JANUARY 1985

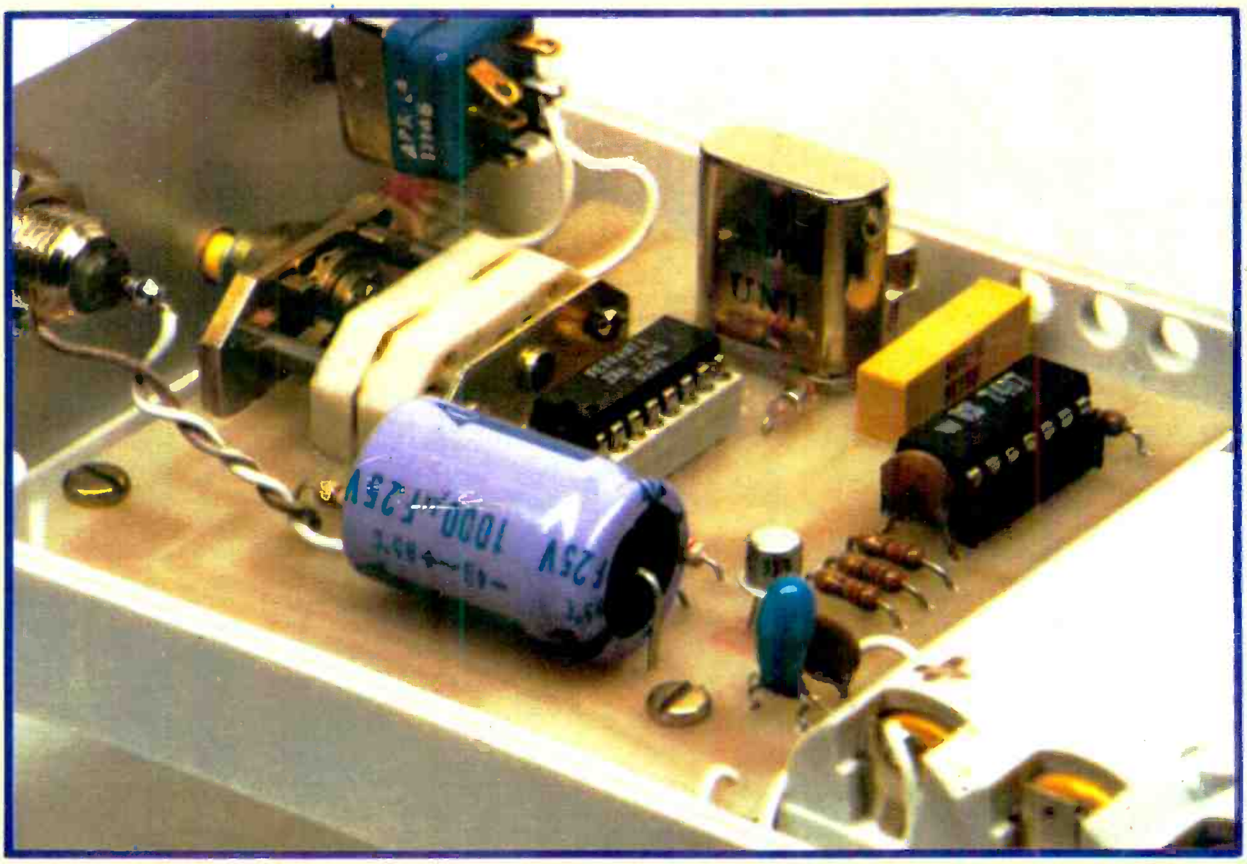
Australia $1.80, New Zealand $2.20, Malaysia $5.50 £1.00

BEER N AGENCY 6 $1.80 BARKLY ST., F'CRAY

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Simple Pattern Generator



The VHS Hi-Fi Sound System

Servicing the s-s Indesit T24

Test Report • Christmas Lights

Goodbye to 405 • DX-TV

VCR Clinic • TV Fault Finding

TELEVISION
SUBSCRIPTION SERVICE

A TV licence enables a householder to enjoy viewing without fear of interruption by callers from the BBC detector van. In the same way a subscription to Television enables you to update yourself on the latest developments without fear of interruption because copies have been sold out.

A regular subscription overcomes this problem. You know how annoying it can be when you have a gap in an important series of monthly articles. Why not avoid sell-out disappointment by arranging for Television to be delivered to you direct from the publisher? Just fill in the the order form overleaf and post in the addressed envelope attached. Then leave us to do the rest.

GIFT SUBSCRIPTIONS

A subscription to Television makes an ideal gift for someone in the same line as yourself. All you have to do is complete the appropriate section of the order form and post in the same way. Wnen we receive it, then we take over. We'll even send a card announcing your gift with your own personal message on it.

TELEVISION
Subscription Service
...we'll keep you posted.

TELEVISION

SUBSCRIPTION RATES

	Twelve Months	Six Months
UK, CI, IOM, IR	£11	£5.50
Overseas	£12	£6

AIR MAIL rates available on request.

Please register the Television subscription(s) below:

- I enclose payment (cheques payable to Television) ☐
- Charge my credit card account: ☐

name of card ______________________

valid from ____________ to ____________

Card no. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Name ______________________ 52 weeks ______ ☐

Address ______________________ 26 weeks ______ ☐

____

____

I would like to arrange the gift subscription to the person named below. (Enter your own name and address above as donor).

Name ______________________ 52 weeks ______ ☐

Address ______________________ 26 weeks ______ ☐

____

______________________ Total amount £S ______

GIFT SUBSCRIPTION MESSAGE TO RECIPIENT

____

____

DETACH HERE

TELEVISION

January 1985

Vol. 35, No. 3
Issue 411

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

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

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

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

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

this month

OUR NEXT ISSUE DATED FEBRUARY WILL BE PUBLISHED ON JANUARY 16

P. V. TUBES
HAVE MOVED

Just phone your order through, we do the rest.

Buy with Access / Barclaycard VISA

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

104 ABBEY STREET, ACCRINGTON, LANCS BB5 1EE.

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
Rank T20	13.00

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	23.00
Philips KT3	14.50
Philips KT30	10.30
ITT CVC 8/9 (mod)	12.00
ITT 6 way with VCR	8.90
Thom 9000 unit	10.60
Thom 9000 switchback	5.30

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
Thom Tx 9/10	1.06
GEC 2040	98
Thom 1591 push on/off	2.90
Rank tuner buttons 1½"×½", 2"×½", 2"×⅜"	35
Rank drive cams	15
GEC 2110 tuner neons	14
Thom 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

EAGLE MULTIMETERS

KEW 7N	6.75	
KEW 14	9.00	
KEW 20	14.50	
EM5	11.95	
EM20A	15.95	
EM10	13.95	
MM50	31.25	Bench
MM100	44.50	Meters
MMT20	21.50	
MM150	75.00	
T1206 intercom	8.50	
MMC100	21.95	Case
TS350	21.95	

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

Decca speaker 16R	4.50
8R	3.75
B+K tube bases Dynascan	
No. 3 9.50 / No. 13	11.11
No. 6 11.08 / No. 14	16.78
No. 8 10.08 / No. 23	13.86
L5 7"×3⅜" speaker	4.25
C12 computer cass.	30
C18 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
Labgear CM7091 UHF/VHF colour bar gen.	116.00
Televerta up converta	37.20

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

K30 SPECIFICS

K30 LOPT	17.50
K30 focus unit	2.90
K30 EHT lead	5.90
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	14.50
Hand set 1234	14.50
Diode ZTX 33B	90
DL 20 delay line	2.20

SPECIFIC COMPONENTS

Philips G8 knobs sm/lg	50
90° transductor	2.60
Thom 1591 speakers sm	4.10
lg	4.50
Thom 1500 controls	59
390K frame 470K line contrast 1k5	each
Focus control Thom/GEC	1.83
Thom 9000 focus unit	5.95
Thom 8500 focus unit	4.75
Thom Tx10 focus cont.	9.00
Decca bridge trans.	1.97
Decca 30 width cont.	50
Decca 2M2 HT cont.	25
Rank T20 focus cont.	2.20
Pye 731 HF choke	6.50
Delay lines DL20, DL60, DL700, DL50	2.20
CRT tube base	70
EHT final anode cap	53
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

SPARK GAPS

Decca 100	52
0.75 pf	1.50
0.01 pf	32

SERVICE AIDS

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

ELECTROLUBE PRODUCTS

Electrolube Adhesive	62
Electro-Mech lubricant	1.49
Elect. cleaning solvent	1.62
Freezer	1.49
Foam cleanser	1.12
Heat transfer compound	1.14
Silicone compound	1.94
Special contact fluid (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
Philips VCC 240	6.20
Philips VCC 360	8.30
Philips VCC 480	10.21
Philips LVC 1700	15.10

VIDEO HEADS

3HSS VHS	32.50
4HSS VHS	32.80
PS3B Beta/Sony	42.00

VIDEO RECORDER HEADS

Philips V2000	52.00
Philips 1700	52.00
Video lamps	1.30
Video lamp holders	3.30

VIDEO DRIVE BELT KITS

JVC HR3330/3600	4.50
JVC HR3360/3660	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	

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

ANTEX SOLDERING EQUIPMENT

C15W Iron 240V	4.41
C240 Element	1.80
Bits 102	90
106	90
820	90
821	90
CS17W Iron 240V	4.41
CS240 Element	2.25
Bits 1100	90
1101	90
1106	90
XS25W Iron 240V	4.59
XS240 Element	2.25
Bits 50	90
51	90
Temp. Controlled	
30W Iron CSTC	10.50
40W Iron XSTC	10.50
Unit for above TCSU1	32.64
Stand	2.00
MLXS Auto Repair Kit	6.30

WELLER

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

LABGEAR

CM7261 Power Unit 12V	10.70
CM7262 Reg. Power Unit 12V	11.67
CM7060 MHA 10db 12V W/B	9.39
CM7065 VHF/UHF MHA W/B 12V	13.66
CM7067 UHF 12V MHA (Specify A-B or C/D)	10.21
CM7068 UHF 12V MHA High Gain (Specify A-B or C/D)	15.19
CM7053 Behind Set UHF Amp. (Mains)	12.13
CM7054 Behind Set UHF Amp. (Battery e.g. Caravans)	9.92
CM7043 Second Set Amp. UHF	11.54
CM7093 Behind Set UHF Amp. 3 Sets	14.54
CM7063 Dist. Amp. VHF/UHF 17db/output 12V	20.10
CM7108 VHF/UHF 8+1 Dist. Amp.	41.20
CM9700 27mhz CB Suppress.	3.86
CM6011 Outdoor Splitter (2 way) W/B	7.46
CM9003 Flush Single Outlet	1.40
CM9010 Flush Twin Outlet	1.86
CM9034 UHF Group Filters with DC Through Pass (state A/B/CD)	6.97
CM6006 6 Way Passive Splitter	10.97
CM7042 TV Games Combin.	2.68
CM9009 Flush TV/FM Outlet	2.90
CM7091 Col. Bar Gen.	116.00

STATIONERY (Zero VAT)

Service Call Pad (100)	1.20
Repair Ticket (100)	3.90
Job Card (100)	2.50
Rental Payment Card (50)	3.50
Rental Agreements (100)	3.50
H.P. Agreements (100)	3.50
Maintenance Agreement (100)	3.50

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)	7.00
13A Plug Top (box 10)	4.80
Portable Oscilloscope	155.00
Probes (x10)	10.90
Probes (x1)	10.90
CRT Tester/Rejuven.	172.00
KHP30 Meas. Probe 30kV	32.00
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	2.20
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
Dynascan CRT Res.	455.00

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
Antistatic Foam (12" sheet)	75
I.C. Inserters	1.18

DATA BOOKS (Zero VAT)

TVT 80 A-Z only	3.75
TVT 80 2N-2S only	4.00
TVT 80/80 A-Z/2N-2S (pair)	7.50
LIN IC Books (data only not equiv.)	
LIN1	5.95
LIN2	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

Specific Video Leads (please state models)	4.25
Universal Video Lead Kit	6.00
EHT Cable	per mtr 25
BNC to BNC Lead	1.75
BNC Plugs	1.16

PLUGS

Phono Plugs	12
DIN Plugs 3 pin	22
4 pin	22p
180° 5 pin	20p
stnd 5 pin	20
Car Aerial Plug	18
2.5mm Jack Plug	14
3.5mm Jack Plug	14
Stand Jack Plug	20
Stereo Jack Plug	36
Coax Plugs	each 18
	ten 1.80
PL259	40
Reducers for PL259	16
Line Connectors	16

CASSETTE DRIVE BELTS

35m	35	46mm	37	57m	37
66m	39	71m	43	76m	43
90m	43	110m	59		

OFFICIAL ORDERS ACCEPTED FROM SCHOOLS, LOCAL AUTHORITIES ETC.

P.V. MICROCOMPUTER CENTRE

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

Spectrum 48K Vic 20 Commodore 64 Oric

We are also authorised dealers for the BBC Micro and accessories.

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	1.91
COB11 Outlet	80
CS200 Combiner/Splitter	3.03
CS1000 Combiner/Splitter	6.15
PU1240 Power Unit	11.00
UP1300 MHA	8.25
XS2U Xtraboost	11.63
4 way VHF/UHF Amp	33.75
6 way VHF/UHF Amp	42.00
XG8 High Gain Aerial A-B-CD-WB	16.00

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 £45

VTC 9300/9500
VTC 5300/5000
VTC 5350
VTC 5500
VTC 9350

REMOTE CONTROL HAND UNITS

Grundig Telepilot 200/300	18.87	Philips G11 Teletext	23.80
Grundig Telepilot 12/16	13.87	Philips G11 non-Teletext	22.00
Philips KT2/KT3	13.87	Decca 100	23.80
JVC/Ferguson TX 10	16.87		

TELEPHONE JACK SOCKETS 5.00

Complete with details connecting diagram.

We also have a full range of telephone fixing accessories. Please ring for prices.

PLEASE ORDER FROM LATEST COPY OF MAG. TO AVOID PRICE INCREASES

P. V. TUBES

TEL: 0254 36521/32611

104 ABBEY STREET, ACCRINGTON

T.T.L. 74LS SERIES

74LS00	58	74LS37	35	74LS92	65	74LS160	90	74LS245	2.30
74LS02	58	74LS38	35	74LS93	60	74LS161	85	74LS251	65
74LS03	58	74LS40	35	74LS107	80	74LS162	4.04	74LS253	95
74LS04	58	74LS42	80	74LS109	58	74LS163	85	74LS257	1.20
74LS05	58	74LS47	85	74LS112	50	74LS164	85	74LS258	95
74LS08	58	74LS48	83	74LS113	44	74LS165	1.50	74LS259	1.70
74LS09	58	74LS49	33	74LS114	70	74LS173	1.32	74LS273	1.90
74LS10	58	74LS51	33	74LS123	80	74LS174	85	74LS283	1.30
74LS11	58	74LS54	43	74LS125	85	74LS175	85	74LS293	1.20
74LS13	37	74LS55	60	74LS126	60	74LS191	1.02	74LS352	1.40
74LS14	46	74LS73	60	74LS132	63	74LS192	1.30	74LS353	1.40
74LS15	33	74LS74	65	74LS138	83	74LS193	1.30	74LS365	75
74LS20	35	74LS75	65	74LS139	65	74LS194A	75	74LS366	82
74LS21	35	74LS76	65	74LS151	85	74LS197	95	74LS367	1.65
74LS22	35	74LS78	65	74LS153	85	74LS240	2.20	74LS368	65
74LS26	44	74LS83A	89	74LS155	65	74LS241	2.20	74LS373	1.40
74LS27	35	74LS86	39	74LS156	1.02	74LS242	2.20	74LS374	1.55
74LS30	35	74LS85	98	74LS157	78	74LS243	2.20	74LS393	1.20
74LS32	90	74LS90	1.22	74LS158	65	74LS244	2.20	74LS670	1.78

VOLTAGE REG.

7805	78
7806	78
7808	78
7812	78
7815	78
7818	78
7824	78
78L05	68
78L08	68
78L12	68
78L24	68
7905	98
7906	98
7908	98
7912	98
7915	98
7918	98
7924	98
79L05	72
79L12	72
79L15	72
79L24	72

'4000 B' SERIES CMOS

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

I.C. SOCKETS

DIL to DIL	
8 way	22
14 way	29
16 way	32
18 way	32
20 way	32
22 way	32
24 way	34
38 way	45
40 way	84
DIL to QUIL	
14 way	32
16 way	34
18 way	37
QUIL to QUIL	
14 way	32
16 way	36

MAINS DROPPERS

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

NEW VALVES

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

THERMISTORS

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

THERMAL CUT OUT

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

L.E.D's

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

CRYSTALS & FILTERS

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

MULTITURN POTS

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

SERVICE WITH A SMILE

DISC CERAMIC CAPS

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

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

LINE OUTPUT TRANS.

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

RECTIFIER TRAYS

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

RECTIFIER STICKS

TV11	90	TV18	1.10
TV13	93	TV20	1.23

REPLACEMENT ELECTROLYTICS

PYE 169 (200/200/100/32)	3.40
PHILIPS 320 (400/400/200V)	2.74
DECCA 30 (400/400.350V)	3.40
DECCA 80 (400/350V)	3.97
DECCA 100 (800/250V)	
DECCA 1700 (200/200/400/350V)	4.83
PHILIPS G8 (600/300V)	2.30
PHILIPS G9 (600/300V)	2.21
PHILIPS G11 (470/250V)	2.90
PYE 691/7 (200/300/350V)	2.70
PYE 731 (600/300V)	2.31
RBM A823 (2500/2500/30V)	1.66
RBM A823 (600/300V)	2.83
RBM Z146 (300/300/350V)	3.55
RR1 T20A (220/400V)	2.00
ITT CVC5/9 (200/200/75/25)	2.98
ITT CVC 20 (220/400V)	2.00
GEC 2110 (600/250V)	1.94
GEC 2040 (1000/2000/35V)	1.19
GEC 2040 (300/300/150/100/50)	4.10
THORN 3500 (400/40V)	30
THORN 950 (100/300/100/16/275V)	1.83
THORN 1400 (150/100/100/100/150/320V)	2.79
THORN 1500 (150/150/100/300V)	2.20
THORN 1500 (12/300V)	31
THORN 3500 (175/100/100/400/350V)	2.78
THORN 3500 (1000/63V)	86
THORN 3500 (1000/70V)	86
THORN 8000/8500 (2500/2500/63V)	3.38
THORN 8000/8500 (700/250V)	2.31
THORN 8000/8500 (400/350V)	2.56
THORN 9000 (400/400V)	3.28
GEC (200/200/150/50)	2.64
PHILIPS 69 2200/63V	1.25
THORN 4700 P/C 25V	1.20
THORN 1591/1691 4700/25V	1.20

CAPACITORS AXIAL

Volts	Mfd	Price		Mfd	Price
			63V	1	12
6V3	33	9		2.2	12
10V	22	10		4.7	12
	47	10		10	11
	100	10		15	12
	220	15		22	13
	470	20		47	19
16V	33	11		100	23
	68	11		220	37
	220	16		470	49
	1000	27		1000	58
	3300	53		2200	94
25V	10	11	100V	10	13
	22	13		22	15
	47	15		47	20
	100	15		100	36
	220	29		220	70
	470	30	450	1	33
	1000	55		4.7	30
	2200	51		10	30
	4700	98		22	65
40V	10	10		33	75
	22	10	500	10	32
	400	48	600	0.1	41

MIXED DIELECTRIC CAPS

Volts D.C.

250V	0.91mF	1.15	1250V	0.1mF	59
400V	0.22mF	29	1500V	0.0047mF	32
600V	0.1mF	38		0.022mF	30
1000V	0.01mF	24		0.033mF	62
	0.047mF	46		0.005mF	65
	0.033mF	33	2000V	0.0052mF	1.20
	0.1mF	35	2500V	0.0022mF	50
	0.22mF	66			
	0.47mF	98			

POLYESTER CAPS

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

TANTALUM CAPACITORS

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

CONVERGENCE POTS

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

METRIC CONVERGENCE POTS

PHILIPS G8 5R-10R-15R-20R-50R — **60**

FUSES

	Per type	Pack of 10
1¼" QUICK BLOW		
100ma		73
250ma-500ma-750ma-1A		60
1.5A-2A-2.5A-3A-5A		60
1¼" ANTISURGE		
250ma, 500ma, 600ma, 630ma, 750ma, 850ma, 1A, 1.25A, 1.5A, 2A		1.70
2.5A, 3A, 5A		2.70
20mm ANTISURGE		
80ma		4.80
100ma		2.50
160ma, 200ma		2.20
315ma, 500ma, 630ma, 800ma, 1A, 1.25A, 1.6A, 2A		1.30
2.5A, 3.15A, 4A, 400ma, 5A		1.90
20mm QUICK BLOW		
100ma, 250ma, 500ma, 630ma, 800ma		90
1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 5A		60
1" MAINS		
2A, 3A, 5A, 10A, 13A		1.00

NEW MONO TUBES

MULL. A31/510 110° 12"	18.50
MULL. A34/510 110° 14"	20.00
A50/120WR 110° 20"	15.00
A61/120WR 110° 24"	17.50
VEGA 12" 90° (Jap Types)	15.00

MULLARD COLOUREX*

18" A47/343X	59.00
19" A49/120X	53.00
20" A51/110X	53.00
22" A56/120X	46.00
25" A63/200X	55.00
26" A66/120X	65.00
26" A67/120X	65.00
22" A56/500X	60.00
A51 570X	72.00
A56 510	67.00
A66 510	92.00

WHILE STOCKS LAST
NEW TUBES

ATX 56-001	95.00
ATX 51-00X	95.00
A56/610	95.00

REBUILT COLOUR TUBES

ALL AVAILABLE EX-STOCK ON GLASS FOR GLASS EXCHANGE FROM TRADE COUNTER. SOME TYPES AVAILABLE WITHOUT EXCHANGE FOR SMALL GLASS CHARGE

17" A44/271X	32.00
18" A47/342X (Low Focus)	32.00
18" A47/343X (Stnd Focus)	32.00
20" A51/110X	30.00
19" A49/120X	30.00
22" A56/120X	30.00
22" A55/14X	30.00
25" A63/200X	34.00
26" A66/120X	34.00
26" A67/120X	34.00
22" A56/140X (410X) 110°	36.00
26" A66/140X (410X) 110°	36.00
20" A51/161X	60.00
22" A56/510X	50.00
A56 540X	89.00
A66 540X	75.00
A66 500X	64.00

P.I.L. TUBES – we can rebuild your own glass – please ring for quotes.

SLIDER POTENT

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

SKELETON PRE-SET POTS

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

MIDGET CONTROLS

Insulated Spindle Length 44mm

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

THICK FILM RESISTOR NETWORK

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

WIREWOUND RESISTORS*

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

(Preferred values)*

EVER READY BATTERIES

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

STOP PRESS

Special Prices
5¼" Floppy Disc

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

SERVICE MANUALS (Zero VAT)

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

CARBON RESISTORS*

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

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

RECHARGEABLES

EVER READY

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

EAST CORNWALL COMPONENTS

1985 CATALOGUE AVAILABLE – Many prices reduced – range increased – 123 pages fully illustrated. Price 65p, per copy (free upon request with orders over £5) – includes 30p Credit Note, special offer sheets, order form and pre-paid envelope. **SEND NOW FOR YOUR COPY.**

VALVES

Type	Price (£)
DY802	0.88
DY86/87	0.75
ECC81	0.95
ECC82	0.65
ECC83	0.75
ECC84	0.65
ECC85	0.90
ECC88	0.95
ECF80	0.95
ECH81	0.75
ECH84	0.75
ECL82	0.75
ECL86	0.98
EF80	0.65
EF86	1.60
EF183	0.75
EF184	0.75
EH90	0.94
EL34	3.25
EL84	0.69
EL509	5.50
EM87	2.55
EY86/87	0.67
EY500A	1.65
PCC84	0.50
PCC85	0.65
PCC89	0.74
PCC189	0.85
PCF80	0.75
PCF86	1.25
PCF200	1.95
PCF801	1.45
PCF802	1.00
PCF806	1.20
PCL82	0.90
PCL83	2.50
PCL84	0.90
PCL86	1.15
PCL805/85	1.35
PD500	3.75
PFL200	1.35
PL33	1.50
PL36	1.45
PL81	0.85
PL82	0.75
PL83	0.65
PL84	0.75
PL95	2.00
PL504	1.20
PL508	2.40
PL509/519	5.95
PY88	1.80
PY500A	2.40
U26	1.90
UCH81	0.90
UCL82	1.70
6J5GT	1.75
6SJ7	2.20
30FL12	1.60

TRANSISTORS + DIODES

Type	Price (£)
AC127	0.30
AC128	0.30
AC128K	0.34
AC132	0.55
AC141	0.26
AC141K	0.40
AC142	0.26
AC142K	0.48
AC151	0.45
AC152	0.45
AC176	0.28
AC176K	0.46
AC187	0.42
AC187K	0.48
AC188	0.44
AC188K	0.50
ACY40	0.88
AD142	1.10
AD143	1.10
AD149	0.96
AD161	0.42
AD162	0.42
AD161/AD162	0.98
AF106	0.48
AF114	2.10
AF115	2.10
AF116	2.10
AF117	2.10
AF118	0.85
AF121	0.62
AF124	0.48
AF125	0.48
AF126	0.48
AF127	0.48
AF139	0.68
AF178	0.68
AF239	0.68
AF279S	0.75
AL100	2.50
AL102	5.90
AL113	2.20
ASY80	1.75
AU110	1.40
AY102	4.32
BA102	0.34
BA110	0.67
BA121	0.40
BA129	0.38
BA148	0.16
BA154	0.08
BA155	0.10
BA156	0.08
BA157	0.28
BA164	0.14
BB104B	0.52
BB105B	0.30
BB105G	0.48
BB110B	0.42
BC107	0.10
A or B	0.12

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

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

Type	Price (£)
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.54
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.50
BF115	0.32
BF117	0.54
BF119	0.82
BF120	0.38
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BF160	0.23
BF167	0.30
BF173	0.25
BF177	0.42
BF178	0.30
BF179	0.32
BF180	0.35
BF181	0.35
BF182	0.32
BF183	0.32
BF184	0.32
BF185	0.32
BF194	0.08
BF195	0.10
BF196	0.10
BF197	0.10
BF198	0.14
BF199	0.16
BF200	0.26
BF222	0.48
BF224	0.20
BF224J	0.16
BF240	0.20
BF241	0.20
BF244	0.26
BF244A	0.28
BF244C	0.24
BF245A	0.28
BF254	0.15
BF256	0.40
BF257	0.32

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

Type	Price (£)
BT101/300	1.15
BT101/500	1.25
BT102/300	1.35
BT102/500	1.65
BT106	1.50
BT108	1.30
BT109	1.18
BT116	1.25
BT119	3.62
BT120	3.60
BT121	3.02
BT138/600	1.30
BT151/560R	0.90
BT151/300R	1.15
BTY79/400R	2.80
BU100A	2.30
BU104	2.00
BU105	2.10
BU105/02	1.56
BU108	1.80
BU124	1.75
BU126	1.25
BU133	1.80
BU204	1.35
BU205	1.30
BU206	1.70
BU208	1.55
BU208A	1.63
BU208/02	2.05
BU326S	1.75
BU407	1.65
BU407D	1.80
BUX80	3.70
BUY20	1.75
BUY69A	2.60
BUY69B	1.98
BY101	0.48
BY118	1.10
BY122	0.68
BY126	0.12
BY127	0.10
BY133	0.16
BY135	0.25
BY164	0.44
BY179	0.66
BY182	0.87
BY184	0.40
BY187	0.24
BY189	4.75
BY198	0.44
BY199	0.47
BY206	0.24
BY207	0.24
BY210/400	0.25
BY210/600	0.26
BY210/800	0.30
BY223	1.20
BY227	0.26
BY229	0.30
BY238	0.68
BYX10	0.24

Type	Price (£)
BYX36/150	0.22
BYX36/600	0.28
BYX48/300	0.72
BYX49/300	0.47
BYX55/350	0.29
BYX55/600	0.33
BYX71/600	1.18
BYZ12	0.42
C106D	0.80
E1222	0.40
E5024	0.30
GET872	0.48
ITT44	0.04
ITT2002	0.11
ME0402	0.20
ME0404/2	0.24
MEU21	0.60
MJ400	1.25
MJ2955	0.90
MJ3000	1.98
MJE240	0.60
MJE340	0.54
MJE370	0.88
MJE520	0.48
MJE2955	0.99
MJE3055	0.70
MPSLO1	0.28
MRF475	2.50
MRF479	5.20
MRP477	10.00
OA47	0.10
OA90	0.08
OA91	0.09
OA95	0.18
OA200	0.06
OA202	0.15
OC25	2.10
OC26	1.70
OC28	1.50
OC29	2.47
OC35	1.75
OC36	1.75
OC42	0.72
OC42K	1.40
OC44	0.72
OC45	0.58
OC71	0.50
OC72	0.52
OC81	0.68
OC200	2.46
OC202	2.20
ORP12	0.85
R2008B	1.50
R2010B	1.52
SHG1.5	0.40
TAG1/100	1.40
TAG3/400	1.78
TIC44	0.40
TIC45	0.45
TIC46	0.48
TIC47	0.70

Type	Price (£)
TIC106A	0.70
TIP30A	0.46
TIP31C	0.54
TIP32	0.40
TIP32C	0.60
TIP33A	0.63
TIP34A	0.72
TIP41C	0.46
TIP42A	0.52
TIP47	0.60
TIP110	0.88
TIP2955	0.60
TIP3055	0.60
TIS43	0.32
TIS88	0.40
TIS90	0.25
TIS91	0.28
ZTX108	0.12
ZTX109	0.12
ZTX212	0.28
IN4001	0.05
IN4003	0.05
IN4004	0.06
IN4006	0.07
IN4007	0.07
IN4148	0.05
IN5400	0.12
IN5402	0.15
IN5405	0.16
IN5406	0.18
IN5408	0.20
IS920	0.08
2N697	0.55
2N706A	0.33
2N2904	0.28
2N2906	0.24
2N2926G	0.10
2N3053	0.22
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.16
2N3906	0.16
2N5294	0.48
2N6107	0.71
2N6126	0.68
2SB337	1.60
2SC495	0.65
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
2SC1226	0.84
2SC1279	0.50
2SC1306	0.92
2SC1307	1.40
2SC1413A	2.70
2SC1444	1.45

Type	Price (£)
2AC1449	0.63
2SC1507	0.63
2SC1678	1.06
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74
2SC1957	0.76
2SC1969	2.88
2SC2028	0.73
2SC2029	2.10
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
2SC2166	1.20
2SC2314	0.80
2SC2335	1.50
2SC2371	0.90
2SC2749	2.70
2SC2752	0.60
2SD234	0.64
2SD348	3.30
2SD986	0.62
2SJ50	5.20
2SK134	3.80
2SK135	4.60
3N126	1.90
3N211	2.52
3SK45	0.76
3SK88	0.66
3SK135	5.20

PVC Insulating Tape. 6 colours available. 10 rolls £1.50

PRESETS

0.25W Type 100R-4M7 V & H **10p** ea. 10/90p 0.1W Type 100R-1M V & H 7p ea. 10/65p

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

HV Disc Ceramic (†)

1kV 1.5nF 18p
8kV 10, 47, 56, 82, 100, 120, 150, 180, 200, 220pF 30p
270, 300pF 39p

ZENER DIODES

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

INTEGRATED CIRCUITS. (£) EACH

Type	(£)
AN240P	3.42
AN214Q	3.88
AN715Q	2.90
CA3065	1.75
CA4031P	2.88
CA4102	3.30
CA4250	3.50
CA4400	2.98
CA4422	3.07
LC7120	5.33
LC7130	5.26
LC7137	5.16
LM380N	1.65
LM1303N	2.52
HA1151P	3.12
MC1307P	1.85
MC1310P	1.85
MC1312P	2.25
MC1327P	1.25
MC1330P	0.83
MC1349P	1.85
MC1350P	1.20
MC1351P	2.50
MC1352P	1.50
MC1357P	2.88
MC1358P	1.30
MC1496L	1.15
ML231B	2.10
ML232B	2.10
ML237B	2.30
MRF475	2.50
MRF479	5.20
MRP477	10.00
NE555	0.50
C-mos 555	0.88
NE556	0.80
SAA1024	5.35
SAA1025	8.40
SAS560A	2.50
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.82
SC9503P	1.10
SL432A	4.00
SL901B	5.20
SL917B	7.25
SL1327Q	1.10
SN76003N	2.44
SN76013N	1.90
SN76023ND	2.90
SN76033N	2.45
SN76110N	1.12
SN76115N	2.00
SN76131N	1.65

Type	(£)
SN76226DN	1.80
SN76227N	1.10
SN76530P	1.40
SN76533N	1.60
SN76650N	1.05
SN76660N	0.75
SN76666N	0.80
STK015	6.50
TA7108P	3.20
TA7120P	2.20
TA7129AP	3.65
TA7130P	1.65
TA7172	1.80
TA7193	5.50
TA7172P	1.80
TA7176	2.50
TA7202P	4.18
TA7204P	1.86
TA7205AP	1.50
TA7208P	3.27
TA7210P	6.50
TA7222P	2.12
TA7223P	3.68
TA7227P	5.60
TA7310P	1.80
TA7609P	4.28
TA7611AP	2.88
TAA263	2.46
TAA310A	2.68
TAA550	0.50
TAA570	1.99
TAA611A12	3.50
TAA630S	3.90
TAA661B	1.70
TAA700	2.80
TAA840	3.38
TAD100	2.80
FM FILTER	1.20
TBA120 AS,	
S,SA,SB	1.30
Q,T,U,UQ	1.32
TBA120B	1.30
TBA231	1.45
TBA281	2.65
TBA395	1.20
TBA480Q	1.50
TBA400	2.30
TBA510	2.60
TBA510Q	2.60
TBA520/Q	1.60
TBA530/Q	1.30
TBA540/Q	1.40
TBA550/Q	1.52
TBA560C	1.70
TBA560CQ	1.60

Type	(£)
TBA570	1.50
TBA641BX1	4.50
TBA673	2.40
TBA700	2.85
TBA750	2.80
TBA800	1.60
TBA810P	1.10
TBA810S	1.20
TBA820	1.60
TBA890	3.88
TBA920/Q	3.00
TBA950/2A	3.05
TBA970	4.05
TBA990	1.88
TCA160C	3.90
TCA270S	4.00
TCA270SA	4.02
TCA800	3.10
TCA940	1.90
TDA440	3.80
TDA1002	1.90
TDA1003A	5.50
TDA1006A	2.40
TDA1035S	4.50
TDA1044	4.30
TDA1170S	3.00
TDA1190	3.50
TDA1200	2.98
TDA1270Q	3.70
TDA1327A	1.66
TDA1352A/B	1.56
TDA1412	1.20
TDA2002	2.80
TDA2020	4.60
TDA2030	2.78
TDA2140	5.90
TDA2521	4.10
TDA2523	3.50
TDA2530	2.70
TDA2540	3.80
TDA2541	3.80
TDA2560	3.50
TDA2571A	2.50
TDA2581	3.20
TDA2590	3.20
TDA2591	2.98
TDA2593	2.98
TDA2610	3.20
TDA2611A	1.94
TDA2640	2.90
TDA2680	3.40
TDA2690	3.50
TDA3950A/B	2.60
UPC554C	1.32
UPC557H	0.90
UPC566H	2.95
UPC575C2	3.20
UPC1018C	1.10
UPC1025H	2.90
UPC1032H	0.90
UPC1156H	4.20
UPC1158H	0.76
UPC1163H	0.98

Type	(£)
UPC1181H	1.60
UPC1185H2	3.75
UPC1212C	1.30
UPC1228H	0.54
UPC1230H	3.90
UPC1350C	4.25
UPC1367C	3.40
UPC1378H	4.40
UPC2002H	2.80

D CONNECTORS

	9 way	15 way	25 way
Male			
Solder	.75	1.00	1.50
Angle	1.40	2.00	2.40
Female			
Solder	1.00	1.45	1.85
Angle	1.50	2.00	2.40
Covers	.80	.80	.80

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	0.10
F.M. Plugs	0.20
PL259 Plugs	0.38
Reducer	0.15
Low loss splitter 1 in, 2 out	1.00

SOLDERING SECTION

XS25 Watt Iron complete with steel and plug attached	7.20
CS 18W, as above	7.00
Antex 15W iron	5.00
Antex 18W iron	5.00
Antex 25W iron	5.20
Antex elements	2.00
Antex bits	0.95
Antex stands	1.90
Soldersucker	4.50
Nozzles	0.65

TERMINAL BLOCKS

2 amp 12 way	0.19
5 amp 12 way	0.20
10 amp 12 way	0.40
15 amp 12 way	0.46
32 amp 12 way	0.90

NOW AVAILABLE –

FULL RANGE OF SONY TV & VIDEO SPARES.

VIDEO HEADS

SLC6-SLC7 A-676-203-8A	£40.00 each
SLC5 A-676-204-4A	£45.00 each

REWIND KIT

SLC5-SLC7	£4.50 each
SLC6	£3.50 each

TELEPHONE SPECIAL

B.T. Approved. Telephone Plug + 3m Lead £1.25
B.T. Approved. Master Socket. Incl. Wiring Inst. £2.85
B.T. Approved. Secondary Socket £1.95
B.T. Telephone now available.

NI-CAD CHARGER

Universal Ni-Cad charger, charges PP3, AA, C, D
Price £5.00

Rechargeable Batteries

AA (HP7)	£0.85 10/ 75p each
C (HP11)	£1.75 10/£1.65 each
D (HP2)	£2.05 10/£1.95 each
PP3	£3.80 10/£3.70 each

CHART RECORDER SPECIAL

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

EXPORT TV's

Attractive prices on 22" remote control T.V. sets for anywhere in the world. Brand new. Normal guarantee etc. Write for details.

I.C. SOCKETS

Dil to Dil

8 pin	0.08	0.70/10
14 pin	0.10	0.95/10
16 pin	0.11	1.00/10
22 pin	0.21	1.95/10
28 pin	0.30	2.75/10
40 pin	0.34	3.10/10

CO-AXIAL CABLE

50ohm UR43 type 34p per metre
75ohm UR202 type 22p per metre

MINIATURE MULTI-CORE

4-core 37p per metre
9-core 46p per metre

TWIN FIGURE 8

Grey & Clear 10p per metre

TEST LEAD WIRE

Red & Black 38p per metre

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

MULTISECTION ELECTROLYTICS

THORN	850	100+300+100+16/300V	1.80
	1400	150+100+100+100+150/320V	2.70
	1500	150+150+100/300V	1.50
	3000	1000/63V	0.56
	3500	175/400V+100+100/350V	1.70
	8000	400/350V	2.10
	8000/8500	2500+2500/63V	1.35
	8000	700/250V	2.10
		1000/70V	0.58
	9000	400/400V	2.25
Timer Amp		4700/25V	0.70
DECCA 10/30		400+400/350V	2.45
	1700	200+200+400/350V	3.52
GEC	2047	2048 2083 2084 2104	
		200+200+150+50/300V	2.32
		600/250V	1.50
ITT/KB		200+200+75+25/350V	2.15
		220/100V	1.95
PHILIPS	G8	600/300V	1.70
	G8 G9	600/300V	1.50
	G11	470/250V	1.50
	G9	2200/63V	1.26
EKCO	T148	125+200+100+32/275V	2.65
	691 Series	200+300/350V	2.15
		600/300V	1.80
RANK		300+300/300V	2.05
	A823	2500+2500/30V	0.98
		220/400V	1.75
		600/300V	1.78

VDRs, etc.

E295ZZ	
01/	0.28
02/	0.28
E298CD	
/A258	0.25
E298ED	
/A258	0.22
/A260	0.22
/A262	0.22
/A265	0.22
/P268	0.22
E299DD/P116-P354	all 0.23
E299DH	
/P230	0.72
VA1015	0.92
VA1026	0.79
VA1033/34/38/39/40/53	all 0.20
VA1055s/56s/66s/67s	all 0.23
VA1074	0.20
VA1077	0.31
VA1091	0.29
VA1096/97/98	all 0.20
VA1103	0.32
VA1104	0.72
VA1108/09/10/11/12	all 0.24
VA8650	1.20
2322 554 02221	0.59

SERVICE AIDS

ALL SERVISOL PRODUCTS		Excel Polish	0.76
		Fire Extinguisher 640g	2.80
Switch Cleaner	0.88	Video Head Cleaner	0.88
Circuit Freezer	0.96		
Foam Cleanser	0.84	Solda Mop (Std)	0.72
Aero Klene	0.78	Solda Mop (L/Gauge)	0.72
Silicone Grease (Tube)	1.60	Heat Sink Comp	1.08
Antistatic Spray	0.82	Additional P&P on above 30p	
Plastic Seal	0.88		

FUSES Prices per 10

1¼" Quick Blow. 100, 150, 250mA **£1.30.** 1, 1.25, 1.5, 2, 2.5, 3, 10, 15A **55p.** **1¼" Time Delay.** 100mA **£3.50.** 150mA **£2.25.** 250, 300, 500, 600, 750, 850mA **£1.84.** 1, 1.25, 1.5, 1.6, 2A **£1.84.** 2.5A, 3.15, 3, 5A **£2.82.** **20mm Quick Blow.** 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. **40p.** **20mm Time Delay.** 100, 125, 160, 200mA **£1.80.** 250, 315, 400, 500, 630, 800mA. **£1.00.** 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A **85p.** **1" Mains.** 2, 3, 5, 7, 10, 13A **85p.**

Manufacturers please note — Very attractive quantity prices available upon request.

RESISTORS – CARBON FILM 5%

¼W 1R0 to 10M (E12 Range)	**2p each. 15p/10. 75p/100**
½W 2R2 to 10M (E24 Range)	**2p each. 15p/10. 75p/100**
1W 10R to 2M2 (E12 Range)	**7p each. 65p/10. 6.00/100**
2W 10R to 2M2 (E6 Range)	**8p each. 70p/10. 6.00/100**

RESISTOR KITS – each value individually packed

¼W pack 10 each value E12 – 10R to 1M 610 pieces	5.00
¼W pack 5 each value E12 – 10R to 1M 305 pieces	3.00
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	6.00
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	3.50
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.00

REPLACEMENT TV MAINS DROPPERS

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

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

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

BARCLAYCARD VISA

ORDERING: All components are brand new and to full specification. Please add 45p postage/packing (unless otherwise specified) to all orders and then add 15% VAT to the total. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our 1984 catalogue – only 65p per copy – details in middle of advertisement.) Delivery by return on ex-stock items. NEW RETAIL 1000 sq ft shop now open Mon-Fri 9.00-5.00. Sat 9-12.00.

TELEVISION

The Video Boom is Over

That remarkable phenomenon the video boom seems to have blown itself out the world over. In the UK the boom peaked in the second quarter of 1983, when deliveries of VCRs to retail and rental outlets totalled 680,000. The figure for the second quarter of 1984 was 268,000 – in fact deliveries for the first half of 1984 were less than for the second quarter of 1983, and the year on year first half comparison shows a decline of 53 per cent. At the peak of the boom, VCR shipments to the UK were exceeding those to the USA and there were more VCRs per household in the UK than in Japan! The rental chains played a great part in getting the VCR established as a household item in the UK but came close to panic earlier last year (1984) when VCR returns rose to the same level as new rental contracts. It seems that the end of the summer produced some increase in consumer demand for VCRs, but rental companies could still be holding very large stocks of returned machines.

The rapid reversal in UK demand was of little consequence to Japanese manufacturers so long as demand in other markets, particularly the USA, continued to increase. But the peaks of the boom appear to have been passed everywhere. Japanese VCR exports rose to a record of just under two million last August. Since then there's been a weakening US demand, accompanying a general economic slow down there, while exports to Europe have continued to decline and sales in Japan itself fell in September. As a result, the Electrical Industry Association of Japan revised its estimate of VCR production for 1984 from 27 million down to 25·7 million. Not a great percentage drop perhaps, but something that hasn't happened before. This levelling off or reduced production is already beginning to affect other parts of the Japanese electronics industry, in particular the semiconductor manufacturers and suppliers of parts to the VCR makers.

The consumer should certainly benefit from this, as price cutting goes hand-in-hand with the introduction of machines offering more features and thus better value. Hi-fi sound and longer playing times are not things that have been easily achieved: they require considerable advances in the basic technology used in VCRs. The Japanese Ministry of International Trade and Industry has been trying to co-ordinate VCR production levels in an attempt to avoid excessive price cutting, but this may have only a limited impact at the retail end of the distribution chain. It's also of significance that South Korean VCR manufacturers are about to start exporting machines – to date they've been limited to domestic production under the terms of the technology transfer agreements entered into with Japanese manufacturers. The next few months may well turn out to be a good time to buy a VCR.

The problem of an over-supplied market does not apply to VCRs alone. Cassette production capacity world wide rose sharply in 1984. Whilst capacity in 1983 has been estimated at being able to supply only 70 per cent of demand, during 1984 it's reckoned to have increased to the point where twice the current demand can be supplied. This again is leading to increased price competition on the one hand and improved quality on the other – 3M for example have been advertising a "lifetime guarantee" for their tapes. 3M's approach has involved considerable investment in tape research and improved production technology. Greater precision has been achieved in specifying parameters for the oxide coating, film and solvents and in monitoring the dispersal of material on the film – specially designed laser scanners are now used for this purpose. Slitting the sheets of coated tape to the width required for spooling has always presented problems. It's claimed that the percentage of satisfactory quality tape coming from the slitters at 3M's Swansea plant has increased from between 60–70 per cent in 1983 to over 95 per cent. The plant is at present in the middle of an investment programme aimed at tripling production. This is against the background of reduced demand – a "serious decline" is the way in which Jarvis Astaire, chairman of Intervision Video (Holdings), has put it. It's evident that the profitability of the distribution side of the tape industry has been badly hit.

One can't help wondering what the Japanese consumer electronics industry will come up with next. There's always been something to offer once a particular market has reached saturation level. Transistor radios, audio equipment, television sets, personal portable audio, then the VCR: the obvious follow-ups would be electronic photography/movie equipment and personal computers. Much work has gone into both fields – 8mm video and camcorders on the one hand, the MSX system on the other. Active video has never been a major market however. People tend to treat video as they do other domestic electronic equipment – as something you switch on and let it do its stuff. Movie making is a world apart and something that by its nature has a much more limited market. With electronic still photography the problem remains that quality is inferior to traditional chemical photography while being a lot more expensive. With the personal computer it could be that the Japanese onslaught on the market has for once come too late. Microcomputer demand has weakened in the main markets – the US, UK and Japan – and MSX hasn't met with the instant success that's usual with Japanese offerings.

Is this the end of the boom for the Japanese consumer electronics industry? That's hardly likely. Customers will start to buy again before long, and what's then bought will depend on the continuing efforts of manufacturers. One thing Japanese manufacturers have always done is to maintain their R and D work whatever the market conditions, something that pays off in the long run.

EDITOR
John A. Reddihough

ADVERTISEMENT MANAGER
Roy Smith
01-261 6671

CLASSIFIED ADVERTISEMENTS
Barbara Blake
01-261 5897

PRICE INCREASE

The price of *Television* will be £1·10 from our next issue dated February. We regret the need for this increase which is due to the continued rise in our production costs. The next issue will have extra pages however and further bumper issues will be published during the coming year.

INDEXES

The index to volume 33 of *Television*, available from our Post Sales Department (see page 121), sold out rapidly. A reprint has been ordered and the index will soon be available again. The index to volume 34 has been compiled and is now being printed.

Teletopics

TRADE SCENE

Trade figures (from BREMA) for the first six months of 1984 compared to 1983 show a dramatic fall in deliveries of VCRs, a small fall in large-screen CTV deliveries and a continued rise in small-screen CTV deliveries. Though the totals are relatively small, an increase of 95 per cent in teletext receiver imports, to 39,000, is worrying. Basic figures are as follows:

Product	Jan-June 1983 (000s)	Jan-June 1984 (000s)	Change (%)
VCRs	1,230	572	−53
CTVs, large	995	899	−10
CTVs, small	504	699	+38*
Mono TVs	449	326	−27

* UK produced +27%, imports +46%.

Stocks are at present large. The latest survey, Media Leisure, from Leisure Consultants (Lint Growis, Foxearth, Sudbury, Suffolk, price £210) suggests that sales and rentals of VCRs and TV sets, also home computers, will drop in 1985/6, with consumer spending in the domestic electronics field remaining static. TV rentals may be given a fillip by the advent of more sophisticated sets with FS tubes, stereo sound and digital circuitry. An even sharper fall in VCR deliveries is forecast.

At mid-1984 there were 47,000 terminals linked to the Prestel network and 2·16 million teletext sets were in use, a household penetration of ten per cent.

SATELLITE SCENE

The setting up of a privately owned, Luxembourg based TV satellite system called Coronet was mentioned in this column last July. Since then the project's sponsors have been seeking financial backing. The Swedish industrial holding company Investment AB Beijer has now taken a ten per cent stake in the scheme and it appears that the US Home Box Office cable film channel service has taken a further five per cent interest. It thus seems that the scheme, which has the backing of the Luxembourg government, is on the move. The cost of putting up the two satellites (one as a reserve) is expected to be around $180 million and a launch date in early 1987 is planned with a service start in about June of that year. Coronet will be responsible for launching and operating the satellites: a consortium is to be set up to provide the actual programme material. The medium-power satellites will have a footprint covering most of western Europe – the EIRP for the primary service area will be 51dBW, and most of the UK will be within this area. The satellites are being designed to provide a sixteen channel service in the 12·5-12·75GHz band, i.e. just above the 12GHz broadcast DBS band. While the primary purpose of the project is to distribute programme material to cable TV networks there's no hiding the fact that direct broadcasting to domestic viewers is envisaged. Beijer's investment will give it an interest in two Nordic language channels.

As a result of recent changes to the plans for a UK DBS service the design of the satellites is under review. When the BBC originally arranged for the design and construction to be undertaken by United Satellites a two TV channel service with extra transponders for telecommunications use was envisaged. Present plans for a three-channel service could lead to the elimination of the satellites' telecommunications channels. In addition cost reductions are being sought to improve the economics of DBS.

The first chairman of the Satellite Broadcasting Board, which is being set up to regulate the UK's DBS services, will be the IBA's chairman Lord Thomson of Monifieth. The board will have six members, half from the BBC and half from the IBA, with the chairmanship alternating annually between the chairmen of the BBC and the IBA. The board has not been formally set up since agreement between the participants in the DBS scheme has yet to be reached. Lord Thomson recently commented that "the challenge the Board will face is to find imaginative new ways of providing the public with services which the present four TV channels cannot fully meet and for which the public will be prepared to pay extra".

The Nordic Council of Ministers has given the go ahead to the establishment of a Scandinavian DBS service (Nordsat) with four TV channels, using the C-MAC/Packet transmission standard. The service is expected to come into operation in 1990.

CABLE DEVELOPMENTS

The government has now announced the names of the majority of the members of the Cable Authority, which is being set up to regulate the provision of cable TV services in the UK. Professor James Ring has been appointed deputy chairman to Richard H. Burton, whose appointment as chairman was announced last August. Other members are Paul Johnson, Elizabeth MacDonald-Brown and Peter Paine. Two further appointments remain to be made. At present the authority doesn't have very much to regulate, but it hopes to start awarding new franchises at the rate of five every four months: Mr. Burton, who feels that the gloom over cable prospects has been overdone, says the "first and paramount priority of the authority will be to get the franchising process moving as fast as possible".

The Cable Television Association's chairman Peter Gosling has appealed to the government for greater help for a "cash hungry business in its formative years". Minister for Information Technology Geoffrey Pattie has ruled out any of the financial concessions proposed by the Association however. He's reported to have commented "I may wish them well but that's all I'm going to do", though he added that "if there's something so fundamentally amiss that there's a danger of them (the cable companies) being wiped out then obviously we would look at it again very carefully indeed".

Plessey Scientific-Atlanta, the Anglo-US joint venture that was set up to develop and sell cable TV equipment in Europe, has ceased operations. Plessey's director of technology Dr. Keith Warren, who was chairman of the joint venture, reported that the parent companies were not prepared to continue to spend money when there was little prospect of any orders materialising. A similar joint venture, GEC-Jerrold, was terminated last March. Plessey Scientific-Atlanta had developed a prototype two-way cable switch which had been specified by three of the original eleven cable

TV franchisees, Clyde, Croydon and Ealing, but no orders have been placed.

Thorn EMI, with British Telecom and local newspaper group Courier Press (Holdings) as minority shareholders, has announced that the Coventry Cable service is expected to begin operations this spring. Meanwhile Thorn EMI's cable activities in Swindon seem to have aroused local opposition – a pressure group called CACTUS (Concern About Cable Television Under Swindon) has been formed. Complaints include the fact that cable ducts are being laid to every house in the area whether the householder wants it or not, the disruption caused by the cable laying operations and the unacceptable condition in which the pavements have been left.

WHICH? ON VCR RELIABILITY

The latest issue of the Consumers' Association monthly *Which?* reports that VCRs are unreliable generally while some models are a lot less reliable than others. The report is based on a survey of 6,340 users in the UK, W. Germany, Holland, Belgium and Denmark. It was found that there's "at least" a one in three chance that a VCR will need repair before it's two years old. The least reliable brands failed four times as often as the most reliable. Panasonic did best with 18 repairs per 100 machines. With all machines the most common faults were streaky pictures and fast wind/rewind problems. A quarter of the repairs to Akai machines related to poor sound, while Sanyo machines tended to go "completely wrong". In the first two years only seven per cent of machines needed new heads: the figure rose to seventeen per cent in the fourth year. The average time taken to repair an owner's VCR in the UK was 8·3 days while rented machines were dealt with in 3·2 days.

MATSUSHITA UK'S TEN YEARS

Celebrations attended by Prince Phillip as guest of honour were held at the Panasonic factory in Cardiff on November 2nd to mark the tenth anniversary of Matsushita Electric UK's establishment. The Cardiff factory now employs over 600 people. Production is expected to reach 220,000 sets this year (1984) of which 45 per cent will be exported. The factory is being extended to increase the production capacity to 300,000 sets a year – there are also plans to start VCR production. Approximately 70 per cent of the components used come from UK or continental sources and productivity is the same as in Matsushita's Japanese plants.

Amongst the interesting items on show at a technology exhibition held at the factory was a record/playback colour video disc system using semiconductor laser technology. The 8in. disc has a playing time of just over thirteen minutes. At present the system is intended for commercial/industrial use.

MITSUBISHI'S COLOUR VIDEO PRINTER

Mitsubishi, who introduced the world's first printer for the instantaneous printout of TV pictures in 1983, has developed a colour version. This consists of five main sections. In the first, composite NTSC video signals are demodulated to provide RGB outputs. These are then converted into digital form and stored in a memory which holds a frame of picture. The signals read from the memory next have to be converted to yellow, magenta and cyan since a subtractive colour printing process is used. The final section produces a full colour print with sixteen gradations by means of a thermal transfer system.

Mitsubishi's colour video printer.

When the print button is pressed a TV frame in digital signal form is stored in the memory, which consists of twelve 64kbit DRAM i.c.s. The memory's output is then processed and the print made on plain paper. The whole process takes about a minute. The ink sheets are easy to change since they're in cassettes that hold enough sheets to produce 100 pictures.

SERVICING HOME COMPUTERS

The problem of servicing the hundreds of thousands of home computers sold recently once their warranties have expired has been taken up by Computer-fix, which has set up a national network of five hundred dealers (initially) offering cheap, guaranteed repairs in only 48 hours plus the time required for delivery to and from the firm's headquarters at Camberley, Surrey. Faults are diagnosed by a computer called ACUMEN (Advanced Computer Memory Tester) which can detect a fault in any of the top brands of home microcomputers in just seconds – it doesn't even need to be told the make or model it's testing. Prices seem very reasonable, ranging from £15·50 for the ZX80/ZX81 to £40·25 for the BBC model, inclusive of labour, spares, postage, insurance and VAT. All repairs are covered by a three-months parts and labour guarantee. Further details can be obtained from Computer-fix, Albany Park Estate, Frimley Road, Camberley GU15 2PL.

THE TV LICENCE FEE

Every three years the BBC has to apply to the Home Office for a review of the TV licence fee. And every three years the same old rows seem to resurface. This time the BBC has asked for an increase of roughly forty per cent in the colour licence fee, from £46 to £65, which would provide the BBC with an extra £1 billion a year. The haggling has started, but a decision is not expected until after January, when the accountancy firm Peat, Marwick Mitchell's "value for money" inquiry into the BBC will be completed. The BBC's case is based on the cost of maintaining the present services, with a modest amount for growth, taking inflation into account. As usual when this triennial business arises there have been calls from the advertising industry for the BBC to cover some of its costs by carrying advertising – the Institute of Practitioners in Advertising has called on the Home Secretary to allow advertising on all UK radio and television networks. Well it would, wouldn't it? The government appears to be paying little attention to this lobbying. The ITV companies don't seem too happy with the idea either, since it would most likely spread much the same amount of advertising more thinly. The levy on the profits of the ITV companies is also under review. What with all this and the problem of financing a future DBS service the broadcasting organisations seem to be rather on edge at present.

VIDEO MATTERS

TDK have introduced a range of new formulation (Super Avilyn) cassettes for use with Beta and VHS hi-fi VCRs.

Fuji has announced that it will shortly be introducing in Japan an 8mm camcorder, the Fujix-8. It seems that the photographic rather than the traditional video companies are pushing this format at present. There's also the Fujix TV-Photo system which enables you to view colour photographs via a television set: the system involves making a magnetic recording of the photographs on a 47mm floppy disc which can be played back. You buy the player unit – at around £200 – but the recording is done as a service at between £3 and £7 per disc. The Fujix-8 and TV-Photo system both operate on the NTSC standard only at present.

The recently opened National Interactive Video Centre in London is being funded by Thorn EMI, Philips and the government. Its purpose is to promote the use of interactive video systems in industry, commerce, education and the professions.

Japanese components manufacturer Alps Electric is setting up a £5 million factory at Milton Keynes to produce tuners and u.h.f. modulators for use in VCRs. It's expected that the factory will employ some 230 people by the end of the year.

ITT SAFETY NOTE

Reference was made in this column last October to a safety recommendation issued by ITT concerning certain of their TV sets. ITT have now advertised the problem in the national press and will reimburse dealers according to a fixed fee for carrying out the work required. Models affected are as follows: CB502, CB602, CB702, CS512, CS712, CS522, CS622, CS722, CB9504, CB9602, CB9604 and CB0506.

TV AND NECK ACHE

It's perhaps not too widely appreciated that the neck is quite a sensitive part of the body and that stress/strain here can give rise to many problems. Most large-screen colour sets have for many years been supplied with a stand that sites the set below the normal seated adult's eye level. This means that much viewing is done with the head lowered excessively, which doesn't seem to be a particularly healthy situation. Maybe some of our readers with medical knowledge would like to comment?

1985 TRADE SHOWS

The agreed date for the annual London hotel trade shows this year is May 19th-22nd. In addition it's proposed to hold a trade/public exhibition, Vidtel 85, at the National Exhibition Centre, Birmingham, from August 29th to September 1st. This event, called the International Home Video and Television Show, would have two trade-only days followed by two days open to the public. For the present it doesn't seem to be eliciting much enthusiasm from the industry.

SOLID-STATE IMAGERS FROM MULLARD

Two imaging devices for use in solid-state cameras have been announced by Mullard. The new arrivals are charge-coupled, frame transfer devices which produce two interlaced 289-line fields with a 4:3 aspect ratio. Both provide a 604 × 575 pixel disply giving a horizontal resolution of 420 TV lines, meeting CCIR standards. The NXA1010 (monochrome) and NXA1020 (colour) sensors have a 7·5mm image diagonal that matches the half-inch camera tube format so that they can be used with low-cost, commercially available lenses. They are suitable for all types of 625-line/50Hz PAL/SECAM cameras (525-line, NTSC compatible devices are expected to be announced shortly). The NXA1020 has an on-chip colour-stripe filter to provide RGB outputs. Complementary i.c.s have been developed to provde the necessary timing and drive signals.

THE EUROMAX AERIAL

With the needs of those touring in caravans in mind Maxview Aerials (Maxview Works, Setch, King's Lynn, Norfolk PE33 0AT) have introduced the Euromax Universal aerial. This is in effect two aerials in one, covering both the v.h.f. and u.h.f. bands. The fixing kit supplied with the aerial includes strong suction pads and a bracket and mast. Price is £23·75 including VAT and the aerial comes in a box which gives fitting instructions in eight European languages plus Arabic.

NEW VCRs

Three new VCRs have been added to the Ferguson range. The 3V43 is a full-specification machine with hi-fi stereo sound, two-speed operation and a suggested price of around £679. The 3V42 replaces the 3V36 as a mid-range model with a suggested price of around £549 while the 3V39 is intended as a budget model selling for around £399.

Sanyo have introduced a Beta hi-fi VCR, Model M40, at around £600. The new Mitsubishi HS306 is intended as a budget machine, carrying a suggested price of £440. Grundig's second VHS machine, Model VS220, features stereo sound. Suggested price is £489. Both machines now have infra-red remote control as standard. The first Philips all European VHS machine, Model VR6560, has been released with a suggested price of £459. There are also three new Philips V2000 format machines, Models VR2334, VR2350 and VR2840.

AERIAL CATALOGUE

South West Aerials (11 Kent Road, Parkstone, Poole, Dorset BH12 2EH) have published their 1985 catalogue which is available at 60p per copy. An extensive range of aerials and associated equipment, including a 6in. v.h.f./u.h.f. TV set of particular interest for DX reception, is available from the firm.

SONY PROJECTION SYSTEM

A new Sony projection TV system being sold in the USA for around \$3,000 is of interest in employing a 5·25in. beam indexing tube. This type of colour tube has a single beam to which the R, G and B signals are applied in sequence, in synchronism with the phosphor

stripes – indexing stripes laid on the screen tell the control circuitry which colour stripe is being scanned. The advantage is the increased brightness obtained by avoiding the need for a shadowmask – Sony say the brightness level is about seven times more than that obtained with a good shadowmask tube, an important point with a projection system. An ethylene glycol-water cooling system is required.

PICTURES VIA THE TELEPHONE

The Philips slow-rate transmission system for sending video pictures via the telephone system has been given BT approval for connection to the network. Further details can be obtained from Philips Business Systems, Cromwell Road, Cambridge.

TV SETS AND MONITORS

Akai's first TV set on the UK market is a 14in. colour model with infra-red remote control and facilities for RGB and composite video inputs. Suggested retail price is £279. Both ITT and Grundig have announced colour sets fitted with 20in. FS tubes. The Grundig FST range also includes two 14in. models. Samsung Electronics UK Ltd. (Hook Rise, Business and Industrial Centre, 225 Hook Rise South, Surbiton, Surrey KT6 7LD) have released a couple of monochrome portables, the 12in. Model BT309K at around £50 and the 14in. Model BT351K at around £60.

Philips' BM7502 monitor has a 12in. green phosphor tube that gives a full screen display of 25 lines with up to 80 characters per line. The circuitry has been designed for minimum distortion and is suitable for graphic displays. There's a built-in speaker for sound and the suggested price is £79·95. It's intended for home computer users and is compatible with most home/personal computers, e.g. the Apple II series, Commodore Vic 20 and BBC.

TV HEADPHONES

Ross Electronics (49-53 Pancras Road, London NW1 2QB) have introduced a headphone set, type RE2280, designed specifically for use with TV sets and VCRs. The frequency response is given as 20Hz-20kHz. The price, which includes a 6·4mm stereo jack plug, an adaptor for 6·4 and 3·5mm monosound sockets and 16½ft of cable, is £8·95.

NEW MULLARD LINE OUTPUT TRANSISTOR

Mullard's new BU508D line output transistor is an uprated version of the BU508A incorporating a parallel efficiency diode. Like its predecessor, the BU508D is encapsulated in the easy to mount SOT93A pack.

Christmas Lights

William Harrison

The mains-driven light chain is a perennial Christmas hazard. A safe alternative is a low-voltage chain using 5mm LEDs of the type available from Sendz. Wire them in colour sequence to get the "travelling" effect. These LEDs require 2V and should be operated at around 20mA for a long life. The red type has a slightly lower voltage drop. To correct for this, I used six LEDs in the green and yellow chains and seven LEDs in the red chain. If the voltage is above 12V it may be necessary to add a series resistor – adjust the value for 20mA drive current.

Fig. 1 shows the basic circuit which uses a 4001B CMOS i.c. as the sequencer. Only three of the four gates in the i.c. are used – the other gate could be used to get four outputs, but I found that start-up was then erratic. The three outputs from the i.c. drive 2N2905 transistors which supply the strings of LEDs.

Fig. 2 suggests some alternative output arrangements to drive longer strings of LEDs. The ULN2003 incorporates seven Darlington amplifiers which can supply 0·5A each. For a still larger output, the ULN2003 can be used to drive TIP2955 power transistors, which will require heatsinks. Note that while the 4001B will work at a lower voltage than 12V the ULN2003 requires a minimum of 12V.

The LEDs are wire-ended, the longer wire being the positive connection. Don't shorten the wires: bend at right-angles, in opposite directions. They can then be soldered in series, in colour sequence along a four-wire cable, to obtain the moving-light effect.

If 2mm LEDs are used the current required is 10mA.

The unit was housed in a Verobox type 303 (120 × 80 × 35mm), with the components on a piece of stripboard. A five-way DIN socket with a mating plug on the light chain completed the job. The LEDs can be obtained from Sendz or from Cricklewood Electronics Ltd., 40 Cricklewood Broadway, London NW2 (who can also supply the box and i.c.s).

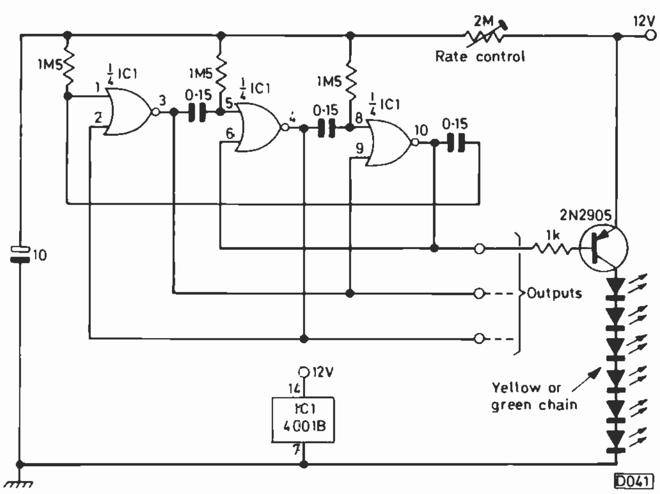


Fig. 1: Basic circuit, with sequencer to drive three chains of LEDs alternately to give the travelling light effect. If miniature electrolytics are used, connect the positive sides to pins 1, 5 and 8 of the 4001B i.c.

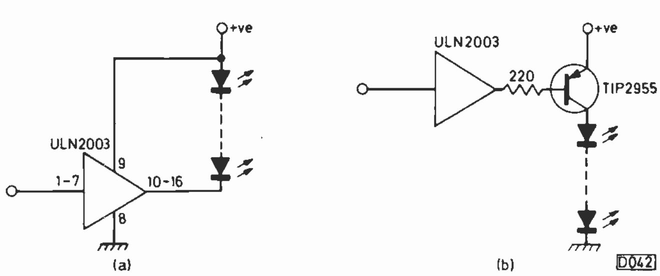


Fig. 2: Alternative arrangements for driving longer strings of LEDs.

VCR Clinic

Reports from Derek Snelling, Dewi James, Philip Blundell, Eng. Tech., Keith Hamer, Garry Smith and Steve Beeching, T.Eng.

Hitachi VT9700

Intermittent no operation was the complaint with an Hitachi VT9700. At switch on all was well for five minutes after which the counter and operate light began to flash on and off though the clock remained steady. We've had problems with the voltage regulator i.c.s used in this machine. They are on the rear panel, bolted to the heatsink. In this case the 9V regulator's output was intermittent, a replacement curing the problem. **D.S.**

Panasonic NV333

A Panasonic NV333 came in with the symptoms playback o.k., no record. In fact no stations could be tuned in with the machine in the E-E mode. The tuner proved to be faulty – only the second faulty tuner I've had in a VCR in three years. **D.S.**

Hitachi VT8000/VT8500

There are two 1.5kΩ resistors in the Hitachi VT8000/8500 power supply circuit (syscon panel), R054 and R069. I've had both fail on several occasions, but not together. R069 has been mentioned before and gives the no record symptom as there's no not-playback 12V line when it goes open-circuit – this line supplies the tuner and the i.f. strip. When R054 goes open-circuit there's no operation, with no operation light, as the regulated 15V supply is no longer present. If you get no operation but the operation light comes on, check the 5V supply to the microcomputer IC901: I've had zener diode D055 (RD5-1EB) go short-circuit on a couple of occasions. **D.S.**

Ferguson 3V35

The complaint with a Ferguson 3V35 was that there was no TV picture on three channels with the machine connected. Sure enough when I got there a quick check showed that with the aerial connected directly to the TV set (an old GEC model) everything was o.k. (ignoring a flat tube and half a dozen minor faults) but when the VCR was connected only BBC-2 worked, the other three channels producing a blank screen. All four channels were present in the E-E mode however. Luckily I had a Philips colour portable in the car. A quick check with this showed that all was well with the VCR – or did it? Closer examination showed that the picture was slightly noisy. In fact the VCR's aerial amplifier turned out to have marginally low gain as far as the TV set was concerned, a replacement curing the problem. Obviously something was faulty or out of adjustment in the TV set to produce a blank screen when the signal was only marginally down – in fact if it hadn't been for this the customer would probably never have noticed the slight loss of gain. **D.S.**

Sharp VC9700

One of these popular VCRs came in with the complaint "chews tapes". On trying the machine we found that it had very little take-up torque but too much supply reel torque. The take-up torque is adjustable but the supply reel torque isn't. To measure the take-up torque you monitor the voltage across R7783, which is in series with the reel motor. This resistor is driven by transistor Q708 which turned out to be short-circuit. **P.B.**

Hitachi VT8500

Little did I know when my friend Geoff sent me an Hitachi VT8500 that wouldn't eject what trouble and expense it would cause. The machine wouldn't unlace and it was found that Q902 in the loading motor drive circuit (see Fig. 1) was open-circuit. The curious thing was that it turned out to be a BD131. Other transistors had been removed and replaced as well – legs were sticking out at all angles. I hate to see this sort of thing. Why can't some people be bothered to tidy up? Three i.c.s had also been soldered and may or may not have been removed. The 9V supply for this part of the circuit comes from the series regulator transistor Q060: R081 (2·2Ω) which is in series with this transistor was open-circuit. I replaced it with a posistor, a standard modification, but this didn't have any bearing on the main fault.

When Q902 was changed to a sturdier TIP31 the threading problem was cured. So the machine went back to Geoff with the comment that it had already received attention. Geoff phoned the following day to complain that it wouldn't wind fast forward and enquired whether I'd checked this? Well yes, play, record, rewind – but perhaps not fast forward. He also said his customer was adamant that apart from head cleaning the machine had received no servicing attention during the three years he'd had it. This time one of the transistors in IC906 (TA4193) was open-circuit. So the i.c. was replaced and Geoff took the machine back to check it for himself as a final quality control. The remote control unit didn't work due to corroded batteries and he had some difficulty in setting it for timer recordings, but apparently the customer wasn't too concerned about the timer.

A week later Geoff called with a "guess what?" comment to tell me that the Hitachi had again blown up. This time we had more accurate information. The customer had left the machine in fast forward and had subsequently returned to find it stopped and smoking. Back on the bench we found Q902 once more open-circuit and R081 burnt up. This was getting serious: it was obvious that the problem was of a somewhat unusual nature.

After replacing the defective components I left the machine in fast forward. After a while Q902 got very hot. So did IC906. This was strange as Q902 should be off for fast forward. I left the machine to cool down then put it into fast forward in order to make a few measurements. Result: there was 600mV that shouldn't be there at the base of Q902. It took some time to find the source of this voltage. Tracing back I found that it came via pins 6 and 7 of IC905 from pin 6 of IC906. Within IC906 the current was flowing via Tr4, a 265Ω resistor, a diode and a 220Ω resistor. Q901 and Tr1 are

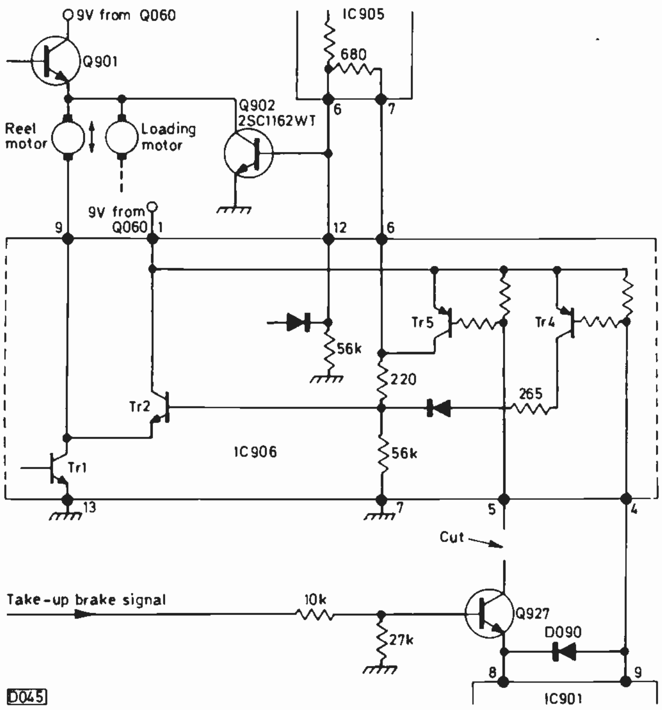


Fig 1: Reel motor drive circuit, Hitachi VT8500. Q901/Tr1 drive the motor for fast forward; Tr2/Q902 drive the motor for rewind. Q901 and Q902 are also part of the loading motor drive circuit.

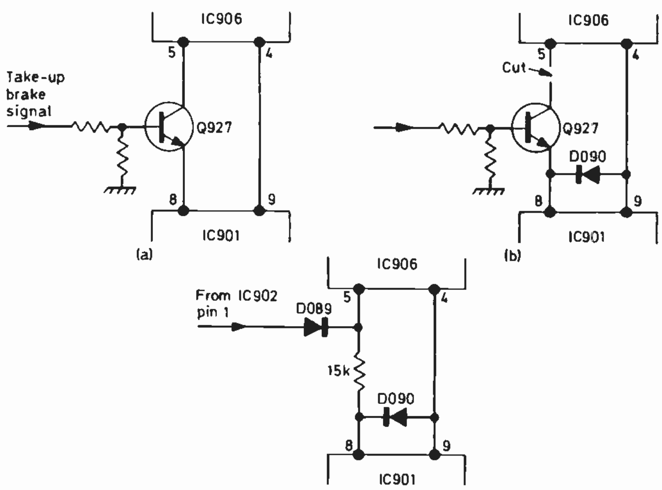


Fig. 2: Modifications to the control circuit: (a) original version; (b) version in the faulty machine; (c) the later version.

on for fast forward: as Tr1 heated so Tr4 turned on more until eventually Q902 turned on. At this time the only circuit I had for the machine was one that didn't show Q927: telephone calls to Hitachi confirmed that there had been modifications to this part of the control circuit.

I suggested to Hitachi that the transistor that should be used in the Q902 position, type 2SC1162WT, might have some special characteristics. It transpired that the Vbe of a 2SC1162WT is 800mV, so some were sent for. On fitting one things were a little better, but as IC906 got hot 800mV was reached at the base of Q902 and it switched on. Cooling IC906 with freezer reduced Q902's base voltage and it switched off.

A new reel motor was tried to see if it ran without heating up IC906 too much. The temperature stability was much improved, but not to my satisfaction as there was some 650mV at the base of Q902. Not enough margin with respect to 800mV for safety. The new reel motor was accused of consuming too much current and thus causing IC906's temperature to rise. Another new motor produced quite good results: I could run fast forward through an E180 cassette without overheating, but that 650mV was still there!

Whilst making further checks it was discovered – by accident – that if the recorder was put into the timer record mode while hot the reel motor turned in a slow rewind. This was due to Tr4 turning both Tr2 and Q902 on. As Tr2 was not fully on it got very hot.

At this point attention was directed at the circuitry around Q927, since a modification had been carried out here. The connection to the collector of Q927 had been cut, leaving pin 5 of IC906 open-circuit, and a diode (D090) had been added between pins 8 and 9 of IC901.

IC906 was replaced but the rogue 650mV persisted. Pin 4 of IC906 was disconnected and it went away. The microcomputer system-control i.c. (IC901) was next suspected and changed but we were still no nearer a solution. It was then realised that the modification had left the base-emitter junction of Q927 in circuit. Now the reverse breakdown voltage of such a junction is only 2-3V, so a leakage current path was present via D090, Q927 and the base circuit resistance. It was enough to turn Tr4 on.

Fig. 2 shows the circuit changes in this area – (a) the original version of the circuit, (b) the version in the machine in question and (c) the final version.

Whoever was responsible for the defective (b) version will probably never be known. What I do know is that the repair was carried out over a number of weeks and cost me a fortune. It cost the customer very little. I wonder who put the BD131 in? **S.B.**

Ferguson 3V35

A one month old machine came in with the complaint "no clock display". The various supply voltages were in order but on disturbing the filament power generator subpanel, which is mounted on the reverse side of the tuner/presetter board, the display returned. Further disturbance extinguished the display but there was no visual evidence of dry-joints around the oscillator. We resoldered all the connections in this area but the intermittent fault remained. The connections inside the oscillator coil screening can were the only ones untouched: to gain access we had to remove the complete coil assembly from the board. We then spotted the cause of the trouble – a loose lump of solder on pin 6 at the base of the oscillator coil (T1) was intermittently shorting to the can. At least it made a difference from having too little solder on the connections. **K.H.-G.S.**

Panasonic NV333

We've had several problems with this machine, as follows.

Intermittent audio erase: Remove R4049 (4.7Ω) in the bias oscillator circuit and replace it with a shorting link.

Intermittent chroma on record: Connect a fast-acting diode (MA161 or MA162) between pins 11 and 12 of IC6003 on the syscon board, cathode to pin 11.

Clock not lighting, capstan motor not turning: No 18V regulated line due to Q1002 (2SD973) being open-circuit. **D.J.**

My friend Jim

Les Lawry-Johns

I've known Jim for a good few years now. He's in the trade and often pops in to buy some bits and pieces he needs and hasn't got in stock. Usually my last G8 line output transformer or 9000 tripler – you know, the kinds of things you're going to need during the next minute or so. He's not all that interested in servicing however. His main interest seems to be in building. The upshot is that whenever he gets a set he doesn't like the look of he'll bring it along with a comment like "have a look at this for me old chap, only I've got a floor up and really must fix it before the wife comes home". And off he goes leaving me with a bitch of a job.

The Thorn 9600

He carted this Ferguson 9600 in and left it with me. The 2·5AT mains fuse had blown in a nasty way so I went straight for the filter capacitor, which was innocent. Next the bridge rectifier, which was short-circuit. So I whistled a happy tune as I replaced it, stuck a new fuse in and switched on. There was the usual pause, then it started up normally. A white line appeared across the screen so I checked the supply to the field timebase and then the output transistors. These were all o.k. It wasn't until I turned to the line/field oscillator subpanel on the right-hand side that I found a BC147 transistor (VT402) open-circuit.

With this replaced we had full scan, quite a nice picture and loud, clear sound. I then remembered something else Jim had said. Apparently the set often worked all right for some ten minutes or so and then tripped out. I left it on for some time and sure enough it suddenly gave a few gulps and went into a strike situation. I noticed that just before it did this the sound went down. So with enormous presence of mind I removed the 500mA fuse (F513) in the supply to the audio panel. The set then came on when asked to and apparently stayed on.

I removed the left-hand side audio panel and checked each transistor separately. They all proclaimed their innocence of course. The output pair were on heatsinks but the driver wasn't, so bearing in mind the loss of volume before the set tripped I reasoned (wrongly of course) that the driver could well be at fault. This is a BD386, which I didn't have in stock. I put in a BD204 instead, confident that it wouldn't give in easily. Quite right, it didn't. The set behaved happily for an hour or so then Jim came in to collect it.

Jim's Return

Within the hour Jim was back with it. "Tripped after ten minutes" he said. So I removed the audio panel and left the set on without it. After half an hour it tripped. Back went the audio panel and the set played away happily enough for quite some time. Then the sound decreased and off it went into sullen silence. Everything shut down except the supply to the chopper circuit. I checked everything in sight and out of sight. Then I started to think.

The sound went down before the set tripped, and the fault wasn't in the audio panel. So I removed the 500mA fuse F511 in the feed to the 24V regulator. This upset the field timebase but the set didn't trip. To cut a long story short, it wasn't until I removed the supply to IC2 (MC1358P) on the signals panel that the tripping stopped. When this i.c. was replaced our troubles were over. The intercarrier sound and audio preamplifier chip for heaven's sake. What next? Jim then came to collect the set.

The GEC-Hitachi

An hour later he was back again. This time however he didn't lug in the Thorn. Oh no! That was just a forgotten incident now. This time he had a GEC set we didn't recognise. It was a C2265 (Hitachi NP81CQ chassis) and it took me some time to realise that what I took to be a chopper transistor was in fact a chopper i.c. (IC901, STR441). So I studied the notes in the manual, hoping to get a clue as to how to start the thing up. They did provide a lead, and when I put the meter on R605/6 in the chopper feedback line the set sprang to life. It frightened the life out of me because the sound had been left turned fully up. I turned it down and switched off. When I switched on again the set remained dead until I prodded around the feedback network – the chopper is a sort of blocking oscillator arrangement. The set then came to life. Until the meter probe slipped. There was a nasty flash and the 2·5AT mains fuse disintegrated. "Oh dear" I said.

Like a fool, I put another fuse in and tried again. FLASH! I checked the strange STR441 and found it short-circuit. So I ordered one and got it (along with some other things) next day. I fitted the three-legged device and bravely switched on. The fault was still there. I checked each item in the feedback network and they all read right. I then took them out to make sure. They were all right, so I put them back again and after that the set performed perfectly. Just another dry-joint? Must have been, but it certainly didn't show.

Thanks Frank

On the subject of GEC I must pass on a message of thanks from several of my trade friends who have had cause to be grateful to Frank Pretty of the GEC technical advice department. He's been most helpful to all who have phoned asking for advice and have received more than they hoped for. I haven't had the pleasure of talking to Frank yet, but I very nearly did over the C2265.

The Passing of Ben

You no doubt remember me chattering about our dog and cat (and bird). Well Ben isn't with us any more and we do miss him. Spock seems to complain all day long, loudly. Ben lost the use of his back legs and was unable to digest his food. He passed away peacefully but still seems to be around. Thanks Ben. I do wish that cat would shut up.

Letters

STREAMLINING THE TRADE

I'd like to discuss a couple of improvements that I feel would greatly improve the TV business. Most of the work of engineers, and most of the content of *Television,* are concerned with the repair of TV sets and VCRs that are a few years old. It strikes me that this whole area could be streamlined, leading to greater efficiency and profit for each individual engineer and company. The following ideas could also provide profitable business opportunities for anyone putting them into operation.

More often than not, repairing an old piece of equipment involves a long and laborious process of testing this, that and the other, working one's way around the equipment often without a circuit diagram. Once the faulty items have been located there starts an equally laborious hunt around for replacement parts. For many sets these are no longer available from the original manufacturer. Even when they are, the prices are often ridiculous in relation to the value of the set – so wherever possible it makes sense to fit second-hand parts in second-hand sets.

Here's how we could improve on all this.

(1) Compile an exhaustive list of every model sold in this country. List first by brand/manufacturer, then chassis, then individual model. On this list should go the manufacturer's address and phone number.

(2) List the common faults on each chassis. List by symptom, and opposite this put the action and parts required, with suitable equivalents. Such information is not supplied in service manuals since common faults show up only after thousands of sets have been in use for some time. Most of the information could be obtained by going through *Television* from around 1970 onwards. The result would be a complete list of models sold in the UK, with the common faults found over a 14 year period and how to deal with them. Surely this would be welcomed by all, especially employers who would prefer to pay for such information rather than continue to pay for their engineers to do their own trial and error research!

All this information could eventually be transferred to computer storage. This would enable a subscriber to get access to information on a particular set within seconds.

(3) List inexpensive sources of further information, i.e. circuit diagram or service manual.

(4) Approach suppliers of second-hand parts from stripped sets for details of what they can supply at what price. This information could be used to expand the list.

When repairing an older set, the action would be (a) to check that the symptoms are as described by the customer, (b) refer to the list, (c) check whether you have a stock fault, (d) look across for the action required, (e) look further for names of suppliers of second-hand parts.

I think this would help us rapidly clear our repair backlogs, don't you?

The converse of this is the business opportunities.

(1) Companies could set themselves up as specialists in new and second-hand parts for particular makes of chassis.

(2) They could advertise, offering to buy abandoned sets cheaply. This would provide a source of parts.

(3) The fault compendium previously described would provide a guide as to the stock levels required for particular parts.

Wouldn't this be better than the present hunt for a line output transformer here, an i.c. there and a speaker somewhere else?

I hope this sets some minds athinking. These suggestions could make a lot of dollars for some people and provide a lot of relief for the rest of us!

Colin Guy,
Telly-Centre,
Tunbridge Wells, Kent.

DISCO-LIGHT EFFECT

Les Lawry-Johns mentions a strange disco-light effect with a Decca Bradford chassis (November issue). I had something similar with a Thorn 3500 and feel sure that it was due to the shadowmask kinking. The mask would kink back and forth, upsetting all purity adjustments. There was also a very slight pinging sound.

Philip J. Lomas,
Television, Audio and Video Repairs,
Coal Aston, Sheffield.

MAINS FUSE PROBLEM

Over the past few weeks I've been plagued by a mains fuse blowing problem with three early GEC C2110 series sets. In the first case I replaced the fuse in the customer's home and could find no other fault. The

same with the second set. After going through this procedure on several more occasions with both sets a third came into the workshop. I replaced the blown fuse, switched on and all was well. The set was left working while attention was turned to another one, then suddenly the fuse blew again. After a quick check I replaced the fuse and discovered that the holder was very hot. It was an old rectangular type with a poor grip on the fuse, so I replaced it with a standard screw-in type in a hole just below the original holder. Result: no more problems! The same action was then taken with the two sets in the field. I hope this word of warning will be of help to others: in future I shall always change the holder just in case.
Kenneth D. Bunting,
Huntingdon, Cambs.

PLUGTOP MYSTERY -1

The subject of loosening terminals has been with us for many a year. I remember first reading about it in the sixties, when a contributor to another journal complained of having to keep retightening immersion heater terminals. I've often come across the problem and have discussed it with colleagues. Two main points have always been made: (1) that the effect is generally evident only with higher current equipment; (2) that as far as anyone can remember it never occurred with d.c. mains supplies.

Two theories have been put forward. First, that with high currents the terminal contact pins heat up. This continual heating on load and cooling off load and consequent expansion/contraction loosens the terminals. This however doesn't explain why the effect is not present with a d.c. supply. Secondly, around any current carrying conductor there's a magnetic field, therefore between any two conductors there's a force generated by that field. With an a.c. mains supply this field/force will be absent a hundred times a second (at the waveform zero crossover points) and will then rise to a peak. This alternate presence and absence of force will result in vibration – it's the same sort of force that makes transformers hum, LOPTs whistle and electric fires sing. Could it be this vibration that loosens the terminals?

On a totally different matter, I take Mr. Bird's point (letters November) about the return visits to the PCL86 fault. In mitigation I'd like to say that many a "valve" fault turns out to be due to an intermittent passive component fault – how many good valves have been slung away because a new one apparently cured the fault, only for it to return a few days later? In this case it just happened to be what it should have been! Also I don't charge the customer for popping my head around the door – it takes only a few minutes when you're in the area anyway!
Nick Lyons,
Normanton, W. Yorks.

PLUGTOP MYSTERY -2

I've been following the correspondence on loosened connections in 13A plugtops with interest. It seems that some of your correspondents, in talking of electron flow from "negative" to "positive", assume the use of a half-wave rectifier in the equipment supplied. With an a.c. mains supply however the neutral pin remains at earth potential while the live side alternates positively and negatively with respect to neutral. Consequently the electron current is alternating too and so far as the load is concerned the crossing over of the brown and blue leads makes no difference – though safety demands that we should follow the code correctly at all times.

I've heard people suggest that "a.c. shakes screws loose" but have no evidence to support this. What I have observed is that both neutral and earth connections can get loose while live generally remains tight. The live connection is usually of a different mechanical type from the simple hole and screw used in the neutral and earth pins. As G.C.C. Wride pointed out, the fuse provides some mechanical isolation for the live termination while neutral and earth can wag about. The cheaper and nastier the plug, the more the likelihood of looseness and burning.

Lastly, a method I've used for years when fitting these plugs. It's never let me down. Strip off enough insulation to provide a length of bared strands twice as long as you need. Twist them first, then double back the end, giving you double thickness. With a heavy cable you'll only just be able to get this into the hole in the terminal, with the screw nearly falling out. Then do up the screw with a good, solid screwdriver (not a grub-screwdriver) as tightly as you can without splitting the screw head. Also use a respectable make of plug. These measures will substantially reduce your troubles. Note also that the quite expensive MK plugs with rigid "bending-post" terminals have never caused me any trouble, even with hefty loads.
Keith Cummins,
Southampton.

Editorial comment: Our thanks to several correspondents who have written on the subject of the a.c. mains supply and the importance of fitting good quality plugs. David McIntyre points out that some cheap imported plugtops bear a marking stating that they are manufactured to BS1363, but if they don't display the BS kite mark they don't need to be tested by the standards authority and are still suspect. The concensus of opinion is that the different mechanical arrangements at the neutral and live terminations are the cause of burning/looseness at the neutral pin.

THE THORN 1400 CHASSIS

The Thorn 1400 was probably the last dual-standard monochrome chassis to remain in production. I've been using a couple of these sets, with 23in. tubes, for over two years for domestic and DX-TV purposes. They've given trouble-free service following renovation and provide pictures that are far superior to those produced by sets of more modern manufacture, despite the fact that both sets are fitted with the original tubes which must be getting on for seventeen years old. I've always found that the 19 and 23in. types of tube lasted much longer and gave much better picture quality than the later 20 and 24in. types.

The 1400 can be recommended for DX-TV use because of its excellent gain and the ease with which it can be modified to receive 625-line v.h.f. transmissions. All that's necessary is to move the lead from tag 43 to tag 44 (marked 625-VHF) and to cut the middle (grey) lead from the microswitch on the v.h.f. tuner, leaving the systems switch inoperative. The v.h.f. coils, accessible at the front after pulling off the tuning knob, now need to be reset for the European channels. There's also a demand for sets modified in this way in areas where RTE can be received at v.h.f.

I hope other readers will find the following notes on renovating these sets of use.

First, whether you're a DX enthusiast or not, it's worth carrying out the systems switch modification described above. We all know the trouble that systems switches give, and there would be nothing worse than getting a phone call from a customer to say that the set switched to 405 but wouldn't switch back to 625! Both contrast controls continue to operate when the modification is done as described.

Secondly, the manual suggests that a PCF808 is a suitable alternative to the 30FL14 sync separator/flywheel sync amplifier valve. This is definitely not the case. I've seen the PCF808 advertised at somewhat cheaper prices than the 30FL14, but using one in the V4 position produces a picture miles out of tolerance with severely loaded-down e.h.t.

If you get the no-results symptom with the 1·5A mains fuse blown the cause is almost certainly the mains filter capacitor C101. It's rated at 600V d.c. but a 1·5kV d.c. rated type should be fitted. As in all sets these filter capacitors can go short-circuit at any time – at switch on or after anything up to several hours' use. Another possibility for fuse blowing at switch on is the BY127 h.t. rectifier diode to the right of the fuse.

No results with the heaters alight usually means that there's a broken mains dropper section. It's better to replace the dropper complete – exact replacements are not expensive. The fusible resistor R145 (100Ω, 5W) on the dropper will give similar symptoms when open. Note that dropper section R135 was changed to 1·7kΩ in later production to eliminate field cramping.

If you have the six-inch grid pattern an inch from the right-hand side of an otherwise perfect picture, replace the line output valve's screen grid decoupling capacitor C115. This is usually 1μF but was changed to 0·1μF, 350V for greater reliability in later production.

Loss of signals on u.h.f. only with background noise is normally due to a faulty u.h.f. tuner. These are available very cheaply. You may well find that the preset channel selector knobs need replacing since modern Thorn tuners use quarter-inch spindle shafts rather than the eighth-inch type previously used.

The 1MΩ width control and its 330kΩ series resistor can fall in value resulting in lack of width – a low-emission PL504 can produce the same symptom.

The most difficult fault I've had to deal with on one of these sets was an intermittent sound spluttering problem (sound intermittently blocked by crackles and spluttering). This was particularly bad while viewing RTE in Band III (I could receive this at times when I lived in Devon). The cause of the fault was eventually traced to one of the ratio detector diodes, W8, which is in the sound detector can. Access to the components in this can is not easy – care is needed while removing the aluminium can itself since the coils can easily break.

As with the later 1500 chassis, the line output transformer is so reliable that it can virtually be forgotten about, which is probably why so many of these sets are still in use. The tripler can give trouble, though I've not personally had this one.

Spares are readily available from advertisers in this magazine – triplers from Manor Supplies, tuners from

Sendz Components, the main electrolytic and dropper from PV Tubes, to name just a few items. PM components (Selectron House, Wrotham Road, Meopham Green, Meopham, Kent DA13 0QX) can supply all the valves at decent prices – their Selectronic brand valves are very reliable.

Finally, don't forget to reconnect any earthing strips/leads to the chassis after servicing one of these sets. Failure to do so can lead to static problems which can be difficult to solve if you don't realise that a lead or strip has been disconnected somewhere! For a more detailed coverage of the 1400 chassis (with circuit and component layout diagrams) refer to Les Lawry-Johns' articles in the August/September 1976 issues of *Television.*

Brian Renforth,
Wallsend, Tyne and Wear.

Long-distance Television

Roger Bunney

October proved to be more active than usual, with relatively plentiful Sporadic E reception and two tropospheric openings. Meteor scatter signals also provided some excitement, with several enthusiasts reporting reception in the lower Band III channels. First the SpE log:

9/11/84	CST (Czechoslovakia) ch. R1.
11/11/84	Unidentified signals in chs. E2/R1.
12/11/84	TVE (Spain) E2-4; TVP (Poland) E3.
13/11/84	RAI (Italy) IA, B; JRT (Yugoslavia) E3; TVE E2-4; RTP (Portugal) E3.
14/11/84	RAI IA, B; TVE E3, 4; RTP E3; MTV-1 (Hungary) R1; EPT (Greece) E3.
16/11/84	RAI IA.
17/11/84	TVE E2-4.
21/11/84	TVE E2, 4; RAI IA; CST R1; NRK (Norway) E2-4; RUV (Iceland) E3, 4; also unidentified ch. R1, 2 signals.
22/11/84	TVE E2, 3; RAI IA; RTP E2, 3; SR-1 (Sweden) E2, 3.
24/11/84	TVE E2-3.
25/11/84	TSS (USSR) R1.
26/11/84	TSS R1; TVP R1.
27/11/84	TSS R1; TVE E2; plus unidentified ch. E2/R1 signals.
28/11/84	SR-1 E2; TSS R1.
29/11/84	RAI IA; TVE E3.
30/11/84	CST R1.
31/11/84	TVE E3, 4.

Our auroral reporter Iain Menzies observed several occurrences. The 11th produced identifiable NRK signals on chs. E2-4 and SR-1 ch. E2 between 21-2300 BST; auroral activity returned on the 18th and 19th, and on the 20th there were identifiable SR-1 signals on chs. E2 and 3. Apart from auroras, which result from storms on the sun, solar activity is at a very low level – we're entering the depth of the present solar cycle.

The two main tropospheric openings could hardly be termed "wide open" unfortunately. During the 12-16th there were widespread signals from the Benelux countries, W. Germany and (unusually) RTE (Eire) in Band III and at u.h.f. RTE Mullaghanish ch. D vertical caused some confusion for most of us, using horizontal Band III arrays. Canal Plus in Band III was widely seen throughout the UK, as far north as Scotland, as were the usual French u.h.f. stations. Conditions tended to favour a more north-south path by the 15-16th, bringing Tyne-Tees ch. 29 to the south coast and NRK (Norway) on all Band III channels to the central/southern UK for example – with Denmark ch. E10 as a bonus. French ATV signals, notably F1EDM and F3LP, were seen over a wide area in south/SE UK. One interesting signal was the new ARD (W. Germany) logo – a figure one with various regional identifications inserted. The second tropospheric opening over the 30/31st produced signals from the Benelux countries, France and W. Germany, in Band III and at u.h.f., also DFF (E. Germany) ch. E11 and RTL (Luxembourg) ch. E7 at quite startling levels.

Canal Plus started operations in early November, with scrambling during the evening transmissions – we had been given to understand that scrambling would not start until January.

My thanks to Iain Menzies (Aberdeen), Tim Anderson (Bexhill), Dave Shirley (Hastings), Cyril Willis (Ely), Tony Privett (Basingstoke) and Gareth Foster (Twickenham) for sending in details of their reception.

From our Correspondents . . .

Remember June 22nd, 1984, when an afternoon SpE opening gave UK reception of multi-hop signals with CBHT, Halifax, Nova Scotia ch. A3 and a mysterious "NTV" caption at 1600BST on ch. A2? Frank Lumen (Denver) has now identified Don Bassnett's reception of the NTV caption in Glasgow as Newfoundland Television. NTV is the new logo of the Newfoundland Broadcasting Company Ltd. The ch. A2 outlet operates at 3kW e.r.p. from Grand Bank. It's part of the CTV Network (Canadian TV), with the NTV main office/studios at St. Johns, Newfoundland. Congratulations to Don and thanks to Frank!

During a recent holiday in Bombay Bindu Padaki received Oman TV chs. E5, 7, 10 and u.h.f., Abu Dhabi ch. E9 and Yemen ch. E5. Bindu reports that the Indian government is establishing a network of 180 Band III transmitters, with typically 1kW e.r.p., to relay the INSAT-B programmes from New Delhi.

Marios Colocassides (Nicosia) has sent us a couple of photos showing "Middle East Television", ch. E12. The station operates from a site in the Lebanese mountains and was established by the "High Adventure Ministries" of California, then sold to another broadcasting concern. The signals are well received in the Lebanon, Syria and Israel as well as Cyprus.

Wenlock Burton (Victoria, Australia) recently sent several photocopies of old DX-TV articles from the magazine *Radio, Television and Hobbies,* the earliest dated January 1949. An item in this issue reports on the conversion at the Moscow TV Centre from 343- to 625-line operation, while the Leningrad TV centre was changing from 240 lines before the war (with regular programmes twice weekly) to 440 lines with programmes four times weekly "soon"! Interesting that such regional variations in transmission standards should have existed concurrently. The March 1957 issue contained reports on London/Sydney ch. B1 reception using a Hallicrafters

SX28 which produced the 41·5MHz sound and a 45MHz vision buzz "several times". The 41·25MHz French TV sound was also heard.

News Items

UK: The RSGB, Alma House, Cranborne Road, Potters Bar, Herts EN6 3JW would welcome reports on reception of the new 50·1MHz beacon. Send to the General Manager.

The "Channel 36" pirate transmitter mentioned last month, operating on ch. E21, was closed down by the DTI on October 18th. It was working from Church Road, Crystal Palace, London. Thameside TV, operating on ch. E28, has continued however, using an accommodation address – 1 Grosvenor Parade, London W5. Incidentally Rotterdam is at present free from TV pirates: the cable companies now monitor the system output following main transmitter closedown – if a pirate signal appears it's removed and a "cable test card" is inserted.

Belgium: The Law Courts, Brussels ch. E48 transmitter has been closed following improved coverage from the Botanic Gardens ch. E25 outlet (BRT-2). TV-5, the French programme distributed by the ECS satellite, has been seen on ch. E64: the source is not known.

Australia: New channel allocations have been announced (see below). The new system allows for the introduction of two-channel sound.

Ch.	*Frequency (MHz)*	*Ch.*	*Frequency (MHz)*	*Ch.*	*Frequency (MHz)*
0	45-52	33	561-568	53	701-708
1	56-63	34	568-575	54	708-715
2	63-70	35	575-582	55	715-722
3	85-92	39	603-610	56	722-729
4	94-101	40	610-617	57	729-736
5	101-108	41	617-624	58	736-743
5A	137-144	42	624-631	59	743-750
6	174-181	43	631-638	60	750-757
7	181-188	44	638-645	61	757-764
8	188-195	45	645-652	62	764-771
9	195-202	46	652-659	63	771-778
10	208-215	47	659-666	64	778-785
11	215-222	48	666-673	65	785-792
28	526-533	49	673-680	66	792-799
29	533-540	50	680-687	67	799-806
30	540-547	51	687-694	68	806-813
31	547-554	52	694-701	69	813-820
32	554-561				

New Products

Antiference have added a twin-input (v.h.f./u.h.f.) diplexing amplifier, Model UP3301, to their Uniplus range. The amplifier draws 37mA at 12V and is housed in a CS1000 type case. Performance figures are as follows. V.H.F.: passband 40-230MHz with gain 27dB ± 1·5dB, a noise figure of 2·8dB and typical maximum signal handling capability 35·5dBmV. U.H.F.: passband 470-860MHz with gain 23·5dB ± 2dB, a noise figure of better than 3·5dB and typical maximum signal handling capability of 36dBmV.

Another interesting unit is the UP1300/V wideband v.h.f. amplifier. Coverage is 40-230MHz with gain 19dB ± 2dB, noise 2·5dB and maximum handling capability 26·5dBmV.

Handling relates to a four-channel throughput at 46dB r.m.s. peak and noise to the complete unit – not the devices.

The W. German Hirschmann company has introduced a new type of Yagi aerial. It has a rather higher gain than previous types as a result of using a double director chain. There's a conventional multi-element director assembly chain with a chain of standard half-wave elements interspaced between the full-wave director assemblies. The result is an increase in gain of some 1-1·5dB. An array with fifteen full-wave director assemblies and the additional complement of half-wave directors spaced along the boom has, in the wideband version, a gain of 12·5dB at ch. 21 rising to 16dB at ch. 40 and 18dB at channel 60, with reference to a half-wave dipole. The front-back ratio is between 27 and 30dB. Ryn Muntjewerff has been testing one recently at his Beemster, Holland location and has found that the system bettered two stacked Fuba XC391 aerials at the group E end of the spectrum though the Fuba aerials had the edge in group A.

Wideband Inductive Combiners/Splitters

Wideband inductive combiners/splitters are available from most UK aerial manufacturers and aerial retail/rigging firms. There are two main versions: external for mast mounting, usually provided with some form of clamp, and indoor types of either wired or integral plug/socket construction. I recently had a need for such a unit with a specific performance requirement and as a result obtained six units from different manufacturers and carried out tests on them.

The performance figures quoted by manufacturers usu-

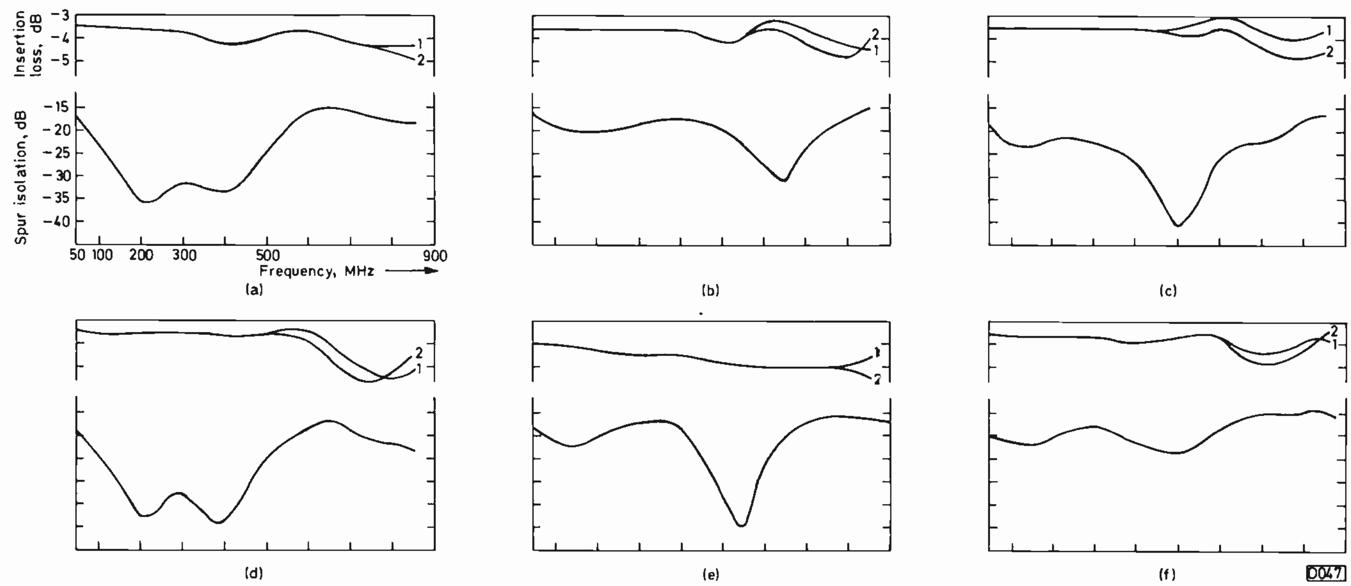


Fig. 1: Results of inductive splitter/combiner tests carried out by Fringe Electronics. (a) Antiference CS1000 unit. (b) Fringe unit. (c) Labgear CM6011. (d) ACL M1S/Maxview ST3. (e) Triax 7200. (f) Wolsey CS1/4.

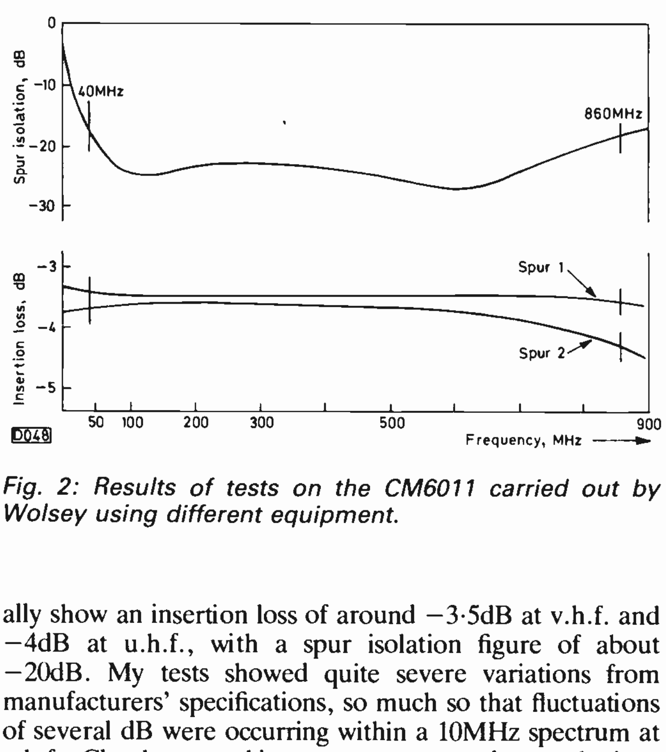


Fig. 2: Results of tests on the CM6011 carried out by Wolsey using different equipment.

ally show an insertion loss of around −3·5dB at v.h.f. and −4dB at u.h.f., with a spur isolation figure of about −20dB. My tests showed quite severe variations from manufacturers' specifications, so much so that fluctuations of several dB were occurring within a 10MHz spectrum at v.h.f. Clearly something was wrong and consultations were held with the various manufacturers. The upshot was that for accurate testing of even such a simple device as an inductive combiner/splitter expensive test equipment is necessary. Fringe Electronics tested all six filters for me, for both insertion loss and spur isolation. The results are shown in Fig. 1. Labgear tested their own unit, with the results shown in Fig. 2. These graphs show the performance of the better known splitter/combiner units at present available in the UK (the Maxview unit is made by ACL) and will enable enthusiasts to decide for themselves which unit best matches their particular needs.

The units are all housed in PVC/polythene boxes. The Antiference CS1000 is perhaps the most attractive, in black with a reusable ratchet type cable strap for mast mounting. The Fringe unit also has a reusable strap, the housing being a distinctive bright red. Triax's 7200 was the largest, housed in a standard "continental" plastic amplifier case with plated bracket/wing nut for mast mounting. Labgear's CM6011/OS fits inside the standard dark green circular plastic box while the Maxview M1S is housed in a square, chocolate-brown PVC box. These two have once-only use ratchet straps for mast mounting. The most compact filter, again with once-only use strap, is Wolsey's cream coloured PVC CS1/4. All these units incorporate a PCB with various discrete components and a large ferrite toroid (or several smaller toroids). Constructional standards are good, with generally minimal lead lengths and boards designed for the purpose – the exception here is Triax which seems to use a general-purpose board.

All the units tested have d.c. throughput on one spur and the d.c. block on the other can generally be shorted to give a d.c. pass on both spurs – the blocking capacitor is usually of about 0·001μF, mounted adjacent to the d.c. blocked spur connection.

In use as a splitter the insertion loss is less than with a resistive unit though an inductive splitter is more expensive.

An inductive combiner is useful where severe ghosting is present and two identical arrays are stacked (using equal feeder lengths!) to obtain a suitable polar response with reduced horizontal beam width.

Don't use a wideband inductive combiner on its own to link the outputs from two different channel group aerials, e.g. where an extra ITV station is required. Since the bandwidth of this type of combiner is over 40-860MHz, pickup of the local signals on the distant aerial and vice versa will produce a confusion of signals at the output. This is likely to be destructive for teletext reception and, depending on the relative phasing of the signals, ghost pickup etc., degraded pictures are likely to be obtained. For this application an appropriate frequency-selective diplexing arrangement with sufficient out-of-group rejection should be used.

Labgear have recently introduced a u.h.f. combiner/splitter, type CM9035, for the 470-860MHz band. It's housed in the usual round case and features stripline techniques. The insertion loss is less than −4dB, typically −3·5dB, with spur isolation −15dB. D.C. passage on both spurs is available. For combining the outputs from different channel group aerials, use 9034 group bandpass filters.

Test Report: Tele-Part Pattern Generators

Eugene Trundle

In the seventeen years (ye gods, is it really that long?) that we in the UK have been in the colour television business, the evolution of the pattern generators we use for test purposes has largely mirrored the development of the sets themselves – in terms of price, circuit integration, current consumption and simplicity. The need for a pattern generator is diminishing with the latest colour sets. Gone are the days when a new set had to be completely set up at the time of installation, and even for routine servicing thereafter the pattern generator tends to stay in the van. Converging a TV set, once a source of satisfaction (or frustration?), is rapidly becoming a lost art, while modern decoders are virtually go/no go devices whose rare failures usually show up in the form of complete loss of colour or an absence or surfeit of one primary colour.

The need for specialised test patterns still exists however, and to meet it two generator "modules" have been introduced by Tele-Part of Wolverhampton. The simpler one, Telegen-1, is a pocket-size (10 × 7·5 × 4cm) instrument powered by an internal PP3 battery or an external power source via a 3·5mm jack socket. It provides five monochrome patterns – crosshatch, dots, white raster, horizontal lines and vertical lines. Its output is at around channel 32, via a flying lead with a standard u.h.f. plug.

On test I found that the twelve vertical and eight horizontal lines are sharp and well defined. The plain white raster is free from hash and patterning, and a scope test showed that the vision/sync ratio is correct at 7:3 on all patterns. The field sync pulse is of the "simple" type (a single broad pulse), but this is quite adequate for the job in hand. The u.h.f. output measured about 4mV, with virtually no spurious radiation on "ghost" channels and a complete absence of frequency drift. Current consumption came out at just over 10mA at 9V: I found that the unit will operate satisfactorily down to 6·3V, still without modulator drift. Good!

I next dismantled the unit and found a little fibreglass PCB mounted to the case by the pattern selector switch, which is a good quality, fully-enclosed type. Three i.c.s, three transistors and 57 other bits complete the ensemble, which I've no doubt will be very reliable.

Turning attention to its big brother Telegen-2, not very big actually at 12 × 10 × 4·5cm, I found a similar design and construction. This is the colour "module", offering standard colour bars and plain rasters in red, green and blue, selected by a four-position switch. Telegen-2 works from an external 14-18V supply via a 3·5mm jack socket and provides a similar u.h.f. output to Telegen-1. It contains five chips, an 8·86MHz crystal, a 5V stabiliser i.c. and an on-board u.h.f. generator, all on a similar PCB to that used in Telegen-1. The switch and mounting method are also similar.

I was happy with the colour bars, which scope checks proved to be correct in every sense, particularly with regard to the chroma/burst/sync ratios and the burst timing (the latter is a weak point with some inexpensive colour generating equipment). The plain coloured rasters, particularly blue, were somewhat marred by a spurious patterning due to a form of internal signal breakthrough – the effect disappeared when the instrument was dismantled, but returned when it was reassembled! This didn't distract much from the usefulness of the patterns however. The review model suffered from intermittent colour, due I believe to an internal dry-joint, and a tendency for the u.h.f. oscillator to drift with time and temperature, but this was probably pure bad luck and I wouldn't expect it to happen with other samples.

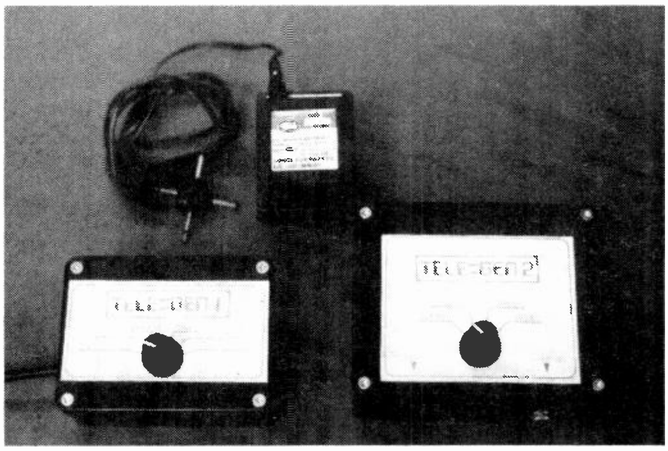
With some types of TV set it's not always possible to lose the colour completely – the colour control sometimes won't turn it down fully, and an efficient a.f.c. system with no cancelling switch may prevent you from mistuning to try for a monochrome display. For this reason, and since Telegen-1 has no grey-scale pattern, I'd have liked a colour/mono switch on Telegen-2 to facilitate easier grey-scale tracking adjustment with these "difficult" sets.

A mains power pack in the form of a "block" mounted directly on to the pin configuration of a 13A plug was supplied with the review pattern generator modules. At £4·55 one cannot complain on grounds of cost, but cheap and cheerful is the only way to describe it! It has six unstabilised output voltages (3V to 12V) which are selected by a slide switch. When modestly loaded by one of the Telegen modules it gave an output voltage between 42 and 90 per cent higher than specified, depending on range. This overvoltage caused no damage to either Telegen model during sustained tests, neither did incorrect polarisation of the (reversible!) plug on the d.c. output lead.

Verdict

The odd negative comments in the above review must be considered in the light of the very reasonable price of the units – £17·20 for Telegen-1, £34·45 for Telegen-2 and £4·55 for the power supply, to which must be added £1·44 post and packing. I found them portable, convenient and useful, and would regard them as good value for money.

The units are available from Tele-Part, 13 Worcester Street, Wolverhampton, WV2 4LJ (telephone 0902-773 122).



The modules under review. Left the monochrome Telegen-1, right the colour Telegen-2, top the mains adaptor.

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Paul Hardy, Keith Hamer, Garry Smith, Malcolm Burrell and Chris Avis

ITT CMC301 Module

I've had a number of faults on the CMC301 remote control/frequency synthesis tuning module. Here's a typical one. The set wasn't tuning a station in – there was just snow on the screen. The scope was used to check the tuning voltage at connector TC12. For our transmitter (Sutton Coldfield) this is normally around 10V, but in this case a ramp voltage varying between 20V and 30V was present.

Checks were made on the counted-down local oscillator signal coming back from the tuner/i.f. module (plug FD1) but the waveform was correct – a 4V p-p sinewave. The frequency divider switching signal at plug FD3 was also correct – a 5V p-p squarewave. As the ramp on the tuning line wasn't going below 20V, the transistors in the D-A converter circuit were checked out of circuit. T1414 turned out to be leaky.

Other faults we've had in this area are as follows:

One inch wide bars across the picture due to C1425 (2·2μF) in the tuning voltage smoothing network going open-circuit.

Intermittent switching to standby due to C1419 (2·7pF) in the crystal clock oscillator circuit being leaky.

Stuck on standby due to the standby power supply mains transformer Tr1401 being open-circuit.

No tuning voltage due to C1072 (0·47μF blue tantalum) on the main panel being short-circuit. **P.B.**

ITT CVC1100 Chassis

Here's an impossible one for you! The reported fault was no sound on VCR operation, and sure enough there was no sound on any signal tuned in via the VCR button. The interstation mute was operating: this is sensed by the TDA1940F sync separator/line oscillator i.c. but a replacement chip made no difference. The VCR button modifies the phase detector time-constant of course, so something in the line generator circuit just had to be out of tolerance. We checked the black electrolytics in the area (usual practice with ITT sets) to no avail. The digital voltmeter was next brought into play so that the voltages around the i.c. could be more carefully checked. The VCR select pin (pin 5) went high as it should have done, but went 1V too high (to 8·5V instead of 7·5V). The pin is fed via a potential divider (R601/R631) and R631, which is connected to chassis, was found to be open-circuit. **P.B.**

Grundig GSC100 Chassis

This was a real pig! The field engineer said that every three weeks he had to resolder R607. Now this resistor normally runs very cool, because it's part of the start-up circuit, and goes open only when the line output stage fails. After a lot of soak testing and probing I found that on certain fairly cold days the set would trip in this way when first switched on. Much time elapsed before I concentrated on the e.h.t. control module, which controls the supply to the line output stage. It contains a 74-series monostable multivibrator chip. Now these digital chips like a supply of exactly 5V: go much higher or lower and they won't work. This one is supplied by a rail that's stabilised by a 4·7V zener diode, Di2502. At times the voltage across this diode was as low as 3V. Replacing Di2502 cured the problem. **M.B.**

Philips K30 Chassis

One of these sets had cross-modulation lines on the picture, as if the r.f. amplifier was being overloaded. A lot of time had been spent trying to locate the exact cause of the fault, which was cleared by replacing the tuner unit.

The fault on another of these sets was field collapse. A quick check revealed that there was no 32V rail, due to R1590 (1·2Ω) being open-circuit. When this was replaced it started to cook while the raster disappeared towards the bottom of the screen. The field scan coupling capacitor C1521 (1,500μF) was short-circuit. **M.B.**

Thorn TX9 Chassis

Lack of width was the customer's complaint with this set. On test card the verticals were seen to be bowed while the width and pincushion controls had no effect. Obviously something to do with the EW correction circuit. A check at the emitter of the EW modulator driver transistor TR72 (TIP110) produced a slightly high voltage reading (not much higher than I'd have expected though – the normal reading is quoted as 0·15V). I decided to check the emitter resistor R251 (2·7Ω) which turned out to be high in value. The transistor seemed to be o.k., and replacing the resistor restored normal operation. **M.B.**

Philips K30 Chassis

The set was brought in because it was tripping. All the usual things around the line output stage, even the deflection coils, had been checked by the field engineer. It was difficult to find the cause of the problem until I decided to try disconnecting pin 6 (excess current protection) of IC7322 (TDA2581Q) – not something to do lightheartedly. A picture then appeared, modulated with 100Hz hum. The fault clearly lay in the power supply and was soon traced to the 285V supply reservoir capacitor C1460b. **M.B.**

Philips K30 Chassis

A sudden drop in contrast with the control itself having no effect led us to suspect a fault in the contrast control network. The fault corrected itself before we could take any further action however and the set remained all right during a prolonged soak test. All we could do was to return it to the customer. Six weeks later it was back with the same fault. Beam limiting is also carried out via the contrast control network, so attention was paid to this. The sample point for the beam limiting is C1565 (0·068μF) which is connected to the earthy side of the e.h.t. circuit. This capacitor, which is close to the smoother at the bottom of the hinged panel, turned out

to be open-circuit. We've since had the same fault on two other K30s – in both cases it was intermittent.
K.H.-G.S.

Thorn TX10 Chassis

We were called out to a six-month old Ferguson colour receiver fitted with the TX10 chassis. The customer had complained that the set was dead, but on arrival we found that it was tripping. Disconnecting the e.h.t. lead made no difference so we humped the set back to the workshop for a more detailed examination. Further checks revealed that the h.t. rail was higher than the specified 150V – the supply was building up and shutting down as soon as the overvoltage protection system came into action. Reducing the setting of the set-h.t. control stopped the tripping and restored normal operation but the control was at one end of its travel. Further checks showed that the feedback resistor R813, connected between the control and the 150V rail, was high in value at 160kΩ instead of 121kΩ. **K.H.-G.S.**

Philips K30 Chassis

"Dead" said the job card. Good we said, thinking we'd be in and out of the house in five minutes. The cause of this fault is usually the mains bridge rectifier's surge limiting resistor R6291 (4·7Ω) going open-circuit. Not this time however. The set worked for several minutes before the gain suddenly fell to zero, producing a blank raster. Lowering the chassis disturbed the fault and the picture and sound returned – but not for long. The tuner is unpluggable so we carried out a quick substitution. This made no difference. Back in the workshop we soon found the culprit. No, it wasn't the TDA2540 i.f. amplifier/detector i.c. A can of freezer (not a whole can incidentally) and a hairdryer led us to the a.g.c. reservoir capacitor C2147 (0·022μF) which is connected to pin 14 of the i.c. It was going leaky. **K.H.-G.S.**

Thorn TX9 Chassis

This set was fitted with the U725 remote control panel. The complaint was line drift. The line generator i.c. had already been changed so I put the set on soak and set up the line oscillator. Nothing happened till I switched off and on again. The line timebase was then *slightly* off frequency. Checks were made on the components around the chip but the only clue was obtained by changing channels. When the line was unlocked, pressing button eight (AV) restored lock until the set was switched off. Disconnecting R207 in the AV line resulted in immediate picture lock, as did disconnecting the AV connection on the remote control panel. Moving over to the remote control panel itself brought me to D916 (F425) which turned out to be leaky. **M.B.**

Grundig 6100

We've dealt with the basic models in the Grundig range for the past two-three years and have found them very predictable with regard to faults. Callouts usually concern tuning troubles, especially on earlier models. With the 6100 we would find that ITV and sometimes Channel 4 had to be retuned every few weeks. If the trouble persisted we would change the tuning voltage supply stabiliser – after removing the fiddly front panel and button unit from inside the cabinet. This wasn't the right diagnosis however as the stations didn't drift to the same extent. We eventually found the true cause of the trouble. What happens is that the cabinet can warp and distort the press-button unit mechanics as the room temperature alters. This distortion affects mainly the middle positions of the assembly. The only cure we know is to remove the assembly, twist it round a little and put it back! In stubborn cases, try telling the customer to get the central heating thermostat checked.

Later models aren't affected in this way because the button unit is directly mounted on to a vertical side chassis assembly. We still get problems however. Customers somehow manage to engage all the buttons. They follow the instructions on delatching given in the Grundig booklet, then we're called out to a broken button unit damaged by hairpins, screwdrivers and, by the look of some of them, garden spades! **K.H.-G.S.**

Thorn 3000/3500 Chassis

Many of these BC (Before Ceefax) vintage sets are still in use. They're prone to displaying teletext "morse code" over the top couple of inches of the picture. I've tried a couple of suggestions relating to the field oscillator circuit without success but a recent consultation with the oracle at the Ferguson service department produced a simple and effective cure: increase the value of R441 in the flyback pulse limiting network across the field output transformer from 2·2kΩ to 5·6kΩ. **C.A.**

Thorn 1500 Chassis

The complaint was intermittent loss of picture, which turned out to be due to a faulty ring trap – the plastic had cracked with the result that the c.r.t. heater was shorting out. Whenever a tube is scrapped I always keep the ring trap if it's any good, so a spare was soon fitted and the set sent on its way. It was back a few days later however, the symptoms being no picture or sound with a visible raster. This time the ring on the replacement trap was grounding pin 1 of the tube so that the set's l.t. supplies, which are derived from the end of the heater chain, were removed. It turned out that the tube's evacuation pip was malformed, as a result of which the plastic base couldn't be pushed firmly home against the end of the tube – it sprang out. All that was necessary was to file the plastic base till it fitted the tube, then apply some adhesive to ensure that it stayed there. **P.H.**

Philips G8 Chassis

Every six months or so the 250mA fuse on the power supply panel would blow. No shorts could ever be found on any of the panels or in the wiring loom, a replacement fuse working for a time until it blew for the same inexplicable reason. This went on for a couple of years! There was obviously a fault somewhere however. Close inspection of the panels revealed a very slight burn mark on the component side of the combined i.f./decoder panel, adjacent to R212. R414, which is beside R212, was mounted horizontally instead of vertically, with the result that the earthed side of R414 was very close to the end of R212 that carries 205V. The 205V was intermittently flashing over from the end cap of R212 to the earthed leg of R414. Repositioning these resistors has provided a cure – to date! **P.H.**

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

16029	1.58
16181	1.13
16182	1.13
16334	0.88
16335	0.72
16446	0.89
16600	1.25
16799	2.16
16801	0.86
16802	1.03
16803	4.81
16905	1.35
17074	6.00
17127	3.91
17376	1.43
1N4001	0.05
1N4002	0.05
1N4003	0.05
1N4004	0.06
1N4005	0.07
1N4006	0.07
1N4007	0.07
1N4148	0.03
1N4448	0.12
1N5401	0.12
1N5402	0.13
1N5403	0.14
1N5404	0.15
1N5408	0.18
1N914	0.05
1S44	0.06
1S5012A	0.73
1S921	0.09
2582	1.94
2N1302	0.24
2N1303	0.34
2N2218	0.38
2N2219A	0.29
2N2222	0.34
2N2646	0.75
2N2904	0.32
2N2905	0.39
2N2906	0.34
2N3053	0.24
2N3054	0.90
2N3055	0.55
2N3055H	0.77
2N3442	1.05
2N3702	0.12
2N3703	0.12
2N3704	0.12
2N3705	0.12
2N3706	0.12
2N3707	0.14
2N3711	0.14
2N3771	1.85
2N3772	1.55
2N3773	1.65
2N3819	0.28
2N3823	1.06
2N3904	0.56
2N3908	0.56
2N4101	1.10
2N4240	3.00
2N4443	1.35
2N4444	1.12
2N4914	0.65
2N5064	0.64
2N5293	0.45
2N5294	0.45
2N5296	0.40
2N5297	0.45
2N5298	0.55
2N5490	1.35
2N5496	0.45
2N6107	0.53
2N6109	1.43
2N6122	1.60
2N6130	0.65
2N6133	0.57
2N6178	0.66
2N6180	0.66
2N696	0.39
2N698	0.39
2N707	0.39
2SA1027	1.15
2SA1076	1.78
2SA329	0.36
2SA351	1.06
2SA489	1.06
2SA490	1.51
2SA493	0.95
2SA628	1.03
2SA637	1.32
2SA673	1.11
2SA683	1.46
2SA684	1.33
2SA748	0.88
2SA818	1.65
2SA835	2.27
2SA940	1.64
2SA951	1.23
2SA966-Y	0.54
2SB325	3.51
2SB337	1.65
2SB375	3.51
2SB400	0.36
2SB407	2.94
2SB411	3.00
2SB511	1.48
2SB54	1.26
2SB56	1.26
2SB618A	1.40
2SB681	2.44
2SB695	1.70
2SB75	0.94
2SB861	0.68
2SC1034	5.61
2SC1050	3.66
2SC1061	0.54
2SC1096	1.05
2SC1104	2.80
2SC1106	4.12
2SC1114	5.61
2SC1124	1.10
2SC1151A	4.29
2SC1152	4.25
2SC1157	4.12
2SC1162	0.95
2SC1172	1.92
2SC1195	2.83
2SC1213	0.75
2SC1226	1.32
2SC1306	0.85
2SC1307	1.35
2SC1316	3.40
2SC1364	0.49
2SC1383	1.39
2SC1398	0.51
2SC1410	2.17
2SC1413	3.88
2SC1505	0.56
2SC1578	6.67
2SC1617	3.35
2SC1670	2.84
2SC1678	1.25
2SC1810	1.40
2SC1815	0.41
2SC1829	2.01
2SC1875	4.77
2SC1891	3.35
2SC1929	2.25
2SC1942	5.70
2SC1945	4.11
2SC1953	1.75
2SC1957	0.86
2SC1959	0.36
2SC1962	1.75
2SC1969	2.92
2SC2027	2.67
2SC2028	1.91
2SC2029	1.49
2SC2057	1.07
2SC2073	1.40
2SC2078	1.25
2SC2091	0.59
2SC2122A	4.65
2SC2141	1.69
2SC2166	1.35
2SC2216	0.62
2SC2233	2.20
2SC2271	3.64
2SC2278	1.03
2SC2335-KIT	7.61
2SC2526	1.70
2SC2551	0.95
2SC2570	1.80
2SC2570A	0.95
2SC264A	4.38
2SC2671	1.99
2SC2728	0.95
2SC372	1.27
2SC373	1.05
2SC383	1.20
2SC388	0.45
2SC41	1.99
2SC458	0.55
2SC495	0.83
2SC508	3.38
2SC515A	1.28
2SC537	0.49
2SC558	3.35
2SC605L	1.05
2SC620	1.32
2SC643A	1.40
2SC673	1.11
2SC681	4.00
2SC684	1.50
2SC685A	2.62
2SC693	0.89
2SC710	0.62
2SC717	1.92
2SC734	1.30
2SC735	1.05
2SC782	2.24
2SC790	1.15
2SC806	10.28
2SC814	1.26
2SC828	0.25
2SC867A	2.49
2SC926A	1.29
2SC930	0.49
2SC935	3.75
2SC936	1.58
2SC937	3.25
2SC940	4.25
2SD1138	0.78
2SD198	3.51
2SD234	0.42
2SD235	0.54
2SD257	2.67
2SD291	2.67
2SD292	2.35
2SD313	2.59
2SD315	2.67
2SD325D	1.36
2SD350	7.03
2SD350A	2.08
2SD353	3.25
2SD389	2.19
2SD401	1.57
2SD551	2.20
2SD588A	1.25
2SD621	8.88
2SD657	2.54
2SD731	1.72
2SD811	3.86
2SD869	2.40
2SD898B	2.67
40408	0.45
40594	1.39
40595	1.39
40636	0.86
40871	1.39
40872	1.39
60857	1.10
74LS132	0.72
74LS138	0.85
74LS157	0.79
74LS161AN	1.18
74LS196	1.25
74LS20	0.25
74LS244	1.65
74LS30	0.29
74LS367	1.05
74LS373	1.55
74LS47	1.05
74LS73	0.39
74LS74	0.39
74LS75	0.52
74LS86	0.49
74LS90	0.75
74LS92	0.75
74LS93	0.75
74LS95B	0.85
7805 TO-220	0.63
7805 TD-3	1.05
7806	0.66
7808	0.54
7812 TO-3	0.54
7812 TD-220	1.05
7815	0.55
7818	0.55
7824	0.55
AC107	0.66
AC117	0.39
AC123K	0.39
AC128	0.28
AC138	0.08
AC141	0.26
AC142K	0.39
AC151	0.25
AC153	0.30
AC153K	0.36
AC176	0.17
AC176K	0.40
AC179	0.25
AC183	0.65
AC186	0.30
AC186K	0.50
AC187	0.35
AC187-01	0.40
AC187K	0.39
AC188	0.33
AC188-01	0.40
AC188K	0.39
AC193K	0.59
AC194K	0.59
AD140	0.96
AD142	0.96
AD143	0.96
AD145	1.45
AD149	0.81
AD161	0.30
AD162	0.30
AD262	0.95
AF114	2.24
AF115	0.79
AF116	0.79
AF117	0.75
AF118	0.75
AF121	0.50
AF124	0.36
AF125	0.36
AF126	0.36
AF127	0.36
AF139	0.48
AF178	0.75
AF179	0.50
AF180	0.50
AF181	0.48
AF182	0.50
AF186	0.48
AF239	0.48
AF279	0.80
AL100	3.66
AL102	1.75
AL103	2.43
AL113	1.80
AN208	3.22
AN210	2.07
AN214	2.05
AN214Q	2.05
AN231	5.56
AN234	5.02
AN235	4.84
AN236	3.02
AN238	4.98
AN239	3.95
AN240P	1.88
AN241	1.55
AN245	2.54
AN247P	2.62
AN252	2.33
AN253	2.70
AN262	1.58
AN272	5.36
AN281	5.52
AN295	5.01
AN301	3.30
AN302	3.62
AN303	3.25
AN305	8.07
AN313	3.10
AN315	2.12
AN316	5.58
AN318	4.75
AN320	4.97
AN322	4.38
AN331	2.99
AN337	3.99
AN340P	1.06
AN355	3.36
AN362	1.47
AN5111	2.34
AN5132	3.99
AN5250	3.33
AN5435	2.80
AN5610	6.75
AN5613	3.72
AN5620X	4.63
AN6320N	3.89
AN6342	1.36
AN6344	4.68
AN6363	10.20
AN6551	0.56
AN6552	0.52
AN7145	2.04
AN7150	2.22
AN7151	2.05
AN7156	2.05
AN7158	2.34
AN7218	1.49
AP58076	4.25
AS560S	1.43
AU106	1.96
AU110	1.96
AU113	2.15
AY102	2.62
AY105K	1.89
AY106	1.98
BA102	0.30
BA1310 (IC)	1.72
BA1320 (IC)	1.22
BA1330 (IC)	1.82
BA145	0.17
BA154	0.08
BA155-01	0.12
BA156	0.12
BA157	0.17
BA159	0.12
BA182	0.17
BA222 (IC)	1.26
BA284/2	0.15
BA301 (IC)	0.92
BA302	0.90
BA311 (IC)	1.06
BA312 (IC)	0.98
BA313 (IC)	1.28
BA316	0.07
BA317	0.07
BA318	0.08
BA328 (IC)	0.80
BA333 (IC)	1.24
BA401 (IC)	0.58
BA511 (IC)	1.98
BA521 (IC)	1.81
BA532 (IC)	1.88
BA536 (IC)	2.72
BA6304A (IC)	2.65
BA843 (IC)	3.60
BAV10	0.10
BAV18	0.10
BAV19	0.10
BAV20	0.10
BAV21	0.17
BAX12	0.10
BAX13	0.10
BAX16	0.10
BB105B	0.22
BB119	0.15
BC107	0.13
BC107B	0.14
BC108	0.12
BC108A	0.12
BC108B	0.15
BC109	0.11
BC109B	0.13
BC113	0.12
BC114	0.17
BC115	0.14
BC116	0.20
BC116A	0.53
BC117	0.18
BC118	0.18
BC119	0.30
BC125	0.18
BC126	0.18
BC132	0.12
BC135	0.12
BC136	0.15
BC137	0.16
BC138	0.30
BC139	0.32
BC140	0.33
BC141	0.28
BC142	0.30
BC143	0.28
BC147	0.10
BC147A	0.42
BC148	0.11
BC148B	0.11
BC148C	0.11
BC149	0.10
BC149B	0.11
BC153	0.12
BC154	0.12
BC157	0.14
BC158	0.09
BC159	0.14
BC160	0.36
BC161	0.36
BC167	0.32
BC168	0.32
BC169C	0.14
BC170	0.14
BC171	0.10
BC172	0.09
BC172B	0.24
BC173	0.15
BC174B	0.24
BC177	0.18
BC178	0.23
BC179	0.23
BC182	0.08
BC182B	0.23
BC182L	0.09
BC182LB	0.12
BC183	0.09
BC183L	0.09
BC183LB	0.23
BC184	0.09
BC184L	0.09
BC184LB	0.23
BC186	0.24
BC187	0.18
BC204	0.14
BC207	0.12
BC212	0.10
BC212B	0.23
BC212L	0.09
BC212LB	0.23
BC213	0.09
BC213L	0.09
BC213LB	0.23
BC214	0.09
BC214L	0.12
BC214LB	0.23
BC225	0.24
BC237	0.09
BC238	0.09
BC238A	0.11
BC239B	0.08
BC251A	0.15
BC252	0.12
BC258	0.22
BC261A	0.20
BC262	0.20
BC287	0.45
BC294	0.45
BC301	0.36
BC302	0.30
BC303	0.34
BC307	0.09
BC307A	0.14
BC308	0.12
BC308A	0.09
BC309	0.15
BC317A	0.11
BC323	0.92
BC327	0.15
BC328	0.10
BC337	0.08
BC338	0.10
BC360	0.30
BC368	0.23
BC440	0.99
BC441	0.40
BC454	0.32
BC455	0.32
BC460	0.38
BC461	0.42
BC462	0.27
BC463	0.58
BC464	0.58
BC465	0.58
BC477	0.25
BC478	0.29
BC479	0.29
BC532	0.25
BC546	0.15
BC547	0.09
BC548	0.09
BC549	0.09
BC550	0.36
BC556	0.12
BC557	0.09
BC558	0.09
BC559	0.09
BC560C	0.10
BC635	0.18
BC636	0.18
BC637	0.18
BC638	0.18
BC639	0.18
BC640	0.18
BC879	0.28
BC880	0.28
BCX32	0.33
BCX33	0.24
BCX34	0.36
BCX37	0.60
BCY70	0.27
BCY71	0.19
BCY72	0.18
BD115	0.29
BD116	0.63
BD124	1.19
BD124P +KIT	0.62
BD131	0.38
BD132	0.38
BD133	0.48
BD135	0.32
BD136	0.32
BD137	0.32
BD138	0.41
BD139	0.27
BD140	0.33
BD144	1.30
BD150	1.08
BD157	0.60
BD159	0.48
BD160	1.45
BD163	0.64
BD165	0.56
BD166	0.38
BD168	0.66
BD175	0.39
BD177	0.39
BD179	0.44
BD181	0.90
BD182	0.90
BD183	0.90
BD184	1.10
BD187	0.48
BD189	0.35
BD190	0.59
BD201	0.54
BD202	0.54
BD203	0.54
BD204	0.54
BD207	1.00
BD208	1.00
BD222	0.44
BD225	0.44
BD228	0.57
BD229	0.63
BD231	0.45
BD232	0.44
BD234	0.38
BD235	0.43
BD236	0.45
BD237	0.38
BD238	0.29
BD239	0.44
BD240	0.36
BD240D	0.47
BD241	0.45
BD242	0.45
BD243	0.44
BD243A	0.50
BD244	0.44
BD244A	0.77
BD245C	0.88
BD246C	0.74
BD253	0.95
BD278A	0.80
BD317	1.96
BD318	2.08
BD375	0.38
BD377	0.23
BD379	0.69
BD380	0.69
BD410	0.44
BD412	5.70
BD418	0.76
BD433	0.33
BD434	0.39
BD435	0.42
BD436	0.42
BD437	0.41
BD438	0.44
BD441	1.29
BD442	0.56
BD507	0.54
BD508	0.54
BD509	1.29
BD510	0.45
BD518	1.36
BD519	1.36
BD529	0.38
BD530	0.80
BD533	0.80
BD534	0.36
BD535	0.44
BD536	0.55
BD537	0.60
BD538	0.60
BD544B	0.75
BD580	1.06
BD590	1.06
BD598	1.13
BD645	3.62
BD677	0.55
BD680	0.69
BD681	1.34
BD695	2.09
BD696	2.24
BD697	3.27
BD698	1.68
BD699	3.17
BD700	3.36
BD702	2.94
BD707	0.55
BD709	0.72
BD710	0.72
BD807	0.60
BD809	0.80
BD810	0.80
BD879	0.64
BD880	0.65
BD895	1.98
BD899	2.25
BD901	0.55
BDV64B	1.14
BDV65B	1.14
BDX32	1.50
BDX53	0.80
BDX53A	3.68
BDX54B	2.37
BDX62A	1.92
BDX63A	1.95
BDX64A	2.37
BDX65A	2.37
BDX76	0.53
BDY20	1.10
BDY62/01	4.20
BDY81	1.07
BF115	0.36
BF117	0.36
BF118	0.60
BF121	0.22
BF123	0.11
BF127	0.11
BF137	0.11
BF152	0.28
BF153	0.52
BF154	0.23
BF157	0.23
BF158	0.16
BF159	0.16
BF160	0.28
BF167	0.34
BF173	0.30
BF177	0.50
BF178	0.36
BF179	0.32
BF180	0.32
BF181	0.29
BF182	0.30
BF183	0.35
BF184	0.39
BF185	0.35
BF194	0.15
BF195	0.12
BF196	0.15
BF197	0.14
BF198	0.15
BF199	0.15
BF200	0.33
BF216	0.32
BF218	0.32
BF222	0.50
BF224	0.15
BF237	0.59
BF240	0.15
BF241	0.15
BF244	0.23
BF245A	0.33
BF255	0.18
BF256	0.25
BF256LC	0.38
BF257	0.30
BF258	0.29
BF259	0.30
BF262	0.51
BF263	0.51
BF264	0.33
BF271	0.30
BF273	0.18
BF274	0.18
BF324	0.16
BF336	0.27
BF337	0.36
BF338	0.36
BF355	0.36
BF362	0.54
BF363	0.54
BF371	0.45
BF391	0.36
BF393	0.90
BF417	1.20
BF418	1.70
BF422	0.26
BF423	0.26
BF435	0.49
BF450	0.30
BF451	0.26
BF457	0.37
BF458	0.35
BF459	0.35
BF460	0.54
BF469	0.27
BF470	0.28
BF471	0.28
BF472	0.28
BF479	0.55
BF480	0.54
BF495	0.58
BF506	0.39
BF509	0.37
BF523	0.18
BF594	0.24
BF595	0.24
BF596	0.16
BF597	0.24
BF617	0.95
BF618	0.95
BF694	0.20
BF757	0.59
BF758	0.59
BF759	0.30
BF760	0.59
BF762	0.30
BF870	0.27
BF871	0.84
BF900	0.68
BF907	1.62
BF959	0.38
BF970	0.55
BFR39	0.36
BFR52	0.45
BFR62	0.36
BFR79	0.29
BFR81	0.45
BFR86	0.98
BFR89	0.39
BFT41	0.27
BFT42	0.39
BFT43	0.39
BFT84	0.36
BFW10	0.79
BFX29	0.30
BFX30	0.59
BFX84	0.33
BFX85	0.25
BFX87	0.50
BFX88	0.30
BFX89	0.36
BFY50	0.24
BFY51	0.24
BFY52	0.24
BFY90	0.96
BLY49	2.00
BR100	0.20
BR101	0.37
BR103	0.45
BR88B	0.58
BRC-M-300	1.58
BRC116	0.80
BRC1330	1.80
BRC300	1.82
BRC4443	1.12
BRC4444	1.12
BRC5296	0.70
BRC6109	0.75
BRC82	0.98
BRC83	0.98
BRC84	0.98
BRX44	0.54
BRX49	0.45
BRY39	0.50
BRY55	0.60
BRY56	0.38
BSR59	1.17
BSS38	0.30
BSTBD1409	2.48
BSTBD1405	4.37
BSTCD146	2.25
BSTC0233	2.25
BSTC0246	4.51
BSTC1233	3.91
BSTC3146	0.71
BSTCC0143	2.79
BSTC0643	3.06
BSV57B	2.66
BSW68	0.38
BSX19	0.30
BSX20	0.30
BSX21	0.45
BSY52	0.45
BSY79	0.46
BT100A	1.46
BT106	1.20
BT108	1.31
BT109	1.31
BT112	2.25
BT113	2.25
BT116	1.52
BT119	1.80
BT120	1.60
BT121	2.25
BT122	2.25
BT123	1.80
BT125	2.25
BT126	2.25
BT128	2.25
BT128P	2.79
BT129	2.25
BT151-800R	1.47
BT151 500R	1.25
BTT6018	2.20
BTT6218	2.20
BTT8024	4.02
BTT8124	4.44
BTT8214	5.44
BTT8224	2.70
BU105	1.66
BU106	2.25
BU108	1.90
BU109S	1.90
BU110	2.52
BU111Y	3.78
BU124	1.25
BU126	1.11
BU134S	4.15
BU204	1.29
BU205	0.98
BU206	1.20
BU207	1.50
BU208	0.98
BU208/02	0.98
BU208A	0.98
BU208D	1.43
BU209	1.80
BU226	2.08
BU312	2.16
BU326	0.75
BU326A	1.40
BU326S	2.25
BU406	1.35
BU407	0.74
BU407D	1.29
BU412	4.80
BU426	1.95
BU426A	1.67
BU427	2.67
BU500	1.61
BU508A	1.33
BU526	1.65
BU608D	1.42
BU806	1.29
BU806D	1.35
BU807	1.40
BU826A	2.79
BUV46	1.13
BUV84	1.12
BUN81A	3.15
BUN84	1.56
BUX84	1.47
BY126	0.11
BY127	0.11
BY133	0.11
BY164	0.50
BY176	1.38
BY179	1.42
BY182	0.95
BY184	0.42
BY187	0.70
BY189	1.20
BY198	2.38
BY201/2	1.36
BY203/20	0.18
BY206	0.17
BY207	0.22
BY210-400	0.24
BY210-600	0.27
BY210-800	0.30
BY223	0.85
BY224-400	0.90
BY225-100	0.79
BY226	0.28
BY227	0.44
BY228	0.54
BY255	0.97
BY298	0.25
BY299	0.25
BY476A	0.76
BYW56	0.30
BYX10	0.26
BYX55-350	0.48
BYX55-600	0.25
BYX71-350	0.67
BYX71-600	0.85
BYX94	0.18
BYY56	1.09
BZV15-C12	0.72
BZV15-C12R	0.72
BZV15-C24	0.72
BZV15-C24R	0.72
BZV15-C30R	0.72
BZX61 Range	0.16
BZX70-C11	0.54
BZX70-C12	0.54
BZX70-C15	0.54
BZX70-C30	0.54
BZX70-C47	0.54
BZX79 Range	0.09
BZY88 Range	0.09
BZY93-C12	0.99
BZY93-C18	0.99
BZY93-C24	0.99
BZY93-C24R	0.99
BZY93-C30	0.99
BZY93-C47	0.99
BZY93-C68	0.99
BZY93-C7V5	0.99
ZTK33	0.39
ZX18	2.47
C106D	0.46
C1129	0.52
CA1310E	2.45
CA3044	3.18
CA3046	2.23
CA3060	1.50
CA3065	1.17
CA3089	3.35
CA3089E	1.30
CA3090	1.25
CA3094	2.00
CA3131EN	2.83
CA3132EN	2.83
CAH76023N	6.00
CBF16848N-07	1.41
CD4001	0.24
CD4002	0.24
CD4008	0.96
CD4011	0.23
CD4012	0.24
CD4013	0.37
CD4016	0.37
CD4017	0.74
CD4020	0.92
CD4021	0.24
CD4023	0.25
CD4025	0.54
CD4028	0.76
CD4047	0.96
CD4049	0.52
CD4050	0.50
CD4052	0.88
CD4053	0.72
CD4069	0.23
CD4081	0.26
CD4093	0.72
CD4511	1.00
CD4517	1.06
CP5521	16.20
CV-12E	2.49
CX034	10.75
CX095D	2.85
CX104	8.49
CX108	6.92
CX109	6.92
CX121	10.75
CX130	4.90
CX131	10.75
CX134	10.75
CX136	10.75
CX137	10.75
CX139	10.75
CX157	4.40
CX158	3.44
CX170	6.92
CX177	5.99
CX506	8.48
CX507	6.92
CX758	6.92
D1693	2.35
DEC1	1.52
DEC2	1.52
E1222	0.36
E5024	0.25
E5386	0.22
E5529	0.22
E8021	1.17
E9003	0.41
E9005	0.45
ER1400	10.12
ESN310BP	3.86
ESM432C	4.18

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

Simple Pattern Generator

Barry J. Thurlow

This pattern generator was originally devised for monitor alignment and for the go/no-go testing of video switches and cables. For this purpose it provides a standard 1V peak-to-peak composite video signal (0·3V sync pulses) when terminated externally with a 75Ω load resistor. An Astec modulator can be incorporated however to obtain a u.h.f. output. The circuit is based around a Ferranti ZNA234E TV pattern generator i.c., with additional circuitry for mixing and providing a reasonable 75Ω output. The whole lot fits into a 705 Verobox which has a compartment for the four 1·25V Nicad batteries used for the supply. The small PCB that holds the circuit has been designed to fit into this box.

Fig. 1 shows the circuit. The ZNA234E generates the patterns by counting down etc. from a 2·5MHz crystal oscillator. Vertical line width is set by an *RC* combination at pin 10 – in practice R8 and the stray capacitance of the pin. These together give a line width of about 100nsec.

The base of output transistor Tr1 is biased at 2·7V by R3 and zener diode D1. This holds the voltage across R4 at a fairly constant 2V. The junction of Tr1 and R4 is used as a current summing point for the video and sync signals.

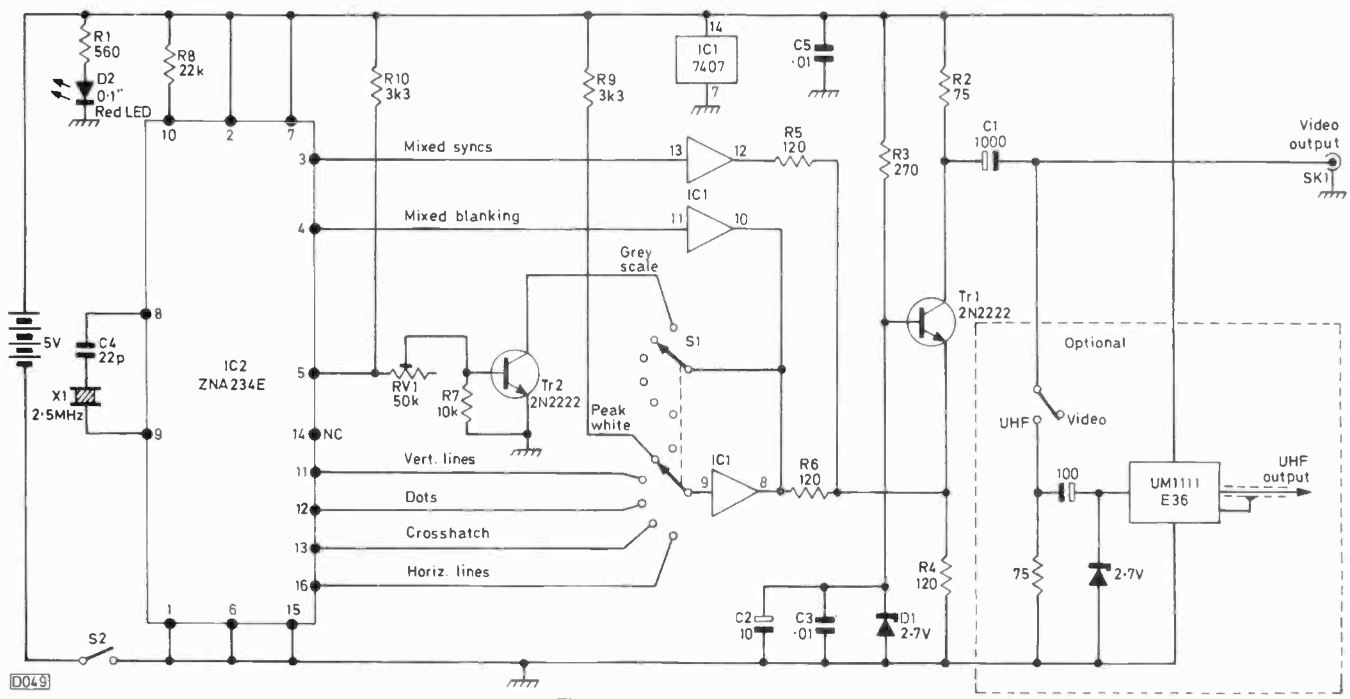


Fig. 1: Circuit diagram.

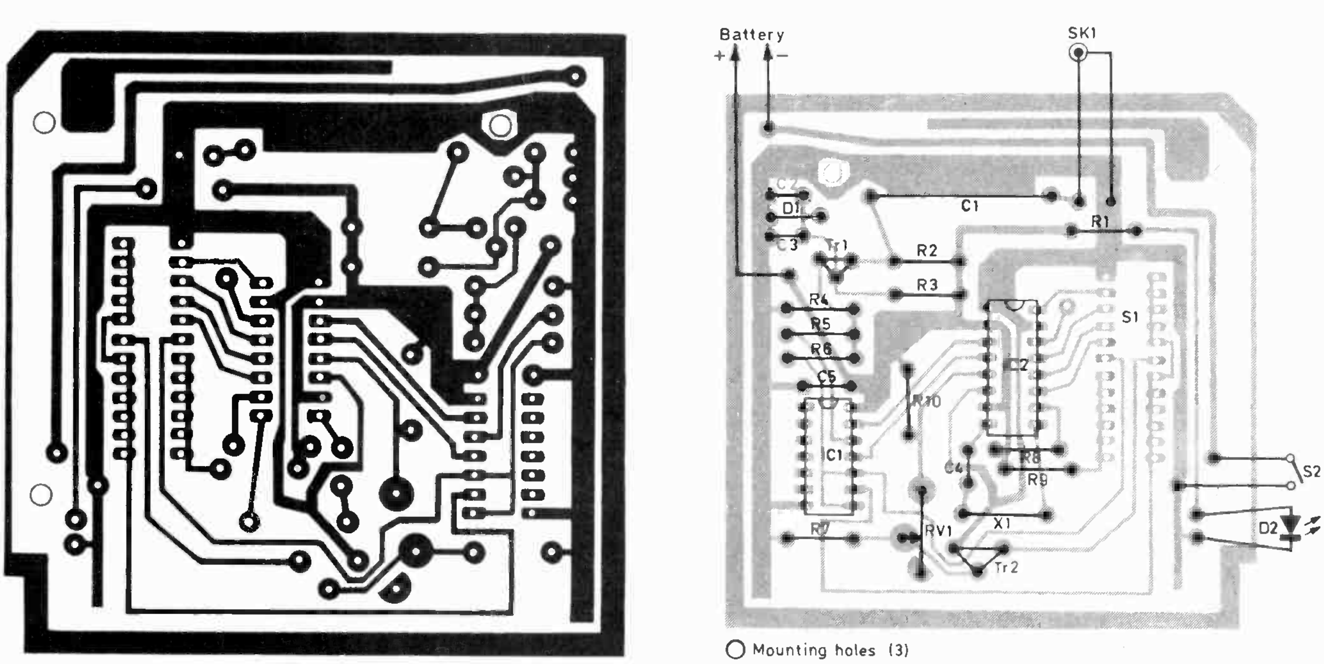
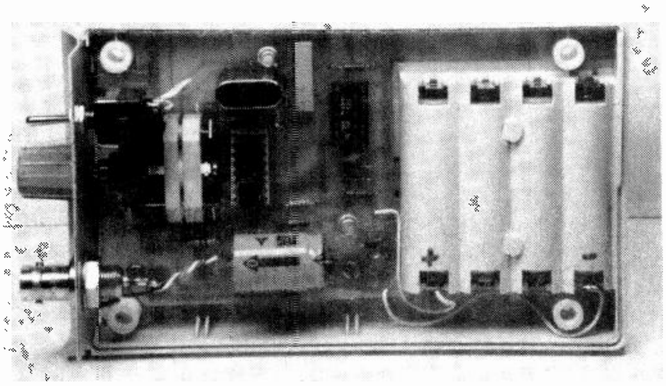


Fig. 2: PCB print pattern, actual size, left; component layout right. C1 25V axial, C2 6·3V tantalum, C3 and C5 disc ceramic, C4 polystyrene or plate ceramic.

By virtue of the transistor's gain, a composite signal of about 2V peak-to-peak is developed across R2. The various outputs from IC2 are buffered by IC1 (Tr2 in the case of the grey-scale pattern).

If the u.h.f. version is used, the output from the modulator can be connected to the front panel BNC socket. Alternatively a second socket and selector switch could be used. Although the UM1111 modulator should be operated with a 7·5V supply it seems quite happy operating at 5V and quite reasonable results were obtained with the capacitive coupling arrangement shown. There's room in the case for the modulator – it can be conveniently mounted inside the top section above the battery compartment. The modulator's bandwidth is limited, so I wouldn't recommend using its output for signal adjustments. The picture provided is quite suitable for adjusting picture geometry however.

The board was originally designed for use with an ITT single-pole, twelve-way switch (see photos). This however is not a stock item. We suggest the use of an RS 327-951 two-pole, six-way rotary switch mounted on the front panel with wired links to the board. The seventh position originally provided, blank raster, is no longer available. To obtain this feature, pin 9 of IC1 was connected to chassis with the other switch positions left open.



View of the unit with top cover removed.

The case was obtained from Maplin and the ZNA234E from Technomatic Ltd., 17 Burnley Road, London NW10 1ED. An alternative source for the i.c. is Celdis Ltd., 37-39 Loverlock Road, Berks RG3 1ED (0734 585 171). It sells for around £10.

Suspect Transistors

George Wilding

As a general rule, the presence of normal working voltages at the collector, base and emitter of a transistor will indicate that it's operational. Where the connection is to the supply line or chassis via a low value resistor or the connection is made to a potential divider however the voltage change with a defective transistor may be small. Fortunately the condition of a transistor can usually be checked in situ with near certainty by making forward and reverse resistance checks across the junctions and a collector-emitter check for possible punch-through. On occasion however you get symptoms suggesting that a transistor is faulty even though these resistance checks indicate otherwise. Here are a couple of examples.

The first was an ITT hybrid colour set (CVC8 chassis) with total lack of line and field lock. The sync separator transistor was naturally suspect but resistance checks at the junctions proved it to be in order. As Fig. 1(a) shows, the collector is connected to a potential divider. It should normally record 65V but in this case the reading was nearer 100V. Considering the proportions of the values of the two resistors in the potential divider network, this suggested that the transistor was cut off all the time. Now this wouldn't be caused by lack of signal at its base, since the input to a sync separator is used to develop the cut-off bias (except during the sync pulse periods). The only possibility therefore was that the 3·3MΩ base bias resistor R330 was open-circuit – a high-value base bias resistor is generally used with a transistor acting as a sync separator to ensure that it saturates each time a sync pulse arrives. What usually happens is that the resistor goes high in value, giving weak field lock. Since the 3·3MΩ resistor couldn't be checked in situ a replacement was fitted, restoring perfect timebase locking.

The second case concerned a Thorn monochrome set fitted with the 1500 chassis, the fault this time being no sound and an unmodulated raster. This could have been due to a tuner, i.f. amplifier or a.g.c. fault. Transistors used as a.g.c. amplifiers seem to be more prone to breakdown than those used in i.f. amplifier stages, so the a.g.c. amplifier transistor VT3 – see Fig. 1(b) – was checked. As is usual in a transistor i.f. strip, forward a.g.c. is used, i.e. the controlled transistors are driven on harder as the signal strength increases. Under no-signal conditions the voltage at the collector of VT3 should be about 0·4V. In fact the collector was at almost the supply line voltage. As a result the controlled transistor would be saturated and thus unable to provide any significant degree of signal amplification.

It seemed likely that VT3 was defective, with one of the junctions open-circuit or the base-emitter junction short-circuit. Resistance checks on the transistor proved that it was perfectly all right however. Further, placing a short from its collector to chassis or to its emitter restored the sound and vision signals. So the cause of the fault was inadequate forward base bias.

The possibilities were an open-circuit or incorrect value resistor in the base circuit, one of the associated electrolytics being leaky or short-circuit, or maybe the a.g.c. rectifier diode W1 leaky (it normally conducts on the tips of the sync pulses only). In fact the diode had a very low reverse resistance, thus placing R34/5 in parallel with R2.

Suspect transistors are often completely innocent!

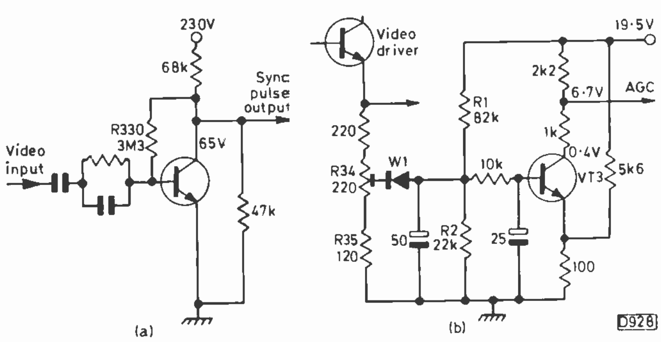


Fig. 1: Sync separator (a) and a.g.c. (b) circuits.

Goodbye to 405 lines

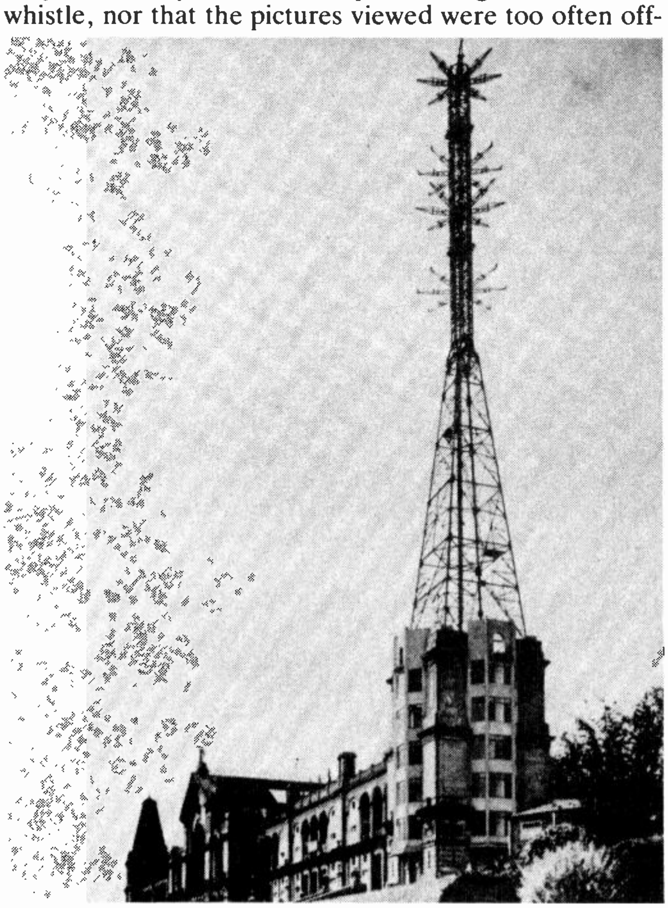
Pat Hawker

The first week of January 1985 sees the end of the TV system that established television in Britain ahead of the rest of the world. All remaining BBC and IBA 405-line v.h.f. transmitters will be switched off. Band I (41-68MHz) and Band III (174-214MHz) will be lost to Britain for TV use, though v.h.f. will continue to provide the main TV channels in virtually every other country. The UK alone is firmly committing its TV future to u.h.f. and to direct broadcasting from satellite in the 12GHz (and later possibly 40GHz) band.

It's the end of the black-and-white system with which the BBC launched the world's first public high-definition service in 1936. Its death has been lingering, entering the terminal phase as long ago as November 1969 when the three-channel colour 625-line u.h.f. service came into being. Broadcasters and the trade have had a decade when few used the 405-line transmissions, but those few who did presented problems with spares and the need for cannibalisation to keep ageing sets going.

Performance

Yet surely 405 deserves a respectful and affectionate wake before the final burial. It served us well. It was not the system's fault that low-cost line output transformers subjected many viewers to a penetrating 10,125Hz line whistle, nor that the pictures viewed were too often off-grey rather than with correct gradations from black to white due to the use in TV sets of a.c. coupling without d.c. restoration.



Back at the beginning: Alexandra Palace in August 1936. The cantilever arms on the mast supported the wire transmitting aerials which were stretched vertically between pairs of arms. Photo courtesy BBC.

At its best, on studio or transmitter control room monitors, 405-line pictures were far from negligible. The positive vision modulation may have been all to susceptible to ignition interference but could give a fine peak white. The 4½in. image orthicon cameras of the 1960s gave superbly crisp studio and OB pictures. Admittedly the 377 active lines did show the line structure, though the public seemed to have little inclination to eliminate this by making use of the spot wobble circuit that was a feature of some sets.

The 405-line transmissions could be comfortably accommodated in 5MHz of precious r.f. spectrum. The IBA could have provided two nationwide channels in Band III, as originally intended, had not the BBC and the radioastronomers intervened! Even 405-line colour was pretty good, though in the end the IBA (then the ITA) and ITV hopes of putting out colour on v.h.f. were defeated when the BBC convinced the Television Advisory Committee that Sporadic E interference would make colour in Band I a non-starter!

The present 625-line system gives us marginally better pictures of course, but the time to have dropped 405 without tears would have been in 1946, when EMI proposed a 605-line system for post-war television.

History

The 405-line system has served us for almost fifty years, with a six and a half year interruption due to the 1939-45 war. It was "invented" one Sunday morning in 1934 in a private house in the London borough of Ealing, the home of that brilliant electronics engineer Alan Dower Blumlein, a member of the EMI and later the Marconi-EMI research team led by Sir Isaac Shoenberg. Alan Blumlein, a perfectionist, had come to EMI as part of the takeover of Columbia records.

The EMI team started to develop television in the mechanical, low-definition era, but soon turned to the concept of all-electronic TV originally proposed by A.A. Campbell Swinton in 1912. The key element was the development of the Emitron electronic camera – initially started as an independent project but in its later stages gaining significantly from the work in the USA of Vladimir Zworykin at RCA, a firm with which EMI had patent and financial links.

Following months of bickering between Baird and EMI, with the BBC anxious to end its agreement with Baird to operate an "experimental" 30-line service in the medium waveband, the government in 1934 set up a Television Committee, chaired by Lord Selsdon, to consider what should be done, after investigating the work going on in Germany and the USA. In 1935 the committee recommended an early start to a UK v.h.f. service with a minimum of 240 lines, 25 frames. Both Baird and Marconi-EMI were invited to supply the transmission equipment. A Television Advisory Committee would make final decisions.

It was intended that there should be a single standard, possibly 240 lines as advocated by Baird or possibly 243 lines interlaced as initially proposed by Marconi-EMI. Electronic interlacing to reduce flicker had been patented by RCA, although an earlier form of mechanical interlace had been used by Baird and others. But the war between Baird and Marconi-EMI could not be resolved. To compound the problem the EMI team next proposed not 243 but 405 lines.

Back to the house in Ealing where, one Sunday morning in 1934, Blumlein, Cork and Eric White had met to discuss how to breadboard a suitable waveform generator to test a system that would put EMI significantly ahead of the Baird company. Baird's 240-line system was developed partly by Captain West and drew on techniques developed by Fernseh in Germany, a company which was loosely linked with Baird. The easiest way of up-grading the 243-line interlaced system proposed by EMI, while retaining this system as a basis for comparison, was simply to change one divide-by-three circuit into a divide-by-five one. Since 243 × 5/3 = 405, this was the system developed and later confirmed by Shoenberg and put into the specification offered to the BBC.

The TAC urged Baird and Marconi-EMI to agree on a single standard, but eventually agreed that both the 240-line, 25-frame sequential and the 405-line, 50-field interlaced systems should be used alternately. It was to be a fight to the bitter end. Baird lost largely because of the inflexibility of his "live" system using the intermediate, fast-processed film technique that had been developed in Germany. He also hoped to use a Farnsworth 240-line image dissector electronic camera, but this proved to be a disaster. Baird's 240-line mechanical film scanner (telecine) on the other hand provided better pictures (though with more flicker) than the original Marconi-EMI telecine.

The 240-line Baird system was dropped in February 1937, leaving the way open for the progressive improvement of the 405-line pictures, continuing right up to the 1960s. But it took time for the pre-war public to accept television as an entertainment medium capable of challenging the then dominant cinema. With screens only 12in. or smaller, apart from a few early projection models, and the cost of a set approaching that of the £100 Ford motor car, it was almost three years before the number of domestic sets in use increased from the initial 300 to 20,000. The BBC was committed to radio rather than television, and the service narrowly avoided extinction. It finally ground to a halt on September 1st, 1939, starting again with the Victory Parade in June 1946.

Sadly, few of the major pioneers of British TV lived to see its post-war success. Baird died in 1946, with his major wartime work on colour largely overlooked. His associate Captain West met with a mountaineering accident at about the same time. Blumlein was killed flight testing airborne radar in 1942. Campbell Swinton died before television was even born. Schoenberg lived on till 1963, Zworykin till 1982. Professor McGee who pioneered the Emitron camera, and Lubszynski of CPS Emitron fame, have happily survived. As also has Dr. Eric White, who was actually present at that meeting in Ealing fifty years ago when the 405-line system was born.

Postscript

Nick Lyons

As I write this the 405-line system is almost at the end of its career. Few people in large urban areas like mine stayed with it to the end, though the odd set has survived – the subject of some sentimental attachment maybe, or as a second or third set in the kids' bedroom, or possibly propped up in the local chippy. It's in circumstances such as these, often with the most pokey bit of knitting needle or coat-hanger to serve as an aerial, that the ability of this v.h.f. system to provide a passable picture come what may proves itself.

As no new sets capable of receiving this standard only have been made for some fifteen or more years, most of the survivors of this breed inevitably now look tired. The same seems to be true of the equipment at the transmitting end. The standards converters used seem to be prone to a variety of problems, with vertical lines of missing picture elements, vision level changes, hum and so on. It's nothing like the quality achieved when origination was on 405 lines.

It's rather sad that the system should end like this. Younger engineers who looked at a surviving set must have wondered how on earth we ever put up with that sort of picture quality. But at its height, from the mid-fifties to the time of its supersession in the late sixties, the system provided very fine pictures indeed. The fifties saw Mullard and Mazda perfecting the display tubes, with a high standard of both picture quality and reliability, while the English Electric Valve Co. brought about a revolution in the camera field with their 4½in. image orthicon tube. This was to become the workhorse of monochrome (or black-and-white as we called it then) television world wide. It was developed by EEV at the BBC's behest for the 405-line system.

Commercial TV also first came to us in 405-line form. This competition stimulated the BBC to produce some very fine programmes indeed. ITV brought some dross but also introduced us to much that was new and innovative, and gave us a taste for the output of that prolific industry across the Atlantic.

But the 405-line system rendered us a TV island. Being so different from any other system, no one else bothered to make sets for it. Mind you in the fifties abroad in electronics meant Europe or the USA: the Japanese industry was just beginning to dabble with transistor radios. UK setmakers had a captive market, and though there was much innovation it was almost a cottage-type industry. Who was to step in and upset this comfy situation? It was the Pilkington committee's report that led to the changing face of the British television industry.

Pilkington signalled the end of 405 lines, though even then it had given us a quarter of a century of service. It brought information and entertainment to millions, whatever your taste, from Quatermass to Perry Mason, Dick Powell theatre to What's my Line, be it Kennedy in Berlin or being shot in Dallas, the excitement of the Tokyo Olympics and pictures via Telstar, the nation rejoicing at a Coronation or the nation in mourning as a barge solemnly carried Sir Winston down the Thames for the last time. All this was brought into our homes by the system that was developed in the early thirties by that brilliant team at EMI.

Video Servicing

Mike Phelan

Last month we looked at a few minor bits of camera electronics – items that have nothing to do with actual signal generation. This month we'll consider first the overall camera system – see Fig. 1.

Overall Camera System

We might as well start at the 12V input line. This input is usually stepped down to 9V via a simple series regulator – one or two transistors, an operational amplifier and a zener diode. The unregulated 12V supply is used for the zoom and iris motors. The various high voltage supplies required for the vidicon tube are often generated by an inverter driven by one of the signals from the SSG – sync and subcarrier signal generator. We'll move over to this section next, but in passing should mention that the electronic viewfinder consists of a conventional though small self-contained monochrome receiver whose high-voltage requirements are generated in the line output stage in the usual manner.

Sync and Subcarrier Generator

Most video cameras of the type we're discussing use a dedicated chip, type HD44007A, in the SSG department (see Fig. 2). Few extra components are required. The output from the free-running crystal oscillator linked to pins 24 and 25 is divided by four within the chip to produce the 4·43MHz chroma subcarrier which emerges at pins 26 and 27 with the correct phase for V (R − Y) and U (B − Y), the V subcarrier being switched through 180° on alternate lines as required for PAL signal processing.

The *LC* oscillator – pins 3 and 4 – runs at 282 times the line frequency and is locked to the 16MHz crystal oscillator by a phase detector within the i.c. and an external varicap diode – the filter components are connected to pin 6.

Most of the other i.c. pins provide various outputs at line and field rate. It may be stating the obvious, but the deflection signals that drive the tube's yoke must be in synchronism with the composite sync added to the camera's outgoing video signal. Line and field drive emerge at pins 8 and 7 respectively and go to their respective output stages. The 7·8kHz output at pin 20, if used, drives an inverter for the high-voltage supplies – otherwise these supplies are obtained from the line output stage as in a TV receiver. The various outputs can be buffered or inverted by CMOS logic gates – if this isn't done it's necessary to fit small-value capacitors, typically 27pF, from each pin to chassis to remove spurious clock pulses.

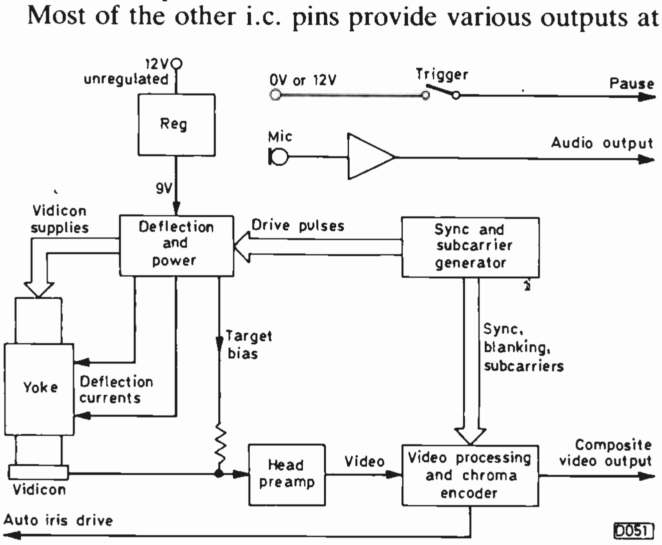


Fig. 1: Block diagram of the electronics of a typical video camera.

Deflection Arrangements

The deflection arrangements used vary from one model to another. Very little power is required and of course the signals are already locked to the master crystal oscillator. A simplified circuit of the arrangements used in the 3V17 is shown in Fig. 3 – this camera uses a driven inverter to provide the tube's high-voltage supplies.

The field output stage is contained in IC2, an operational amplifier. Part of IC5 acts as an integrator whose sawtooth output is fed via the height control to the non-inverting input of IC2. Negative feedback from the output to the inverting input enables the linearity to be adjusted – this is more important than in a TV set, for reasons that will become apparent when we come to the chroma encoding. There's a conventional shift control and C11 with R19 provide a path to chassis for the scanning a.c. The parabola generated across R19 is fed back to provide additional linearity correction.

The line output circuit is in two halves. Transistors X1 and X2 are driven by the line drive pulses from the SSG and in turn drive the line output transistor X3. When X3 conducts, the current in the output transformer T1 rises exponentially. X3's collector is coupled to the scan coil via C4. The rate of change of the current flowing in T1 is governed by the conduction of X4 and X5, this in turn being dependent on the setting of the width control. The other end of the scan coil is driven by a linearising

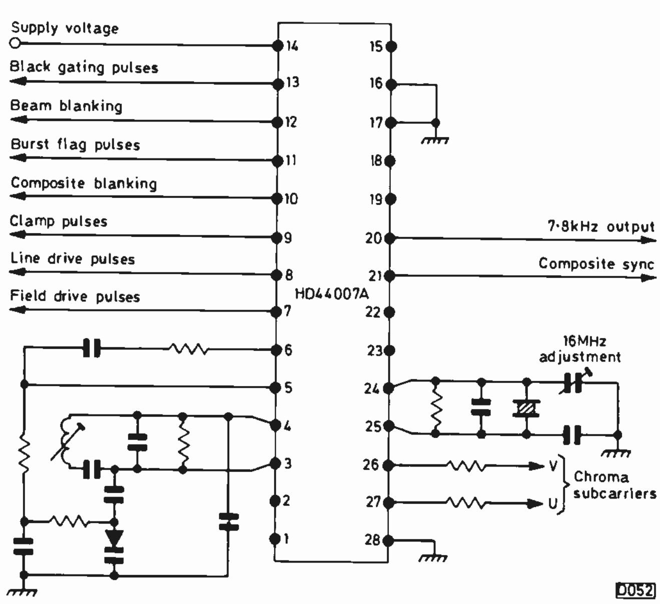


Fig. 2: Outputs from the HD44007A sync and subcarrier signal generator i.c., and the external oscillator components.

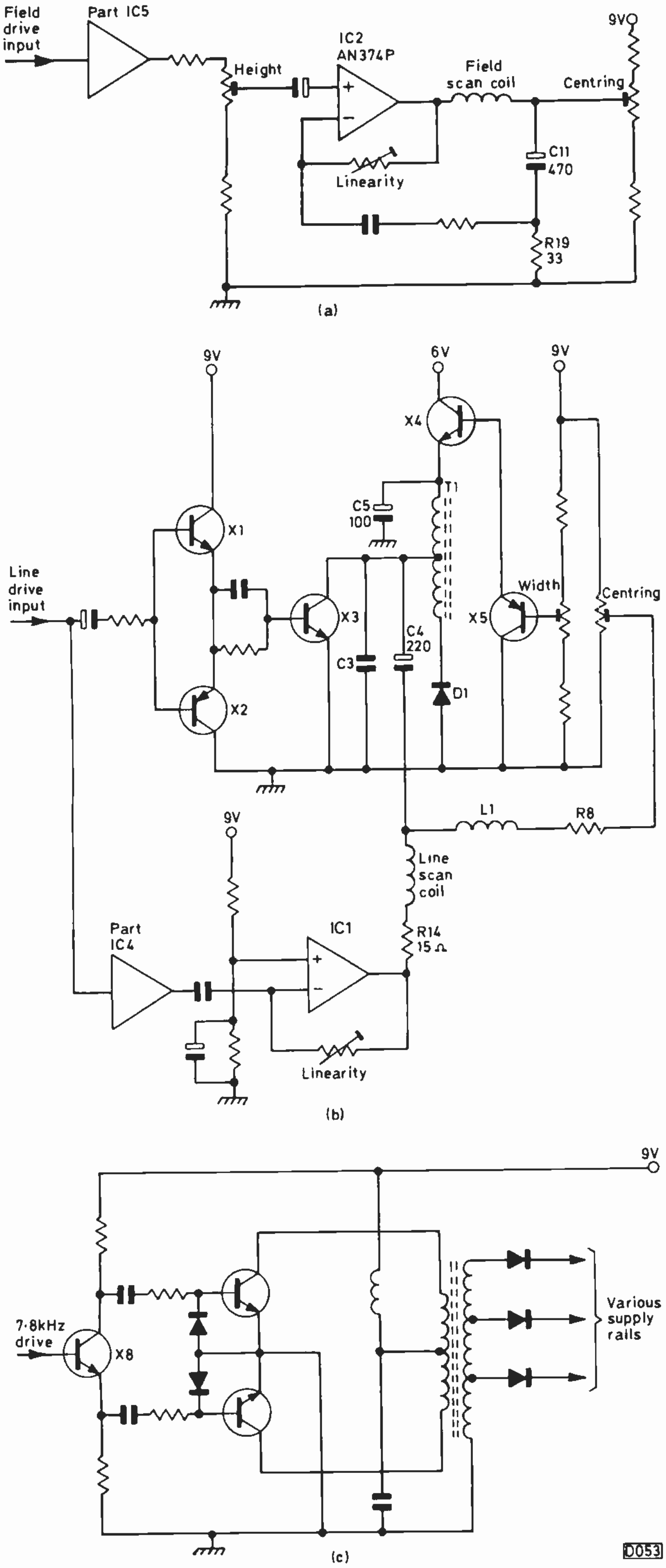


Fig. 3: The deflection and high-voltage supply arrangements used in the Ferguson 3V17 camera – simplified circuits. (a) The field timebase. (b) The line timebase. (c) Inverter used to provide the high-voltage supplies.

sawtooth current produced by IC4 and IC1, the latter having a feedback linearity control. At the start of the flyback X3 is turned off and the scan coils resonate with C3. The efficiency diode D1 conducts to damp the overswing in the usual manner. L1 and R8 isolate the a.c. component from the shift control.

What happens if one or other of the timebases fails? No, you don't get a display of line or field collapse on the monitor! Consider failure of the field scan. You might think that the vidicon will produce a single line which will be repeated on every line of the monitor's screen – such a display would consist of vague vertical lines. Since the vidicon's target would be ruined in a matter of seconds, protection circuits that monitor the scanning and shut off or reduce the beam current in the event of scan failure are generally incorporated – just one thing to look for when servicing. Only field scan failure protection is required in cameras where the vidicon's supplies are derived from the line output stage.

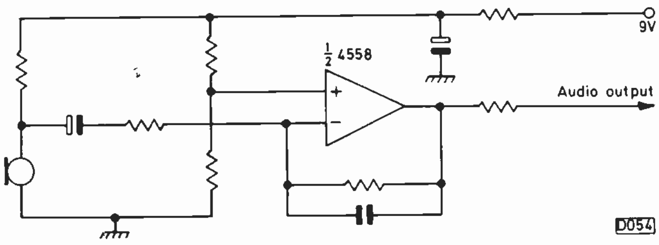


Fig. 4: Simple audio amplifier used in the 3V17.

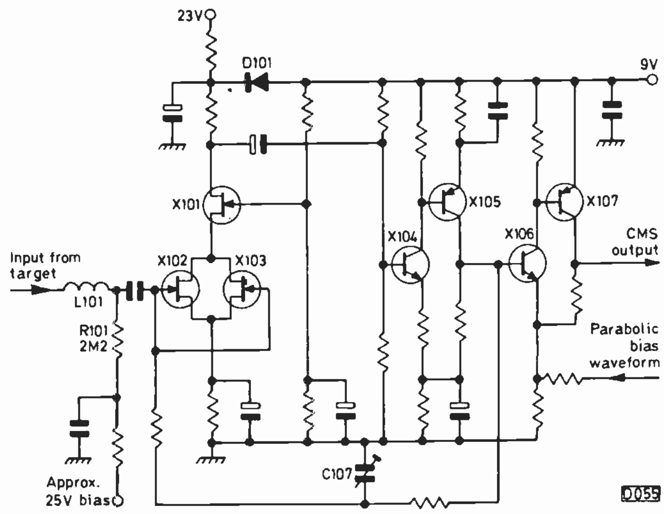


Fig. 5: Video preamplifier circuit used in the 3V20.

Audio Channel

The audio circuit is self-contained and independent of the rest of the electronics – all it has to do is to amplify the signal from the microphone to a suitable level. A typical circuit is shown in Fig. 4.

Video Preamplifier

Now to the video circuitry, starting at the front – the head preamplifier, see Fig. 5. This has to take the minute signal from the vidicon's target and amplify it while adding as little noise as possible. In this example the first stage consists of a cascode f.e.t. arrangement – X101-3. It has the advantage of very high gain with low noise and excellent linearity. The gates of X102/3 are a.c. coupled to the target as the latter requires a d.c. bias of about 25V, supplied via R101. The reason for using two f.e.t.s in parallel is to reduce noise: as the noise is random, some of it must cancel out – this applies only to noise produced by the f.e.t.s of course. X103 was omitted in later production. X104-7 comprise a direct-coupled amplifier from which feedback is taken to the gate of X102, adjustable by C107. L101 is toroidally wound on a ferrite core and is included to compensate for the capacitive signal source (the target). X106's emitter is not decoupled so that the gain of this stage can be modulated by a waveform derived from the deflection circuits. This waveform is also used for dynamic focusing – it consists of field- and line-rate parabolas. The reason for applying it to the preamplifier is to increase the gain at the edges of the picture to compensate for the slight darkening that would otherwise occur. This feature is not used in many cameras.

The entire preamplifier is enclosed in a heavily screened box which is attached to the vidicon's shield – the connection to the target is less than half an inch long. Note that the output is labelled "CMS": this stands for colour multiple signal – next month we'll discuss how the colour information comes to be there and how it's encoded to provide a conventional PAL signal.

Servicing the solid-state Indesit T24EGB

Mike Phelan

The 24in. solid-state monochrome Indesit Model T24EGB (chassis C) looks similar to its hybrid predecessor (Model T24EGB, chassis B) both inside and outside, but there are a great many differences. Gone are the mechanical tuner and rotary controls, but there's still a row of wirewound resistors along the top edge of the chassis, and as before they do their best to burn holes in the panel. Still present is the aerial socket that backs away from you when it's approached with a plug, due to the mountings bending.

Chassis Arrangement

The chassis consists of a long, narrow vertically mounted PCB that hinges down to a horizontal position. It looks like the PCB used in the ITT VC200 or GEC Series 1 chassis. The i.f. strip, which consists mainly of a TBA440C i.c., resides in the larger of the two cans along the edge of the panel. The small can houses the TBA120 intercarrier sound i.c. Although most of these Italian made sets should have been converted, one or two slipped through with 5·5MHz filters fitted – a coil and capacitor conversion was available from the manufacturers, or 6MHz filters. Sibilance can be reduced by changing the value of C1314 in the intercarrier sound can from 0·022μF to 0·047μF. There are separate modules, each with a TBA800 i.c., for the audio and field output stages. These modules are interchangeable – quite often a TBA800 that gives slight sound distortion works o.k. in the field output position. All cases of sound distortion can't be blamed on the chip however – the speaker can give problems. Another module contains the TBA950 sync/line oscillator i.c. and its associated components.

Circuit Features

Before going farther, a brief description of the circuit, which has some unusual features. The power supply is shown in Fig. 1. Mains rectifier D901 is followed by a series of dropper resistors that supply 170V to the collector of TR901. This transistor, in conjunction with R906, R928, TR902 and the 6·2V zener diode D904, reduces the h.t. to a reasonably stable 120V. This is the supply to the line output stage – the set's other supplies are derived from the line output transformer. The 120V rail is set by R911 which acts as the width control (set for 120V at TP20).

D905 produces 30V across its reservoir capacitor C913. R921/C912 drop this to 25V for the field output TBA800 while R923/C916/D907 (12V zener diode) produce a stabilised 12V supply for most of the rest of the circuitry. R924/C919/D909 (12V zener diode) produce a stabilised supply for the timebase oscillators. D906 produces 26·5V across C917: R922/C908 and the shunt stabiliser consisting of TR903/D902 and associated components produce a regulated 13V supply for the audio output TBA800 – this helps to stabilise the current demand from the line output transformer, as the current drawn by the audio output TBA800 is a function of the volume.

Note that the negative side of C901/2/3/4 (common can) is connected to chassis via C921. The 2·6V present across C921 is used as the start-up supply.

Apart from the TBA800, the field timebase consists of a unijunction transistor oscillator (TR401, type 2N4871) and the flyback switch transistor TR501 (BC327). If the BC327 goes short-circuit the result will be severe top foldover. The unijunction transistor can cause field jitter – so can the sync separator bias resistor R1406 (1·8MΩ) on the TBA950 module.

The line driver and output stages (see Fig. 2) look very strange – there's no driver transformer for a start. The output from the TBA950 switches TR402 on and off. When it's on, TR403 and TR404 are off. When TR402 is switched off, TR403 and TR404 can conduct. The key to this is D401, which produces some 4·6V across C406 during normal operation. In addition, C404 is charged by TR404's emitter current. When TR403 switches on C404 is discharged and the emitter of TR404 is at almost chassis potential. The arrangement is self-stabilising up to a point, as the voltage produced by D401 to forward bias the bases of TR403 and TR404 is dependent on the line output transformer's load.

Common Faults

So much for the theory, now for the problems. The usual one is a dead set. In this event check all the wirewounds in the power supply for being open-circuit or having dry-joints – they sometimes burn holes in the PCB. If all is in order there should be 120V at TP20 – check here or at one end of R907 – and a similar voltage at the collector of TR404. Next check pin 8 of the line oscillator module for a burst of line frequency squarewave at switch on – if this is absent, a 9V battery connected across C919 will supply a start-up voltage for the oscillator. If everything sounds strained, switch off. A feature of this system is that if anything stops the line output stage working the 12V l.t. rail will disappear and stay that way until the set is switched off, R925 discharges C903/C921, and the set is then switched on again.

A short-circuit BU205 will open the fusible resistor R902. Other line output stage faults give the h.t. present but otherwise dead set symptom. The most common fault

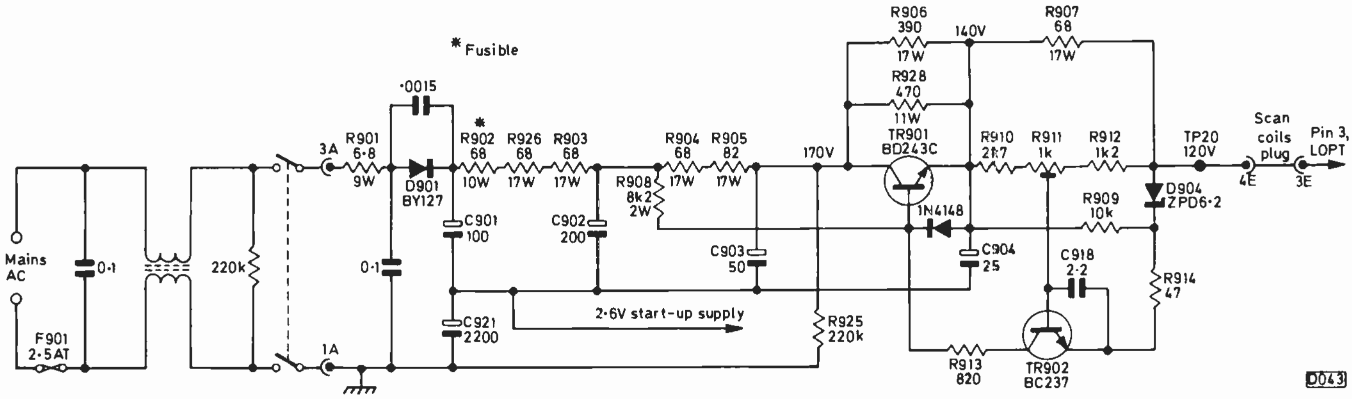


Fig. 1: The mains input and h.t. supply circuitry. The mains filtering components may not be fitted in UK sets.

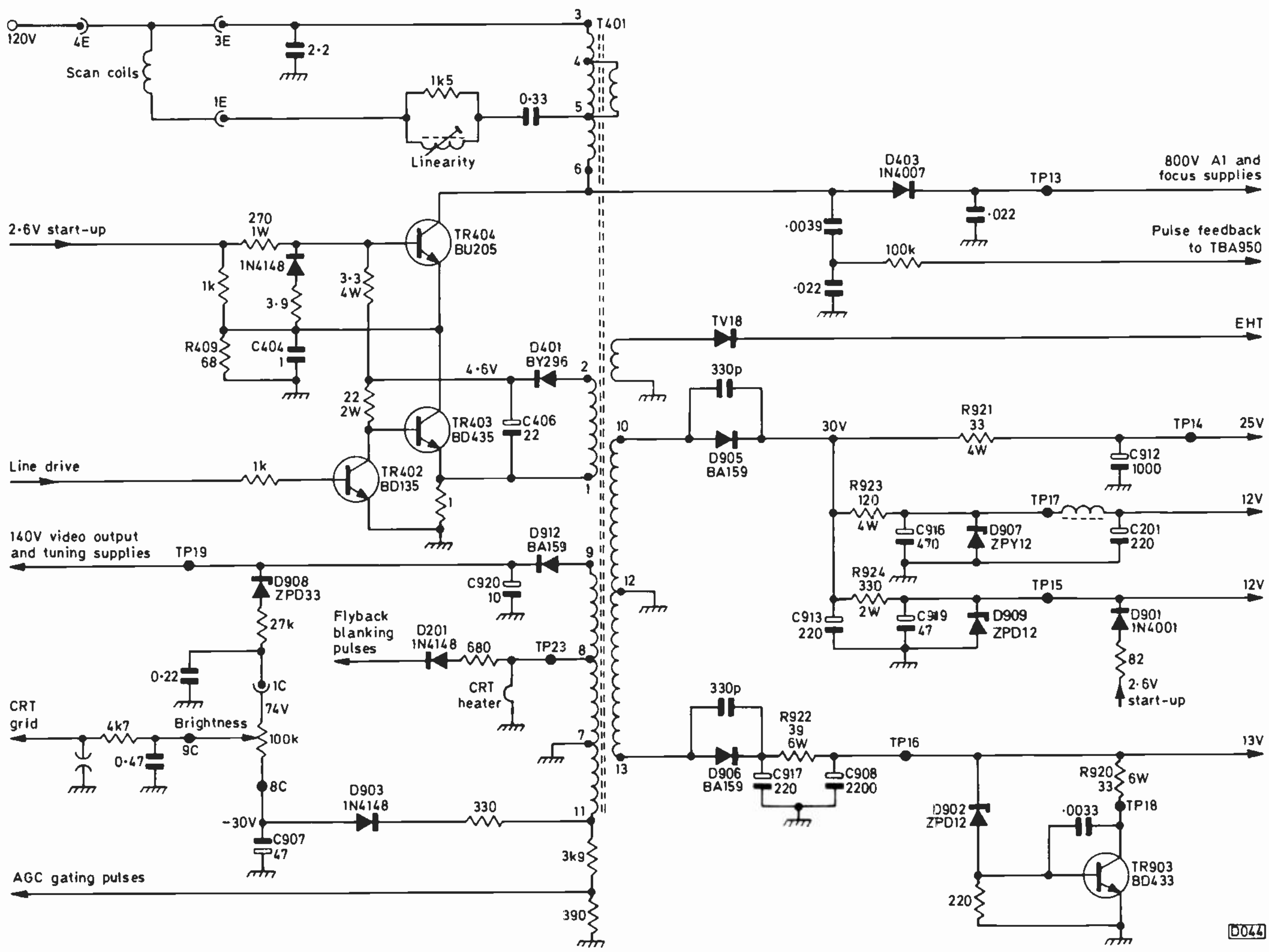


Fig. 2: The line output stage, showing the various supplies derived from the transformer. R922 may be 27Ω, 6W with R930 12Ω, 4W in series.

of this type is a defective e.h.t. stick – unfortunately it's in the line output transformer. All the large resistors in the line can are worth checking for dry-joints or being open-circuit, as are TR402 and TR403. If the line oscillator isn't working, check C1407 (0·01μF) and the TBA950.

Nothing will happen if the 2·6V supply is not generated across C921.

If there's no supply to the audio output stage, check D902 (ZPD12) and TR903 (BD433) in the shunt stabiliser circuit. Repeated failure is due to R920 (33Ω) going open-circuit. The line/field oscillator supply regulator D909 (ZPD12) is prone to going leaky.

The signal sections are fairly reliable. The tuner occasionally fails, as also do the video driver transistor TR201 (BC238B) and the video output transistor TR202 (BF257), failure of TR201 giving a negative picture.

The on/off switch sometimes falls to bits – or the contacts burn out. It's a special type unfortunately.

Spares

Spares, including the line output transformer, for the T24EGB chassis C can be obtained from RTC International Ltd., Victoria Parade, Urmston, Manchester (telephone 061 748 1129). Certain spares for other Indesit TV sets can also be supplied (excluding the mains lead and aerial plug for the T12). Spares can be supplied only as long as present stocks last.

Colour Bar Program

G. J. Phillips, B.Sc., C.Eng.

The standard BBC Model B microcomputer can be easily programmed to generate the colour bar test pattern (see below). This may seem like using a sledgehammer to crack a nut, but many establishments now possess a microcomputer that may stand idle for a lot of the time. The program consists of only eleven lines of basic and can be typed in a few minutes.

Line five clears the screen and line six calls up mode two of the microcomputer to facilitate colour graphics. The Move and Plot commands are used to generate a series of triangles which are joined together to form vertical rectangles. Line fifty is an algorithm to convert the rectangle or bar number to the correct colour number recognised by the computer. This number is called up at line sixty. Line 100 is merely a dummy statement which is jumped to at line 110: this is done to avoid the computer's prompt appearing – it would contaminate the graphics.

The u.h.f. modulated output can be plugged into the set's aerial socket just as for normal operation. In addition, the BBC microcomputer has a composite video output which can be connected to the video input socket of a VCR to enable the pattern to be recorded for future fault finding use.

Program

```
  1 REM TV COLOUR BAR GENERATOR. G.J. PHILLIPS
  5 CLS
  6 MODE 2
 10 MOVE 0,1000
 30 PLOT 85,0,0
 40 FOR bar=1 TO 8
 50 IF INT(bar/2)=bar/2 THEN colour=(8-bar)/2 ELSE
    colour=(8-bar)+INT(bar/2)
 60 GCOL 0,colour
 70 PLOT 85,(bar*160),1023
 80 PLOT 85,(bar*160),0
 90 NEXT bar
100 REM
110 GOTO 100
```

MISFITS

Richard Roscoe

Well over half the sets that come my way turn out to have more than one fault. In line with the modern mania for giving everything a fancy name I call them MISFITS (Multiple Independently Situated Faults in Television Sets). You know the type of thing I mean. The set finally packs up and after you've been called in to replace the tripler or whatever and got it going you find that the tuning drifts, the volume control crackles, or there's a bad hum bar. When you tackle the owner about it you get something like: "Well it's been like that for a while but I didn't think it was worth bothering about, not at today's prices anyway. Mind you, now you're here . . ."

In many cases these secondary faults are the work of moments to put right. On the other hand some can take much longer to fix than the fault you were actually called to see – and woe betide you if you try to charge for this extra work. "How much?? – the whole set's not worth that!" I recently had a concentrated burst of these MISFITS. They made a complete mess of an otherwise perfect summer's day.

The Thorn 3500

It started first thing in the morning. Everything was bright and clear – except in the back of a Thorn 3500 where things were decidedly wintry. According to the owner the set had gone off without any warning the previous night. The thermal cutout hadn't tripped and none of the fuses had blown, so I switched on. Meter checks showed that power was getting to the chopper transistor and that the 30V line was working. Further checks soon revealed that the chopper driver transistor was without collector voltage due to R607 being open-circuit – it's part of the "dropper". Well, it's nice to start the day with an easy one. Switching on after replacing the dropper produced sound and a good picture – but no colour. I turned to the owner who was hovering behind.

"Ah" he said, "it does that. If you twiddle the tuner it'll come back."

I could see the set was on tune so I ignored that. Instead I concentrated on the decoder board. Tap, tap on the top of the board and R312, one of the small presets in the burst detector circuit, fell apart. I prodded the rest of the presets but they remained intact. So far so good, out with the remains of R312 and in with a new 47kΩ preset. Colour was now present but was unsteady: the hue was correct but the saturation was going up and down like a yo-yo. I was beginning to wish I'd not started on the set.

I took a deep breath and tried to think. If the hue was correct, most of the decoder circuitry would be in order (burst channel, reference oscillator, etc.). Obviously the gain of the chroma amplifier was varying, which could have been due to a fault in the colour-killer department. The colour-killer action depends on the operation of the ident amplifier (no ident, no turn-on bias, no colour). Voltage checks took me back to the ident amplifier but the d.c. conditions here were correct. So, lacking a scope, I tried bridging the decoupling capacitors. First time lucky: the transistor's emitter decoupling capacitor C321 ($0{\cdot}22\mu F$) was faulty. A replacement restored good, steady colour: so much for the easy ones.

The GEC C2110

I headed for the next patient on the list, a GEC C2110 (plastic) series, with high hopes. It's one of my favourite designs though getting a little long in the tooth now and the fault on the card, picture rolling, is a stock one – C452 ($4{\cdot}7\mu F$) in the field sync circuit. I always go equipped with replacements for the other electrolytics on the field timebase panel, C455 $47\mu F$, C457 $47\mu F$, C458 $22\mu F$ and C462 $220\mu F$. These usually cure the sagging height and bottom cramping the customer didn't bother to mention. My foresight was well rewarded – they were all well past their best in this particular set.

"Super" said the customer as I set up the picture. "I don't suppose you can stop the hum while you're here?"

"Hum?"

"Yes, in the quiet bits you get this hum. It's not too bad but I thought, you know, while you're here . . ."

Turning down the volume control (noisy, so out with the trusty Servisol) I found that there was indeed a definite background hum. Another electrolytic showing its age? Bridging C195 (100μF) which smooths the 24V supply to the audio output chip made no difference, but bridging C121 (150μF) which smooths the 12V supply to the intercarrier chip did. In went a spare 220μF, the nearest value I had.

Amidst smiles all round – i.e. the customer smiled, having got two repairs for the price of one; I had more of a fixed, glassy grin – I set off for a Sanyo CTP3101 colour portable. By now I was feeling that this was not my day, and though the reported fault was uncontrollable volume I feared the worst. I was not disappointed.

The Sanyo Colour Portable

As I approached the house I could hear Play School, accompanied by a chorus of blood-curdling screams. The door was opened by a haggard mother who greeted me with obvious relief. Apparently the opportunity to watch tele with the volume at full blast without getting whacked for it was too good for her offspring to miss – and they'd asked all their friends around to join in the fun.

Like most modern sets this one uses a variable d.c. voltage for volume control, acting on a voltage-controlled amplifier within a chip, in this case IC161 (AN340). The voltage at pin 4, from the volume control, was o.k., so in went a new chip. The sound was now under control and the lady of the house cheered up enormously, which is more than I did when I caught sight of the picture. All the faces were green.

"The ident's wrong" I squawked.

"Pardon? Oh you mean the tuning." She twisted the rotary tuner and brought it back with perfect colours. "It sometimes comes on with funny colours but I can always get it right. I shouldn't bother about it. Now how much do I owe you for the new volume control?"

It was an emotional moment. Was I to leave this long-suffering paragon of virtue with a faulty set? Of course not! It seemed likely that the flip-flop controlling the R – Y switching was not being synchronised by the ident signal. The relevant circuitry is contained in IC252 (TA7161P), and since Sanyo kindly fit holders for their chips it was easy to verify that this was indeed the culprit.

The GEC Series 1

I managed to get back to the van before the kids could let my tyres down. Things were looking up, or so I thought. The next call was to another GEC set, this time a 20in. monochrome one (Series 1 chassis). The fault on the card was the opposite to that with the Sanyo – almost non-existent, very distorted sound. I realised that I was in for my fourth consecutive MISFIT when the picture came on – rolling badly. The owner cleared his throat, but I got in first.

"Rolls, does it?"

"For a bit, then it stops. I thought, while you're here . . ."

I wearily opened the valve case. Into the set went a new PCL805 and a PCL86. This stopped the rolling but the sound was as bad as ever. Voltage checks then revealed that the audio output pentode's screen grid was without voltage, due to R152 (6·8kΩ) being open-circuit. Replacing this brought the sound up to the normal level with no distortion. Finished, I thought. Not a bit of it. Now the picture wasn't rolling I could see that the bottom was cramped.

The usual causes of bottom cramping with a valve field timebase are the components in the output pentode's cathode circuit. The resistor can change value and the decoupling capacitor can dry up. In so doing they put more strain on each other and the valve, so that the process is cumulative. The cramping in this case wasn't too bad and the owner hadn't noticed it. Nevertheless the resistor (R208) had fallen in value from 390Ω to 200Ω and the capacitor (C207, 250μF) appeared to be on its last legs. So both were replaced.

The Rank Z718

The final MISFIT was a 26in. Bush Model BC6438 with the Z718 chassis, touch tuning and remote channel change. There'd been a loud crack (damp in the e.h.t. section) after which the set had stuck on Ch. 1 with only snow and noise. This one couldn't be dealt with in the field, so I whipped it back to the workshop where I could dismantle the difficult-to-get-at Z916B touch tuning unit in safety.

The heart of the unit is an ETT6016 i.c. which performs the channel-switching action. There are two associated transistors, 9VT1 (BC157) which acts as a shunt stabiliser for the i.c.'s supply and 9VT2 (BC147B) which is used to ensure that Ch. 1 is selected when the set is first switched on. In view of the fact that the set was stuck on Ch. 1, 9VT2 seemed a likely culprit. A replacement restored channel selection but a couple of channels were faulty. So in went a new chip. Finally 9VT1 was leaky, pulling down the tuning line but not the supply to the i.c.

After all that plus drying out and cleaning the e.h.t. stick and its holder I set about tuning in a picture. Up it came – with very bowed sides! No one had mentioned this of course. So over to the EW modulator circuit.

None of the controls had any effect, while the modulator diodes 5D5/6 and the driver transistor 4VT19 all read o.k. on the meter. Voltage checks took me right back to the first transistor in the control circuit, 4VT15, which was off due to lack of base bias because 4R58 (82kΩ) was open-circuit. This resistor is used to provide the basic width/e.h.t. stabilisation in the set, being fed from the 260V line.

All I had to do after this was to resolder the deteriorating joints on the line timebase plugs and set up the field linearity – about par for the course – then return the set to its owner.

What a day!

Book Notice

A new edition (the third) of **Beginner's Guide to Colour Television** has been published by Newnes Technical Books at £4·50. The first edition of this book was published as long ago as 1964. This latest edition, revised by Eugene Trundle, is thoroughly 1984 however. Much of the material in earlier editions has been condensed and a great deal of new material has been added. Thus we get for example single-chip decoders, the latest types of colour tubes, teletext developments (CCIR levels 1–5), MAC, high-definition TV and worthwhile sections on satellite and cable TV. A good introduction to current TV technology.

VHS Hi-Fi Sound

Derek Snelling

Both VHS and Betamax machines with hi-fi sound, based on the use of f.m. and recording with rotary heads, are now available in the UK. This article deals with the system used in VHS machines, with particular reference to the Panasonic Model NV850B.

Principles

First the principles involved. The stereo hi-fi sound is recorded on the tape as f.m. by two heads mounted on the video drum assembly. The signals are recorded beneath the normal video signal – or to be more accurate the video signal is recorded on top of the sound signals. The left and right carriers are at 1·4MHz and 1·8MHz. The arrangement of the head drum is shown in Fig. 1: the audio heads are mounted 60° round from the video heads and have an azimuth of ±30° (this compares with ±6° for the video heads). In addition, the sound head track with +30° azimuth is laid down beneath the video head track with −6° azimuth, thus giving a 36° difference to minimise crosstalk.

The sequence in which the tracks are laid down is shown in Fig. 2, starting with audio head 1 which lays down a 26μ wide track. The next head around is video head 2 which lays down a 70μ track on top of the audio one. The audio track is more strongly laid down however, using a higher record current and lower frequency. The f.m. video signal erases the upper part of the audio track but the audio is still present at a deeper level in the tape, as shown in Fig. 3. Audio head 2 next lays down a track, erasing the edge of video track 2. Finally video head 1 records its track, further erasing the edge of video track 2 and the upper part of audio track 2. We end up with 49μ wide video tracks that have 26μ wide "buried" audio tracks at their centres. Note that audio tracks 1 and 2 are not left and right: both audio signals are recorded by each head. The audio tracks are laid down at the centre of the video tracks to avoid crosstalk – if the audio track was to stray on to the adjacent video track the azimuth difference would be reduced from 36° to 24°.

The audio f.m. level on playback is lower than the video f.m. level, because of the lower frequency and the fact that the video is recorded on top. As a result, there's a danger that drop-outs may occur. To overcome this problem the f.m. detector is followed by a hold circuit which keeps the signal at the same level until the drop-out has passed. By passing the output from the hold circuit through a low-pass filter to smooth out the "kink" effective drop-out compensation is achieved – see Fig. 4.

A problem with having two rotating heads is that you must be able to switch from one to the other. For video switching the PG pulses are used. The same pulses are used for audio head switching after being shifted by 60° to allow for the different positions of the heads. A further problem arises however because the switching point introduces noise. For video, the switching is arranged to occur off screen during the field blanking period. You can't do this for audio, so the hold circuit is used to maintain the audio during head switching, the head switching pulse being applied directly to the circuit.

Practical Aspects

So much for the theory. Now for a few details of the Panasonic NV830/NV850. The sound is also recorded on the standard linear track for compatability with other VHS machines/tapes but the linear track is mono only. The f.m.

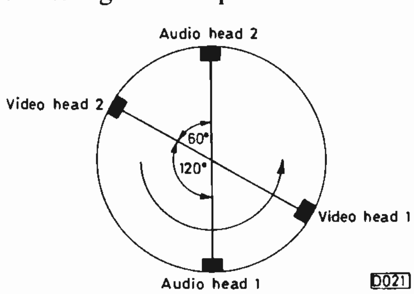


Fig. 1 (left): Positions of the video and audio heads in the drum.

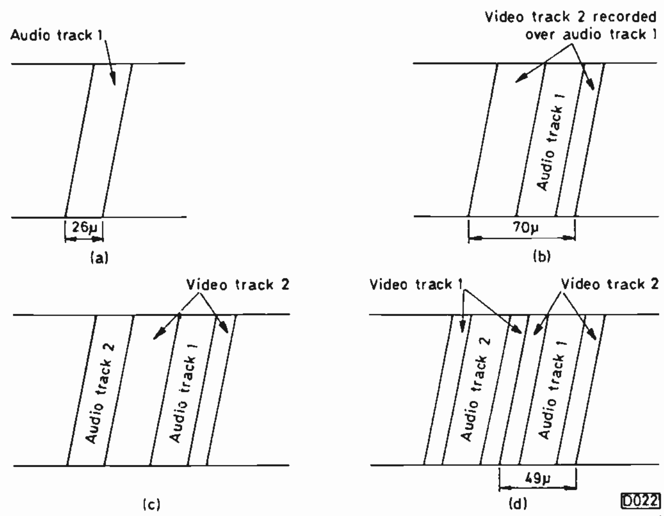


Fig. 2: Sequence in which the tracks are recorded on the tape, starting with audio head one.

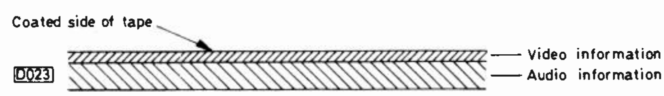


Fig. 3: The audio signals are recorded at a deeper level in the tape's oxide coating than the video signals.

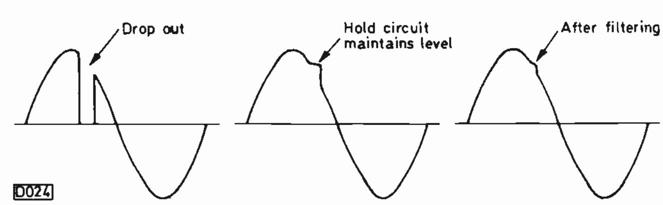


Fig. 4: Overcoming the effect of an audio drop-out.

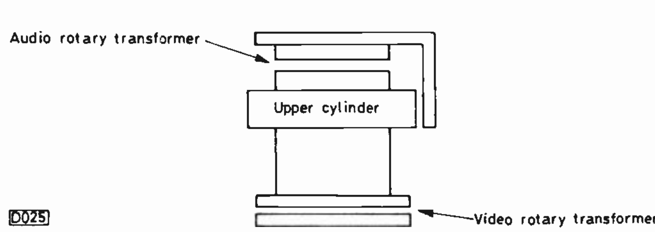


Fig. 5: Drum assembly, Panasonic Model NV850.

sound signals are passed through record level circuits that have a ganged level control with a "click" normal position: left and right record-level meters are provided. The linear audio circuit is the same as with ordinary machines. Recording can be done from the off-air TV or an external source – straight audio, a camera or a simulcast transmission (simultaneous TV and radio broadcast).

It follows from this that the machines can be used as high-quality sound only recorders. This raises a problem in that without video there's no field sync pulse to which the heads can be locked, so in this mode the field sync input to the servo is earthed and a 50Hz signal counted down from the 4·43MHz oscillator is used instead.

During record the TV set can be used to monitor either the f.m. or linear sound track – when monitoring the f.m., the E-E sound level varies with the setting of the record controls. A noise reduction system is used during both record and playback to achieve a dynamic range of 80dB. Audio dub is available but operates with the linear track only: this means that you can have a tape with a stereo track and a separate commentary on the linear track or three separate mono signals – useful perhaps for multilingual recordings. Ch. 1, 2 or linear can be separately selected during playback, which can be either via the TV set or an external sound system.

If a non hi-fi tape is played on the machine or the f.m. output from the heads drops below 50 per cent an f.m. mute circuit switches the machine to linear sound.

The f.m. sound will be affected by the tracking control of course: as the track width is narrower than that for the picture the setting is more critical – because of this one of the record-level meters doubles as a tracking meter during the playback of f.m. sound (the f.m. output is fed to the meter via an a.c. to dB converter). As the audio track is in the centre of the video track, optimum audio tracking should correspond with optimum video tracking.

One of the differences between the NV830 and the NV850 is that the latter has an extra video head for super fine stills etc. Because of this the mechanical arrangement of the video/audio head assemblies used in the two machines differs. The NV850 has a separate rotating transformer mounted above the video heads for sound pick-up – see Fig. 5: the NV830 has them all combined beneath the video heads. This is probably because with five heads (NV850) crosstalk could be a problem with a combined transformer whereas with four heads (NV830) the windings can be "spaced out" more so that the problem does not arise.

Table 1: Performance comparison.

Characteristic	*Linear operation*	*Hi-fi operation*
Relative speed	23.99mm/sec	4,850mm/sec
Dynamic range	50dB	more than 80dB
Frequency response	80Hz-8kHz	20Hz-20kHz*
Wow and flutter	0·2%	less than 0·005%

* The hi-fi frequency response is deliberately limited to 20kHz by bandpass filters.

Performance Characteristics

Table 1 compares the performance figures for conventional linear and hi-fi sound operation.

Service Bureau

Requests for advice in dealing with servicing problems must be accompanied by a £1·50 postal order (made out to IPC Magazines Ltd.), the query coupon from page 163 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.

JVC HR3300

I cannot resolve a locked picture in the E-E mode and when a known good tape (made on another machine) is played back there's a negative colour picture with heavy hum on sound – the TV set has to be retuned to get a little sound with the negative picture.

The overloading on playback and E-E points to either the circuitry on the luminance/chrominance board common to both or the r.f. converter (modulator). Try another converter if possible. Should the converter turn out to be o.k., reduce the playback luminance level (R37 on Y/C board). If the converter is at fault, try adjusting it – remove its cover, plug it back into the machine, then adjust the preset farthest from the small coil can.

PHILIPS G11 CHASSIS

There's intermittent cramping at the bottom of the picture – the lower lines of the frame rise by one-two inches though the rest of the picture remains fairly stable.

The trouble could be due to poor regulation of the 33V or 37V lines – greatest current consumption occurs at the end of the field scan. Try scoping the LT3 rail and pin 15 of the field timebase i.c. If any significant 50Hz ripple is present, check C3144 or C2097/8 respectively. If all is well here, look for dry-joints on the convergence panel and the output filter coil L2092 then suspect the field scan coupling capacitors C2099/2100, also C2083.

PANASONIC NV8600B

This machine plays prerecorded tapes faultlessly. In the E-E mode and when recording however there's persistent flashing on the screen while the brightness fluctuates between very high and very low.

First check the record/playback switches on the thin hinge-open board beneath the machine. Clean or preferably replace them. If the switches are o.k., there's almost certainly a dry-joint in the r.f./i.f. stages. You can check by feeding a video signal in at the video input socket or by scoping TP301 on the luminance panel to see if the waveform here varies with the fault.

SONY KV1810UB Mk II

When the set is first switched on a grainy picture appears. The set keeps trying to produce a normal picture and eventually does so, but may alternate between grainy and normal several times. The problem is not present once the set has warmed up. Also the height occasionally fluctuates when the set is cold.

First check the tuner a.g.c. action by applying an external source of 3V d.c. to the tuner's a.g.c. pin, i.e. across C133. If this restores normal operation from cold, check the tuner a.g.c. transistors Q211/212 and the associated components as necessary. If not, replace the tuner. Height fluctuations are generally caused by thermistor Th501 in the field output stage. Also check that the field timebase presets are not noisy.

FERGUSON 3V22

The picture has a horizontal wobble, as if there's a tape speed variation. The capstan and other parts in contact with the tape have been cleaned but this has made no difference.

Almost certainly the pinch wheel requires replacement. Be careful not to bend the arm on which it's mounted. Less likely causes are defective ball races in the lower drum or the relay pulley – usually audible – or a defective drum motor (the ripple on the positive side should be less than 0·2V in pause).

PHILIPS N1700

The fault on this machine occurs only when playing back one of the longer tapes. The picture momentarily goes to monochrome, with vertical white lines equally spaced but tending to zig-zag superimposed. Horizontal bands of colour flash can also be seen at times in this condition. The time between the "drop-outs" can vary between a few seconds and several minutes.

As the fault appears only with longer tapes, i.e. when there is a greater weight of tape on the reels, it would seem that there's either a lack of capstan drive torque (clean the capstan and pinch wheel and check the latter for wear) or more likely the back-tension brake is defective. To gain access to this, remove the reel disc assembly, noting the positions of all shims. Examine the two neoprene brake pads attached to the chassis under the lower reel disc and the felt friction clutch. Clean with alcohol.

NATIONAL PANASONIC TC86G

When the set is first switched on the sound is normal but the picture is very snowy. A clean picture can be obtained by turning the a.g.c. delay control fully anticlockwise then fully clockwise. The set will then operate normally until switched off. In the fault condition the voltage at the tuner's a.g.c. input pin is 1·5V but when the gain is restored the voltage rises to 5·5V. There's a corresponding change at pin 4 of the AN331 jungle i.c. The latter has been changed along with the various electrolytics in this area.

We suspect that the trouble is in the tuner's gain-controlled stage where there's some sort of leak to chassis. A new tuner would cure this but you might be able to overcome the problem by permanently biasing pin 1 at 5·5V. Try connecting a 5·6kΩ resistor between pins 7 and 1 and a 4·7kΩ resistor from pin 1 to chassis, disconnecting the a.g.c. line.

JVC HR3300

This machine plays back its own recordings correctly, and they are all right on other machines, but when a prerecorded tape or a tape recorded on another machine is played back there's no colour.

It seems that the colour a.f.c. loop is slightly out of adjustment. Try slight adjustment of R249 on playback – return it to its original position if this has no effect. In the absence of a scope and frequency counter, suspect IC204 (AN236) and IC202 (AN305) in that order.

SANYO CTP5101

The fault is tuning drift, with low sound and caption buzz. The voltages around the tuner seem to be o.k. and the a.f.c. and i.f. i.c.s have been replaced.

If the fault can be cleared by retuning it's likely that the tuner itself is defective – we've had trouble with this type of tuner on several occasions. If the trouble is confined to the sound, the picture remaining in colour during the fault condition, concentrate on the intercarrier sound circuit – use of heat and freezer should help pinpoint the culprit.

TEST CASE

265

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

The Decca 30 was one of the better hybrid chassis, though most of these old sets must by now have been consigned to the scrapheap – after long and honourable service. As with all equipment that's approaching the end of its useful life, the decision whether to repair or scrap is a difficult one. So often it happens that a repair is carried out only to have the set fail, due to quite another cause, within a short time.

Such were the circumstances that attended our dealings with a Model CS2230 recently. On its first visit to the workshop we found that the BY127 h.t. rectifier D600 was short-circuit, taking with it the 3.9Ω surge limiting resistor R603. After replacing these items we returned the set to the customer – the picture was reasonable in view of the age and condition of the set. All went well for a couple of weeks, then the set reappeared in our out-patients' department, with a cryptic "same again, recent repair, no charge" label. The symptoms were the same – dead set. The cause was quite different of course, and the "no charge" bit became something of a bone of contention!

This time the h.t. fuse F1 (500mA) had blown. When we replaced it the anode of the PY500A boost diode glowed cherry red within a few seconds of switching on. The PL519 line output valve remained quite cool. New valves produced similar results. Lack of line drive was discounted because the result of that is generally overheating in the PL519, which remained cool beside its throbbing neighbour. It appeared that there was a short from the cathode of the PY500A to chassis, and an ohmmeter check produced a reading of just a few ohms. The short remained with both top caps removed (measuring from the PY500A's top cap to deck), so the valves were o.k.

The fifth-harmonic tuning capacitor C435 is connected directly from the PY500A's top cap to chassis – it sits on the line output transformer's pins. Disconnecting this item proved its innocence, so a less direct short-circuit path was sought. The boost capacitor C436 lives down on the timebase panel – it links the transformer's primary winding to chassis via a secondary winding. We confidently snipped it out, but the short-circuit still remained! C431 (feedback to the width control circuit) had no leakage, and disconnecting plug PT/B (timebase panel) made no difference to the short-circuit reading. Continuing along these lines, we disconnected the plugs associated with the scan yoke and the convergence coils, again with no effect on the reading. The tripler connection was next removed, and a careful inspection of the connections and leads to the transformer was carried out. No burn or arc marks were visible, and still the short was there.

At this point the tube was tested to see whether the case was worth pursuing. The emission was reasonable, so after a telephone conversation with the owner the decision to carry on was taken. The culprit was found soon after. What was it? – see next month.

ANSWER TO TEST CASE 264
– page 105 last month –

We were embroiled in the vision detector/video driver/sync separator/a.g.c. section of a Thorn 1590 monochrome portable last month – no wonder this part of the circuitry was called the jungle when it was put into i.c. form. In the jungle and up the creek without a paddle we were – until we got that scope trace at the collector of the video driver transistor VT6.

When we looked at the waveform at VT6's emitter we were confronted with huge negative-going line pulses. They were larger still at the other end of R1, which links the video signal to the preset contrast control in the a.g.c. detector/amplifier circuit. They were coming through the a.g.c. detector/amplifier transistor VT1, whose emitter was open-circuit and whose collector-base junction was leaky. The a.g.c. gating diode W1 was also leaky, so that there was a clear path from pin 7 of the line output transformer via W1, VT1, the preset contrast control and R1 to the emitter of VT6, where the flyback pulses used to gate the a.g.c. circuit were playing havoc with VT6's operating conditions.

We stuck to our estimate of £16 (supply and fit two transistors and one diode!) though the true cost of the time spent on this one would have bought a handsome new monochrome portable! It's fortunate that this is not too common an occurrence . . .

QUERY COUPON

Available until 16th January 1985. One coupon, plus a £1·50 (inc. VAT) postal order, must accompany EACH PROBLEM sent in accordance with the notice printed on page 162.

TELEVISION JANUARY 1985

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

MAIL ORDER ADVERTISING

British Code of Advertising Practice
Advertisements in this publication are required to conform to the British Code of Advertising Practice. In respect of mail order advertisements where money is paid in advance, the code requires advertisers to fulfill orders within 28 days, unless a longer delivery period is stated. Where goods are returned undamaged within seven days, the purchaser's money must be refunded. Please retain proof of postage/despatch, as this may be needed.

Mail Order Protection Scheme
If you order goods from Mail Order advertisements in this magazine and pay by post in advance of delivery, Television will consider you for compensation if the Advertiser should become insolvent or bankrupt, provided:

(1) You have not received the goods or had your money returned; and
(2) You write to the Publisher of Television summarising the situation not earlier than 28 days from the day you sent your order and not later than two months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the Advertiser has been declared bankrupt or insolvent.

This guarantee covers only advance payment sent in direct response to an advertisement in this magazine not, for example, payment made in response to catalogues etc., received as a result of answering such advertisements. Classified advertisements are excluded."

SETS & COMPONENTS

BRAND NEW MONOCHROME 20" 110 degrees CRT's £10. Each. 10% off tens. 01-897 2602.

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

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

TRADE COLOUR TVs ALWAYS 200 IN STOCK

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

BRAND NEW VIDEOS
V2022 and V2023
VHS and BETA

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

ALL STOCK CHANGES WEEKLY

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

WOODSDALE COMPONENTS

RANK BUSH MURPHY

TRANSFORMERS

Line Ouput
Z718 (T703A, T706A)

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

Genuine RBM Units.

AERIALS

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

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

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

TELEVISION

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

GENERAL FACTORS
UNION STREET
DONCASTER
DN1 3AE

TEL (0302)
68416

GOOD MOTORWAY ACCESS

TELEVISION

No other consumer magazine in the country can reach so effectively those readers who are wholly engaged in the television and affiliated electronic industries. They have a need to know or your products and services.
The prepaid rate for semi display setting £6.30 per single column centimetre (minimum 2.5 cms). Classified advertisements 37p per word

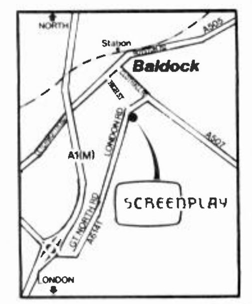
SCREENPLAY

Your Friend in the TV Business

Guaranteed – Complete Sets	**from £5.00**
Trade Workers	**from £25.00**
Panels by Post	**from £3.00**
Mono's	**from £1.00**

Stands Aerials Accessories Etc.

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



A.B.D. TELEVISIONS

Suppliers of colour and mono televisions to the trade.

Workers and non-workers:

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

Many other modern sets by popular manufacturers.

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

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

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

VHS★★★V2000★★★
BETAMAX★★★UMATIC

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

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

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

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

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

Thorn 3000/3500
Thorn 9000
UNIVERSAL
1 year guarantee

TRIPLERS
£4.95 inc. p&p

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

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

SERVICE PAGES

(minimum 12 words), box number 70p extra. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank Ltd". Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Television Room 2612, IPC Magazines Limited, Kings Reach Tower, Stamford Street, London SE1 9LS. (Telephone 01-261 5846).

11GHz Satellite TV Receiver

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

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

T.V PANELS

REPAIR EXCHANGE SALES SERVICE

PRICES FOR REP. EXC. AS FOLLOWS

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

All panels are repaired and aligned according to rank std.

Ring for prices to buy panels. Prices shown inclusive of postage, etc.

All panels guaranteed for 3 months.

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

WIZARD DISTRIBUTORS TV & VIDEO SPARES

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

Open Monday to Friday 9 am to 4.45 pm
Trade Only

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

WORKING CTV's

The Best & Cheapest in Lancashire

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

All sets are tested & working

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

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

FOR SALE

CRT Regunning Plant:
Comprising of:-

2 × Ovens,
2 × Vacuum Pumps and Diffs,
1 × Spot Knocker,
1 × Getter Fireer,
1 × Welding Machine,
1 × Annealing Oven,
1 × Precision Emission Tester,
1 × Let Down Station,
1 × Custom Built Extraction System,
All gun and glass stock, plus goodwill. Plus many other items.

To be sold as a complete lot, £6,500.

Contact: Mr Adolpho on 0622 872400

REBUILT COLOUR TUBES

EXAMPLE PRICES DELTA

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

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

20 AX £40.00
30 AX £48.00

Fast U.K. Delivery
Call or Phone:

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

Wholesalers REG in North & South Wales
Competitive Prices

TELEVISION TUNER REPAIRS

BRITISH, EUROPEAN JAPANESE ETC.

ELC 1043/05 TUNERS AS NEW £4.60 inc.

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

GUARANTEED 90% WORKING
100's of GEC 2110/2111 stripped to spares

Decoder	Line Output	Power	Convergance	Tram-Time Base	Tripler
13.00 single combined	£4.00	£2.50	£2.50	£3.00	£2.50

Other types e.g. Bush, G8, Thorn 8500, Pye, GEC Hybrid
all non-working/complete.

	Decoder	Line	Power	Convergence	Frame	IF	Tripler
Bush	£5.00	£5.00	£3.00	£3.00	£3.00	£2.00	£2.50
G8	£3.00	£5.00	£4.00	—	£3.00	£5.00	£2.50
3500 Thorn	£3.00	£4.00	£4.00	£3.00	£2.00	£2.00	£2.50
GEC	£3.00	£5.00	£4.00	£2.00	£2.00	£2.00	£2.50
Pye	£3.00	£5.00	£5.00	£2.00	£2.00	£2.00	£2.50

SABACO, Elastic Yarns Building,
Derby Road, Sandiacre, Notts.
Tel: (0602) 397555

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

PL519 £4.45. PL508 £1.80
PY500A £1.60
New – Boxed – Guaranteed
BILLINGTON VALVES
IRWIN DRIVE, HORSHAM

WORKING COLOUR T.V's

TO THE TRADE FROM

£15

LARGE SELECTION OF COLOUR T.V's INCLUDING GOOD DISPLAY OF WORKING SETS, MANY LATE MODELS, IN OUR SHOWROOM

DELIVERY CAN BE ARRANGED

'PHONE MARK WOODWARD 0299-250161

TRADE, UNIT 40,
HARTLEBURY TRADING ESTATE,
NR. KIDDERMINSTER, WORCS.

EX-RENTALS TELEVISIONS IN BULK

Most makes including late models.

MONITEC 0299 400233.

Always hundreds in stock

COUNTY DURHAMS ONLY WHOLESALER

All markets catered for

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

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

REGUNNED TUBES

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

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

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

Order form

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

Heading ....

Signature ....

Date ....

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

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

1/85

NAME AND ADDRESS

! YOU HAVE TRIED THE REST NOW TRY THE BEST !

Quality 6 Button TVs on Offer

Ultra 6725 22"	GEC S/S
Furg. 3738 22" T/T	ITT CK505
Furg. 3749 22"	Philips 550 22"
Furg. 3722 22"	Bush T20

Also 17" 8000 various models + many more to choose from.

SCARBOROUGH TV TRADERS CO LTD
85 Columbus Ravine, Scarborough, N. Yorks. 0723 368087.
1 hour from A64/A1 junction

TELEVISION

Trade & Retail supplies of s/h colour & mono TVs. Most makes available, workers or non-workers

SOUTHPARK DISTRIBUTORS
Unit 4 Rubastic Road, Brentpark Industrial Estate, Southall, Middx. UB2 5LL. 01-574 4631, Ext 28

SITUATIONS VACANT

WANTED: Exp TV engineer to work in Northern Ireland starting Feb 85 to service ex-rental televisions. Must have good exp on most sets including British and Japanese. Good wages and accommodation. Write to TV Box No. 190.

AERIALS

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

EVERYTHING NECESSARY for multi-outlet systems. Filters, diplexers, amplifiers, etc. Use trade gear and save pounds. Catalogue 50p (refundable). Professional system planning/advice £5.00 (refundable). Quick queries free. Wrights Aerials, 43 Greavesike Lane, Micklebring, Rotherham.

CLEARVIEW AERIALS

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

Send large SAE for our comprehensive catalogue

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

AERIAL BOOSTERS

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

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

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

BUSINESS OPPORTUNITES

BUSINESS OPPORTUNITY
LUMINANCE DELAY LINES FOR COLOUR T.V.

We are looking for stocking distributors in all the countries for Luminance Delay Lines manufactured by our unit INDIAN TELEVISION INDUSTRIES as per Standard Specifications, and tested and passed by Department of Electronics Govt. of India. Business Houses and individuals interested in this offer are requested to write to us for terms, giving details of their contacts with colour T.V. manufacturers and other consumers of LDL with technical data and quantity of LDL required by them and market potential they command in their area, within 15 days.

DIPLOMAT PRIVATE LIMITED
49/2, Gurjaipal Nagar, JALANDHAR-144 001 INDIA

SERVICE SHEETS

TELEVISION SERVICE SHEET SPECIALISTS

Thousands of British, European and Japanese models in stock.

Colour £2.00 Mono £1.50

Manual prices on request.
All our prices include post and packing costs.
Send stamped envelope for free catalogue and enquiries.

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

30,000 SERVICE SHEETS IN STOCK ALL AT £3.00
ALSO COLOUR MANUALS AVAILABLE AT £6.00 EACH

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

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

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

EQUIPMENT FOR SALE

COMPLETE TUBE re-gunning plant in good working order. Electric ovens for regunning. Re guns 15 colour (Sony Trinitron, Pil, in line, tubes, etc). Tubes in 24 hour cycles. Only £4,000 plus VAT. Free training provided. Tel. 0582 410787.

VIDEO

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

THEN YOU NEED

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

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

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

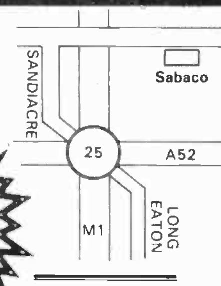
FOR SALE

Sabaco For a great deal!

VAN LOAD DIRECT FROM SOURCES

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

VHS VIDEOS £95.00 + VAT
BRAND NEW SETS AT COMPETITIVE PRICES



Only 2 minutes Junction 25 M1

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

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

Telephone: (0602) 397555

FOR SALE

173 TELEVISION COPIES 1962 to 65. 1974 to 83. Complete less five copies. Enquiries Chorley 73081.

100 TELEVISION RENTAL accounts for sale in North London/Herts area, turnover 10,000 pa. TV Box No. 191.

TRADE ONLY

Closing down warehouse. All stocks to be cleared.

TV Components, Audio, Wire, Electrical, Racking. Etc.

Offers are invited for bulk purchase of stocks listed above.

No reasonable offer refused.

Send for catalogue to:

ELECTRONIC SUPPLIES

18 Leucha Road, Walthamstow E17 7LG or Telephone: 01-521 3912, after 6.30 evening.

BOOKS AND PUBLICATIONS

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

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

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

WANTED

SERVICEABLE TRINITRON TUBE. Type 520KB22 for Sony KV2000UB. Telephone Reading 0734 475869.

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

WANTED: Quantity Pye Philips G11. Televisions also Ferguson videos. Telephone 04024 58513.

MISCELLANEOUS

DON'T RELY ON the testcard. Labgear colour bar generators £55 post paid. Also GEC minitest multimeters (requires Altai leads) £6 post paid. Both working order. Beacon TV, 335a Cotmanhay Road, Ilkeston, Derbys 0602 303613.

2 LABGEAR CM6022/RA Tele-Verta. £18 each. G M LO-VEL, Orchard House, Boscastle. N. Cornwall PL35 0AT.

MANOR SUPPLIES MkV test generator tube restorer books etc. Phone Southampton (0703) 899062.

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

When replying to Classified Advertisements please ensure:
(A) That you have clearly stated your requirements.
(B) That you have enclosed the right remittance.
(C) That your name and address is written in block capitals, and
(D) That your letter is correctly addressed to the advertiser.
This will assist advertisers in processing and despatching orders with the minimum of delay.

If an advertisement is wrong we're here to put it right.

If you see an advertisement in the press, in print, on posters or in the cinema which you find unacceptable, write to us at the address below.

The Advertising Standards Authority. ✓

ASA Ltd, Dept 3
Brook House, Torrington Place,
London WC1E 7HN

IRISH T.V. DEALERS

Large selection of fully reconditioned precision in-line UHF-VHF colour T.V.s at keen prices

Also in stock: Dual Standard Beta & VHS Video Recorders

Quantity discount. Delivery arranged.

(Limited amount of spare panels, components, button units, etc.)

SPECIALISTS IN OVERSEAS ORDERS

T.V. TRADE SALES
EDI House, Kylemore Park West, Ballyfermot, Dublin 10.
Tel: 264139 ext. 11.

(Open 10 a.m.-5.30 p.m.)

COLOUR TELEVISIONS

THORN 9000, 9200, 9600 Remote Control
PYE 420/450, G11
MANY OTHER TYPES

Working panels and tubes available.

REBUILT TUBES
Delta – In Line – PIL.

SOUTHBRIDGE TV CENTRE
120, Selhurst Rd., London, S.E.25.
Tel: 01-771 3535.

EMCO – EUROSONIC – GRUNDIG – TELETON + ALL BRITISH MAKES ETC. ETC. ● ALL SPARES READILY AVAILABLE ●

IMMEDIATE CREDIT AVAILABLE — TRADE ONLY

If you are a trader simply phone for the part you require and we will send it – no quibble – no hold up for status check. Satisfy us over the phone that you are a trader and we will supply almost any TV component by return "off the shelf". e.g. LOPTX – EHT trays – droppers – OSC coils – switches – cans – smoothers – I.C.'s, etc. etc.

YOU CAN BE 95% SURE WE CAN SUPPLY ANY TV COMPONENT BY RETURN
IF YOU NEED SPARES FAST – RING NOW!

ACCESS AND BARCLAYCARD ACCEPTED. *Applies to U.K. only.*

TELE-PART (W'TON) 32 TEMPLE STREET, WOLVERHAMPTON (0902) 773122

20AX Line lin coil **50p**

GEC switch mode trans 20AX

ITT CVC20 etc mains switch **60p**

ITT 2,800 mains remote switch **50p**

2110 GEC Power Panel **£8.00**

Line o/p frame panels GEC 20AX **£10.00**

GEC 20 AX Transductor **£1.00**

All diodes at 10p or less in this list 20 of one type **£1.00**

OA 47 **8p**
OA 90 **8p**

IN 60 **5p**
IN 541 **5p**
IN 914 **3p**
IN 2069a **10p**
IN 2070 **10p**
IN 4001 **3p**
IN 4002 **3p**
IN 4003 **4p**
IN 4004 **4p**
IN 4005 **4p**
IN 4006 **4p**
IN 4007 **5p**
IN 4148×40 **£1**
IN 4448×40 **£1**
IN 4722 **10p**
IN 4751 **10p**
IN 5235 **10p**
IN 5254 **10p**
IN 5349 **10p**
IN 5392 **10p**
IN 5928B **10p**

IAV 30 **10p**

IM 72Z55 **10p**

IR 106a **20p**
IR 3051 **10p**

IS 164 **10p**
IS 921 **10p**
IS 3011a **10p**
IS 3072a **10p**
IS 5024a **50p**
IS 5030 **50p**

ITT 921 **10p**
ITT 923 **10p**
ITT 1075 **10p**
ITT 2001 **10p**
ITT 2002 **10p**
ITT 4150 **10p**

Rank Panels
Z904 Line **£10**
Z905B Decoder **£10**
Z736 Tuner I.F. **£10**
A805 Conv. **£2**
T136A Scan Drive **£10**
Z780 Line O/P **£10**
Z968 **£10**

AA 113 **10p**
AA 119 **8p**
AA 144 **10p**

BA 102c **10p**
BA 157 **8p**
BA 159 **8p**
BA 173 **8p**
BA 182 **8p**
BA 201 **8p**
BA 202 **8p**
BA 243 **8p**
BA 248 **8p**
BA 316 **5p**
BA 318 **5p**

BAV 10 **10p**
BAV 21 **10p**

BAW 21 **10p**

BB 103 **10p**
BB 105A×12 **£1**
BB 105B×12 **£1**
BB 105G×12 **£1**
BB 121a **10p**

BRC 83c13 **10p**

BZX 46c22 **15p**
BZX 61 9-1 **6p**
BZX 61c110 **6p**
BZX 61c20 **10p**
BZX 61c30 **10p**
BZX 61c220 **10p**
BZX 70c6v2 **8p**
BZX 70c12 **20p**
BZX 70c33 **8p**
BZX 79c3v9, 4v7, 5v1, 5v6, 6v2, 6v8, 7v5, 11, 12, 30, 47 **10p each**
BZX 83c4v3, 5v6, 8v2, 12, 13, 24, 27, 33 **10p each**
BZX 84c6v8×10 **30p**
BZX 85c8v2 **10p**
BZX 88c0v7, 3v9, 4v3, 6v2, 8v2,12 **10p each**

1A/1600V **10p**

2 amp bridge rec. wire end **15p**

CV 8617 **10p**

Y 716 **10p**
Y 729 **30p**
Y 730 **10p**
Y 827: 6A/1KV **20p**
Y 860 **30p**

G11 470M/250V SP **£1 each**

Min 12 volt Relays **75p**

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

BU 105/04 **80p**
BU 108 **£1**
BU 124 **50p**
BU 126 **80p**
BU 180a **65p**
BU 204 **70p**
BU 205 **£1**
BU 206 **£1**
BU 207 **£1**
BU 208 **80p**
BU 208 on heat sink **70p**
BU 208A **£1.10**
BU 208D **90p**
BU 222 **£1**
BU 326 **£1**
BU 407 **60p**
BU 426V **60p**
BU 500 **£1.10**
BU 508A **£1.20**
BU 526 **75p**
BU 807 **£1**
BUX 84 **50p**
BUW 84 **30p**
BUY 71 **£1**

TIC 106a **30p**
TIC 116m **40p**
TIC 116n/Y 1003 **35p**
TIC 126N **40p**
TIC 206m **30p**
TIC 225S **40p**
TIC 226E **40p**
TIC 226m **30p**
TIC 236m **30p**
TICV 106D (T092 case 2A/400V) **10p**
TIP 29 **20p**
TIP 30 **35p**
TIP 30A **35p**
TIP 30B **40p**
TIP 30C **45p**
TIP 31 **30p**
TIP 32 **25p**
TIP 33B **50p**
TIP 33C **70p**
TIP 34A **50p**
TIP 34B **60p**
TIP 34C **70p**
TIP 35B **50p**
TIP 35C **70p**
TIP 35D **80p**
TIP 36 **50p**
TIP 36C **70p**
TIP 41B **40p**
TIP 41D **70p**
TIP 42/BRC 6109 **30p**
TIP 48 **40p**
TIP 49 **30p**
TIP 57 **30p**
TIP 100 **30p**
TIP 102 **30p**
TIP 112 **30p**
TIP 115 **50p**
TIP 117 **50p**
TIP 120 **35p**
TIP 125 **35p**
TIP 130 **30p**
TIP 131 **25p**
TIP 136 **30p**
TIP 140 **50p**
TIP 147 **50p**
TIP 640 **50p**
TIP 2955 **35p**
T 6032 **30p**
T 6036 **40p**
T 6040 **40p**
T 6047 **40p**
T 6049 **40p**
T 6051 **40p**
T 6052 **40p**
T 9004 **40p**
T 9005 **40p**
ZTX 102c **10p**
ZTX 107 **10p**
ZTX 108c **10p**
ZTX 109k **5p**
ZTX 213 **5p**
ZTX 341 **10p**
ZTX 342 **10p**
ZTX 384 **10p**
ZTX 451 **10p**
ZTX 550 **10p**
MJ 2253 **60p**
MJE 3040 **60p**
MJE 2209 **10p**
SP 8385 **50p**
SAB 3205 **£1.00**
SAB 4209 **£1.00**

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

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

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

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

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

Bush thyristor RCA 76122 **£1**
ITT computer bookset 2020 **£2**
G8 20 turn 100K pot **35p**
Transformer 240v/20v-500Ma **75p**
Viewdata torroidals **£6**
CVC 20 tube base **£2**
Tube Base Rank & G11 **£1.20**
Sankyo tape motor **75p**

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

Mono scan coil 110° small neck **£1.50**

Infra red led LD57CA **15p**
Mono scan coil **£3**
G 8 transductor **£1.25**
AT 4041/41 transductor **£1**
2K5 Lin pot with 40mm spindle **20p**
1982 Hitachi Ae isolator **50p**
Mullard FM decoder 1401 **£1**
Philips service pack, flat films, 57 condensers 56nf-2.2uf **£2**
VHF 3 Transistor rotary tuner DX-TV **£1**
15K-20 turn pots **20p**
Thorn panel 6×100 pot + changeover switch (Irish) **50p**
Battery converter TA 75 for colour TV. 12/24v Thorn 3787 **£6**
Thorn 3500 2A cut out **75p**

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

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

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

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

10 Mixed TV & radio speakers **£4**

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 19 I.C. **£5**

Philips GP422.4CH (£40 cost) **£6**

Stereo Dynamic Cartridge

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 **£12**

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

20AX GEC Split Diode lead **£1.00**

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

Mullarad 12.5V/170 Mc/s 45 watt
BLW60 **£5.00**
BLW60C **£5.00**

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

Various Tools and Accessories

Philips **£1.00**
Philips Neon Lamps for TV sets **5p**
Freeze **£1.20**
Foam Cleaner **£1.20**
Contact Cleaner **£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
25mm × 20M **50p** 50mm × 20M **70p**
ITT CVC **£8.25** Chassis **£40.00**
Screen locking agent, large can **£1.50**
20 GEC Service Manuals & Rank **£5.00**
Red E.H.T. LAED and Anode Cap **£1.00**
10 × G11 Cap 470/250 **£15.00**
Soldering iron 6v/23w **£2.50**
TX 10 Focus Units **£6.00**
Weller solder iron 15 watt/25 watt **£5.00**
2 way baby alarm/intercom with long leads **£5**
Phillips universal battery tester/charger, fuse/bulb tester **To Clear £4**
Eisenmann NICAD CHARGER 5.5V/150 ma **£2**
12V Nicad pack. "AA" **£2.50**
Hitachi 7.2v/1.8A Nicad pack **£6.00**
Hitachi TP 007 Battery pack 7.2v/1.6A **£7**
Hitachi Silver Oxide Battery G13 UCC357 IEC SR44 1.5V **60p**
70ML Silicone Sealer (clear) **£1**
100 Coax Plugs **£10.00**
De-solder pump + 2 nozzels **£5.20**
Plastic box for i.c.s with anti-static pad 6"×3"×½" **75p**
Can of handy oil 'mobil' **40p**
Flat Red LED **12p**
500gm 60/40 solder reel **£7**
Clearweld glue pack **30p**
Dual v/u meter -20 – +10db **£1**
3 × C90 Cassettes **70p**
K30 thermistor 232266298009 **75p**
GEC Mains Power Supply R.E.G. **£3.00**
1Kg reel of solder **£8.00**

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

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

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

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

SENDZ COMPONENTS
TO ORDER SEE BACK PAGE

SENDZ COMPONENTS

TO ORDER SEE BACK PAGE

DETACH HERE MOISTEN HERE AND FOLD DOWN

Thorn Spares

9000 Frame panel	£8
9000 Cyclops panel	£1.50
8000/8500 timebase panel	£8
8800 convergence panel	£6
8500 convergence panel	£6
4000 Chroma	£20
4000 Power supply	£3
1600 Mains lead, switch	
3500 6 push button + cable form	£1.50
T605 1vNPN T066 80v/6A	10p
9000 Sound output panel	£1
3500 Focus unit	£1.50
3500 Mains Trans	£4
3500 2amp thermal cutout	75p
3500 IF panel	£2
3500 Frame panel	£3
3500 Line panel	£3
3500 A1 Diode	20p
Export 3500 IF panel	£2
IC board with set of SN74LS	£1
4000 Tube base	£4
3500 A1 pots	50p
Beam limiter panel	£1.50
3500 Power panel with Y969	£1
3 Way regulated adaptor 240V 6V/7.5/9V/300mA	£3.50
Rank/Toshiba preh unit 0354	£9.50
2 banks of 3 PB unit. Pye 731	£2
4 Push button unit preh	£1.00
5 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
5 Push button Unit Thorn	£1.00
6 Push button Unit fits GEC & Decca etc.	£6.00
6 Push button unit for GEC 2040 and ELC 1043/05	£6.00
Hearing aid unit	£3
6 Push button unit PYE 713	£7.00
7 Button Unit GEC with Lamps	£7

Mains Droppers

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

Speakers

5×4 G11	25 ohm	70p
5¼×2½	3 ohm	£1.00
5×3	80 ohm	70p
5×3	50 ohm	50p
5×3	35 ohm	70p
6×4	15 ohm	£1.00
7×3	70 ohm	£1.00
5×3	8 ohm	70p
7×3	16 ohm	£1.00
6" dia	16 ohm	£1.00
5" dia	8 ohm	£1.50
5¼" dia	4 ohm	£1.50
6¼" dia	3 ohm	£1.50
2¾" dia	8 ohm	75p
3" dia	8 ohm	75p
4¼" sq.	15 ohm	75p
KT3 speaker	K30	75p
3" dia	15 ohm	60p

K30

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

Diodes

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

International Rectifier EHT Diodes G770/HV34 6KV — 3 for 8p
6A/600V Stud Diodes — 20p
6A/1000V Stud Diodes — 20p

20.AX

GEC Degausing Panel 809 with PT37 — £1.00

Line Transformers

2 J/Pots 3,500 1 off each type	£3.00
G8 Symmetry Coil	£2.00
G8 Trans. Philips	£7.00
G11 Split Diode	£12.00
CVC820 Split Diode ITT	£10.00
Thorn B/W AD5308F + Stik + Lead	£1.50
GEC 2040	£3.00
GEC 2110	£7.00
Mullard AT 2036	£1.50
Pye 169 Line Trans	£3.00
Pye mono	£3.00
Rank mono T704A	£3.50
GRC 20 AX Split Diode Trans	£7.00
CVC20 ITT	£3.50
CVC32 ITT	£7.50
A12080/15 600M/300V	£1
CVC800 Line Trans	£6.00
GEC Portable G1OT2041	£3.00
GEC Portable G1OT2046	£3.00
EHT Split Diode Leads ITT	£1.00
EHT Cable/Metre	20p
Ex panel "14" Fidelity portable	£5

Triplers

8500 Triplers	£6.50
11 TEZ Rank	£3.00
G9 Philips	£4.00
GEC 2110	£4.00
3500 Thorn	£3.50
9000 Thorn	£5
9500 Thorn	£4.50
2040 GEC	£3.50
GEC TVM25 Tripler	£2.00
Universal Tripler	£5.00
TVK 76/9	£3.00
G8 Philips (Mullard) with cap	£6.00
CVC 825 ITT CVC 20/25/30/32	£3.50
Decca 80 100	£4.50
Grundig TVK 52	£2.50
11TBQ Pye 731	£3.00
11THY	£4.00
D22 for Pye 18" colour portable	£4.00
LP 1193/63	£4.00
BG 100/41	£3.25
BG 100/61	£3.25
KT3 BG200/43	£3.50
T/text ultrasonic rec'r panel	£14.00
Video cassette lamps on lead. 12-14V.	50p or 3 for £1.00
20 for £5.00	200 for £25.00
GEC 8 touch unit assy complete with all I.C.'s + pots	£4.00
G11 E.W. coils	£1.00
G11 Transient Suppressors 245V	10 for £1.00
G11 Scan Coils	£5.00
G11 100K tuner pots	12 for £1
KT3 IF panel	£6.00
KT3 line OSC transformer	£1
KT3/K30 infra-red receiver head	£3
K30 drawer unit with IC's (home)	£10
K30 drawer unit with IC's (export)	£10
KT3 AE Sockets	25p
KT3 receiver panel	£8
KT3 line driver transformer	50p
Decca 80/100 IF panel	£5
NPN PNP 80V 6 Amp TO66 O.P. Trans.	pair 25p
5 button touch tuner BBC1/2 ITV1/2 video with ic SAS 560T/570T	£7.00
Control panel 5 sliders + mains lead	£1.50
G11 8 touch button unit replaces old 6 P.B.U.	£24
Tube base + base unit for 820 Euro chassis	£4.00
GEC Line O/P Trans. & Rec Stick for Portable	£3.00
CVC 20/25/30/35/40 decoder panel	£10
CVC 20/25/30/35/40 decoder panel (untested)	£5
CVC 40/45 IF panel	£5
40K Transducer	50p
PHILIPS NE511N	£1.20
LM337M Reg.	30p
20 GEC Black Spark Gaps	£1.00
G11 Line Driver Transformer	35p
KT3 Front Panel Control Assy.	£2.50
BTW 30/50	50p

TELETEX DECODER

I.C. SAA 5051	
I.C. SAA 5042	
I.C. SAA 5030	
I.C. SAA 5020 etc.	£12.00
BTW 92/800R	£3
25A473 PNP C/P	10p

NEW PYE 725 line O/P panel with L.O.P.T. & Tripler	£10.00
Thorn Mains Isolator unit for 70-80Ω. Ex-speaker	£2
NEW GEC 20AX Power Supply Switch Mode	£12.00
Complete new GEC portable chassis M1201H/M1501H with P.B.U., v.cap/LOPTI	£10
Field + Jungle panel for GEC 3133/3135	£1.50
GEC 2110 line panel with transformer	£7.00
GEC 2110 tuner unit + IF Panel	£12.00
Pye/Chelsea Line op panel	£12.00
Pye 713 IF panel and tuner	£7.00
Pye 713 Chroma	£10.00
Pye/Chelsea Timebase panel with LOPTI	£10.00
Pye 731 Frame Panel	£5.00
Pye 731 Convergence Panel	£5.00
Pye 731 line O/P panel with transformer + tripler	£12.00
Pye 731 Chroma	£10.00
Pye 731 IF panel + tuner	£10.00
Pye 607/205 Line panel with transformer	£10.00
Pye CDA/205 panel	£6.00
GEC portable chassis + LOPTI 2114 New	£4.00
Thorn 1613/1713 chassis	9.75
Hills 520 multimeter + case. 20,000Ω/volt, fuse diode protected + logic test facility. 10meg/1200 volt	£19.50

NEW MULLARD TELETEX

Decoder Panel (VM6230)	£15.00
Panel 6101	£15.00
Panel 6330	£15.00
G8 Tuner Unit + Panel	£6.00
G8 Convergence Panel (late type)	£12.00
G8 Power Supply	£6.00
G8 6 Sloping PBU	£8.00
G8 IF & Chroma	£12.00
G8 Chroma	£6.00
G11 IF Detector	£3.00
G11 Selector gain module	£3
Complete CVC 825 Chassis (both panels)	£40.00
AEC V/Cap Resistor Unit UHF with IC SAS660 SAS670	£3.00
Z714 RANK IF Panels 6MHz 1 I.C. SL437F	£3.00
Z909B RANK IF Panels Export 5.5MHz 2 I.C.'s TBA1205B TCA2705Q	£2.50
Z743 RANK IF Panel Export 5.5MHz 3 I.C.'s TBA750+SC9504P+SC9503P	£1.50
Pye G11 Front panel with transducer, pots, tuner pots, 6 pb switch+lead	£5.00
GEC V/cap VHF/UHF tuner and IF+ sound O/P PC 706B3 (Export)	£12.00
GEC Line O/P PC 659B3	£6.00
2110 GEC Power Panel	£8.00
GEC Power Supply (Export)	£10.00
G11 dynamic correction panel	£6
CVC 20 Front panel with sliders + mains input panel	£4
CVC 40 PUSH BUTTON ASSY with sliders: complete with lamp assy + pots	£14
CVC 5 Mains on/off + 5 pots	£2
Universal Focus. Fits Pye, Thorn and Decca Units.	
Large Type	75p
Decca Small	75p
KT3 Focus Unit	75p
K30 Focus Pot	75p
TX10 Focus Units	£6.00
CVC 32 Focus Unit	
Focus Rod	25p
G11 focus	£2.00
ITT Small for use with Split Diode	50p
TV11	50p
Remo TV12SP	50p
TV13	50p
TV14	50p
TV18	60p
TV20	£1.00
TV45	50p
Thorn 14/1500 rec stick	5p
16 Button Key Pad 1 to 0 + * + #+ 4 blank (Cherry)	£3.00
G7000 Philips Video Games Packs 11 types	**£8.75 each**
G11 drawer ASS 3 pots Mains switch and lead	£2.00
Line O/P panel GEC 2217/2218/2213/2214/2226/2227/2228	£10
3500 thick film	£2.00
4000 thick film	£2.00
PYE 731 thick film	£2.00

DISPLAYS

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

250/64	10p
3300/70	50p
.1/100	5p
1/100 × 10	30p
22/100	10p
4.7M/100	5p
470/100	20p
2000/100	70p
4700/100	75p
47/160	10p
600M/300V	£1.00
800/160	50p
.1/250 Pulse	5p
G11 0.47/250	10p
2.2 250v	10p
3n3/250 A.C.	10p
.33/250V	20p
.39/250V	15p
4n7/250 tested 5KV	25p
.91/250	35p
.91/400	30p
22/250	15p
47/250	10p
100/250	20p
G11 470/250V	£1.75
GEC600/250	60p
700/250	£1
800/250	40p
32/300	20p
4/350	5p
8/350	8p
12/300	10p
4.7M/350v	10p
16/350	25p
33/350	20p
50/350	10p
220/350	30p
300/350	40p
400/350	50p
10/375	10p
22/375	15p
220/385	75p
330/385 CVC 820HT	60p
0.1/400	15p
KT3 E/W .39/400	20p
.56K/400v	20p
4700pf/400	10p
.22/400	10p
8/400	15p
33/400	20p
400/400	40p
394K/400V	20p
220/450	40p
.47/500	25p
0.1/600	10p
.047/600	15p
0.047/1000	10p
0.01/1000	10p
0.1/1000	10p
.15/1000	20p
.47/250V A.C.	10p
.001K/1250	10p
0.0047/1500	10p
.005/1500	10p
.0105/1500	10p
1n8/1500	15p
2n0/1500	10p
2n2/1500	15p
G11.11000/1500	15p
.01/1600	15p
G11.8200/2KV	15p
0.1/2KV	20p
10n/2KV	15p
3n9/2KV	15p
0.0015/2KV	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

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

210/12KV	10p
1000/12KV	10p
1200/12KV	10p

Multi-Caps

470/250 G11	10 for £15
Thorn 3500	
175/100/100/350v	£1.75
KT3/200/25/25/385v	£1.00
300+300+150+100+50MFD 350V	£2
47/220/350v	60p
150/150/100/100/100/320v	£2.00
2500/2500/63v	50p
470/470/250v	50p
150/200/200/300v	70p
400/400/200v	£1.70
300/100/100/16/275v	£1.50
100/200/325v	40p
150/150/100/375v	£1.50
300/300/100/32/32/300v	2.00
1500/2000/30v	50p
Jelly pot Thorn 00D4/013	£3
150/150/100/100/320v	£2.00
100/350 + 300/200/100/16/275v	£2.00
300+300/300	£1.00
225+25/380	70p
200/100/100/350v	£1.50
500/500/25v	50p
150/150/100/300v	75p
200/150/150/300v	1.00

ITT Panels

CVC 40/2 Chassis, new £30, complete with intrfase panel	
CVC 820 Line O/P Panel	
CVC20 Mains Panel	£3.00
ITT 8 & 6 Push Button Unit	£1.00
CMA 10	£2.00
CMA 11	£2.00
CMA 30	£2.00
CMA 40	£1.50
CMC 10/2	£5.00
CMC 16	£4.00
CMC 38	£8.00
CMC 45	£1.50
CMC 47	£1.00
CMC 52	£15
CMC 57	£6.00
CMC 58	£8.00
CMC 59	£8.00
CMC 67	£3.75
CMC 67/2	£4.00
CMC 68	£4.00
CMD 12	£10
CMD 32	£5.00
CMD 33	£5.00
CMD 40	£5.00
CMD 41	£5.00
CMF 25	£2.00
CMF 26	£2.00
CMF 40	£2.00
CMH 10	£1.50
CMH 31	£1.00
CMK 12 (untested)	£4.00
CMK 30 (untested)	£4.00
CMN 20	£1.50
CMN 21	£1.50
CMN 40	£1.00
CMN 45	25p
CMP 10	£2.00
CMP 11	£4.00
CMP 40	£2.00
CMS 11	£2.00
CMS 40	£2.00
CMU 12	£10.00
CMU 14	£8.00
CMU 30	£7.00
CMU 45	£7.00
CMZ 30	£5.00
GMA 90	£5.00
GMC 120	£2.50
GMR 64	£5.00
TMN 2	£2.00
VCA 20	£10
VCA 21	£10.00
VMC 26	£3.00
VMC 34	£5.00
VMC 44 + 45	£4.00
VMC 51	£5.00

Hand Sets

Transducer Hand Set Insert, crystal, transducer, SAA 1124 & lead	£3.50
8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H	£15.00
New Replacement for G11 Ultrasonic Full Remote	£12.00
Thorn 4000 insert with 7 buttons	£5.00
Decca RC 11	£14.00
Decca RC 12	£14.00
G11 Infra-red full teletext	£19.00
C11 Ultrasonic full teletext for G26c 674/02 and G22c 66/02	£16.00
G9 Philips R/C Transmitter	£8.00
Rank, Infra-red	£10.00
Dynatron-Full remote CTV 62, 63, 64	£19.00
Hitachi infra red handset	£18
Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826	£12.00
G11, Full remote top button assy.	£12.00
G11, Full remote repair service (exchange unit)	£12.00
Philips infra red full remote 9 channel for 60 CP2605	£6.00
Philips infra red full remote 12 channel for 60 CP2605	£12.00
Philips Key Pad set KT3/K30	£3.00
KT3/K30 T/Text	£15.00
KT3/K30 Full remote	£15.00
KT3 Power supply	£4.00
Hitachi 8 button unit with resistor unit. Last year mod.	£7.00
GEC infra-red 2236-2026	£4.00
GEC push pad hand set button blobs	10p each