

Any recurrent signal applied to a series *RC* combination yields two outputs – one across the resistor and the other across the capacitor. When the output is taken from the resistor the circuit is often referred to as a differentiating network because, if the time-constant is small compared to the period of the input signal, the output waveform approximates to the differential coefficient (or first derivative) of the input. Thus if the input is a sawtooth as shown in Fig. 13(a) the output is the pulse waveform shown in Fig. 13(b), the relationship between them being that the ordinate at any instant in waveform (b) measures the gradient at the corresponding instant in waveform (a). If the time-constant is not short but is comparable with the period of the input the output waveform is as shown in Fig. 13(c). With a long time-constant the input and output waveforms are the same, this being the condition required for an interstage *RC* coupling network in an analogue amplifier.

If the output from the series *RC* combination is taken from the capacitor the arrangement is known as an integrating network because, if the time-constant is long compared with the period of the input signal, the output waveform approximates to the time integral of the input. Thus if the input is a sawtooth, as in Fig. 14(a), the output has the parabolic form shown at (b), the relationship between them being that the ordinate at any instant in waveform (a) measures the gradient at the corresponding instant in curve (b). In this case when the time-constant is decreased the output waveform changes until, with a small time-constant compared to the period of the input waveform, the input and output waveforms resemble each other.

It's possible therefore with suitable choice of output point and time-constant to obtain from a series *RC* combination any shape of signal between the full differential and the full integral of the input. Sometimes the output from the *RC* circuit is itself the wanted waveform: this is the case when the network is used as an integrator or differentiator. Alternatively the network can be used to give a correcting signal which, after attenuation if necessary in a potentiometer, can be added to or subtracted from the waveform to be shaped. Thus the use of *RC* networks is a most versatile method of waveform shaping and is one that's extensively used in field timebases. With wide-angle tubes the values are adjusted to achieve the scan-correction required.

TV Fault Finding

Reports from Les Grogan Larry Ingram and John Coombes

Decca 130 Series Chassis

An unusual fault came our way on a Decca/Tatung set fitted with the 130 chassis, remote control and teletext: the set would intermittently go into standby when changing channels, either manually or via remote control. Changing the microcomputer i.c. on the frequency synthesis panel made no difference and the d.c. supplies from the regulators on this panel checked o.k. with a digital voltmeter. A scope check on the output from the 5V regulator (IE01) provided a clue: there was a nasty hum present on this rail, which feeds the microcomputer i.c. The input to this regulator is obtained from the centre tap on the standby transformer winding that feeds the bridge rectifier. The winding has two 7V a.c. sections and one of these was open-circuit. A new standby transformer cleared the trouble. **L.G.**

Hitachi CTP1471/1473

The picture collapsed, then went off. Several things were found to be faulty, the root cause apparently being the chopper i.c. (IC901). The field output i.c. – two diodes and the output pair of transistors encapsulated in a block – and two associated resistors R772 and R682 were found to be faulty (the resistors were charred and one of the output transistors was leaky). Unfortunately the i.c. is available only from the makers. Further examination revealed that the 2SD898B line output transistor was leaky and when we checked the h.t. with a dummy load we found it to be 175V instead of 111V. Replacing IC901 and the associated components didn't effect a cure so the makers were contacted. It appears that early production runs of the chopper i.c.'s sometimes went haywire, and that this can be the case with stock items. The "modification" kit from Hitachi consists of IC901 (STR6020), a 2SD898B, Q681 (2SC1213A), fusible resistor R772 and an STA441C field output i.c. if this was found to be faulty. **L.I.**

Thorn 8500 Chassis

At odd times over many months the red button cutout would operate. Resetting it would restore the vision and sound for days or weeks on end with no other reported symptoms. After three days on soak test there was a slight increase in picture size and the cutout operated. Eventually R724 (120kΩ) in the set h.t./e.h.t. control network was found to be varying in value. **L.I.**

Hitachi CBP260 (NP9A Chassis)

The complaint was erratic starting from cold using the on/off switch while it became increasingly difficult to switch on and off by means of the remote or mains switch as the set warmed up. The switch operated correctly and it seemed that the cause of the trouble was something to do with the chopper circuit. This is on its own board in the middle of the main board and is not very accessible. The chopper transistor's collector fixing screw was found to be loose but tightening this and replacing the transistors and small electrolytics in the control circuit didn't improve matters.

At this point a similar set arrived in the workshop. In this case the chopper circuit stopped working intermittently when hot. There was no reason to suspect dry-joints – everything looked quite sound – but each and every joint on the PCB was resoldered with great care. This cured the problem. Back to the first set. Maybe it was the same trouble? Again nothing looked at all suspect, but the same treatment worked. There was still the problem of intermittent starting. The plug and leads were checked one more time: solder up, tighten again and the fault had been cured. **L.I.**

Grundig CUC720 Chassis

There was no field scan and R2771 (6·8Ω) in the supply to the output section of the TDA2653 field timebase i.c. on the deflection module had burnt out. The i.c. was replaced and we found that the flyback boost capacitor C2768 (100μF) between pins 7 and 11 had a nasty leak. This has been the trouble on several occasions: C2768 seems to be the start of the problem and should be changed if there is any suspicion. In passing, most of the field timebase modules of this and similar Grundig types seem to have daylight between the i.c. heatsinks as fitted. It would seem to be good practice to correct this. **L.I.**

Decca 70/90/110 Series Chassis

Here's a summary of some of the faults we've had on these sets.

Set tripping: Check, in the following order, the overvoltage zener diode D602 (ZPD22) for leakage, the current sensing resistor R636 for being open-circuit, and C633 (680pF) in the h.t. rectifier circuit for being short-circuit or leaky. Other possible causes are the TDA2581 chopper control i.c. (IC601) – check by substitution – and a break in the c.r.t.'s Aquadag earth return.

Intermittent tripping: Check C617 (6·8nF) in the set-h.t. control circuit for leakage.

Intermittent chopper transistor failure: Check whether R637 (2·2kΩ, 7W) in the snubber circuit is open-circuit and for dry-joints around Tr604 (BSR59) in the driver circuit.

Power supply not working: Check whether the bridge rectifier's reservoir capacitor C624 (100μF) is open-circuit.

White screen/curved black area on the screen: Check the TDA2571 line oscillator/sync i.c.

Vertical red stripes on the screen: Check the R−Y coupling capacitor C208 (22nF).

Poor field lock: Check whether C308 (10μF) in the field sync pulse integrator stage is open-circuit.

Lack of brightness: Check R910 (180kΩ, 1W) in the first anode supply circuit for being open-circuit, also if necessary the control (VR908, 2·2MΩ) for the same condition. (70/90 series chassis).

Bright red/green/blue raster with flyback lines: Check R913 (220kΩ) on the tube base panel for being open-circuit. (110 series chassis.) **J.C.**

Editorial note: An error occurred in Fig. 1, page 597 of the September 1983 issue. The output across C637 should have been shown as 150V, not 195V, for the 90 series chassis. The diagram showed the switch-mode power supply circuit used in these sets.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

HA1338	7.50
HA1339	2.33
HA1342	2.23
HA1350	3.27
HA1365	4.02
HA1366WR	1.86
HA1367	4.32
HA1368	1.90
HA1368R	1.98
HA1370	3.71
HA1374A	8.80
HA1377	3.96
HA1389	2.39
HA1389R	2.05
HA1392	3.90
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HA17723	5.94
HBF4030AF	2.48
HD38750A53	8.71
HC4480	17.16
HD44801A05	17.49
HEF4001P	0.67
HEF4001BP	0.67
HEF4011	0.29
HEF4528	0.00
HM6231	9.81
HM6232	8.89
HM9102	3.22
HM9104	3.24
HM9105	3.24
HT4207	17.16
ITT2003	0.22
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	5.54
L129V	0.25
L200CV	1.69
LA1111AP	0.88
LA1201	1.02
LA1210	1.56
LA1230	2.87
LA1320	2.87
LA1352	1.54
LA1357N	6.49
LA1363	6.21
LA1364	3.02
LA1365J	3.44
LA1378	6.52
LA1385	1.87
LA1387	7.60
LA3155	1.25
LA3300	1.54
LA3301	1.41
LA3350	1.43
LA3361	1.23
LA4030P	4.20
LA4031P	3.20
LA4032P	1.92
LA4050P	1.57
LA4051P	1.79
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	4.83
LA4125	2.25
LA4138	3.38
LA4140	0.88
LA4192	3.65
LA4220	1.62
LA4400	2.25
LA4420	1.72
LA4422	1.72
LA4430	1.47
LA4460	2.32
LA4461	2.95
LA4520	2.15
LA5112N	2.65
LA7020	7.33
LA7025	8.05
LA7027	9.35
LA7800	2.65
LA7801	4.15
LB1274	2.49
LC4011B	1.24
LD3120	1.13
LM1011N	3.46
LM1017N	3.41
LM1111	4.29
LM1303P/N	1.65
LM1310P/N	1.38
LM1877	10.92
LM3065N	0.85
LM317CKC	1.38
LM339N	0.80
LM3407	1.42
LM340T5	0.83
LM340T12	0.83
LM340T5	0.83
LM342N	0.62
LM342P 12V	1.62
LM342P 15V	1.62
LM342P 5V	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.43
LM748	1.82
LM8360	3.22
LM8361	2.97
LM8361	3.57
M1024	2.81
M1025	5.17
M1124	2.80

M1130	5.35
M191	6.32
M193	18.55
M51102L	6.35
M5115P	5.24
M51231P	3.04
M5124P	4.82
M5134-9341	4.13
M51394P	11.97
M5142P	5.49
M5143P	7.33
M5144P	3.77
M51513L	2.55
M51515BL	3.23
M51516L	3.95
M51517L	3.71
M5152L	2.88
M51522	5.39
M5191P	4.94
M5192	2.20
M5194AP	5.74
M53273P	1.02
M53274P	1.33
MA06	1.07
MA8001	0.82
MB3705	1.79
MB3712	1.85
MB3713	1.69
MB3730	3.25
MC13002	6.22
MC1303P	2.16
MC1307P	1.92
MC1310P	1.30
MC1327P	1.33
MC1330P	1.69
MC1349P	0.81
MC1350P	1.21
MC1351P	1.33
MC1352P	1.12
MC1357P	2.15
MC1358P	1.30
MC14001	2.40
MC14013	0.41
MC14016CP	0.84
MC14011	0.26
MC14025	0.60
MC14049UBC	0.58
MC1438R	1.05
MC14493P	2.82
MC14556BCP	3.47
MC1712	3.88
MC7724CP	3.49
MC7818C	2.18
MC7824CP	4.68
MC78M12	0.83
MC78M24	0.94
MCR100	0.38
MCR101	0.67
MCR106/5	1.57
MCR220/7	2.28
ME0402	0.17
ME0404	0.26
ME0404/2	0.47
ME0411	0.28
ME0412	0.24
ME4102	0.50
ME545B	10.02
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X0096CE	4.29
X0109CE	9.90
X1074AF	7.00
XC9494P	1.33
Y730	0.05
Y969	0.82

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The Tantrums of Tiny Tim

Les Lawry-Johns

Tiny Tim had seen the set before but couldn't remember much about it.

"It keeps flicking in from the sides, sort of bowing in if you know what I mean, and we've still got those bars that travel up the screen" said Mr. Crankcase.

"Sometimes they travel down" said Mrs. Crankcase, "but we don't mind that – we're used to the bars."

"Don't worry" said Tiny Tim, "I'll sort it out tout suite."

Clearly impressed by Tim's confidence, the Crankcases departed and left him to it.

The CVC5

The 26in. CVC5 proved to be a nightmare. Bowing in at the sides on a set fitted with a 90° tube and no EW diode modulator circuit . . . Tim plugged the set into the mains supply and pressed the on/off switch. Being a hybrid chassis, the valves lit up and Tim waited. And waited. There was no cover over the line output stage (shades of Ike Hodge) so Tim held his little neon near the PL509. It didn't light up and he noticed that the valve was getting red hot. So he checked the h.t. supply to the PCF802 line oscillator valve. This was present and the PL509 cooled down. Suspecting the polywhat'sname capacitors in the line oscillator stage Tim changed the PCF802 – this was easier than changing the capacitors. There was no further trouble with the line drive and the e.h.t. rustled up. The picture appeared but it kept flicking sideways and doing all sorts of funny things like bowing in quickly then bowing out again.

Tim's diagnosis was immediate. "Up with this I'll put no more" he said, "it's poor earthing like in the Bush TV181 series, tabs not soldered properly." So he ran wires from the top to the bottom of the chassis and soldered them securely at each earth point. This solved the flicking and bowing and left Tim with the hum bar.

The Hum Bar

Now we all know what to do about this. Change the AD161 series regulator transistor in the l.t. supply and the bridge rectifier for a start. Tim did all this and more, though the curve that accompanied the hum bar should have told him that the l.t. supply wasn't responsible. He turned to the h.t. lines and found that all the electrolytics had been resoldered – not very tidily.

"I'll shunt them one by one" he thought. He switched off and used a 470μF test capacitor with jump leads and crocodile clips. First he clipped it across the h.t. reservoir capacitor – that couldn't be it because the h.t. was well up, but just in case – and switched on. No change. Why had he switched off? Because the spark might have frightened him (and the dog). Actually he hadn't switched off, he'd pulled the plug out – that was easier. Now that the test capacitor was charged it could be applied to the other electrolytics without frightening him and the dog.

While he was playing around the lower electrolytic he accidentally touched the earth tag with the live lead. This should have produced a nasty spark and made him jump. It didn't and he frowned a little. He touched it to the main frame and jumped for his life at the loud crack. The dog fled and Tinker Bell came in demanding to know what he'd done to him.

"Sod the dog" said Tiny Tim. "What about me? I nearly jumped out of my skin."

"Yes but you know what happens when you discharge those things. The dog doesn't."

So Tinker Bell went out and Tim was left on his own. Why hadn't the capacitor discharged when he'd touched the lower electrolytic's earth tag? Because it wasn't earthed. He connected the voltmeter to the tag and it said 200V. He took his glasses off and peered closely. The earth track was very thin and was open-circuit. Tim soldered another wire in to ensure that the earthing was sound. But he still hadn't cured the hum trouble.

"If it's not the smoothing, what else?" thought Tim, getting a bit edgy now. Heater-cathode leakage in the PCF802? He'd just replaced that. Fit another one. Still no change. That side ripple had a sort of ghost like foldover in the background, like you get when the tuning is out and the a.f.c. is off.

So Tim operated the a.f.c. switch, which is incorporated with the brightness control. The set went off. The switch had already been in and pressing it had allowed it out (a.f.c. off). So he pressed it in and the set came back on. He pressed the volume control switch – the real on/off switch – and nothing happened. Tim jumped up and down in rage. "Where's the bloody cat" he bawled.

"She's in the kitchen and she'll stay there until you've done your job properly" said Tinker Bell. "She's not here for you to kick when you can't think of anything better to do."

"Someone's taken the mains leads off the volume control and connected them to the brightness control" moaned Tim.

"What's wrong with that?" asked Tinker Bell.

"Putting them on the brightness control will put hum on the picture" said Tim.

"In that case" said Tinker Bell "putting them on the volume control will put the hum on the sound, and anyway why don't you take the mains leads off the controls and tape them up so that the set is on all the time, like on that Philips portable you were so proud of – no set should have an on/off switch you said, they're dangerous."

So Tim did what he was told. He took the leads off the a.f.c. switch and connected them together. He replaced the plug and was rewarded with a cloud of smoke from the i.f. strip. The neutral mains lead should have gone to chassis via the switch. He'd taken off the mains live and neutral leads, also the a.f.c. lead that's taken to chassis via the switch. The net result was that mains neutral was finding its way to chassis via the a.f.c. circuit.

Tim bashed his head on the bench and broke his glasses. He replaced the burnt out 470Ω resistor and checked inside the a.f.c. can. There was a scorched resistor but the transistor read all right. He decided to put the lot back in and wired the neutral direct to chassis, refitting the brown a.f.c. lead back to chassis where it belonged. Then he plugged in, gingerly, and waited.

The picture came on and was lovely. Who said he wasn't a good engineer? – apart from Tinker Bell. Mr. Crankcase came back at five o'clock to pick up his set and was told that in accordance with Tiny Tim's new rules the on/off switch was no longer operative.

"We never used it anyway. We always pulled the plug out." Mr. Crankcase took out the CVC5 and came back in with a CVC20. "Run the rule over this will you Tim?"

The CVC20

Tim peered into the back and was surprised to see the front control panel lying inside the set in pieces. This upset him in view of the trouble he'd had with the previous set. His little mind immediately rang up fifteen quid. He removed the pieces and put them back together. The control panel now fitted nicely and he had a.c. leaving it and making its way across to the chopper. But nothing came from the chopper.

The driver is often the cause of this but turned out to be o.k. Tim then took out the chopper control subpanel and checked this, that and the other. He could find nothing wrong and was by now feeling fed up. So he locked up the shop, put out the lights and went upstairs.

The Next Day

Tim was up bright and early next day – in a vain bid to stop the dog chewing the morning paper.

"You're not a dog. You're just a pig and barking machine. We'd be better off with a tape recorder that makes barking noises than with you" said Tim.

"Leave the dog alone" bawled Tinker Bell. "What's he done for you to kick up such a fuss?"

"He only chewed up your competition page. The rest is untouched."

"I'll kill the dog when I come down."

Tim hurriedly taped together the pieces of the page then got on with breakfast.

"Before you start eating, nip down to the newsagent and get me an untorn paper" said Tinker Bell, "I must have my entry in the post before nine o'clock."

What a start. But Tim was soon at work on the CVC20. He put the chopper control panel back, switched on and was surprised to hear the e.h.t. rustle up and the sound boom out. "Fancy that" he said. "The control panel couldn't have been making proper contact. What a clever boy I am". He then wrapped it up and moved it to the soak test bay – the other end of the bench.

Another ITT

Tim was a bit surprised to see this CVC5 come back since it had been collected only a couple of days ago after he'd restored the colour. He'd spent some time checking around the top left corner of the chassis and had eventually moved down to the chroma amplifier transistors T27 and T28 where he'd found that slight pressure applied to T28 (the small round BF128) would restore the colour. Although there didn't appear to be any poor contacts he'd resoldered the base, emitter and collector. After doing that the colour couldn't be lost: the set had behaved itself on test but here it was back again with the same fault.

This time he dived straight for the BF128 transistor. A cold check revealed that it was non-conductive. So he fitted a BF197, leaving the screen unused, and switched on. He was bitterly disappointed to find no colour. A voltage check showed that there was no forward base bias, a cold check revealing a short-circuit from the base to chassis. This was due to a speck of solder between the base and the screen (unused) print: a flick of the screwdriver blade restored normal operation which lasted for hours on end.

Tim's Terrible Trouble

Tim thought it was time he paid some bills. So he gathered them all together and added them up. The total frightened him out of his life and as he lay dead Tinker Bell came in to find out what the scream had been for. She kicked Tim in the ribs and he stirred and moaned.

"Get up and get something done you fool. How am I going to get a new dress if you just lie there moaning?"

Tim got to his feet and showed Tinker Bell his piece of paper. "Look, this is what we owe. Now look at this one which shows what we've got. It's not enough."

"You ought to be able to afford me a new dress" snapped Tinker Bell. "If you can't earn enough by mucking about with those daft TVs you could always write about them like that clever Mr. Trundle and that Silly Simon. I've been looking at that magazine and I'm sure the editor is a nice man who might pay you if you could bestir yourself and do a bit of writing instead of keep complaining and trying to kick the cat."

"He might, he might" mused Tiny Tim. "If I could learn to type, that is."

Line Selector Unit

A. B. Bradshaw

Many lower-priced oscilloscopes have good wideband deflection systems but poor triggering facilities. This is particularly a disadvantage if you want to examine the vertical interval test signals transmitted during the field flyback blanking period – these signals are very useful for monitoring the performance of the TV transmission path.

The unit described in this article has been in use for several years to provide improved TV triggering. It's in two sections, the first of which produces trigger pulses for display of the selected line. The second section was originally designed to provide X-scan and bright-up signals for the Hewlett-Packard 1707 oscilloscope, but if required the unit can be used to provide line triggering only. If the unit is also used to provide X-scan and bright-up outputs the only oscilloscope controls that need to be operated are horizontal and vertical position with sweep magnification by ten times. In this mode the oscilloscope's timebase is switched to "external" – see Fig. 1 for typical connections. When the oscilloscope's timebase provides the X scan the unit provides a selectable line trigger pulse at the start of the line required. Fig. 2 shows the complete circuit.

There are three switches which provide the following functions. The rotary switch S1 selects the line to be displayed. The latching push-button fast-scan select switch S2 is for use with the oscilloscope's sweep magnification × 10 control, enabling the 2T pulse to be displayed over a large percentage of the scan – thus K rating graticules can be used. The non-latching field select push-button switch S3 is used to give a "field slip" so that the alternate field can be selected. This latter arrangement is a simple solution – the alternative logic circuit technique would mean that the last line of the field would have to be identified (half or full line). The "field slip" method is not elegant but is very cheap!

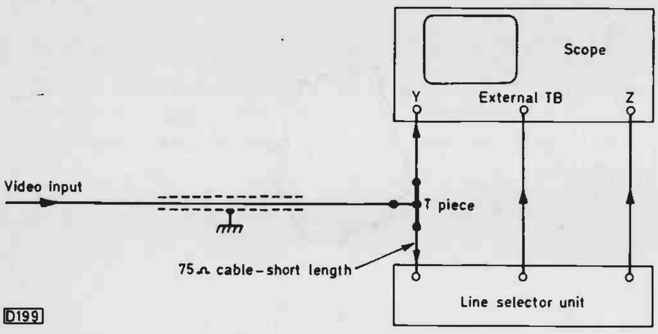

Fig. 1: Typical scope/line selector unit connections.

Circuit Operation

Positive-going composite video with an amplitude of 1V peak-to-peak is fed to Tr1 which provides a voltage gain of ten. The output is capacitively coupled to the base of Tr2 with d.c. restoration by means of D1. The sync pulses are stripped off at the collector of Tr2 while Tr3 provides a TTL compatible output for the following i.c.s.

IC1 and one of the gates in IC2 are arranged as a field sync pulse separator, the output being made available at TP2. IC3 is a "start delay" monostable multivibrator which drives IC4. This latter i.c. is used to provide an enable pulse for the following BCD decade counter IC5. Line sync drive for IC5 is provided by IC2b. When enabled, IC5 counts the line sync periods: its outputs are decoded by the BCD-to-decimal decoder IC6.

The decimal decoded outputs from IC6 are brought out to Vero pins on the PCB. These are the basic line trigger pulses used for display selection. IC6's outputs are "loose wired" to a low-capacitance rotary selector switch (S1). Switching the live logic signals in this way is done for cheapness: the method works satisfactorily in practice provided the leads are kept short (2in.).

We now have pulses for each line during the flyback period of interest. The second part of the circuit provides bright-up and X-scan signals. The emitter-follower Tr8 is used to drive the cable bright-up pulse feed to the oscilloscope. The reason for the unusual arrangement in its collector circuit is to provide a measure of protection should the feed from Tr8 become short-circuit.

The selected line trigger pulse is fed to the fast-scan latching switch S2 and to the delay gates IC2c/d. The need for this delay in the fast-scan position will vary depending on the starting rate of the X amplifier in the scope and may require adjustment to the values of C9 and C10 to centre the displayed pulse in the scan.

The selected line pulse is also fed to IC7 and Tr4, via R22/C11 and R23/D6 respectively. Tr4 is used to discharge C13/14. When Tr4 is off, these capacitors charge linearly via the constant-current source Tr5. The resultant voltage ramp is buffered by the cascaded voltage-followers

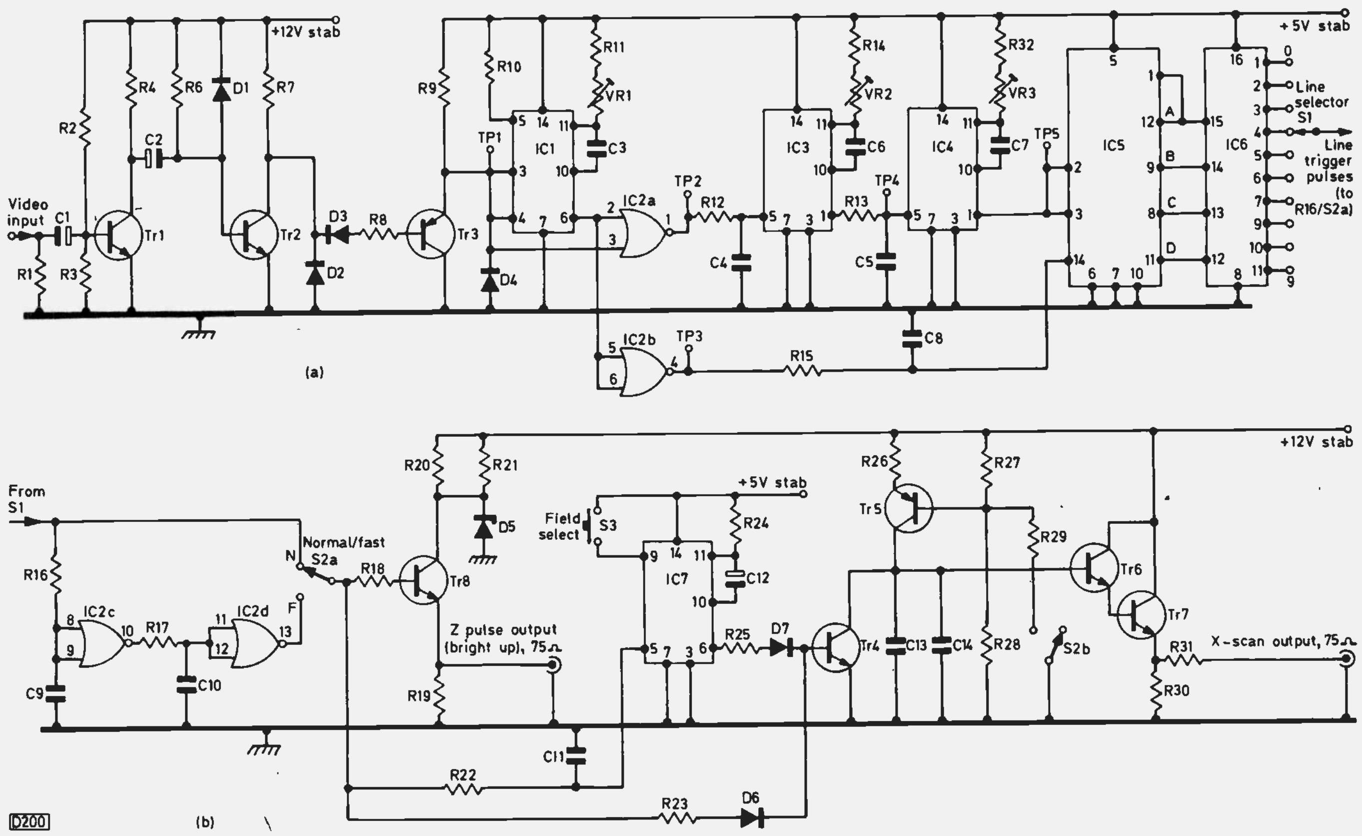

Fig. 2: Circuit diagram. (a) Line selector section. (b) Scan generator section.

Tr6/7 to provide a low-impedance output – the X-scan signal. The charging rate is increased when the fast-scan push-button switch S2 is operated.

The field gating multivibrator IC7 is made to slip to the alternative field by operating S3.

A dual-beam oscilloscope is required to set up the unit as the various start and stop waveforms must be related to the TV waveform. VR1/2/3 are adjusted until the correct waveforms are obtained at the test points – see Fig. 3.

Components list

Resistors:

R1 75Ω
R2 56k
R3 10k
R4 1k
R5 100Ω
R6 1M
R7 10k
R8 1k8
R9 10k
R10 1k
R11 13k
R12 100Ω
R13 100Ω
R14 8k2
R15 100Ω
R16 100Ω
R17 100Ω
R18 27k
R19 1k
R20 680Ω, 1W
R21 680Ω, 1W
R22 100Ω
R23 100k
R24 5k2
R25 10k
R26 100Ω
R27 13k
R28 100k
R29 75k
R30 1k
R31 1k
R32 3k9
All 5% and 0·25W unless otherwise indicated

Presets:

VR1-3 10k multiturn

Semiconductor devices:

Tr1,2 BC107
Tr3 2N4121
Tr4 BC107
Tr5 BCY70
Tr6-8 BC107
D1-4 BAX16
D5 6V8, 1W
D6,7 BAX16
IC1 74121
IC2 7402
IC3,4 74121
IC5 7490
IC6 7442
IC7 74121

Capacitors:

C1 100, 12V
C2 20, 12V
C3 820p, S.M.
C4 470p, S.M.
C5 470p, S.M.
C6 0·1, polyester
C7 0·1, polyester
C8 0·001, polyester
C9 0·022, polyester
C10 0·022, polyester
C11 150p, S.M.
C12 6·4, tant
C13 2,200p, S.M.
C14 0·033, polyester

Switches:

S1 Low-capacitance, 10-pole 1-way rotary
S2 Dual-latching push-button
S3 Single push-button (non-latching)

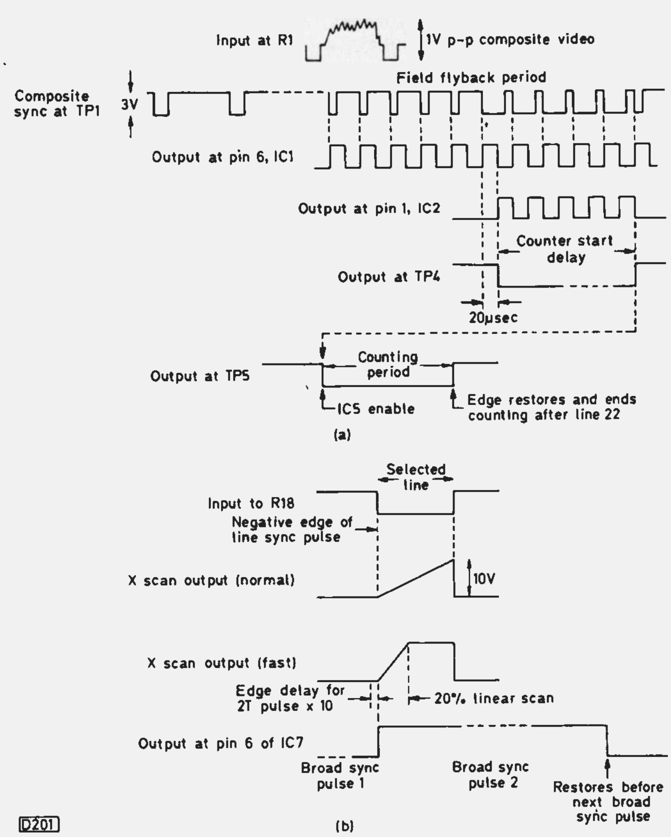

Fig. 3: Waveforms at various points (a) in the counter section and (b) in the scan generator section.

Philips G11 Chassis Fault Chart

Dennis Apple

Before itemising specific fault conditions we'll provide some general comments on the chassis.

Voltage Surges

The G11 has been found to be susceptible to h.t. and mains surges which tend to destroy the BU208A line output transistor and the TDA2600 field timebase chip, also other components as indicated later. Such surges can be caused by intermittent mains leads and by the h.t. reservoir capacitor C4029 (470μF) which tends to produce internal arcing due to poor riveting at its terminals. Since other components can be responsible for mains fuse blowing, failure of the line output transistor etc. the following procedure is recommended in cases where this transistor breaks down for no apparent reason – as well as to ensure more reliable working:

(1) Check that the mains plug is securely wired and that the bared mains wires have not been soldered before fitting into the mains plug (any connections so made tend to become intermittent over a period of time).

(2) Change the h.t. reservoir capacitor C4029 to a DALY/ITT type (Philips part no. 124-47056).

(3) Check for dry-joints, especially around the top, right-hand line scan panel.

(4) Connect a 1Ω, 4W resistor (Philips part no. 113-80245) in series with the anode of each of the mains rectifier thyristors (4018/4020).

(5) Remove mains fuse FS1302 and replace it with a 1·5Ω, 10W resistor – ensure that it's well clear of surrounding components.

(6) Ensure that the mains on/off switch is in good condition, with fast snap action. The contacts should be clean and nonpitted.

Intermittent Faults

Erratic performance and various intermittent faults have usually been found to originate in dry-joints, loose connections etc. on the various panels. These poor joints and connections are common on the line scan panel at the top right-hand side of the chassis. Attention should be paid to this section first not only when the chassis has obvious poor connections but also when the symptoms range from a completely dead set through lack of width to bowed picture edges etc. By tapping the panels whilst the set is switched on the poor joints are often revealed as the set resumes normal operation, often giving a spark to assist with the accurate location of the faulty part of the panel. In severe cases it may be quicker to resolder the whole line scan panel than attempt to trace transient faults that seldom seem to put in an appearance when the set is on the bench.

Now to specific faults.

1: Dead set.
Check R3106 (820Ω); R2010 (5·6kΩ); R4044 (120kΩ); R3120 (15Ω); R4059 (15kΩ); diodes D4091, D4092 in the mains bridge rectifier circuit; Tr4085 (BC148) and Tr4086 (BC158) in the beam limiter circuit; the BF458 RGB output transistors. Also check for dry-joints in the interconnecting plugs and sockets, especially around 3D6, 3D7, 15A15 and 15A16; on the top right line scan panel around R3106; and at the mains filter chokes.

2: Blown mains fuses FS1301/2.
Check mains bridge rectifier diodes D4091/2. It's best to replace all four diodes in the bridge with more robust types, e.g. BY127s. Carry out modifications given in the introductory comments, especially if no specific reason can be found for the fuse blowing.

3: Blown h.t. fuse FS4037.
Check D3133 (BY223) which often destroys Tr2150 (BD238) as well; the h.t. decoupling capacitor C4040 (47μF); the series smoothing transistor Tr4032 (BD201); the 27V zener diode D4021; C4029 (see introductory comments); the BU208A (see general comments and fault 8); C3135 (0·91μF). Ensure that the screened cable between the timebase panel and the line output panel is making good contact and that the screening is earthed at both ends, also that the foil on the line output transistor's heatsink is not punctured.

4: No sound or raster, e.h.t. present.
Check the TDA1412 12V regulator (IC5073) on the i.f. panel.

This i.c. can go faulty a short time after switch on, in which case the picture fades away and colour is lost. It can be responsible for many symptoms including a dark picture with normal sound, and a dark picture with no colour and the h.t. pulsating when the brightness is turned up.

5: Blank screen, e.h.t. present.
Check the 4·7V zener diodes D4090 and D6011 in the beam limiter circuit (in later sets D4090 was replaced with an 0·0022μF ceramic capacitor); Tr2164 (BC148) in the field flyback blanking circuit.

6: Blank raster, no sound.
Check Tr6462 (BF196) in module U5400.

7: Blank raster with teletext sets (sound normal).
Check the SAA5050 i.c. on the teletext panel.

8: BU208A line output transistor short-circuit.
Check C4029 (see introductory comments); the screened cable from the timebase panel to the line output panel (see fault 3); C3135 (0·91μF) – this capacitor sometimes disintegrates spontaneously. Also check for sparking at the mains switch or plug.

9: Intermittently pulsating raster.
Check R4059 (15kΩ) on the power supply panel.

10: Dark picture, no colour, h.t. pulsating.
Check the TDA2590Q sync separator/line generator i.c. (IC2510). In later sets this i.c. is a TDA2591Q which is a direct replacement.

11: Intermittent h.t. variations.
Check the TDA2590Q i.c. (see fault 10); R4059 (15kΩ, 9W); and for dry-joints, especially around the upper right-hand line scan panel.

12: Intermittent tripping, i.e. regular clicks heard from an otherwise dead set.
Check the diode-split line output transformer.

13: No h.t. at fuse FS4037.
Check R4059 (15kΩ) and the beam limiter transistors Tr4085/6 – to confirm, temporarily disconnect the emitter of Tr4086.

In sets with full ultrasonic remote control check standby switch transistor T519 (BC158) on the remote control receiver panel.

14: Hum bars.
Check Tr4032 (BD201); Tr4033 (BCX32); C4034 (10μF); D4021 (BZX79-C27).

15: Field flyback lines present (often intermittent).
Check C2156 (0·0022μF) – this component may be found dry-jointed.

16: Whole raster shifts vertically (often intermittently) followed by blowing of FS3143 after a short time.
Check IC2520 (TDA2600); poor timebase panel connections; poor contact at pins of IC2520; C2099/2100 (both 1,000μF).

17: Striations (faint vertical lines, especially at the left-hand side of the screen).
Add a ferrite tube on the wire link between tag 14 of the line output transformer and C3128; ensure that flying leads are correctly tied in their original positions.

18: Dark vertical bar at the right-hand side of the screen.
Check the TDA2590Q sync separator/line generator i.c. – see fault 10.

19: Line jitter.
Most likely with sets using a TDA2591Q sync separator/line generator i.c.: to eliminate, connect a 27kΩ resistor in parallel with C2029.

20: Field collapse with FS3143 probably blown.
Check IC2520 (TDA2600) – destruction of this i.c. is often caused by a defective C4029 (see introductory comments); poor contact between IC2520 and holder (fault may be present after FS3143 has been replaced); R2066 if the voltage at pin 16 of the TDA2600 is much lower than 19V; C2099/2100 (both 1,000μF); L2092/C2060/R2066 – dry-joints around these components are likely.

21: Top cramping, often with bright horizontal line.
Check C2072 (4·7μF).

22: EW raster distortion with width and shaping controls inoperative.
Check D3133 (BY223); Tr2150 (BD238); D3132 (BYX55-600); L3134; L3137; Tr2119 (BC148C)/Tr2140 (BC158)/Tr2149 (BFX85). Check also for dry-joints around the above components – a dry-joint is often found at pin 14 of the line output transformer, usually on the wire link to C3128.

23: Field bounce with VCR operation.
Check the tuner a.g.c. smoothing capacitor C5010 (150μF). Ensure that C2039 on the timebase panel is 0·0039μF; if necessary R2003 can be reduced in value but not below 1·5MΩ.

24: No field sync (vertical rolling).
Check for broken print at the left-hand corner of the timebase panel. If necessary check C2072 and C2080.

25: Narrow picture.
Check C3135 (0·91μF).

26: Intermittent black horizontal lines.
Suspect the tuner. This is normally not repairable though it may be worth using a very hot iron to resolder all earth connections etc.

27: Inability to tune over the whole range.
Suspect the tuner – assuming that preset adjustments have not been altered.

28: Low gain.
Suspect the tuner.

29: Tuning stuck on channel 1.
Check for poor contact at pin 2, plug 4C, on the power supply panel.

30: Gradual detuning over a long period.
Replace the TAA550 tuning voltage stabiliser i.c.; check for dry-joints on the control panel.

31: Set goes into the standby mode when remote control on/off is operated.
Suspect failure of small contact pair on the mains on/off switch.

32: Volume and brightness controls inoperative in manual or remote mode.
Check IC1 (SAA5010) and R49 (10Ω) on the remote control panel.

33: Loss of one colour.
Check for open-circuit print in control unit 1617.

34: Remote control unit battery has limited life.
IC3606 (SAA5000) has been replaced by an SAA5000A to reduce current drain: with this the values of R3601-5 and R3609 are increased to 100kΩ (from 33kΩ).

35: Loss of colour.
Check C6062/6070 (both 0·33μF) on the decoder panel; alignment of L5630 in module U5600.

36: Pulsating red/green/blue picture.
Check relevant BF458 RGB output transistor – Tr6105 blue, Tr6093 green, Tr6083 red.

37: Intermittent bottom cramping.
Check C2083 (15μF).

38: Picture pulsates on high contrast scenes.
Check C3129 (0·47μF).

Long-Distance Television

Roger Bunney

Though Sporadic E reception during July was less than during the exceptional preceding month of June, conditions were nevertheless very good. There was also tropospheric enhancement on several days, producing central European Band I/III/u.h.f. signals in the UK. The collated UK SpE reception log is as follows:

- 7/7/85 ARD (West Germany) ch. E2; ORF (Austria) E2a; MTV (Hungary) R1; NRK (Norway) E2, 3, 4; JRT (Yugoslavia) E3; RAI (Italy) IA; TVE (Spain) E2, 3, 4; RUV (Iceland) E3; TSS (USSR) R1, 2.
- 8/7/85 EPT (Greece) E3; RAI IA, B; SR (Sweden) E2; CST (Czechoslovakia) R1; TSS R1; YLE (Finland) E3.
- 9/7/85 RAI IA; RTP (Portugal) E2, 3; TSS R1, 2, 3; SR E2, 3, 4; NRK E2, 3, 4; ARD E2.
- 10/7/85 RAI IA, B; TVE E2, 4; RTP E2, 3; MTV R1, 2; JRT E3.
- 11/7/85 RAI IA, B; TVE E2; TVE-2 E2; EPT E3; JRT E4; RTS (Albania) IC; CST R1; ORF E2a.
- 12/7/85 RAI IA, B; EPT E3; DR (Denmark) E3; TVE E3; SR E2; VOA harmonic on ch.E2!
- 13/7/85 NRK E2, 3, 4; SR E2; TSS R1, 2; CST R1; JRT E3, 4; RAI IA.
- 14/7/85 RAI IA.
- 15/7/85 RAI IA; TVE E3; CST R1; SR E3; DR E3.
- 16/7/85 MTV R1, 2; JRT E3, 4; RAI IA; TVE E3; TSS R1, 2; DR E3.
- 17/7/85 RAI IA, B; MTV R1, 2; JRT E3, 4; ORF E2a; CST R1, 2; TVR (Rumania) R2; TVE E2, 3, 4; ARD E2; DR E3; SR E3; +PTT (Switzerland) E2, 3.
- 18/7/85 ARD E2; ORF E2a; RAI IA, B; CST R1, 2; JRT E3, 4; TVP (Poland) R1; SR E3; TSS R1.
- 19/7/85 ORF E2a; TSS R1, 2; RAI IA, B.
- 20/7/85 TVE E2, 3, 4; TVE-2 E2; RAI IA, B; RTP E2; MTV R1.
- 21/7/85 CST R1, 2; JRT E3, 4; ORF E2a; ARD E4; TSS R2; TVP R2; TVE E2, 4; Aramco TV ch. E3, see later.
- 22/7/85 RAI IA, B; NRK E2, 3; TVE E2, 3.
- 23/7/85 JRT E3; RAI IA, B; NCT (Udine – Italian private station) E3; EPT E3; MTV R1, 2; NRK E3; TVE E2, 3, 4; Arabic exotics on chs. E2, 3 – see later.
- 24/7/85 TSS R1, 2; CST R1; YLE E3; TVE E2, 3, 4; RAI IA.
- 25/7/85 TSS R1, 2; TVP R1, 2; CST R1, 2; DR E3; TVE E3; ARD E2.
- 26/7/85 TVE E2, 3, 4; TVE-2 E2; RAI IB; ORF E2a; ARD E2, 4; DFF (GDR) E4; MTV R1; JRT E3; +PTT E3; RTP E2, 3; SR E2, 3, 4; NRK E2, 3, 4; RUV E4; YLE E3, 4; TSS R1, 2; CST R1, 2.
- 27/7/85 TSS R1, 2; NRK E2, 3; SR E3; YLE E3, 4; CST R1; RAI IA.
- 28/7/85 RUV E3, 4; NRK E2, 3, 4; TSS R1, 2; TVR R2; ORF E3; TVE E2, 3; suspected RTM (Morocco), see later.
- 29/7/85 MTV R1; JRT E3, 4; RAI IA, B; RTS IC; CST R1; DR E3; NRK E3; SR E2, 3, 4.
- 30/7/85 TSS R1, 2; SR E2, 3, 4; NRK E3; TVP R1; JRT E3; RAI IA, B; TVE E2, 3, 4; RTP E2, 3.
- 31/7/85 MTV R1; JRT E3, 4; RAI IA, B; TVE E2, 3, 4; TVE-2 E2; TVR R2, 3; NRK E2.
- 1/8/85 NRK E2, 3; TSS R1, 2.

Several exotic signals were received during the month. Between 0855-0945 BST on July 21st Tim Anderson (St. Leonards) noted a ch. E2 electronic test pattern comprising pulse and bar/sawtooth – rather smeary and unstable – from the south. Thoughts as to the origin suggest GBC (Ghana) though I wonder if it could have come from Dubai? At 1840 on the same evening Iain Menzies (Aberdeen) clearly identified the station logo "Aramco TV Saudi Arabia" on ch. E3 from the south east, floating over a JRT signal. This transmitter is sited at Dhahran and has an e.r.p. of 5kW – a very good catch.

Between 1656-1706 on the 23rd Tony Privett (Basingstoke) noted Arabic type figures with "Kurdish" style headgear on ch. E3. This would suggest JTV (Amman). On the 28th Iain Menzies logged a ch. E4 Arabic-subtitled programme without VITS from the south, consisting of Tom Sawyer with US dialogue. This suggests RTM (Morocco) though the time (1130 BST) seems a little too early for RTM to be on programme.

There was an intense Band I opening on July 30th, to the eastern USA as far south as Florida: various UK amateurs worked two-way contacts with many US amateurs from 2230 onwards at 50MHz. This suggests that the path could have supported ch. A2 vision but at the time of writing there have been no reports of TV reception. The opening came some 28 days (solar rotation) after an aurora but I feel that the mechanism was more likely to be intense E layer ionisation giving multiple-hop propagation. Unfortunately I was away on holiday from July 27th through to August 4th – typical!

Tropospheric propagation was similarly very active. Two small openings on the 7th and 13th produced Benelux and French Band III/u.h.f. signals in the southern UK. The main event occurred on 23rd/24th however when an intense spell produced very strong Band I/III/u.h.f. signals throughout much of the UK and central Europe. In particular W. German Band III signals were well received in the midlands and as far west as Plymouth late on the 23rd and from early on the 24th to midday. Switzerland was well received along the south coast on chs. E4, 7, 12, 30, 31 and 34. Very deep fading was experienced here at Romsey in Band III. At the same time West German signals were noted by several enthusiasts in the south west. TVE ch. E3 was a very steady signal from 2250BST at St. Leonards, with picture quality up to P5 (noise free).

Swiss signals on chs. E3, 4, 9, 30, 31, 35 and 59 were again seen on the 24th. French Band III/u.h.f. signals were present during this period at very high levels. There appeared to be a degree of ducting with many of the more distant signals. The tropospheric lift didn't help much with reception in the north of the UK. Finally, NOS Lopik ch. E4 has in recent weeks been seen with an occasional FUBK test pattern, fortunately including an identification. Sound tests with two-channel stereo and mono information are carried from 0945-1020 and 1345-1420 CET on Mondays-Saturdays.

In all a good month. My thanks to the following for sending in details of their reception: Reg Roper (Torpoint), Tony Privett (Basingstoke), Roger Pates (Nottingham), Simon Hamer (Powys), Jeremy Cecil (Shoreham), Alan Beech (Dollar), Tim Anderson (St. Leonards), Cyril Willis (Ely), Dave Shirley (Hastings), Bill Cotteril (Tipton) and Iain Menzies (Aberdeen).

News Items

France: Changes are being made to the structure of TV broadcasting in France. Briefly, there will be four private TV channels; the existing third channel FR3 will be split into two forms of programming, one purely regional and the other as "the foundation of a European cultural channel" which will eventually be broadcast to Europe by satellite; Canal Plus is being reorganised as a non-subscription channel, obtaining finance from commercials. Incidentally the French government has been providing technical and financial assistance for a radio/TV service in the overseas colony of Cape Verde.

Finland: The Swedish first programme is to be transmitted by a number of local stations in Finland, starting with Aaland Island (ch. E28, 20kW) and Pyhavuori. YLE has proposed a third channel, financed by advertising, to start initially in built-up areas.

Hungary: MTV is drawing up plans for a third channel, with regional content, to start in the late 1980s. Additional programming may be obtained via satellite links. MTV-2 currently has regional programming in Budapest, Pecs and Szeged.

Eire: A new (July 1985) transmitter network information sheet is available from Reception Investigation Department, Radio Telefis Eireann (RTE), Dublin 4, Eire – those interested should send a stamped s.a.e. (foolscap) for a copy.

UK V.H.F. allocations: Further information on the reallocation of the emptied v.h.f. TV bands has been released. Apart from a 500kHz paging service (frequency not specified) the 49·82-49·9MHz band will be used for "low-power devices, such as toys and telemetry equipment" – this may result in greater use of cordless phones, a situation that must be monitored. There's to be a considerable expansion of private mobile radio in Band III throughout the UK, though not with networking, i.e. excluding circuit interconnections. Five 1MHz blocks in Band III are to be used for commercial cordless phones. Various data handling systems will also be permitted.

DTI Radio Investigation Service

Until now the DTI's Radio Investigation Service could be called in to investigate causes of interference to the reception of broadcasting services at domestic premises. The DTI recently announced a "phased withdrawal" from the provision of this service, justifying this action on the basis that most complaints are due to defective aerials, poor installations or customer misuse of equipment. The RIS staff is to be reduced from the present 340 to around 240 and will be mainly concerned with tracing radiation from unlicenced sources. The following measures have been announced:

(1) A comprehensive booklet, available from post offices now and including pictures, has been published to assist viewers in identifying the causes of problems.

(2) BS905, which specifies minimum interference immunity standards, is to be incorporated in legally binding regulations as soon as possible, making it an offence to make, sell or import receivers not complying with this standard.

(3) A charge of £21 will be made prior to an RIS call to a domestic property, the call being subject to confirmation that an external aerial is in use and that a detailed log of interference observations has been made on the appropriate form.

(4) The names of all applicants for an interference call will be sent to the TV licence office.

(5) From January 1st 1987 visits will be made only when they coincide with other visits to the same area and when a TV dealer has been unable to remedy or identify the cause of the problem.

(6) From January 1st 1988 the RIS will only visit receivers that comply with BS905.

(7) From the present time all commercial users will be charged at a business rate for diagnostic/remedial work.

If there is sufficient demand, the RIS may provide training courses in interference location and correction.

These changes mark a profound alteration to a service that's been available for many years. Weak-signal enthusiasts will in future have to carry out much more investigative work themselves. Rectification of mains-operated equipment causing interference must be carried out by qualified and experienced personnel, but location of many sources of interference can be carried out using a cheap a.m. v.h.f. air-band portable with its whip aerial, by gradually closing the whip as one gets closer to the source.

We're always interested in hearing about readers' interference problems – and any solutions devised. Notes on this subject may well be featured in future columns.

From our Correspondents . . .

Jeremy Cecil of Shoreham has written to tell us of his experiences as a DXer over some twenty years. He commenced TV-DXing with a rented TV set and 13-channel turret tuner, using a home-made double eleven-element Band III array with adjustable polarity via four parachute strings. This gave such 405-line memorabilia as St. Hilary, Lichfield and Emley Moor, plus at times 819-line signals from RTF (France). He found that reception of long-haul signals was often best with polarisation of other than the correct (transmitted) type – his infinitely variable polarisation system was obviously most effective (has anyone any comments on this polarisation shift?).

His experiments continued until 1977 when he married and moved to Portslade, some seven metres a.s.l., where he concentrated on reliable daily reception of Caen using a single 21-element group A Yagi which cost all of £2.19s.6d! In 1981 he acquired a PAL/SECAM Grundig set able to receive B/G/I/L standard transmissions, a Fuba XC391 u.h.f. array and a three-element wideband Trumatch Band I array. In addition a VCR with system L capability was acquired. He also uses a Philips VR2120 (2000 system) machine that works well in terms of stability with deep fading signals – unlike the VHS machine.

He's at present using a Salora Model J60/90, an all singing/dancing set with system B/G/I/L/D capability, plus teletext and stereo sound, giving v.h.f. coverage from 45-300MHz and slightly extended u.h.f. coverage. Teletext DX reception has been successful and Jeremy is seeking any comments on real-time and recorded teletext recovery. As a result of ill health Jeremy has now retired, but his DX-TV activities provide him with a full and satisfying hobby. We wish him the best of luck with future reception.

US Satellite TV

As mentioned briefly last month, Frank Lumen of Denver, Colorado paid us a short visit recently. He had much of interest to tell us about the satellite TV scene there. Readers may recall that we showed a shot of his dish last December (page 95). Frank is now using an 85°K LNA feeding a Luxor (Swedish) 4GHz satellite receiver, his interest having drifted from v.h.f. DX-TV because of the large number of high-power local transmitters that can be received at his location, leaving few channels open for DXing.

Satellite TV has become big business in the USA as viewers seek alternatives to their normal programmes. Over 15,000 dealers attended the recent Las Vegas SPACE/STTI trade show where over 600 dish aerials were on display. Services at 4GHz are seen as the growth market, with an estimated sale of some 600,000 units this year. Two problems are beginning to arise for satellite TV viewers however. First, zoning (planning) control – local authorities are beginning to take an interest in large dishes in suburban back yards. Secondly there's the prospect of programme scrambling. The 4GHz satellites were originally intended for programme distribution to cable networks, the cable operators paying for the programme material they received and put out over their networks. The explosion in 4GHz TVRO installations means that there's no check on who is actually watching, a situation with which the programme companies are not exactly happy – hence the likelihood that scrambling will be increasingly used.

The many US satellite TV magazines are full of advertisements for dishes, LNAs, LNBs, receivers, feedhorns, actuators and even dish surface warming elements (to prevent snow/ice build up, dish distortion and thus reduced gain). Many include programme guides. There is generally 4° spacing between satellites, but with the shortage of orbital space 2° spacing is being suggested. This will introduce problems where smaller dishes are used since these tend to have a beamwidth of 2° at −3dB: sidelobes will add to the possibilities of adjacent satellite interference. Dishes start at 5ft in diameter: most of those sold are in the 6-10ft range but dishes are available at up to 30ft diameter.

The large number of satellites that can be received means that computer control of the aerial is desirable. You pre-programme the computer with the positions and polarities of your favourite satellite transponders then just push the button and the dish swings to the appropriate position, adjusting the polariser for either vertical or horizontal polarisation. The market has reached the stage where discount satellite outlets are being opened.

Many of the domestic US satellites (DOMSATS) have up to 24 downlink transponders with output powers of 8-10W. With such a large number so the programming is comprehensive, from popular sit-coms to specialised language programmes for ethnic majorities and of course not forgetting prime-time movie channels. As an example of ethnic programming, RAI-TGI (Italian TV news) is uplinked via a N. American Intelsat bird and downlinked via Satcom 1, giving US-wide RAI though the programme was originally intended for a community in New York. Frank views ITN news (News at One, News at 5.45) which is again Intelsat uplinked then cross linked via Satcom 1 from New York to Los Angeles where a further Pacific link takes it to TCN9 Sydney. The signals Frank receives have PAL colour and 625 lines.

Frank can receive signals from 19 satellites at his Denver home. With anything up to 20 downlinks on some of these craft Frank reckons that 150 channels are available to him for viewing with acceptable quality. His future plans include a lower noise LNA, possibly down to 65°K, and resiting his dish so that it can see several Atlantic ocean satellites which are at present obscured by a neighbour's house. With prices for complete systems starting at $1,000 for a system with 6ft dish and 100°K LNA one can readily appreciate how satellite viewing has grown as both a hobby and a source of home entertainment. With a mass of equipment that can be merely plugged in (your friendly local satellite dealer will install) no technical knowledge is required apart from the need to be able to programme the dish control system.

We hope to include some photos of reception next month.

Service Bureau

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

FERGUSON 3V29

The problem is loss of colour on playback. Colour is present to start with but fades when the machine has warmed up. Checks around the AN6360 colour signal processing chip revealed that pin 16 is 6·3V instead of 1·4V, but fitting a replacement chip has made no difference.

It looks as if either the coupling capacitor C415 (120pF) between pins 16 and 17 of the i.c. is defective or that the burst gating pulse at pin 4 is missing or low in amplitude. This pulse gates the burst to provide the a.c.c. action. Suspects are L407 (5·6μH), C441 (0·012μF), C440 (1μF) and IC402 (AN6362) in that order, plus all the tubular pink capacitors in this part of the circuit. Use of freezer and a hairdryer should localise the component responsible.

HITACHI CNP190

There are two faults on this set. First excessive ballooning when the brightness is turned up. Secondly retuning is necessary every ten-fifteen seconds. The latter condition is present whether the set is warm or cold and applies to all buttons.

The tuning control assembly used in these sets gives a lot of trouble. A replacement four-button unit can be obtained from Hitachi or wholesalers such as HRS and SEME and may well solve the problem. If not the tuner is suspect. For the ballooning, check the h.t. voltage as the brightness control is adjusted. If it varies, suspect the series regulator transistor TR41 and its control circuit, especially the zener diode CR40. If the h.t. remains steady, suspect the e.h.t. rectifier circuit which is inside the line output transformer assembly.

ITT CVC32 CHASSIS

A month after fitting a new line output transformer the EW correction transformer L22/3 burnt up and the driver transistor T13 failed. These items were replaced with the correct types but two days later they again failed following the appearance of centre line foldover. No obvious faults can be found in this area.

The trouble can be caused by intermittent failure of one of the capacitors in this part of the circuit. Suspects are C65 (EW tuning), C68/69 (scan correction) and C70 (T13 collector supply filtering). Ensure that the replacement EW correction transformer is fitted the right way round.

DECCA 100 CHASSIS

A fault in the line output stage keeps blowing the mains fuse. To start with there was what looked like loss of EW drive (bowing at the sides). A few weeks later the fuse blew and the BU208A line output transistor was found to be short-circuit. The line drive waveform is correct but the set will operate for only a fraction of a second before ruining the BU208A. A new line output transformer has been fitted and no obvious faults can be found on the line output panel.

The e.h.t. tripler could well be at fault, loading the line output stage. Check by disconnecting it. If the problem persists, ensure that no reverse leakage can be measured in the EW modulator diodes D401 and D402. If these are o.k. the EW correction transformer T402 could be in trouble: the only way to check it is by substitution.

PHILIPS G8 CHASSIS

There's intermittent ballooning which lasts for only a fraction of a second. It occurs every few seconds and is sometimes more pronounced than at other times.

The problem is probably due to an h.t. voltage fluctuation, but a scope will be required to confirm this – a meter will not respond quickly enough. The BT106 mains rectifier thyristor could be responsible but the BR100 trigger diac is a more likely suspect. The 4EX581 is a more reliable replacement which will work only one way round: if you fit one, change R1382 to 47Ω. Also make sure that the set-h.t. control R1370 is in good condition and working smoothly.

SONY KV1810UB

The display consists of three separate rasters displaced from each other by about one and a quarter inches. Disconnect the red and blue drives and you get a perfectly centred, linear green picture. Reconnect red and a second, impure green picture appears to the left of centre. The picture produced by the blue gun is to the right of centre.

The effect is tied up with the convergence voltage that's passed to the c.r.t.'s button connector along with the e.h.t. The e.h.t. lead and tube connector are both coaxial types. Remove the e.h.t. cap carefully and check the central spring and claw connector. If these are in order and not shorted, and adjustment of the static convergence control (mounted on the tripler) doesn't eliminate the problem, a new tripler assembly will be required.

TOSHIBA V9600

The rewind is at first sluggish, then ceases. The counter turns slower and slower and finally stops. The fault has become progressively worse over a period of months though some tapes rewind satisfactorily. I suspect the rewind idler clutch assembly – would you agree with this suggestion?

The problem is unlikely to be in the reel drive mechanism: excessive friction in the tape path is more likely.

QUERY COUPON

Available until 16th October 1985. One coupon, plus a £1·50 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice printed above.

TELEVISION OCTOBER 1985

First check the voltage across the reel motor (pins 1 and 3 of connector P611 on the servo/syscon/audio panel). This should be at least 11V: if not, replace the two Darlington drive transistors Q636 and Q640. If this check proves o.k., replace the upper drum assembly above the video heads – the fault is almost certainly due to the tape sticking to the surface of this assembly. Toshiba changed the type of alloy used for this, so a replacement will provide a permanent cure. Some improvement can be achieved by removing the assembly and scouring the surface with fine steel wool used wet. When replacing it, make sure that the surface is hard up against the vertical locating post: take care not to disturb any spacers fitted and to avoid damage to the heads themselves.

TEST CASE

274

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

The most common fault with the Sony C5, C6 and C7 series VCRs is failure to rewind as a result of problems in the friction-drive system for the feed spool turntable. So when a C7 arrived in the workshop with the complaint that it "sometimes fails to rewind" we weren't expecting any great challenge to our intellect!

After confirming with a known good prerecorded tape that the video heads were in reasonable condition we dismantled the cassette cradle and fitted the rewind modification kit. This was the work of a few minutes (we've had plenty of practice) and within another twenty minutes the deck had been serviced – heads cleaned, tensions checked, guide alignment tested and so on. In went an L750 tape to record a test card while we wrote out the invoice. That completed it remained only to replay the recording as a test before wrapping up the job.

Pressing the rewind button stopped the tape transport system but did nothing to wind the tape back. The fast-forward mode worked correctly, as did the cue (search forward) function. The tape wouldn't reverse on selecting review, and it soon became apparent that this had nothing to do with the mechanics of the reel-drive system – which had just been renewed anyway.

It seemed obvious that the cause of the trouble lay in the tape-end sensor system, the likelihood being that it was falsely signalling "end-foil present" to the syscon department, thus inhibiting rewind. In Betamax machines the sensors take the form of ferrite-cored coils which are mounted close to the tape path. Their inductance falls considerably when the tape's end-foil passes nearby, this loading effect stalling an oscillator of which the sensor coil forms a part. When this happens a "high" signal passes to the syscon chip which then prevents tape transport in the prohibited direction.

The forward (left-hand side of the deck) and rewind sensors in the C7 use identical circuits, each built around a BX342 chip that contains an oscillator and a detector. In view of the intermittent nature of the fault we started by thoroughly checking for dry-joints in the relevant plugs, sockets and PCBs. Finding none, and with the fault becoming rarer, we had an inspiration: we interchanged the two BX342 chips so that if the suspect IC9 was responsible the fault would be transferred to the forward sensor department. It was fairly easy to transpose the two i.c.s, but when we'd done this the forward and rewind functions behaved perfectly!

The machine was set to run on test, with us thrashing the rewind and fast-forward buttons at frequent intervals. Nothing untoward happened until next morning, when the machine once again malfunctioned, shutting down halfway through a rewind cycle. So it wasn't the chip! We'd taken the precaution of hooking an oscilloscope to the rewind sensor coil and were able to see the sinewave "twitter" and fall in amplitude before the syscon shut the show down. No amount of tapping, flexing, heating or cooling of the SY11 (syscon) or LS3 (junction) panels would instigate or settle the fault.

The next test we made established with certainty the faulty component, but in carrying it out we had to take certain precautions to forestall the murder of a tape cassette. What were they? And where lay the root of the evil? Fast forward to next month's issue!

ANSWER TO TEST CASE 273 – page 646 last month –

September's puzzle was a mixture of nostalgia and recalcitrance! You'll recall that the display obtained on a set fitted with the ITT VC200 hybrid monochrome chassis obstinately lacked width while there was some overheating of the large components in the line output stage. All likely and several unlikely suspects were fruitlessly checked before we were left wondering whether we'd have done better (and quicker) to exchange the whole chassis for the one in the scrap set.

Our approach in such cases however is "better the devil you know" – what evil faults, intermittent or otherwise, might have been lurking in the other well-worn chassis? In fact if we'd replaced it complete the fault would still have been present!

So what cabinet or tube mounted component could have been responsible? The deflection coils of course. There must have been short-circuit turns in the line section because swapping over the yokes produced a full-width raster, enabling us to reclaim most of the bits and pieces we'd fed into the falsely accused line oscillator and output stages. With normality restored to this vintage set, back to the problems associated with more recent equipment – see test case 274 alongside!

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BU100A 110p
BU104 100p
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HA1125	£1.50
HA1137	£1.75
HA1149	£1.40
HA1156	£1.10
HA1166	£1.60
HA1197	£1.50
HA1199	£1.40
HA1306W	£1.60
HA1319	£2.00
HA1322	£1.60
HA1339A	£1.60
HA1342A	£1.70
HA1366W	£1.50
HA1366WR	£1.50
HA1367	£3.20
HA1368	£1.60
HA1368R	£1.65
HA1374	£4.50
HA1377A	£2.20
HA1388	£2.75
HA1389	£1.75
HA1389R	£1.40
HA1392	£2.30
HA1397	£2.50
HA1398	£2.40
HA1457	£0.90
HA11221	£2.30
HA11225	£1.95
HA11235	£2.00
HA11705	£4.75
LA1111P	£0.80
LA1201	£0.85
LA1222	£0.80
LA1230	£1.50
LA1240	£1.75
LA1320	£1.50
LA1365	£1.20
LA1368	£2.20
LA1460	£1.95
LA2200	£1.75
LA3101	£1.60
LA3155	£0.95
LA3160	£0.90
LA3201	£0.95
LA3300	£1.40
LA3301	£1.20
LA3350	£1.20
LA3361	£1.10
LA4030P	£2.00
LA4031P	£1.40
LA4032P	£1.40

LA4051P	£1.60
LA4100	£1.00
LA4101	£1.00
LA4102	£1.20
LA4110	£1.40
LA4112	£1.30
LA4120	£2.50
LA4125	£2.00
LA4140	£0.70
LA4200	£1.50
LA4220	£1.20
LA4230	£1.75
LA4400	£1.90
LA4420	£1.40
LA4422	£1.20
LA4430	£1.30
LA4440	£2.20
LA4460	£1.75
LA4461	£1.75
LA7800	£1.85
LC7120	£3.50
LC7130	£3.50
LC7131	£3.75
LC7136	£2.75
LC7137	£2.75
M5106P	£2.25
M5115P	£3.50
M5134P	£2.75
M5135P	£2.30
M5155	£1.50
M51513L	£1.50
M51514AL	£1.75
M51515BL	£2.50
M51516L	£2.50
M51517L	£2.50
M51518L	£1.75
MB3705	£1.60
MB3712	£1.60
MB3730	£1.75
MB3731	£2.50
MB3756	£2.60
MB8719	£3.50
PLL01A	£2.30
PLL03A	£4.95
SI-1125	£7.50
SI-1125H	£7.50
STK011	£3.75
STK013	£6.25
STK014	£6.25
STK015	£5.00
STK016	£4.75
STK020	£4.50
STK022	£5.25
STK041	£6.50
STK077	£5.95
STK078	£5.50
STK080	£7.20
STK082	£7.75
STK086	£9.25
STK415	£5.75
STK430	£4.75
STK433	£4.50
STK435	£5.00
STK436	£5.00
STK437	£6.30

STK439	£5.50
STK441	£6.00
STK443	£6.95
STK457	£5.50
STK459	£5.75
STK460	£7.50
STK461	£6.50
STK463	£7.40
STK465	£8.50
STK0025	£4.95
STK0029	£4.35
STK0039	£4.25
STK0040	£5.50
STK0049	£5.75
STK0059	£6.00
STK0080	£6.50
STK2028	£6.50
STK2029	£3.75
STK2230	£6.00
STK2240	£9.75
STK3042	£6.50
TA7028M	£1.90
TA7045M	£1.30
TA7050P	£0.80
TA7051P	£0.80
TA7054	£1.70
TA7063	£0.80
TA7066	£1.50
TA7070P	£1.40
TA7072P	£1.20
TA7073	£2.25
TA7074P	£1.95
TA7104P	£1.35
TA7108	£1.50
TA7109	£2.30
TA7119	£1.75
TA7120P	£0.50
TA7130P	£1.00
TA7136P	£1.00
TA7137P	£0.80
TA7139P	£1.50
TA7145P	£1.80
TA7146	£2.50
TA7150P	£1.80
TA7152P	£1.70
TA7153P	£1.60
TA7176P	£1.50
TA7193P	£3.50
TA7200	£2.00
TA7201	£2.00
TA7202P	£2.00
TA7203P	£1.80
TA7204P	£1.10
TA7205AP	£1.00
TA7207P	£1.50
TA7208P	£1.50
TA7210	£2.00
TA7214P	£2.50
TA7215P	£1.80
TA7217AP	£1.20
TA7220P	£1.75
TA7222AP	£1.20
TA7223P	£1.95
TA7224P	£2.75
TA7225P	£2.50

TA7226P	£2.20
TA7227P	£1.60
TA7229P	£3.00
TA7230P	£1.75
TA7232P	£2.75
TA7310P	£1.40
TA7312P	£1.30
TA7313	£1.30
TA7315	£1.75
TA7325	£0.85
TA7328	£1.60
TA7607	£2.75
TA7608	£3.50
TA7609	£2.30
TA7611	£2.75
TA7658	£1.50
UHIC001	£4.80
UHIC004	£4.80
UPC16C	£1.30
UPC20C	£2.20
UPC30C	£1.80
UPC554C	£1.25
UPC555H	£0.60
UPC561C	£2.00
UPC566H	£0.60
UPC571	£1.95
UPC572C	£2.00
UPC573C	£2.20
UPC576H	£1.75
UPC577H	£0.70
UPC580	£2.75
UPC592H	£0.95
UPC595C	£1.70
UPC596	£1.50
UPC1001H	£2.00
UPC1018C	£0.95
UPC1020	£1.75
UPC1023H	£0.60
UPC1025H	£2.30
UPC1026C	£1.00
UPC1028H	£0.90
UPC1031H	£1.80
UPC1032H	£0.50
UPC1156H	£1.40
UPC1158H	£0.60
UPC1171C	£1.50
UPC1181H	£1.00
UPC1182H	£1.00
UPC1183H	£2.20
UPC1185H	£2.20
UPC1186	£0.80
UPC1187V	£2.50
UPC1230H	£2.50
UPC1350C	£1.20
UPC1353C	£1.75
UPC1363C	£2.50
UPC1365C	£3.00
UPC1485C	£0.90
UPD277	£4.50
TRANSISTORS	
2SA12	£0.50
2SA15	£0.50
2SA52	£0.50
2SA70	£0.75
2SA71	£0.60

2SA74	£0.60
2SA92	£0.60
2SA101	£0.60
2SA102	£0.60
2SA103	£0.60
2SA104	£0.60
2SA201	£0.60
2SA202	£0.60
2SA203	£0.60
2SA221	£0.60
2SA234	£0.60
2SA235	£0.65
2SA341	£1.75
2SA342	£1.15
2SA350	£0.60
2SA353	£0.65
2SA354	£0.70
2SA355	£0.70
2SA483	£1.75
2SA495	£0.35
2SA509	£0.30
2SA539	£0.30
2SA562	£0.30
2SA634	£0.60
2SA643	£0.65
2SA678	£0.35
2SA699A	£0.85
2SA720	£0.35
2SA726	£0.35
2SA748	£1.00
2SA762	£1.95
2SA777	£0.60
2SA844	£0.35
2SA899	£0.75
2SA940	£0.80
2SA950	£0.35
2SA1015	£0.30
2SA1102	£1.90
2SA1103	£1.90
2SA1104	£1.90
2SA1105	£2.25
2SA1106	£2.50
2SB22	£0.40
2SB33	£1.20
2SB54	£0.70
2SB56	£0.95
2SB75	£0.60
2SB155	£0.90
2SB156A	£0.95
2SB171	£1.20
2SB172	£0.80
2SB173	£0.95
2SB187	£0.95
2SB341V	£2.60
2SB364	£0.80
2SB365	£0.80
2SB370	£0.90
2SB405	£0.80
2SB407	£2.65
2SB422	£0.60
2SB426	£2.60
2SB449	£3.70
2SB463	£1.95
2SB467	£1.95
2SB468	£3.25

2SB471	£3.50
2SB475	£0.90
2SB481	£2.00
2SB492	£0.75
2SB509D	£1.70
2SB511C	£1.20
2SB536	£0.95
2SB555	£3.50
2SB561	£0.30
2SB647	£0.60
2SB698	£0.30
2SB754	£0.95
2SB755	£2.50
2SC352	£0.90
2SC370	£0.30
2SC371	£0.30
2SC372	£0.30
2SC373	£0.30
2SC380A	£0.30
2SC382	£0.30
2SC454	£0.30
2SC458	£0.20
2SC460	£0.30
2SC461	£0.30
2SC486	£0.90
2SC494	£2.75
2SC499	£0.30
2SC503Y	£0.70
2SC535	£0.30
2SC536	£0.20
2SC537	£0.30
2SC558	£2.75
2SC620	£0.50
2SC632	£0.30
2SC634A	£0.40
2SC644	£0.30
2SC681	£2.20
2SC681A	£2.30
2SC682	£0.40
2SC696	£1.50
2SC710	£0.30
2SC717	£0.50
2SC732	£0.30
2SC733	£0.30
2SC735	£0.30
2SC772	£0.30
2SC781	£1.25
2SC785	£0.30
2SC791	£1.75
2SC792	£2.85
2SC799	£1.75
2SC828	£0.20
2SC839	£0.35
2SC840	£1.50
2SC856	£0.60
2SC867	£2.75
2SC900	£0.35
2SC923	£0.50
2SC928D	£0.65
2SC929D	£0.30
2SC930D	£0.30
2SC931D	£2.25
2SC945	£0.35
2SC1030	£2.75
2SC1034	£3.75

2SC1047	£0.35
2SC1061	£0.95
2SC1096	£0.60
2SC1098	£0.75
2SC1114	£3.50
2SC1115	£3.75
2SC1124	£0.80
2SC1164	£0.30
2SC1170B	£2.95
2SC1172A	£2.75
2SC1172B	£2.75
2SC1307	£1.25
2SC1308	£2.70
2SC1316	£2.95
2SC1317	£0.30
2SC1342	£0.75
2SC1364	£0.40
2SC1417	£0.30
2SC1419B	£0.75
2SC1427	£0.30
2SC1505	£0.70
2SC1546	£0.30
2SC1664	£2.50
2SC1675	£0.35
2SC1682	£0.30
2SC1722	£0.95
2SC1815	£0.25
2SC1826	£0.60
2SC1849	£0.30
2SC1945	£2.50
2SC1957	£0.80
2SC1969	£1.30
2SC2026	£0.65
2SC2028	£0.75
2SC2036	£0.85
2SC2075	£0.25
2SC2078	£0.75
2SC2086	£0.50
2SC2091	£0.60
2SC2092	£0.95
2SC2098	£0.95
2SC2120	£0.30
2SC2166	£0.95
2SC2238	£0.65
2SC2275	£0.95
2SC2320	£0.30
2SC2335	£1.50
2SC2365	£4.25
2SC2570	£0.95
2SC2577	£1.90
2SC2578	£2.20
2SC2579	£2.20
2SC2580	£2.20
2SD24	£0.50
2SD72	£0.60
2SD170	£0.60
2SD187	£0.60
2SD313	£0.95
2SD315	£1.80
2SD325	£0.65
2SD348	£4.50
2SD352	£0.60
2SD371	£1.30
2SD389	£0.95
2SD467B	£0.30

2SD718	£1.50
2SD733	£2.80
2SD734	£0.30
2SD822	£2.95
2SD916	£0.95
2SG613	£5.50
2SJ50	£4.00
2SK19	£0.70
2SK38A	£2.70
2SK49	£0.60
2SK120	£0.90
2SK125	£1.25
2SK130	£1.75
2SK135	£4.00
3SK22	£1.75
3SK35	£3.50
3SK45	£0.60
3SK48	£4.30
3SK49	£2.30
3SK88	£0.50
AY51013A	£2.50
AY52376	£7.50
BRC-M-200	£0.60
BRC-M-300	£0.60
BRC1330	£1.40
BTT822	£1.00
BTT6018	£1.60
BTT8124	£1.00
BTT8224	£1.30
CA270AE	£0.50
CA748C	£0.40
CA1310E	£0.80
CA3018	£1.50
CA741CS	£0.35
CA3065	£0.50
CA3076	£1.50
CA3085	£1.50
CA3086	£0.50
CA3088E	£1.50
CA3094E	£0.50
CA3401G	£1.00
LM10CH	£1.95
LM324N	£0.45
LM391-80	£1.80
LM566N	£1.20
LM747CN	£0.50
LM1017N	£2.75
LM1872N	£2.75
LM2917N	£2.75

LM8361	£2.60
MC358G	£1.00
MC364G	£1.00
MC846P	£1.00
MC1310P	£1.50
MC3403L	£0.60
MFC8020A	£0.75
ML237B	£1.20
ML239B	£2.00
MSW901	£3.50
NE521F	£1.75
NE562B	£1.75
NE591F	£2.50
NE5504N	£2.50
NE5534H	£1.20
SAA570	£1.00
SAA1058	£1.75
SAA1059	£1.80
SAA5000	£1.30
SAA5010	£4.50
SAS590	£1.60
SL403D	£3.95
SL437F	£2.75
SL917B	£5.50
SL60745	£1.50
SN15845N	£1.00
SN15846N	£1.00
SN16862N	£1.00
SN72560P	£0.70
SN76226DN	£1.00
SN76227N	£1.00
SN76228N	£1.20
SN76530P	£1.40
SN76477N	£4.50
SN76660N	£0.50
TAA300	£2.20
TAA350	£0.70
TAA550	£0.30
TAA570	£0.85
TAA630S	£2.20
TAA661B	£0.70
TAD100	£2.20
TBA120A	£0.50
TBA120B	£0.50
TBA395	£0.60
TBA440C	£1.30
TBA520	£1.00
TBA540Q	£1.00
TBA570Q	£1.30

TBA673	£1.20
TBA700	£1.90
TBA700Q	£2.00
TBA810AS	£1.00
TBA810SH	£1.75
TBA900	£1.50
TBA920	£1.00
TBA990	£1.00
TBA990Q	£1.00
TCA270Q	£1.20
TCA270S	£0.50
TCA430	£1.50
TCA650	£2.00
TDA1024	£1.25
TDA1036H	£2.00
TDA1170S	£1.30
TDA1515	£4.30
TDA2002	£0.80
TDA2003	£0.90
TDA2004	£2.20
TDA2005	£2.75
TDA2006	£1.20
TDA2020	£1.40
TDA2030	£1.40
TDA2532	£1.40
TDA2540	£1.20

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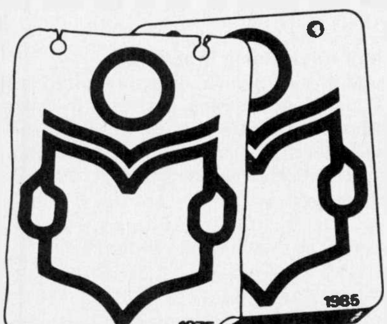

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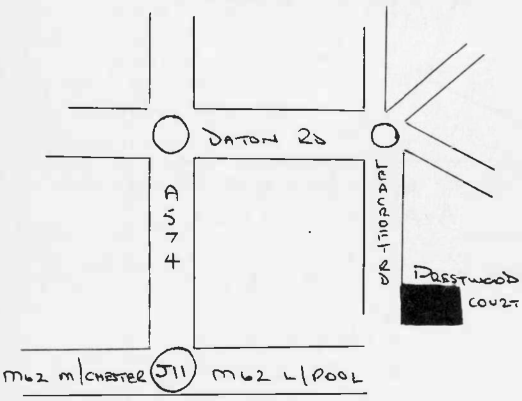

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GEC 2110	10.00		5.00		12.00	6.00	5.00	5.00	5.00	5.00
PYE 731			10.00		18.00	10.00	7.00	8.00		4.50
BUSH Z/718	7.50	6.50	14.00		24.00	3.00	5.00	14.00		
BUSH T/20	7.50	6.50	14.00		19.00	19.00	5.00	14.00		
DECCA BRADFORD	3.00		7.00			4.00		4.00		
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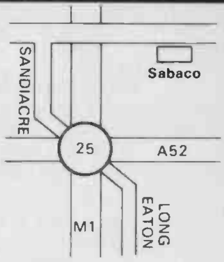

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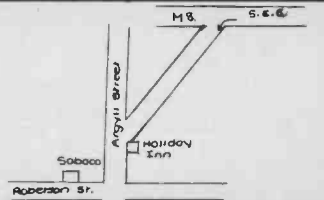

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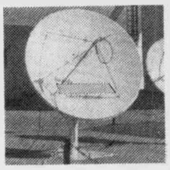

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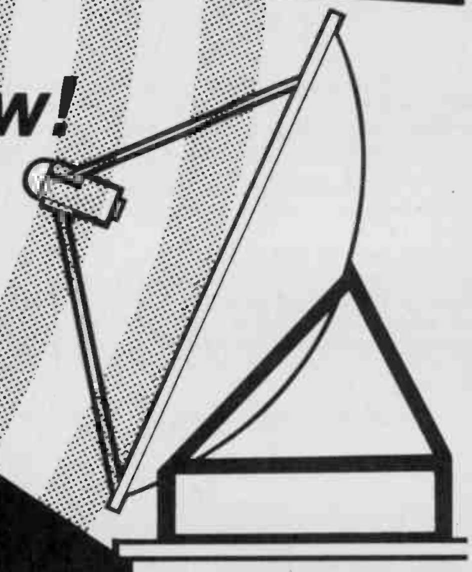

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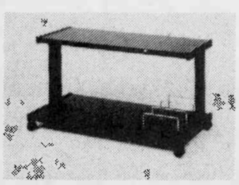

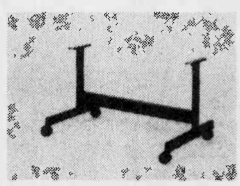

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C. Core 240v 4v+4v 4v04v 2AMP 12v 1amp £2
Mullard split diode AT2076/80 £6
4 Types Fedility front panels with i.c. & pats £2 each
Amstrad TV chassis Complete damaged print £5 + £5 post
BB 103 10p
BB 105A×12 £1
BB 105B×12 £1
BB 105G×12 £1
BB 121a 10p
47 10p each

A 823A chassis

Scan drive £5
IF £3
Scan control panel £3
NEW A31/510 tubes with s/coil £6 + £2 post

1A/1600V 10p
2 amp bridge rec. wire end 15p
CV 8617 10p
Y 716 10p
Y 729 30p
Y 730 10p
Y 827: 6A/1KV 20p
Y 860 30p
Y 933 5p
Y 969 50p
Y 997 30p
Min 12 volt Relays 75p
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 30p
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
2SD898B £1

Hitachi sets etc.

STR454 £2
2SC940 £1
BU 105/04 80p
BU 108 £1
BU 124 50p
BU 126 80p
BU 180a 65p
BU 204 70p
BU 205 £1
BU 206 £1
BU 207 £1
BU 208 80p
BU 208A £1.10
BU 208D 90p
BU 222 £1
BU 326 £1
BU 407 60p
BU 426V 60p
BU 500 £1.10
BU 508A £1.20
BU 526 75p
BU 807 £1
BU 824 50p
BUW 84 30p
BYW 20-08-9 £1
TIC 106a 30p
TIC 116m 40p
TIC 116n/Y 1003 35p
TIC 126N 40p
TIC 206m 30p
TIC 225S 40p
TIC 226E 40p
TIC 226m 30p
TIC 236m 30p
TICV 106D (T092 case 2A/400V) 10p
TIP 29 20p
TIP 30 35p
TIP 30A 35p
TIP 30B 40p
TIP 30C 45p
TIP 31 30p
TIP 32 25p
TIP 33B 50p
TIP 33C 70p
TIP 34A 50p
TIP 34B 60p
TIP 34C 70p
TIP 35B 50p
TIP 35C 70p
TIP 35D 80p
TIP 36 50p
TIP 36C 70p
TIP 41B 40p
TIP 41D 70p
TIP 42/BRC 6109 30p
TIP 48 40p
TIP 49 30p
TIP 57 30p
TIP 100 30p
TIP 102 30p
TIP 115 50p
TIP 117 50p
TIP 120 35p
TIP 125 35p
TIP 130 30p
TIP 131 25p
TIP 136 30p
TIP 140 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 107 10p
ZTX 108c 10p
ZTX 109k 5p
ZTX 213 5p
ZTX 341 10p
ZTX 342 10p
ZTX 384 10p
ZTX 451 10p
ZTX 550 10p
MJ 2253 60p
MJE 3040 60p
MJE 2209 10p
SP 8385 50p
SAB 3205 £1.00
SAB 4209 £1.00

G11 condenser £1.75
300M + 700 320V £1.80
200 + 100 + 100 + 50 300V 50p
150 + 200 + 250M 300V 50p

Chassis complete £35
Computer Transformer 20v/2.25A; 20v/1.5A; 17/.5A; 19/.5A; 28/.05A £3
Mains ViewData Torroidals £3.75
240V/240/6V/4 amp/6v 500m/a in / out

Mains trans 240/12v-0-12v 2 amp £3.50

Voltage Regulators

+5V/UA78PO5SC 30p
−5V/LM79MO5CP 25p
−8V/79M08c 30p
+6V/78M06c 30p
+10v/78LA10 20p
LM 337 30p
LM 342/18 30p
LM 340T 5.0 50p
+12V/LM 340T12 50p
+15V/78M15 15p
+18V/MC78M18 20p
+24V/78M24 30p
MC 7724cp 40p
MC 7824 40p

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

U 19885 40p
U 3832 15p
U 3845 15p
MR 508 10p
MR 501 10p
MR 502 10p
BCW 71R 30p
BYF 1202 10p
BYF 1204 10p
BYF 3126 40p
BYF 3214 40p
BYX 10 6p
BYX 36/600 35p
BYX 38/300 25p
BYX49/600R 75p
BYX 55/350 10p
BYX 55/600 (Bead) 10p
BYX 71/350 20p
BYX 71/600 50p
BYX 72/300 20p
BYX 36/600 50p
BYV 95B 10p
BVY 95C 12p
BYZ 106 10p
BPW 41 15p
BYW 56 2A/1000v G11 8p
BZU 15/24 54p
BZY 93c75 50p
BZV 15/18 30p
BZV 15/30 30p
BZW 70c6v2 10p
BZX 79.3v 10p

Bush thyristor RCA 76122 £1
Transformer 240v/20v-500Ma 75p
Chassis type Transformer 240v/12 Volts 500m/a 75p
CVC 20 tube base £2
Tube Base Rank & G11 £1.20
6v-9v-13v tape motor 75p

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

Infra red led LD57CA 15p
Mono scan coil £3
G 8 transductor £1.25
AT 4041/41 transductor £1
VHF 3 Transistor rotary tuner DX-TV £1
15K-20 turn pots 20p
Thorn panel 6×100 pot + changeover switch (Irish) 50p
Battery converter TA 75 for colour TV. 12/24v Thorn 3787 £6
Thorn 3500 2A cut out 50p

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

SPECIAL OFFER
Decca-TTT etc.
FEO4/1/250AC/4
Mains filters
(grey type) × 4
80p

BRIDGES

SKB 2/08 L5A 30p
KBL 005 30p
KBL 02 30p
KBP 04 30p
W02 15p
W004 15p
W005 20p
AT 2076/35 £7
AT 2076/55 GEC split diode transformer £10
AT 2048/11 LOPTI Mullard £2.50

HITACHI CPT2225 CHASSIS WITH TELETEX £30

10 Mixed TV & radio speakers £4
Philips car radio speaker door pair £7
2× Hi-Fi Philips car tune up tweeter EN8320 £10
ITT CVC45 8 way resistor unit for v/cap £3
4700/10v × 10 50p
68/16 × 10 50p
150/16 × 10 50p
47/25 × 10 50p
220/25 × 10 50p
1/250 × 10 50p
G8 Speaker £1
8000/30v 50p
470/40v × 10 £1
22/100v × 10 £1
100/350v 70p
400/350v 70p
.47/500v 25p
1/600v 25p
.022/1kv 10p

VIEW DATA PANELS
NEW £3

Philips GP422.4CH (£40 cost) £6

VM6101
MULLARD TELETEX DECODER
With interface panel and data command panel
New £6 Post £2

12 Volt Aerial Changer over Relays 144 Mc/s 45 watts 50p

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

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

20AX GEC Split Diode lead £1.00

MODEM
Line Terminal Unit
VM6501 £6
Designed to work at 1200/75 or 1200/1200. Diagram and Connection Data Supplies

Indicator Tube ITT 58705 £1
8 Seg Display FND500 20p
Mullarad 12.5V/170 Mc/s 45 watts BLW60C £4.00
Mullard Broadband R.F. power modules UHF. BGY22E £10.00
PT4236C, PT8706C, PT9783 £3
ITT Micro Phone M5 50p with switch
Sub-min Relay low voltage 50p
Mains relay coil 230v 30p
Philip PP3 batterys 10 for £3
12v battery holders A.A. 50p 1.5 battery
T/V 12v 2 pin battery lead 30p

Various Tools and Accessories

T/V V/Aerial 300Ω or 75Ω	£1.50
L.C.D. clock display with alarm	75p
* D/P push mains switch	20p each
Mains lead & two pin socket for radio cassette	35p
3 Video Leads	£1.00
Xcelitr cutter	£3.90
T/V loop aerial	75p
Radio Telescopic Aerial	£1.00
Philips Neon Lamps for TV sets	5p
Freeze	£1.20
Foam Cleaner	£1.20
Contact Cleaner	£1.20
Cans of Anti Static, Degrease Cleaner and Anti Corona	All at £1.20
Push Button Mains	75p
Lorlin Full Remote Relay Switch fit most T/V sets, mains 4 tag, 2 tag 12 volt	£1.00
Mains timer. 13 amp — up to 2 hours: easy to use, plugs into socket	£3.00
Sellotape PVC Electric Insulation 50mm × 20M	70p
Screen locking agent, large can	£1.50
20 GEC Service Manuals	£5.00
Red E.H.T. LAED and Anode Cap	£1.00
10 × G11 Cap 470/250	£15.00
Weller solder iron 15 watt/25 watt	£5.00
2 way baby alarm/intercom with long leads	£5
Phillips universal battery tester/charger, fuse/bulb tester	To Clear £4
12V Nicad pack. "AA"	£2.50
Hitachi 7.2v/1.8A Nicad pack	£6.00
Hitachi TP 007 Battery pack 7.2v/1.6A	£7
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V	60p
70ML Silicone Sealer (clear)	£1
100 Coax Plugs	£12.00
De-solder pump + 2 nozzels	£5.20
Plastic box for i.c.s 6"×3"×½"	50p
Can of handy oil 'mobil'	40p
Flat Red LED	12p
500gm 60/40 solder reel	£7
Clearweld glue pack	30p
Dual v/u meter -20 – +10db	£1
K30 thermistor 232266298009	75p
GEC Mains Power Supply R.E.G.	£3.00
1Kg reel of solder	£8.00

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

Quantity Reductions

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

Plastic Boxes 4¾ × 4 × 1 × ¾ 50p
100 Fuses £2.00
100 W/W Res. £1.50
BF 199 20 for £1
10 × 20 Turn 100k pots. Rank £2
Thorn 9 volt power supply regulated £3.00
BF 470 20 for £2
20 Slider Knobs 70p
6 Mixed UHF Aerial Isolating Sockets, some with long leads. Fit ITT, GEC, Philips, Pye £1.00

Mixed Packs

TO66 12 Power Trans RCA 16182 NPN Replacement for BD124 and Mounting Kits £1.00
50 Mixed AC series Transistor £4.50
15 Panel mount rocker switch 250V/10A £1.50
25 Panel Mount Bulbs & Neons £1.50
10A £1.50
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
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
5 Tube Bases £1.00
1,000 Diodes, Condensers, Resistors on Bandolier £2.00
Lucky Dip 600 gram £1.00
Jungle Bag 5Kg £5.00
20 Knobs £1.00
20mm Fuse Holders Chassis Mount 20 for £1
IN4001/6 100 mixed £2.50
EHT Diodes, small 20 for £1
20 Mixed Switches £1

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

Thorn Spares
- New 9000 Decoder £8.50
- 9000 Frame panel £8
- 9000 Cyclops panel £1.50
- 8000/8500 timebase panel £8
- 8800 convergence panel £6
- 8500 convergence panel £6
- 4000 Power supply £3
- 1600 Mains lead, switch
- 3500 6 push button + cable form £1.50
- T605 1vNPN T066 80v/6A 10p
- 9000 Sound output panel £1
- 3500 Focus unit £1.50
- 3500 Mains Trans £4
- 3500 cut outs 10 for £4
- 3500 IF panel £2
- 3500 Frame panel £3
- 3500 Line panel £3
- 3500 A1 Diode 20p
- Export 3500 IF panel £2
- IC board with set of SN74LS £1
- 4000 Tube base £4
- 3500 A1 pots 50p
- Beam limiter panel £1.50
- 3500 Power panel with Y969 £1
- 3 Way regulated adaptor 240V 6V/7.5/9V/300mA £3.50
- Rank/Toshiba preh unit 0354 £9.50
- 2 banks of 3 PB unit, Pye 731 £2
- 4 Push button unit preh £1.00
- 6 Push button VHF/UHF for v/cap. GEC-Decca type £7.00
- 7 Push button for CVC5 ITT £8.00
- KT3 12 Push button unit £2.00
- KT3 (Export) 12 P.B.u £2
- 6 Push button Unit Thorn £1.00
- 6 Push button Unit fits GEC & Decca etc £6.00
- Hearing aid unit £3
- 6 Push button unit PYE 713 £7.00
- 7 Button Unit GEC with Lamps £7
- Bush T515A 6 button unit with Pos & mains lead. 6 bush buttons. Bush £6.00

Mains Droppers
- G8 2R2+68R £1.25
- G8 47R 15 watt 75p
- Pye 731 3+56+27R 50p
- Pye 3R5/15R/45R 50p
- Thorn 50/17/1K5 £1.00
- 120/20/20/48/117 £1.00
- 270/10/6 for Thorn 4000 50p
- 18/320/70/39 £1.10
- Thorn 50-40R-1K5 50p
- Ac Socket & Lead GEC, ITT, Philips, Pye, 25p
- 7×3¾ Thorn 2p
- Rank Toshiba Tube Bases 30p

Speakers
- Pair 25 watt 4Ω speaker & tweeter in cabinet £15.00
- 6×4 G11 25 ohm £1.00
- 5½×2½ 3 ohm £1.00
- 5×3 80 ohm 70p
- 5×3 50 ohm 50p
- 5×3 35 ohm 70p
- 6×4 15 ohm £1.00
- 7×3 70 ohm £1.00
- 8×5 8 ohm 15 watt £2
- 8×5 8 ohm £1
- 5×3 8 ohm 70p
- 7×3 16 ohm £1.00
- 5" dia 16 ohm £1.00
- 5" dia 8 ohm £1.50
- 6½" dia 4 ohm £1.50
- 6½" dia 3 ohm £1.50
- 2¾" dia 8 ohm 75p
- 3" dia 8 ohm 75p
- 4½" sq. 15 ohm 75p
- KT3 speaker K30 75p
- 3" dia 15 ohm 60p
- 1690 5×3 12 ohm £1
- K45 Philip 15 ohm 75p
- K30 15 watt £1

KT3-K30
- OF-550 E.W. correction 10p
- OF-513 10p
- OF-557 50p

Diodes
- BY 126 10p
- BY 127 10p
- BY 133 10p
- BY 134 10p
- BY 164 50p
- BY 176 25p
- BY 179 40p
- BY 184 25p
- BY 187 10p
- BY 190 40p
- BY 196 30p
- BY 198 10p
- BY 204/4 8p
- BY 206 8p
- BY 208/800 8p
- BY 210/400 5p
- BY 210/800 10p
- BY 223 60p
- BY 224/600: 4.8A/600v bridge 50p
- BY 226 15p
- BY 227 15p
- BY 229/400 30p
- BY 237 5p
- BY 254 10p
- BY 255 30p
- BY 298 10p
- BY 299 10p
- BY 406 8p
- BY 527 20p
- BY 407a 10p
- BY 602 10p
- F 247 10p
- XK 3102 50p

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

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

- KT3 Decoder £8
- K30 Sound OP £4
- Hitachi 2A/1500V metal case wire end FARST/REC 20p
- Fidelity Tube Base with transitor & focus pot £1.50
- Bush Tube Base on panel £1.00

Line Transformers
- 1690 Lopt £6
- Hitachi Split Diode and GEC 1981 to 1984 £13
- 2 J/Pots 3,500 1 off each type £3.00
- G8 Symmetry Coil £2.00
- G8 Trans. Philips £7.00
- G11 Split Diode £12.00
- CVC820 Split Diode ITT £10.00
- Thorn B/W AD5308F + Stik + Lead £1.50
- 1690 Thorn EHT over-wind with diode lead & anode cap £2.50
- GEC 2040 £3.00
- GEC 2110 £7.00
- Mullard AT 2036 £1.50
- Pye 169 Line Trans £3.00
- Pye mono £3.00
- Rank mono T704A £3.50
- Split Diode Trans £7.00
- GEC 20 AX Rank Z522 £3
- Rank L.O.P.T. Z970 £3
- CVC 5-8-9 £3.00
- CVC20 ITT £3.50
- AT2080/15 £5.00
- CVC30 ITT £5.00
- CVC32 Line Tran £4.75
- CVC800 Line Trans £6.00
- CVC40 Slip/Diode £12.00
- CVC 45 £5.00
- GEC Portable G1OT2041 £3.00
- GEC Portable G1OT2046 £3.00
- EHT Split Diode Leads ITT £1.00
- Ex panel "14" Fidelity portable £5
- 3500 L.O.P.T. & HT Trans each £2
- LOPT Rank Z763 £5

Triplers
- ITT CVC 5-8-9 £3.50
- Rank T251E Tripler £2.00
- Rank 11TCP A823 £3.50
- TU 25 30K Rank £3.00
- 8500 Triplers £6.50
- 11 TEZ Rank £3.00
- G9 Philips £4.00
- GEC 2110 £4.00
- 3500 Thorn £3.00
- 9000 Thorn £5
- 9500 Thorn £4.50
- 2040 GEC £3.50
- GEC TVM25 Tripler £2.00
- Universal Tripler £5.00
- TVK 76/9 £3.00
- G8 £4.00
- CVC 825 ITT CVC 20/25/30/32 £3.50
- Decca 80 100 £4.50
- Grundig TVK 52 £2.50
- 11TBQ Pye 731 £3.00
- 11THY £4.00
- D22 for Pye 18" colour portable £4.00
- LP 1193/63 £4.00
- BG 100/41 £3.25
- T/text ultrasonic rec'r panel £14.00
- Video cassette lamps on lead. 12-14V. 50p or 3 for £1.00 20 for £5.00 200 for £25.00
- GEC 8 touch unit assy complete with all I.C.'s + pots £4.00
- G11 E.W. Transformer 50p
- G11 E.W. coils £1.00
- G11 Transient Suppressors 245V 10 for £1.00
- G11 Scan Coils £5.00
- G11 100K tuner pots 12 for £1
- KT3 IF panel £6.00
- KT3 line OSC transformer £1
- KT3/K30 infra-red receiver head £1
- K30 drawer unit with IC's (home) £10
- K30 drawer unit with IC's (export) £10
- KT3 AE Sockets 50p
- KT3 receiver panel £8
- KT3 line driver transformer 50p
- Pye, K30, GEC, etc. Pre-mains stand-by switch £1
- Decca 80/100 IF panel £5
- NPN PNP 80V 6 Amp TO66 O.P. Trans. pair 25p
- 5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T £7.00
- Control panel 5 sliders + mains lead £1.50
- G11 8 touch button unit replaces old 6 P.B.U. £24
- Tube base + base unit for 820 Euro chassis £4.00
- GEC Line O/P Trans. & Rec Stick for Portable £3.00
- CVC 20/25/30/35/40 decoder panel £10
- CVC 20/25/30/35/40 decoder panel (untested) £5
- CVC 40/45 IF panel £5
- 40K Transducer 50p
- PHILIPS NE511N £1.20
- LM337M Reg. 30p
- 20 GEC Black Spark Gaps £1.00
- G11 Line Driver Transformer 35p
- KT3 Front Panel Control Assy. £2.50
- BTW 30/50 50p

TELETEX DECODER
- I.C. SAA 5051 K30
- I.C. SAA 5042
- I.C. SAA 5030
- I.C. SAA 5020 etc. £8.00

- BTW 92/800R £3
- 25A473 PNP C/P 10p

- NEW 1617 THORN Chassis with ICs & AU113 £8.00
- 30V Power Supply 500M/A 4×2¼ £2.50
- Pye 731 Power Panel £13
- 6 Diode Universal Triplers £3.25
- NEW PYE 725 line O/P panel with L.O.P.T. & Tripler £10.00
- Thorn Mains Isolator unit for 70-80W. Ex-speaker £2
- NEW GEC 20AX Power Supply Switch Mode £12.00
- Complete new GEC portable chassis M1201H/M1501H with P.B.U./v.cap/LOPTI £10
- Field + Jungle panel for GEC 3133/3135 £1.50
- GEC 2110 line panel with transformer £7.00
- GEC 2110 tuner unit + IF Panel £12.00
- Pye/Chelsea Line op panel £12.00
- Pye 713 IF panel and tuner £7.00
- Pye 713 Chroma £10.00
- Pye/Chelsea Timebase panel with LOPTI £10.00
- Pye 731 Frame Panel £5.00
- Pye 731 Convergence Panel £5.00
- Pye 731 Chroma £10.00
- Pye 731 IF panel + tuner £10.00
- Pye CDA/205 panel £6.00
- GEC portable chassis + LOPTI 2114 New £4.00
- Thorn 1613/1713 chassis 9.75
- G9 Power Panel £6.00
- Mono RANK Chassis 127A NEW £10.00
- NEW G9 Frame Panel £10.00
- NEW G11 IF Panel £10.00

NEW MULLARD TELETEX
- Decoder Panel (VM6230) £6.00
- Panel 6101 £6.00
- G8 Tuner Unit + Panel £5.00
- G8 Convergence Panel (late type) £12.00
- G8 Power Supply £6.00
- G8 6 Sloping PBU £8.00
- G8 IF & Chroma £10.00
- G8 Chroma £6.00
- G11 IF Detector £3.00
- G11 Selector gain module £3
- Complete CVC 825 Chassis (both panels) £40.00
- AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670 £3.00
- Z714 RANK IF Panels 6MHz 1 I.C. SL437F £3.00
- Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705O £2.50
- K35 IF £6.00
- Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P £1.50
- Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead £5.00
- Pye 6 button switch portable £1.00
- GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export) £12.00
- GEC Line O/P PC 659B3 £6.00
- 2110 GEC Power Panel £8.00
- GEC Power Supply (Export) £10.00
- G11 dynamic correction panel £6
- CVC 20 Front panel with sliders + mains input panel £4
- CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots £14
- CVC9 slider pots panel 50p
- CVC 5 Mains on/off + 5 pots £2
- Universal Focus. Fits Pye, Thorn and Decca Units.
- 1147 Rank tube base on panel £1.00
- Z718 Focus Unit £1.50
- T20 Focus Unit £1.00
- Large Type 75p
- Decca Small 75p
- KT3 Focus Unit 75p
- K30 Focus Pot 75p
- K30 Tube base on panel £1.00
- TX10 Focus Units £6.00
- CVC 32 Focus Unit 75p
- Fedility Focus Unit 14R–14S 30p
- 3500 Thorn Focus Unit £1.00
- ITT Small for use with Split
- Z718 Bush Focus £2.00
- Diode 50p
- TV11 50p
- Remo TV12SP 50p
- 1600 Thorn EHT Rec and Lead 50p
- TV13 50p
- TV14 50p
- TV18 60p
- TV20 £1.00
- TV45 50p
- Thorn 14/1500 rec stick 5p

G7000 Philips Video Games Packs 11 types **£8.00 each**

G11 drawer ASS 3 pots Mains switch and lead £2.00

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

CLOCK DISPLAY
- 4 SEG ACDM45 £1.00
- 4000 thick film £2.00

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

- 250/64 10p
- 3300/70 50p
- .1/100 5p
- 1/100 × 10 30p
- 22/100 10p
- 4.7M/100 5p
- 470/100 20p
- 2000/100 70p
- 4700/100 75p
- 47/160 10p
- 300 300/300V 80p
- 800/160 50p
- .1/250 Pulse 5p
- 2.2 250v 10p
- 3n3/250 A.C. 10p
- .33/250V 20p
- .39/250V 15p
- 4n7/250 tested 5KV 25p
- .91/250 35p
- .91/400 30p
- 22/250 15p
- 47/250 10p
- 100/250 20p
- G11 470/250V £1.75
- GEC600/250 60p
- 700/250 £1
- 300+300 MFD 350v £1.00
- 800/250 40p
- 32/300 20p
- 4/350 5p
- 8/350 8p
- 4.7M/350v 10p
- 33/350 20p
- 220/350 30p
- 300/350 40p
- 400/350 50p
- 10/375 10p
- 22/375 15p
- 220/385 75p
- 330/385 CVC 820HT 60p
- 0.1/400 15p
- KT3 E/W .39/400 20p
- .56K/400v 20p
- 4700pf/400 10p
- .22/400 10p
- 8/400 15p
- 33/400 20p
- 400/400 40p
- 394K/400V 20p
- 220/450 40p
- .47/500 25p
- 0.1/600 15p
- 0.1/1200V wire end 20p
- 0.1/450 A/C wire end 20p
- .047/600 15p
- 0.047/1000 10p
- 0.01/1000 10p
- 0.1/1000 10p
- .47/1000v 65p
- .47/250V A.C. 10p
- .001K/1250 10p
- 0.0047/1500 10p
- .005/1500 10p
- .0105/1500 10p
- 1n8/1500 15p
- 2n0/1500 10p
- 2n2/1500 15p
- .01/1600 15p
- G11.8200/2KV 15p
- 0.1/2KV 20p
- 10n/2KV 15p
- 3n9/2KV 15p
- 0.0015/2KV 10p
- 5n2/2KV 10p
- 6n2/2KV 15p
- 2n0/2KV 15p
- 2n2/2KV 15p
- 7500pf/2KV 10p
- 4n7/2KV 15p
- 8n2/2KV 15p
- 0.0082/2500 15p
- 150/3500 10p
- 1800/4KV 5p
- 4.7nf/5KV 10p
- 170/8KV 10p
- 180/8KV 10p
- 210/8KV 10p
- 1000/10KV 10p
- .47/100V 80p

- CVC 20-25-30 Mains Switches 75p
- Infra Red and Ultrasonic G11 Teletext Decoder Panel £30
- RANK & ITT Mains Remote On-Off Switch (720R) £1.50
- RANK & ITT Mains Remote Switch 2865 ohm £1.50
- RANK & ITT Remote Switch 2800 ohm £1.50
- G11 Mains Switch 50p
- 4 amp Mains Switch 25p
- GEC Mains Switch 4 amp 30p
- KT3 Mainswitch £1.00
- THORN Rotary Mains Switch 50p
- G8 Mains Switch 75p
- Thyristor 600/4 amp C106/2 24p
- G11 Preh Red LED P/Button for C.H. Change 20p
- RANK TOSHIBA Transductors TPC-2011 50p
- Mains Switch ITT Long Type Print 75p
- Mains Switch Philip Long Type TAG 75p
- Mains Switch GEC Long Type TAG 75p
- Thorn 12 or 24 volt battery convertor for portable colour T/V £6.00
- Tape Heads R/Play/Back Mono/Stereo £1.00

- 9V Power Supply THORN 9V 200 M/A £2.00
- Rank Secam Decoder Panel UHF & VHF T115A £13.00

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GRUNDIG MODULE TYPES

Tuner IF. AF TRX LOP. TP preamplifier Tuning board. Colour RGB. LED Board. Deflection Board

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- 350V 400M 60p
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- 47/220/350v 60p
- 150/150/100/100/100/320v £2.00
- 2500/2500/63v 50p
- 150/200/200/300v 70p
- 400/400/200v £1.70
- 300/100/100/16/275v £1.50
- 100/200/325v 40p
- 150/150/100/375v £1.50
- 300/300/100/32/32/300v 2.00
- 1500/2000/30v 50p
- Jelly pot Thorn 00D4/013 £3
- 150/150/100/100/320v £2.00
- 100/350 + 300/200/100/16/275v £2.00
- 225+25/380 GEC 70p
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- 500/500/25v 50p
- 150/150/100/300v 75p
- 200/150/150/300v 1.00

ITT Panels
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- CVC 820 Line O/P Panel
- CVC20 Mains Panel £3.00
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- CMD 41 £5.00
- CMD 800 £10.00
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- CMN 21 £1.50
- CMN 40 £1.00
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- CMP 10 £2.00
- CMP 11 £4.00
- CMP 40 £2.00
- CMS 11 £2.00
- CMS 40 £2.00
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- CMU 45 £7.00
- CMZ 30 £5.00
- GMA 90 £5.00
- GMC 120 £2.50
- GMR 64 £5.00
- TMN 2 £2.00
- VCA 20 £10
- VCA 21 £10.00
- VMC 26 £3.00
- VMC 34 £5.00
- VMC 44 + 45 £4.00
- VMC 51 £5.00

Hand Sets
- G11 Ultrasonic Teletex Handset £24.00
- 8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
- New Replacement for G11 Ultrasonic Full Remote £12.00
- Thorn 4000 insert with 7 buttons £5.00
- Decca RC 11 £14.00
- Decca RC 12 £14.00
- G11 Infra-red full teletext £24.00
- Rank, Infra-red £10.00
- Dynatron-Full remote CTV 62, 63, 64 £19.00
- Hitachi infra red handset £18
- Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
- G11, Full remote top button assy. £12.00
- G11, Full remote repair service (exchange unit) £12.00
- Philips infra red full remote 9 channel for 60 CP2605 £6.00
- Philips infra red full remote 12 channel for 60 CP2605 £12.00
- Philips Key Pad set KT3/K30 £3.00
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- KT3/K30 Full remote £15.00
- KT3 Power supply £4.00
- Hitachi 8 button unit with resistor unit. Last year mod. £7.00
- GEC infra-red 2236-2026 £4.00
- GEC push pad hand set button blobs **10p each**
- Pye & Philips handset KT3-K30 chassis. No RC4001-RC5150-RC5176-RC5171-RC5177. **Special Price** £13.00
- ITT Hand Set with TV-Teletex-VCR £12.00