NORDMEND FC25 Signal Strength Meter - GEC 2110

DECEMBER 1985

Australia $2, New Zealand $2·50, Malaysia $5·75 £1·10

TELEVISION

SERVICING·PROJECTS·VIDEO·DEVELOPMENTS

Signal Strength Meter

IC Field Timebase Circuits

Servicing the NordMende FC25

Electron Test Pattern Program

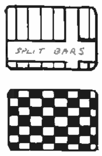
TV Fault Finding • DX-TV

Test Report • VCR Clinic

MANOR SUPPLIES

MKV PAL COLOUR TEST GENERATOR FOR TV & VCR.

TEST DEMONSTRATIONS AT 172 WEST END LANE



- ★ 40 different patterns and variations.
- ★ Broadcast transmission accuracy (fully interlaced sync pulses with correct picture blanking).
- ★ EBU colour bars, BBC colour bars, whole rasters & split bars (specially useful for VCR service), white, yellow, cyan, green, magenta, red, blue and black.
- ★ Chequerboard.
- ★ Mono outputs with border castellations, cross hatch, grey scale, vertical lines, horizontal lines and dots. UHF modulator output plugs straight into receiver aerial socket.
- ★ Additional video output for CCTV & VCR.
- ★ Facilities for sound output.
- ★ Easy to build kit, standard parts. Only 2 adjustments. No special test equipment required.
- ★ Mains operated with stabilised power supply.
- ★ All kits fully guaranteed with back-up service.
- ★ Also available with VHF Modulator.

Price of Kit	**£70.00**
Case (10″×6″×2¼″) app.	**£7.40**
Optional Sound Module (6MHz or 5.5MHz)	**£3.90**
Built & Tested in Case including Sound Module	**£105.00**

SPECIAL TEST REPORT 'TELEVISION' DEC. 1982

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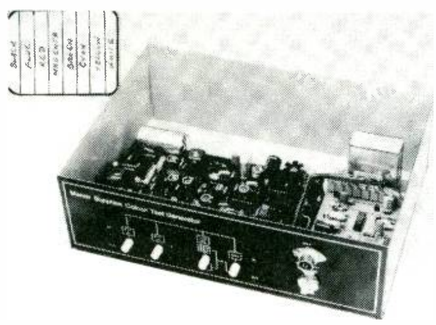
PAL COLOUR BAR GENERATOR (Mk4)



- ★ Output at UHF, applied to receiver aerial socket.
- ★ In addition to colour bars R-Y, B-Y etc.
- ★ Cross-hatch, grey scale, peak white and black level.
- ★ Push button controls, battery or mains operated.
- ★ Simple design, only five i.c.s on colour bar P.C.B.

PRICE OF MK 4 COLOUR BAR GENERATOR KIT £30.00. CASE £7.40. BATT HOLDERS £2.80. MAINS SUPPLY KIT £4.20 (Combined P&P £2.20).

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MK 4 (MAINS) BUILT & TESTED £68.00 + £2.20 P & P.
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TELEVISION

December 1985

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Issue 422

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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").

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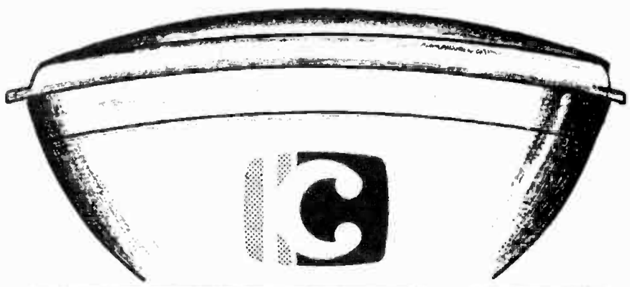

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AC153K	0.46
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AC188	0.28
AC188K	0.38
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BC113	0.42
BC115	0.12
BC116	0.12

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BC140	0.27
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BC142	0.24
BC143	0.26
BC147	0.18
BC147B	0.14
BC148	0.10
BC148B	0.12
BC149	0.10
BC149C	0.14
BC157	0.10
BC158	0.12
BC159	0.12
B/C	0.14
BC160	0.30
BC161	0.30
BC168B	0.20
BC169C	0.12
BC170	0.16
A B or C	0.16
BC171	0.10
A or B	0.10
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BC182	0.10
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BC183	0.10
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BC213	0.10
A B or C	0.10
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BC251	0.14
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BC262	0.20
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BC302	0.30
BC303	0.30
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BC338	0.12
BC350A	0.24
BC351	0.16
BC440	0.36
BC441	0.40
BC461	0.58
BC478	0.24
BC516	0.48
BC547	0.12
A or B	0.10
BC548	0.12
A B or C	0.10
BC549	0.10
A or B	0.10
BC550	0.10
A or B	0.10
BC557	0.10
BC558A	0.10
BCY70	0.16
BCZ10	3.21
BCZ11	2.60
BD124P	0.70
BD129	0.90
BD130Y	0.68
BD131	0.36
BD132	0.36
BD135	0.26
BD136	0.26
BD137	0.28
BD138	0.30
BD139	0.30
BD140	0.28
BD142	1.26
BD145	1.82
BD150A	0.72
BD160	1.58
BD165	0.45
BD183	0.70
BD201	0.52
BD202	0.57
BD204	0.50
BD222	0.80
BD225	0.40
BD232	0.45
BD234	0.30
BD235	0.30
BD236	0.30
BD237	0.38
BD410	0.76
BD434	0.58
BD438	0.58
BD439	0.85
BD441	1.00
BD507	1.05
BD520	1.20
BD687	0.88
BD707	0.88
BDX18	1.00
BDX32	1.48
BF115	0.32

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

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

Type	Price (£)
BY199	0.72
BY206	0.14
BY207	0.16
BY210/400	0.21
BY210/600	0.24
BY210/800	0.28
BY227	0.22
BY228	0.46
BY238	0.65
BYX10	0.20
BYX36/150	0.40
BYX36/600	0.48
BYX48/300	0.70
BYX55/600	0.30
BYX71/600	1.18
BYZ12	0.78
C106D (400V)	0.48
C106F (50V)	0.36
D40C1	1.08
D40N1	1.12
E1222	0.30
E5024	0.30
GET872	0.60
GET881	1.70
GET882	1.90
ITT2001	0.18
ITT2003	0.34
MCR106/5	1.20
ME0413	0.70
ME6002	0.26
MEU21	0.62
MJ400	0.45
MJ2955	1.00
MJ3000	1.80
MJE340	0.46
MJE520	0.44
MJE2955	1.60
MJE3055	1.40
MPSA05	0.30
MPSA12	0.30
MPSL01	0.34
MPSU05	1.05
MPSU06	1.18
MR502	0.40
MR854	0.88
OA91	0.07
OA210	0.66
OC26	2.65
OC35	4.75
OC36	1.75
OC44	0.72
OC72	0.70
OC81	0.68
ORP12	0.85
R2008B	1.20
R2010B	1.20
R2540	2.71
TIC45	0.45
TIC47	0.70
TIC29	0.30
TIP30A	0.32
TIP31C	0.39
TIP32	0.35

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

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

74LS

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

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

CHART RECORDER SPECIAL

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

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

SOLDERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	67.95
XS25 W Iron kit/ complete with steel & plug attached	10.00
CS 18W, as above	9.90
Antex 15W iron	5.25
Antex 18W iron	5.50
Antex 25W iron	5.75
Antex elements	2.75
Antex bits	0.90
Antex stands	2.10
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

CAPACITORS

Metallised Paper

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

SPECIAL OFFER – DECEMBER ONLY

DESOLDER PUMP – normally £4.50 – this month **£2.99**

ONLY AVAILABLE WITH ORDERS OF £10.00 & OVER

Look for our Special Offer for each month.

SONY T.V. & VIDEO SPARES

Idler Kit SLC5.SLC7	(Rewind Kit)	A-670-634-8A	£4.80
SLC6	(Rewind Kit)	A-670-639-1A	£3.06
Video Head SLC9UB		A-676-208-8A	£45.05
SLC5/C6/C7		A-676-212-9A	£43.05
Motor Kit MT General		X-354-931-41	£14.44
Limiter Assembly SLC7UB		X-365-331-00	£2.45
Power Switch KV General		1-554-820-11	£5.50

Diodes ICs Thyristors Belts Transistors Switches Remote Controls Instruction & Service Manuals

POTENTIOMETERS

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

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

INTEGRATED CIRCUITS (£) EACH

709	0.35
741	0.25
747	0.70
AN214Q	3.80
AN240P	3.42
BTT6218	1.98
CA301AT	2.88
CA358	0.66
CA801CM	1.20
CA3020	2.10
CA3065	1.60
CA3080E	0.68
CA3140	0.45
HA1366W	1.59
LA4422	3.20
LC7131	4.90
LC7137	5.40
LM324N	0.48
LM380N8-P	1.15
LM380N14-P	1.80
LM1011N	3.20
LM1488N	0.98
LM3900N	0.85
M51513L	3.18
M51515L	3.18
MC1307P	1.99
MC1327P	1.50
MC1330P	1.60
ML23213	2.10

ML23713	2.30
NE555	0.25
SAA1025	4.00
SAS560	2.50
SAS570	1.85
SAS580	2.85
SN76023N	2.00
SN76033N	2.50
SN76131N	1.99
SN76226DN	1.70
SN76227N	1.10
SN76660N	0.75
SN76666NO	1.40
STK015	6.20
TA7146P	4.60
TA7203P	2.76
TA7204P	1.50
TA7205AP	1.30
TA7222P	2.32
TAA550	0.50
TAA611A12	3.50
TAD100	2.90
TDA120A	0.80
AS/S/SB/T/U	0.80
TDA120B	1.30
SA/SQ/UQ	1.30
TBA520	1.50
TBA530	1.20
TBA540	1.64

TDA560C	1.50
TDA800	0.80
TBA810S	1.20
TBA950/2A	3.05
TCA270SA	4.02
TDA1003A	5.50
TDA1004	4.95
TDA1006A	2.45
TDA1035S	2.20
TDA1170S	1.99
TDA1352A	1.80
TDA2002	1.80
TDA2020	4.00
TDA2030	1.90
TDA2140	
TDA2160	
TDA2522	
TDA2530	
TDA2532	
TDA2560	3.20
TDA2561	4.65
UPC57562	1.48
UPC741G	0.92
UPC1156H	2.75
UPC1182H	2.75
UPC1218H	1.80
UPC1370C2	2.50
UPC2002H	2.78
UPC2002V	2.78

CMOS

4000	0.19
4001	0.24
4002	0.24
4006	0.68
4007	0.24
4008	0.59
4009	0.44
4010	0.39
4011	0.23
4012	0.24
4013	0.35
4014	0.58
4015	0.58
4016	0.38
4017	0.54
4018	0.59
4019	0.59
4020	0.78
4021	0.58
4022	0.68
4023	0.30
4024	0.49
4025	0.24
4026	0.89
4027	0.44
4028	0.44
4029	0.73
4030	0.33
4031	1.28
4033	1.25
4034	1.40
4035	0.68
4036	2.48
4038	0.73
4039A	2.70
4040	0.58
4042	0.48
4043	0.42
4044	0.48
4049	0.38
4050	0.34
4051	0.68
4052	0.58
4053	0.58
4066	0.44
4068	0.24
4069	0.24
4070	0.24
4071	0.24
4072	0.24
4073	0.24
4075	0.24
4076	0.68
4077	0.24
4078	0.24
4081	0.24
4082	0.24
4085	0.58
4086	0.58
4089	1.22
4093	0.37
4094	0.70
4095	0.93

4096	0.98
4097	2.65
4098	0.78
4099	0.75
4161	0.96
4162	0.96
4163	0.96
4174	0.96
4175	1.00
4195	0.99
4501	0.38
4502	0.58
4503	0.38
4507	0.45
4508	1.28
4510	0.54
4511	0.54
4512	0.54
4514	1.10
4515	1.20
4516	0.60
4517	2.70
4518	0.48
4520	0.05
4521	1.10
4522	1.20
4526	0.58
4527	0.64
4528	0.68
4531	1.20
4532	0.64
4536	2.50

SERVICE AIDS

Switch Cleaner	1.18
Circuit Freezer	1.34
Foam Cleanser	1.16
Aero Klene	1.10
Plastic Seal	1.28
Excel Polish	1.12
Antistat Spray	1.18
Aero Duster	1.40
Super 40	1.82
Video Head Cleaner	1.06
Fire Extinguisher	3.06
Silicone Grease Aero	1.42
Ditto Tube	1.64
Heat Sink Compound	1.08
Solda Mop 0.12mm	0.74
Ditto 0.06mm	0.76

TERMINAL BLOCKS

2 amp 12 way	0.22
5 amp 12 way	0.24
15 amp 12 way	0.42
32 amp 12 way	0.88

RESISTORS – CARBON FILM 5%

¼W 1RO 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	5.75
¼W pack 5 each value E12 – 10R to 1M 305 pieces	3.35
½W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.95
½W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.75
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	15.00
2W pack 5 each value E6 – 10R to 2M2 317 pieces	18.50

RESISTORS – WIREWOUND. Generally 5%

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

ZENER DIODES

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

*Only available while stocks last

HV Disc Ceramic (†)

1kV 1.5nF 18p
8kV 10, 47, 56, 82, 100, 120, 150, 180 30p

ZENER DIODE PACK

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

Price £3.50 each.

TELEPHONE SPECIAL

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

NI-CAD CHARGER

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

Rechargeable Batteries

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

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

FUSES Prices per 10

20mm Quick Blow. 100, 125, 160, 200, 250, 315, 400, 500, 630, 800mA, 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A. **40p. 20mm Time Delay.** 100, 125, 160, 200mA **£1.80.** 250, 315, 400, 500, 630, 800mA. **£1.00.** 1, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3A **85p. 1" Mains.** 2, 3, 5, 7, 10, 13A **85p.**

REPLACEMENT TV MAINS 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
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

MULTISECTION ELECTROLYTICS

THORN	850	100+300+100+16/300V	1.80
	1400	150+100+100+100+150/320V	2.70
	1500	150+150+100/300V	2.00
	3000	1000/63V	0.74
	3500	175/400V+100+100/350V	2.56
	8000	400/350V	2.10
	8000/8500	2500+2500/63V	1.99
	8000	700/250V	2.15
		1000/70V	0.80
	9000	400/400V	3.00
Timer Amp		4700/25V	0.95
DECCA 10/30		400+400/350V	3.20
	1700	200+200+400/350V	3.75
GEC	2047	2048 2083 2084 2104	
		200+200+150+50/300V	2.50
		600/250V	1.85
ITT/KB		200+200+75+25/350V	2.90
		220/100V	1.95
PHILIPS	G8	600/300V	2.20
	G8 G9	600/300V	2.10
	G11	470/250V	1.80
	G9	2200/63V	1.25
EKCO	T148	125+200+100+32/275V	2.65
	691 Series	200+300/350V	2.50
		600/300V	2.20
RANK		300+300/300V	1.75
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CORRECTIONS

We seem to have been plagued by inadvertent errors in recent issues. Please note the following corrections:

(1) September issue, page 627, An Approach to Adding Teletext, Fig. 3. R11 should have been shown connected to the 12V rail, not the 5V rail.

(2) October issue, page 701, Line Selector Unit. R5 was omitted from the circuit (Fig. 2). It's connected between the emitter of Tr1 and chassis.

(3) October issue, page 684, The Lid off Microcomputers. In discussing corrupt link addresses it was stated that the line will be shown as a string of capital zeros. This should have said a string of capital Us.

(4) November issue, page 24, The Lid off Microcomputers Fig. 1. The polarity of the boost reservoir capacitor was shown incorrectly, i.e. reversed.

Can Technology be Sold?

Back in 1975 Philips and Mullard introduced the 20AX tube. Do you remember the 20AX girl? And the extensive advertising campaign that accompanied the launch of 20AX? We didn't get such a thing when 30AX came along, and we probably won't now that that 45AX (see Teletopics) is here. This raises an interesting question. Mullard obviously felt that it was worth running an advertising campaign for their advanced technology back in 1975, but come 1985 it's not considered to be worthwhile. Why?

Presumably Mullard no longer feel that the technology within a TV set is by way of being a sales feature. This despite the fact that 45AX is noticeably different at a glance. There are of course other flat, square tubes, and no setmaker is going to be without models fitted with such tubes in his range. The new look may well be an important consideration when someone decides to buy a new set. But how decisive will it be? And will it initiate a surge of sales as customers feel that they must have the latest technology in their homes?

There are of course those who must have the newest and latest. Trendsetters they're called. But by and large this is not the way in which the British public goes about making its buying decisions. You'd almost think that TV is not high technology at all: it tends to be regarded and sold just like any other item, say cans of beans, with the emphasis always very much on price. It was Sir Jack Cohen, founder of Tesco, who summed up this sales approach with the immortal words "pile 'em high and sell 'em cheap". This has indeed worked well for many retailers of domestic electronics goods. But it has added to the public's tendency to regard TV as a sort of background item – something that's just there, switched on without a thought as to the technological wonders that lie behind the switch. True, it may have remote control, or teletext, as obviously advanced features. But so long as Coronation Street etc. come on at the appropriate times does anyone care all that much?

Has the industry lost out to some extent in this respect? The fact is of course that TV chassis are indeed much of a muchness. Some may be particularly well laid out, others may have some quirky bits of circuitry, but such things make negligible difference to what's seen in the average living room. More important, in terms of reliable long-term performance, is component specification – generous ratings and care over heat considerations. But these don't show up initially and can hardly be demonstrated in the showroom. Inside the set there'll be a tuner and tube that's common to any number of makes and models and a selection of i.c.s that probably owes more to the time at which the design was finalised than anything else. Apart from the optional extras one telly is much like any other and the public seems to realise this.

One factor that's led to a certain amount of discussion in recent times is the sales environment. Stacking the brown and white goods up in great big displays hardly contributes to an impression of technical excellence. Perhaps the camera shop – one thinks of Dixons of course – with all its gadgetry is a more sympathetic environment in which to emphasize the technological aspects of TV. That may well be, and perhaps the up-market sets with all the trimmings – satellite ready and so on – could more easily be plugged in such a setting. But the fact is that the shop with the technological look still has to compete with the shop that stacks the TVs next to the washing machines – and Dixons are as price competitive as anyone else.

Shop aura is indeed a strange thing. Why not put the TV sets next to the fridges and freezers? After all you go to an electrical shop to buy electrical goods, and to make a TV set or a microwave oven work you plug it into the mains. But what a difference when you go into a large store and find the TVs discreetly displayed on the first floor next to the pianos while the dishwashers and vacuum cleaners are relegated to the basement! Psychology there: the TV set is to sit in the living room while the tumble drier resides in the kitchen. Which is all very well but hardly applicable to the high street shops competing hotly with each other. There are also the back street shops where the TV sets nestle with bikes and batteries (well sometimes, anyway!) – the sets are the same though you're more likely to be given the offer of a secondhand one.

Advertising that emphasizes the technological aspect of television is not entirely lacking. ITT for example have made much of their digital TV chassis, while others are putting the emphasis on satellite reception. Is it too late to try to sell TV as high technology? To encourage the public to see TV in the same light as radar and avionics, with which TV does of course have links? I'd say that it would be hard indeed to change the ingrained habits of the British public and to give TV a new image. TV is likely to retain for the foreseeable future its rather anonymous image as something you buy cheaply, plug in and forget.

Might UK setmakers have done better to have dwelt on TV technology, as for example was once common in Germany? The overriding factor here is the power of the large retailers – particularly since the ending of retail price maintenance many years ago now. In most UK markets it's the large retail organisations that call the tune and set the scene – Sir Jack and his opposite numbers in other fields. The emphasis here is on turnover rather than the finer features of the goods. This is something we have to live with – and something that's been of great benefit to the public. Unfortunately it doesn't exactly encourage a sales pitch based on emphasizing high technology. Even if the emphasis could be shifted one wonders whether the public would respond: it seems to take technology for granted today.

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Hugh MacMullen, Brian Renforth, Steve Illidge and Paul Hardy

Körting Mariner PC1 (10 Chassis)

These colour portables seem to have an appetite for TDA1170S field timebase chips. This one had burnt out its tripler as well! On powering up via the variac we found that the self-oscillating chopper power supply didn't begin to regulate with a 110V input as it should – in fact it wasn't dropping the mains voltage at all. This turned out to be due to D622 (BA157) being open-circuit. **P.B.**

ITT CVC1210/CVC1215 Chassis

For a dead set with a buzzing power supply, check R744 (145V feed to the line driver transformer) for being open-circuit. It should be replaced with a modified 1kΩ type (3154-09·05) as it's a safety component. You'll probably also find that R503 in the line scan circuit has been overheating – ITT recommend that this resistor be removed. **P.B.**

ITT CVC20/CVC30 Series

With reference to Ray Dunleavy's letter (October issue, we've also had the problem of blown field output transistors every month or so with the CVC20 chassis due to C21, and the blank raster problem with the CVC30 chassis due to R28 going open-circuit. Here are a couple more tips on the CVC30 chassis. Trips from cold, the fault clearing temporarily if the chassis is moved – replace the line hold control. Intermittent top foldover with R2021 on the field timebase module burning out – D10 (BY133) in the field output stage is going open-circuit intermittently. **P.B.**

National Panasonic TC42GA

The whole left-hand half of the picture was almost blacked out, though all voltages were correct and with a very bright scene the picture looked almost right. We discovered that there was ripple on the 220V line that supplies the colour-difference output stages, due to the relevant reservoir capacitor C514 (4·7μF) being completely open-circuit – the supply is derived from the line driver transformer. **H.MacM.**

Panasonic U2 Chassis

There was complete loss of raster after three minutes, though the e.h.t. and all relevant voltages were correct. Although there was no luminance or chrominance a locked raster could be seen by advancing one of the first anode presets. We also noticed, before the picture disappeared, that there was rather severe top foldover. In view of the latter symptom the TDA1106 field timebase i.c. was replaced. This provided a complete cure – as a safety measure, the chip blanks the screen in the event of field collapse. **H.MacM.**

Decca 100 Chassis

This 26in. set came in dead. Although the 3·15A mains fuse was o.k. the e.h.t. overwinding on the line output transformer was burnt, the tripler was no good and the BU208A line output transistor was short-circuit. After replacing all these things a good picture was obtained – but with a quarter inch wide rope effect from the top to the bottom of the screen about two inches from the right-hand side. The plugs and sockets on the line output panel were, as usual, burnt but after wiring over and resoldering these the rope effect was still present. Scope checks then showed that everything was in order apart from an unusual kink in the waveform at the collector of the line driver transistor Tr304 (BF355). Replacing this transistor cured the effect. **H.MacM.**

Rank A816 Chassis

The problem with one of these sets (a 24in. Bush TV311) was lack of height with foldover – the picture occupied only one third of the screen. As the 23V supply to the field timebase was correct the d.c. coupled driver/output transistors 3VT11-14 were checked. It turned out that one of the output transistors, 3VT13 (BC287), was open-circuit collector-to-emitter.

Another of these sets came in with the no-results symptom due to 3R86 (150Ω) in the l.t. feed to the SN76533N sync separator/line generator i.c. being open-circuit. It's best to use a replacement rated at 1W.

In passing, though Rank boasted about this all-transistor chassis when it was introduced in the early seventies I think they'd have done better to stick to their hybrid chassis. **B.R.**

Decca 80 Series Chassis

The complaint with this set was that the picture suddenly went, leaving a thin vertical line at the centre of the screen. It's in fact a common fault with this chassis and can be caused by poor connections around the linearity or width coils or at the plugs on the line output panel. The scan correction capacitor C403 can produce the same symptom when open-circuit. Due to possible damage to the line output transformer and/or tripler it's essential to check for poor connections in this area whenever one of these sets comes in for service. The problem with this particular set turned out to be a bad joint at the linearity coil L401 – in fact it was virtually unsoldered from the panel. Resoldering restored a full raster. **B.R.**

Hitachi NP6C Chassis

We've had a number of these sets with no sound or vision, or intermittent sound and vision. The problem is due to dry-joints on the high-wattage carbon resistors mounted on stems. Resoldering R933, R918, R928, R935 and especially R924 normally provides a cure. **S.I.**

Panasonic U4 Chassis

One of these sets had no sound or picture, just a plain white raster. The fault was traced to peaking coil L102 on board B – it was open-circuit.

A fault that's occurred several times with this chassis is a dry-joint at pin 5 of socket E6 (video input to the power supply/timebase panel). The symptoms are no sound and no sync.

The problem with a teletext version (Model TX-C21) was that after approximately a quarter of an hour the screen would go bright blue with flyback lines, then go off completely. The fault was traced to Q5010 (2SD637-QR) on the teletext panel. **S.I.**

Sony KV1810UB

Engineers must by now be quite familiar with the causes of GCS failure in these sets. I've found however that C605 (22μF, 400V) on board PR can be responsible. It's well worth removing this capacitor to check its condition, i.e. look for leaking electrolyte. If you're at all suspicious, replace it. **P.H.**

Philips KT3 Chassis (Remote Control)

This colour portable would "change channel" – unfortunately the customer's description of the fault turned out to be less than adequate. After testing for a while it became apparent that with any even-numbered channel selected the set would eventually change to the odd-numbered channel immediately below, e.g. from channel 12 to channel 11. The channel number display at the front of the set wouldn't change however. This set had a TMS1000 microcomputer i.c. in the remote control department. The channel display and channel change circuits are driven by different ports in the i.c. Since the display didn't change in the fault condition the microcomputer chip wasn't necessarily to blame – in fact the fault was due to IC70 (40174). The least significant bit from IC70 was intermittently going to zero when it should have been a one – the channel change i.c.s then interpreted this as a channel change command. Fortunately the i.c. lives in a socket and is easy to change. **P.H.**

Philips G9 Chassis

This set turned out to be a disaster – but you don't always know that to start with! The original fault was quickly cured by replacing C5138 (2,200μF, 63V) on the line scan panel and R3141 (39Ω) on the signals panel – two common offenders. The resulting picture left much to be desired however – distinctly tubey! A quick check revealed that there was only 200V instead of over 1kV at the first anode controls. The 1kV supply reservoir capacitor C5157 was replaced but this made no difference. So N1, the 1kV supply connector, was disconnected to check whether the controls were loading the supply in some way. The resulting bang and flash was something to behold! Fuse FS5141, zener diode D8017 on the power supply panel and the field output transistors had to be replaced. With N1 reconnected the set worked but we still had low first anode voltages. Changing the tripler restored the supply. But the tripler wasn't faulty – someone had fitted the type used in the G8 chassis. Finally all three RGB output transistors had to be replaced as they were leaky (presumably due to overwork as a result of the low first anode supply). After resetting the video levels, the preset brightness and beam limiter controls a presentable picture was obtained. But what a job! Not having a clipper diode in it the G8's tripler can't provide a proper first anode supply for the G9. **P.H.**

The Story of G9AED

Andrew Emmerson, G8PTH

Lest we forget, 1985 saw the thirtieth anniversary of the start of commercial TV broadcasting in the UK. It's also thirty years since the conception of G9AED, a callsign once very familiar to TV dealers and enthusiasts. G9AED was the so-called pilot station for the new Band III network. It provided valuable help in getting the new services going successfully.

G9AED consisted of a mobile TV transmitter in a rather ungainly trailer which, along with an 85ft. mast, was towed to the sites of the new transmitters before they came on air. By radiating a test signal from the same site, albeit from a smaller aerial, dealers were able to demonstrate the new Band III sets and aerial riggers could install aerials ready for the start of the new programmes. This enterprising effort was provided not by the ITA (as it then was) but by Belling and Lee Ltd., who were then major manufacturers of TV aerials. A "Belling-Lee" mobile research unit used the signal for plotting coverage and for propagation tests. The ITA recognised the value of the service and during the following summer purchased the equipment from Belling and Lee.

The transmitter operated in the London area for six and a half months prior to the ITA opening on September 22nd, enabling over a quarter of a million aerials to be erected and aligned for the best signal and minimum ghosting. Belling and Lee considered the operation to be a worthwhile investment even though it helped their competitors as much as it did themselves. It provided Britain's first ever TV commercial, a caption telling viewers that new high-power Band III transmissions would start soon – make sure your receiver and aerial are ready!

The 1kW transmissions were on the same channel as the regular ITA programmes that were to follow. They lasted for forty hours a week, from 9.30-12.30 a.m., 2-4.30 p.m. and 7.30-8.30 p.m. on weekdays and from 10-1 p.m. on Saturdays – but not on Sundays and Bank Holidays. A sound signal was generated and pictures were produced by two monoscope cameras. One was the "new transmissions" message and the other a special test card. This included a wavy line and contrasting panels with calibration in miles. The idea was that any ghost images caused by multipath reception would show up on the panels: the distance of the obstruction producing the reflection could then be estimated from the mile-marked scale. Contemporary articles show that ghosting was considered to be a major threat to good Band III reception. The test card also gave the sound and vision carrier frequencies being used and a national grid reference for the transmitter site.

Belling and Lee were proud of the fact that their mobile transmitter had been built in less than three months "in the true amateur spirit". It was allocated the special callsign G9AED, which they said stood for Aerial Development. It was in fact a normal G9 test and development call: as such calls are issued in strict sequence it was a matter of luck that the allocated letters made sense!

The amateur spirit was also reflected in the QSL cards that were issued for reception reports. Many of the reports probably came from amateurs, for although the transmissions were intended for the trade many TV enthusiasts used them for testing home-brew Band III converters – several designs had been published.

G9AED's test transmissions enabled Belling and Lee to publish maps showing where locked pictures had been received. It was pointed out that in view of the low height of the transmitting aerial and the low output power reception of the ITA transmissions when they arrived could only be better.

Once commercial programme transmissions started at a site G9AED was moved to the next ITA transmitter site ready to perform the same role. Its usefulness would have been much reduced once the main stations had come into operation, and I've not been able to trace its final resting place. Its work was invaluable however and its picture is to be seen in several articles published in *Television* during 1955 and 1956.

Books

A Hardware Guide for the BBC Microcomputer by A.D. Derrick, B.Sc., D.S. Harding, B.Sc., S.D. Middleton and M.P. Smith, published by Wise-Owl Publications, Hull Innovation Centre, Guildhall Road, Hull, North Humberside HU1 1HJ at £13·45 including post and packing.

The electronics-orientated BBC/Acorn microcomputer user should find this a worthwhile publication to have available for reference. It comes with a loose-leaf circuit diagram and a complete circuit description. A study of the two leaves one in no doubt as to what does what in the machine.

In their preface the authors point out that the machine was originally designed by the BBC as an educational tool which can be expanded into a very sophisticated computer with powers rivalling those of present-day minicomputers. The guide provides information on many of the modifications, upgrades and circuit changes that can be carried out. It includes a comprehensive survey of the link modification system built into the machine and many hints and tips. An appendix reproduces data sheets for the main i.c.s used in the microcomputer – essential information for getting to grips with the detailed operation of the machine.

I found the book clearly laid out and easy to follow. The BBC machine is a lot more complicated than many of the microcomputers that arrived on the scene during the recent 'micro boom': this guide will enable the reader to get the maximum from the machine and will help those with servicing experience to deal with fault conditions – though access to the official diagnostic test equipment, a Progressive Establishment Tester (PET) or Final Inspection Tester (FIT), might be required to deal with the more obscure problems. **J.A.R.**

Micro and Television Projects by Trevor Brown, published by BATC Publications, 14 Lilac Avenue, Leicester LE5 1FN at £3 plus 0·50p post and packing.

This book provides anyone thinking of setting up an ATV station with a great deal of practical information based on up-to-date technology. It's also worthwhile for those already active in the ATV field since it devotes much space to adapting and using a domestic microcomputer for TV purposes. Most of the information on microcomputer applications – including simple programs – relates to the Sinclair Spectrum, which is fair enough – we found the basic description of how this machine works extremely clear and to the point.

The microcomputer applications are quite sophisticated, but are mostly easy to build since PCBs are in many cases available from the BATC. Microcomputer based projects include a user port, TV repeater arrangement, EPROM programmer and a picture freezer. A project called Teletron consists of a microcontroller (this differs from a microcomputer in using mainly PROM instead of RAM in the memory) which can be used for such purposes as a slow-scan test card or teletext generator – which brings us to a new version of teletext called Hamtext!

In all this is a very interesting book that's certainly value for money. Our only minor quibbles are about the rather eccentric diagram layout in chapter 4 and the fact that Fig. 2 on page 48 doesn't show quite all that the text suggests. In addition to the microcomputer based projects there's a sync and test pattern generator using the ZNA234 chip, an electronic caption writer, a simple video source switcher, a test card generator and both PAL and SECAM coders. **J.A.R.**

Newnes Questions and Answers manuals, (a) Radio, (b) Television, both by Eugene Trundle, published by Newnes Technical Books (Borough Green, Sevenoaks, Kent TN15 8PH) at £2·95 each.

These books are intended as introductions to their subjects, taking the reader in easy to follow question and answer style from rock-bottom basics (what is an electron? in the case of the radio book) to quite sophisticated aspects of the subjects. It's amazing just how much can be got into a small book given a bit of careful planning. One strong point about both these books is that they are thoroughly up to date, bringing in CB radio in the case of the radio book and teletext, MAC and computer control in the television book. As a quick test we decided to ask the TV book how much memory was required to store a TV field – and it told us! These books are obviously not for those already clued up in the subjects, but can be recommended for anyone wishing to make a start. **J.A.R.**

Colour and Mono Television, Vol. 2 by K. J. Bohlman, published by Dickson Price Publishers Ltd., PO Box 88, Gravesend, Kent DA13 9PR at £8·95.

Volume 1, which we've not seen, dealt with tuners, i.f. stages, demodulation and the sound and video sections of monochrome and colour receivers. The present volume covers sync separation, timebases, display tubes, convergence and raster correction circuitry, power supplies, vision a.g.c., beam limiting and flyback suppression. It's quite a lot of book (over 225 pages) for the money and covers the subject matter thoroughly and clearly, with the emphasis on practical aspects – circuitry, current requirements, etc. We couldn't fault the book in any way in what it covers but were a little disappointed to find it not quite as up to date as one might expect: there's quite a lot on valve circuits and it would seem to cover the techniques used roughly up to the era of chassis such as the Philips G11 and Thorn 9000. **J.A.R.**

Field Timebase Circuit Survey

Part 3: IC Field Timebases

S. W. Amos and E. Trundle

The previous two parts in this series illustrated the development of field timebases and showed how the need for increased output power and greater efficiency led to circuit designs incorporating mid-point voltage stabilisation, quiescent current stabilisation and so on. As a result, the original single valve output stage had by the 1970s developed into a complex driver/output stage arrangement using some six transistors and several diodes. It was inevitable that i.c.s would come to take over the various field timebase operations. During the last decade they've made steady progress in this area, to the point where a single chip with a modest heatsink can on its own drive the yoke of a large-screen, wide-angle colour tube. In this concluding instalment we'll examine the principles employed in i.c. field timebases and trace their evolution to date.

It's important to bear in mind that due to the frequencies involved an i.c. used for field deflection will have no internal reactive or frequency-determining elements. Thus waveshaping and timing must be provided by external components. Apart from the scan coils, these consist of resistive and capacitive elements. Internally a linear i.c. generally consists of a number of direct-coupled transistors plus some diodes and fixed resistors. For field deflection the transistors used are bipolar pnp and npn types arranged in any of the three possible basic transistor configurations (common-emitter/base/collector): with one notable exception, the output stages are of the class B type. The internal diodes may be conventional or zener types, used for voltage stabilisation, temperature compensation and voltage-dropping as well as in their basic role as unidirectional devices. As we shall see, the first circuits using i.c.s had to be adapted to the device itself: but, as dedicated i.c.s became available, the cart was put firmly behind the horse. As design and fabrication techniques improved, such functions as scan-correction, flyback boosting, thermal and output stage protection, flyback blanking and c.r.t. burn protection came to be incorporated.

Contemporary field timebase i.c.s fall into two basic categories: those that incorporate a sawtooth generator and thus form a complete timebase, and those that act as a "power booster", intended for use with a separate timebase processor chip that performs the scan timing and waveform generating actions.

Use of Audio ICs

The first i.c.s that came to be used in field deflection circuits were basically low-power, class B chips intended for audio output applications. The similarity between audio and field output stages was touched on in Part 1 and designers of small-screen monochrome portables were quick to see the advantages of adopting these low-cost devices to drive the field scan coils. Typical of this approach was the use of a 14-pin i.c. capable of providing a 2·5W output from a 10·8V supply to drive a 7·5Ω, 10mH yoke. With scanning currents of less than about 800mA peak-to-peak, i.e. for use with a 90° small-screen tube with a 20mm neck, the i.c. required no heatsink.

Fig. 1 shows an early-seventies design along these lines. The device used is a TBA641BX1 with an output capability of 4·5W and a built-in heatsink. Capacitor C1 is charged via R1 and the height control R2 from a 24V boost supply derived from the line output stage. The field oscillator acts as a switch to discharge C1 via D1. A linear ramp with a period of 20ms is thus presented to the i.c.'s non-inverting input (pin 7). The centre point of the chip's class B output stage is connected to pin 1, which drives the scan coils L1/2 via the large coupling capacitor C7. The bootstrap arrangement formed by C6 and R10 increases the output voltage swing and hence the maximum current flowing in the scan coils.

The current sampling resistor R9 (0·5Ω) develops across it a sawtooth voltage proportional to the scan current. Feedback from this point is taken to the i.c.'s inverting input (pin 8) via R8 and C3 which forms the series element of a differentiator. As the scan progresses, the voltage drop across C3 determines the curvature of the output current ramp: the smaller C3's value, the greater the ramp's curvature. There's also voltage feedback via the integrating network R4/R3/C2. The parabolic waveform developed across C2 forms the "grounding point" for C1, and as a result a variable curvature (governed by the setting of the linearity control R3) is given to the ramp applied to pin 7 of the i.c.

The network C5/R7, connected to pin 6 of the i.c, is known as a Bucherot cell: it ensures amplifier stability by curtailing the r.f. response. Such r.f. damping circuits are often found "holding down" i.c. amplifiers which have a high gain up to the r.f. spectrum.

Flyback Pulse Isolation

With some audio i.c.s there's a danger that the combination of the yoke's inductance and the supply voltage could produce a flyback pulse (across the scan coils) too high for the i.c.'s health and safety – the i.c. would have been designed to operate with the virtually resistive load presented by a moving-coil loudspeaker. Thus with a yoke inductance greater than about 10mH it was necessary to devise a means of diverting the flyback pulse away from

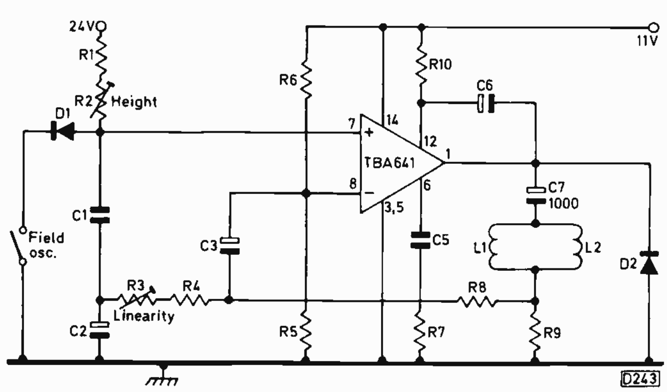


Fig. 1: Audio i.c. used as a field scan amplifier (Thorn 1612 chassis dating from about 1973).

the i.c. In Fig. 1 D2 clamps the negative-going pulse, preventing any excursion below chassis potential since this could cause breakdown or excessive dissipation in the i.c.

Fig. 2 shows a more elaborate approach to the problem of buffering the i.c.'s output stage during the flyback. As with the previous circuit, the chip's output voltage ramp (at pin 1) is positive-going during the forward scan, returning suddenly to chassis potential to initiate the flyback. In this circuit Tr1 and D1 are interposed between the i.c.'s output pin and the scan-coil load. During the first (negative) half of the forward scan period the scan current flows via D1: during the second (positive) half of the forward scan period the current flows via Tr1. When the flyback is inititiated by pin 1 of the i.c. falling to zero volts, the pnp transistor Tr1 is cut off. L1/2 then form a resonant circuit with C2, the negative-going flyback voltage pulse reverse biasing D1 and Tr1's collector-base junction. The i.c. is in this way isolated from the flyback action. Further oscillatory action is damped when D1 conducts again at the start of the next forward scanning stroke. In other respects this design is virtually the same as that shown in Fig. 1, with C3 and Bucherot cell C4/R4 to prevent r.f. instability.

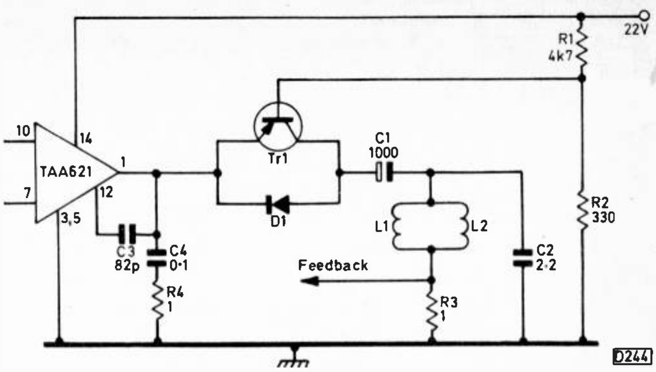


Fig. 2: Audio i.c. with flyback pulse isolating switch.

Special-purpose ICs

The first dedicated field timebase i.c.s had output stages and feedback arrangements very similar to those already described. Again the intended application was the small-screen monochrome portable, and the overriding aim was to reduce the peripheral component count. Fig. 3 shows such a circuit, with just a handful of non-critical passive components external to the i.c. The composite sync signal undergoes double integration by R1/C1/R2/C2 to separate the field sync pulses which are fed to the i.c. via C3. The time-constant network VR1/R3/C4 determines the oscillator timing, the ramp forming components being R5/VR2/ C6/C7. The sawtooth waveform generated at pin 4 is coupled by C5 to the non-inverting input of the class B power amplifier at pin 7. C8 couples the output to the yoke, which is returned to the positive supply line via the sampling resistor R7. C9 is a bootstrap capacitor and a.c. feedback is applied to the amplifier's inverting input via C10. The linearity control VR3 forms a variable integrator with R6 and C7 to superimpose an opposite-polarity integral on the input ramp waveform, slowing down the early part of the forward scan and increasing its rate-of-change towards the end.

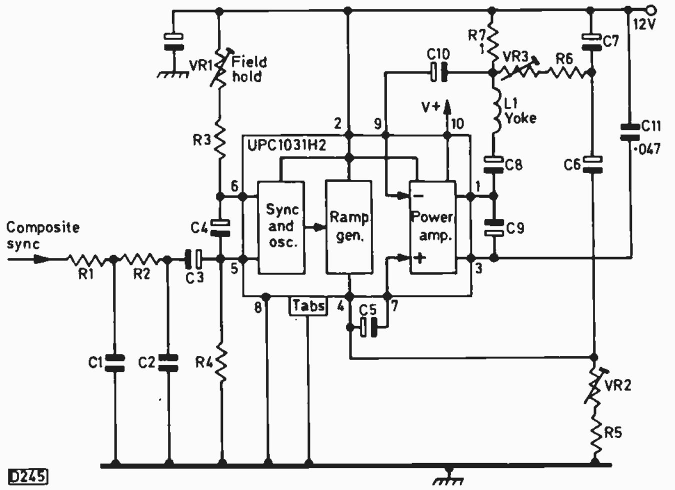


Fig. 3: Complete field timebase in a single NEC i.c. The voltage applied to pin 10 defines the flyback clamping level: the flyback time, depending on yoke characteristics, can be adjusted by varying this voltage.

Enter the Flyback Generator

We have to use more bulky yokes with larger screen sets, the inductance of the scan coils increasing proportionally. Consider a yoke whose field coils have a resistance of 10Ω and an inductance of 20mH. During the forward scan the current rate-of-change is relatively slow and the load can be regarded as resistive. With a typical 2A peak-to-peak scan current a supply voltage of 20V is suitable. During the flyback however a complete current reversal must occur in the yoke within about 1ms. The yoke's time-constant is $t = L/R = 0{\cdot}02/10 = 2$ms, representing the time required for the current to reach 63 per cent of its final value when a d.c. voltage is suddenly applied. The "aiming current" here needs to be about 4A for the flyback to be completed in 1ms, and this implies (bearing in mind the yoke's 10Ω resistance) a supply voltage of around 40V. If we operate the output stage from a 40V supply however the difference between this and the 20V level suited to the forward scan must, during the first half of the forward scan, be absorbed by the upper transistor of the class B output pair (see Fig. 4).

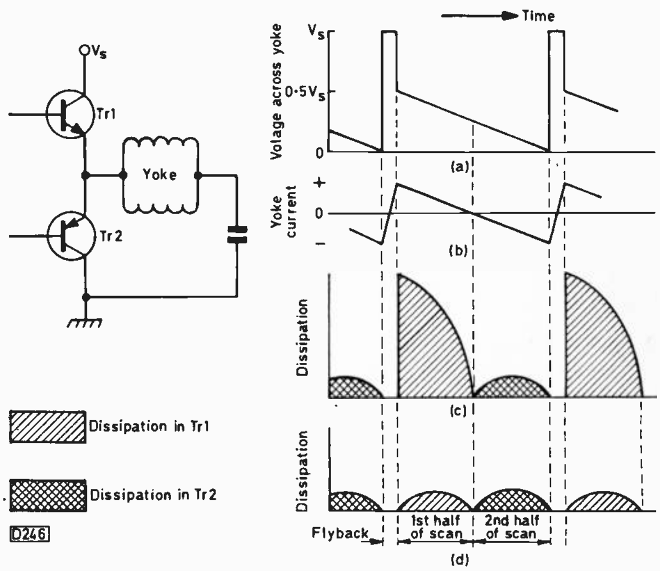


Fig. 4: Power dissipation in a class B field output stage: (a) shows the voltage waveform across the scan coils and (b) the current flowing in them. The shaded areas in (c) indicate the energy dissipation in the output transistors Tr1/Tr2, with Tr1 absorbing the difference between the applied and the required voltage for much of the time. The low and equally-distributed dissipation when a flyback booster is used is shown at (d).

The "flyback generator", or "flyback booster", was developed to overcome this problem. Fig. 5 shows the principle of operation. During the 19ms forward scan period the i.c.'s output stage is supplied from the 20V line via D1. C1 charges to 20V via D1 and R1. At the end of the forward scan the voltage at pin 4 of the i.c. will have fallen to about 2·7V, the saturation voltage of Tr2. To initiate the flyback Tr2 is abruptly turned off while Tr1 simultaneously turns on. When, as a result, the voltage at pin 4 rises to 20V the flyback generator comes into operation. This acts as a switch, linking pins 2 and 3 with the result that +20V appears at the negative plate of C1. Since C1 is too large to change its charge rapidly its stored voltage is added to the newly present 20V so that the cathode of D1 is at 40V. Thus D1 switches off and the output stage supply is doubled. This occurs only during the flyback period and is what's required to smartly reverse the current in the scan coils – and the direction of the magnetic field they produce. C1 plainly loses charge during its 1ms stint of duty: this is replenished during the following forward scan period. The waveforms shown in Fig. 5 further illustrate the circuit's operation. In theory the use of this technique should reduce the power dissipation in the i.c. by 80 per cent: in practice a very worthwhile reduction of about 65 per cent is achieved.

The flyback booster technique was not unknown in discrete transistor field output stage circuits, being used for example in the Bang and Olufsen 3400 series chassis to drive the field deflection coils of a 110° delta-gun tube. Not all modern TV sets call for the use of this principle: much depends on the *L/R* ratio of the scan coils, the available supply voltage and the deflection current required. This latter is in turn related to the diameter of the tube's neck, the deflection angle and the e.h.t. voltage – a high e.h.t. voltage "stiffens" the electron beam.

Direct Yoke Drive

The field section of the 30AX deflection yoke has a resistance of 6·2Ω, an inductance of 10mH and requires a scan current of 2·1A peak-to-peak. This gives a time-constant of 0·01/6·2 = 1·2ms, which is within the capability of an i.c. without a special flyback booster circuit. Fig. 6 shows the arrangement of the Mullard TDA2652 which is designed to drive the 30AX yoke directly. Two techniques are used here to minimise the power dissipation in the i.c. First, the parallel combination of C2, D1 in series with the supply to the i.c. provides a tuned flyback period which increases the flyback voltage and enables a lower supply voltage to be used. Secondly, due to the relatively low value of the supply decoupling capacitor C1 (220μF) and the high value of the filter resistor R1 (22Ω) a large field-rate ripple is present at the anode of D1. This reduces the average voltage supplied to the i.c., and hence its dissipation, without significantly affecting the voltage present during the flyback. It's interesting to compare the dissipation and supply voltage with this i.c. (4·4W and 35V respectively) with the relevant figures for a similar chip equipped with a flyback booster used to drive the same yoke (4W and 26V).

Power Boosting

It's only comparatively recently that i.c.s capable of driving large-screen, wide-angle tubes unaided have been developed. For some years it was necessary to add a discrete component class B (or occasionally class A, using

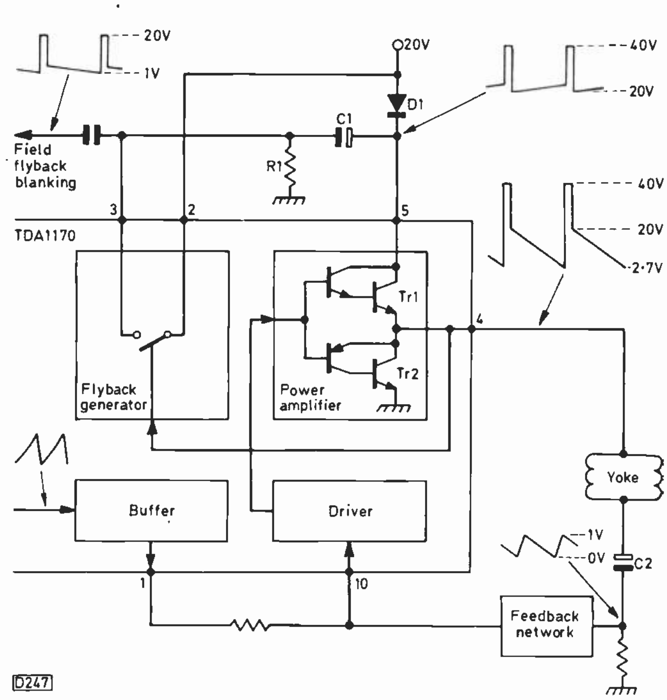


Fig. 5: Flyback booster principle.

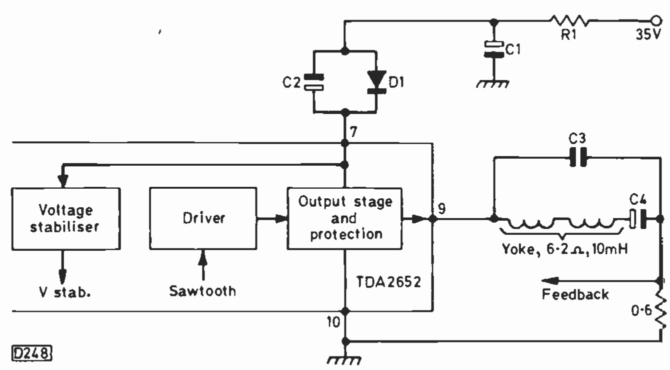


Fig. 6: High efficiency without a booster. C3 has counterparts in other circuits: it shunts away line flyback pulses, preventing these upsetting the interlacing via the feedback circuit.

two npn transistors) output stage to act as a current amplifier, especially where low-efficiency yokes like the early PIL toroidal types were used. Devices such as the TDA1170, TDA1270 and TDA1044 were used in this way and Fig. 7 shows a typical arrangement. The i.c. produces a negative-going ramp at its output pin 4. At the beginning of the forward scan Tr1 turns on, its emitter current flowing via R7, C5 and the scan coils. The first part of the forward scan is produced in this way. At the half-way point there's a period during which neither Tr1 nor Tr2 is conductive – their bases are directly coupled and there's no quiescent current. Since the base-emitter threshold of each output transistor is 0·6V, the "gap" in their conduction lasts for about 1·2V of the output ramp during the centre section of the scan. During this short period the yoke's power requirement is very small – it's passing through the zero current point: the small current required is supplied by the i.c. via R6. Crossover distortion is thus minimised, with the aid of feedback to pins 10 and 11 of the i.c. Tr2 takes control of the scan current during the second half of the forward scan.

Another way of looking at this arrangement is as a "current-dumping" circuit, a system much used in audio power amplifiers. The i.c. can be regarded as driving the yoke directly (via R6) for small signal currents, with the current-dumping transistors Tr1 and Tr2 assisting for large signal currents.

There's no flyback booster in the arrangement shown in Fig. 7: the circuit drives a 20AX yoke from a 35V supply. This implies that the dissipation in Tr1 is large (refer back to Fig. 4). In later circuit designs flyback booster equipped chips were used: Fig. 8(a) shows a circuit using the technique previously described; in Fig. 8(b) an emitter-follower transistor (Tr1) is added.

HF Damping

Earlier (see Fig. 1) we encountered the Bucheron cell, an *RC* network used to limit an amplifier's r.f. gain. The *RC* combination R1/C1 connected between pins 4 and 11 of the TDA1170 i.c. shown in Fig. 9 provides a frequency-selective negative feedback path around the output stage, introducing an h.f. roll-off to prevent parasitic r.f. oscillation. Since the i.c.'s scan-coil load is inductive its impedance rises with frequency: this too could lead to instability where the amplifier has significant h.f. gain. The Zobel network R3/C3 is included to prevent this: it has the effect of equalising the load impedance to ensure stable operation at all frequencies.

Waveform Shaping

Some more sophisticated i.c.s incorporate special circuits over and above the feedback/linearity shaping arrangements already described. In Part 2 we saw how scan correction was provided in the sawtooth generating section of a discrete transistor field timebase. Fig. 10 shows how the same function was achieved in i.c. technology in a mid-seventies design (the TDA1044) that also incorporated a flyback booster and a 2A output stage.

Before we embark on a description of some of this i.c.'s internal circuitry a couple of terms require explanation. A *constant-current source* is one that drives a fixed, preset current through a load whose resistance is subject to change. It usually consists of a transistor with a fixed emitter resistor and a stabilised base voltage: the collector current depends on these factors and not on the load resistance – provided the latter is not so high that it limits the current available from the supply. A constant charging current provides a perfectly linear voltage ramp across a capacitor. An *image circuit* is one that provides a current (or voltage) mirrored about a V or I axis. Thus the image of a current flowing to the supply line is an equal current flowing via the earth line. Similarly the image of a negative voltage with respect to the supply line voltage is an equal voltage above ground potential.

In Fig. 10 R9/R10/Tr12 provide a fixed, temperature-compensated bias for the base of Tr9: the value of its emitter resistor Rt, which provides timing, thus determines Tr9's constant collector current. Charging capacitor Ct is in effect charged by Tr9's collector current, but to avoid the need to refer it to the supply voltage the image circuit Tr10/11/8 is used to generate across Ct a ramp that rises from chassis potential. When the voltage across Ct reaches a certain level a threshold detector in the i.c. switches Tr13 on, rapidly discharging Ct to initiate the flyback. Thus a single capacitor is used to set the field oscillator frequency and to generate the ramp, a useful feature that obviates the need for the separate oscillator timing and ramp generating capacitors used in earlier designs. The sawtooth generated across Ct is buffered by the Darlington pair Tr6/7 to provide a low-impedance source for general use within the chip.

The scan-correction operation is carried out by the circuitry to the left. The sawtooth waveform is applied to the bases of the npn transistor Tr1 and the pnp transistor Tr2. Tr1 conducts only during the second half of the forward scan while Tr2 conducts only during the first half of the scan. The point at which they start to conduct depends on their emitter bias, i.e. the voltage at pin 1 of the i.c.: their degree of conduction thereafter depends on the current applied, i.e. the value of the series resistor Rkr. Tr2's collector current is imaged by Tr3 and Tr4 and added to Tr1's collector current before being applied to the tap on R6/7, the constant-current image transistor Tr8's emitter resistor. Conduction of either Tr1 or Tr2 thus reduces Ct's charging current, with the effect that the ramp is flattened. By varying the voltage at pin 1 and the value of the series resistor we can introduce the degree of scan-correction required for different types of picture tube.

For all its sophistication the TDA1044, being a mass-produced device, is not expensive. It has been used in sets ranging from low-cost monochrome portables, e.g. the Bush BM6530, to full-specification colour sets, e.g. the Thorn TX10 chassis (in conjunction with an output power booster).

Before we leave this chip a note on its noise-immunity circuit. A hold-off circuit is incorporated to prevent premature triggering of the flyback by noise or interference spikes. This uses a level detector to examine the amplitude of the field ramp, whose period in the free-running state is set at about 21ms by Ct/Rt. Only when the ramp is nearing completion does the level detector open the sync enabling gate to allow the sync pulse through to the base of Tr13.

Class D Operation

One theme in the evolution of field timebase design has been power consumption. Very early circuits operated under class A conditions, with more energy dissipated in the amplifier than in the load. The move to class B circuits made for greater efficiency, but still with considerable power loss in the output devices. Except in a battery-operated set the odd few watts absorbed by the field output stage are not significant in terms of running costs, but the reliability of electronic equipment depends very much on its operating temperature, both locally (at semiconductor junctions) and generally, in terms of the temperature within the cabinet and the extremes of the temperature cycling to which the electronic and mechanical components are subjected. It's well known that class D operation, in which the active devices have only two operating states, on and off, is theoretically capable of very high efficiency. This principle was used by Mullard in a field timebase i.c. released in 1976 – the TDA2600. It represented a radical departure from conventional practice, and was used in the Pye/Philips G11 chassis to drive the yoke of a 20AX tube.

If we feed a square-wave input to an integrating circuit the energy available at the output will be proportional to the ratio of the square wave's on to off times (the mark-space ratio). If, over the 20ms field scan period, we apply a square wave of steadily increasing mark-space ratio to an integrator and scan yoke the current flowing in the scan-coil load will increase in a linear manner – see waveforms (d) and (f) in Fig. 11, where an *LC* integrator is shown. At the end of the forward scan the input

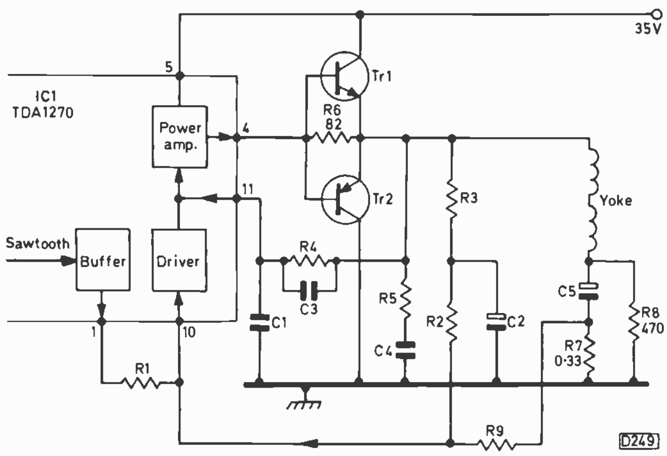


Fig. 7: *Use of a boost circuit where the deflection yoke has a high energy requirement.*

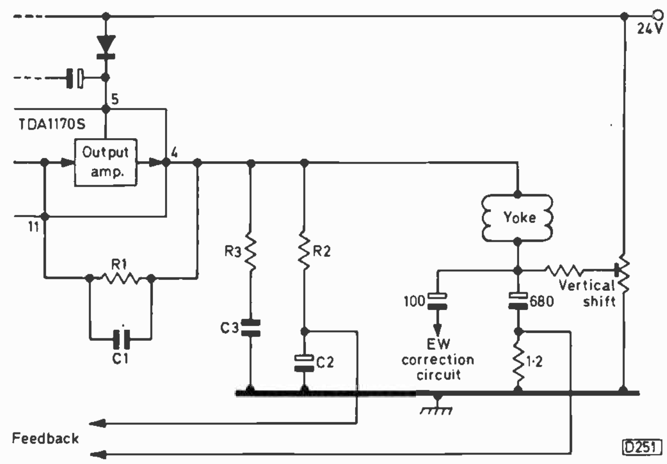


Fig. 9: *Use of RC networks to prevent h.f. instability.*

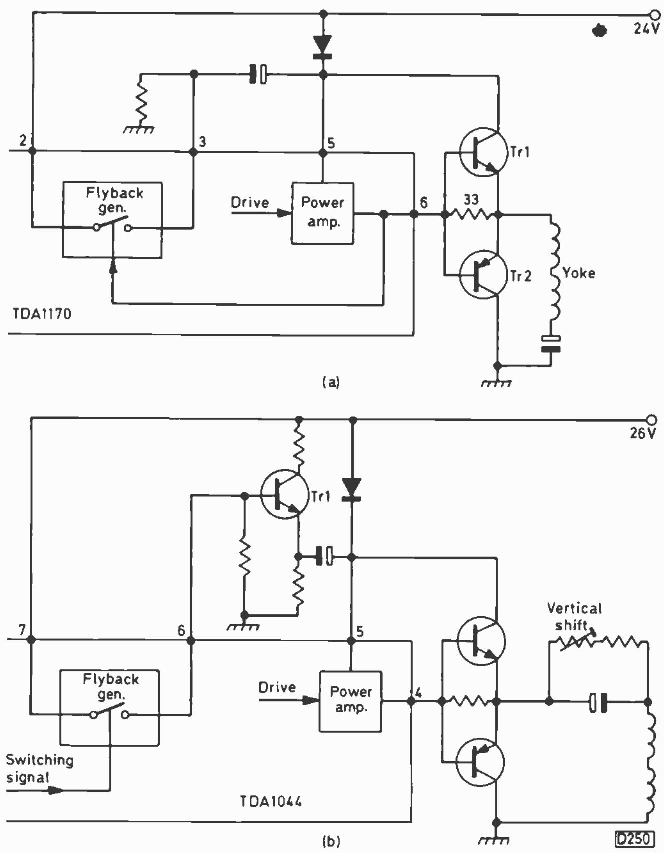


Fig. 8: *Application of flyback boosters: (a) as used in the Bang and Olufsen 8800 series; (b) as used in the Thorn TX10 chassis.*

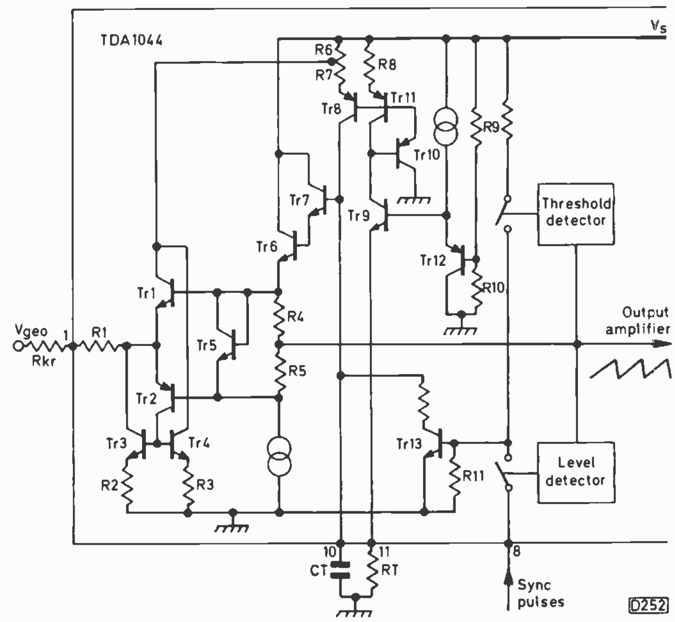


Fig. 10: *Geometric correction of the scan waveform: part of the TDA1044's internal circuit.*

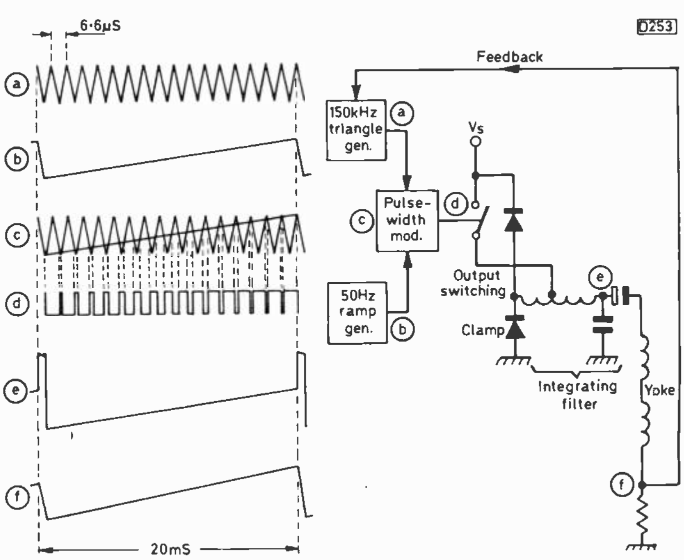


Fig. 11: *Operation of the Class D field timebase.*

waveform suddenly reverts to narrow pulses, whereupon the current flowing in the yoke reverses to give the flyback. At any instant the output transistors within the chip are either on or off, and in neither state do they dissipate much power.

It's not practical to generate the drive pulse train required by direct means, especially as linearity and scan correction have to be applied – these call for additional, adjustable variation of the mark-space ratio during the forward scan. The technique used to produce the variable mark-space ratio pulse train is to incorporate within the chip a pulse-width modulator. This consists of a differential amplifier whose output state depends on the instantaneous level of the waveforms applied to its two inputs: these are an internally generated 150kHz triangular wave – waveform (a) – and a 20ms sawtooth that's produced by a conventional *RC* network – waveform (b). Whenever the ramp input voltage exceeds the level of the triangular waveform the amplifier's output goes high, linking, via the

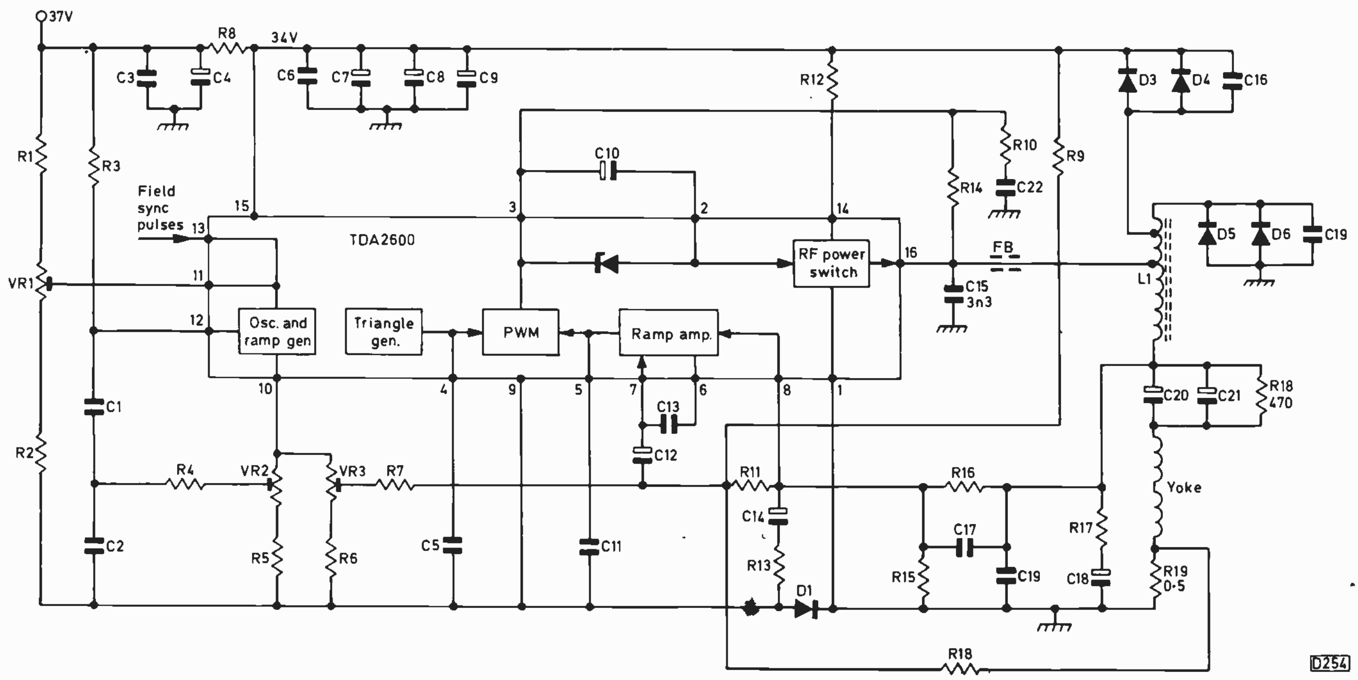


Fig. 12: Class D field timebase circuit used in the Philips G11 chassis. It produces a falling current ramp through the scan coils (compare with Fig. 11).

output stage, the integrator's input to the supply voltage. As the ramp builds up it slices the triangular waveform at progressively higher levels, thus generating the required advancing mark-space ratio waveform.

The circuit used in the G11 chassis is shown in Fig. 12. The ramp is produced by C1/2 which charge via R3, with VR1 providing ramp timing. VR2 is the linearity control and VR3 the height control. The ramp and feedback signals are coupled to pin 7 of the i.c. by C12. After internal buffering the ramp is applied to the pulse-width modulator whose output is coupled to the r.f. output switching transistors by C10.

The output at pin 16 is fed to the integrating filter consisting of L1 and C19: the filter's time-constant is long enough to "lose" the 150kHz square wave while having little effect on the shape of the 20ms current ramp that flows in the scan coils. Clamp diodes D3/4 and D5/6 prevent voltage spikes appearing at the i.c.'s output (pin 16) while overshoots at the filter's output are damped by R17/C18. Many of the chip's peripheral components are present to provide suppression of spurious high-order components of the 150kHz switching frequency. In this connection diode D1 deserves special mention: it isolates the early stages of the i.c. from earth to prevent crosstalk from the power output switching, providing a "clean earth" at its anode.

Direct yoke drive makes heavy demands on the supply rail. It's heavily decoupled at 50Hz by C7/8/9 and at 150kHz by C6. To counteract the small remaining ripple a sample is fed to the ramp coupling circuit via R9, where it has an "equal and opposite" cancelling effect.

The TDA2600 and its host chassis, the G11, seem to have represented both the debut and the finale of the class D field timebase technique, at least in consumer market TV sets. The heatsink that surmounts the TDA2600 is comparable in size to those fitted to its class B counterparts, and the need for a special wound component, along with the apparently embarrassing presence of the r.f. square wave (whose penetrating ability has been suggested above), seem to have led to abandonment of the technique. It's reliability has not in practice been of the best.

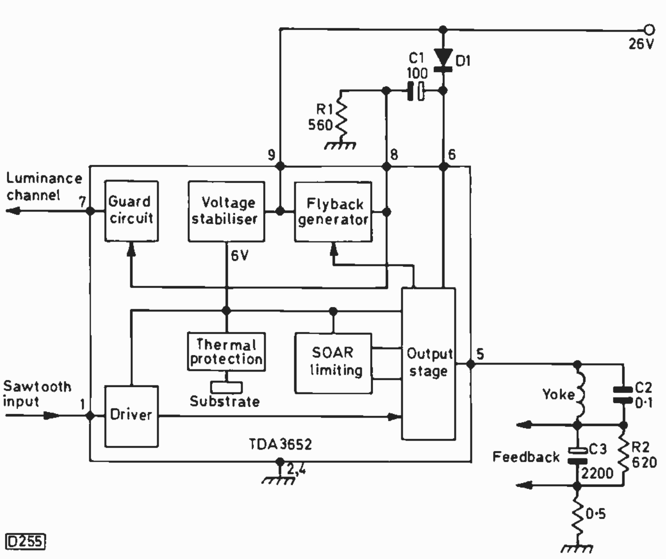


Fig. 13: The latest generation of field output i.c.s use a class B output stage with a flyback booster and incorporate sophisticated protection circuits.

Contemporary Field ICs

The current trend is towards higher output power using class B output stages in conjunction with a flyback generator. Modern devices like the TDA3652 can supply a scan current of 3A peak-to-peak without the need for a power output booster. Fig. 13 shows a typical modern field amplifier i.c. with some of its peripheral components. A 3V peak-to-peak sawtooth, generated by another i.c., is applied to pin 1. The driver stage is powered from an internal voltage stabiliser that provides a 6V line. The output stage consists of two complementary Darlington pairs operated in class B, each with a maximum operating current of 1·5A. They are protected against excessive dissipation by a thermal sensing bridge circuit on the crystal substrate. If its temperature exceeds 150°, the

Darlingtons' base currents are limited to reduce the total dissipation. Further protection is provided by a SOAR (Safe Operational Area) limiting circuit that monitors the voltage drop across the aluminium emitter leads of the output transistors: if the collector-emitter voltage of either Darlington pair increases beyond a certain threshold the base current (and hence the collector current) of that pair is automatically reduced. The working point of the output transistors is thus maintained within the permitted Ic/Vce boundary (SOAR) at all times.

Guard Circuit

Another modern feature is the guard circuit that provides an output at pin 7. This output is d.c. coupled to the luminance section and provides a tube bias-off voltage when no scan current flows at output pin 5. In some i.c. designs the field flyback blanking pulses are also delivered to the guard pin and take the same route to the tube which is thus protected against screen burn in the event of scan failure.

Picture Shift

Picture shift facilities are seldom required with modern colour tubes whose production tolerances are such that with zero d.c. in the yoke the raster displacement from central should be small enough (±3mm) for all but the most critical of applications. If necessary a variable d.c. yoke bias current can be derived from a potentiometer. In the circuits we've been discussing however the average yoke current is not zero because the scanning current is not perfectly balanced about the zero line. The field scan current is exponential in shape, the resulting asymmetry of the upper and lower halves of the waveform giving a slight downwards displacement to the raster. Compensation is provided in Fig. 13 by R2 which provides a d.c. path across the coupling capacitor C3: R18 in Fig. 12 and R8 in Fig. 7 serve the same purpose – in Fig. 8(b) a variable shift control is provided in this position. Some i.c.s have provision for altering the output stage's mid-point voltage by means of a low-current external potentiometer. This works in conjunction with a fixed bleed resistor across the scan coupling capacitor or a potential divider feeding the "outer" end of the yoke in a d.c. bridge configuration.

Height Stabilisation

In the early days, particularly in the valve era, the scan coils were outside any feedback loop. Since they are wound with copper wire, which has a positive temperature coefficient, the scan current decreases as the operating temperature of the coils rises. Compensation was provided by including a thermistor in series with the coils. In modern transistor and i.c. designs the need for this is obviated by including the coils in a negative feedback loop. In some circuits the sampling resistor in series with the coils is used as a height control, the output from the slider being applied as negative feedback to the inverting input of the power amplifier within the i.c. In this case the input ramp is of fixed amplitude.

Acknowledgements

In conclusion the authors would like to express their thanks to Thorn EMI Ferguson and Mullard Ltd. for the provision of much useful information.

Wag's Wireless

Les Lawry-Johns

Wag's a well known local waterside figure and has been for many years. He's been a customer of mine for nearly as long. Last week something that threatened this long-standing relationship occurred. He brought in his son's music centre, a Ferguson Studio 6.

His son lives down in Sussex (I think) and being very busy he didn't have time to bring it in himself. So Wag went off to collect it, leaving behind the speakers since they weren't suspect. There were complaints about the main amplifier, the cassette and the record deck. So I spent a few hours sorting it out, replacing the output transistors, their emitter resistors and a few other odds and ends. Fitting the test speakers proved that the work had been done well, but it was left on test for some time just in case. Some days later Wag called to collect it, settled the bill and departed in his usual high spirits.

Wag's Return

The next day he was back. "It doesn't work Lawry, and that's going to upset my son. Didn't you test it?"

"Yes Wag, I tested it for hours. I'll test it again now." So saying I plugged it in and fitted the test speakers. The radio boomed out loud and clear and Wag's face became worried.

"What's them things?" he said, pointing to my test speakers.

"They're the speakers, Wag. It won't talk without them."

"I haven't got things like that."

"No Wag, you left them in Sussex, so you can't test the machine till everything's connected together again. What did you do?"

"I just plugged it in at home and it didn't work at all, but my record player works without those things."

"That's because they're built into your record player, Wag. This hi-fi has spacially distributed sound from separate stereo speakers, see?"

So Wag went off, feeling a bit foolish – like I do several times a day.

I Never Slept a Wink

A chap carried in a Bush T20. He was followed by an elderly lady who looked a trifle unhappy. He put the set on the bench and retreated. The lady advanced.

"This set was in here three months ago and it went wrong again at teatime yesterday. I couldn't stop worrying all evening and couldn't sleep at all last night. It's not right that it should go wrong so soon after being serviced. I've a good mind to complain to Radio Kent about it."

She was so busy complaining she didn't notice that I'd removed the rear cover and checked one or two points. I quickly replaced the 1Ω resistor (5R8) in the line output transistor's base circuit and refitted the rear cover.

"Well now madam" I said politely, "let's see what's caused you so much sorrow." I plugged it in and switched on. Up came the sound and a few seconds later a good picture appeared. "Now then, what would you like me to do?"

She stared at it transfixed. "I lay awake all night worrying about it and the moment I get it here it's all right. What's wrong? Will it go again? How do I know it won't go off again tonight? What have you got to say about it?"

"I think it wanted a ride in the car. If it goes again take it for a ride then straight back home again."

"I haven't got a car. My son-in-law brought it down for me because I was so worried. I just couldn't sleep. I've nothing else."

I felt a bit sorry and decided to tell her the truth. "While you were telling me your problems I managed to find out what was wrong and put it right. So you can sleep in peace tonight."

"But how do I know it won't go wrong again? I can't stand another night like last night."

So I took the back off again and examined the scan plug socket which showed some signs of distress. I made that good and checked around the other weak spots on the T20. Everything seemed to be all right so I refitted the back and pronounced everything to be in order.

"I hope it is. Do I owe you anything?"

"I'm afraid so dear. You girls have to pay for my services."

At this point Honey Bunch appeared, towed by Zeb. The old girl screamed.

"Take that dog away. My mother was scratched by an Alsatian once and the scar didn't heal till the dog died."

The old girl called her son-in-law and off they went, vowing not to return to such an unruly place.

New Chassis

I must admit that some of the newer models in the Ferguson and Decca ranges worry me and probably will do for a while – until I get used to their habits. It was the same some years ago when I sold a customer a Philips G6 rather than a G8, because the latter set was new to me and I was afraid of it whereas the G6 had lovely things like valves in it, things I was at home with. Sounds silly, doesn't it? That particular G6 ended up with a tripler in place of the e.h.t. overwinding and valve rectifier. Why? Economy, that's why. The family I'd sold it to fell on hard times and couldn't afford a new transformer. It still gives a good picture. The G8 and G11 are now old friends to me, but I can't say the same about the G9. This one still worries me a bit. As for the Ferguson TX10, who would have thought the line output transistor is actually the chopper when he first opened one up? Once I'd got used to the layout they just had to alter it to confuse me. Only the siting of the focus unit convinced me that I was still dealing with a TX10. I must get out the books and bring myself up to date.

GEC 20AX Chassis

This set really had me going. The tripler had decided to burst out of its confinement: the makers had decided to pass a cableform against the bottom corner of the tripler and this is where the insulation breakdown had occurred. It had been allowed to go on arcing for some time before the owners had switched off, so arcing had also taken place over on the chroma panel. In this chassis the group of chroma panels used in the C2110 series was replaced by a single panel and this had taken the brunt of the arcing.

Having replaced the tripler I switched on to see what damage had been done.

The screen was a lovely bright blue, the brightness control having no effect. I removed the blue connection plug from the top of the board and some red and green showed with chroma only, turning to a blank screen when the colour control was turned down. Considerable time had to be spent checking voltages, i.c.s, transistors etc. before an acceptable picture was eventually obtained. I'd have given my left arm for a replacement panel but no one seemed to have one locally. Working through the panel was agony – and all because a cableform had been tied up close to the tripler's bottom corner.

Bookie's Lair

Do you remember me telling you about my bookie friend who lives in a back-to-front house? You go up the drive, through the garage, ring the bell on the kitchen door, go through the kitchen into the hall then into the lounge where you can look out over the front garden and the swimming pool which is normally empty of water. This room contains many items including a bar and a 26in. Dynatron with the Pye 731 chassis, the rear cover being held by ten thousand screws. A door leads from this lounge to another one that also overlooks the front garden. It contains another 26in. Dynatron, this time with a Philips VCR in the top. So the rear cover is held on by fifteen thousand screws. The chassis is the same (nearly) as the one in the set in the other room. I've looked after these two monsters for many years and of late John's been asking me about fitting up-to-date receivers in the handsome cabinets. I've avoided this exercise on the grounds that I'm no carpenter and might damage the woodwork. Apparently he's made other enquiries and been told that a 26in. Sony would fit in snugly. My reply to this idea was not helpful.

"Bugger you mate. If you have Sony sets fitted let them that fits 'em look after them. Not me. I shall not darken your door again."

So the Pye interiors stay inside the cabinets and the sets still perform.

The Hitachi Portable

What's all this about? Well, John suddenly appeared with a Hitachi colour portable which had the annoying fault of intermittent severe top compression that completely ruined the horse racing (office set). As he brought it into the shop I said I'd have a quick look but wouldn't dwell too long on it as these sets frighten me.

I soon found a small daughter board that held the field output stage and discovered that if this was moved to port the raster remained steady. If it was moved to starboard the compression proceeded apace. I didn't like the look of the items on the board so, being the fool that I am, I fitted a wire and spring to hold the board hard to port. It seemed perfectly all right to me so he took it and paid for my highly technical expertise.

The next day he was back. "In the middle of the 3.30" snarled John.

So out came the offending board (soldered in not plugged) and all the connections on it were carefully resoldered (though none looked suspicious). Refitting the board proved that the operation had been successful and John's office is now at peace. Long may it continue. Still, it could have been a TX10 . . .

Teletopics

ENTER 45AX

1975 saw the introduction of the Philips/Mullard 20AX tube and 1978 the advent of the 30AX tube. Now in 1985 comes the 45AX, another major step forward in tube design. The 45AX range is of the new flatter, squarer screen type (see June issue, page 448). The particular significance of the 45AX range is that it comprises both 90° and 110° types in sizes from 14 to 26in., with both flatter and squarer screens. There are also two neck diameters, narrow (29mm) and mini (22·5mm). The complete range is as follows:

36, 41 and 51cm. (14, 16 and 20in. approximately) 90° tubes with mini necks for use in economy sets.

51cm. 90° tube with narrow neck for optimum screen performance.

51, 59 and 66cm. (20, 23 and 26in. approximately) 110° tubes with narrow necks for use in sets with fuller specifications.

In addition to the extermal features there are significant internal improvements. These include the use of a low-wattage cathode to give a faster, more stable picture at switch on and a new shadowmask support system with reduced thermal inertia.

Mullard point out that when deciding on the parameters for the range key glass dimensions had already been established in Japan for 14-20in. tubes with 90° deflection. These dimensions were adopted in the interests of compatibility and interchangeability. For the larger tube sizes with 110° deflection however Philips have decided upon their own parameters since there are no established dimensions in the Far East. These tubes have slimmer outlines that are better suited to the push-through presentation favoured in Europe. Note that the tube sizes quoted follow the new international system, being based on the phosphor diagonal rather than the overall glass screen diagonal.

The 51cm., 90° narrow-neck tube is already in production at Mullard's Durham plant: the minineck version will go into production there next year. The 110° tubes are being produced at Philips' plants in Germany (Aachen) and France (Dreux). The small-screen sizes will go into production next year at Lebring, Austria.

The first thing that has to be decided in tube design is the neck diameter, since this determines everything else. A narrow neck reduces the deflection power required but poses design problems with respect to colour purity and beam focusing. A large neck implies greater convergence errors. As mentioned above the standard narrow and mini neck diameters have been adopted for the 45AX range. The guns used in 45AX tubes need to be physically smaller than in previous tubes while giving an equivalent or better spot performance. To this end a novel approach has been adopted in the design of the triode section, giving what Mullard call an "aberration reduced triode": the electron optics of the individual guns in the assembly "overlap" to reduce the aberration effects associated with small guns.

Smaller guns mean smaller cathodes, and usually a smaller area contributing to the total beam current. In order to maintain good life performance at higher current densities a new high-technology cathode assembly is used in 45AX tubes. Normal cathode construction starts with spot welding the cap to the barrel. Subsequent preparation has to be a compromise for the best treatment of each part. The 45AX's 0·65W cathode is built up from two separate pieces joined by laser welding: only through laser welding can the minute parts be connected without risk to the prepared coatings. Since the cathode coating can be optimised without fear of damage, its potential activity in the finished tube is greatly increased. The temperature at which it is run can thus be reduced, extending tube life. The new 0·65W cathode runs 15°C cooler than earlier types while retaining greater activity.

As with the 30AX tube, the gun contains a magnetic ring that's factory premagnetised to provide static convergence. This is the first time the technique has been used with 90° tubes.

Traditionally shadowmasks have been suspended near the centre points of their sides, though theory would suggest that corner suspension would result in a more stable assembly. Flattening the glass screen calls for a flatter shadowmask of course, but a flat mask is more prone to bulge and bow, with impurity effects, as the electron beam heats it to the normal running temperature. The bimetal compensators used in previous tubes need spot-welding to a strong shadowmask surround or "ring" – a lightweight ring would buckle and destroy the colour purity. The corner suspension system used in the 45AX tube involves no ring and no twisting motion: the four corner brackets simply swing the mask towards and away from the screen as it heats and cools. The precise extent of the movement at any temperature (beam current) is defined by the mechanical dimensions of the brackets.

A bismuth coating is applied to the mask to improve its heat dissipation properties. The lightweight mask assembly is fastened to its support pins after the phosphor screen has been laid – laser welding is used to avoid damaging the phosphors.

The design features so far mentioned are used in each of the tubes in the 45AX range, though their implementation varies with different tube types. The scan coils have to be designed specifically for each tube type however and there are noticeable differences between those for the 90° and 110° versions of the tube. The self-converging feature of all the tubes needs to be especially powerful with the 110° versions: to achieve this, precision double saddle windings are used in conjunction with the pin-shooting technique pioneered in the 30AX tube.

The yokes for 90° 45AX tubes employ the more usual saddle-toroidal winding arrangement with pin-shooting retained for the line windings. This helps to achieve the high level of raster shape accuracy necessary with a flat, square tube, where the slightest picture distortion is easily spotted. In addition to being fully self-converging the 90° tubes require no raster shape correction circuitry: the square picture is designed in.

RENTAL SCENE

In a recent report entitled "The Television Rental Industry" stockbrokers Fielding, Newsome-Smith point out that the industry will remain substantial for many years despite a continuing, gradual decline of the rental habit. Turnover is likely to remain at some £1b annually, at 1985 prices, over the next decade. The total number of subscribers has been falling at roughly five per cent a year – from 11·75 million in 1978 to about 8·9 million at present. The report mentions that the disconnection rate for VCRs is high – about 33 per cent during the first year. It suggests that the larger concerns in the industry – Thorn EMI, Granada and Electronic Rentals (Visionhire) – may well increase their share of the market. Two recent takeovers confirm the view. Telefusion, with 250,000 rentals plus the Connect retail chain, has been taken over by Electronic Rentals while Telebank (STC) with 130,000 rentals has been taken over by Granada. ERG's deal with Telefusion has created a substantial service operation, with an annual turnover of some £4m, carrying out work for third parties including Boots and local electricity boards.

VIDEO DISC SYSTEMS

JVC has unveiled in Japan a 3-D version of its VHD video disc system and expects to have this on sale by the end of next year. One of the problems will be software, since programmes have to be shot using a dual-camera arrangement. The viewer has to wear special liquid-crystal filter spectacles developed by Sharp: these are switched electronically, obscuring the vision of each eye alternately in synchronism with the field scanning.

Further details of Hitachi's record (once only)/playback disc system, mentioned briefly last month, have been released. The system is intended primarily for still picture storage, having a playing time of only sixteen seconds for a moving display. The machine (Model VIR1000) is available in an NTSC version only and has a port for direct connection to a microcomputer.

MINI TVs

Casio's Model TV21 2in. monochrome pocket TV set is now on sale in the UK with a suggested retail price of £99·95. It employs a liquid crystal display with a "solar projection" arrangement and has auto-tune channel change plus brightness and volume controls. The earphone cable is also the aerial and the set, weighing just seven ounces, operates with two standard AA size batteries. For further details apply to Casio Electronics Co. Ltd., Unit 6, 1000 North Circular Road, London NW2 7JD (01-450 9131). At the recent Osaka Electronics Exhibition Casio showed two colour versions which are now on sale in Japan at £200 and £230. Citizen and Sanyo also showed pocket receivers using colour LCDs. Sanyo's set has a 4 × 3in. display with 384 × 216 pixels, weighs 1·5kg and has a consumption fo 4·9W.

DON'T USE A BU208!

When in doubt many engineers tend to use a BU208 as a replacement line output transistor. Thorn point out that this is not a suitable replacement for use in their 1615 series large-screen monochrome chassis. A BU205 was selected during development of the chassis and this is what should be used – a BU208 generally fails after a few weeks. Exact replacements are often important in the line output transistor position.

TRADE SCENE

Colour receiver sales in the UK increased by 4·6 per cent during the second quarter of the year. There's been a reversal of the trend of the last couple of years, with sales of large-screen sets rising by 9·3 per cent while sales of small screen sets fell by 1·8 per cent. Deliveries to the trade were down 11·2 per cent overall during the quarter, large-screen CTV deliveries falling by 5 per cent to 353,000 while small-screen CTV deliveries fell by 18 per cent to 274,000. Imports have fallen, with UK production accouniting for 78 per cent of large screen sets and 56 per cent of small-screen sets. VCR deliveries fell by one per cent to 232,000 while home computer deliveries fell by 53 per cent to 203,000.

A recent report by Mintel Publications (KAE House, 7 Arundel Street, London WC2R 3DR) on the £2·6b UK leisure electronics market suggests that the outlook is for substantial but uneven growth. By 1984 44 per cent of UK homes are expected to have a microcomputer and 48 per cent a VCR – these estimates compare with 1984 figures of 23 and 35 per cent respectively. Some £250m worth of home computers were sold in 1984. Mintel suggests that there will be a fall to £100m in 1989, a drop of 60 per cent. The market is becoming software led however – sales of software are expected to rise by 125 per cent to £270m in 1989 while sales of peripherals should rise by 275 per cent to £300m, resulting in an overall increase in the home computer market of 48 per cent, up from £450m in 1984 to £670m in 1989. Mintel sees much the same story in the video market, while CTV sales should climb 44 per cent from £528m in 1984 to £760m in 1989 with increasing numbers of households having two or more sets.

For the first time since 1976 Japanese VCR exports recorded a decline in August – a one per cent year-on-year fall compared to August 1984. Production continued to increase however. It seems that Japanese manufacturers are going though a tough period – both Hitachi and JVC recently announced sharp declines in first half profits (in Hitachi's case the main problem was a substantial drop in sales of semiconductor devices). JVC's 37·2 per cent profit drop is largely attributed to softer VCR prices, with tough competition in a shrinking market. JVC plans to launch a range of high-resolution VCRs during the next half year but the profit contribution from this won't show through until the following financial year.

According to a recent *Screen Digest* report more than half the world's households (473 million) now have a least one TV set. In the USA, General Electric has announced its withdrawal from TV receiver production. In future it will sell sets manufactured by Matsushita (Panasonic). GE's consumer electronics business general manager Jacques A. Robinson commented that the move will give GE "the advantage of Matsushita's leadership in cost and engineering technology". Matsushita is expected to build up deliveries of CTVs to GE from its US plant outside Chicago to over 500,000 sets annually. This will probably give Matsushita leadership of the US TV market. GE will continue to produce colour tubes.

CD PLAYER TRAINING COURSES

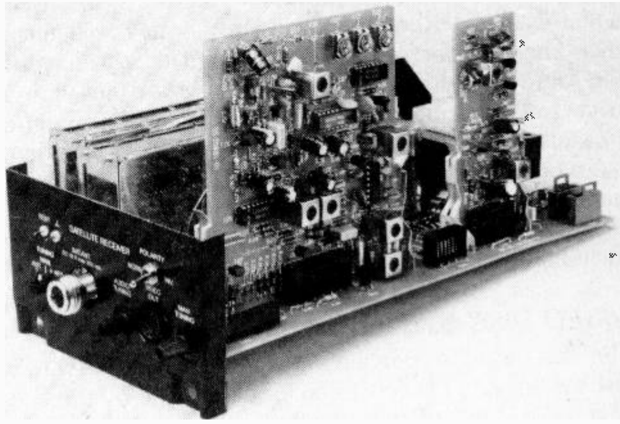
Starting in December, Ferguson will be holding a series of two-day training courses on the mechanics and electronics used in the CD01/CD02 disc players. These courses, dealing with theory and principles, fault diagnosis, repair and maintenance, are being held at both the Edmonton and Chadderton dealer training schools. At the end of the course a delegate should be competent to deal with all field problems that might affect Ferguson disc players and will have an adequate background to assimilate changes/enhancements that may be introduced in later, more sophisticated models. The charge for the course is £34·50 (including VAT) per delegate – lunch is provided on both days, also refreshments in the morning and afternoon. Any bona fide professional engineer interested should apply to Frank Pack, Thorn EMI Ferguson Ltd., PO Box 121, Lea Valley Trading Estate, Angel Road, London N18 3BP.

SATELLITE TV

The official European Telecommunications Satellite Organisation Eutelsat, of which the posts and telecommunications authorities of 25 European countries are members, is studying the feasibility of moving into the DBS field. The idea is to pool European resources and establish a satellite TV broadcasting system that would provide 18 channels from two orbiting satellites (with a third held in reserve) covering most of Western Europe. The organisation believes that a pan-European system would avoid costly duplication and be the most economical way of establishing DBS services in Europe. The Department of Trade and Industry has approached Eutelsat expressing interest in the proposals as a possible means of starting UK DBS services.

Meanwhile in Luxembourg the Societe Europėene des Satellites (SES), a company set up earlier this year, has announced that it's to buy a 16-channel satellite from RCA and will be taking an option on a second one. A launch date in early 1987 is suggested for the first satellite, which will be used for TV transmissions. It seems that SES is unwilling to comment further at present on its plans.

Luxor (UK) Ltd. have released two satellite TV receiving systems which will enable viewers to receive pictures from the Intelsat and Eutelsat satellites. Dennis Swannack, Luxor (UK) Ltd.'s managing director, comments that "we have been highly encouraged by the initial response to the two new systems, which we believe to be a business proposition for domestic, commercial and educational users who wish to receive satellite television programmes." System 2000 is for use with Luxor's SX9 chassis: it includes a satellite receiver module that slots into the SX9. System 3000 is intended for use with previous Luxor models and other makes of receivers.



The indoor receiver unit with the Luxor 2000 satellite TV receiving system, shown above, is designed as a module to fit into the SX9 chassis.

System 2000 includes a 1·25m glassfibre reinforced parabolic dish with a flame-deposited aluminium reflective surface and a white weatherproof coating. This is used with a Cassegrain feed system and an 11GHz low-noise amplifier-converter with a noise figure of better than 3·25dB and an i.f. output of 950-1,750MHz. Features of the indoor receiver unit include manual tuning or automatic tuning via the television set's self-seek system, remote control via the normal TV handset, a video output for feeding to a VCR, a programmable two-channel sound system, and video polarity switching. The receiver module was provided for in the design of the SX9 chassis, so that when fitted there are no external cables or peripheral equipment. System 2000 comes with a bracket and clamp for mounting on a 50mm tube for wall fixing. A price of around £900 plus VAT is suggested.

System 3000 includes the same dish and head assembly but has a separate receiver with a u.h.f. modulator whose output is fed to the TV set's aerial input socket. Features of the receiver include: infra-red remote control; four sound system which is mono/stereo switchable; Dolby noise reduction; wide or narrow audio bandwidth; built-in signal strength meter; two-speed frequency scanning; video and audio outputs; video polarity switching; and ready for polar rotor and aerial actuator drive connections. The suggested price is around £1,100 plus VAT.

For further details apply to Luxor (UK) Ltd., 87-89 Farnham Road, Slough, Berkshire SL1 4UL.

Philips have announced that they will have available an adaptor for reception of DBS signals using the MAC standard by early 1987. The adaptor will feed a conventional TV set and together with an outdoor parabolic dish aerial will constitute a complete TVRO system. Work on the design and production preparation of i.c.s for use in the adaptor is at present being carried out. With the introduction of this advanced adaptor Philips will be contemplating a gradual conversion to future high-definition TV. The design conforms to the full specification MAC standard agreed between the EBU and the Euro-pean Electronics Industry last February and already offers a wide range of new possibilities in this respect. In particular the adaptor will continue to be suitable for use should a different aspect ratio be adopted in the future. There's also the possibility of using a key for pay-TV or for broadcasts for closed viewing circles.

Astec, who are well known for their u.h.f. modulators, have introduced a range of modules to provide a satellite TV receiver unit, i.e. the indoor bit. The AT1000 series tuner units have an input bandwidth of 950-1,450MHz and a 612MHz i.f. output: the conversion gain is 30dB with a noise figure of 6dB. Frequency conversion options range from a low-cost, high-performance voltage-controlled oscillator arrangement through a module with ÷256 prescaler to a unit with an integral phase-locked loop. These modules all use high-side mixing and are available with single or dual inputs. Demodulator unit AT3010 employs a SAWF to select the 612MHz input and provides a composite baseband output. Module AT1020 provides an i.f. gain of 40dB and the a.g.c. and low-noise converter control voltages. For further details apply to Astec Europe Ltd., 16 Albury Close, Reading, Berkshire RG3 1BD.

IN BRIEF

The first ever demonstrations of the IBA's enhanced C-MAC wide-screen, higher resolution TV system over an operational satellite link were given at the Royal Television Society's Cambridge Convention last September . . . The eleventh International Broadcasting Convention (IBC 86) will be held at Brighton on September 19-23rd 1986 . . . New workshops for the repair and calibration of electrical and electronic test equipment, from Avometers to oscilloscopes, have been opened by John Firth Instruments Ltd., Beech House, Hob Hey Lane, Culcheth, Warrington, Cheshire WA3 4NY – apply to Customer Service Dept. The workshops complement the company's sales and distribution operations. A test equipment showroom, in which examples of veteran and vintage makes and models will be displayed alongside the very latest instruments, is to be opened. JFI would be interested in hearing from anyone who has vintage equipment for sale or loan or has anything available in the way of "test equipment trivia" that would add interest to the collection . . . British Telecom's 60,000 Prestel customers can now send telexes anywhere in the world, and receive them, over Prestel's Telex Link . . . The BBC is to set up a data transmission system called Datacast that uses spare teletext capacity. The data transmission rate will be 12 kilobits a second and the data will be delivered all over the UK. The aim is to provide a fast, scrambled information service for business and industrial subscribers, avoiding the cost of telephone lines. It will be run by the Corporation's commercial arm, BBC Enterprises.

PUBLICATIONS

A new catalogue, dated 1985-6, has been published by East Cornwall Components, 119 High Street, Wem, Shropshire SY4 5TT (0939 32689). East Cornwall Components now carry a very extensive range of items with delivery generally by return of post.

Publication by Newnes-Butterworths of the second edition of Steve Beeching's VCR servicing book has been delayed – it's understood that the new edition will be available in about a month's time.

Spectrum-monitor Interface Follow-up

John de Rivaz, B.Sc. (Eng.)

My article in the July 1984 issue described a Spectrum-monitor interfacing circuit, i.e. a YUV/RGB adaptor. Many readers have built this circuit and several have written to us about difficulties they've experienced. These notes are intended to help such readers.

The circuit was originally used with a Ramtek monitor obtained from Opus Supplies. This particular monitor is no longer available but I see no reason why the circuit shouldn't work with other monitors. It does of course use an SL901B i.c. in a way the manufacturers didn't intend, and it's possible that there are chip design variations that can cause problems.

The level of the V input signals at pins 19 and 20 of the i.c. is very low. This is because of the high gain of the following stages within the i.c. To test the circuit, check that the two transistors (Tr7/8) that drive these pins are both npn devices and that they are correctly connected. There should be square waves at their bases while the V signal should be present at their emitters. It should also be visible at the junctions between the balance control and the two 1·5kΩ emitter resistors. Check through the circuitry that recovers the ident signal, referring to the original article, and ensure that it's working properly.

The Spectrum's output, in terms of brightness, is low for colour 1 (blue) and high for colour 7 (white). This means that red, which is colour 2, is also rather low. This has given some readers problems and I've advised altering the gain of the three channels in the monitor to suit.

Sync pulses are still present at the outputs of the adaptor circuit. These can be sliced off using diodes. I've in fact now done this in order to make the RGB input to the monitor compatible with that from a QL microcomputer. Alternatively the monitor's amplifiers can be biased back to cut off the sync pulses. There's a control for this purpose in the Ramtek monitor.

The blue and red levels obtained from the adaptor are low but I've found them to be perfectly satisfactory. The problem is that the adaptor circuit renders the colours exactly as the Spectrum initially generates them, whereas when the colours are passed through the PAL converter (which is bypassed by the adaptor) deliberate distortion of the levels is introduced in order to produce brighter, more garish colours. This effect could be recreated by altering the gain of the three channels, but this would mean either adding attenuators and making the monitor provide the additional gain or alternatively building 20MHz bandwidth amplifiers for each of the three channels. This approach may give problems with grey-scale tracking with regard to the Spectrum's two brightness levels.

I've found that a resistor of 10kΩ or thereabouts between the SL901B's demodulator bias pin 3 and the positive rail reduces the green output and increases the red and blue outputs. Unfortunately this impairs the i.c.'s stability, though this effect may not be noticeable.

There's scope for further experimentation with this application of the SL901B i.c. Readers are invited to do so and to share their conclusions with other readers through the pages of the magazine.

Electron Test Pattern Program

Andrew J. Heron

Whenever I consider buying a test pattern generator I'm deterred only by the cost. So, looking at a beastly micro lying idle, I though who not use it for a worthwhile purpose? The following program has been written for the Acorn Electron, but should also work on the BBC micro: I must stress however that it has not been tested on the BBC machine.

The program will produce the following test patterns on any 625-line TV set or monitor: (1) plain raster in a choice of eight colours; (2) colour bars; (3) split bars; (4) horizontal bars; (5) vertical bars; (6) crosshatch; (7) dots; (8) chequerboard; (9) centre circle. One disadvantage of the program compared with a conventional test pattern generator output is that the displays don't cover the whole raster. This is because the micro displays both text and graphics in a "window" which reduces the horizontal dimension to 83 per cent of the raster and the vertical dimension to 95 per cent – the 4:3 aspect ratio is also lost. This shouldn't be of great significance however, especially as most convergence adjustments are ideal around the centre. A sound signal is not available since the sound produced by the micro goes to the internal speaker and the cassette recorder connector, not the modulator.

Use

Some notes on the use of the program, which is loaded by typing LOAD"TSTGEN" or CH." ". The operator is prompted to select a colour for the chequerboard and circle patterns. 1 = red, 2 = green, 3 = yellow, 4 = blue, 5 = magenta, 6 = cyan, 7 = white. The colour is selected by pressing the appropriate number, then the return key. The colour for the plain part of the display must next be selected. This is done in the same way. Then, after pressing the return key, the plain raster will be displayed in the selected colour.

The next pattern (colour bars) is obtained by pressing the space bar. The following pattern is obtained in the same manner, in the sequence (1) – (9) given above. After displaying the circle pattern, pressing the space bar will return the program to the stage where the colours are selected. The colours can then be changed. At this point the operating procedure repeats.

While any of patterns (1) – (8) are displayed on the screen the circle can be superimposed by pressing the shift key – this brings up the circle in the colour selected. If the space bar is pressed at this point the program again returns to the point where the colours can be changed.

The program should be self-explanatory. The following points are worth noting however. (1) The return key must be pressed after entering the colour number. (2) If a number greater than 7 is entered for the colours you'll be prompted to make another entry. (3) If the split bars are being displayed and you want a plain raster for example it's quicker to press the shift key to display the circle rather than to work through the remainder of the patterns. Then press the space bar and select the plain raster colour. (4) If you require only the standard patterns (those for which you don't select a colour), press the return key twice when prompted to select a colour. This will bring up the colour selectable patterns in black.

Editorial note: It seems that lines 1960-2030 of the following program may require some modification to produce a circle suitable for linearity setting up (see letters in the September issue, pages 612 and 614, on BBC microcomputer programs). We are looking into this.

Program

```
10 MODE 2
20 VDU 23; 82 02; 0; 0; 0;
30 COLOUR 134: CLS
40 COLOUR 0
50 PRINT TAB (7, 8); "TEST"
60 PRINT TAB (6,12); "PATTERN"
70 PRINT TAB (5, 16); "GENERATOR"
80 COLOUR 4
90 PRINT TAB (3, 24); "By A. J. Heron"
100 TIME = 0
110 REPEAT UNTIL TIME = 200
120 COLOUR 4: CLS
130 PRINT TAB (4, 8); "THE PROGRAM"
140 PRINT TAB (4, 12); "DISPLAYS THE"
150 PRINT TAB (3, 16); "FOLLOWING TEST"
160 PRINT TAB (6, 20); "PATTERNS"
170 TIME = 0
180 REPEAT UNTIL TIME = 500
190 COLOUR 135: CLS
200 COLOUR 1: PRINT TAB (3, 4); "PLAIN RASTER"
210 COLOUR 2: PRINT TAB (3, 6); "COLOUR BARS"
220 COLOUR 3: PRINT TAB (3, 8); "SPLIT BARS"
230 COLOUR 4: PRINT TAB (3, 10); "HORIZONTAL BARS"
240 COLOUR 5: PRINT TAB (3, 12); "VERTICAL BARS"
250 COLOUR 6: PRINT TAB (3, 14); "CROSSHATCH"
260 COLOUR 1: PRINT TAB (3, 16); "DOTS"
270 COLOUR 2: PRINT TAB (3, 18); "CHEQUERBOARD"
280 COLOUR 3: PRINT TAB (3, 20); "CENTRE CIRCLE"
290 COLOUR 8: PRINT TAB (2, 28); "PRESS SPACE BAR"
300 IF INKEY (-99) THEN 320
310 GOTO 300
320 CLS
330 COLOUR 128: CLS
340 COLOUR 3: PRINT TAB (2, 4); "THE PATTERNS ARE"
350 PRINT TAB (2, 7); "DISPLAYED IN THAT"
360 PRINT TAB (7, 10); "ORDER"
370 PRINT TAB (2, 14); "AT ANY TIME THE"
380 PRINT TAB (2, 16); "NEXT PATTERN IS"
390 PRINT TAB (0, 18); "OBTAINED BY PRESSING"
400 PRINT TAB (3, 20); "THE SPACE BAR"
410 COLOUR 8: PRINT TAB (2, 28); "PRESS SPACE BAR"
420 IF INKEY (-99) THEN 440
430 GOTO 420
440 CLS
450 COLOUR 5: PRINT TAB (4, 6); "AT ANY TIME A"
460 PRINT TAB (4, 9); "CIRCLE MAY BE"
470 PRINT TAB (2, 12); "DISPLAYED WITH THE"
480 PRINT TAB (2, 15); "PRESENT PATTERN BY"
490 PRINT TAB (4, 18); "PRESSING THE"
500 PRINT TAB (5, 22); "SHIFT KEY"
510 COLOUR 8: PRINT TAB (2, 28); "PRESS SPACE BAR"
520 IF INKEY (-99) THEN 550
540 GOTO 520
550 CLS
560 COLOUR 6: PRINT TAB (4, 6); "YOU CAN SET"
570 PRINT TAB (3, 9); "THE COLOUR OF"
580 PRINT TAB (5, 12); "THE CIRCLE"
590 PRINT TAB (8, 15); "AND"
```

```
600 PRINT TAB (2, 18); "THE CHEQUERBOARD"
610 PRINT TAB (6, 21); "PATTERNS"
620 COLOUR 8: PRINT TAB (2, 28); "PRESS SPACE BAR"
630 IN INKEY (-99) THEN 650
640 GOTO 630
650 CLS: CLG: COLOUR 128
660 COLOUR 8: PRINT TAB (0, 1); "CIRCLE/
    CHEQUERBOARD"
670 PRINT TAB (6, 2); "COLOUR"
680 COLOUR 1: PRINT TAB (4, 6); "1.. RED"
690 COLOUR 2: PRINT TAB (4, 8); "2.. GREEN"
700 COLOUR 3: PRINT TAB (4, 10); "3.. YELLOW"
710 COLOUR 4: PRINT TAB (4, 12); "4.. BLUE"
720 COLOUR 5: PRINT TAB (4, 14); "5.. MAGENTA"
730 COLOUR 6: PRINT TAB (4, 16); "6.. CYAN"
740 COLOUR 7: PRINT TAB (4, 18); "7.. WHITE"
750 COLOUR 8: PRINT TAB (4, 22); "ENTER COLOUR"
760 VDU7
770 COLOUR 7: PRINT TAB (0, 28): INPUT G
780 IF G > 7 THEN CLS: GOTO 660
790 *FX11, 0
810 REM PLAIN RASTER
820 CLS
830 COLOUR 7: PRINT TAB (4, 8); "ENTER RASTER"
840 PRINT TAB (7, 10); "COLOUR"
850 VDU 7
860 PRINT TAB (0, 28): INPUT C
870 IF C > 7 THEN 820
890 COLOUR 128+C: CLS
900 VDU 7
910 IF INKEY (-99) THEN 940
920 IF INKEY (-1) THEN 1960
930 GOTO 910
940 COLOUR 128: CLS
950 REM COLOUR BARS
960 N = 0
970 FOR X = 0 TO 1280 STEP 160
980 IF N = 8 THEN 1080
990 READ B
1000 GCOL 0, B
1010 MOVE X, 0
1020 MOVE 1280, 0: PLOT 85, 1280, 1024
1030 MOVE X, 0
1040 MOVE X, 1024: PLOT 85, 1280, 1024
1050 DATA 7,3,6,2,5,1,4,0
1060 N = N+1
1070 NEXT
1080 VDU 7
1090 IF INKEY (-99) THEN 1130
1100 IF INKEY (-1) THEN 1960
1110 GOTO 1090
1120 REM SPLIT BARS
1130 MOVE 0, 341
1140 GCOL 0, 7
1150 MOVE 1280, 682: PLOT 85, 1280, 341
1160 MOVE 1280, 682: MOVE 0, 682: PLOT 85, 0, 341
1170 VDU 7
1180 IF INKEY (-99) THEN 1220
1190 IF INKEY (-1) THEN 1960
1200 GOTO 1180
1210 REM HORIZONTAL BARS
1220 CLS
1230 GCOL 0, 7
1240 FOR Y = 100 TO 1024 STEP 100
1250 MOVE 0, Y
1260 DRAW 1280, Y
1270 NEXT Y
1280 VDU 7
1290 IF INKEY (-99) THEN 1330
1300 IF INKEY (-1) THEN 1960
1310 GOTO 1290
1320 REM VERTICAL BARS
1330 CLS
1340 FOR X = 1 TO 1280 STEP 100
1350 MOVE X, 0
1360 DRAW X, 1024
1370 NEXT X
1380 VDU 7
1390 IF INKEY (-99) THEN 1430
1400 IF INKEY (-1) THEN 1960
1410 GOTO 1390
1420 REM CROSSHATCH
1430 FOR Y = 100 TO 1024 STEP 100
1440 MOVE 0, Y
1450 DRAW 1280, Y
1460 NEXT Y
1470 VDU 7
1480 IF INKEY (-99) THEN 1520
1490 IF INKEY (-1) THEN 1960
1500 GOTO 1480
1510 REM DOTS
1520 CLS: VDU 23,225,0,0,0,16,0,0,0,0
1530 FOR Y = 0 TO 31 STEP 2
1540 FOR X = 0 TO 19
1550 PRINT TAB (X, Y); "."
1560 NEXT X
1570 NEXT Y
1580 VDU 7
1590 IF INKEY (-99) THEN 1640
1600 IF INKEY (-1) THEN 1960
1610 GOTO 1590
1620 REM CHEQUERBOARD
1640 CLS: VDU 23,224,255,255,255,255,255,255,255,255
1650 COLOUR G
1660 D = 0
1670 Y = 0
1680 N = 0
1690 GOSUB 1770
1700 GOSUB 1840
1710 N = N+1
1720 D = D+1
1730 IF D = 50 THEN 1910
1740 IF N = 5 THEN Y = Y+3
1750 IF N = 5 THEN 1680
1760 GOTO 1690
1770 READ X%
1780 DATA 0,4,8,12,16,2,6,10,14,18
1790 DATA 0,4,8,12,16,2,6,10,14,18
1800 DATA 0,4,8,12,16,2,6,10,14,18
1810 DATA 0,4,8,12,16,2,6,10,14,18
1820 DATA 0,4,8,12,16,2,6,10,14,18
1830 RETURN
1840 PRINT TAB (X%, Y); CHR$ (224)
1850 PRINT TAB (X%+1, Y); CHR$ (224)
1860 PRINT TAB (X%, Y+1); CHR$ (224)
1870 PRINT TAB (X%+1, Y+1); CHR$ (224)
1880 PRINT TAB (X%, Y+2); CHR$ (224)
1890 PRINT TAB (X%+1, Y+2); CHR$ (224)
1900 RETURN
1910 VDU 7
1920 IF INKEY (-99) THEN: CLS: GOTO 1960
1930 IF INKEY (-1) THEN 1960
1940 GOTO 1920
1950 REM CIRCLE
1960 R = 300
1970 GCOL 0, G
1980 MOVE 640, 512
1990 FOR A = -180 TO 180 STEP 10
2000 X = COS (RAD(A))*R
2010 Y = SQR (ABS(R*R)-(X*X))
2020 MOVE 640, 512
2030 IF A < 0 PLOT 85, X + 640, Y+512 ELSE PLOT 85,
     X+640, 512-Y
2040 NEXT A
2050 VDU 7
2060 RESTORE
2070 IF INKEY (-99) THEN 650
2080 GOTO 2070
```

Letters

ALL ABOUT CONTEC SETS

In reply to your request (October issue, page 677) for information on Contec colour sets, these were imported and sold by Dixons shops for some three years until last Christmas or thereabouts. They were made by a firm called Cony in Hong Kong and seem to give good results and reliable service. There are three basic models as follows: (1) A 14in. transportable, Model 8135, with a half-mains chassis and a series switch-mode power supply. This was probably the best of the three. There are very few common faults apart from the two 330kΩ start-up resistors and the tuner (MCES can repair these). It does however have a tendency towards dry-joints and enormous cracks in the print, especially if mishandled – check around the line output transformer.
(2) A 14in. transportable with remote control, Model 3732, which is basically the same as the 8135 except that a single start-up resistor replaces the two 330kΩ resistors.
(3) A 20in. receiver, Model 8250, which has an isolated chassis and a parallel switch-mode power supply, also remote control (clips into the front). There are two common faults. First the single 150kΩ start-up resistor (for a change!). Secondly a defective TA7609 line/field generator i.c. which can be responsible for funny line tearing to ripply pictures to faults that appear to be a.f.c./a.g.c. related – so replace the TA7609 first. Oddly the same i.c. is used in all three models but gives trouble only in the 20in. sets.

Service information for these sets can be obtained from: Mastercare, 653 London Road, High Wycombe, Bucks HP11 1EH (0494 21200).

Spares should be ordered from Mastercare Components, Halifax Road, Cressex Industrial Estate, High Wycombe, Bucks HP12 3UB (0494 33311).

In passing, while the remote control units are different they will operate either set, also some Sony models (and vice versa).

Stephen Denning,
Oldfield Park, Bath.

Editorial note: Our thanks to several readers who answered our appeal for help, including B. Sharp, Stephen Howe, L. Bailey, A. Brown and Dave Mackrill. Manuals and spares are also available from Dixon's Service Division, Commerce House, Cartwright Road, Stevenage, Herts SG1 4QD (0438 314371).

Several readers have written to us for a source of spares for **York** TV sets. These are available from Tech-Semco, 176-188 Acre Lane, Brixton, London SW2 5UL (01 733 5588) who tell us that they also stock spares for **Crown, Ingersoll, NEC, Silver, Cap Ten and Murphy** (post Rank production and not VCRs) sets.

HEATSINK ARRANGEMENTS

In the October issue Larry Ingram comments on the way in which the i.c. heatsinks are fitted in various Grundig field timebase modules and suggests that it would be "good practice" to correct the gap between the heatsink and the i.c. body. Heatsinking of the i.c. in this arrangement is accomplished by thermal conduction via the i.c.'s connection fins which are soldered to the PCB and to the heatsink: the gap between the heatsink and the body of the i.c. is deliberately left to avoid returning the heat to the i.c. There's no evidence that sitting the heatsink on the i.c. will damage it, but as this is not what's intended it's best to leave things as they are.

Steve Beeching, T. Eng.,
Newark, Notts.

THE G11's HT RESERVOIR CAPACITOR

I was interested to read Alan Turner's letter (November issue, page 28) on the continuing saga of the 470μF h.t. reservoir capacitors used in the Philips G11 chassis. As an independent wholesaler we are only too well aware of the problem and have been for some years. We also supply the blue LCR type, but the ones we supply have the word "welded" clearly stamped on the casing.

I'd like to point out that a high percentage of substandard components are dumped on the surplus market to be off-loaded at so-called special prices by the less worthy "independent wholesalers". The moral is: it pays to know your supplier!

Bryan Tuckfield, Sales Manager,
Willow Vale Electronics Ltd., Reading, Berks.

SOLDERING IRONS AND UNUSUAL FAULTS

Your test report (October) on the Miniscope soldering iron reminds me of a similar type of soldering iron that was used in 1955 when building the prototype of the Ferranti Pegasus computer at the Ferranti computer laboratory in Portland Place, London. These irons had a short bit, about ⅜in. in diameter, and were very useful when soldering connections to the heater bus bars as a lot of heat in a small area was needed. If the switch was held down for longer than a few seconds with the bit in free air it quickly glowed red – this feature was often used for lighting cigarettes, much to the annoyance of the person using the iron since the bit had to be cleaned and retinned.

Another popular prank was to unplug the supply transformer whilst the iron was in use: as the bit cooled rapidly this usually resulted in the iron being firmly soldered to the bus bar.

Whilst writing, you might be interested in some unusual faults that could occur in most types of equipment.

A Tektronix oscilloscope had an intermittent fault – the trace often became very distorted. With the timebase switched off and no input, the usually finely focused spot looked like three question marks joined together. The fault could sometimes be cleared by pressing on the power supply panel or any of the components on it, but a close inspection and prodding didn't reveal anything amiss. Though dry-joints aren't common in Tektronix scopes we decided to resolder all the connections on the board. After this the fault was no longer intermittent – it was permanent! Another close inspection, using a watchmaker's eyeglass, revealed a small line at the end of a small high-stability resistor – it looked like a crack in the paint. The resistance was measured and the component was found to be open-circuit, though it had previously measured correctly at 270Ω. Resoldering the connections had evidently moved the cracked resistor sufficiently for it to go open-circuit and reveal the crack. Heating the solder to remove the resistor allowed the end to drop off completely. The resistor was connected in the base circuit of a regulator transistor, in series with a 220pF capacitor. It seems that the stabiliser oscillated when the resistor went open-ciruit.

The power supplies were all wrong in another Tektronix scope: it seemed that two supply lines were shorting. All the components and wiring in the relevant area were tested, and nothing wrong could be found with the printed conductors. It was eventually discovered that the short was through the epoxy glass board to a conductor running on the other side of the double-sided printed board. As it was impossible even to see the reverse side of the printed circuit without a major strip down normal working was restored by isolating the small part of the print that was faulty and mounting the two or three small components concerned above the board.

A Gould OS255 double-beam scope had traces that bent downwards at the ends: when shifted to the bottom of the screen they bent up at the ends with a kink in the middle. In this type of scope the brightness and focus controls are at the rear with long steel rods running under the tube to the knobs at the front. These rods had become magnetised: a metal strip supporting the chassis, which runs alongside the tube, and even the metal strip in the carrying handle had also become magnetised. Demagnetising these parts restored a straight trace.

L. Bailey,
Carnforth, Lancs.

TIPS ON SINCLAIR MICROS

Following Sinclair's recent price cut I decided to obtain a QL and to connect both this and my Spectrum to the same monitor. I set up a relay to switch between the two feeds but found that the output from my YUV/RGB adaptor (*Television*, July 1984) didn't match the QL's RGB output. The problem was due to d.c. levels on the outputs and was dealt with by fitting 1N918 (or similar) silicon diodes in series with each output from the YUV/RGB unit, with 1kΩ resistors to chassis (see Fig. 1), the outputs being taken from across the resistors. Three diodes in series were used in the R and B feeds and six in the G feed. This restored compatibility between the two sets of signals. Otherwise, the monitor's d.c. level controls would have needed adjustment depending on which computer was in use. As the Spectrum has a large border and the QL none, the changeover relay contacts also adjust the width and height by switching in additional resistors.

A useful tip for connecting to the QL's serial port is to use a six-way BT connector (e.g. Cirkit, 97p) instead of buying Sinclair's £15 lead – a bit has to be sculpted off one side to get past the ribs in the QL to prevent its use. If you have a Spectrum with interface 1 and a parallel port you can use it as a serial-to-parallel converter to print from the QL. This saves an additional £40 or so for a new QL serial/parallel adaptor.

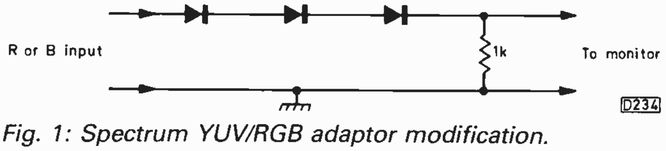


Fig. 1: Spectrum YUV/RGB adaptor modification.

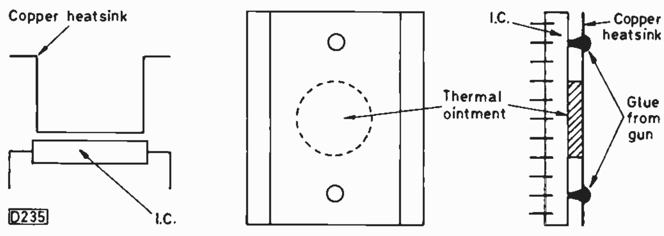


Fig. 2: Adding a heatsink to the Spectrum's ULA i.c.

Cirkit also sell an eight-pin DIN plug that can be used for the monitor connector to the QL, at 69p against Sinclair's £8 for a monitor lead: the DIN however needs two pins bending slightly for it to fit.

An intermittent fault on the Spectrum was traced to heating of the ULA i.c. Even stroking the i.c. with a finger would remove the fault, so a heatsink was made from copper sheet (see Fig. 2). It was U-shaped, the sides being as long as possible consistent with the space available. It was sanded flat on a belt sander and two holes were drilled at either end. Some thermal contact ointment was smeared in the middle and it was then placed on the i.c.: two blobs on the two holes from glue gun fixed it to the i.c. This procedure cleared the fault, which is just as well as there's no free market in these chips and a replacement would have involved the delay and expense of sending the whole computer back to Sinclair.

John de Rivaz, B.Sc. (Eng.),
Truro, Cornwall.

THE SONY KV1810UB

I've now successfully converted several Sony KV1810s to use a BU208 in the line output stage following articles in *Television*. It then occurred to me that it might be possible to use the BTW58-1300R gate-controlled switch, which is available from RS for £2·34 plus VAT (catalogue no. 262-753). This device is rated at 1,300V 6·5A peak, which is a little too critical for line output stage use. It goes a treat in the power supply however and is easy to fit.

My thanks to all those contributors who've made me less wary of Sony sets through their well written articles.

Bob McClenning,
Tacolneston, Norwich.

TOSHIBA C2095B

The problem with this set, used in conjunction with a T534B remote-control transmitter unit, was that the working range of the remote control unit gradually decreased until it would work only within a foot of the set. The cause of the trouble was found be to the 1,000μF, 16V decoupling capacitor C3 within the handset.

Stephen Howe,
Broughton, South Humberside.

A SAFETY HAZARD

We have received several sets fitted with the new basic Pye/Philips A2 chassis (e.g. Models 2060 and 2600) ahead of the relevant service information. Be warned! The chassis resembles the CTX but is half dead and half live – the live section is the power supply, which is in the corner farthest from the aerial socket. The live area isn't marked in any way *and extends to the front half of the divided heatsink*. Despite the fact that we were warned about this by a technical rep. one of my colleagues has suffered a severe shock from accidentally touching his hand across both halves of the heatsink while fault finding. It's something that's all too easy to do.

H. Peters,
R. C. Snelling Ltd., Blofield, Norfolk.

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

16181	1.04
16182	1.04
16334	0.51
16335	0.80
16446	0.98
16600	1.38
16799	2.88
16801	0.54
16802	1.14
16803	5.30
16905	0.86
17074	9.30
17127	3.51
1N4001	0.06
1N4002	0.06
1N4003	0.06
1N4004	0.04
1N4005	0.08
1N4006	0.08
1N4007	0.07
1N4148	0.04
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.35
1N914	0.04
1S44	0.09
1S5012A	0.81
1S921	0.10
2N1302	0.27
2N1303	0.38
2N2218	0.42
2N2219A	0.40
2N2222	0.38
2N2646	0.80
2N2904	0.36
2N2905	0.43
2N2906	0.38
2N3053	0.27
2N3054	0.99
2N3055	0.61
2N3055H	0.85
2N3442	1.16
2N3702	0.14
2N3703	0.14
2N3704	0.14
2N3705	0.14
2N3706	0.14
2N3707	0.16
2N3711	0.11
2N3771	2.04
2N3772	1.71
2N3773	2.29
2N3819	0.41
2N3823	1.17
2N3904	0.62
2N3908	0.62
2N4101	1.33
2N4240	3.30
2N4444	0.90
2N4914	0.72
2N5064	0.71
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N5490	1.49
2N5496	0.59
2N6107	0.59
2N6109	1.58
2N6122	1.76
2N6130	0.72
2N6133	1.25
2N6178	0.73
2N6180	0.73
2N696	0.43
2N698	0.43
2N707	0.43
2SA1027R	0.45
2SA1076	1.96
2SA329	0.40
2SA351	1.17
2SA489	1.17
2SA490	1.67
2SA493	1.05
2SA628	1.14
2SA637	1.46
2SA673	1.27
2SA683	1.61
2SA684	1.33
2SA748	1.08
2SA818	1.82
2SA835	2.50
2SA940	1.81
2SA951	1.26
2SA966-Y	1.16
2SB325	3.87
2SB375	3.87
2SB400	0.40
2SB407	3.24
2SB411	3.30
2SB511	2.50
2SB54	1.39
2SB56	2.80
2SB618A	2.22
2SB681	3.96
2SB695	1.98
2SB75	1.04
2SB861	0.85
2SC1034	6.75
2SC1050	5.06
2SC1061	1.26
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	6.75

2SC1124	1.26
2SC1151A	4.72
2SC1152	4.68
2SC1162	1.05
2SC1172	2.22
2SC1172Y	2.20
2SC1195	3.26
2SC1213	0.89
2SC1226	1.46
2SC1306	1.98
2SC1307	1.98
2SC1316	4.10
2SC1364	0.49
2SC1383	1.20
2SC1398	0.84
2SC1410	2.39
2SC1413	3.55
2SC1505	1.00
2SC1578	8.74
2SC1617	3.89
2SC1670	3.13
2SC1678	1.98
2SC1810	1.70
2SC1815	0.66
2SC1829	2.22
2SC1855	1.88
2SC1875	4.77
2SC1891	3.69
2SC1893	3.02
2SC1929	2.25
2SC1942	5.70
2SC1945	4.53
2SC1953	1.93
2SC1957	0.95
2SC1959	0.31
2SC1962	1.93
2SC1969	2.92
2SC1985	1.75
2SC1983 TR	7.00
2SC2009	0.34
2SC2029	2.33
2SC2027	1.42
2SC2028	2.11
2SC2057	1.18
2SC2073	1.54
2SC2078	2.39
2SC2091	1.30
2SC2122A	5.12
2SC2141	1.86
2SC2166	1.98
2SC2216	0.69
2SC2233	2.20
2SC2271	4.01
2SC2278	1.14
2SC2314	0.87
2SC2335	10.41
2SC2526	1.87
2SC2551	1.26
2SC2570	2.39
2SC2570A	1.05
2SC2578	6.75
2SC264A	4.82
2SC2671	1.99
2SC2728	0.95
2SC2785	0.75
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC41	2.19
2SC458	0.34
2SC495	0.92
2SC508	3.70
2SC515A	1.85
2SC536	0.29
2SC537	0.54
2SC558	3.69
2SC605L	1.16
2SC620	1.46
2SC673	1.23
2SC681	4.40
2SC684	1.65
2SC685A	2.89
2SC693	0.63
2SC710	0.69
2SC717	1.20
2SC734	1.43
2SC735	1.16
2SC782	2.47
2SC790	1.27
2SC806	11.29
2SC814	1.39
2SC828	0.28
2SC867A	3.04
2SC876	0.96
2SC901	4.55
2SC926A	1.42
2SC930	0.54
2SC935	4.13
2SC936	5.25
2SC937	3.58
2SC940	4.68
2SC982	0.70
2SD1051	0.75
2SD1128	2.25
2SD1138	0.94
2SD1265	0.76
2SD1398	2.25
2SD1453	0.75
2SD198	3.87
2SD234	0.49
2SD235	0.60
2SD257	2.94
2SD291	2.94
2SD292	2.59
2SD313	2.59
2SD315	2.94
2SD325D	0.91

2SD348	16.13
2SD350	5.20
2SD350A	2.29
2SD353	7.50
2SD389	2.41
2SD401	3.55
2SD551	2.42
2SD588A	1.99
2SD600	3.25
2SD621	12.67
2SD636	0.40
2SD657	2.80
2SD679	3.35
2SD731	2.11
2SD787E	0.62
2SD811	5.54
2SD823	1.98
2SD856	6.61
2SD869	7.17
2SD898B	7.45
40408	0.50
40594	1.53
40595	1.53
40636	1.43
40871	1.53
40872	1.53
60857	1.21
74LS30	0.32
7805 TO-220	0.63
7805 TO-3	1.16
7806	0.73
7808	2.39
7812 TO-3	2.85
7812 TO-220	1.16
7815	0.64
7818	0.70
7824	0.64
AC107	0.73
AC117	0.43
AC123K	0.43
AC128	0.34
AC138	0.09
AC141	0.29
AC142K	0.43
AC151	0.28
AC153	0.34
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
AC187K	0.43
AC188	0.37
AC188-01	0.44
AC188K	0.43
AC193K	0.65
AC194K	0.65
AD140	1.06
AD145	1.60
AD149	0.90
AD161	0.56
AD162	0.45
AD262	1.05
AF114	2.47
AF115	1.24
AF117	0.50
AF118	1.20
AF127	0.50
AF139	0.53
AF178	1.45
AF179	0.55
AF180	0.55
AF181	0.53
AF182	0.55
AF186	0.53
AF239	0.53
AF279	0.88
AL100	4.03
AL102	5.69
AL103	2.68
AL113	1.36
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN214	2.26
AN214Q	2.40
AN231	14.89
AN234	5.92
AN236	3.33
AN238	6.79
AN239	5.88
AN240P	1.72
AN241	1.71
AN245	4.49
AN247P	4.22
AN252	2.57
AN253	2.97
AN262	1.98
AN272	7.92
AN281	6.53
AN295	5.52
AN301	5.55
AN302	3.99
AN303	4.39
AN305	8.88
AN313	3.41
AN315	2.46
AN316	5.53
AN318	6.20
AN320	5.47
AN331	4.59
AN337	5.37
AN340P	1.17
AN355	5.98
AN362	1.75
AN5111	2.92
AN5132	4.39
AN5250	2.89

AN5435	3.08
AN5610	7.43
AN5612	3.51
AN5613	3.41
AN6320N	4.28
AN6326	3.98
AN6342	1.61
AN6344	5.87
AN6363	16.00
AN6551	1.35
AN6552	0.68
AN7115	2.52
AN7145	2.80
AN7146	9.90
AN7150	2.45
AN7151	2.26
AN7156	2.78
AN7158	6.75
AN7218	1.64
AP58076	4.68
AS560S	1.58
AU113	2.97
AY105K	2.08
AY106	1.09
BA130	0.14
BA1310	1.98
BA1320	1.38
BA1330	2.75
BA145	0.19
BA148 DIOD	0.33
BA154	0.40
BA156	0.05
BA157	0.22
BA159	0.12
BA182	0.19
BA222	1.66
BA284/2	0.17
BA301	0.87
BA302	1.24
BA311	1.32
BA312	0.97
BA313	0.76
BA317	0.04
BA318	0.09
BA328	4.77
BA333	1.37
BA401	0.64
BA511 (IC)	2.92
BA521	2.02
BA524	8.94
BA526	7.98
BA532	2.67
BA536	3.44
BA6304A	2.92
BA843	3.96
BAV18	0.21
BAV19	0.11
BAV20	0.11
BAV21	0.34
BAX12	0.11
BAX13	0.11
BAX16	0.11
BB119	0.17
BC107	0.13
BC107B	0.11
BC108	0.15
BC108B	0.15
BC109	0.12
BC109B	0.15
BC113	0.14
BC116A	0.25
BC119	0.36
BC126	0.20
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC140	0.45
BC141	0.34
BC142	0.34
BC143	0.33
BC147	0.08
BC147A	0.12
BC148	0.13
BC148B	0.13
BC148C	0.11
BC149	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC157	0.14
BC158	0.10
BC159	0.16
BC160	0.40
BC161	0.28
BC167	0.36
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172	0.10
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.20
BC178	0.26
BC179	0.26
BC182	0.09
BC182	0.11
BC182B	0.26
BC182L	0.10
BC182LB	0.14
BC183	0.10
BC183L	0.11
BC183LB	0.26
BC184	0.13
BC184L	0.14
BC184LB	0.26

BC186	0.27
BC187	0.28
BC204	0.16
BC207	0.14
BC212	0.11
BC212B	0.26
BC212L	0.10
BC212LB	0.26
BC213	0.10
BC213L	0.10
BC213LB	0.15
BC214	0.10
BC214L	0.14
BC214LB	0.26
BC225	0.40
BC237	0.10
BC238	0.10
BC238A	0.13
BC239	0.12
BC239B	0.25
BC251A	0.12
BC252	0.10
BC258	0.25
BC261A	0.22
BC262	0.22
BC287	0.50
BC294	0.50
BC301	0.45
BC302	0.53
BC303	1.04
BC307	0.18
BC307A	0.14
BC308	0.18
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.11
BC337	0.08
BC338	0.12
BC360	0.34
BC368	0.24
BC440	1.09
BC441	0.44
BC454	0.36
BC455	0.36
BC460	0.42
BC461	0.47
BC462	0.30
BC463	0.64
BC464	0.64
BC465	0.64
BC477	0.32
BC478	0.32
BC479	0.41
BC532	0.28
BC546	0.17
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.40
BC556	0.16
BC557	0.10
BC558	0.10
BC559	0.10
BC560C	0.14
BC635	0.36
BC636	0.20
BC637	0.24
BC638	0.20
BC639	0.20
BC640	0.24
BC879	0.39
BC880	0.31
BCX32	0.42
BCX33	0.27
BCX34	0.40
BCX37	0.67
BCY70	0.30
BCY71	0.21
BCY72	0.20
BD115	0.36
BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.42
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.36
BD137	0.36
BD138	0.46
BD139	0.34
BD140	0.37
BD144	1.43
BD150	0.75
BD157	0.67
BD159	0.53
BD160	1.60
BD163	0.71
BD165	0.62
BD166	0.42
BD168	0.73
BD175	0.43
BD177	0.43
BD179	0.49
BD181	0.99
BD182	0.99
BD183	0.99
BD184	1.21
BD187	0.53
BD189	0.69
BD190	0.69
BD201	0.67
BD202	0.60
BD203	0.60
BD204	0.40
BD207	1.79
BD208	1.23

BD222	0.49
BD225	0.49
BD228	0.63
BD229	1.05
BD231	0.50
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.45
BD239	0.45
BD240	0.37
BD241	0.39
BD242	0.50
BD243	0.50
BD243A	0.37
BD244	0.51
BD244A	0.85
BD245C	0.99
BD246C	0.89
BD253	1.05
BD278A	0.80
BD317	2.60
BD318	2.59
BD375	0.42
BD377	0.26
BD379	0.76
BD380	0.76
BD410	0.52
BD412	6.27
BD418	0.87
BD433	0.41
BD434	0.49
BD435	0.49
BD436	0.60
BD437	0.49
BD438	0.40
BD441	1.42
BD442	0.66
BD507	0.60
BD509	1.42
BD510	0.75
BD518	1.50
BD519	1.50
BD529	1.32
BD530	1.10
BD533	0.67
BD534	0.53
BD535	0.77
BD536	0.61
BD537	0.74
BD538	0.67
BD544B	0.83
BD580	1.17
BD590	1.17
BD598	1.25
BD677	0.53
BD679	0.57
BD680	0.76
BD681	1.48
BD695	2.30
BD696	2.47
BD697	3.60
BD698	1.85
BD699	3.49
BD700	3.70
BD702	3.70
BD707	1.06
BD709	1.12
BD710	0.80
BD807	0.34
BD809	0.75
BD810	0.69
BD879	0.74
BD880	0.79
BD895	2.31
BD899	2.48
BD901	0.79
BD902	0.84
BDV64B	1.26
BDV65B	1.26
BDX32	1.75
BDX53	1.25
BDX53A	4.93
BDX53B	3.35
BDX54B	2.61
BDX62A	1.96
BDX63A	1.96
BDX64A	2.61
BDX65A	2.61
BDX76	0.59
BDY20	1.21
BDY62/01	4.62
BDY81	1.18
BF115	0.40
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.13
BF127	0.13
BF137	0.29
BF152	0.31
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.55
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14

BF195	0.14
BF196	0.17
BF197	0.16
BF198	0.17
BF199	0.17
BF200	0.37
BF216	0.36
BF218	0.36
BF222	0.55
BF224	0.17
BF237	0.65
BF240	0.17
BF241	0.17
BF244	0.57
BF245A	0.37
BF255	0.20
BF256	0.28
BF256LC	0.42
BF257	0.34
BF258	0.36
BF259	0.34
BF262	0.57
BF263	0.57
BF264	0.37
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.23
BF336	0.33
BF337	0.36
BF338	0.40
BF355	0.49
BF362	0.66
BF363	0.60
BF371	0.50
BF391	0.25
BF393	1.59
BF417	0.84
BF418	1.87
BF422	0.29
BF423	0.29
BF435	0.54
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.39
BF459	0.52
BF460	1.56
BF469	0.31
BF470	0.55
BF471	0.31
BF472	0.33
BF479	0.61
BF480	0.60
BF491	0.32
BF495	0.64
BF506	0.43
BF509	0.41
BF523	0.20
BF594	0.27
BF595	0.27
BF596	0.18
BF597	0.27
BF617	1.05
BF618	1.05
BF694	0.22
BF757	0.59
BF758	0.65
BF759	0.47
BF760	0.65
BF762	0.75
BF870	0.30
BF871	1.81
BF900	0.83
BF959	0.42
BF970	0.69
BFR39	0.44
BFR52	0.50
BFR62	0.50
BFR79	0.29
BFR81	0.50
BFR86	1.08
BFR89	1.63
BFT41	0.30
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX30	0.65
BFX84	0.37
BFX85	0.41
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.32
BFY52	0.27
BFY90	0.61
BLY49	2.20
BR100	0.22
BR101	0.70
BR103	0.66
BR88B	0.64
BRC-M-300	0.97
BRC116	0.67
BRC1330	1.76
BRC300	2.01
BRC4443	1.02
BRC4444	1.02
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.53
BRY39	0.69
BRY55	0.67
BRY56	0.50

BSR59	1.29
BSS38	0.59
BSTBD140G	4.98
BSTC0146	2.48
BSTC0246	6.99
BSTC0233	6.12
BSTC1233	4.34
BSTC3146	0.79
BSTCC0143	3.07
BSTC0643	3.37
BSV57B	3.49
BSW68	0.60
BSX19	0.34
BSX20	0.34
BSX21	0.87
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT106	1.18
BT108	1.45
BT109	1.45
BT112	2.48
BT113	2.48
BT116	1.20
BT119	1.76
BT120	2.17
BT121	2.48
BT122	2.48
BT123	1.98
BT125	2.48
BT126	2.48
BT128	2.48
BT128P	3.07
TBA970	3.06
BT151-800R	1.15
BT151 500R	1.38
BTT6018	2.42
BTT6218	2.51
BTT8024	4.43
BTT8124	4.89
BTT8214	5.99
BTT8224	2.97
BU105	1.50
BU106	2.48
BU108	1.50
BU109	2.25
BU110	5.69
BU111Y	4.16
BU124	1.38
BU126	0.90
BU134S	4.57
BU204	1.58
BU205	1.08
BU206	1.27
BU207	1.65
BU208	1.12
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.93
BU226	2.45
BU312	2.38
BU326	2.00
BU326A	2.20
BU326S	2.20
BU406	1.49
BU407	0.82
BU407D	1.00
BU412	5.29
BU426	1.90
BU426A	1.67
BU500	1.95
BU508A	1.89
BU526	2.02
BU608D	1.57
BU807	0.94
BU826A	1.63
BUV46	1.53
BUV84	1.24
BUW81A	3.06
BUW84	1.39
BUX84	0.95
BY126	0.13
BY127	0.13
BY133	0.11
BY164	0.47
BY176	1.52
BY179	1.42
BY182	1.05
BY184	0.47
BY187	0.77
BY189	1.76
BY198	1.62
BY201/2	1.50
BY203/20	0.41
BY206	0.17
BY207	0.22
BY208	0.46
BY210-400	0.18
BY210-600	0.27
BY210-800	0.34
BY223	0.85
BY224-400	0.99
BY225-100	1.13
BY226	0.25
BY227	0.49
BY228	0.60
BY255	1.07
BY298	0.20
BY299	0.60
BYW56	0.34
BYX10	0.29
BYX55-350	0.53
BYX55-600	0.15
BYX61 RANGE	0.18
BYX71-600	1.25
BYX71-350	0.72
BYX71-600	0.85
BYX94	0.14
BYY56	1.20

BZX79 RANGE	0.10
BZY88 RANGE	0.10
C106D	0.46
C1129	0.58
CA1310E	2.70
CA3044	3.50
CA3046	2.06
CA3060	1.65
CA3065	1.29
CA3089	0.83
CA3089E	1.43
CA3090	1.38
CA3094	2.20
CA3131EM	3.12
CAH76023N	6.60
CBF16848N-07	1.56
CD4001	0.38
CD4002	0.27
CD4008	1.06
CD4011	0.29
CD4012	0.24
CD4013	0.47
CD4016	0.45
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4047	1.06
CD4049	0.46
CD4050	0.55
CD4052	0.75
CD4053	0.80
CD4069	0.29
CD4081	0.35
CD4093	0.72
CD4511	1.10
CP5521	17.83
CV12E	3.07
CX034	11.83
CX095D	3.14
CX104	9.64
CX108	8.16
CX109	7.86
CX121	11.83
CX130	4.35
CX131	11.83
CX134	11.04
CX136	11.49
CX137	11.83
CX139	11.83
CX157	4.84
CX158	4.10
CX170	7.62
CX177	6.75
CX506	9.33
CX507	7.62
CX755	12.95
CX758	7.62
01693	2.59
DEC1	2.20
DEC2	2.20
E1222	0.40
E5024	0.28
E5386	0.25
E5529	0.25
E8021	1.29
E9003	0.46
E9005	0.50
ESM432C	4.60
ESM532C	4.60
ESM632C	4.60
ESM732C	4.60
ETTR6016	2.65
FND500	5.78
FT3055	1.16
GF758	0.84
GF759	1.13
GF761	1.20
GH3F	1.82
HA11211	2.53
HA11215	5.06
HA11223W	0.00
HA11225	4.29
HA11226	8.71
HA11229	2.88
HA11235	2.48
HA1124	5.25
HA11244	2.82
HA1125	4.29
HA11251	4.47
HA1137W	2.87
HA1138	5.03
HA1141	5.65
HA11414	5.65
HA1144	7.87
HA1156	1.16
HA11580	9.00
HA1160	3.80
HA1166X	5.36
HA1166	1.55
HA1167	5.36
HA11711	20.16
HA11713	8.13
HA11714	7.76
HA11714	8.13
HA11715	8.13
HA11724	22.25
HA11725	18.26
HA11738	22.25
HA1180	5.15
HA1192	0.00
HA1196	7.43
HA12005 IN	9.00
HA1203	1.72
HA1306	2.26
HA1308	6.95
HA1322	2.18

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

ECONOMIC DEVICES, PO BOX 228, TELFORD TF2 8QP

HA1338	7.50
HA1339	2.33
HA1342	2.65
HA1350	3.27
HA1365	4.02
HA1366WR	1.86
HA1367	4.32
HA1368	1.90
HA1368R	2.45
HA1370	3.71
HA1374	8.80
HA1374A	8.80
HA1377	3.96
HA1389	2.39
HA1389R	2.05
HA1392	3.90
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.07
HA1452	1.63
HA17723	5.94
HBF4030AF	2.48
HD38750A53	8.71
HD4480	17.16
HD44801A05	17.49
HEF4001P	0.67
HEF4001BP	0.67
HEF4011	0.29
HEF4528	0.00
HM6231	9.81
HM6232	8.89
HM9102	3.22
HM9104	3.24
HM9105	3.24
HT4207	17.16
ITT2003	0.22
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	5.54
L129V	0.25
L200CV	1.69
LA1111AP	0.88
LA1201	1.02
LA1210	1.56
LA1230	2.87
LA1320	2.87
LA1352	1.54
LA1357N	11.07
LA1363	6.21
LA1364	3.02
LA1365J	3.44
LA1378	6.52
LA1385	1.94
LA1387	7.60
LA3155	1.25
LA3300	1.54
LA3301	1.41
LA3350	1.43
LA3361	1.23
LA4030P	4.20
LA4031P	3.20
LA4032P	2.35
LA4050P	1.57
LA4051P	1.79
LA4100	1.25
LA4101	1.30
LA4102	2.81
LA4112	4.83
LA4125	2.25
LA4138	3.38
LA4140	1.15
LA4192	3.65
LA4220	1.62
LA4400	2.25
LA4420	1.72
LA4422	1.72
LA4430	1.47
LA4460	2.32
LA4461	2.95
LA4520	2.15
LA5112N	2.65
LA7020	7.33
LA7025	8.05
LA7027	9.35
LA7800	2.65
LA7801	4.15
LB1274	3.08
LC4011B	1.24
LD3120	1.13
LM1011N	3.46
LM1017N	3.41
LM1111	4.29
LM1303P/N	1.65
LM1310P/N	1.38
LM1877	10.92
LM3065N	0.85
LM317CKC	1.38
LM339N	0.80
LM3407	1.42
LM340T5	0.83
LM340T12	0.64
LM340T5	0.83
LM342N	0.62
LM342P 12V	1.62
LM342P 15V	1.62
LM342P 5V	1.62
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.43
LM748	1.82
LM8360	3.22
LM8361	2.97
LM8361	3.57
M1024	2.81
M1025	5.17
M1124	2.80

M1130	5.35
M191	6.32
M193	18.55
M51102L	6.35
M5115P	5.24
M51231P	3.04
M5124P	4.82
M5134-9341	4.13
M51394P	11.97
M5142P	5.49
M5143P	7.33
M5144P	3.77
M51513L	2.55
M51515BL	3.23
M51516L	3.95
M51517L	3.71
M5152L	2.88
M51522	5.39
M5191P	4.94
M5192	2.20
M5194AP	5.74
M53273P	1.02
M53274P	1.33
MA06	1.07
MA8001	0.82
MB3705	1.81
MB3712	1.85
MB3713	1.69
MB3730	3.25
MC13002	6.22
MC1303P	2.16
MC1307P	1.92
MC1310P	1.30
MC1327P	1.33
MC1330P	1.69
MC1349P	0.99
MC1350P	1.21
MC1351P	1.33
MC1352P	1.12
MC1357P	2.15
MC1358P	1.30
MC14001	2.40
MC14013	0.41
MC14016CP	0.84
MC14011	0.26
MC14025	0.60
MC14049UBC	0.58
MC1438R	1.05
MC14493P	2.82
MC14556BCP	3.47
MC1712	3.88
MC7724CP	3.49
MC7818C	2.18
MC7824CP	4.68
MC78M12	0.83
MC78M24	0.94
MCR100	0.38
MCR101	0.67
MCR106/5	1.57
MCR220/7	2.28
ME0402	0.17
ME0404	0.26
ME0404/2	0.47
ME0411	0.28
ME0412	0.24
ME4102	0.50
ME545B	10.02
ME6002	0.26
ME6102	0.28
ME8001	0.29
MED411	0.75
MJ2501	3.30
MJ2955	0.99
MJ3000	2.37
MJ3001	1.69
MJ3028	2.65
MJ481	1.53
MJ802	5.45
MJE2955	1.89
MJE3055	1.65
MJE340	0.49
MJE520	0.49
ML231	0.99
ML232B	2.15
ML237B	2.51
ML238	5.77
ML741CS	0.59
ML923	3.30
ML0926	3.58
MM5314N	4.02
MM5316N	3.96
MM5318N	3.11
MM5369N	2.01
MM5387AA/N	16.20
MM5841N	6.49
MP8112	1.49
MP8113	1.49
MP8512	1.57
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.45
MPSU05	0.86
MPSU10	1.56
MPSU55	0.99
MPSU56	0.60
MPSU60	1.33
MR510	0.67
MR812	0.21
MR914	0.51
MVS240	0.51
MVS460	0.34
MVS460-02	0.61
NE555	0.38
NE556	0.95
NE5560N	3.48
NE565N	1.33
NE645BN	3.35

NE646N	2.98
NE650N	4.34
NE654BN	4.18
NP1106	5.61
OA200	0.11
OA202	0.11
OA47	0.14
OA90	0.08
OA91	0.09
OA95	0.09
OC28	2.52
OC29	2.15
OC35	1.06
OC36	1.28
OC44	0.35
OC45*	0.18
OC75	0.44
ON188	1.87
ON236	1.06
OT112	1.08
OT121	1.32
PD144	2.24
PT2014	3.04
PT5006	2.48
PT6042	1.79
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2001B	1.33
R2029	1.33
R2030	1.33
R2257	2.38
R2265	1.49
R2305	1.18
R2306	1.36
R2322	0.59
R2323	0.76
R2348	2.01
R2354A	2.01
R2354B	2.01
R2441	0.49
R2443	0.88
R2461	1.50
R2477	1.02
R2501	1.28
R2540	1.98
R2540X	3.30
R2615	0.67
RC4195NB	2.16
RCA16083	5.30
RCA16029	2.01
RCA16334	1.02
RCA16335	1.36
RCA16600	1.38
RCA16799	2.38
RCA16801	0.95
RCA16802	1.08
RCA17028	2.48
RCA17074	6.60
RCA17376	1.58
RCA60857	4.95
RGP10	0.50
RT402	1.58
RT905A	2.38
S0280	2.14
S0281	2.14
S1299	4.74
S175	31.48
S2062D	2.07
S2800	7.73
S2800D	5.54
S2802	3.47
S3702S	5.21
S3703F	5.21
S3707	4.32
S40W	10.89
S551	4.54
S552	4.54
S6080B	8.80
S6087AR	4.90
SAA1020	4.76
SAA1021	4.76
SAA1024	2.81
SAA1025	4.40
SAA1050	4.16
SAA1051	5.83
SAA1061	3.61
SAA1075	4.86
SAA1082	8.85
SAA1121	4.43
SAA1124	3.25
SAA1130	4.99
SAA1174	7.77
SAA1250	3.96
SAA1251	4.98
SAA5000	4.02
SAA5010	5.39
SAA5012	4.50
SAA5020	5.78
SAA5030	8.25
SAA5040A	16.23
SAA5050	7.74
SAA661B	1.98
SAA700	3.30
SAB1009B	4.99
SAB1046P	4.03
SAB3011	7.34
SAB3012	5.88
SAB3013	5.61
SAB3021	7.90
SAB3022B	13.58
SAB3023B	12.30
SAB3024	6.36
SAB3209	5.23
SAB3210	3.49
SAF1031	2.53
SAF1039	3.35
SAS5010	8.39

SAS560	1.85
SAS560S	1.65
SAS560T	5.42
SAS570	1.78
SAS570S	2.61
SAS570T	5.42
SAS580	2.85
SAS5800	2.89
SAS590	2.85
SAS5900	2.56
SAS660	2.97
SAS6600	1.33
SAS660S	1.33
SAS6610	1.33
SAS670	3.96
SAS6700	1.33
SAS670S	1.33
SAS6710	1.33
SAS6800	2.53
SAS6810	1.43
SBA550B	2.15
SBA750	1.61
SC9488P	2.09
SC9503	1.65
SC9504P	1.95
SC9511P	2.09
SCR957	1.33
SG264A	5.26
SG608	5.26
SG613	8.75
SG629	8.27
SG6533	10.31
SI-1125HD	13.86
SI1125H	7.50
SKE2F 1/04	1.39
SKE2G 2/04	0.95
SKE2G 3/04	0.99
SKE4F 1/02	1.39
SKE4F 1/06	0.73
SKE4F 2/06	0.85
SKE4F 2/08	0.86
SKE4F 2/10	1.24
SKE4G 2/02	0.96
SKE5F 3/10	1.60
SL1310	3.14
SL1327E	1.33
SL1430	1.39
SL1430T	2.31
SL1432	2.25
SL414	3.69
SL432A	3.44
SL437	7.43
SL439	2.48
SL480	3.14
SL490	2.37
SL901B	8.32
SL917B	11.96
SL918A	9.07
SN16861N-07	2.72
SN16880N	3.63
SN16965	8.95
SN16966N	10.25
SN29715N	6.04
SN29716N	3.66
SN29717N	7.19
SN29722	11.95
SN29723AN	7.65
SN29744N	2.29
SN29764AN	1.38
SN29767	4.98
SN29770BN	4.24
SN29771BN	4.93
SN29772BN	4.91
SN29773	2.51
SN29770AN	2.25
SN29791	1.67
SN29845	2.36
SN29848	1.66
SN29861	2.29
SN29862	2.29
SN72709	0.44
SN75110N	0.83
SN76001ANQ	1.65
SN76003N	5.54
SN76013ND	2.48
SN76013N	3.99
SN76013NDG	8.90
SN76023N	2.59
SN76023ND	3.50
SN76033N	2.68
SN76105N	0.54
SN76110N	0.90
SN76115AN	1.61
SN76131	1.92
SN76226DN	1.98
SN76227N	0.75
SN76228N	3.27
SN76231	2.55
SN76242	5.23
SN76243	5.23
SN76322	2.77
SN76360	2.17
SN76390	3.08
SN76396	2.90
SN76510N	1.05
SN76532N	0.91
SN76533N	2.47
SN76530P	1.57
SN76546N	3.47
SN76540N	1.98
SN76540N	1.98
SN76544	2.89
SN76546	1.65
SN76549	2.59
SN76550	0.37
SN76551	1.49
SN76570	3.08
SN76600	1.21
SN7660N	0.00
SN76611	2.59

SN76620	2.59
SN76622	1.65
SN76623	0.69
SN76630	2.55
SN76640	4.24
SN76651	1.49
SN76660N	2.48
SN76665N	1.49
SN76666N	1.41
SN76705N	1.34
SN76707N	4.39
SN76709	5.12
SN76709N	5.45
SN76730	5.36
SN76810N	0.60
SN76920N	2.90
SN94041	5.54
SN94042	4.35
SP8385	0.55
STA441C	2.75
STK0029	5.54
STK0039	5.35
STK0050	7.67
STK0059	7.13
STK0080	9.16
STK011	3.96
STK013	9.25
STK014	8.84
STK015	7.75
STK016	6.91
STK022	5.25
STK025	12.50
STK040	8.70
STK043	10.48
STK054	7.13
STK070	22.31
STK077	7.67
STK078	8.52
STK082	11.86
STK086	13.59
STK2101	6.32
STK2110	7.33
STK2230	7.70
STK415	7.70
STK433	4.95
STK435	5.94
STK436	7.21
STK437	7.80
STK439	8.31
STK441	11.28
STK443	10.29
STK459	9.40
STK460	10.75
STK461	9.68
STK463	11.53
STK465	10.31
STK466	11.77
STR441	9.45
STR453	8.16
STR6020	8.31
T6007V	0.95
T6007	0.62
T6016	0.40
T6017	0.72
T6018V	0.72
T6021	0.40
T6022V	3.92
T6026	0.98
T6027	0.81
T6028V	0.39
T6029V	4.86
T6032V	0.98
T6033V	0.60
T6035V	0.73
T6036	0.67
T6037	2.11
T6041V	0.73
T6044V	0.95
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	0.59
T6059	1.16
T8001V	1.20
T9003V	0.95
T9005V	2.38
T9010V	0.62
T9011V	0.49
T9013V	7.96
T9014V	1.68
T9016	1.02
T9034V	1.38
T9035V	1.39
T9038V	9.42
T9051	4.29
T9053V	1.40
T9054V	0.75
T9057V	0.70
T9063V	3.24
TA5814	1.49
TA7020P	4.80
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.68
TA7071	3.69
TA7072P	2.57
TA7073P	5.86
TA7074P	1.98
TA7076P	7.50
TA7089M	1.56
TA7089P	1.50
TA7092P	6.84
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61

TA7109	3.71
TA7120P	0.64
TA7122B/P	0.92
TA7124P	2.34
TA7130P	1.27
TA7136AP	1.27
TA7137P	0.98
TA7141AP	3.87
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7161P	5.45
TA7162P	2.59
TA7169	9.54
TA7171P	2.79
TA7172P	1.41
TA7176P	2.48
TA7193AP	6.67
TA7193P	7.26
TA7201P	2.71
TA7202P	2.47
TA7203P	2.18
TA7204P	2.16
TA7205	1.38
TA7206P	6.25
TA7207P	3.34
TA7208P	2.15
TA7210P	3.58
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.37
TA7222	1.95
TA7227P	2.81
TA7229P	4.45
TA7233P	3.67
TA7240AP	7.83
TA7245P	7.50
TA7314	5.94
TA7325P	1.15
TA7609	3.17
TA7676P	2.81
TAA300	2.97
TAA310A	1.16
TAA320A	1.27
TAA350A	0.80
TAA435	1.82
TAA550	0.37
TAA570	1.74
TAA611B12	1.30
TAA621AX1	2.00
TAA640	4.24
TAA661B	1.00
TAA700	2.59
TAA840	2.50
TAA930	4.87
TAA970	2.83
TAD100	2.52
TAG232-600	0.73
TAG626-600	1.06
TBA120	1.05
TBA120A	1.05
TBA120AS	1.24
TBA120S	1.05
TBA120SB	1.05
TBA120T	0.95
TBA120U	2.50
TBA1440	2.03
TBA1440G	7.20
TBA1441	1.62
TBA240A	3.99
TBA395	1.10
TBA395Q	1.10
TBA396	0.80
TBA400	2.39
TBA440P	2.45
TBA480	1.57
TBA480Q	1.30
TBA510	1.37
TBA520	1.84
TBA520Q	1.68
TBA530	1.30
TBA530Q	1.30
TBA540	1.15
TBA540Q	1.15
TBA550	4.50
TBA550Q	4.50
TBA560C	1.40
TBA560CQ	1.60
TBA570	1.60
TBA570A	1.71
TBA570Q	1.35
TBA625A	2.17
TBA625B	2.17
TBA625C	2.17
TBA641BX1	1.89
TBA641A12	4.13
TBA651	1.76
TBA673	2.45
TBA700Q	2.00
TBA720	2.50
TBA730	2.14
TBA750Q	2.90
TBA760	1.71
TBA780	1.65
TBA800	1.08
TBA810AS	1.00
TBA810S	1.61
TBA820M	0.82
TBA890	1.61
TBA900	2.48
TBA920	1.89
TBA920Q	2.31
TBA940	1.87
TBA950	1.55
TBA970	1.79
TBA970Q	3.28
TBA990	1.82
TBA990Q	1.68
TBA231	2.57

TC4053BP	4.34
TCA150	1.79
TCA160B	1.79
TCA270Q	1.71
TCA270S	2.15
TCA270SQ	1.65
TCA290A	2.39
TCA420A	2.16
TCA440	1.93
TCA4500A	2.15
TCA530	2.16
TCA640	10.26
TCA650	2.04
TCA660B	3.30
TCA730	3.81
TCA740	2.48
TCA750	2.25
TCA800	5.95
TCA800Q	5.95
TCA830S	2.38
TCA900	2.04
TCA910	1.65
TCA940E	2.93
TCE330	3.89
TCE527	1.86
TCE82	1.08
TCE83	1.08
TCE84	1.08
TCEP100Q	10.25
TCEP100	9.61
TD190	0.95
TD3F700H	6.60
TD3F800H	4.86
TD3F800R	3.66
TD3F900H	4.16
TDA1003A	1.79
TDA1005A	2.22
TDA1006A	1.69
TDA1010	1.15
TDA1011	2.40
TDA1028	2.45
TDA1029	4.89
TDA1035T	2.55
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TDA1037	2.95
TDA1037D	3.25
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TDA1044	2.62
TDA1047	4.10
TDA1054M	1.21
TDA1059B	0.80
TDA1060	2.59
TDA1082	3.06
TDA1104	5.61
TDA1151	1.17
TDA1170	2.37
TDA1170S	3.25
TDA1180	3.25
TDA1190	2.11
TDA1190Z	2.48
TDA1200A	1.43
TDA1220	1.95
TDA1230	3.23
TDA1235	3.88
TDA1270	3.76
TDA1327A	1.50
TDA1327B	1.82
TDA1330	1.76
TDA1365	6.99
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TDA1420	1.52
TDA1470	2.90
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TDA1950	3.80
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TDA2020	2.77
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TDA2140	1.59
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TDA2590	2.50
TDA2591	2.50
TDA2591Q	0.83
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TDA2594	3.08
TDA2600	5.50
TDA2610	2.79
TDA2611A	1.25

TDA2611AQ	2.98
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TDA2630	1.96
TDA2631	2.73
TDA2640	2.59
TDA2643	12.12
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TDA2670	2.48
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TDA2690A	2.65
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TDA2791	2.50
TDA2795	2.78
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TDA3190	2.68
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TDA3500	4.25
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TDA3520	9.71
TDA3521	13.39
TDA3540	2.98
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TDA3561	6.50
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TDA3571Q	2.83
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TDA3590	6.79
TDA3590B	1.54
TDA4050A	3.47
TDA4180P	1.92
TDA4260	1.54
TDA4280	7.20
TDA4290	4.47
TDA440	4.90
TDA4400	2.27
TDA4420	3.95
TDA4422	8.32
TDA4430	4.78
TDA4431	2.27
TDA4432	2.27
TDA4400	2.87
TDA4600	2.84
TDA4610	3.11
TDA4620	4.46
TDA5500	2.73
TDA5700	2.31
TDA9400	2.92
TDA9403	5.15
TDA9503	2.92
TDA9513	5.44
TE527	1.38
TE538	0.40
TE626	1.49
TEA1002	3.47
TEA1009	1.86
TEA1020SP	8.21
TEA1087	0.51
TIC106C	0.61
TIC106M	0.77
TIC116	2.07
TIC44	0.72
TIC45	0.77
TIC47	0.77
TIP120	1.06
TIP110	0.53
TIP112	0.88
TIP117	0.95
TIP120	0.55
TIP121	0.87
TIP126	0.73
TIP127	1.43
TIP2955	0.86
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP3055	0.60
TIP30A	0.41
TIP30B	0.70

TIP30C	0.40
TIP31A	0.34
TIP31B	0.38
TIP31C	0.50
TIP32B	0.69
TIP32C	0.40
TIP33C	0.80
TIP34	1.18
TIP41A	0.49
TIP41B	0.31
TIP41C	0.45
TIP42A	0.49
TIP42B	0.79
TIP42C	0.53
TIP47	0.65
TIP48	0.92
TIP49	3.61
TIP55A	3.65
TIS43	1.34
TIS90	0.28
TIS91	0.29
TMS1000NL	11.86
TMS3748HS	16.13
TMS4116	2.06
TV106	1.76
TY6010B	2.97
U05G	1.14
U143M	3.08
U37003	0.49
UA723CA	5.53
UA758PC	5.29
UA783P3C	3.38
UAA170	2.31
UAA180	2.36
ULN2165	1.49
ULN2204	7.70
ULN2216F	2.15
UPC1009C	6.32
UPC1001H	2.75
UPC1026C	1.24
UPC1028H	2.00
UPC1020H	2.77
UPC1025H	2.90
UPC1032H	0.62
UPC1030H	2.27
UPC1031H	4.50
UPC1031H2	6.00
UPC1154H	1.93
UPC1156H	2.96
UPC1185H	2.94
UPC1182H	1.82
UPC1186H	1.05
UPC1181H	1.25
UPC1213C	0.99
UPC1217C	2.47
UPC1212C	1.72
UPC1351C	1.81
UPC1353	7.85
UPC1350C	1.07
UPC1355C	2.13
UPC1362	7.75
UPC1365	7.10
UPC1366	7.14
UPC1360C	4.51
UPC1458	8.66
UPC2022	1.48
UPC30C	2.51
UPC32C	4.94
UPC41C	4.10
UPC554C	1.85
UPC558C	4.04
UPC566H	2.95
UPC572	3.87
UPC575C2	2.40
UPC576H	2.58
UPC577H	0.76
UPC587C2	1.34
UPC592H	1.13
UPD1514C	8.32
UPX27C	2.18
X0022CE	4.04
X0035TA	5.11
X0056CE	5.11
X0062CE	6.52
X0065CE	4.78
X0096CE	4.29
X0109CE	9.90
X1074AF	7.00
XC9494P	1.33
Y730	0.05
Y969	0.82

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Servicing the NordMende FC25 Chassis

Pete Saunders

Foreign TV sets first started to come into the UK in large quantities in the early seventies. One foreign manufacturer who supplied sets to a number of rental companies at that time was NordMende of W. Germany. They were predominantly large-screen sets fitted with the FC25 chassis, which was designed to drive a 110°, delta-gun tube. Although the sets are now about ten years old they still have quite a modern appearance, with touch tuning and slider controls.

The chassis is split into two main sections. The vertically mounted section on the left-hand side contains the tuner, i.f. strip, colour decoder and audio amplifier. It's easy to remove by unscrewing two large winged bolts: it can then be hung on two screws set into the side of the cabinet for servicing. The front panel, which incorporates the touch-tuning assembly and slider controls, is also secured by two winged nuts and is equally accessible. The horizontal chassis contains the power supply and the line and field timebases: it slides out on metal runners and can be tilted at 90° or 45° leaving both sides free for servicing. The convergence panel is hinged centrally to the top of the cabinet and can be swung up for access.

Power Supply Arrangements

The power supply (see Fig. 1) is fairly straightforward in design and produces stabilised 210V and 185V outputs. Various other supplies are obtained from the line output stage.

The mains input goes via filter choke L531 and the surge limiter R532 to diode D532 and the regulating thyristor D538 which produces 210V d.c. across the reservoir capacitor C539. This voltage depends on the thyristor's firing point, which is controlled by the trigger transistor T501. When the set is switched on D531 rectifies the a.c. fed to its anode via R531, producing about 10V d.c. across C540. This is applied as bias to the emitter of T501 which produces a pulse waveform at its collector to fire D538. As a result some 60V is developed across C539. This voltage appears at the cathode of zener diode D543 which comes into operation, increasing the voltage at the emitter of T501 to 33V. The bias applied to T501 is thus increased, advancing the thyristor's firing point to produce 210V across C539. We thus have a soft-start action.

T501's base samples the mains input and the h.t., via R534, R537 adjusting the output voltage for 185V. An active filter circuit employing D559, T505 and T506 is used to reduce the hum content to an acceptable level. Some models have an over-voltage subpanel fitted.

The other main supplies in the set are a 28·5V line which is produced in the conventional manner by the action of the EW diode modulator, a 26·5V line (U2) which is obtained from the 28·5V line via an *RC* filter, and an 11·5V rail (U3) which is obtained from the U2 line via a simple series regulator circuit employing T203 (BC140). Fig. 2 shows the l.t. supply arrangements. The tuning voltage is derived from the U1 rail, and the RGB output stages are fed from the U4 supply via an *RC* filter. In later models fuse V410 (2AT) is included in the 28·5V line and fuse V415 (2AT) is present in the heater supply which includes a rectifier circuit D417 (BY196)/C417 (1,000μF). The 12V supply for the line oscillator panel is obtained from the U1 supply via R401 (3·3kΩ, 9W) with stabilisation by D590 – R401 is the centre one of the three stand-up wirewound resistors directly behind the first anode supply presets on the bottom chassis.

Dealing with a Dead Set

I always make a point of isolating the line output stage by simply disconnecting plug three on the bottom chassis. If you have no h.t., low h.t or mains fuse blowing with plug three out the fault is almost certainly in the power supply. The thyristor D538 can go short-circuit to blow the fuse: I've used the good old BT106 or BT116 as a replacement for the original BSTC type and have had no failures. T506 and C539 can also go short-circuit. A point to note is that a short-circuit on the U1 rail may not always blow the fuse. If the mains fuse is intact and there's no h.t. it's still worth checking for a short-circuit across the U1 rail. If the U1 rail comes up when plug three is disconnected the fault is in the line output stage.

If the U1 rail isn't present when plug three has been disconnected, first check whether the surge limiter resistor R532 (2·5Ω, 27W) is open-circuit. It's the smaller of the two green power resistors mounted vertically on the bottom chassis. Also check the top section R539 (15Ω, 15W) of the fusible green power resistor (R539/R404). Still no joy? Then check, by substitution if necessary, T501 (use a BC187), T505 (BC174), D543 (ZTK33) and R531 (27kΩ, 2W). I've had these components measure o.k. but fail under load. Still dead? Measure D531 and D533 (1N4148). A scope check is very useful here. Fig. 3(a) shows the waveform that should be present at the junction of R531/D531/D533 and Fig. 3(b) the waveform that should be present at the collector of T501.

Incorrect HT

Excessive h.t. is normally caused by D543. Low h.t. (60V) will be the result when R542 goes open-circuit. Low h.t. together with "motor boating" signifies a very loaded U1 rail. Disconnecting plug three will usually return the U1 supply to normal. If the power supply is still not operating correctly, unplug the overvoltage trip panel near the smoothing block: if the U1 supply returns to normal you've a faulty trip panel. The panel has been removed on many of the sets we've encountered.

Line Timebase Faults

If the U1 rail is being pulled down or the fuse blows and the power supply is not at fault, inspect the condition of the BU208 line output transistor's mica washer. If this is in order, disconnect the tripler. The tripler and the line output transformer both fail occasionally. Before suspecting them however remove the horizontal shift transformer U416: this often has short-circuit turns or shorts to the core. The set will work with U416 disconnected but the line shift control will be inoperative.

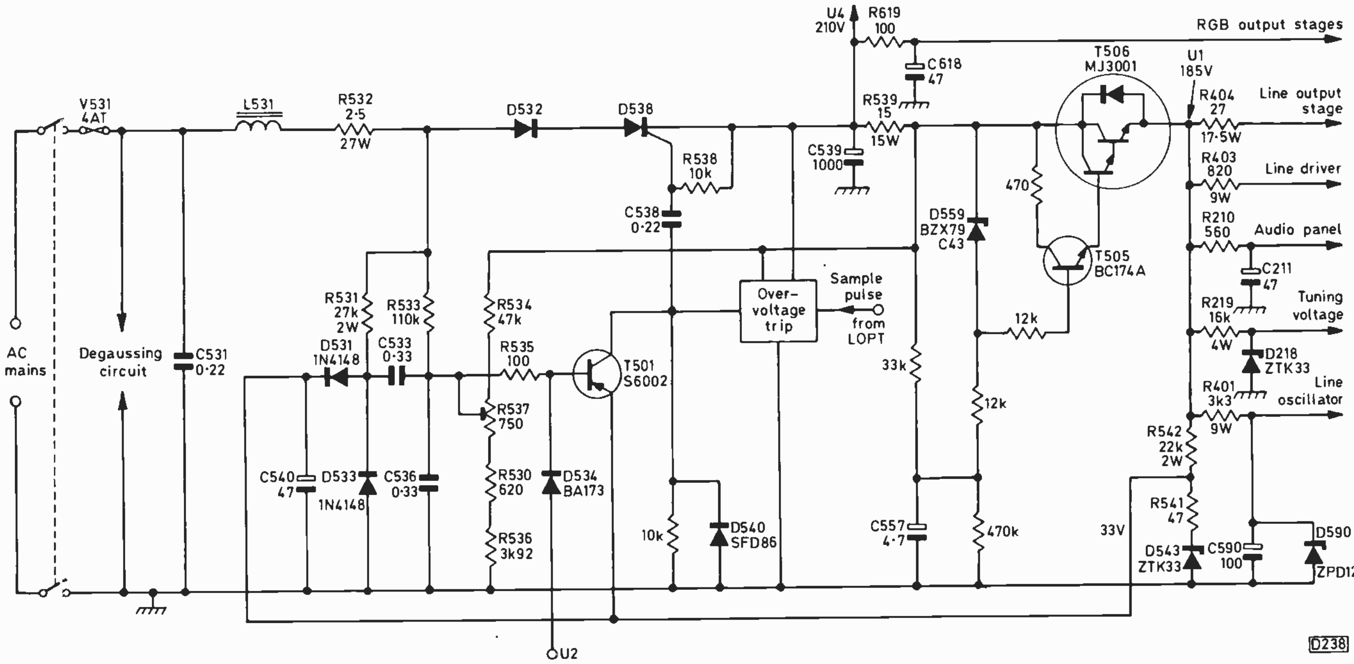

Fig. 1: The regulated power supply circuit used in the NordMende FC25 chassis. R403 and R404 are fusible resistors.

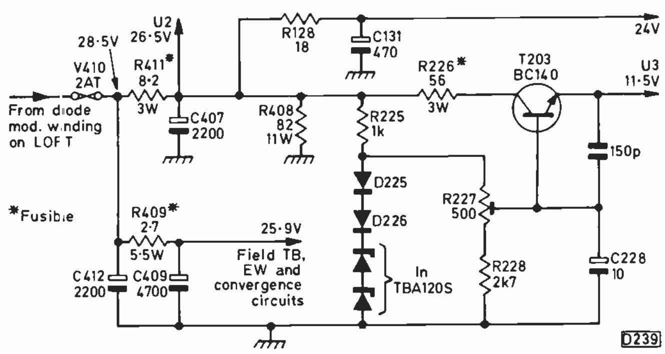

Fig. 2: L.T. supply arrangements.

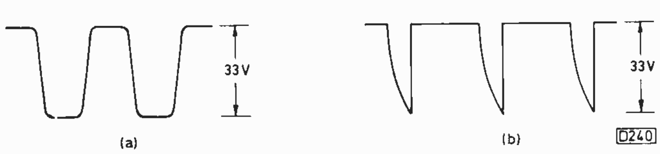

Fig. 3: Waveform at the junction of D531/R531 (a) and at the collector of T501 (b).

The dead set symptom will be present when R401, the 3·3kΩ stand-up flame proof resistor on the bottom chassis, is open-circuit since the line oscillator will be inoperative. I've experienced no trouble with the line driver stage but focus problems are fairly common – usually caused by R416 (11MΩ) which is connected between the tripler and the focus control. It changes value and quite often has a burn mark around it. The focus control itself (R418, 12MΩ) causes intermittent focus trouble. R413 (47MΩ) and R421 (33MΩ) are also worth checking. I've found the tripler to be a not so common cause of focus problems. On occasions R416 goes completely open-circuit, the result being no brightness at all.

Width faults are fairly common. The usual causes of reduced width are the EW modulator driver transistor T410 (BD234) going open-circuit or C415 (0·047μF) leaky. If the problem is not due to either of these check whether the flyback tuning capacitor C408 (0·0091μF, 1·5kV) is open-circuit. If T410 repeatedly fails replace C415. Excessive width is the result of T410 or one of the MR854 EW modulator diodes D414/5 going short-circuit – BYX71-600 diodes tend to be more reliable.

The EW modulator diodes can also go open-circuit. As a result the U2 voltage falls and there's a blank raster, no sound, lack of height and no channel indicators.

R525 (150kΩ) high-resistance or open-circuit causes flyback lines – it's in series with the first anode controls.

Field Faults

A class A field output stage with a single SM5 transistor (T406) is used. It doesn't usually cause field collapse but can cause height variations during warm up. Use a 2N3055 for replacement purposes. The driver transistor T405 (BC237) going short-circuit is the usual cause of field collapse – with T406 overheating. Poor field linearity is not uncommon: if T406 is not the cause check the field charging capacitors C443 (3·3μF) and C442 (4·7μF) by substitution. If you're faced with two or four inches of field scan, then R469 (1·5Ω) is open-circuit.

Now to some less common faults connected with the field timebase. If the picture drops half way down the screen check the field scan coupling capacitor C471 (1,000μF). If a set suffers from field jitter after changing channels, fit a 1N4148 diode in series with the base of T406 (cathode to the junction of the base and C447) – if this hasn't already been done. Field collapse or roll when changing channels or when the aerial is unplugged occurs when C433 (0·1μF) is open-circuit. Field jitter on ch. 1 only? Check C431 (470pF) and C432 (0·0047μF) in the field sync pulse integrating circuit.

The IF Strip

The i.f. strip is housed in a plug-in module and is extremely reliable. The only fault I've encountered here was intermittent loss of picture due to a dry-joint on one of the chokes. Note that removing the i.f. screening can causes detuning and consequent loss of signals: the d.c. conditions can still be used as a fault guide however and soldering a 6·8pF capacitor across L119 will give a reasonable picture for test purposes.

The Decoder

The decoder is part of the vertical chassis and is of the well-known Philips/Mullard four-chip type (TBA520/530/540/560C) – the TBA540 reference oscillator i.c. and its associated components are on a small plug-in subpanel. It's important to make sure that the decoder is fitted with a TBA560C and not a TBA560 otherwise you'll be involved with a curious colour fault – the symptom is that the red output fades and goes spotty when the colour control is turned up. Remember that man-made faults can be the worst to trace!

No colour and the brightness control inoperative is caused by the small choke L313 going open-circuit. Intermittent grey-scale flashing is a common fault on these sets. There are several causes: the BF458 RGB output transistors, the TBA530 matrixing i.c. (IC302) and the 100Ω presets R393/R396/R397. If the fault appears to be on the c.r.t. base however change the c.r.t. socket. I've found that this is a very common fault and that soldering or tightening the socket never seems to work. You can use the base from a Pye 725 series chassis as it's of the same type.

For critical colour tuning check for dry-joints on the burst phase coil L328. Dry-joints also appear on the luminance delay line V322 and the tuner mounting where it solders directly on to the main panel. Chroma breakthrough on monochrome transmissions is usually caused by the TBA540 chip on the subpanel.

Here's a quick way of isolating a no-colour fault on these sets. Measure the voltage at TP42 on the subpanel: it should be 1·1V on a colour and 4V on a monochrome transmission. If you've no colour and 1·1V at TP42, check the colour slider control. If it's faulty replacement means changing all six slider controls as they are contained in a plastic housing – a bit of a tedious job. If the colour slider control is o.k., suspect that the TBA560C i.c. is not producing a chroma output. If there's 4V at TP42 this means there's no burst ripple present. Override the colour-killer by shorting TP31-32 (just below the TBA560C). If there's still no colour, very weak colour or out-of-phase colour, suspect oscillator failure, possibly the TBA540. If there is colour but just out of lock there's no burst or a fault in the a.p.c. loop: replacing the TBA540 seems to cure most of these problems. The ident is incorrect if the voltage at TP42 is 10V: I've found the cause to be the TBA520 i.c. (IC304). If there's only 0·2V at TP42 the bistable has packed up, probably due to the TBA520 again though C384 (0·33μF) on the subpanel can go open-circuit.

Having said all this, colour faults are not that common and the decoder is pretty reliable.

Sound Circuits

Crackling sound is usally due to a noisy volume control or the BD129 audio output transistor. This operates under class A conditions and runs pretty hot. Some sets are fitted with an alternative sound panel using a four-transistor circuit with class B output stage. This is more reliable.

The BD129 can also cause no sound. I've also been plagued by intermittent loss of sound: very frustrating since the fault can cure itself for several hours or days in some cases. First check for dry-joints on the sound output panel and the plugs and sockets relating to the sound circuit. If this fails to find the cause of the problem check the condition of the screened lead to the volume control: replace it if in doubt.

Intercarrier sound buzz and/or distortion can be due to the quadrature coil F180 being off-tune or its parallel tuning capacitor C178 (0·001μF) having changed value.

Convergence Faults

If you get any kind of convergence trouble check carefully for cracks in the central area of the panel. For red and green verticals bowing and won't set up, check C804 (2·2μF) then T801 (BC237) and T802 (BC307). The only other convergence fault I've encountered is blue droop on horizontals due to potentiometer R863 (250Ω) going open-circuit: this results in R865 (18Ω) burning up and D863 (1N4148) going open-circuit since these items are connected in parallel with R866/R863.

Tuning Troubles

In common with many continental sets you may find twin v.h.f./u.h.f. tuners soldered into a plug-in panel mounted on the vertical chassis. Removal is very easy. The u.h.f. tuner sometimes goes low gain but the most common tuner fault is patterning on channel one only. This is due to a touch-tuning fault causing the v.h.f. tuner to remain on and interfere with the u.h.f. tuner. The easiest course is to open-circuit the supply to the v.h.f. tuner by breaking the relevant print leading to the back of the tuner panel.

There's no a.f.c. on these sets, the tuner being very stable. Tuning drift is more likely to be due to the TAA550 33V stabiliser i.c. or zener diode DB30 (ZPD13) on the touch-tune oscillator panel, though the tuner can be the cause of the problem.

Now for a more obscure fault – where the picture drifts off tune when the brightness or contrast control is operated. Check D218 (TAA550/ZTK33) as before then suspect the 33V zener diode D543 in the power supply.

The eight-channel touch-tuning was quite advanced for its time. There are three small plug-in modules behind the touch-tuning board. Two of them contain an SAS560 and an SAS570 respectively for electronic channel selection. The third panel contains an oscillator which puts a 70V peak-to-peak sinewave voltage on the touch plates. Channel selection is achieved by touching one of the plates, thereby momentarily interrupting the oscillator voltage on that plate. This causes the SAS560 or SAS570 to latch to that particular channel.

Faults to look for on these three modules are as follows:

Blank raster, no sound and no channel indicators, oscillator transistor TB22 (BC212) open-circuit or shorted turns on the oscillator coil LB22.

Touch tuning sticks on one channel, random channel changing or several channel indicators lit up, suspect the SAS560 or SAS570 i.c.

All eight channel indicators lit up, change CB23 (10μF) on the oscillator panel.

It's important when working on the touch tuner not to operate the set with any of the following items out of circuit: D218, the tuner panel, and plug X1 (adjacent to the tuner). To do so will usually result in the destruction of the SAS560 or SAS570. In other words this is the result if either the 24V or 33V rail goes missing.

If R128 (18Ω) on the vertical chassis burns or has burnt up the 24V rail has suffered a short-circuit: DB30 on the oscillator panel is probably short-circuit – watch out that D218, the SAS560 and the SAS570 have not been damaged.

Less Common Faults

Finally a few not so common faults we've had.

Bright raster with flyback lines, no picture but the audio circuit is working, make sure that the U3 (11·5V) rail is present: R226 (56Ω fusible) just above the i.f. can trips open; other causes are C352 (0·1μF) at pin 8 of the TBA530 short-circuit or R619 (100Ω) which supplies the RGB output stages open-circuit.

A very loud buzzing noise like a demented bumble bee will be due to the mains input choke L531 on the horizontal chassis: it can affect the picture, causing hum on the field.

Finally, to remove residual hum on the supply to the RGB output stages C618 was increased in value from 4·7μF to 47μF and L618 was replaced by a 100Ω resistor (R619) – these changes are included in Fig. 1.

In Conclusion

So there you have it. A set which after careful attention will give years of trouble-free service. Note that the F IV and FC1 25-T chassis are very similar. The latter is modified in the convergence section to operate with an in-line gun tube. The tripler is of the universal type and line output transformers can be obtained from Tidman Mail Order Ltd., 236 Sandycombe Road, Richmond, Surrey. Spares can be ordered through the present UK NordMende agents Hayden Laboratories Ltd., Chiltern Hill, Chalfont St. Peter, Bucks SL9 9UG. (0753 88847).

Desoldering Iron Test Report

Eugene Trundle

Ever since there have been printed-circuit boards there's been the difficulty of removing components from them, especially when these are multi-legged devices. A great variety of desoldering aids has appeared over the years, working on several different principles with varying degrees of success. There was an aspirated soldering iron with rubber pipes and tubes leading off to compressors or pumps; also big, sizzling, branding-iron style bits designed for the removal of particular components, typically a 16-pin DIL chip; hollow "poking tubes" made of solder-repellent metal; hand-held solder-sippers with a pretty blue or green finish, working like a spring-loaded bicycle pump in reverse; resin-impregnated copper braid with (hopefully!) a thirst for liquid solder; heat guns which do the necessary by means of a searing-hot stream of air; and so on. Enquiries around our workshop indicate that braid is the current favourite, after long dalliance with the hand-pump system – the latter's nozzle tends to wear and clogging is something of a handicap.

The Doranuro SA-6

The Doranuro SA-6 electric desoldering iron is a new tool that combines two older ideas. Superficially it looks like a conventional and rather chubby soldering iron. In fact it has a hollow nozzle in place of the bit and a spring-loaded plunger pump in the hollowed out handle section. The business end is kept hot by a 30W heating element, and the pump assembly clicks out for easy cleaning or replacement. The iron is 26cm (10¼in.) long and weighs 113gms (4oz). It's made in Taiwan by OK Industries Inc. (glorious name!) and comes with a choice of two nozzle sizes, 1·5 or 1·7mm, and three element voltages, 230, 115 or 24V. The one I had for test was the standard Model SA-6-230 with 1·5mm nozzle and UK mains input.

Operation

Operation is straightforward. You prime the plunger, make sure the nozzle is tinned, then push it over the wire component leg to be desoldered. Press the button and the plunger flies backwards, sucking molten solder up the hollow nozzle and into the vacuum chamber where it gathers on the face of the piston for later removal. The desoldering operation can be performed with one hand, particularly when working on a horizontal board at table level.

On Test

How did it work? I used it on a great variety of jobs over a period of weeks and found that, like the curate's egg, it was good in parts. My first problem was a physical one – what to do with it between sips of solder? There's no stand available from the distributors as yet and its 7cm of shimmering barrel is a bit difficult to stow safely on the bench.

For most desoldering work on PCBs I found that the instrument worked well. By its nature it's best with "pinned" components. It's very good indeed for the removal of line output transformers, conventional i.c. packages and transistors, provided the iron can be positioned at 90° to the board. One of its strongest points is its ability to deal with double-sided PCB joints, where a pin can usually be fully released so long as a reasonably air-tight butt joint can be achieved between the nozzle and the panel – and a good heat transfer to the pin established.

There were none of the clogging and jamming problems to which manual solder pumps are so prone, probably because the nozzle and airway are in this case so hot. There was no need to use the declogging wire supplied, and the recovered solder that built up in a conical heap at the front of the piston was easy to remove – at long intervals, because there's plenty of room to accommodate the solder.

There were several desoldering jobs that the SA-6 couldn't cope with easily. For example the wide tags on some large electrolytics, and "heat-spreader" i.c. connections; also the "edge-on" solder joints with Hitachi tuners and ITT and Grundig i.f. modules; and various interboard links. Difficulty was also experienced with very small multipinned i.c. packages such as the syscon chips in the Sony F1 VCR, and with surface-mounted components in the very latest equipment. I don't mean to slate the instrument – it will effectively deal with say 80 per cent of the desoldering jobs likely to be encountered.

It has to be said however that a fresh length of good desoldering braid, in conjunction with a very hot conventional iron, can in my experience cope with virtually anything. Since the braid has to be kept on hand to deal with the awkward jobs mentioned above I found myself inclined to pick it up for every job, especially when use of the sucking iron meant either keeping it hot, throbbing and idle most of the time or plugging it in and waiting for two or three minutes until it reached working temperature.

Given a straight choice I'd plump for braid, but having seen and tried this instrument I'd very much welcome it alongside as a useful addition to the armoury. Where double-sided print and plated-through holes are likely to be encountered it would soon save its very modest cost of £16 in terms of time and frustration alone! Spare nozzles are available at £2·35 each.

Source

The iron is distributed by Enfield Transformers Ltd., 7 Centenary Estate, Jeffreys Road, Enfield, Middlesex EN3 7UF (phone 01-805 5438 or 01-805 6078).

Signal Strength Meter

Jeff Allan

A signal strength meter is invaluable for ascertaining TV signal levels – it's also useful for showing the customer why the picture is "snowy on TV". Such meters don't appear to be generally available, though Manor Supplies do one in kit form. I decided to see what I could do by way of making my own.

Basic Arrangement

For simplicity and to save on cost and time I decided to use a ready-made tuner/i.f. strip assembly. It so happens that we've recently been scrapping a number of GEC C2110 series colour sets that had previously been out on rental. They are getting to be a bit unreliable – customers have come to expect a higher degree of reliability than two or so breakdowns a year. The tuner/i.f. panel used in this chassis turned out to be a good choice for use in a signal strength meter. The only additional circuitry required (see Fig. 1) is that to provide the necessary voltage supplies and to drive the meter. This circuitry can be built on a piece of Veroboard. Telepanels (52 Mount Pleasant Road, Chigwell, Essex, telephone 01-729 0506) can provide the tuner/i.f. panel at £10 plus £1·50 post and packing. As I used a scrap panel I decided to incorporate in the meter the small sound sub-panel that's mounted on the main i.f. panel. The sound panel is available from Telepanels for an extra £5.

Accuracy

The accuracy of the signal strength meter obviously isn't going to be up to the standard of something for which you'd have to pay ten times more, but it gives a perfectly satisfactory meter-scale reading of 0-5. In addition the panels provide composite video and audio outputs which can be taken off via phono sockets.

Circuit Details

The unit is powered by twelve HP7 batteries which supply the 12V regulator with 18V. The 7812 regulator i.c. converts this to a stable 12V output. LED D4 provides power-on indication and also indicates when the batteries need changing – it goes out when the battery voltage drops to 13·5V.

The 555 timer chip IC1 is connected as a free-running oscillator whose output at pin 3 is used to drive Tr2. This transistor is switched on and off, producing at its collector voltage peaks which are rectified by D3/C2, with smoothing by R7/C3, to give the 33V tuning supply required. Note that coil L1 and Tr2 are critical components: the types specified in the components list must be used.

Tr1 is connected as a shunt regulator, setting the point at which the meter responds to weak signals.

Construction

Assemble the power supply/meter drive circuits on a piece of Veroboard. Fig. 2 shows the arrangement of the GEC tuner/IF panel, with the sound sub-panel in place. The composite video output is present at pin 2 of plug PL13. This can be taken via screened lead to a phono output socket, with the braid connected to pin 1 of PL13. The audio output is taken from pin 8 of IC181 on the small, vertical sound sub-panel (assuming that IC181 is a TBA800 – take the output from pin 1 when IC181 is an SN76013ND07). The audio is controlled by VR2 which acts on the TBA120SQ intercarrier sound chip IC180. A speaker can be driven from pins 2 and 3 of plug PL9. I found it convenient to mount the aerial input and the output sockets and speaker on the rear panel of the signal strength meter.

The positive terminal of the signal-level indicator meter M1 is connected to pin 4 of the TCA270Q detector chip IC102: the other terminal goes to preset P1.

VR1, VR2 and M1 are mounted on the front panel.

The project can be housed in the box of your choice. I used a BICC-Vero Hi-Style instrument case measuring 220 × 105 × 230mm. This is available from Verospeed (Stansted Road, Boyatt Wood, Eastleigh, Hants SO5 4ZY) under code no. 75-2443A. At the time of writing the price is £21·98 inclusive of post and packing but not VAT (at 15 per cent). This case has the advantage of being fitted with a handle/tilt foot that can be locked in several positions. Those who are proficient at woodwork could use a wooden box with lid.

Setting Up

Before switching on, adjust the a.g.c. delay preset P102 on the i.f. panel fully anticlockwise. The LED should light when the unit is switched on. With a loudspeaker con-

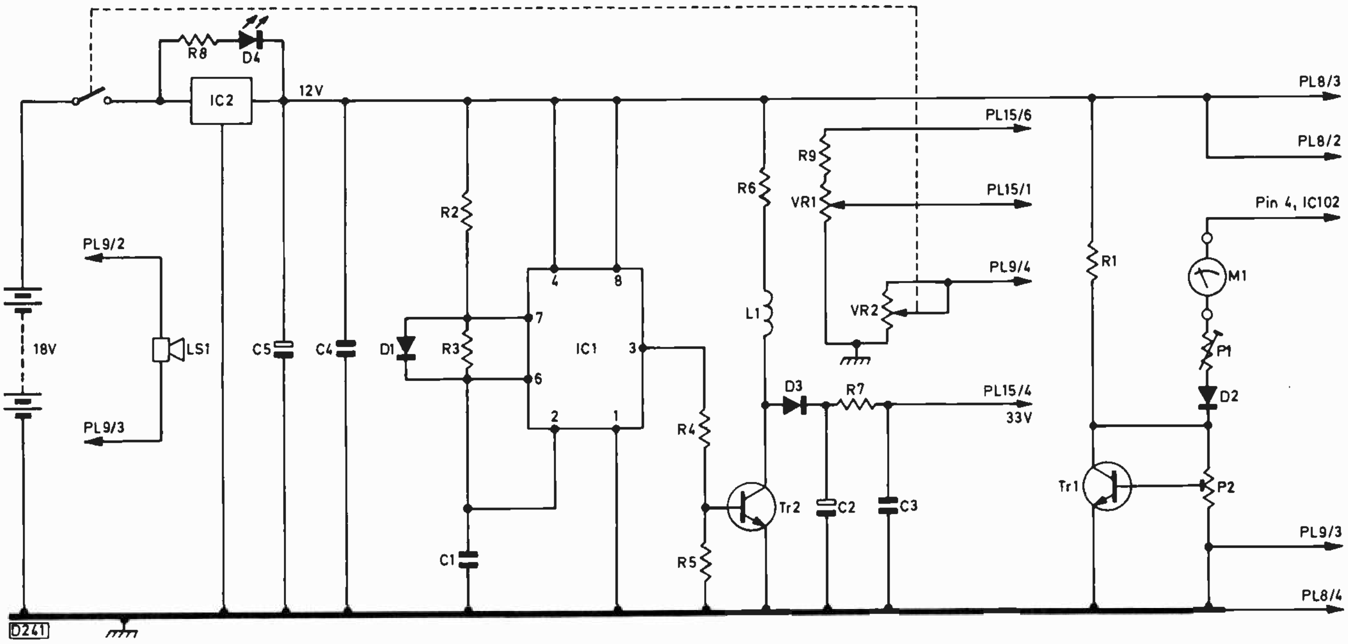

Fig. 1: Circuit of the signal strength meter.

nected, noise should be heard when the volume control is turned up. Plug in an aerial and tune VR1 until a station is heard. If the meter's needle is off the scale, adjust P1 to bring the needle back on to the scale.

Adjust P2 for 2V at the collector of Tr1 then tune the signal strength meter to the strongest station available. Adjust P1 so that M1 reads maximum deflection. Next unplug the aerial from the meter and plug it into a colour set. Attenuate the signal until the picture is just acceptable. Now reconnect the aerial to the signal strength meter and note the reading on the scale. Ideally, it should give a mid-scale reading. If not, i.e. if it reads say too high,

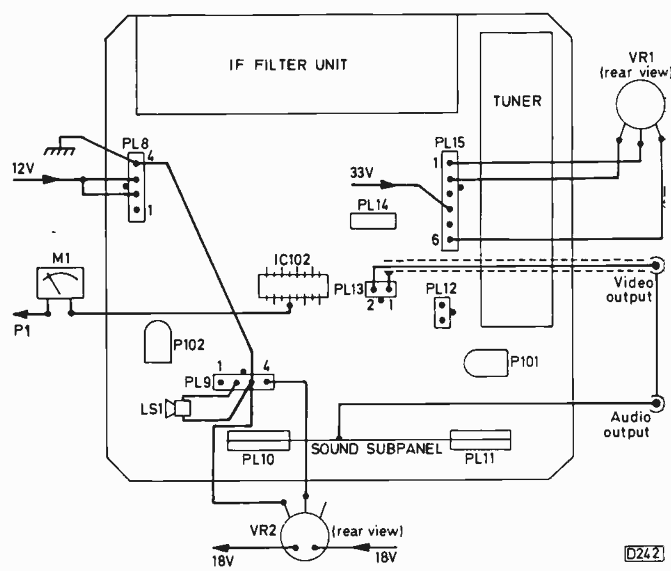

Fig. 2: Connections to the i.f./tuner panel.

readjust P2 for a slightly higher voltage (e.g. 2·5V) at the collector of Tr1 then readjust P1 so that the meter's needle doesn't go off scale with strong signals.

Calibrating VR1 so that the control is near the end of its travel when channel 68 is tuned in might call for the addition of a resistor in the R9 position. Use a suitable value up to 47kΩ.

★ Components

Capacitors:

C1	4700p polystyrene
C2	1µ 63V electrolytic
C3,4	0·1µ 250V mylar
C5	100µ 25V electrolytic

Semiconductor devices:

D1,2	1N4148
D3	1N4002
D4	LED
Tr1	BC107
Tr2	TIP41A
IC1	555
IC2	7812

Resistors:

R1	4k7
R2	4k7
R3	47k
R4	1k
R5	330
R6	2·2
R7	1k
R8	330
P1	47k
P2	4k7
VR1	100k
VR2	4k7

R1-8 ¼W. P1,2 subminiature presets. VR1,2 linear pots VR1 with switch

Miscellaneous:

M1 Maplin LB80B 250µA f.s.d. meter
L1 Maplin WH47B 1mH choke
LS1 20Ω 70mm speaker
Tuner/i.f. panel, case, knobs, sockets, 10346 Veroboard, holder for 12 HP7 batteries.

Use

With experience you will get to know what reading on the scale 0-5 constitutes a good, bad or reasonable signal level.

The meter's consumption when in use is high – 170mA! This is mainly due to the tuner/i.f. panel. It shouldn't be a problem if you remember this point.

When armed with this signal strength meter you'll have some authority when you tell a customer that the poor picture on his colour set is due to a poor aerial – after all the signal strength meter can't lie, can it?!

VCR Clinic

Reports from Mick Dutton, Steve Illidge, Steve Beeching, T.Eng. and Eugene Trundle

Panasonic NV333

This machine would replay prerecorded tapes in colour but wouldn't record in colour. Waveform checks in the colour recording circuits revealed that chroma was present as far as the low-pass filter (TP8003) though very little arrived at the input (pin 8) to the record amplifier in IC8001. The voltage at this pin was found to be high: it's linked to the colour-killer stage in IC8003 by D8005 (MA165) which turned out to be leaky. **M.D.**

Panasonic NV370

Noisy sound in record was the problem with this new machine. The sound processing is all done within a single i.c. while a second chip (IC4001, type TA7355P) provides switching between record and playback. It was this second i.c. that proved to be defective. It's worth noting that this machine also appears under the Philips and Pye labels. **M.D.**

Salora SV8200

The problem with this machine, which is basically the Mitsubishi HS303, was no colour in record or playback. Since there was no sign of a 625kHz signal IC6A0 (HA11741) was first suspected. A replacement was fitted before we discovered that pin 15 was at 0V instead of 3·2V due to C6D1 (0·22μF) being short-circuit. **S.B.**

Sony SLF1

I've had considerable problems with a Sony SLF1 portable recorder. It's been to another dealer and also to a Sony service depot in northern climes where "no fault found" was reported. The customer was doing his nut as the fault was very obvious – severe herringbone patterning in areas of saturated colour. We first checked the luminance and chrominance drive levels, which were correct: there then followed several weeks of trying various things. The record amplifier was replaced in case there was cross-modulation between the two carriers, the video heads also in case they were out of specification or something else was amiss. A set of heads sent to us by Sony as under-guarantee replacements were themselves faulty, or at least one tip was. As with the previous repairers I was getting nowhere fast, except that the fault was established to be on record. The record drive figures are given as luminance 300mV ± 20mV at the slider of RV18 and chrominance 260mV ± 20mV at the collector of Q5. By trial and error the patterning was reduced to a reasonable level with the luminance drive at about 450mV, just before the video heads saturated, and the chrominance at about 200mV.

Unfortunately before the customer could collect the machine I had powering-up problems due to C231 on the TTF1 tuner unit failing to provide IC231 with a reset pulse. **S.B.**

JVC HR7700/Ferguson 3V23

The complaint was poor still and slow-motion pictures. This was a weird one. When still was selected the tape sometimes carried on going: when it did respond it went to slow motion, with the picture covered in black spots each time the tape moved! The trouble was that the emitter-follower X21 was feeding oscillations to the motor drive amplifier, hence the spots. The cause? Well, in later production versions of these machines two fusible resistors, R38 and R39, were deleted and replaced with wire links. As a result C75 which decouples the 22V rail on the servo-1 panel was also removed. In this machine the capstan motor, while healthy, was putting spikes on to the 22V rail: these were returning via X21 as positive feedback. Simply replacing C75 cured the fault. Maybe the next one will be easy! **S.B.**

Sony SLC7

The fault here was intermittent poor recordings – it was another time-consuming job, until the fault put in an appearance. We then found that there were no syncs, just spikes – the picture was ragged to. The cause was poor contacts on the TV/camera selector switch. **S.B.**

Mitsubishi HS303

The symptom with this machine was black lines overshooting from peak white areas of the picture. They were present only with the machine's own recordings. This was obviously a record fault, of the type normally associated with incorrect setting of the white/dark clip controls. We decided to look into this first and a quick scope check confirmed the diagnosis: adjusting the white clip control produced a cure. The customer had mentioned that the problem was intermittent however, so we left the machine recording. When the tape was played back we found that after about fifteen minutes the recordings had reverted to a similar white clip problem, only much more severe. IC2B0 (AN6310) which amongst other things contains the white/dark clip circuits was then replaced, providing a complete cure. **S.I.**

Guide Rollers

With VHS machines some very misleading symptoms can arise from the effects of what might be called "running faults" in the rotating tape guides at each end of the tape head wrap: lateral wobble and jitter on the picture; closely-spaced near sinusoidal ripples across the picture; booming effect on sound; and usually an acoustic noise from the afflicted guide itself, due to its "shuddering" rotary motion. Whilst almost any machine is vulnerable to this sort of thing we've found it to be most prevalent in JVC/Ferguson piano-key machines, Hitachi VT8000 series machines and Panasonic machines like the NV333. Why does the effect almost always disappear when the top cover is removed? **E.T.**

Panasonic NV366

"Poor picture after cue and review" said the job card. Sure enough there was a good picture in the normal playback and trick modes, but sometimes when reverting to playback from the search or pause mode the picture would give every indication of video head problems – flickering, snow and drop-outs. The cause of the problem was the video head switching relays RL3501 and RL3502 on the head amplifier board – a good tap on one or the other of them would clear the problem. Shades of Hitachi models in which sound head switching was done with latchety relays! If ever there was a graphic demonstration of the superiority of solid-state switches over mechanical types this must be it! Very low-level playback signals coming directly from a head are vulnerable indeed to the effects of contact resistance and noise. **E.T.**

JVC HRD120

One of the heads in this very new machine clogged before it got half way through a tape: the picture became progressively more snowy and flickery until it was virtually obliterated. Cleaning the heads provided a temporary cure but regardless of the type and state of the tape used the head clogging would again occur, within an hour at most. After checking the guides for cleanliness and any abrasiveness the head drum was condemned and changed. This cleared the problem. **E.T.**

JVC HR2200/Ferguson 3V24

This combination of a camera and an HR2200 VCR gave us pause . . . The problem was that the VCR would go into the pause mode by itself at random intervals during a recording session. Checks with another VCR proved that the camera was blameless.

Somehow X9, the first pause switch transistor in the VCR, was being made to conduct. With its base and emitter leads firmly shorted it stayed off and the problem disappeared. A strange varying voltage was found at the base of X9, and at the "outer" end of the series resistor R40. What had happened was that the large "memory" capacitor C11 (3·3F, 1·6V – really a battery cell in disguise!) had gone bad and leaked on to the mechacon (front) panel. The gunge had embraced the control line print track from the camera socket and insidious leakage here was putting a varying voltage on to the pause line. The construction of this panel is such that much dismantling is required to gain access to C11. **E.T.**

JVC GXN70 Camera

We've had several of these cameras in the workshop recently – one with a broken handle pivot (no joke to replace!) and several with dry-joint problems on the Y-C processing board. This is a tightly-packed assembly with a high count of surface-mounted devices (SMDs). The joint problems seem to arise mainly in the luminance channel and can take some finding.

A recent case was a little more serious – no picture at all, but captions o.k. (this one has a built-in caption generator) and good sound. It took us longer than it should to discover that the line output stage was inoperative due to an open-circuit CP601 protection device. A milliammeter connected in its place registered around 400mA and there were strange noises coming from the mini-wound components in the line output stage. The 2SD781 line output transistor (Q602) turned out to be leaky, a replacement restoring normal operation with a current of about 180mA through CP601. **E.T.**

Long-distance Television

Roger Bunney

As September passes the evenings draw in and those hectic sporadic E openings have become but a memory of the recent, past season. There was some Sporadic E reception during September, but the persistent high-pressure systems, particularly towards the end of the month, boosted tropospheric reception. This month's SpE log is as follows:

7/9/85 TVE (Spain) ch. E2; RTP (Portugal) E2, 3; RAI (Italy) IA; unidentified signals on chs. R1 and 2.
9/9/85 NRK (Norway) E2-4; SR (Sweden) E3.
10/9/85 NRK E3.
11/9/85 TVE E2, 3; CST (Czechoslovakia) R1.
12/9/85 TVE E3; SR E3; NRK E3; RAI IA; TVP (Poland) R1.
13/9/85 ARD (W. Germany) E2.
14/9/85 ORF (Austria) E2a.
15/9/85 ARD E2; RAI IA, B; TVP R1, 2; TSS (USSR) R1, 2.
18/9/85 TVE E2; NRK E2.
19/9/85 RAI IA; DFF (E. Germany) E4.
20/9/85 TVE E2-4; ORF E4; ARD E2, 4; RAI IA; NCT (Italian private station) E3; +PTT (Switzerland) E3; DR (Denmark) E3; CST R1; TVP R1, 2.
22/9/85 TVE E2; NRK E3.
25/9/85 CST R1.
27/9/85 CST R1; DR E3; SR E3.
28/9/85 DR E3.
29/9/85 NRK E3; SR E3.
30/9/85 CST R1.

There were two main tropospheric openings during September – unfortunately neither coincided with the International ATV Contest on the 14/15th. The first occurred during the 7-12th, giving widespread reception of French signals in Band III and at u.h.f. throughout much of the UK, with W. German signals present in the Midlands and the southern UK. Unfortunately the opening never really intensified. Excellent reception of RTE (Eire) was maintained on a daily basis in the Midlands and along the east coast during the period. Along the south and south-west coasts excellent reception from a southerly direction was noted, with Swiss stations on chs. E31, 39 and 45 and Spanish signals from Zamora ch. E31, Gamoniteiro ch. E39 and Santiago ch. E45.

A short but intense opening on the 18th produced many W. and E. German signals in the south, the Midlands and along the east coast. The main sustained high-pressure system arrived on the 24th and persisted into early October, unfortunately with a tendency to sea winds in the south. Thus really long-distance reception was not possible and the period was dominated by French v.h.f./u.h.f. signals. W. German reception was confined to the 24th, 29th and 30th. There was some Dutch reception and conditions along land paths were slightly better, with various Czechoslovakian stations being noted at u.h.f. Despite auspicious weather conditions this year's September tropospheric reception proved to be a disappointment.

My thanks to Bill Cotteril (Tipton), Roger Pates (Nottingham), Iain Menzies (Aberdeen), Tim Anderson (St. Leonards), Dave Shirley (Hastings), Roger Fussell (Torpoint), Simon Hamer (Powys), Cyril Willis (Downham), Reg Roper (Torpoint) and Ryn Muntjewerff (Holland) for their reception reports. Dave Shirley also reports that from early October the non-scrambled Canal Plus times are: 1745-2035 Saturdays; 1225-1400 and 1745-2100 Sundays; 1230-1400 and 1745-2035 on Mondays, Tuesdays and Thursdays; 1230-1400 and 1745-2100 on Wednesdays and Fridays.

News Items

France/Switzerland: A new ch. E69 transmitter at La Dole is due to come into operation on November 30th with a service area covering a major section of France. Trials were carried out from 0800-2000 CET during September 7-20th with a test pattern and a series of test films. This is to be the first private TV channel intended for reception in France and will have programming biased towards films – it's intended to show up to 400 annually. Scrambling is to be used, with a month's access card costing 20 Swiss francs and initial decoder installation costing 150 Swiss francs. The new station is called Telecine: the PM5544 test pattern carries the identification "Telecine" at the top and "Chaine du Cine" at the bottom.

W. Germany: The two famous aerial companies Fuba and Hirschmann are to form a joint venture to produce and supply 12GHz DBS receiving equipment. It's expected that "realistically priced" equipment will become available later this year or early next year.

Sweden: The Horby ch. E2 SR-1 transmitter is to close on January 1st.

Iceland: A recently passed bill has broken the RUV monopoly, allowing commercially financed stations to be set up.

In brief: The Djibouti TV service now covers much of the country, using the SECAM system . . . The Yuri-2B satellite is to be launched early next year. It's claimed that

The international flavour of TV news links now available in Europe. Left: ABC news during the Lebanon hostages crisis. Centre: CBS news from Frankfurt – this is an Intelsat half transponder feed received via a 1·8m dish at Potters Bar! Right: The Tele Malta Corporation PM5544 test pattern, received by Mel Thurlbourn on ch. E10 at 10kW.

the overheating problem that led to the failure of two of the three travelling-wave tube amplifiers in the Yuri-2A satellite has been overcome . . . The DTI has given approval for the use of higher-powered cordless phones and more frequencies from 1988 . . . A new service, called channel TV5 or "Media TV", may be set up in S. Africa backed by newspaper interests. The u.h.f. transmissions would be scrambled, with a decoder charge of 36 Rand a month.

New EBU Listings

Holland: Soesterberg ch. E70, 20kW e.r.p. horizontal. This is an American Forces base transmitter operated by the AFRTS, using system M (525 lines). The ch. E70 vision carrier is at 867·25MHz and the sound carrier at 871·75MHz.
Rumania: Turnu Severin ch. R2, 15kW e.r.p. H; Dobrogea Sud ch. R3 15·5kW e.r.p. V; Bucuresti ch. R4 50kW e.r.p. H.

New VHF/UHF Scanner

Lowe Electronics Ltd. of Chesterfield Road, Matlock, Derbyshire DE4 5LE have introduced the AR2002 scanner, a replacement for the famed AR2001. The new scanner covers 25-55MHz and 800-1,300MHz and features wide/narrow band operation for either a.m. or f.m. reception: the 2001's membrane keyboard has been replaced with a positive button keyboard. Perhaps the most interesting feature is a tuning knob. The usual up and down scan buttons at times make for inconvenient manual tuning: the knob gives full coverage in segments relating to the bandwidth selected. The price is rather high at £375 including VAT, but as scanners go this one does represent good value. Send a stamped s.a.e. to Lowe for further details – supplies are expected by late December.

Correction

A couple of readers have pointed out that the clock photograph shown in the September issue (page 642) is the Jordanian, not the Syrian, clock.

New Mono Portable for DXers

Tandy are expected to have available shortly at £90 including VAT (catalogue number 16-9030) a 5in. monochrome portable with v.h.f./u.h.f. tuning and, apparently, system I, B/G and L capability.

DTI Book

The DTI's new book *How to improve Television and Radio Reception* is intended as a guide to problems such as interference, ghosting etc. and includes a technical section with information on filters. Highly recommended – it's available free of charge from main post offices.

Penge Effect

Details of a mid-fifties phenomenon known as the Penge Effect (it was generally restricted to the London district of Penge) appeared in the technical press recently. I'd not heard of this before and have now obtained further information.

Until 1956 BBC Television was transmitted from Alexandra Palace. Most readers will be familiar with the famous lattice mast, which was equipped with two aerials arranged in an octagonal formation with eight end-fed dipoles and reflectors behind. The upper aerial was used for the vision signal and the lower one for sound. Subsequently of course vision/sound diplexing combiners allowed both transmitter outputs to be fed to a common aerial. From 1956 Crystal Palace replaced Alexandra Palace, with an even more impressive self-supporting lattice mast. Initially two transmitter sets (a set had one vision and one sound transmitter) were operated in parallel, the output from each being fed to its own array on the mast. Penge lies at the bottom of the hill on which the Crystal Palace mast is sited and thus "looks up" at the mast.

Due to the vertical separation of the two sets of aerials on the mast sharp nulls were produced in the vertical radiation pattern – where the two transmitted signals arrived out of phase there was partial or complete cancellation. The problem was very severe at Penge. It was eventually overcome by using a diplexing arrangement which combined the outputs from the two transmitters on to a common feeder, with splitting again at the roof of the transmitter and separate feeders to the aerials: phase correction was inserted into the transmitter system from reference information at the transmitter rooftop. I'd be pleased to hear from any readers who had experience of the Penge effect or who have any observations to make on the subject. Our thanks to Marconi Communication Systems for providing information.

Stereo Sound in the USA

The progress of stereo TV sound in the USA is slow, with many stations unwilling to adopt stereo, mainly on the grounds of cost. NBC is the only network at present supplying stereo programming: this is limited to a couple of light entertainment shows, certain weekend movies and

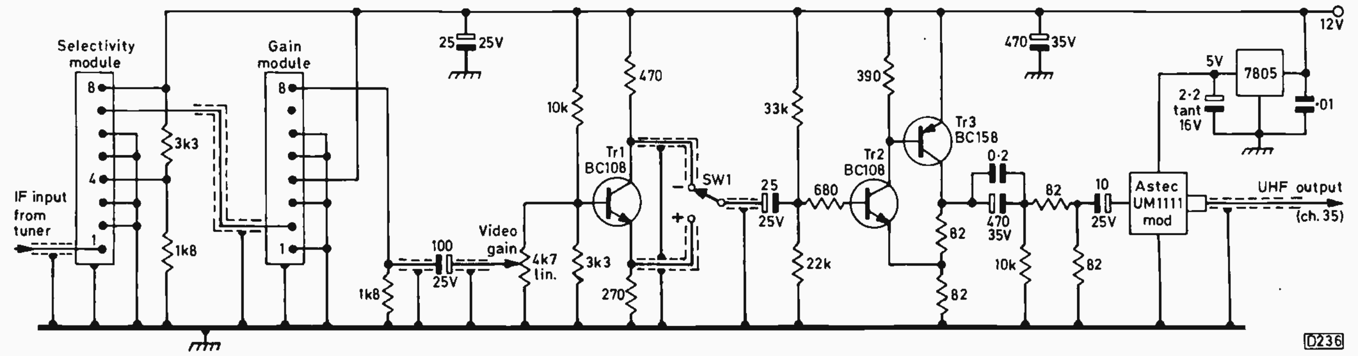

Fig. 1: DX i.f. circuit using G8 modules, with switching for negative or positive vision modulation. The Astec modulator provides an output for feeding to a standard system I receiver.

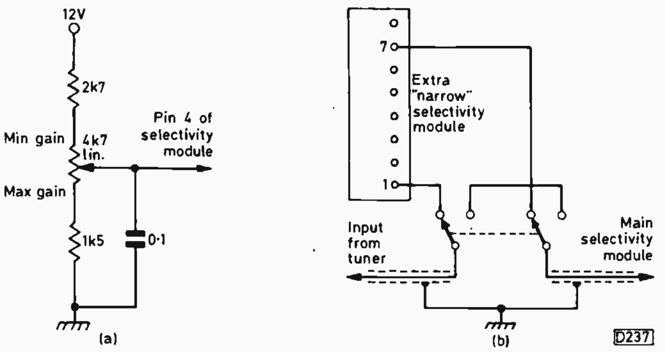

Fig. 2: (a) I.F. gain control circuit. (b) Adding an extra selectivity module with switching to provide narrow or wideband operation. Use a 2-pole, 2-way miniature toggle switch or pin-diode switching.

a few sporting events. Some 33 stations across the country are now transmitting stereo for part of the week, ranging from two hours (WPBT-TV Miami and KATU-TV Portland) to 66 hours (WVJV-TV Boston).

Versatile DX IF System

A query I often get is how to receive French TV pictures without investing in a system L receiver. The problem of course is that French TV transmissions use positive vision modulation while the rest of Europe uses negative vision modulation. It's at present cheap and simple to build a converter unit using the Philips G8 chassis U800 vision selectivity and U300 vision gain modules currently available from South West Aerials – these are sold "as new, surplus stock". Fig. 1 shows the circuit devised for the purpose. Provision is not made for reception of the French 6·5MHz a.m. sound since DXers generally prefer to operate with reduced i.f. bandwidth in the interests of better selectivity and signal-to-noise performance. Versatility has been provided by including positive/negative video switching. When used with a varicap tuner, r.f., i.f. and video gain controls can be incorporated, giving a "communications receiver" approach. The demodulated video is amplified and applied to the cheapest Astec modulator available. The output from this, on channel 35, can be fed to the aerial input socket of a standard system I receiver.

No modification is necessary to the Philips modules, which are supplied with screening cans and connections via pins at one end. The output from the varicap tuner goes to pin 1 of the selectivity module, with appropriate connections to the other pins: the i.f. output at pin 7 goes to pin 2 of the gain module, which provides its output at pin 8. In the circuit shown a fixed voltage for maximum gain is applied to the selectivity module's a.g.c. pin (4). A variable gain control could be used here, providing 3·5V for maximum gain and 8V for minimum gain. Alternatively a simple a.g.c. system could be used.

The output from the gain module is capacitively coupled to the slider of the video gain control which is incorporated in the base circuit of a simple phase inverter stage. Either positive- or negative-going video is selected by a single-pole, two-way miniature toggle switch – note that all feeds are via coaxial cable (due to the low impedances, the feeds can be up to 9in. long). The output from the phase splitter Tr1 goes to the video amplifier Tr2/3 and then to the modulator which produces a high-level output at its phono socket. The i.f. selectivity could be increased by inserting a second selectivity module. Provision should be made to switch this in or out of circuit, using a toggle or pin-diode switching, thus giving selection of narrow or wide i.f. bandwidth.

Alignment of the modules will be required. I've found that they are almost in tune and that only slight adjustment of the cores is necessary. Where a second selectivity module is added to give switched wide/narrow bandwidth this will need to be aligned to reduce the i.f. bandwidth. Once the main selectivity and gain modules have been peaked the additional narrow module can be switched into circuit and aligned for optimum signal resolution on a weak signal. You'll find that two of the four selectivity coil cores have a sharp response while the other two have a very flat response. Align the cores to the peak obtained nearest to the case of the modules, i.e. the outermost peaks. I would suggest applying a.g.c. to the main selectivity module and operating the narrow-band module at fixed gain.

The use of a Band I/III/u.h.f. varicap tuning system is assumed – a suitable circuit was given in the March 1982 issue of *Television*. Sendz Components have a selection of tuner units available.

Physical construction of the unit is not critical though it's sensible to minimise lead lengths. The prototype was constructed on Veroboard with the modules stacked on top of each other to give a very compact converter unit. The G8 chassis i.f. strip circuit was shown in the July 1978 issue of *Television*.

The overall cost is lowish – I'd expect the total for a case containing a power supply, tuner, G8 modules, modulator and a 4in. tuning meter to be not more than £20. There's at present no unit that provides the suggested features on the market. The constructor could of course consider adding a sound selectivity module (U500) to provide sound facilities, though this would necessitate operation in the wideband mode. Comments from constructors of this or alternative systems will be welcome.

Service Bureau

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

HITACHI CPT1473

Field collapse was traced to failure of Q681. Since a 2SC1213A was not available I fitted a BC337, which appers to be an equivalent, but the BC337 failed after about four hours. All the voltages around Q681 and the STA441C field output i.c. are correct.

Q681 provides the flyback boost supply, conducting briefly but heavily for the 1msec duration of the flyback stroke to double the supply (in conjunction with D681 and C681). Because of its short duty-cycle, the usual transistor ratings quoted are not an accurate guide to suitability. Only the correct transistor should be used.

FERGUSON 3V00

New heads were fitted about a year ago. Since then the playback picture has gradually become marred by blue crosshatching – this occurs with both own recordings and prerecorded tapes. The crosshatching is present right across the screen and there are also three brighter vertical bars, one at each side and the other about a third from the left. A tape giving a blank raster results in the same symptoms.

Check the four screws that retain the pre-rec board behind the video heads – they must be tight and all screws must be in position. Try retuning the r.f. converter and the TV set to another channel. Note that you'll get this effect if the machine is too close to the TV set. The r.f. converter sometimes produces spurious beats.

TANDBERG CTV2 CHASSIS

There is momentary loss of sound and vision accompanied by a loud click from the rear of the set. This is usually accompanied by a change to channel one if the set is not already switched to this channel. Occasionally the picture becomes very snowy, correcting itself after about half a minute. There is also occasional complete loss of sound. This corrects itself after about five minutes – switching the set off and on again also restores the sound.

The click and loss of normal operation are likely to be due to a spark in the e.h.t. or focus areas. Carefully watch the set's interior in a blacked-out room: a spark may well appear at the e.h.t. tripler, c.r.t. bowl or focus spark gap – clean and/or replace as necessary. For the intermittent snow problem check for dry-joints or bad connections at the aerial socket, on the tuner panel and on the i.f. board before suspecting the tuner itself. Spasmodic loss of sound is a common problem with these sets. It can be due to bad jointing on the control panel but more often the plug/socket system that carries the audio between the main panel and the front control panel is faulty. A sure cure is to remove the plugs and solder the leads direct to the print.

SHARP VC6300

The picture is all right and speech is normal most of the time. Any music appears to wail however. The motors and pulleys seem to be free enough.

This symptom is generally due to jitter in the rotational speed of the capstan motor. Clean and service the deck, then select record and adjust the capstan lock potentiometer R794 for zero voltage between TP713 and TP717 (this voltage should be 5V d.c. above chassis potential). If the fault persists and the peak-to-peak ripple voltage at TP721 (as observed on an oscilloscope) exceeds 500mV it's likely that the capstan motor is faulty.

HITACHI NP6C CHASSIS

There's intermittent loss of height on this set – about a quarter to half an inch at the top and bottom. Resetting the height control will restore a full picture but the fault returns. There's also a buzz that can't be tuned out by adjusting the tuning buttons – it doesn't seem to be present on all channels.

First check for dry-joints at the connections between the HM6231 field output module and the main PCB. If necessary check the field charging capacitor C603 (10μF) and the bootstrap capacitor C606 (10μF) by substitution. If the fault persists, replace the field output module. For the buzz, try careful adjustment of the sound detector coil L405.

PHILIPS VR2021

The problem with this machine is a dot pattern on all coloured areas of the playback picture, also slight colouring and smearing of the Ch. 4 test pattern frequency gratings at around 4-4·5MHz. The dots seem to run diagonally through the colour: the patterning is not severe but is noticed by the customer. The problem has been lessened but not cured by reducing the chroma record current control setting. A replacement chroma module made no difference, and as the picture is perfectly all right when the incoming off-air signal is played through the video channel the i.f. module would seem to be o.k.

We've noticed this patterning on several of these machines. It seems to be due to a beat between the colour subcarrier and the four DTF frequencies. In a domestic setting the problem is usually made more acute by putting the VCR beneath the TV set, where a two-way interaction takes place. A mild steel plate under the set fixes the latter problem.

QUERY COUPON

Available until 18th December 1985. One coupon, plus a £1·50 (inc. VAT) cheque or postal order, must accompany EACH PROBLEM sent in accordance with the notice printed above.

TELEVISION DECEMBER 1985

SERIES REGULATOR TRANSISTORS

We repair a lot of monochrome portables and often find that the series regulator transistor requires replacement. The trouble is the large number of different types in use, often obscure devices in imported sets. Is there something that can be used as a general replacement?

We've found that provided they are properly heatsinked the TIP41 (npn) and TIP42 (pnp) can be used to replace almost any series regulator transistor in a monochrome portable set.

TEST CASE

276

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

Mrs. Tedham – everyone in the Service Department knows Mrs. Tedham. She's been with us for years, and at least one of our greying senior technicians remembers calling on her as a slip of a lad to twiddle all the vision i.f. transformers in her monochrome set in order to get as much gain as possible out of it in the face of the very low received signal strength. "Never mind the definition, let's have a bit of contrast" she'd say.

The years rolled on and Mrs. Tedham graduated to 625 lines then, in the fullness of time, to colour TV. The u.h.f. signal strength was not much greater than with the v.h.f. channels of yore, and they never got to the Montfield valley with a relay transmitter. Mrs. T. is fond of her telly, and to clarify as far as possible the doings of David Bellamy, Annie Sugden and the rest Ace Aerials (motto: We'll Top the Lot) had masterminded a massive installation. With scaffold poles, guylines and an Amplified Ultragain GXL Supersonic Mk V aerial they'd squeezed every microvolt possible from the scant field strength in the valley. In terms of pounds per microvolt it was the dearest in the patch . . .

The resulting pictures were just acceptable, though somewhat dependent on weather and season. When Mrs. T. came to enquire about VCRs our salesman had serious doubts. Could the signal strength justify four hundred and fifty pounds worth of VCR? The machine worked surprisingly well when it was demonstrated, and Mrs. T.'s firm opinion was that replay of its recordings gave better results than off-air reception – in terms of picture grain, anyway. Looking at the picture we had to agree. Perhaps this was a case of history repeating itself – lesser bandwidth, lower noise!

The VCR in question was an ITT VR3905 (Ferguson 3V35), a basic machine with infra-red remote control. The Service Department's phone started to ring the day after it was installed! "Clocks keep flashing" – our intrepid field technician had to talk her out of a lifelong habit of switching everything off at the wall plugs whenever she went out. "Won't record" – use a cassette with a tab in it Mrs. T. And so on. Several complaints of snowy pictures were put down to the poor signal conditions at the site.

Finally we had to bring the machine into the workshop with an intermittent recording fault. It seemed that manually controlled recordings were all right but timer recordings were virtually unwatchable. The field technician had gone to considerable trouble on site, watching Mrs. T. go through the timer procedure, waiting for the VCR to perk up, and watching the programme in the E-E mode while the recording took place. Playback showed a good recording. Samples of previous recordings were shocking however – full of grain and snow, in fact quite useless.

Nothing showed up on a soak test of course. The machine was programmed and put into a corner each day but the recordings were perfect. The aerial socket and u.h.f. tuner were subjected to all kinds of indignities without detriment to the r.f. gain. Back it went to Montfield Vale, back it came to us. It's currently with Mrs. Tedham, and she and her VCR are in perfect harmony, nestling under their great landmark of an aerial mast. Timed recordings are fine – better in fact than live off-air programmes. So what was the problem? See next month.

ANSWER TO TEST CASE 275
– page 47 last month –

Last month's tale of woe concerned a troubled salesman and a Mitsubishi set with teletext and other features. Like many modern sets the CT2627TX has a sweep-tuning system, with the facility for automatic station tuning. When it's in the search mode the set should stop at each active broadcast channel and await instructions (manual mode) or commit the carrier frequency to memory for as many broadcasts as it can find (auto mode). This set was not stopping at any point though the signals were there to be had, and could be seen as bursts of unlocked lines at intervals during the sweep process. It was the unlocked condition of the displayed picture information that provided the clue. The attention that had been directed at the self-seek (ETS) board had all been futile, as the Real Technician at once realised.

The sweep tuning process, which consists basically of generating a long ramp voltage for the varicap tuner, comes to a halt when a time-coincidence between off-air sync pulses and the line flyback pulses is detected (in IC7202 on the ETS panel); that's to say, when the line timebase is locked to the incoming signal. For this to work the flywheel phase-locked loop has to get its act together quickly. If not the brakes in the sweep-seek department fail to come on and the search goes on and on.

So all R.T. did was to adjust the line hold control – VR502 on the main PCB. John then took the set back to the customer and completed the sale.

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LINEOUT TRANSFORMERS

3600	DECCA 100	7.95
3601	DECCA 110	9.80
3604	DECCA 1730/1830	8.50
3599	DECCA 80	7.22
3727	DECCA MS1700-2420	10.13
3729	FIDELITY FTV12/TVR120	5.50
5529	FIDELITY ZX3000 22"	13.95
3808	FIDELITY ZX2000/3000	13.95
3731	GEC 2100/2040	5.50
3732	GEC 2114	9.72
3734	GEC 3133	3.60
3733	GEC M1201/M1501H	12.80
3614	GRUNGIG 5010/6010ETC	12.95
3755	INOESIT 24EGB	11.25
3617	ITT CVC30	7.95
3619	ITT CVC45	9.75
3615	ITT CVC5-8	10.25
3620	KORTING A21100 90° HYBRID	14.95
4508	PHILIPS E2 CHASS	10.00
2861	PHILIPS G8	7.00
2862	PHILIPS G9	9.95
5305	PYE 691 WIRED	5.00
3628	PYE 725 90°	9.25
3629	PYE 731 110°	8.95
3632	RANK A823	5.50
3634	RANK T16A	8.95
3636	RANK T20A	12.95
3726	RANK T26A	15.50
3637	RANK Z179	11.95
3639	RANK Z718 22"	21.75
3770	REDIFUSION MK1 CHAS	9.38
3771	REDIFUSIDN MK3 CHAS	12.00
3775	SANYO CTP5101	15.50
3643	THORN 1400 SERIES	5.95
3644	THORN 1500 20"	5.95
3645	THORN 1500 24"	5.95
3646	THORN 1590 SERIES	10.85
3647	THORN 1600 SERIES	10.85
3648	THORN 1615 SERIES	10.94
3649	THORN 1690/91 SERIES	10.42
3713	THDRN 1790	8.95
3714	THDRN 3787	15.23
3652	THORN 3K 3K5 EHT TX	8.95
3651	THORN 3K 3K5	8.96
6172	PHILIPS G8 SPECIAL	7.85
2868	PHILIPS KT3	10.95

EHT TRAYS

5400	BG1895-641	7.50
5403	BG1897-642	7.50
5404	BG2097-642/333	7.50
3663	DECCA 100	7.25
3665	DECCA 1830	3.00
3662	OECCA 80	5.25
3667	GEC 1028/CS108	3.50
3677	ITT CVC45	7.95
3675	ITT CVC5/9	3.50
3678	KORTING HYBRID	7.95
3683	PHILIPS 550 G8	6.50
3681	PHILIPS 570 (5 LEAD)	9.00
3684	PHILIPS G9	4.00
3685	PHILIPS KT3	9.95
3686	PYE 691/697	6.95
3688	PYE 725/731/741	6.95
5395	SEIMANS TVK186/5	8.50
5393	SEIMANS TVK52	8.50
4696	SEIMENS TVK196/17	11.95
5406	TCE 1400 LARGE SCRN	4.95
3696	TCE 1500 17"-19"	5.85
3697	TCE 1500 23"&24"	4.95
3698	TCE 1600 SERIES	2.95
3700	TCE 4000	4.50
3703	TCE 9000	7.85
3699	TCE3000/3500	7.75
3706	TV11 EHT STICK	0.95
3709	TV20 EHT STICK	0.95
5275	TV45 EHT STICK	2.45
3705	UNIVERSAL EHT TRAY U.K.	4.95

TV ELECTROLYTICS

3547	DECCA 10/30 400X2/350V	2.90
3549	DECCA 100 400+800 350/250V	2.90
3548	DECCA 80/100CHAS 100/400V	2.90
5304	FIDELITY ZX2000 330 385V	3.98
5303	FIOELITY ZX3000 220 385V	3.98
3557	ITT CVC20/RRI T20 220/400	1.20
3556	ITT CVC5/9 200X2+25+75ETC	2.60
3560	PHILIPS G11 470UF/250V	1.65
3559	PHILIPS G9 2200/63V	1.55
3561	PHILIPS KT3 200+25X2/385V	1.95
3554	PHILIPS G8/GEC 2110 600/300V	1.90
3558	PHILIPS G9/PYE 731 600/300 PC	3.16
3565	PYE 725/731 800/250V	1.90
3564	PYE 691/697 200+300/350V	2.00
3576	RRI AB23 2500X2/25V	1.48
3588	TCE 3000/3500 1000/70V	0.89
3585	TCE1500 150X2+100/300V	1.90
3587	TCE3000 200+100X2/350V	2.86

MIXED DIALECTRIC CAPACITORS

4270	0.01 600V X5	0.75
4272	0.022 1KV X5	1.40
4273	0.033 1KV	1.40
4274	0.047 600V X5	0.85
4275	0.047 1KV X5	1.80
4276	0.1 600V X5	1.20
4277	0.1 1KV X5	3.00
4278	0.1 1250V X5	0.44
4279	0.1 2KV X1	0.75
4280	0.22 600V X5	1.45
4281	0.22 1KV X1	0.74
4282	0.47 1KV X1	1.02
4283	4700PF 1.5KV X5	1.50
4271	0.01 1KV X5	1.60

SLIDE CONTROLS

4883	100K LIN STD TV	0.55
4884	150K LIN STD TV	0.55
4874	1K LIN STD TV	0.55
4880	22K LIN STD TV	0.55
4881	22K LOG STD TV	0.55
4875	3K3 SEMI LOG STD	0.55
4885	470K LOG STD TV	0.55
4720	470R LG STD	0.99
4719	470R LM STD TV	0.99
4876	4K7 LIN STD TV	0.55
4877	4K7 LOG STD TV	0.55

PRESETS

STANOARO RANGES

VERTICAL STANDARO X 5	0.60
HORIZDNTAL STANOARD X 5	0.60
VERTICAL MINI X 5	0.60
HORIXONTAL MINI X 5	0.60

TUNER UNITS

4662	OECCA 30 SERIES MECHANICAL	4.95
4664	ELC 1043/05 EXCH TUNER	6.00
4663	ELC 1043/05 NEW TUNER	8.25
4666	ELC 1043/06 EXCH TUNER	6.00
4665	ELC 1043/06 NEW TUNER	8.25
4972	ELC 2003 EXCH TUNER	12.50
5534	GEC 2100 TYPE REPAIR CHGE	10.25
4675	PHILIPS G8 EXCHANGE TUNER	7.25
4679	RRI RANGERI/2 EXCH TUNER	9.75
4680	RRI 720 NEW TUNER	10.25
4678	RRI RANGER2/3 NEW TUNER	11.25
4668	U321 EXCH TUNER	6.50
4667	U321 TUNER NEW	7.95
4670	U322 EXCHANGE TUNER	6.50
4669	U322 NEW TUNER	7.95
4673	U341 EXCHANGE TUNER	7.25

VALVES

3883	DY802 VALVE	0.89
3932	PCF802 VALVE	0.95
3938	PCL805	1.08
3935	PCL82 VALVE	0.95
3936	PCL84 VALVE	0.85
3937	PCL86 VALVE	0.95
3940	PFL200 VALVE	1.20
3943	PL504 VALVE	1.40
3944	PL508 VALVE	2.06
3945	PL509 VALVE	5.95
3946	PL519	5.95
4870	PL802 VALVE	4.95
3950	PY500A VALVE	2.25
3951	PY801 VALVE	0.95

THORN SPARES

2897	T1590 MAINS TRANSFORMER	9.80
4590	T1600 MAINS TX	7.92
5430	T1690 MAINS TRANSFORMER	9.80
4973	T1690 SLOW MOT. TUN. POT	1.39
2906	T3000/3500 A1 SWITCH	1.15
2904	T3000/3500 MAINS TX	5.00
2908	T3000/3500 METAL CUT OUT	2.34
4587	T3500 100R CONVERG POT	0.85
3277	T3500 200R CONVERG POT	0.56
3278	T3500 500R CONVERG POT	0.56
4585	T3500 50R CONVERG POT	0.65
2905	T3500 5MEG A1 POT	1.17
4589	T3500 SPARK GAP .1/1500	0.51
2907	T3500 THICK FILM VID LOAD	1.40
4563	T38000 MAINS ON/OFF SW.	3.10
4412	T4000 FOCUS CONTROL UNIT	7.60
3273	T6818 220K BRIGHT CTRL	2.18
2909	T8500 FOCUS CONTROL UNIT	2.56
2911	T8500 MAINS CHOKE	17.45
4415	T8500 MAINS TX	12.75
2910	T8500 PLASTIC CUT OUT	3.72
2918	T9000 FOCUS UNIT	3.95
4556	T9000 FR1 THICK FILM	1.65
2919	T9000 OVER VOLT THICK FILM	3.95
4555	T9000 T701 CHOPPER TX	13.75
4982	T9600 0.33 2KV CAP	2.35
2914	T9600 CHOPPER TX T512	17.65
2916	T9600 FOCUS UNIT	2.95
2913	T9600 SWITCH MODE TX T511	9.98
2917	T9800 FOCUS UNIT	5.93
4429	T9800 MAINS CHOKE	0.00
4437	TX10 .0022 2KV	0.27
4658	TX10 100K TUNING PDT	0.64
2938	TX10 CHOPPER DRIVER TX	3.27
5427	TX10 SW NONREM CONT.	2.32
2922	TX10 TUNER DRAWER ASSY	1.95
4859	TX9 4" RND 15R SPEAKER	3.56
2937	TX9 INPUT CHOKE L65	12.05
2936	TX9 L64 BILIFAR CHOKE	4.25

DECCA SPARES

4616	OECCA 100 0.01 2KV CAP	0.98
2933	DECCA 100 BEDIGE TX	2.65
2932	OECCA 100 FOCUS CONTROL	2.65
4615	OECCA 100 LINE DRIVE TX	2.25
2928	OECCA 10SER 470K SH+VOL	2.15
4603	OECCA 2230 10R FUSIBLE	0.65
2930	DECCA 2233 PSH PSH SH	5.14
2931	DECCA 2263 PSH PSH SH	4.20
2926	DECCA 30 SER 3R9 RESIS.	0.50
2924	OECCA 30 SER MAINS TX	11.18
2929	DECCA 30 SER 47K SH+VOL	2.43
2939	DECCA 80 470R SH+VDL	2.45

RESISTORS

CARBON

STANDARD RANGES

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

SAFETY CERAMIC

STANDARD RANGES

5 WATT X 5	0.70
7 WATT X 5	0.80
11 WATT X 5	0.95
17 WATT X 5	1.15

OTHER RESISTORS

3279	2M2 H/V FOCUS RESISTOR	0.43
3280	22M H/V FOCUS RESISTOR	1.50
3281	33M H/V FOCUS RESISTOR	1.50
3282	47M H/V FOCUS RESISTOR	1.50
3283	56M H/V FOCUS RESISTOR	1.50

MAINS DROPPERS

3025	MAINS DROPPER RANK A640	1.20
3013	MAINS DROPPER DECCA 80/100	1.60
3016	MAINS DROPPER GEC 2010	0.98
3031	MAINS DROPPER THORN 3600	0.98
3030	MAINS DROPPER THORN 1600	1.45
4910	MAINS DROPPER DECCA 100 2R5	0.82
3034	MAINS DROPPER THORN 9800	1.48
3027	MAINS DROPPER THDRN 1400	1.45
3026	MAINS DROPPER RANK A823	0.89
3028	MAINS DROPPER THDRN 1300	1.60
3029	MAINS DROPPER THORN 1500	1.63
3018	MAINS DROPPER PHILIPS G8	0.84
3022	MAINS DROPPER PYE 725/731	1.40
3017	MAINS DROPPER PHILIPS 210	0.98
3019	MAINS DROPPER PHILIPS G8 47R	0.48
3033	MAINS DROPPER THORN 8500/8800	0.98
5385	MAINS ORDPPER OECCA 80	2.97
5386	MAINS DROPPER DECCA 100	1.88
5533	PYE CT200 PHILIPS 579 DROPPER	3.45

UNIVERSAL CONVERGENCE POTS

5R, 10R, 22R, 20R, 25R, 50R, 75R, 100R, 200R, 250R, 500R — 0.48

FIDELITY SPARES

2940	CHOPPER TX FIDELITY CTV14R	4.50
2942	DRIVER TX FIOELITY CTV14R	2.25
2941	FOCUS UNIT FIDELITY CTV14R	0.50
5408	MAINS INPUT CHOKE ZX2000	3.45
5504	MAINS FILTER TX CTVI4R	2.95
5505	ORIVER TX ZX3000 404387	2.95
6162	ON/OFF SH FIDELITY CTV14R	3.65
6163	ON/OFF SH FIDELITY CTV14S	1.65

GEC SPARES

2965	GEC 1401 CHOPPER TX	16.56
2964	GEC 1401 INPUT CHOKE	9.63
5531	GEC 1501 MAINS TX	5.25
4758	GEC 2100 3R FUSIBLE RES	1.45
4759	GEC 2110 SH2 2KV CAPS	2.39
2959	GEC 2100 ETC FOCUS VDR	1.60
2958	GEC 2100 THERMAL CUT OUT	0.97
2962	GEC 2110 10K CONTRAST CTRL	3.95
2961	GEC 2110 1K BRIGHT CTRL	2.25
4760	GEC 2110 FOCUS CONTROL	5.98
4771	GEC 2110 LUM. DELAY LINE	1.83
4728	GEC 2110 MAINS CHOKE	7.05
4996	GEC 2110 NEONS	0.20
4751	GEC 2114 VDL+SWITCH CDNT	1.98
4656	GEC 22K MULTI TURN POT	0.64

GRUNDIG SPARES

2949	GRUNDIG 5010 FOCUS VDR	3.25
4633	GRUNDIG 5010 CONTROL TX	4.76
2948	GRUNDIG 5010 FOCUS UNIT	3.75
4865	GRUNDIG 5010 L515 CHOKE	1.63
4744	GRUNDIG 5010/6010 LIO	2.62
4745	GRUNDIG 5011 LID	2.59
4637	GRUNDIG 5011 SH+SLIDERS	11.69
2952	GRUNDIG 6010 MIXIE MOD	22.50
4630	GRUNOIG 6011 MAINS SH	3.60
4631	GRUNDIG 6110 MAINS SH	4.86
2947	GRUNDIG A6400 MAINS SH	4.95

REMOTE CONTROL UNITS

PLEASE STATE MODEL NUMBER

4311	DECCA 100 NONTEXT RCU	20.78
4314	DECCA 100 (TEST+PREST) RCU	20.78
4310	DECCA 80/100 SERIES RCU	19.20
4315	DECCA 90/100 N/TXT RCU	20.78
4324	GEC 2 FUNCTION RCU	18.45
4325	GEC C2057H/2067H RCU	19.20
4326	GEC TELEMASTER 12 RCU	20.03
4327	GEC TELEMASTER 16 RCU	20.03
4328	GEC TELEMASTER 8 RCU	22.13
4332	GRUNDIG TELEPILOT 12 RCU	26.25
4333	GRUNDIG TELEPILOT 16 RCU	25.05
2955	GRUNDIG TELEPILOT 7	29.95
4334	GRUNDIG TELEPILOT 8 RCU	20.03
4357	KORTING 12 CHANNEL RCU	22.13
4358	KORTING 16 CHANNEL RCU	22.50
4380	PHILIPS G11 NDNTEXT RCU	19.20
4378	PHILIPS G11 T/TEXT 8CH RCU	20.78
5409	PHILIPS G11 T/TEXT U/SONIC	24.50
5453	PHILIPS KT3 REMOTE RC4001	16.00
4379	PHILIPS/PYE G11 2 FUNC RCU	18.90
4359	PHILIPS/PYE KT3/KT30	16.13
4385	RBM 16CH NONTEXT RCU	19.20
4386	RBM 8CH NDNTEXT RCU	19.20
4387	RBM TEXT&V/DATA RCU	20.78
2980	REMOTE CTRL UNIT PHILIPS G9	8.97
4390	TCE 9000CHAS 2 FUNC RCU	20.24
4398	TCE TX10(9653)+TEXT RCU	20.78
4400	TCE TX10(9670)+PREST RCU	20.78
4397	TCE TX9/TX10	19.20

PUSH BUTTON UNITS

2870	4 WAY DECCA ETC	7.50
2871	6 WAY DECCA	9.40
2873	4 WAY HITACHI ETC	8.94
2875	4 WAY PYE/TCE	10.87
2877	6 WAY GEC 2110	11.25
2878	7 WAY GEC 2112	12.95
2879	6 WAY T3500	2.75
2880	6 WAY PYE 713	15.30
2881	6 WAY T9000	3.95
2882	4 WAY BUSH A823	10.65
2884	6 WAY MOO CVC9	12.85
2885	6 WAY 520 PHILIPS	16.46
2886	6 WAY PHILIPS 550	14.98
2887	T1P SWITCH UNIT PHILIPS G11	24.95
2888	6 WAY PHILIPS G11	6.95
2889	PIANO KEY MOO DECCA 2631	22.48
4935	7 WAY ITT CVC5	12.90
5278	GEC 2136 TAPERED	10.95
5279	ITT 6 WAY +VCR	10.70
5280	6 WAY BUSH T20	11.50

ITT SPARES

2972	ITT CP340 PB ASSY	31.50
4501	ITT CP340 SLIOER ASSY	7.58
4683	ITT CV40 FOCUS UNIT	1.95
5543	ITT CVC20 LINE ORIVE TX	3.05
4571	ITT CVC20 MAINS SWITCH	1.36
4787	ITT CVC25 6N2 2KV CAP	1.35
4786	ITT CVC25 8N2 2KV CAPS	2.15
2970	ITT CVC25 BRIDGE COIL	3.95
4789	ITT CVC25 E/W LOAD COIL	1.92
4567	ITT CVC25/30 MAINS SW.	6.89
2969	ITT CVC32 ORIVER TX	2.55
4568	ITT CVC32 REMOTE MAIN SH	6.84
2971	ITT CVC32 SH MODE TX	6.35
4795	ITT CVC45 ON/OFF SWITCH	2.09
3286	ITT CVC5 1MFD 250V CAP	0.40
4569	ITT CVC5 MAINS SWITCH	2.83
4781	ITT CVC5 SHIFT POT 25R	1.82
4780	ITT CVC5 SLIDER BANK	7.41
2967	ITT CVC5-9 MAINS TX	8.48
4570	ITT CVC9 MAINS SWITCH	5.61

FUSES

STANDARD RANGES

20MM Q/B FUSE X 10	0.50
20MM A/S FUSE X 10	
63MA - 160MA	1.80
200MA - 5A	1.20
1.25" Q/B FUSE X10	
250MA - 800MA	0.95
1A - 5A	0.70
1.25" A/S FUSE X 10	
250MA - 2A	1.50
2.5A - 5A	2.30
PLUG TO P FUSE X 10	
2, 3, 5, 7, 10, 13A	0.95

SERVICE MANUALS

5032	BUSH/MURPHY A823	12.00
5011	OECCA 101/100	6.80
5047	OECCA 80 CHASIS	4.50
5442	OECCA/TATUNG 120	7.00
5022	GEC C2055H-C2255H	6.00
5023	GEC C2065H-C2265H	4.95
5026	GEC C2110-C2149	6.00
5068	HITACHI CPT2024	3.00
5074	HITACHI CPT2234	3.00
5094	ITT CVC20	2.00
5095	ITT CVC25+30	9.00
5096	ITT CVC40	5.00
5097	ITT CVC45/1	4.75
5513	ITT CVC800/801	3.00
5093	ITT CVC9	4.00
5123	MITSUBISHI CT200B	1.50
5527	PANASONIC TC2205	4.00
5116	PANASONIC TX2234	3.00
5127	PHILIPS G11 CHASSIS	4.00
5126	PHILIPS G8 CHASSIS	6.00
4515	PHILIPS KT3 SERV.	5.00
5135	PHILIPS T8-E	1.00
5136	PHILIPS TX	2.00
5143	PYE 725 731 SER	4.00
5145	REOIFFUSION MK1	3.00
5146	REDIFFUSION MK3	9.90
5147	REOIFFUSION MK4	4.00
5148	REDIFFUSION MK5	3.00
5167	THORN 1500	1.50
5168	THORN 1600	1.50
5171	THORN 1615	3.00
5172	THORN 1690-1691	3.00
5184	THORN 38030	2.00
5187	THORN 3V01	12.00
5188	THORN 3V16	12.00
5178	THORN 9000	6.00
5182	THORN 9800	10.80

RANK RADIO SPARES

4650	RRI T20 SPEAKER	2.36
5524	RRI T24E ON/OFF + VOL SH	2.35
4842	RRI 1122 SH+VDL 22K PULL	3.10
4843	RRI A823 100K TUNER POT	1.78
4847	RRI A823 FOCUS ASSEMBLY	6.03
2998	RRI A823 PLASTIC CAM	0.48
5300	RRI A823ETC RING SPK GAP	0.55
4988	RRI T20 (TYPE) FOCUS ASY	0.60
3001	RRI T20 3K3 SH+VOL CTRL	2.67
4852	RRI T20 9N1 2KV CAP.	1.98
4853	RRI T20 CONTRAST+AFC POT	3.23
3003	RRI T20 E/W CORR. COIL	3.41
3000	RRI T20 FOCUS ASSY	4.95
3004	RRI T20 SH MODE TX	11.20
4849	RRI 2718 3K3 SH+VOLUME	3.15

PHILIPS PYE SPARES

4969	PHILIPS 128711 4K7 VOL+SH	3.23
3288	PHILIPS 300 470L VOL+SWITCH	2.87
4449	PHILIPS 570/713 IF MODULE	7.00
5425	PHILIPS CTX-S EHT LEAD	0.95
5418	PHILIPS CTX-S FOCUS UNIT	4.04
4655	PHILIPS G11 100K TUNER POT	0.64
2983	PHILIPS G11 CVC32 B/CDIL	2.31
2984	PHILIPS G11 E/W CORR CDIL	1.92
2985	PHILIPS G11 FILTER CDIL	8.89
2986	PHILIPS G11 FOCUS UNIT	8.48
2987	PHILIPS G11 G2 CONTROL ASSY	7.98
4575	PHILIPS G11 RNO SHAFT SH.	2.32
4576	PHILIPS G11 SQ SHAFT SWITCH	2.32
4645	PHILIPS G11 TDA2600 HOLDER	0.65
5284	PHILIPS G8 100K TUN P/SET	0.84
2977	PHILIPS G8 10K COLOUR CTRL	0.98
4525	PHILIPS G8 10K CON POT (550)	0.87
4524	PHILIPS G8 15R CON POT (550)	1.07
2975	PHILIPS G8 2K2 BRIGHT CONTL	0.85
4526	PHILIPS G8 2H A1 POT (550)	3.80
4522	PHILIPS G8 5N1 1500V CAP.	1.88
4523	PHILIPS G8 5R CONV POT (550)	0.64
4858	PHILIPS G8 6×4" 7OR SPKR	5.98
2979	PHILIPS G8 EQUALIS. COIL	2.25
4503	PHILIPS G8 METAL SH	1.72
2978	PHILIPS G8 RED/GRW SYM COIL	3.33
4504	PHILIPS G8/G11 NON REM SH	1.72
5307	PHILIPS K12 THICK FILM UNIT	12.96
4649	PHILIPS KT3 4X4 SPEAKER	2.85
4566	PHILIPS KT3 MAINS SWITCH	8.60
4907	PHILIPS KT4 THICK FILM UNIT	10.29
4564	PHILIPS T173 MAINS SWITCH	3.45
4648	PHILIPS G11 6X4 SPEAKER	2.85
2992	PYE 169 LINE OSC COIL	3.45
4839	PYE 731 3R3 50W RESISTOR	1.29
4535	PYE 731 47K VOL SWITCH	3.11
2992	PYE 731 FOCUS UNIT	4.05
5545	PYE 731 L/H 3X 100K PSET	3.20
5546	PYE 731 R/H 3X 100K PSET	3.20
2994	PYE 731 THICK FILM ASSY	1.55
4938	PYE KT2 FOCUS UNIT	2.85
4864	PYE T194/6 SPEAKER	5.05
5556	PHILIPS G11 SHDRT SHAFT SH	1.98

THORN VIDEO SPARES (OVER 450 PARTS)

QUOTE THORN PART NUMBER IF POSSIBLE

5561	T3292 BOOSTER	44.62
5562	T3292 CAPSTAN BELT	3.48
5563	T3292 CAPSTAN MOTOR	51.16
5568	T3292 CASSETTE LAMP	1.62
5569	T3292 COUNTER BELT1	0.60
5571	T3292 COUNTER BELT2	0.60
5575	T3292 ORUM MOTOR	47.70
5577	T3292 F/F IDLER	2.02
5582	T3292 GUIDE ROLL ASSY	11.40
5585	T3292 LOWER DRUM ASY	80.48
5587	T3292 PINCH ROLL ASSY	9.84
5591	T3292 REWINO IDLER ASSY	7.04
5592	T3292 REWIND RUBBER TYRE	0.60
5621	T3292 UNLOAOING BELT	0.60
5622	T3292 UNLOAOING IDL ASSY	6.43
5624	T3292 UPP/DRUM KIT+MOD	35.94
5629	T3V00 CAPS. MOTOR BELT	0.60
5635	T3V00 COUNTER BELT 1	0.60
5637	T3V00 DRUM MOTDR	49.39
5646	T3V00 PINCH ROLLER ASSY.	7.31
5648	T3V00 RECORDING LAMP	2.80
5650	T3V00 SERVICE MANUAL	17.51
5655	T3V00 T/U IDLER ASSY	5.58
5657	T3V00 UPPER DRUM+MOO KIT	35.94
5663	T3V16 PINCH ROLLER ASSY	7.31
5666	T3V00 CAPSTAN MOTOR	51.16
5688	T3V00 TENSION BAND	1.86
5689	T3V00 TIMING GEAR	4.12
5692	T3V00 UNLOADING IDLER ASSY	6.43
5710	T3V01 TENSION BAND	1.86
5716	T3V16 CAPSTAN BENT	3.48
5720	T3V16 CASSETTE LAMP	1.62
5721	T3V16 CHANGE GEAR	0.86
5726	T3V16 DIODE STACK	3.41
5727	T3V16 DRIVE ARM ASSY	4.50
5750	T3V16 SERVICE MANUAL	26.24
5758	T3V16 T/U IOLER ASSY	5.58
5759	T3V16 T/U IDLER ASSY (LA)	7.55
5765	T3V16 UNLOADING IDLER	6.43
5772	T3V22 CAPSTAN MOTOR	51.16
5773	T3V22 CAPSTAN MOTOR BAND	0.60
5774	T3V22 CAPSTAN BELT	3.48
5790	T3V22 F/F IDLER	1.74
5803	T3V22 GUIDE ROLLER ASSY	8.39
5807	T3V22 MICRO SWITCH	4.25
5809	T3V22 PINCH ROLLER ASSY	7.31
5814	T3V22 REWINO IDLER ASSY	7.04
5822	T3V22 SUPP SPOOL CARRIER	4.00
5824	T3V22 TAKE UP IDLER SMALL	5.58
5825	T3V22 TAKE UP IOLER LARGE	7.55
5828	T3V22 TENSION BAND	1.86
5834	T3V22 UPPER ORUM ASSY	35.94
5840	T3V23 BOOSTER	24.71
5844	T3V23 CAPSTAN MOTOR	55.83
5852	T3V23 CONNECT GEAR ASSY	6.56
5856	T3V23 GUIDE ROLLER TYRE	0.60
5862	T3V23 PINCH ROLLER ARM AS	4.10
5868	T3V23 REEL IDLER ASSY	2.47
5869	T3V23 REEL MOTOR ASSY	32.81
5879	T3V23 T/U REEL DISK ASSY	5.17
5880	T3V23 TAKE UP REEL ASSY	2.58
5882	T3V23 UPPER ORUM ASSY	35.94
5885	T3V23 WORM GEAR SPINDLE	5.95
5886	T3V23 WORM GEAR SPROCKET	1.63
5888	T3V24 BRAKE SHOE	0.60
5896	T3V24 CASSETTE LAMP	1.62
5899	T3V24 DEW SENSOR ASSY	9.05
5902	T3V24 F/ERASE HEAD ASSY	10.41
5908	T3V24 LOADING GEAR ASSY	28.91
5909	T3V24 LOADING MOTDR	8.57
5912	T3V24 PINCH RLR LVR ASSY	0.62
5920	T3V24 SERVICE MANUAL	28.50
5945	T3V29/30 BOOSTER	24.71
5946	T3V29/30 BRAKE SHDE	0.67
5951	T3V29/30 CAPSTAN BELT	1.74
5952	T3V29/30 CAPSTAN MDTOR ASSY	27.32
5957	T3V29/30 CASSETTE LAMP	1.48
5962	T3V29/30 EJECT LCK ARM	0.60
5974	T3V29/30 LOADING MOTDR	0.60
5976	T3V29/30 LOHR DRUM ASSY	78.72
5980	T3V29/30 PINCH RLLR ASSY	8.66
5981	T3V29/30 PINCH RLLR SLND	8.26
5985	T3V29/30 REEL MTR ASSY	34.66
5990	T3V29 SERVICE MANUAL	25.85
5991	T3V30 SERVICE MANUAL	15.75
5998	T3V29/30 TAKE UP CLUTCH	0.60
5999	T3V29/30 T/U CLUTCH ASSY	2.36
6001	T3V29/30 T/U LDG RING ASSY	2.73
6003	T3V29/30 T/U SPL IDLER	2.25
6012	T3V31 BOOSTER	32.37
6016	T3V31 CAPSTAN BELT	1.74
6017	T3V31 CASSETTE LAMP	1.71
6027	T3V31 LOADING GEAR ASSY	6.60
6028	T3V31 LONG TRIMMING TOOL	0.93
6030	T3V31 PINCH ROLLER ASSY	8.66
6033	T3V31 SERVICE MANUAL	27.31
6034	T3V31 SERVO TEST JIG	49.94
6038	T3V31 TAKE UP CLUTCH ASSY	2.36
6039	T3V31 T/U LOAD/RING ASSY	2.73
6042	T3V31 UPPER DRUM ASSY	35.49
6044	T3V32 BDOSTER	32.37
6048	T3V32 CAPSTAN BELT	1.74
6053	T3V32 CASS MOTOR ASSY	9.45
6066	T3V32 LOADING GEAR ASSY	6.60
6068	T3V32 PINCH ROLLER ASSY	8.66
6071	T3V32 SERVICE MANUAL	18.50
6072	T3V32 SUPP/LDG RING ASSY	2.58
6081	T3V32 UPPER DRUM ASSY	35.94
6085	T3V35/6 BRAKE PAD X2	0.67
6086	T3V35/6 BRAKE SHOE	0.67
6087	T3V35/6 BRUSH ASSY	2.07
6090	T3V35/6 CAPSTAN MOTOR	23.91
6091	T3V35/6 CASSETTE MOTOR	6.93
6103	T3V35/6 PINCH ROLLER	9.84
6105	T3V35 REMOTE CONTROL	19.43
6107	T3V35/6 SERVICE MANUAL	27.00
6117	T3V35/6 TENSION BRAKE	0.60
6118	T3V35/6 UPPER DRUM ASSY	35.94
6119	T3V40 SERVICE MANUAL	12.00
6158	T3V29/30 UPPER DRM ASSY	35.94

SONY VIDEO

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

GEC

6173	V4000H UPPER CYLINOER	34.66
6174	V4000H RELAY	2.81
6175	V4000H PINCH ROLLER	0.00
6178	V4000H CAPSTAN MOTDR	32.63
6181	V4000H TAPE SENSDR LAMP	0.68
6185	V4001H PINCH ROLLER	0.00
6192	V4002H UPPER CYLINDER	34.66
6204	V4004 CLUTCH ASSY	9.51
6207	V4100 AUDIO CONTROL	28.13
6253	V4000H SERVICE MANUAL	7.08
6254	V4001H SERVICE MANUAL	7.08
6255	V4002H SERVICE MANUAL	9.45
6256	V4004 SERVICE MANUAL	7.85
6257	V4100 SERVICE MANUAL	7.08

HITACHI VIDEO SPARES

6214	8000 UPPER CYLINDER	38.99
6218	8000 AUDID CDNTROL	20.33
6220	8000 F/FWD REWINO ASSY	0.59
6224	9300E RELAY	2.81
6230	9300E TAPE SENSOR LAMP	0.95
6231	9300E TUNER	15.53
6240	VT33E UPPER CYLINDER	38.99
6244	VT33E CAPSTAN MOTOR	23.63
6249	VT11E F/FWD REWIND ARM	3.26
6252	VT11E CAPSTAN MOTOR	23.63

VIDEO HEADS

SEE FULL LIST FOR COMPARISON CHART

6258	BETA – A VIDEO HEAO	40.50
6259	BETA – B VIDEO HEAD	40.50
6265	VHS – A VIDEO HEAO	32.50
6266	VHS – A VIDEO HEAD	32.50
6274	PHILIPS H1500 VIDEO HEAD	47.06
6275	PHILIPS H1700/2 VIDEO HEAD	51.09
6276	PHILIPS 2020/2 VIDEO HEAD	53.77
6277	PHILIPS 2030 VIDEO HEAD	53.98

GENERAL SPARES

4999	ANTEX BIT 1/8" OIAMETER	1.45
5000	ANTEX BIT 3/16" DIAMETER	1.45
4452	ATTENUATOR 12DB	1.46
4469	ATTENUATOR 18DB	1.55
4451	ATTENUATOR 6DB	1.46
5419	COLOUR CRYSTAL 8.86MHz	0.60
4659	HEAT SINK COMPOUND	1.08
5001	QUICK TEST MAINS CONN.	6.99
4700	SERVISOL FOAM CLEANER	0.95
4453	SERVISOL FREEZE-IT	1.13
4724	SERVISOL SW CLEANER	0.98
4516	SERVISOL VIDEO HEAD CLEANER	0.85
4976	SOLDER 0.5 KILO REEL	7.02
4466	SUPER WICK 2MMX1.6M	0.75
4970	TV LOOP AERIAL	0.55
4998	WELLER INST. HEAT GUN TIP	0.59

QUICK SAVE TV SPARES THE COACH HOUSE, MUXTON LANE, TELFORD, SALOP

FULL LIST OF OVER 3000 ITEMS SENT WITH ORDER OR SEND 9" × 4" SAE. PLEASE USE STOCK NUMBER WHEN ORDERING, OR USE SET MAKER'S PART NUMBER. ACCESS AND VISA ACCEPTED. OFFICIAL ORDERS FROM GOVERNMENT OR SCHOOLS WELCOMED. ALL GOODS ARE STOCK ITEMS.

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 fulfil 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

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

HITACHI, Mitsubishi, Panasonic, Sony, Toshiba, JVC, Sharp. Sharp fully refurbished. PEARSON TELEVISION. 0484 863489. Delivery arranged.

OCHRE MILL TECHNICAL for GRUNDIG sets, moduales, manuals. TELEQUIPMENT OSCILLOSCOPES spares, manuals. Assorted items RECONDITIONED TEST EQUIPMENT. 0785 814643.

THORN GEC Deccas stripped for spares. Panels, tuners from £2.50, phone for prices. WELLINGTON, Dartford 0322 337212.

QUALITY SETS FROM CORNWALL. Workers/non workers. Spares, Panels, etc. Details ring 0726-81-5389.

PHILIPS G11 AND BUSH T20 regular supplies. For prices phone 01-845-2036.

TUBES

£29.00 **£14.50** INCLUSIVE, REGUNS TWO YEAR GUARANTEE, QUANTITY DISCOUNTS SIX MONTH GUARANTEE SLIGHTLY USED

A56-120 A56-140 A51-110 A49-191 A47-342 or 343 A44-270-1 A66-120 A66-140 (410) A67-120

(All 26" add £5)

No need to spend £5 returning old delta tube.

Slightly used in-line tubes from £29. Six months guarantee.

IN-LINE 1 YEAR GUARANTEE

51-161, 51-510, 51-570, 56-500 — **£45** inclusive

56-540, 66-540, 66-500 — **£55** inclusive

TOSHIBA NEW SI-110

47-342 47-343 **£29** inclusive

Special discounts for more than 2

SPECIAL OFFER MULLARD

56-540, 66-540 — **£64** inclusive

SONY £66 inclusive

330AB · 470 KLB · FWB · DLB · KTB · KLB 520 HB · TB · KB · LB · NB · MB · 570 HB EB · DB · GB · JB

MOST IN STOCK. IMMEDIATE DELIVERY

HITACHI

490DKB22 **£34**

560DZB22 **£49**

Plus 490 DVB 510 or 560 VLB

PROFESSIONAL STICK

DE-GAUSSING COILS

£19.50

RADIO and TELEVISION SERVICING BOOKS

(MacDonalds). New 74/75 £15; 75/76, 76/77, 77/78, 78/79, 79/80, 80/81, 84/85, 82/83, 83/84 £22.50.

FREE DELIVERY

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29, Warmsworth Road, Doncaster, Yorkshire DN4 0RP. Tel: 0302 855017.

Callers ring first, open every day including Sunday

½ a mile from A1

G11 PANELS ETC

IN GOOD WORKING ORDER

	FOR SALE	OR EXCH.
DECODER	12	10
IF	15	12
TIMEBASE	15	12
LINE SCAN	18	15
POWER	20	15
PUSH BUTTON UNIT (6)	15	12
SCAN COILS/ DYNAMIC CORRECTION	5	—
PANEL DRAWER ASSEMBLY 3 POTS AND ON/OFF	4	—

U-VIEW **FREE DELIVERY** Adress as above

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 of your products and services.

The prepaid rate for semi display setting £6.78 per single column centimetre (minimum 2.5 cms). Classified advertisements 40p per word

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BOLTON T/V

WHOLESALE

NEW BUSINESS NO RIP OFFS

PHILIPS G11	**£40**
PHILIPS G8	**£12**
THORN 8800	**£15**
THORN 9000	**£20**
THORN 9600	**£30**
GEC 2111	**£15**
VIDEO 2020	**£30**
VIDEO FERGUSON from	**£50**

Good Tubes Tested on Rig from **£10**

Many more makes in stock

Discount on quantity

Lorry loads direct from source

BOLTON T/V

FLASH STREET MILLS, BOLTON.

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SCREENPLAY

Your Friend in the TV Business

COLOUR SETS FROM	£5.00
MONOS FROM	£3.00
PANELS BY POST – PRE-CALIBRATED	
WORKING SETS TO ORDER	

Phone Baldock 894905

SECTION 3, UNIT 4, SERL COMPLEX, LONDON ROAD, BALDOCK, HERTS.

OPEN 6 DAYS 10-6.30pm/10-5pm SAT.

PRECISION VISION LIMITED

THE COMPANY THAT CARES

Offers for sale

- ★ Ex hotel rental colour TVs
- ★ Graded colour TVs and Audio
- ★ VHS Video Recorders

Please phone for current stock position

Unit 10, Chiltern Business Centre, 198 Garsington Road (Opposite BL works), Cowley, Oxford. Phone: (0865) 711966.

VIDEO & HI-FI ELECTRONICS

379 EDGWARE ROAD
LONDON W2
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ALL VHS PARTS AVAILABLE. EXAMPLES:

VIDEO HEADS

JVC, Ferguson, Akai, Saba, Telefunken	£35.00
Sony (Betamax)	£45.00
National Panasonic	£45.00
All Hitachi heads from	£42.00

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UPC 1365C	£6.30
UPD 553C	£10.20
UPD 552C	£9.56
HA 11711	£10.50

All makes of idlers, pressure rollers, clutch assembly and motors in stock.

Many other parts available. Send SAE for list.

ALL PRICES INCLUSIVE OF VAT
ADD £2.00 FOR P&P

SERVICE PAGES

(minimum 12 words), box number 70p extra. All prices plus 15% VAT. All cheques, postal orders etc., to be made payable to Television, and crossed "Lloyds Bank PLC". 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 5942).

N.W. ELECTRONICS

25 YEARS SUPPLYING THE TRADE

COLOUR TV'S AND VIDEOS
H.P. REPOS AND EX. RENTALS

ANNUAL CLEARANCE
ROCK BOTTOM PRICES

PYE G11 EXC CAB............£40
BUSH T20/26 CH...............£35
HITACHI 191.....................£20
FERGUSON TX
(NOT D.E.R. Etc.)...........£65
GEC 2010..........................£20
PYE 222............................£20
PHILIPS 550......................£15
BUSH 718.........................£20
BUSH 2 CHIP.....................£8
GRUNDIG 5010...............£10
PYE KT3..........................£50
GEC 2213.........................£30
THORN 3000.....................£7
GRUNDIG G415/4206

Best Stock in the Country — over 2000 in stock (90% of our TV's Switch on)

Special Price Quoted For Bulk Purchases From Source.

REFURBISHED TV'S

BUSH T20/T26......£45, G11......£50,
PYE KT3......£70, Others done to order.
DISCOUNT FOR QUANTITY

VIDEO

SHARPS 7300,8300,9300,HITACHI,VT11
FERGUSON 3V29 (Not Ex D.E.R. etc.)
SANYO, SONY, BETA

100's PX **HOOVER JUNIOR VACS**
— All models in stock
Fully reconditioned HOOVER JUNIORS (Like new)£27

CASH ONLY

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UNIT 12, Wharfedale Rd
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OPEN 6 DAYS
SAT 9-5.30

KM

* Britain's most reliable source of quality TVs.
* Hundreds of working polished TVs.
* GEC Starline
* Decca 80
* Decca 88
* Decca 100
* Pye G11
* Thorn 8800
* Pye 222 Series

All working and polished. These are not from major companies. A lot are from hotels and have had very little use.
Excellent reliable sets for rental.

Krystal Marketing Ltd, Breedon Cross Storage, Dale Road, Selly Oak, Birmingham B29 6AQ.
Phone 021-471 3023
Telex 335540-G
Ask for Les

TELEVISION

COLOUR TV PANELS Fully Tested & Working

	IF	CDA/ Video	Decoder	LTB	Line Board	Power
GEC 2040	3.50	3.50	4.00	5.00	–	–
DECCA 13/30	3.00	–	7.00	5.00	–	4.00
BUSH A823	4.00*	–	10.00*	5.00*	2.50	4.00
THORN 8/8½	–	–	10.00	5.00	–	5.00
PYE 205	3.00	3.50	5.00	10.00	–	–
THORN 3/3½	5.00	5.00	5.00	8.00	–	10.00
G8	6.00	–	8.00	7.00	15.00 fitted with brand new transformer	5.00

*Please specify prefix A or Z.

Please add 15% VAT to above prices, then add post + packing.
Post + Packing: 1 panel £1.50; 2 panels £2.25; 3 panels £3.00 etc.

Hybrid panels do not include valves. *Terms cash with order.*

Also a vast selection of modern working and non-working TVs at low prices. Please ring for current stock.

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Old C of E School, Church Street, Golcar, Huddersfield. Tel.: 0484 643273
Callers by appointment only.

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VIDEO AND TELEVISION WHOLESALE DISTRIBUTORS

LARGE STOCKS OF REFURBISHED THORN VIDEO RECORDERS
20″ 9000
AND
22″ R/C 9600
COLOUR TELEVISIONS

ALSO LARGE STOCKS OF NEW VIDEO TV AND Hi-Fi
(all Leading Brands)
AT UNDER TRADE PRICES

IRELAND'S LARGEST SUPPLIERS OF VIDEO, TV and Hi-Fi
SESKINORE
OMAGH, CO. TYRONE
Tel: (0662) 47447/841389
OPEN 6 DAYS 9 to 6

NORMAN ENTERPRISES LTD

Weston-Super-Mare, Avon.
Tel: 413991/418545

Colour TVs fully engineered with a special care on tubes

Hitachi 217 Remote Control £95
Thorne 9000 Remote Control £37.50
Pye G11 .... £47.50
Rank T20 .... £37.50
Pye Chelsea 6 Button £27.50
Pye 725 .... £37.50
Pye 721 .... £27.50
Thorne 9600 .... £45
Thorne 9200 .... £42.50
Bush T20 Remote Control £45
Bush T24 .... £55.50

All above prices include hand sets and VAT.
Ready for sale.
Phone now, limited number each month. All the above off the pile, less a 3rd

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LARGE STOCKS OF WORKING NON-WORKING SETS, MOST MAKES AND SIZES.

FAIR PRICES – TRADE ONLY

WAREHOUSE OPEN:
Mon-Fri 9-1, 2-5; Sat 9-1

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11-15 FRANCIS AVENUE,
WALLISDOWN. TEL: 0202 581932

PLEASE MENTION TELEVISION WHEN REPLYING TO ADVERTISEMENTS

HALTON TV TRADE DISPOSAL

Wide range of TVs available.
Working and non-working.
TRADE ONLY
(We have NO retail outlet)
St Michaels Industrial Estate, Widnes
Tel. 051 423 1577

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

STARLITE ELECTRONICS

WILLOWS FARM,
A13 RAINHAM, ESSEX.
Rainham 23225 also
Hornchurch 50238.

EX RENTAL TVs
UNTESTED FROM £15.00
WORKING TVs £20.00
RE-GUNNING TUBES

2 year guarantee
Most types available including Sony

SERVICE PAGES

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COME AND SEE OUR LARGE RANGE OF
S/H COLOUR TVs AT LOWEST PRICES EVER

CONTACT:

S. M. ELECTRONICS
11 SANDHOLES ROAD, COOKSTOWN, CO. TYRONE
Telephone: Cookstown 06487/64277

Open: Mon.-Sat. 9.00 am-6.00 pm (Closed Wednesday)

LOOK HEAR TV

NOW OPEN. Our new trade warehouse. For the best service and quality in the East Midlands.

* Good quality working TV's
* Off the pile also available
* Low prices
* *No minimum quantity*
* Limited number of VHS videos
* Lots of TV panels for sale

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Only 5 mins. from Junction 21, M1.

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MR. A. L. BALMER

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FOR QUALITY REBUILDS
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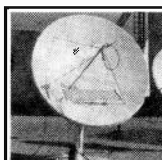

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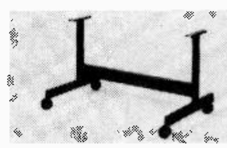

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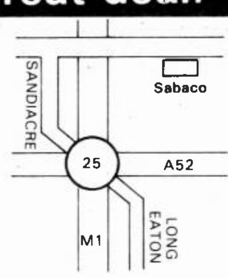

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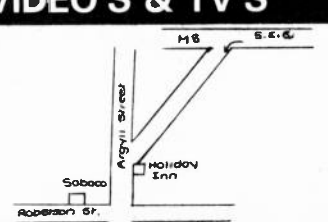

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- K30 Focus Pot 75p
- K30 Tube base on panel £1.00
- TX10 Focus Units £7.00
- CVC 32 Focus Unit 75p
- Fedility Focus Unit 14R-14S 30p
- 3500 Thorn Focus Unit £1.00
- ITT Small for use with Split Diode 50p
- Z718 Bush Focus £2.00
- TV11 50p
- Remo TV12SP 50p
- 1600 Thorn EHT Rec and Lead 50p
- TV13 50p
- TV14 50p
- TV18 60p
- TV20 £1.00
- TV45 50p
- Thorn 14/1500 rec stick 5p

G7000 Philips Video Games Packs 11 types £5

G11 drawer ASS 3 pots Mains switch and lead £2.00

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

CLOCK DISPLAY

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

DISPLAYS

- 4040 Clock £1.00
- 7seg Red LED 50p
- 2 digit LED 8.8 50p
- 2 digit LED ÷1.8 with panel + MC14511 £1.00
- 4700/63 £1.50
- 250/64 10p

- 3300/70 50p
- .1/100 5p
- 1/100 × 10 30p
- 22/100 10p
- 4.7M/100 5p
- 470/100 20p
- 2000/100 70p
- 4700/100 75p
- 47/160 10p
- 300 300/300V 80p
- 800/160 50p
- .1/250 Pulse 5p
- 2.2 250v 10p
- 3n3/250 A.C. 10p
- .33/250V 20p
- .39/250V 15p
- 4n7/250 tested 5KV 25p
- .91/250 35p
- .91/400 30p
- 22/250 15p
- 47/250 10p
- 100/250 20p
- G11 470/250V £1.75
- GEC600/250 60p
- 700/250 £1
- 300+300 MFD 350v £1.00
- 800/250 40p
- 32/300 20p
- 4/350 5p
- 8/350 8p
- 4.7M/350v 10p
- 33/350 20p
- 220/350 30p
- 300/350 40p
- 400/350 50p
- 10/375 10p
- 22/375 15p
- 220/385 75p
- 330/385 CVC 820HT 60p
- 0.1/400 15p
- KT3 E/W .39/400 20p
- .56K/400v 20p
- 4700pf/400 10p
- .22/400 10p
- 8/400 15p
- 33/400 20p
- 400/400 40p
- 394K/400V 20p
- 220/450 40p
- .47/500 25p
- 0.1/600 15p
- 0.1/1200V wire end 20p
- 0.1/450 A/C wire end 20p
- .047/600 15p
- 0.047/1000 10p
- 0.01/1000 10p
- 0.1/1000 10p
- .47/1000v 65p
- .47/250V A.C. 10p
- .001K/1250 10p
- 0.0047/1500 10p
- .005/1500 10p
- .0105/1500 10p
- 1n8/1500 15p
- 2n0/1500 10p
- 2n2/1500 15p
- .01/1600 15p
- G11.8200/2KV 15p
- 0.1/2KV 20p
- 10n/2KV 15p
- 3n9/2KV 15p
- 0.0015/2KV 10p
- 5n2/2KV 10p
- 6n2/2KV 15p
- 2n0/2KV 15p
- 2n2/2KV 15p
- 7500pf/2KV 10p
- 3000PF/3000V 10p
- 4n7/2KV 15p
- 8n2/2KV 15p
- 0.0082/2500 15p
- 150/3500 10p
- 1800/4KV 5p
- 4.7nf/5KV 10p
- 170/8KV 10p
- 180/8KV 10p
- 210/8KV 10p
- 1000/10KV 10p
- .47/100V 80p

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

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

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GRUNDIG MODULE TYPES

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- 350V 400M 60p
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- 47/220/350v 60p
- 150/150/100/100/100/320v £2.00
- 2500/2500/63v 50p
- 150/200/200/300v 70p
- 400/400/200v £1.70
- 300/100/100/16/275v £1.50
- 100/200/325v 40p
- 150/150/100/375v £1.50
- 300/300/100/32/32/300v 2.00
- 1500/2000/30v 50p
- Jelly pot Thorn 00D4013 £3
- 150/150/100/100/320v £2.00
- 100/350 + 300/200/100/16/275v £2.00
- 225+25/380 GEC 70p
- 200/100/100/350v £1.50
- 500/500/25v 50p
- 150/150/100/300v 75p
- 200/150/150/300v 1.00

ITT 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
- CVC40/2 New Chroma Panel £10.00
- 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
- CMD 800 £10.00
- 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

- G11 Ultrasonic Teletex Handset £24.00
- 8 C.H. Ultrasonic GEC Full Remote C2014H/C2219H £15.00
- New Replacement for G11 Ultrasonic Full Remote £12.00
- Thorn 4000 insert with 7 buttons £5.00
- Decca RC 11 £14.00
- Decca RC 12 £14.00
- G11 Infra-red full teletext £24.00
- Rank, Infra-red £10.00
- Dynatron-Full remote CTV 62, 63, 64 £19.00
- Hitachi infra red handset £18
- Philips full remote KT3, 16C928/20C934; 7228/7324; K12 26C 797/1ST 66K 1826 £12.00
- G11, Full remote top button assy £12.00
- G11, Full remote repair service (exchange unit) £12.00
- Philips infra red full remote 9 channel for 60 CP2605 £6.00
- Philips infra red full remote 12 channel for 60 CP2605 £12.00
- Philips Key Pad set KT3/K30 £3.00
- 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
- Pye & Philips handset KT3-K30 chassis. No RC5150-RC5176-RC5171-RC5177.
- **Special Price** £13.00
- ITT Hand Set with TV-Teletex-VCR £12.00
- RC4001 £17.00
- Philips Tops for Teletext & Full Remote KT3-K30 £9.75

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NEW G8 Tuner V/Cap	£5.50
ELC2000 on Panel	£2.50
GEC 6 Push Button Unit	£6
ITT 6 Push Button Unit	£6
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GEC or Hitachi 6 push button unit 2110 Conversion	£8
GEC 2110 V/Cap	£5
ELC1043 (Ex Panel)	£3.75
ELC1042 (Ex Panel)	£5.00
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ELC2004	£10.00
ELC2006 NEW	£10.00
GEC Tuner V/Cap Hitachi After 1979 ET548, ET547, ET546, ET541B	£8.00
ASTEC UM1183	£10.00
U322 (UHF) ,,	£4.00
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V317 (VHF)	£5
V334 (VHF)	£5
U321	£6
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U342 (UHF)	£5
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U.V. 415	£7.00
U.V. 417	£7.00
ELC1043/05 Thorn	£5.90
ELC1043/06 Thorn	£5.00
Small V/Cap Mitsumi UHF ,,	£4.00
VHF ,,	£3.00
Portable & rotary Tuners Sanyo & Mitsumi UHF	£5.00
NSF-UHF/VHF Varicap (old type)	£8.00
Mosfit UHF/VHF (new type)	£8.00
UE2-B31 Fidelity V/Cap T/Unit	£6.00
UHF-VHF V/Caps on panel	£3.00
Thorn Tuner PANEL with 6×100K pots + cursors NO TUNER	£1.00
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U321 on panel	£6.00
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Small Tuner DX 175-220MHz Auto Changeover	£5.00
9000 Thorn Tuner on Panel	£7.00

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THORN 1500 4P.B. Mech. Tuner	
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ML232	£2.00
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NE555	60p
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SAA1272	£3.00
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SAA5000A	£1.50
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SAA5040A	£4.40
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TA7315AP	50p
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TA7609P	50p
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TBA120SB	40p
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TBA120SQ	£1.00
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TBA231	75p
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TDA2532	£1.00
TDA2540	80p
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TDA2560	75p
TDA2571AQ	£2.50
TDA2575A	£1.00
TDA2577	£2.00
TDA2581	£2.50
TDA2590	£1.00
TDA2591	£1.00
TDA2593	£1.00
TDA2560	50p
TDA2600	£5.00
TDA2611A	£1.00
TDA2611AQ	£1.00
TDA2653	£4.00
TDA2640	£2.00
TDA2680	£1.00
TDA2690	£1.00
TDA2593	£1.00
TDA3190	£1.00
TDA3560	£4.00
TDA3571Q	£1.50
TDA3650	£4.00
TDA3651AQ	£3.50
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MJE340	28p

MJE660	25p
MJE661	25p
MJE3055	£1.00
MJE2801	30p
MJE2955	50p
MJE13005	50p
Sanikron Diode	30p

Philips Cartridges

GP412	£6.00
GP412/11	£6.00
GP406	£6.00

Transistors

A1222	15p
A1223	15p
AC106	15p
AC121	15p
AC124	15p
AC128	15p
AC137	15p
AC151	15p
AC131	15p
AC138	15p
AC152	15p
AC153K	15p
AC142K	15p
AC169	15p
AC176	15p
AC176K	15p
AC178K	15p
AC179	15p
AC186	15p
AC187K	15p
AC188	15p
AC188K	15p
ACY21	25p
AD143	50p
AD149	50p
AD161/162 pair	40p
AF17A	25p
AF139	25p
AF181	£1.00
AF239	25p
AF367	25p
AL102	£1.75
BC161	30p
BD507	50p
BD509	30p
BD510	30p
BD517	30p
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BD535	30p
BD544D	30p
BD562	30p
BD610	40p
BD646	50p
BD676A	30p
BD678	50p
BD681	25p
BD807	20p
BD826	50p
BD948	30p
BDX75	20p
BDX32	£1.25
BLY49	50p
BF115	20p
BF121	20p
BF127	20p
BF137	20p
BF157	20p
BF160	20p
BF161	20p
BF164	60p
BF179	30p
BF180	20p
BF181	20p
BF182	20p
BF184	20p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	16p
BF244	40p
BF245b	20p
BF257	20p
BF258	25p
BF262	15p
BF263p	25p
BF264	15p
BF271	10p
BF273	10p
BF274	10p
BF324	25p
BF337	50p
BF355	30p
BF362	20p
BF363	15p
BF367	15p
BF391	15p
BF394	10p
BF419	30p
BF422	15p
BF423	15p
BF448	30p
BF450	20p
BF458	30p
BF459	30p
BF468	30p
BF469	30p
BF470	20p
BF480	50p
BF594	10p
BF597	10p

BF694	10p	BC107	10p	BC462	10p
BF758	30p	BC108	10p	BC463	10p
BF760	30p	BC109	5p	BC478	10p
BFT34	15p	BC113	10p	BC527	10p
BFT43	10p	BC114	10p	BC532	10p
BFT84	8p	BC115	10p	BC546	10p
BFW11	20p	BC116	10p	BC547	10p
BFX29	30p	BC117	20p	BC548	10p
BFX84	25p	BC119	20p	BC556	10p
BFY50	15p	BC125	10p	BC557	10p
BFY52	20p	BC126	10p	BC558	10p
BFY90	25p	BC139	10p	BC559	10p
BLY49	25p	BC140	30p	BC635	10p
BPW41	25p	BC141	25p	BCX31	25p
BRC116	25p	BC143	25p	BCX32/36 Pair	75p
BRX43	15p	BC147	10p	BCX32	25p
BRX48X	10p	BC148	10p	BD116	25p
BRY56	30p	BC149	10p	BD124	50p
BSS68	10p	BC153	10p	BD124 (metal)	60p
BSY79	10p	BC154	10p	BD130Y	25p
BSY95a	10p	BC157a	10p	BD131	30p
BTY80	20p	BC158	10p	BD132/238	30p
BSX19	17p	BC159	10p	BD135	25p
BSX20	17p	BC160/16	25p	BD136	30p
FT3055	30p	BC171	10p	BD138	30p
TCE82	30p	BC172	10p	BD140	30p
2N930	5p	BC173	10p	BD176	25p
2N2221	8p	BC174	10p	BD182	£1.00
2N2222	8p	BC183	10p	BD183	70p
2N2906	10p	BC184	10p	BD202	60p
2N3055	40p	BC204	10p	BD204	60p
2N3566	10p	BC207	10p	BD207	60p
2N3702	10p	BC212	10p	BD221	20p
2N3711	10p	BC213	10p	BD222	30p
2N3583	50p	BC214	10p	BD228	30p
2N3904	15p	BC237	10p	BD226	20p
2N4355	10p	BC238	8p	BD233	30p
2N4442	£1.00	BC239	10p	BD235	30p
2N4444	£1.00	BC250	8p	BD238	30p
2N5296	40p	BC251	10p	BD239	15p
2N5983	30p	BC252	10p	BD240	50p
2N6099	40p	BC262	10p	BD243c	50p
2N6109	40p	BC263b	20p	BD244	50p
2N6130	50p	BC294	30p	BD250a	30p
2N6133	20p	BC298	10p	BD252	20p
2N6348	20p	BC300	30p	BD253B	30p
2N6399	10p	BC301	30p	BD331	20p
2X 2N6099 on heat sink	50p	BC303	30p	BD373b	20p
2SA437	20p	BC307	7p	BD416	25p
2SB407 Sanyo TO3	10p	BC308	7p	BD433	25p
2SB474	30p	BC309	10p	BD437	25p
2SB566	10p	BC327	10p	BD439	50p
2SC381	10p	BC328	10p	BD678	30p
2SC458	50p	BC328/338 pair	15p	BD681	30p
2SC515	10p	BC337	10p	BD682	30p
2SC732	10p	BC338	10p	BF761	30p
2SC733	10p	BC347	10p	BF819A	30p
2SC1030	£1.00	BC349b	10p	BF858	30p
2SC1546	20p	BC350	20p	BF871	30p
2SC1725	20p	BC365	10p	BFR39	15p
2SC2068	20p	BC384	10p	BFR52	7p
2SC2073	8p	BC394	10p	BFR79	15p
2SC2122A	£1.00	BC413	10p	BFR81	15p
2SC2229	15p	BC414	10p	BFR87	10p
2SC7350	15p	BC416	10p	BFS60	10p
2SD180 TO3 80v/6A	15p	BC440	30p	BFT42	20p
2SD200	£2.00	BC454	10p	BFT57	20p
2SD787	30p	BC455	10p	MR1366	20p
2SK30A	10p	BC456	10p	BRC-M-200	40p
		BC460	25p	BRC-M-300	50p
				BRC 1330	75p
				BRC 3064	£1.00
				BTT822	£1.00
				BTT6016	£1.20

Thyristors

BT151/800R	80p
BT106 Plastic	30p
BT106 Metal	£1.20
BT119	£1.00
BT120	£1.00
BRC4443	75p
G11 Thyristor	60p
Decca 80-100	60p
2N4444	£1.00
MCR72-6	25p
OT112	£1.00
TF320M	£1.00
HC8441	£2.00
17052	£2.00
17088H	£2.00
17089R	£2.00
17053R	£2.00

Thermistors

G8 Degausing	35p
Philip type VA1104	70p
ITTP7266312	15p
PTH451 AOR	15p
PT37P Fits Pye & PT34	20p
Degausing Thermistor (fits most sets)	20p
GEC Double Thermistor	25p

Filters

5-5MHz	15p
6MHz	30p
BFU455K	5p

I.C. Heat Sink	20 for £1
20×TO5 Heat Sink	£1.00
CVC 9 power supply board	£1.50
CVC 20/2 mains panel	£2.00
ITT Mains Filter .1/250v/	
CVC 20 to 45 chassis	50p
Pots 10 k with Switch	25p
Mullard Surface Wave Filter RW 153P Colour TV Filter	40p
Mullard Surface Wave Filter RW 154 Colour TV Filter	40p

TV Crystals

4MHz	
4.433-619	
6MHz	
8.867238	
Large or small	50p each

NEC 4730312	£3.00
Line Tran Tripler in Case	
Antistatic Isolators	
Disc Type Black	10p

I.C. Holders

DIL - DIL		DIL - QIL	
40 Pin × 4	£1.00	16 Pin × 10	£1.00
42 Pin × 5	£1.00	18 Pin × 10	£1.00
28 Pin × 5	80p	28 Pin × 4	£1.00
16 Pin × 10	70p	16 Pin G11	each 10p
24 Pin × 5	75p	AB Mains Switch	
14 Pin × 10	70p	u/v	30p
18 Pin × 10	80p		

64 Vicarage