OCTOBER 1987

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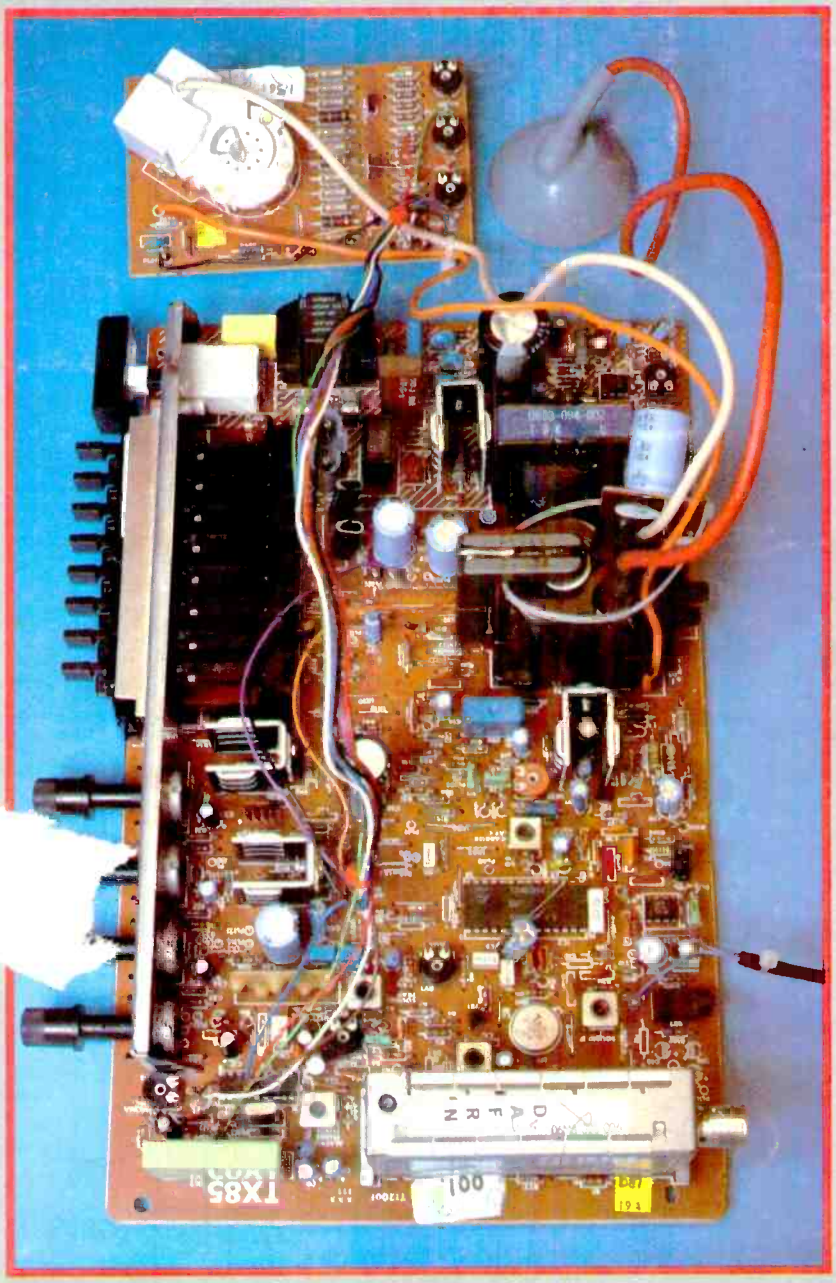

The Ferguson TX85 Chassis • Recording Teletext Subtitles • DX-TV • The ED Beta Format • TV Fault Finding • VCR Clinic • The TDA3562A Colour Decoder Chip • Simple Polar Mount Adjustment

TELEVISION

October 1987

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On sale September 16th

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

SUBSCRIPTIONS
An annual subscription costs £16 in the UK, £19 overseas (by surface mail). Send orders with payment to Quadrant Subscription Services Ltd., Oakfield House, Perrymount Road, Haywards Heath, Sussex, RH16 3DH.

BACK NUMBERS
Some copies of issues published **during the last six months** are available from the Editorial Office at £1·40 inclusive of postage and packing. Address requests to Television, Editorial Office, IPC Magazines Ltd., King's Reach Tower, Stamford Street, London, SE1 9LS.

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

this month

OUR NEXT ISSUE DATED NOVEMBER WILL BE PUBLISHED ON OCTOBER 21

P.V. TUBES

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TELEX: 635562 GRIFFIN G FOR P.V.

CALLERS ALWAYS WELCOME

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SONY	C7/J7/SL17	4.35
JVC	TCE3V00/01/06/16/23/24	4.35
JVC	HR2200/3320/3330/3660/1100/7700	4.35
AKAI	VS9700	4.35
HITACHI	VT5000	4.35
SHARP	VC6300/6500	4.35
SONY	TC6 GEN	4.35

VIDEO BELT KITS

VEKIT 1 AKAI	VS9300/VS9500/VS9800	
JVC HR3300/HR3320/ **HR3330/HR3360**		
TCE	8903/3V00/3V16/3V22	3.50
VEKIT 2 PANASONIC	NV7000B/NV7200B	3.00
VEKIT 3 SONY	SLC5/7	3.75
VEKIT 4 SONY	SL8000/8500/8600	4.50
VEKIT 5 SONY	SL3000UB	4.00
VEKIT 6 PANASONIC	NV3000B	3.00
VEKIT 7 SANYO	9300P	4.25
VEKIT 8 PANASONIC	NV2000B	3.75
VEKIT 9 PANASONIC	NV8600B/8610/V011	4.42
VEKIT 10 TOSHIBA	V8600	3.00
VEKIT 11 SHARP	VC7300	3.50
VEKIT 12 SHARP	VC6300/6600	4.00
VEKIT 13 SANYO	VTC5000	1.95
VEKIT 14 SANYO	VTC5300	2.50
VEKIT 15 JVC	HR7650	2.50
VEKIT 17 SHARP	8300	1.76
VEKIT 18 SHARP	9300	1.47
VEKIT 19 HITACHI	VT8000	1.12
VEKIT 20 HITACHI	VT11/33	2.15
VEKIT 21 HITACHI	9500	1.12
VEKIT 22 SONY	SLC6	3.75
VEKIT 25 TOSHIBA	V7540	1.90
VEKIT 26 JVC	HR7000	96p
VEKIT 27 THORN	3V29	1.95

VIDEO IDLER TYRES

	O.Dia	I.Dia	Width	
SONY	23.7	17.4	4.9	50p
SONY	24.2	18	5.1	50p
HITACHI	31.8	25	4.9	50p
PANASONIC	37	27	3.9	52p
AKAI	26	20	3.9	50p
JVC	39.3	32.8	3.9	56p
JVC	33	23.9	4	56p
NATPAN	31.2		56p	

VIDEO HEADS

Thorn New Life (Nat Pan)*	25.95
Thorn New Life Heads (exchange)*	22.95
3HSSV	24.93
4HSS (3HSSN)	24.93
PS3B Sony/Beta	28.12
Philips V2000 and V2023	64.00
Philips 1700	64.00
Sanyo 9300/9455/9500	53.00
Sanyo 5000/5300/5400	53.00
Toshiba 9600 Upper Ass.	12.50
Toshiba 9600 (Rep. type only) PS3BT	37.50
Sony 8000 UB	49.39
Sony SLC9	49.39
Sony SLC5, 6, 7	49.39
Sharp 3300/9700	56.00
Sharp 3HSS (S.P.)	40.62
Hitachi HIVI/VT8000E	35.62
Hitachi VT33E/GEC 4004	35.62
Hitachi VT11/GEC 4100	35.62
Hitachi 9300/4001 3HSSHA	32.12
Hitachi 4000/5000/5500 3HSSH	32.12

* Thorn New Life heads are refurbished heads and we have types to cover most VHS types on an exchange basis

VIDEO TAPE

SKC	E60	2.50	Scotch	E30	3.66
	E120	2.88		E60	4.00
	E180	2.80		E120	3.24
	E240	3.78		E180	3.86
	L500	2.90		L750	5.22
	L750	3.40		VCC360	6.33
				VCC480	7.23

VIDEO SUNDRIES

VHS Drum Motor	25.50
VHS Capstan Motor	25.50
Sanyo 5000 Reel Motor	12.95
Sharp Reel Motor	19.50
Take up idler Ass./Clutch Ass.	
VHS (general purpose) Thorn/JVC etc.	5.95
Sharp 381/383/386/9100 9300/9500	2.97
Sanyo	6.95
Hitachi F.F. Idler VT11E/VT33E	3.91
Video Lamps	
Nat. Pan. Bulb VHS	1.30
General Purpose VHS	1.41
3V23 with plug VHS	1.95
Video Care	
Universal Copy Kit	5.50
Head Cleaner	90
Beta Eccentricity Gauge	55.00

VARICAP TUNERS

ELC1043-05	8.40
ELC104305 Mullard	12.50
ELC1043-06	8.40
ELC2003	19.50
Philips G8/G9	10.50
Philips G11 (U321)	9.90
TX90	13.75
U322	7.30
U341	9.50
U342	8.50

PUSH BUTTON ASS.

Hitachi 4 way	12.36
Philips G8 (early)	17.82
Philips G8 (late)	18.97
Philips G11 Tip Switch unit	26.50
Philips KT3	16.67
Philips KT30	13.22
Thorn 9000 6 way	20.70
Pye 697 repair kit	10.35
Pye 725-735 (also Red Mk.1)	12.60
Pye 725-735 tuning head with PCB	12.50
Decca 4 way	7.93
Decca 6 way	9.17
Decca 4/6 way conversion kit	17.50
Decca 7 way piano key rep. kit	15.62
GEC 2110 6 way	10.92
GEC 6 way slim	10.29
GEC/ITT/PYE 7 way	16.67
GEC Conversion kit	16.50
Rank A823	12.36
Rank T20A	11.21
ITT CVC 8/9 (mod)	13.80
ITT 6 way with VCR	8.90
Thorn 8500	6.50
GEC 7 B/P c neons	10.50

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Philips G8	8.75
Philips G9	9.50
Philips KT3	15.95
Philips K30	17.94
Philips TX2	13.39
Philips TX3	14.41
Philips G11	15.58
Pye 713/715	10.00
Pye 725 90°	10.50
Pye 169	10.00
Pye 741	9.90
Bang & Olufson (2000,3000)	14.69
DECCA 80	8.58
Decca 100	8.58
Decca 1700	9.00
Decca 1730	8.58
Decca 2230	8.58
GEC 2110	16.75
GEC 2040	9.50
ITT CVC 1/9	10.85
ITT CVC 25/30/32	8.65
ITT CVC 20	8.60
ITT CVC 45	8.60
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R.B.M. BUSHRANGER T16A	10.00
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Thorn 3000 SCAN	7.95
Thorn 8500	17.50
Thorn 3000/3500 Mains	10.00
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Thorn 1691	9.68
Thorn TX9	23.85
Thorn 9600 (Gen Thorn)	21.79
Thorn 9000	25.53

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Thorn 3500	7.98
Thorn 8000	6.95
Thorn 8500/8800	7.15
Thorn 9000	8.70
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Decca 30	6.76
Decca 80	7.12
Decca 100	7.50
Decca/Tatung 120/130	6.50
GEC 2100	7.40
GEC 2200 (20AX)	6.50
GEC 2040/2028	6.60
GEC 2110 (pre Jan '77)	7.00
Philips G8 Short Focus Lead	7.12
Philips G8 Long Focus 550	7.12
Philips G9	6.37
Pye/Philips KT3	12.50
Pye 691/3	7.58
Pye 713 4 Lead	8.79
Pye 713 5 Lead	8.79
Pye 731/25	8.75
R.B M. A823 plug in	8.75
Rank T20/22	7.12
ITT CVC5/9	7.50
ITT CVC20/25/30 (Mullard)	7.12
ITT CVC45	8.65
Universal	6.00
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TV 13	1.26
TV 14	1.29
TV 18	1.10
TV 20	1.43

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B2	Eurobell Comp.	21.00
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B6	"C" Polycarb. box with back plate	7.80
B7	Freidland Bell	12.47
CA15	4 core cable	5.55
CA16	6 core cable	7.94
CA17	8 core cable	10.31
817S	Shorrock P.I.R.	22.50
815S	Shorrock P.I.R.	41.50
010	Orion I.R.	24.00
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137	Shorrock SAB	8.76
BA9	1.9A battery	7.77
S3	712 Siren	5.75

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GEN. EQUIPMENT/TOOLS

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Probes (x10) or (x1)	10.90
Philips Switchable Probes	13.25
Automatic Wire Strippers	6.95
I.C. Inserters	1.18
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Micro Cutters	5.00
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Long Nose Pliers	1.20
Sm. Neon Screwdriver	40
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470 model inc. bases *	299.00

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No. 1	9.09	No. 14	16.63
No. 3	9.50	No. 15	16.44
No. 5	9.09	No. 18	10.83
No. 6	11.08	No. 19	10.83
No. 7	9.09	No. 21	14.40
No. 8	10.08	No. 23	13.86
No. 9	9.09	No. 24	27.07
No. 13	11.11	No. 25	12.57

Avo Meters Factory Recon.	119.00
Avo Battery	2.09
Solder Sucker Antistat min.	4.50
Solder Sucker Antistat std.	5.40
Solder Sucker Antistat lge.	6.20
Solder 500g	7.00
D.I.Y. Solder Small Pack	45
Solder Sucker Nozzles	81
Solda Mop Stnd.	77
For sold. irons see Antex/Weller Under Specific Spares	
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Fuse Wire 5A, 15A, 30A	05
Fluorescent Starter 4-80W)	15
Battery Press Studs min.	11
Battery Press Studs std.	15
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18SWG 45 Amp	1.86
14SWG 100 Amp	1.86
17SWG 60 Amp	1.86
19SWG 45 Amp	1.86
20SWG	2.75
22SWG	1.86
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Cable Ties ALT1 per 100 (small)	84
Cable Ties ALT21 per 100 (large)	1.69
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US8511 80/100 3 Func. US	19.50

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FD09141 CTU 20R/140R (IR8876)	13.75

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HA1339A	2.95
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HA1366WR	1.85
HA1374	2.45
HA1377	2.95
HA1392	2.95
HA1397	3.95
LA1201	1.25
LA1230	2.95
LA1365	2.45
LA4440	2.75
LA4445	2.45
LA4460	2.45
LA4461	2.45
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SAA1250	3.85
SAA1251	4.95
SAA3027	3.95
SAA5010	4.95
SAA5012	4.95
SAA5030	5.95
SAA5050	5.65
SAF1032P	3.25
SAF1039P	2.75
SL470	2.95
SL480	2.85
SL490	2.50
SL1430	1.95
SL1432	1.75
SN76660N	.65
STK0039	6.45
STK0040	5.95
STK077	6.95
STK078	6.95
STK2129	8.50
STK433	5.95
STK4332	5.95
STK435	5.95
STK437	6.95
STK439	7.50
STK459	8.55
STK461	9.95
STK463	9.95
STK465	9.95

TYPE	PRICE (£)
TA7193P	4.45
TA7204AP	1.90
TA7205AP	1.45
TA7222P	1.85
TA7227P	2.95
TBA120AS	.95
TBA120T	1.25
TBA120U	.95
TBA530	1.25
TBA720A	2.95
TBA800P	.75
TBA810S	1.25
TBA820	1.10
TBA890	3.25
TBA920S	1.95
TBA950/2X	2.25
TBA1440G	2.95
TCA270S	1.55
TDA440	2.95
TDA1035T	2.40
TDA1037	1.95
TDA1044	2.95
TDA1170S	1.80
TDA1180P	2.65
TDA1190Z	2.85
TDA1470	3.25
TDA1506	4.35
TDA1510	3.80
TDA1512	3.35
TDA1515	4.50
TDA1670A	4.20
TDA1770A	3.55
TDA1870	6.50
TDA1908A	2.25
TDA1950A	3.95
TDA2002	1.50
TDA2003	1.55
TDA2004	2.90
TDA2005	3.20
TDA2006	1.95
TDA2020	3.20
TDA2030	1.80
TDA2170	2.95
TDA2270	2.95
TDA2521/3	2.95
TDA2523	2.80
TDA2525	2.95
TDA2530	2.00
TDA2532	2.10
TDA2540	1.70
TDA2541	2.70
TDA2560	1.95
TDA2571A	4.95
TDA2576A	3.25
TDA2578A	2.95

TYPE	PRICE (£)
TDA2581	2.00
TDA2582	1.95
TDA2591/3	2.30
TDA2594	2.95
TDA2600	6.35
TDA2611A	1.50
TDA22653A	3.55
TDA2655B	5.95
TDA3190	1.95
TDA3540	2.95
TDA3541	2.95
TDA3560	4.95
TDA3561A	4.95
TDA3562A	5.50
TDA3650	4.75
TDA3651A	1.95
TDA3651AQ	3.80
TDA3652	2.95
TDA4500	3.95
TDA4503	4.65
TDA4600/2	2.85
TDA4600/2D	3.30
TDA8180	4.50
TDA8190	2.80
TDA9503	2.95
UPC1031H	2.60
UPC1181H	1.70
UPC1182H	1.70
UPC1185H	2.50
UPC1230H	4.35
UPC1363C	3.95
UPC1365C	4.20
UPC1378H	3.70
UPC1394C	2.95

TRANSISTORS

TYPE	PRICE
BC107	.14
BC147	.10
BC148	.10
BC327	.11
BC337	.11
BC548	.10
BC558	.10
BC639	.25
BC640	.25
BD131	.33
BD132	.33
BD201	.80
BD222	.50
BD225	.50
BD237	.40
BD238	.40

TYPE	PRICE (£)
BD438	.70
BD439	.70
BD677	.65
BD701	.95
BD707	.95
BF337	.28
BF338	.30
BF458	.35
BF757	.70
BF871	.80
BF960	1.25
BR103	.75
BR303	1.95
BT116	1.30
BT151/800	1.15
BU126	1.50
BU205	1.40
BU208A	1.45
BU208D	1.95
BU326A	1.45
BU500	1.95
BU508A	1.75
BU508D	1.95
BU526	2.20
BU807	1.30
BUW81A	3.50
BUX84	.90
R2008B	.70
R2540	2.35
TIP31C	.45
TIP32C	.45
TIP33	.90
TIP41C	.45
TIP42C	.45
TIP112H	.75
TIP125	.95
2SB618	2.20
2SC867A	3.20
2SC1034	3.95
2SC1114	5.95
2SC1124	1.00
2SC1413A	2.95
2SC1942	2.90
2SC3156	2.50
2SD588A	2.20
2SD725	4.95
2SD870	6.50
2SD1398	2.35
2SD1453	2.95
SG613	8.95
15/80H	2.45
15/85R	2.45

COMPUTER SPARES

Z80A CPU	1.75
2114 (200ns)	1.35
4116-2	1.00
4164	1.35
4532/3	2.50
4532/4	2.50
ZTX213	.20
ZTX650	.30

DIODES

TYPE	PRICE
BY127	.10
BY164	.45
BY179	.65
BY223	1.25
BY227M	.20
BY229/800	.95
BY299/800	.25
BYX10	.20
BYX55/600	.30
SKE5F3/10	1.45
1N4001-7	.07
1N5401-8	.18

E.H.T. TRAYS

DECCA 80	7.20
DECCA 100	7.35
DECCA 120/130	8.95
ITT CVC20/30	6.95
PHILIPS G8	7.90
PHILIPS KT3	7.95
RBM T20/T22A	7.35
THORN 8500/8800	7.20
THORN 9000	8.00
UNIVERSAL	5.70

FUSES

20mm A/S: (Pkts of 10) 250MA, 315MA, 400MA, 500MA, 630MA, 800MA, 1A, 1.25A, 1.6A, 2A, 2.5A, 3.15A, 4A, 5A, 6.3A 1.20

20mm Q/B: (Pkts of 10) 200MA, 500MA, 630MA, 800MA, 1A, 1.6A, 2A, 2.5A, 3.15A ..... .60

FIDELITY LINE O/P TRANS

All models 14"/16"/20" inc. mod. kit 9.95

LINE O/P TR.

DECCA 80	7.95
DECCA 100	8.30
FIDELITY ZX 3000	11.95
ITT CVC20	8.50
ITT CVC25/30/32	8.40
PHILIPS G8	9.75
PHILIPS G11	14.95
PHILIPS KT3	9.75
PHILIPS K30	14.50
RBM T20/T22A	9.95
THORN 1615	9.95
THORN 1690/1	9.95
THORN 1790/1	7.95

ON/OFF SWITCHES

Decca 80/100	1.00
Fidelity	1.45
Fidelity (Remote)	2.95
Philips G8 (Metal)	1.95
Philips G11	1.35
Philips G11 (Remote)	1.85
Philips KT3 (Remote)	1.95
Pye G11 (Remote)	1.85
RBM T20A (3K3)	2.45
Sony KV1612 (Remote)	4.95
Sony KV2022(Remote)	4.95
Thorn (Universal)	1.00
Thorn TX (Remote)	1.95

PUSH BUTTONS

AMSTAD CTV1401	5.95
DECCA/ITT 6 way	8.50
FIDELITY CTV140	6.20
ITT CVC5 7 way	11.75
ITT CVC8/9	12.80
ITT CVC20/30	8.50
ITT CVC45 (port.)	22.95
PHILIPS G8 (S/L 550)	16.50
PHILIPS KT3	8.95
PHILIPS KT30	9.95
RBM T20A 6 way	11.95
THORN TX9	19.50
THORN TX10	19.50

TUNERS (NEW)

ELC 1043/05	8.50
ELC 1043/06	9.35
ELC 2003	18.95
ET548	14.20
MEU-B31 (Fidelity)	14.95
MEU-B31F (Fidelity)	14.50
U321	8.75
U322	8.80
U431	8.30
U343 (Coax. skt)	14.95
U343 (Phono)	16.95
U344C	9.95
U411	11.95

TV ELECTROLYTICS

DECCA 80 (400/800)	4.50
FIDELITY ZX (220/385)	2.95
PHILIPS G8 (600/300)	2.95
PHILIPS G9 (2200/63)	1.95
PHILIPS G11(470/250)	2.20
RBM T20A(220/400)	2.50
THORN 1690/1 (4700/25)	1.35
THORN 9000 (400/400)	2.90

VALVES

PCF802	1.10
PCL82	1.05
PCL85/805	1.05
PCL86	1.05
PL504	1.60
PL508	3.00
PL509/519	5.95
PY500A	2.25
PY81	1.05
PY88	1.10

VOLTAGE REGS

7805	.60
7808	.70
7812	.60
7815	.70
7824	.75
7912	.80

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Top Quality MAXELL E180 Video Cassettes £2.95 each

FERGUSON TV SPARES

TX9

Dual PTC	2.85
I.F. Gain Unit	22.95
Line O/P Trans	23.50
Linear Line Coil	1.35
RFI Choke	2.55
Tuner	14.95

TX10

Ceramic Filter	1.25
Focus Unit	8.50
Line O/P Trans	32.95
On/Off Switch	1.70
Tuner	14.95
10K ROT. POT.	.60

TX90

Line O/P Trans	19.30
Loudspeaker	2.95
On/Off Switch	1.20
Tuner	15.95

TX100

Choke	.85
Line O/P Trans	16.95
On/Off Switch	1.10
Teletext Board	64.95
Tuner	15.95

FERGUSON VIDEO SPARES

3V00/16/22

Capstan Motor	24.95
Drum Motor	24.95
F/F Idler	1.60
Pinch Roller	4.95
Rewind Idler	6.25
Take-up Idler (LG)	6.95
Take-up Idler (SM)	5.80

3V29/30

Booster	24.95
Capstan Motor	38.60
Full Erase Head	9.75
Loading Motor	8.95
Pinch Roller	4.95
Pilot Bulb	.95
Reel Motor	31.90
Take-up Clutch	2.35
Take-up Idler	1.40
Take-up Spool	3.95

3V35/36

Capstan Motor	25.95
Cass. Housing	28.95
Cass. Motor	6.70
Erase Head	9.60
Guide Roller	.30
Leaf Switch	1.45
Reel Idler	2.85
RF Converter	24.95
Take-up Clutch	2.45
UHF Tuner	36.50

GEC/HITACHI TV SPARES

HM6232	5.95
HM6251	4.70
HM9032	5.70
STR4211	3.95
STR441	5.50
STR451	5.50
STR454	4.95
STR6020 (Kit)	5.95
ET548 Tuner	14.20
ET556A Tuner	9.95

GEC/HITACHI VIDEO SPARES

V4000H/VT8000

Audio Head	18.95
Capstan Motor	31.90
Idler F.F./Rew	1.85
Pilot Lamp	.65
Pinch Roller	4.95
Play Idler	3.95
Pulley F.F./Rew	.65
Video Head	28.95

V4001H/V4002H 9300E/9500E

Capstan Motor	30.95
Idler F.F./Rew	1.80
Play Idler	4.30
Pilot Bulb	.95
Pinch Roller	4.95
Pulley F.F./Rew	.75
Relay	2.25
R.F. Converter	28.95
Video Head	28.95

V4100H/VT11E

Audio Head	19.95
Capstan Motor	21.95
Clutch Assy	9.40
F.F./Rew Arm	2.90
Pinch Roller	5.50
Relay	2.95
Video Head	27.95

V4004H/VT33E

Capstan Motor	29.95
Clutch Assy	8.95
F.F./Rew Arm	2.90
Video Head	29.95

V4005H/VT63E

Capstan Motor	15.95
Video Head	49.95

NAT. PAN. VIDEO SPARES

NV333 Idler	1.10
NV2000 Idler	1.30
NV3000 Idler	1.25
NV7000 Idler	1.20
NV333 Play Idler	1.20
NV370 Play Idler	3.95
NV333 Load. Gear	2.50
NV2000 Load. Gear	1.60
NV7000 Load. Gear	1.60
NV333 Pinch Roller	4.95
NV2000 Pinch Roller	4.95
NV7000 Pinch Roller	4.95

REMOTE CONTROLS

PHILIPS KT3/30
Repair Kits
Buttons & Foils
Text or Non Text
£6.50

PHILIPS RC5 HANDSET
Suitable for:
KT3/K30/K35/KT40
Text & Non Text
£21.95

SANYO VIDEO SPARES

5000/5300

Capstan Motor	32.95
Gear Idler	6.95
Load. Roller	1.95
Pinch Roller	6.85
Reel Motor	9.95
Reel Pulley	6.95

SERVICE MANUALS

TELEVISION

Ferguson TX9	28.50
Ferguson TX10	39.95
Ferguson TX90	10.95
Ferguson TX100	10.95
Ferguson 1790/1	1.95
Fidelity AVS1600	2.50
Fidelity CTV14R	2.50
Fidelity CTV14S/20R	2.50
Fidelity CTV20	2.50
Fidelity ZX (text)	2.50
GEC C1403H	2.75
GEC C1405H	2.95
GEC C1407H	3.50
GEC C2095H/C2295H	3.50
GEC C2096H/C2296H	3.50
Philips CTX-E	1.00
Philips CTX-S	1.00
Philips G11	3.50
Philips KT3	3.50
Philips K30	3.50
Philips K35	3.50
Philips K40/KT4	3.50
Sony KV2212UB	8.50
Sony KV2252UB	8.50
Sony KV2705UB	8.50

VIDEO RECORDERS

Ferguson 3V29	24.95
Ferguson 3V35/36	26.95
Ferguson 3V44/45	9.95
Ferguson 3V46/47	9.20
GEC V4005H	6.95
GEC V4100H	6.50
Philips 6460/00/05	6.50
Philips 6520/00/05	6.50
Sony C5	9.40
Sony C6	9.40
Sony C6 MkII	9.40
Sony C7	9.40
Sony C9	9.40

SHARP VIDEO SPARES

9300/381/383

Capstan Motor	27.50
Loading Motor	8.85
Pinch Roller	5.95
Reel Idler	3.30
Reel Motor	17.50
Unlock Assy.	.75

481/483

Reel Idler	3.25
Reel Motor	16.95

SONY SPARES

C5/C7

Ace Head Assy	33.95
Brake Assy	1.80
Capstan Motor	28.70
Limiter Assy	3.15
Pinch Roller	1.30
Remote Control (C7)	46.95
Rewind Kit	5.25
Timer Lid	1.25

C6

Ace Head Assy	42.20
DC Motor	14.35
Forward Assy	3.55
Pulley Assy	1.25
Reel Motor	14.95
Reel Motor (C6MKII)	19.90
Rewind Kit	4.20

C9

DC-DC Conv.	22.70
Door Assy	4.95
Front Door Assy	4.95
Gear Kit	6.70
Guide Pin Kit	4.95
Video Head (genuine)	49.95

V.C.R. PILOT BULBS

Amstrad 7000	2.65
Hitachi 8000	.65
Hitachi 9300	.95
National NV2000	1.00
Sharp 8300	1.00
Sharp 9300	2.65
Thorn (Plugged)	.95
Universal	.50

VIDEO BELT KITS

AKAI 9300/9700	2.50
Amstrad 7000	1.50
Ferguson 3V00/16/22	2.50
Ferguson 3V29/30	1.80
Hitachi 8000	1.95
Hitachi 9300/9500	1.80
Hitachi VT11E	1.95
JVC HR7200	1.80
Nat. Pan. NV333	2.20
Nat. Pan. 2000	2.25
Nat. Pan. NV3000	1.95
Nat. Pan. NV7000	1.95
Sanyo VTC5000	1.00
Sanyo VTC5300	1.95
Sanyo VTC5500	1.95
Sanyo VTC9300	2.95
Sharp 8300	2.40
Sharp 9300	2.40
Sony C5/C7	2.50
Sony C6	1.95

VIDEO HEADS

Amstrad 4600/7000/9000	28.95
Ferguson 3V00/22/29/35	25.95
Hitachi 8000 (genuine)	28.95
Hitachi 9300 (genuine)	28.95
Hitachi VT11E (genuine)	27.95
Hitachi VT33E (genuine)	29.95
JVC HR2200/7700	25.95
Nat. Pan NV333	25.95
Nat. Pan NV366	47.25
Nat. Pan NV370/380	28.50
Nat. Pan NV2000/7000	25.95
Philips VCR6460	28.50
Philips VCR6462 (genuine)	43.95
Sanyo VTC5000 (genuine)	47.50
Sharp 9300/9700	29.70
Sony C5/6/7	28.90
Sony C5/6/7 (genuine)	45.00
Toshiba 9600/V31B	33.95

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12V Twin Fluorescent Lamp
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IDEAL FOR BOATS
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ATTRACTIVE WHITE FITTING, RIBBED PERSPEX DIFFUSER. ON/OFF SWITCH. 3ft CABLE. TRANSISTORISED CIRCUITRY. KEYHOLE FIXING. 12V D.C. 8W TUBES. 368 × 67 × 43 mm.

ONLY £4.99

12 VOLT RECHARGEABLE UNIT

10 × D Size Ni-Cads (4 Ah) encapsulated in a black plastic case. Fuse holder. Gives 12 volt output when charged. Ex-equipment. Fully guaranteed. Dimensions: 245 × 75 × 75mm

£5.99 P&P £1.85 + VAT

CHARGING UNIT FOR THE ABOVE 12V UNIT

Manufactured by Saft, these chargers are suitable for the above battery packs (as advertised in the May issue of "WHAT VIDEO" — Page 6). The chargers are stated as we have modified them to a standard charger. Full charge of the packs is obtained after 10-12 hours (overnight) charging. Supplied complete with main lead and charging lead fitted with a 4-pin plug (6 pin plug version available upon request). Although ex-equipment, these chargers are fully tested and guaranteed. Dimensions: 335 × 260 × 150 mm

4-PIN £15 6-PIN £16 + £1.85 P&P + 15% VAT

BATTERY CHARGER (Universal Nickel Cadmium)

An attractive nickel cadmium battery charger ideal for charging the rechargeable batteries detailed below. The charger will charge all the sizes listed: AAA, AA, C, D and PP3 and up to four AAA, AA, C and D types and one PP3 can be charged at the same time. The charger has a hinged plastic dust cover for easy viewing. The five battery positions have L.E.D. 'charge' indicators. The unit also has a switch allowing batteries to be checked for current state of charge.
Power: 240V A.C.
Dimensions: 210×100×50 mm
ORDER CODE – BAT CHARGE
1+ **£4.50**
10+ **£4.25**
100+ **£3.75**

Ni-CAD BATTERIES

AAA	£1.25	£1.20 ea/10
AA	90	.85 ea/10
C	2.10	1.90 ea/10
D	2.50	2.20 ea/10
PP3	4.10	3.90 ea/10

SOLOERING SECTION

Soldering Station complete with 30W or 40W Iron (state which)	72.50
XS25 W Iron kit/complete with stand, 1m lead & plug attached	8.20
CS17 Iron Kit	7.99
C15 Iron Kit	8.30
XS25 W Iron kit/complete with steel & plug attached	11.00
CS 18W, as above	10.90
Antex 15W iron	5.40
Antex 18W iron	5.60
Antex 25W iron	5.80
Antex elements	3.20
Antex bits	1.15
Antex stands	2.20
Soldersucker	4.50
Spare nozzles for Soldersucker	0.65

SERVICE AIDS

Goldklene Degreasing Solvent	1.75
Switch Cleaner	1.15
Supa Freeze-it	1.38
Foam Cleanser	1.18
Video/Tape Head Cleaner	1.10
Plastic-Seal	1.35
Aero-Klene	1.10
Anti-Static Spray ellist	1.20
Excel Polish	1.19
Aero Duster	1.49
Super 40	1.88
Rapid Fire Extinguisher	3.30
Silicone Grease Tube	1.80
Silicone Grease Spray	1.38
Heat Sink Compound	1.18

Solda-Mop

Light guage 0.08mm	0.78
Standatd gauge1.2mm	0.76
Industrial reel 1.2mm	2.96

SOLDER: 60% TIN 40% ALLOY

22g. Non-corrosive Multi-core Solder.
500gm Reel £4.99 each
10 Reels £3.75 each

ORYX PORTASOL GAS IRON
Powered by lighter fuel
£14.50

SPARE TIPS
1.0mm/2.4mm/3.2mm/4.8mm £4.00

RESISTORS – CARBON FILM 5%

1/4W 1RO to 10M (E12 Range)	2p each. 15p/10. 75p/100
1/2W 2R2 to 10M (E24 Range)	2p each. 15p/10. 75p/100
1W 10R to 2M2 (E12 Range)	5p each. 40p/10. 3.00/100
2W 10R to 2M2 (E6 Range)	8p each. 60p/10. 5.00/100

RESISTOR KITS – each value individually packed

1/4W pack 10 each value E12 – 10R to 1M 610 pieces	4.50
1/4W pack 5 each value E12 – 10R to 1M 305 pieces	2.95
1/4W pack Popular – 10R to 10M 1000 pieces	6.50
1/2W pack 10 each value E12 – 2R2 to 2M2 730 pieces	7.75
1/2W pack 5 each value E12 – 2R2 to 2M2 365 pieces	4.70
1/2W pack Popular – 2R2 to 10M 1000 pieces	9.50
1W pack 5 each value E12 – 2R2 to 1M 353 pieces	13.75
2W pack 5 each value E6 – 10R to 2M2 317 pieces	21.75

ADDITIONAL KITS

DISC CERAMIC 50V	(125)	£3.50
ZENER DIODES 5ea	(55)	£3.50
ELECTROLYTICS R.	(100)	£7.25
FUSES Q/BLOW 20mm	(80)	£3.75
FUSES T/DELAY 20mm	(80)	£7.50
PRE-SET POTS-H	(120)	£6.75
PRE-SET POTS-V	(120)	£6.74
NUT & BOLT	(800)	£3.00

EXTENSION MULTI SOCKETS

ALL 13A, FUSED WITH NEON INDICATOR

2-WAY	£2.75 £2.50ea/5
3-WAY	£3.80 £3.50ea/5
4-WAY	£3.99 £3.75ea/5
4-WAY + 3m lead & plug	£5.75 £5.25ea/5
PLUGS 13A 3-pin fused, white	£0.46 £0.42ea/10

FUSES 20mm

QUICK BLOW – 80mA, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.5, 1.6, 2, 2.5, 3.15, 4, 5, 6.3 45p/10
TIME DELAY – 50mA, 60, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1A, 1.25, 1.6, 2, 2.5, 3.15, 4, 5, 6.3, 10 90p/10

1" DOMESTIC MAINS FUSES

ALL 13A, FUSED WITH NEON INDICATOR
2A, 3A, 5A, 13A £1.00/10
Full range FUSE HOLDERS.

MULTISECTION ELECTROLYTICS

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

FULL RANGE IN CATALOGUE

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GEC 2018	10R+15R+19R+70R+63R+188R	1.15
Philips G8	2.2R+68 R	1.00
Philips G8	–47R – 15W	0.48
Philips 70	6R+124R+84R	0.68
Philips 300	118R+148R (with link)	1.35
RRI A640	250R+14R+156R 50W	1.05
RRI A816	302R+70R+6.2R	0.78
Thorn 1500	350R+20R+148R+1.5K+317R	1.34
Thorn 3000/3500	6R+1R+100R Fused	1.05
Thorn 8500	1K5+40R+50R	1.28

Plus Many More. Please enquire.

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BT App Telephone Plug + 3m Lead	£1.25
BT App Master Socket inc Wiring instrns	£2.75
BT App Secondary Socket	£1.85
4-way plug	25p each
BT 4-Core Cable per metre	15p/m £12.00/100m
Cable clips for above	10/15p 100/98p

COAXIALS

Coax Plugs Metal	.20	.18/10
Coax Plugs Plastic	.10	.085/10
Coax Chassis Sockets	.12	.10/10
Coax Line Sockets	.25	.22/10
Coax Line Connectors	.12	.10/10
Coax Cable 75ohm TV Download	18p m – £12.50 100m reel	

VALVES

Enquiries are welcomed for any other valve not listed here.

Type	Price (£)	Type	Price (£)
AZ31	4.55	PC92	3.05
AZ41	2.05	PC900	1.45
DAF96	1.05	PCC88	0.85
DF96	0.80	PCC89	0.80
DK96	2.70	PCC189	0.90
DM71	3.00	PCF80	1.00
DY86/87	0.70	PCF82	1.00
DY802	1.00	PCF84	0.80
CV850	2.55	PCF86	1.30
CV4015	2.85	PCF87	0.60
E180F	6.55	PCF200	2.00
EABC80	1.05	PCF201	2.00
EAF42	1.55	PCF800	1.25
EB91	1.35	PCF801	1.10
EBC41	2.05	PCF802	1.10
EBF80	0.80	PCF805	2.05
ECC81	1.05	PCF806	1.25
ECC82	0.95	PCF808	1.65
ECC83	1.05	PCL82	1.05
ECC84	0.85	PCL83	2.55
ECC85	1.00	PCL84	1.05
ECC88	1.30	PCL86	0.95
ECC189	0.90	PCL88	2.55
ECF80	1.25	PCL805	1.10
ECF82	0.90	PD500	2.95
ECF83	1.95	PFL200	1.90
ECH35	3.80	PL33	1.55
ECH81	1.45	PL36	1.80
ECH84	1.55	PL82	0.80
ECL85	0.80	PL95	2.05
ECL86	1.80	PL504	1.55
EF80	0.80	PL508	2.75
EF86	1.85	PL519/509	5.30
EF91	2.05	PL802	5.55
EF95	1.70	PY81/800	1.15
EF183	0.95	PY82	1.80
EF184	1.05	PY88	0.85
EH90	1.00	PY500A	2.25
EL34	3.30	PY801	0.75
EL36	2.30	UABC80	0.90
EL81	7.00	UAF42	1.30
EL84	1.05	UBC41	3.05
EL85	5.00	UBC81	1.55
EL86	6.95	UCC85	0.80
EL509	7.90	UCF80	1.25
EL519	8.00	UCH42	2.55
EM80	0.90	UCH81	2.05
EM84	1.80	UCL82	1.85
EM87	2.60	UCL83	3.30
EY51	0.95	UF41	1.30
EY86/87	0.70	UF89	2.55
EY88	0.80	UL84	1.30
EY500A	2.55	UY85	1.20
EZ41	2.85	2D21	1.65
EZ81	0.85	6AT6	1.30
GY501	1.45	6AU6	1.05
GZ32	1.25	6C4	1.05
KT66(G.E.C.)	18.00	6GH8A	1.25
KT77	11.50	6J5GT	2.55
KT88(G.E.C.)	19.00	6K7G	2.05
PC88	1.45	6K8G	2.80
		6KD6	6.55
		6X4	1.55
		30FL2	1.75
		30FL12	1.65

IOLER KITS/(REWIND KITS)

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0006		SHARP-0013	3.05
SONY SLC5/7UB		IK-01	5.85
SONY SLC6UB		IK-02	4.70

VIDEO HEADS

AKAI	ALL	39.50
FERGUSON	3V00/22/16/23/24/31/29/30	39.50
HITACHI	VT5000E	37.99
JVC	ALL	39.44
NAT/PANASONIC	VE and NV FROM	39.44
SANYO	ALL	46.30
SONY	SLC 9UB/6/7/9/20/30/40/8000	49.95
TOSHIBA	ALL	48.66

SERVICE MANUALS

FIDELITY CTV 145/CTV140/R/CTV 2022	ALL	2.75
SONY HMK3000		2.45
SONY KV1810UB Mk.1/KV1400UB	ALL	8.15
SONY KV2212/KV2705/KV2252	ALL	5.85
SONY SLC5UB/SLC6UB/SLC7UB/SLC9UB	ALL	10.50

VIOEO BELT KITS

NAT/PANASONIC	VDB01	2.05
JVC HR 7700	VDB02	.40
HITACHI VT 5000E	VDB03	1.50
JVC HR 3360/HR3660	VDB04	4.15
SONY SLC7	VDB05	2.40
JVC HR3300/HR3320/HR3330/HR3600	VDBo6	4.65
SONY SL8000	VDB07	6.75
NAT/PANASONIC NV8600	VDB08	1.55
SONY SLT-7ME	VDB10	.98
SONY SLT-9ME	VDB11	.98
TOSHIBA V5470	VDB12	1.45
TOSHIBA V5475	VDB13	1.56
TOSHIBA V8600	VDB14	4.50
NAT/PANASONIC NV300	VDB15	2.05
SANYO 5500	SANYO-012	2.05
SANYO 9300	SANYO-013	4.05
SHARP VC381	SHARP-020	3.15
SHARP C6300	SHARP-021	5.33
SHARP VC7300	SHARP 023	5.65
SHARP VC9300	SHARP-024	3.30
SHARP VC9700	SHARP-025	2.65

BOOKS

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DATA VOLUME 2 – as above C-Z	£10.75
DATA VOLUME 3 – 2N-2N6735	£10.20
DATA VOLUME 4 – 2SA & on	£13.50
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DIODES VOLUME 2	£10.65
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741	0.16
CA358	0.66
CA810QM	1.20
CA3020	2.10
CA3065	1.60
HA1366WR	1.59
LA4422	3.20
LC7131	4.90
LM324N	0.40
LM380N8-P	0.80
LM380N14-P	1.80
LM1011N	3.20
LM1458N	1.35
LM3900N	0.50
M51513L	2.30
M51515L	3.15
MC1307P	1.99
MC1327P	1.50
ML237B	2.30
NE555	0.20
SAS560S	1.85
SAS570S	1.85
SAS580	2.85
SAS590	2.85
SN76226DN	1.30
SN76227N	1.10
SN76533N	1.45
STK015	6.20
TA7203P	2.50
TA7204P	2.50
TA7205AP	1.80
TAA550	0.50
TAA611A12	3.50
TAA621AX1	3.50
TA120B	1.30
SA/SQ	1.30
TBA520	1.50
TBA530	1.20
TBA540	1.45
TBA560C	1.50
TBA810S	1.70
TBA950/2A	3.05
TCA270SA	4.02
TDA1006A	2.45
TDA1035S	4.50
TDA1170S	1.99
TDA1352A	1.85
TDA2030	1.80
TDA2530	2.20
TDA2532	2.80
TDA2560	3.20
TL061	0.40
TL071	0.32
TL072	0.55
UPC575C2	1.45
UPC1350C	4.05
UPC1156H	2.75
UPC1182H	2.75
UPC1208C	1.25
UPC1356C2	3.00

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AC127	0.28	BC125	0.14	BC550	0.10
AC128	0.30	BC140	0.48	A or B	0.10
AC128K	0.38	BC141	0.36	BC557A	0.10
AC141	0.58	BC142	0.26	BC558A	0.10
AC141K	0.38	BC143	0.36	BCY70	0.36
AC142	0.40	BC147B	0.16	BCZ10	3.21
AC142K	0.38	BC148	0.10	BCZ11	2.60
AC151	0.45	BC148B	0.12	BD124P	1.20
AC152	0.48	BC149	0.12	BD129	0.90
AC153	0.60	BC149C	0.14	BD130Y	0.68
AC153K	0.46	BC159	0.14	BD131	0.42
AC176	0.25	B/C	0.16	BD132	0.50
AC176K	0.32	BC160	0.38	BD135	0.26
AC187	0.40	BC161	0.30	BD136	0.26
AC187K	0.42	BC168B	0.25	BD137	0.28
AC188	0.24	BC170/A/B/C	0.12	BD138	0.30
AC188K	0.38	BC171/A/B	0.10	BD139	0.30
ACY22	1.50	BC172/B/C	0.12	BD140	0.29
AD142	0.88	BC177/B/C	0.24	BD142	1.60
AD143	0.88	BC182/A/B/C	0.10	BD145	1.82
AD149	0.95	BC182L	0.12	BD150B	0.50
AD161/162	1.20	LA LB LC	0.10	BD160	1.58
AD162	0.40	BC183/A/B/C	0.10	BD165	0.45
AF114	0.88	BC183L	0.10	BD183	0.70
AF115	2.10	LA LB LC	0.12	BD201	0.52
AF116	2.10	BC184	0.08	BD202	0.57
AF121	0.66	A B CL LC LB	0.10	BD222	0.40
AF124	0.70	BC212/A/B/C	0.10	BD225	0.40
AF125	0.50	BC212L	0.10	BD232	0.52
AF126	0.50	LA LB	0.10	BD234	0.30
AF127	0.50	BC213/A/B/C	0.10	BD235	0.30
AF139	0.56	BC213L	0.10	BD236	0.38
AF178	1.50	LA LB LC	0.10	BD237	0.38
AF239	0.65	BC237	0.12	BD410	0.76
AF279S	1.40	BC238	0.12	BD438	0.64
ASY80	5.20	BC251/A/B	0.14	BD439	0.85
ASZ17	2.00	BC262	0.26	BD441	0.85
AU110	2.90	A B	0.29	BD507	1.05
AY102	4.32	BC301	0.36	BD520	1.20
B40C200	1.03	BC302	0.38	BD587	0.78
BA115	0.12	BC303	0.36	BD707	0.80
BA121	0.40	BC307A	0.15	BDX18	1.00
BA148	0.16	BC317B	0.15	BDX32	1.75
BA155	0.12	BC323	0.90	BF115	0.60
BA157	0.20	BC327	0.10	BF117	0.50
BB105B	0.32	BC328	0.10	BF119	0.82
BB105G	0.30	BC337	0.08	BF125	0.42
BB110B	0.42	BC338	0.10	BF127	0.44
BC108	0.10	BC350A	0.24	BF154	0.14
A,B or C	0.14	BC351	0.16	BF157	0.16
BC109	0.10	BC516	0.38	BF160	0.23
A,B or C	0.14	BC547	0.16	BF167	0.42
BC115	0.15	BC440	0.36	BF177	0.32
BC117	0.28	BC548	0.16	BF178	0.36
BC118	0.20	A B or C	0.10	BF180	0.27
BC119	0.43	BC549	0.08	BF181	0.27
		A or B	0.10	BF182	0.32
				BF183	0.32
				BF184	0.47
				BF185	0.15
				BF194A	0.12
				BF195	0.10
				BF224J	0.20

Type	Price (£)	Type	Price (£)	Type	Price (£)
BF240	0.15	BY100	0.80	TIP121	0.63
BF241	0.18	BY103	0.50	TIP2955	0.68
BF257	0.22	BY122	0.60	TIP3055	0.85
BF258	0.26	BY126	0.10	TIS88	0.50
BF259	0.30	BY127	0.08	TIS90	0.27
BF262	0.34	BY133	0.10	Y723	0.92
BF263	0.38	BY135	0.35	Y969	2.80
BF270	0.30	BY164	0.45	IN4001	0.04
BF271	0.28	BY179	0.60	IN4003	0.05
BF273	0.22	BY182	0.80	IN4004	0.05
BF274	0.34	BY184	0.38	IN4006/7	0.07
BF298	0.46	BY187	0.65	IN4148	0.04
BF336	0.40	BY189	6.75	IN5400	0.08
BF337	0.38	BY198	0.64	IN5402	0.12
BF338	0.28	BY199	0.72	IN5405	0.12
BF355	0.38	BY206	0.14	IN5406	0.14
BF371	0.27	BY207	0.16	IN5408	0.18
BF450	0.30	BY210/400	0.20	2N2122A	0.34
BF457	0.36	BY210/800	0.22	2N2222	0.30
BFR51	0.36	BY227	0.28	2N2904A	0.48
BFR61	0.32	BY228	0.50	2N2926G	0.14
BFR90	0.86	BY238	0.65	2N3053	0.30
BFT41	0.68	BYX10	0.28	2N3054	0.80
BFT43	0.38	BYX36/150	0.40	2N3055	0.60
BFY50	0.32	BYX36/600	0.48	2N3703	0.14
BFY51	0.32	BYX48/300	0.70	2N3773	1.90
BFY52	0.32	BYX55/600	0.30	2SB337	1.90
BFY90	0.80	BYX71/600	1.50	2SC1098	0.94
BFY90S	1.34	E1222	0.30	2SC1172Y	1.70
BR100	0.20	E5024	0.20	2SC1173Y	0.88
BR101	0.76	MCR106/5	0.30	2SC1413A	2.70
BR103	0.60	ME0413	0.70	2AC1449	0.80
BR303	2.75	ME6002	0.26	2SC1507	0.60
BRY39	0.80	MEU21	0.62	2SC1678	1.80
BRY56	0.42	MJ400	1.45	2SC1758	0.68
BSX20	0.20	MJ2955	1.10	2SC1953	0.70
BSY52	0.35	MJ3000	1.80	2SC1957	0.95
BSY95A	0.25	MJE340	0.50	2SC2029	2.70
BT100A/02	0.90	MJE520	0.60	2SC2122A	3.20
BT101/300	2.75	MJE2955	1.60	2SC2335	1.50
BT101/500	3.25	MJE3055	1.40		
BT102/300	3.60	MPSA05	0.30		
BT106	1.15	MPSA12	0.30		
BT116	1.20	MPSL01	0.34		
BT119	3.30	MPSU05	1.05		
BT138/600	0.98	MPSU06	1.20		
BT151/560R	0.90	MR502	0.40		
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BU104	1.80	OA91	0.14		
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BU108	1.90	R2008B	1.40		
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BU208A	1.50	TIP32	0.36		
BU326S	1.75	TIP33A	0.75		
BU407	1.40	TIP34A	0.90		
BUX80	2.90	TIP41C	0.36		
BUY20	2.75	TIP42	0.38		
BUY69A	2.90	TIP47	0.60		
BUY69B	1.98				

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78L12	0.28
78L15	0.28
7805	0.36
7808	0.36
7812	0.36
7815	0.36
7818	0.36
7824	0.36
7905	0.38
7912	0.38
7915	0.38
7918	0.38
7924	0.38
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LM317K	2.40
LM317T	0.95
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COVER PHOTO
This month's cover photograph shows the Ferguson TX85 chassis. See article on page 838.

CORRECTION
Our apologies for icorrect Ferguson/JVC equivalents shown in VCR Clinic. The JVC equivalent of the Ferguson 3V29 is the HR7200. The HRD110 and 3V39 are equivalents.

Charting the course ahead

In discussing, some months ago, the problems that the Japanese consumer electronics industry would face as a result of the high exchange rate value of the yen we suggested that one way to maintain profitability would be to place greater emphasis on higher value-added products, i.e. your all talking, all dancing, feature-full goods and systems. We are already beginning to see the expected move in this direction. The approach is appropriate not only for the Japanese of course. It has been tried with success by some rental chains seeking to maintain profitability in a declining market, and is a logical way of combating the market saturation conditions now found in many countries. What do you do when every household has a music centre, a VCR and several TVs? You have to try and sell them a remote control TV with stereo sound, teletext, an FS tube and so on. And do much the same with other consumer goods. Will this approach work? There are two fundamental problems here. First, if every manufacturer adopts the same policy the overall effect is likely to be a stagnant industry rather than an increasingly profitable one. And secondly the public might not accept the bait.

The current biennial Berlin Consumer Electronics Fair has seen a host of new, technologically advanced products launched and announcements of new developments. Two of these are of particular significance, first Sony's decision to go ahead with the introduction of the digital audio tape (DAT) system in Europe and secondly Philips' decision to launch the new-generation laser disc system, in particular the compact video disc (CDV). There has also been the now usual talk about the home of the future and the way in which it might be equipped electronically – with a computer linking everything together, including security surveillance, heating and so on, something that Philips refers to as the domestic digital bus. Philips has suggested that by 1990, only three years off, we shall be using remote control units which will be capable of five times as many commands as the most sophisticated now available. The company believes that in ten years' time half the entertainments products available will be completely new. There is something strangely ironical about the idea of highly sophisticated remote control arrangements. The basic intention is to make life easier, but if you've got to master and remember how to use something really complex you can end up finding that life is more difficult. There's also the prospect of considerable technological redundancy. Just what is the point of having – and paying for – a hundred controls when all you ever use is half a dozen?

The basic problem here is whether developments in consumer electronics and allied fields are being technology driven or market driven. Just because something is technically possible doesn't mean that there's a market for it. To assume that markets exist or can be created for whatever you can make can lead to traumatic consequences for manufacturers. As a relatively simple example, the failure of RCA's capacitance video disc did the company great harm and could well have been a major factor in ending the company's days as an independent entity. The technology was sound, and much had been spent on its development. It's difficult when the crunch comes and you have to decide whether to try to make something of it or call a halt. The strange thing is that the Japanese, despite their very different lifestyle from western norms, seem to be better at making sound judgements on international market prospects for technology.

The DAT system, developed in Japan, looks a reasonably sure bet that could do a great deal for Japan's consumer electronics industry. A price of about £1,300 has been suggested for the initial machines. As we've seen in the past however prices can soon start to fall dramatically once production expands after a product has caught on. The system offers saleable advantages: high quality performance coupled with flexibility in use, something that's obviously relevant in the domestic context. It has been held back by the music copyright problem and by the lack of software, but in the long term there's no holding back something that offers obvious advantages.

One has far greater reservations about the new video/audio discs, especially the compact video one with its five minute audio-visual section followed by twenty minutes of audio only. This tends to look like an effort to make a market for something simply because it exists. The format was originally devised for promotional purposes: whether it's relevant in the domestic context remains to be seen. The CDV disc will cost about £5 and the player about £500. Due in the shops this autumn.

There is no stopping the onward march of technical development. The question is whether there's a use for the outcome. Audio is now going digital since there's a considerable advantage in terms of quality. Storing video in digital form is something that's being worked on but one wonders, when it becomes a feasible prospect in terms of a price suited to domestic markets, whether it will offer much of an advantage. Sure, you will be able to mess about with the stored material – change its colours and so on – but who wants to sit around doing that? There is always the constraint of the time available for leisure activities: the more options on offer, the less likely it is that fringe ones will represent a viable market.

Whatever the outcome in terms of consumer reaction in the years ahead, of greater concern to some of us will be the servicing aspects. High-tech servicing as it's coming to be called offers some daunting prospects in terms of viability. Having to invest in expensive test gear to deal with something you might see twice a year, then having to start fault-finding from first principles, is going to mean horrendous bills for the public or bankruptcy for the service trade. There's an educational job to be done here to prepare the public. It's something we should be considering as a matter of urgency.

Long-distance Television

Roger Bunney

There were some incredible, sustained Sporadic E openings during July and numerous reception logs have been received. Without further ado, here's the collated log for UK SpE reception during the month.

4/7/87 TVE (Spain) chs. E2, 3, 4; RTP (Portugal) chs. E2, 3; RAI (Italy) chs. IA, IB; EPT (Greece) E3.
5/7/87 RAI IA, B; TVE E2, 3; RTP E3; MTV (Hungary) R1, 2; JRT (Yugoslavia) E3, 4.
6/7/87 RAI IA; TVE E2, 3, 4; RTP E2, 3; EPT E3; ORF (Austria) E2a; CP+ (Canal Plus, France) L3; CST (Czechoslovakia) R1; ARD (West Germany) E2; TVP (Poland) R1; TSS (USSR) R1, 2; NRK (Norway) E3.
7/7/87 RAI IA, B; MTV R1, 2; TVP R1, 2; CST R1, 2; +PTT (Switzerland) E2, 3; DR (Denmark) E3; TSS R1, 2, 3; SR (Sweden) E2, 3, 4; NRK E2, 3, 4; RTE (Eire) IB (received in Cornwall); JRT E3.
8/7/87 TVE E2, 3, 4; RTP E2, 3; RAI IA; CST R1; TVP R1, 2; TSS R1, 2; SR E2, 3, 4; ARD E2; RUV (Iceland) E4.
9/7/87 EPT E3; JRT E3, 4; ORF E2a; JTV (Jordan) E3; TVP R1, 2; SR E2, 3, 4; NRK E3, 4; TSS R1; RUV E3; CST R1.
10/7/87 CST R1, 2; TVP R2; DFF (East Germany) E4; TSS R1; ORF E2a; TVP R1, 2; SR E2, 3, 4; NRK R2; TSS R1; ORF E2a; SR E3; DR E3, 4; C+ L3; JRT E3; RAI IA; RTP E3; MTV R1; TVE E2, 3, 4.
TVE E2, 3, 4.
11/7/87 TSS R1, 2; RAI IA, B; TVE E2, 3, 4; TVE-2 E2; RTP E2, 3; TVR (Rumania) R2; JTV E3; MTV R1, 2; TVP R1; +PTT E2; ARD E2; ORF E2A; C+ L3; EPT E3.
12/7/87 TVE E3; RAI IB; ARD E2.
13/7/87 TVE E4; TVE-2 E2; RTP E3; RAI IA.
14/7/87 RAI IA; TVE E2, 3, 4; RTP E2, 3; JRT E3, 4; SR E3, 4; YLE (Finland) E3.
15/7/87 TVE E2, 3, 4; RTP E2, 3; RAI IA, B; RTP E2; TVE-2 E2; ARD E4; NRK E4; SR E2, 3, 4.
16/7/87 TVE E2, 3; TVE-2 E2; RAI IA, B; RTP E2; +PTT E2; ORF E2a; CST R1; DFF E4; RUV E4; NRK E2.
17/7/87 NRK E2, 3, 4; SR E2; DR E4; ORF E2a; MTV R1, 2.
18/7/87 RAI E2, IA, B; TVE E2, 3, 4; TVE-2 E2; RTP E3; C+ L3, 4; CST R1; MTV R1; JRT E4.
19/7/87 TSS R1, 2, 3; SR E2, 3, 4; NRK E2, 3, 4; DR E3; CST R1, 2; DFF E4; ARD E2, 3; TSS R1, 2; +PTT E3; C+ L3; RUV E4; RAI IA; JRT E3.
20/7/87 C+ L3; RAI IA; RTS (Albania) IC; JRT E4; TVR R2; TVE E2, 3, 4; RTP E2, 3; TVE-2 E2; SR E2, 3, 4; TVP R1, 2; TSS R1, 2; ORF E2a, E4; JTV E3.
21/7/87 RAI IA, B; 'Telemarket' E2 (Italian private station); +PTT E2, 3; JRT E3, 4; MTV R1; ORF E2a, E4; TVR R2; TVE E2, 3, 4; RTP E3; C+ L3; DR E3; CST R1, 2; TVP R1, 2; TSS R1, 2, 3; NRK E2, 3, 4; SR E2, 3; YLE E3; ARD E2, 3, 4; EPT E3; ch. A2 (N. America).
22/7/87 +PTT E2, 3; CST R1; TVP R1; TSS R1, 2; SR E2, 3; DFF E4; NRK E2, 3, 4; RAI IA, B; JRT E3, 4; TVE E2, 3, 4; RTP E2, 3; C+ L3.
23/7/87 RTP E2, 3; TVE E2, 3, 4; +PTT E3; ARD E2, 4; CST R1; TSS R1; NRK E2, 3, 4; SR E2, 3, 4; Arabic station ch. E2 (suspect Abu Dhabi).
24/7/87 YLE E3, 4; NRK E2, 3, 4; SR E2, 3, 4; TSS R1; CST R1, 2; MTV R1, 2; DR E3; TVE E3.
25/7/87 RAI IA; TVE E2, 3; NRK E2; RTP E3.
26/7/87 RAI IA, B; TVE E2, 3; RTP E2, 3; RTS IC; ORF E2a; JRT E3, 4; +PTT E3; CST R1; ARD E2, 3; TSS R1, 2, 3; RTM (Morocco) E4.
27/7/87 RAI IA, B; RTP E2, 3; TVE E2, 3, 4; TSS R1, 2; TVP R2; TVR R2; SR E2, 4; NRK E4; unidentified Arabic E4 signal.
28/7/87 TVE E2; TVE-2 E2; RAI IA, B; NCT (Italian private station) IA; RTP E3; NRK E2, 3, 4; SR E2, 3, 4; unidentified dark-skinned announcer on ch. E3 at 1840BST.
29/7/87 TVE E3; DR E3.
30/7/87 TVE E3; RAI IA; CST R1; TSS R1, 2; RUV E4.
31/7/87 RAI IA; TVE E2.
1/8/87 EPT E3; RAI IA, B; MTV R1; JRT E3; Syria E3, 4.

Thus July proved to be an extremely rewarding month for SpE operators. With increased amateur radio activity in the 50MHz band so further information on reception possibilities is becoming available. It's evident that the trans-Atlantic path to N. America is often open. Perhaps we should pay greater attention to the possibilities here and take a look to the west from time to time from late afternoon, particularly when strong signals are present from RUV (Iceland).

Congratulations are due to Cyril Willis (Norfolk) on his reception of N. American ch. A2 signals on the 21st, for some thirty minutes from 2325-0008 with strong though impossible to identify vision. The programme went on to the news at the hour and a second much weaker signal was also present.

Perhaps more dramatic was his reception of Syria ch. E3 and later E4 on August 1st. The signal consisted of a PM5544 test pattern with an upper identification in Arabic script and "ORTAS-DAMAS" lower, going on to a caption and clock (plus two hours at 1350). A similar caption was visible on ch. E4. The ch. E3 signal was present for over an hour! Later on the same afternoon Ray Davies (Norwich) received a smeary ch. E2 signal from the south, undoubtedly from Nigeria or Ghana. This was a spectacular day!

As this is being written news has just arrived from Mark Baldwin (Rugby) of Band III SpE reception on August 5th, from 1735-1752 BST. The ch. E6 signal started with a Star Trek cartoon dubbed in Arabic. This was followed at 1745 by a female announcer then a rural scene with singing which faded away to noise. Fortunately Mark recorded the reception via his VCR. Photographs have been promised and attempts are being made to identify the source of the signal. Tunisia or Algeria is the most likely source, Libya being a less likely possibility.

A ch. E2 signal suspected of being from Abu Dhabi, was seen on July 23rd carrying adverts for Gulf Air. Other unusual signals were RAI (Italy) ch. E2 and JRT (Yugoslavia) also on ch. E2.

On several days there was intense SpE to blanketing levels, with openings of up to an hour in the 144MHz amateur band. Reports suggest that the m.u.f. reached ch. E12 on one day. According to the RSGB there were trans-Atlantic 50MHz SpE amateur openings on June 7/8/13/14/19/20 and July 11/14/17/18. On the 21st there was a six-hour opening from the UK to the USA. Many of the signals received during these openings came from as far as central USA, for example Kansas, Arizona and Missouri on the 11th. 144MHz SpE openings were noted on June 23rd and July 7/10/11/13/20/21. Apart from news of the go ahead for 50MHz operation in Norway and Malta, contacts have been made with Spain and Yugoslavia (these countries have no official 50MHz allocation – yet!).

According to Stanford University the sunspot peak in the present cycle should occur during 1991, with an estimated count of around 125.

One mystery has been cleared up. The Telsur caption mentioned in the August column is from a regional afternoon TVE programme.

A new listing has enabled Hugh Cocks to identify some of the US stations he reported receiving last month. WSB-TV comes from Atlanta and the WFMY-TV and WUND-TV stations are both in N. Carolina. The signals were received in ch. A2. A Spanish language programme heard beneath Puerto Rico ch. A2 is thought to have come from Cuba. Hugh also comments on interference from CD players and digital tuning hash in Band I!

Tropospheric enhancement was noted on July 4/5th, the 9th (giving TVE chs. E5/31/37 in the western UK) and the 22nd. During the latter day Band I/II and ch. E29 NRK signals were received in Aberdeen.

An extremely busy month then. My thanks to the following for logs to supplement my own: Bill Cotterill (Tipton), Dave Shirley (Hastings), Roger Fussell (Torpoint), Peter Schurbert (Rainham), Tim Anderson (St. Leonards), Simon Hamer (Powys), Iain Menzies (Aberdeen), Mark Baldwin (Rugby), Tony Privett (Basingstoke) and Cyril Willis (Norfolk).

News

UK: The DTI and the Electronic Engineering Association have started work on a programme to introduce a digital, short-range radio service by the early 1990s. It will use digitally encoded voice and data transmission with powers no greater than 5W and 25kHz bandwidth channels. There are likely to be some 80 channels, one of these being a control channel which will scan the others to find a clear frequency within the band. Ranges will be up to 5km. No frequencies have been allocated yet and licences won't be issued before 1990.

Benelux: The Belgian government has agreed to pay 224m Belgian Franc damages for the destruction of the RTL-TV transmitting mast in 1981. A Belgian Mirage plane hit the mast, putting RTL off-air for a period. There is talk of a new commercial TV station that would broadcast to the French-speaking parts of Belgium. It would be called simply TV1 and would be established by RTL and a group of French newspapers. In Holland, Roermond-3 ch. E34 is now on test during the morning and afternoon periods. The FUBK card is used, with identification.

50MHz: The Maltese Ministry of Wireless Telegraphy has announced that amateur radio operation in the 50-52MHz band is now permitted to class A licence holders. The Norwegian radio authorities have permitted 50MHz operation subject to non-interference with TV transmissions. Austria is believed to be considering similar concessions.

Sri Lanka: A second TV channel is to be inaugurated shortly. It will be used for education/instruction only, aimed at both students and adult viewers.

Satellite news: Japan launched its first true DBS craft in mid-July. The satellite provides a 24-hour English-language service including ITN/BBC news. Israeli enthusiasm for TVRO equipment has resulted in a rash of large dishes on roofs. Dishes of under 2·44m diameter are to be allowed but larger dishes will not be permitted in residential areas. Voice of America Europe in stereo is now available on a SAT-1 subcarrier.

Transmitter Listings

The following list of Italian private TV stations has been provided by the Benelux DX Club (BDXC):

Ch. IA: Radio Tele Uno; Nord Center TV; Teleatalia; Telleomellina; Tele Spazio Campano. The latter is in central Italy, the rest in the north.

Ch. IB: Tele Trieste Mia (north); Teleradio S. Marco (east); Tele Bari (SE); To Sardegna (N. Sardinia); Teleor (C. Sardinia); TVC Quattro Mori (S. Sardinia); Telemarket (Rimini).

Ch. IC: Radio TV Atri (east); Tele Sud Italia (toe of S. Italy).

There are other stations whose location is not known.

The following is a definitive list for the Danish TV2 transmitter chain. Note that the second TV network has no connection with the state run Danmarks Radio (DR).

Station	*Channel*	*E.R.P.*	*Opening date*
Nord Fyn	E22	500kW	December 1988
Aarhus	E26	600kW	November 1988
Rodekro	E27	600kW	June 1988
Thy	E28	250kW	February 1989
Vejle	E30	500kW	August 1988
Syd Fyn	E32	250kW	December 1988
Brammingg	E33	500kW	May 1989
Alborg	E35	600kW	February 1989
Vendsyssel	E37	50kW	February 1989
Ringkobing	E40	600kW	September 1988
Jyderup	E48	600kW	March 1989
Nakskov	E52	100kW	August 1989
Kobenhavn	E53	600kW	March 1988
Bornholm	E56	800kW	September 1989
Skive	E56	500kW	June 1989
Vordingborg	E58	600kW	August 1989

Apart from Thy all transmissions will be horizontally polarised.

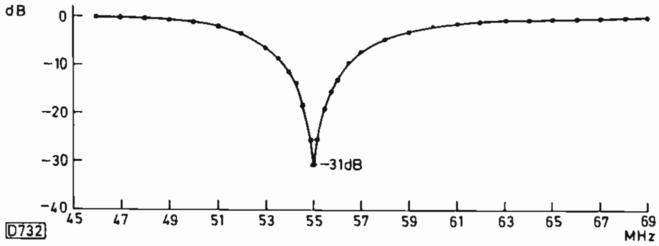

Fig. 1: Measured characteristic of the Aerial Techniques TDNF1 Band I notch filter at 55MHz.

The main transmission centres for the Spanish TV3 Television De Catalunya service are as follows: Tibidabo ch. E44 10kW; Rocacorba ch. E52 10kW; La Mussara ch. E63 10kW; Alpicat ch. E52 10kW; Montcaro ch. E29 5kW. There are at present 73 u.h.f. relays with powers from 0·625W to 200W.

405-line Equipment

A number of requests were received for the equipment mentioned in the August column. Obviously there are many enthusiasts who are seeking mature equipment and information. So rather than junk old magazines, manuals, test equipment and receivers write in to offer them.

Aerial Techniques Catalogue

My connection with South West Aerials ended about three years ago. The company was subsequently renamed Aerial Techniques and it's interesting to note developments as reflected in the latest catalogue, which is available for 75p. Many of the old and popular lines have been continued but there are many new items of interest. These include the active Triax UFO aerial (shortly to be reviewed), the Revco discone aerial and new very wideband head amplifier, field strength meters, a new Band I filter and new rotors. Most welcome is an extended list of TV receivers suitable for v.h.f./u.h.f. TV-DXing, covering several transmission standards. Good reading for the enthusiast.

From our Correspondents . . .

Jean Louis Dubler, resident in Seoul, S. Korea, has been on a trip through S.E. Asia. He mentions that there are some eight TV networks in Japan. Many programmes are of high quality, with few imported shows. In prime time however the commercials occupy about 25 per cent of programme time – a two hour movie can last for three hours! Video equipment is cheap in comparison with Europe but 10-15 per cent higher than in Hong Kong. It's an expensive country to visit. In comparison, living standards in S. Korea have a long way to go to catch up with Japan. Korean industry is export orientated and the output is sold at higher prices in the home market than overseas.

Paul Barton has been developing a new variable-bandwidth TV-DXing system which will be featured in these pages when finalised. Diode switching provides two bandwidth settings: in the narrow-band (2MHz) position the response at 8MHz is 60dB down. Video polarity switching and sound tuning will be provided. Paul has tried out various tuners from Sendz Components to check on their suitability for DX use. The Mitsumi MEC1-FS1 covers the French channels A-C, 1-6 and 21-69. It uses thick-film printed components mounted on a PCB – a data sheet is provided. He reports that the best currently available tuner seems to be the Toshiba EG522F which gives coverage of 45-110MHz, 105-250MHz and 430-860MHz. It's a good buy at £5. MOSFET devices are used and the pin connections are as follows: 1 a.g.c. (8V for maximum gain); 2 12V u.h.f.; 3 12V v.h.f.; 4 leave open-circuit for Band I, connect to chassis for Band III; 5 0-30V tuning; 6 omitted; 7 12V for oscillator (i.c. type TA7635P); 8 i.f. output at 36MHz. The pin numbers are stamped on the base of the can. A frequency counter output is also provided.

Band I Notch Filter Review

The double-notch Band I filter listed in the current Aerial Techniques catalogue has now been replaced by the single-notch type TDNF1. A sample has been tested and my comments are as follows.

The new filter resembles a CB braid breaker type, being of slim in-line construction. It's housed in a 3in. × ⅝in. diameter tube covered with shiny, black heat-shrink sleeving (so you can't get inside to examine it!), with inbuilt socket and a Belling-Lee plug on a flying lead some 4in. long. A small preset capacitor provides tuning, accessible through a hole in the case. Tuning throughout Band I is available – a small metal screwdriver can be used without detuning effects. Fig. 1 shows the response when tuned to 55MHz, the notch depth being 31dB. This is a measured response plotted with inputs at 250kHz intervals. The result is good though the slope is wider than with say the 10M1X ferrite toroid which gives −6dB at ±1MHz and −0·8dB at ±3dB. The insertion loss away from resonance is excellent at well under 1dB – 0·1dB at the extreme band edges. At 48MHz (ch. E2) the notch depth is 22dB, the peak being 45dB at 70MHz. In general the filter gives acceptable results for DX-TV use though it's a pity that the maximum notch depth isn't in the 50MHz region where problems may be experienced with radio amateurs. The 22dB level should deal with most such problems however with the filter tuned to the 51MHz mid-band frequency.

A d.c. pass is available via both the inner and outer (braid) circuits, with no short between them. The filter can thus be used with a coaxial feeder that carries d.c. supplies to a masthead amplifier.

In conclusion, a useful filter at a reasonable price. For further details contact Aerial Techniques (see advertisement in this issue).

Dutch Third TV Network

The following list of transmitters for the Dutch third TV service has been received from the BDXC:

Station	*Channel*	*E.R.P.*
Wieringermeer	E42	300kW
Markelo	E51	300kW
Goes	E35	250kW
Hulsberg	E43	100W
Arnhem	E43	30kW
Maastricht	E39	1kW
Noorbeek	E52	5W
Losser	E34	3kW
Smilde	E44	1,000kW
Lopik	E30	1,000kW
Roermond	E34	250kW
Eys	E48	1kW
Wijk aan Zee	E21	4W
Slenaken	E32	10W
St. Pietersberg	E23	250W

Keith and Alex

Les Lawry-Johns

Keith and Alex have been up again from Pompey to straighten me out. They keep having to do it. If you recall, on the last occasion they were in the shop I'd sold a chap a tripler and told him to join the diode and earth leads together, whereupon Keith had commented "it won't last long like that". I wondered about this as I've always joined them for use in the ITT CVC32 chassis. Apparently the receiver had been a CVC5, not a CVC32 – the evidence being the tripler he'd had in his hand. Now I honestly didn't see a tripler of any type and understood that he wanted one for a CVC32. Hence the confusion. The chap never came back, so I assume that he must have read the leaflet and connected it correctly. My apologies, all round.

The Philips G11

While Keith and Alex were paying their latest visit I told them about the Philips G11 that had me going for some time. In a nutshell, it blew the BU208A line output transistor every four days, despite fitting a nice new 470μF h.t. reservoir capacitor – on the first day. Three times it came back, and each time I went over the joints, resoldering every suspect and non-suspect. I could have fitted a new line scan panel but wasn't happy with this approach to the problem. When I'd fitted the last BU208A I kept the set on test for several days.

One morning I switched it on and it refused the start. The h.t. fuse was intact – it had always blown when the BU208A had gone short-circuit. The set started when the top plug supplying the BU208A was touched. My troubles were over when I connected an extra lead from the socket's base connector to the base of the transistor. The set's been going all day every day since but the owner hasn't been back to collect it. I suppose he was a bit fed up with it and with me.

The joke was when a gentleman came in to buy a black-and-white receiver since he's colour blind. Said he'd been everywhere (I doubt that) but hadn't been able to purchase one. He looked at the G11's picture – a black-and-white film happened to be on.

"I like that" he said.

I told him that one wasn't for sale, so he bought a 20in. Thorn 1500 which had had a new tube fitted. He told me that he could identify the balls on a snooker table without seeing the colours. Well I never . . .

The Bush T20

Shortly after this a Bush T20 came in and a quick test proved that the BU208A was short-circuit. I fitted another one and resoldered all suspect joints. After switching on there was a lovely picture – for three minutes. Bonk. The BU208A had bit the dust. I did everything I could think of, including the addition of an earth lead from the timebase panel to the line scan panel, renewed the BU208A and the driver transistor and tried again. Two and a half minutes later the BU208A died. I put the set to one side and got on with some more rewarding jobs – not that there are many about nowadays.

I eventually tackled the T20 again. After fitting yet another BU208A I concentrated on the joints that looked good and resoldered all that played a part in driving the line output stage. When I removed the solder from the legs of the line driver transformer I noticed that they weren't clean. I scraped them until they were shiny and resoldered them. This time the BU208A survived and so did I. Fooled by an old one like that!

Dr Dicey's Dynatron

When Dr. Dicey phoned I knew I couldn't ask him to bring his set in – it's a great big 26in. Dynatron. So I would have to go to see him, and I didn't have a car. Mine had broken down on the way to Heathrow a few days earlier and as the cylinder head was now warped I would be without it for some time. I remembered my friend Les whose Dynatron I'd fixed a couple of days previously. He'd said he would like a new set but would like to have it fitted into the existing cabinet. I'd declined to do this on the grounds that it would be difficult to get one to fit. As Les is retired I got on the phone to him to see whether he would run me up to Dr. Dicey. He said it would be no trouble at all and he'd like to see Dr. Dicey again – he'd not seen him for some years.

"But he was a woman's doctor, one of those gynaecologist fellows" I said.

"Yes of course. I knew him outside his practice."

By now we were almost there and soon came to a halt in his drive. I went in and examined the patient, which had severe damage to the power supply and remote control receiver boards. The chassis is similar to that used in the Pye 731 series.

The doctor commented that had it been a woman he'd have sorted out its inside, but a TV set was another matter and he didn't feel inclined to have it repaired. He wanted to retain the cabinet and fit a new set inside it. I knew that this would mean two transplants, one for the doctor and one for Les. Oh well.

I carefully measured the inside of the cabinet and jotted down my findings. We returned to the shop to pick up a G11 in good working order to serve as a loan set while I ordered a new one. This kept him happy for a few days, and in the meantime I picked out the Pye 59KE2703 as the most suitable candidate for the operation. This arrived a few days later. It had a dark cabinet (anthracite) and a remote control handset. I quickly unpacked it and lined up the programmes.

The 24in. FST screen looked lovely and flat and I felt it would fit nicely into the doctor's cabinet, being 27in. wide and just over 18in. high. I contacted Les who was only too pleased to assist with the fitting, knowing that if all went well there'd be a repeat performance with his own set.

Up we steamed and I ripped out the panels and removed the tube. Then came the job of removing all the bits and pieces that would have impeded the entry of the new set. The Dynatron's nice looking front panel had to be removed, but shortly afterwards the new Pye looked out over the doctor's lounge and produced a good picture. All that was now necessary was to line up a programme for the doctor's video, which was quickly done.

I piled all the panels into a bin liner and struggled out with the tube, the G11, etc. while the doctor wrote out his cheque. On the way back Les said he wanted a set just like that and a video to go with it. When I ordered these the chap at the other end was interested to hear about our success in fitting the 24in. Pye into the Dynatron cabinet. Apparently he has one of them himself and wanted just this information . . .

Teletopics

POCKET CTV

Ferguson has launched an LCD pocket TV set, Model PTV01, which is expected to sell at around £250 and will be in the shops from November. An up market with high disposable income is envisaged and the launch is timed to benefit from the Christmas gift buying season. In addition to its use as a watch-anywhere TV set it can be used as a colour monitor with Ferguson camcorders that have playback capability. A rechargeable battery pack will be available at £20, a car adaptor at £16, an external aerial adaptor at £5 and an a.c. adaptor/charger at £16. The set has a 2·6in. (diagonal) screen, weighs 330g and measures 85 × 145 × 35·3mm. Automatic channel selection is by press-button sweep tuning. There's on-screen indication of channel tuning and press-button adjustment of volume, with an earphone socket provided – an earphone comes with the set.

The set is manufactured in Japan by Seiko Epson. Ferguson undertook the design work for European 625-line, PAL operation. The screen is of the active drive twisted nematic liquid crystal type with 56,000 pixels. Active drive means that the pixels are individually driven by semiconductor devices built into the display. MIM (metal insulator metal) technology is used for this purpose, the drive devices having a diode-like configuration. RGB filters arranged in a triangular pattern, with black in-filling, are laid over each group of pixels. Back lighting is used to provide a bright picture even in dim lighting conditions.

Ferguson expect to sell about 20,000 of these sets in the first year and estimate that this will represent 20-30 per cent of the market.

The Citizen colour LCD set mentioned in this column last month is expected to be available in limited quantities from October. An initial retail price of about £190 is envisaged. This is expected to drop as production builds up.

FINLUX FLAT TV

Further details of the prototype Finlux "Face" flat TV set mentioned last month have been released. The 7in. electroluminescent screen is 2cm deep and has a microscopic layer of zinc sulphide on a glass substrate. At present the set, which despite its size offers stereo sound, teletext and remote control, is not being manufactured as a commercial product – obstacles still to be overcome are those of price and colour (the present prototype has a monochrome display). It's likely that the display panel will be used in computer systems initially, coming into domestic use some time in the mid-90s when a 12in. colour version should be available.

THORN EXPANSION

Thorn, whose takeover of the US Rent-A-Center business was announced last month, has bought the north country Vallances TV/electrical retail/rental chain which consists of 28 high street shops and 13 out-of-town Atlantis stores. Most of the shops will be integrated with Thorn's Rumbelows retail chain; three will become part of Thorn's Focus TV operation. Vallances' profits peaked in 1983. Last year the company made a pre-tax loss of £1·3 on a turnover of £46·8m.

It's understood that Thorn have expressed an interest in taking over the Granada TV rental business.

MITSUBISHI'S GIANT TUBE

Mitsubishi, whose 31 and 35 inch colour tubes are already in use in production receivers, has announced the development of a yet larger tube with a 40in. diagonal screen. Mitsubishi sets fitted with the 40in. tube will go on sale in Japan shortly. They are expected to be used for such purposes as teleconference monitors and concourse terminals.

The large tubes have a resolution of 560 lines and employ a new gun (type XF) which has multiple-stage convergence and a scandium oxide dispersion cathode that can provide a beam current four times greater than a conventional cathode.

NEW CEEFAX COMPUTER SYSTEM

Softel Ltd. is to provide the BBC with a new Ceefax computer system to replace the one taken into service in 1979. The new system will enable the BBC to continue its policy of improving the teletext service. The use of more spare TV lines will give faster access to pages, and a clearer and more varied page format will be used during "Pages from Ceefax" broadcasts.

VIDEO DISCS

It seems that the LaserVision disc system is at present being played down in preparation for the launch of the new generation of 8 and 12in. LD discs and the 5in. CDV disc. These will all have digital sound, which will make the discs incompatible with current LaserVision players. In the present system the analogue sound signal amplitude modulates the f.m. vision signal and is separated during playback by filtering. A new generation of players will be able to handle all types of laser scanned audio and video discs.

In the USA, GE/RCA have demonstrated a relatively low-cost disc that stores the vision signal in digital form: the company aims to develop a 5in. compact disc that will provide over an hour of full-motion, full-resolution vision stored digitally. The system allows interactive operation and at present has a resolution of 256 × 200 pixels. Data compression techniques are used to enable the material to be stored in the small disc. GE/RCA say that the system could be made available in about two years' time, with players selling for around $1,000.

PLESSEY-PHILIPS TVRO CHIP COLLABORATION

Plessey and Philips are to collaborate over the production and marketing of a set of chips for satellite TV receiver systems. The companies have signed an exclusive licence with the Norwegian firm Nordic which has developed a multi-standard MAC decoding system. Philips microcontroller chips will be used, with Plessy contributing VLSI chips.

S-VHS CAMCORDER

Hitachi has announced an S-VHS specification camcorder which is expected to be available in Japan and the USA this autumn. The MOS pick-up device has a resolution of 450 lines.

NEW PRODUCTS

Test Reliability Ltd. (PO Box 20, Petersfield, Hants GU32 3JQ) has announced a low-cost automatic colour analyser for use when setting up monitors, VDUs and TV sets. The system caters for tubes in sizes from 9-26in., is portable and can be used to accurately and repeatably set up the red, green and blue guns to predetermined target colours in under a minute. It operates via a sensing head that incorporates three phototransducers. The head is attached to the screen and enables measurements taken at high and low light levels to be processed for deviation from target values. An interface connects with the monitor/TV set via the aerial or other socket, enabling the results to be displayed as bar graphs. The operator then adjusts the RGB outputs to colour specification. Colour details for up to 32 types of tube can be programmed and selected as required.

Adcola has changed the colour scheme of its range of soldering stations and added a version with LED temperature read out – the visual indication of actual bit temperature is said to be accurate to within ±2 per cent.

Fringe Electronics Ltd. (Fringe House, 50 Mansfield Road, Clipstone, Notts NG21 9EQ) has introduced two "two set power units" that enable two TV receivers to be operated from a single masthead amplifier. The internal inductive splitter is suitable for all f.m./v.h.f. radio and TV signals in the 40-860MHz frequency range. The two units, P1215/2 and P1290/2, differ in their output current capability. Through loss is 3·5dB at 40-230MHz, 3·5dB at 470MHz and 5dB at 860MHz. Average isolation is 17dB and the minimum input signal level 1mV.

THE SONY HANDYCAM PRO

George Cole writes: Sony UK is to introduce a new lightweight Video 8 camcorder later this year. The Handycam Pro, Model CCD-V90, weighs just 1·1kg yet has many features normally found only on heavier Pro-range camcorders. A newly developed LSI chip which incorporates the entire system control and servo circuitry has contributed to the reduced weight. The size and weight have also been decreased by the use of high-density chip mounting technology which makes use of both sides of the boards. A newly developed battery weighs just 150 grams, half the weight of a conventional camcorder battery yet providing up to 45 minutes' recording time. The new CCD pick-up device has 380,000 pixels, giving Super Beta quality resolution.

Other features of the CCD-V90 include a variable speed digital shutter (five speeds from 1/60 to 1/2,000 sec), an edit/search function, vision and sound fader, double azimuth head for noise-free special effects, and a date/time recording function. The 99 × 130 × 330mm CCD-V90 will cost around £1,400.

Non-tripping Faults

George Wilding

While a short-circuit power diode or transistor in any position, a broken down tripler, or shorted turns in a line output or chopper transformer will generally instigate fuse blowing or overload trip operation, there are many instances where a lighter overload current won't, nor is it expected to, produce cut-off action.

A typical instance is leakage in the common or individual high-voltage capacitor(s) used to decouple the supply/supplies to a tube's first anodes. The result of such leakage will be reduced brightness or reduced output from one gun. Until there's a severe value reduction the high-value feed resistor(s) will limit the overload current and prevent trip operation.

When a tripler starts to break down the initial picture symptoms will be poor focus, reduced brightness and overscan due to the reduced e.h.t. voltage. Because of the increased beam current demand all these symptoms are accentuated when the brightness control setting is advanced.

A leak or excessive current demand from one chopper power supply rail will to some extent reduce the voltages provided by all the supply's rails since the power supply is being asked to operate at the fringe of or beyond its normal self-regulating limits. Similarly, because of the very tight magnetic coupling an excessive load on one line output stage derived rail will tend to reduce the voltages on all these rails. In such instances voltage checks at the individual reservoir/smoothing capacitors won't positively identify the rail across which the excessive loading is being applied. This blanket reduction of chopper and line output stage derived supplies will mean that the e.h.t., the tube's first anode voltage(s) and the h.t. for the RGB output stages will probably all be reduced. Thus the most common symptom is a black screen with no sound.

How do you find the cause quickly? There will almost always be a slight smell of burning within a few minutes of switching the set on: this is generally caused by one or more composition resistors being overrun.

Since the h.t. voltage in a modern receiver is not high, instances of capacitor failure are not common. Even miniature electrolytics have a good service record.

Thus the cause of most non-tripping leaks and shorts will be traced to a semiconductor device, the voltage regulator chips often used to provide a highly stabilised 12V rail for the small-signal handling circuits being common offenders.

The first move should be resistance checks for a short in such an i.c. The breakdown will problably be across the output since a short across its input, with only a low-value feed resistor present to limit the current flow, is likely to result in fuse failure or operation of a trip or fusible resistor.

Should such a short be detected, its presence probably confirmed by a discoloured feed resistor, the question that arises is whether the short is within the chip or across its output. Even if the short is across its output the excess current will have stressed and probably damaged the i.c., so it's best to remove this item. If the i.c. seems to be all right however and the feed resistor is not discoloured the stressed component will be obvious soon after switching on because of the rising hot air thermal or slight smoke.

In such circumstances the overheating component will almost certainly be a composition resistor and the cause of the overload is likely to be one of the following: (1) a shorted or defective zener diode operating at well below its normal voltage rating; (2) a transistor with a base-collector or collector-emitter short-circuit (blowthrough); (3) a short or heavy leakage within an i.c., this being most common with types fitted with a heatsink (such a fault will usually blow a fuse or operate a trip, but this is not always the case); (4) a short or heavy leakage within a capacitor resistor fed from a supply rail. In this latter event the excess current and the loading imposed will depend on the value of the resistor and the rail voltage. Thus an excess load which a 12V supply would tolerate for some time before the resistor's value fell further would produce immediate switch-off action if it was across an h.t rail.

Remember that with most meters the black probe is positive and the red probe negative when making resistance checks.

Typical Example

A typical example of a non-tripping short came our way recently in a Ferguson TX10 chassis. The symptoms were a blacked out screen, though some e.h.t. could be felt on the tube's faceplate, and no sound with an above normal hum. A check at the output pin of the 12V regulator IC621 produced a reading of only a few ohms in both directions. Removing the i.c. proved that it was responsible for the short. Normal results were restored after replacing it along with the feed resistors R612 (3·9Ω) and R613 (10Ω).

VCR Clinic

Reports from Philip Blundell, Eng. Tech., Alfred Damp, Eugene Trundle and Nick Beer

Ferguson 3V45/JVC HRD140

The fault with this machine was that the clock half of the display worked but the play/rewind/etc. half didn't. Switching off at the mains and powering up again had no effect and I couldn't find any dry-joints on the panel. Finally I removed the memory back-up capacitor for a few seconds, refitted it and then powered up. This brought the display back on again. **P.B.**

Panasonic NVM5 Camcorder

Unloading was incomplete because the pinch roller was returning in front of the drum exit loading guide. Removing the pinch roller arm assembly and reinstalling it would clear the fault for a couple of uses, but it would then jam again. The problem was caused by excess grease on the cam gear and hardened grease in the teeth of loading gear C. Cleaning loading gear C, the sector gear and both sides of the cam gear is the only long-term solution. Careful realignment of these gears, with reference to the service manual, is essential. The NVM5 uses the same deck as the NVM1 and the Philips VKR6800. **A.D.**

Philips VR6542/Sharp VC651

Four or five of these machines, under both brand names, have come our way over the last couple of months. All required the same repair. The symptoms vary from failure to load a cassette, failure to eject a cassette, to intermittently doing either. In all cases careful repositioning of the mode control switch was what was needed. Full details are given in the manual, but extreme care should be taken to ensure that the loading poles are in the fully unloaded position. If not the machine works but leaves a small loop of tape hanging from the cassette. These machines were all only a matter of months old. **A.D.**

Mitsubishi HS337

This VCR had a clock fault. It lost about ten minutes a day and the clock intermittently displayed the power loss warning. A check revealed that the oscillator in IC8A0 was working intermittently. The chip, type μPD7516HG, had to be replaced to cure the fault. It's a surface-mounted type, about three quarters of an inch square, with 64 legs. **A.D.**

Fitting Hi-fi Heads

Fitting new video heads in a Ferguson 3V29 is usually straightforward. Just two leads per head have to be threaded through the holes in the drum assembly. Minor irritation occurs when one of the leads bends over and fails to go through the hole. Imagine however the irritation when fitting new heads to a hi-fi VCR with long-play facility. With two leads per head and three heads per channel (one SP head, one LP head and one hi-fi head) you have to try to get six leads of unequal length through the holes at the same time, a very frustrating and time consuming job. It needn't be however. Cut two pieces of shrink-fit sleeving, about 1·5in. long, and push these over the leads of each head. The sleeving, with the leads inside, now easily threads through the holes in the head assembly. When the head is installed the sleeving is simply pulled off. Remember only to push the shrink-fit sleeving on – don't heat it. **A.D.**

Sony TTF1UB

The TTF1 was the tuner-timer partner to the late and lamented Beta SLF1 portable/component VCR. It has a switch-mode power supply to provide 12V. This one gave a green light indication with no load, but on connecting the SLF1 the green on LED would flicker and only a low, pulsing output voltage was available. The power supply would often then cut out altogether. The problem was due, as so often with Sony equipment, to dried up electrolytic capacitors, in this case the switching transistor couplers C618 and C619. Both are 4·7μF, 350V types and both were growing white fur around their legs. Maybe we were lucky not to lose the power switching transistors . . . **E.T.**

Fisher FVHP530

This one had an audio problem for a change. There was intermittent recording of the sound, with the E-E sound disappearing when the fault was present. Playback was always o.k. During the rare appearances of the fault the output at pin 10 of IC401 disappeared, though it remained at input pin 18. The 8·6V supply to pin 15 of the i.c. simultaneously fell to 4·7V. The cause of the trouble was a partial open-circuit in transistor Q404's base-emitter junction – complete loss of sound was probably due to the action of the comparators within IC401. This chip, type BA5102A, can be responsible for an obscure no-sound fault on timed recordings (the audio signal disappears from pin 4). **E.T.**

Hitachi VT11

These machines have two loading belts in series, which seems to be tempting fate somewhat! One that came in for service would occasionally fail to operate from cold – it was made to misbehave by being kept in a cold place. We found that in the fault condition the take-up reel didn't turn, giving rise to a growing loop of tape until the syscon switched to stop. The second (small) loading belt was slipping, but we replaced both as a precaution. **E.T.**

Hitachi VT33

Having been told that this machine didn't work at all we thought we'd an easy one. What we found was that the head drum turned all right but the tape wouldn't load and there was no response from the fast forward and rewind keys. After a prolonged foray into the syscon section we discovered that the loading mechanism was stiff. This led us to the loading motor which was virtually seized solid. A new loading motor cleared all the symptoms. **E.T.**

Hitachi VT5000

All piano-key operated machines are now getting old, but this one worked well enough apart from a horrible wow on sound at varying intervals during both record and playback. At its most severe the wow was accompanied – useful clues – by horizontal white bars across the picture and a slight dimming of the fluorescent clock display. In view of these symptoms we checked the 12V regulator whose output, observed on a scope, was seen to vary somewhat when the fault was present. Tapping, flexing and probing led us to a junky 12V preset control (R662) on the servo board. Replacing this and resoldering some suspect joints in the area put everything to rights. **E.T.**

Panasonic Booster Amplifiers

The ENPE716 r.f. booster is used in several Panasonic VCRs, amongst them the NV333 and NV366. We encountered one in a triple-standard Model NV390 which had been imported from the middle-east – we'd converted it for System I sound. The complaint with it was low gain on r.f.–through. E-E, recording and playback on ch. 36 were perfect. So far as I can see there's no circuit diagram for this module, but to save the cost of a new one we decided to have a go. By trial and error we found that one of the 2SC2671 transistors had base-emitter leakage – it was marked Q3 on the board. No substitute r.f./u.h.f. transistor from our stores would give good results: we finally found a scrap booster which provided us with a 2SC2671. This restored full gain, but what the owner saved in materials largely went in labour charges! **E.T.**

Saisho VR805

Faulty reel motors are a fairly common problem with these machines. New motors are readily available from Willow Vale Electronics. **N.B.**

Hitachi VT63/4/5/GEC V4004

We often get the following series of events with these machines. Switch on, put in a tape, eject it. The tape in light then remains on and the machine won't accept another one. The cause is faulty end of tape sensors. **N.B.**

Ferguson 3V16/JVC HR3660

The problem with this machine was that the drum speed varied after one and a half hours. The cause was dry-joints on the servo board, around the BA814 i.c. **N.B.**

Triumph VR9500

Loads of these machines come in with the no rewind complaint. The cause is the idler, but don't despair – the Saisho VR805 idler fits and is available from Willow Vale Electronics. **N.B.**

Micro Clinic

Roger Burchett and
Steve Beeching, T. Eng.

Sinclair Spectrum Plus

I've mentioned before the Spectrum Plus computers sold to a local school after modification. This one did at least appear to have started life as a Plus, being an Issue 6A machine. It had been in with every stock fault imaginable. Through all this there had been complaints of slow resets and locking up. It was also suggested that the membrane was faulty. We changed this, but I could never see any other definite fault. One day my colleague managed to duplicate the fault(s) and rang me up about it. Have you ever tried fault-finding by phone? Although an experienced software man he doesn't claim to be an engineer. Armed with a meter, he had checked the CPU's pins and found pin 25 (/BUSREQ) low. It was presumably floating, the meter's internal impedance pulling it down. We eventually discovered that the pull-up resistor for this line, R30, was missing. As a result the CPU thought it was getting requests for an external device to take control of the bus.

On test the machine again locked up. This time we discovered that pin 24 (/WAIT) of the CPU was floating. The pull-up resistor for this line, R29, which is next to R30, was the cause of the problem. When removed it promptly fell in half.

It seems that this machine had been well and truly got at. **R.B.**

JVC HC7

We've had several problems with these machines. One had an intermittent display. The cause was an intermittent 5V supply to the display controller chip due to a dry-jointed link next to C407. On another the fault was intermittent resetting to the start-up pages while a program was running – these start-up pages are displayed as an introduction after a power-up reset. We first changed the MSX controller chip but the fault turned out to be in the main LH0080A microprocessor chip. It was running slightly warm, though this is not unusual.

Intermittent audio, which sometimes sounded as if it was running slow, was traced to a poor connection at pin 11 of the MSX controller chip. This pin feeds clock pulses to the AY-3-9910A programmable sound generator chip for timing purposes.

Power supply failure was not the only fault on one computer. While checking we tried a substitute power supply, but the computer failed to reset and produce the introductory pages. Further fault tracing revealed that both the MSX controller and the microprocessor chips had to be replaced to restore normal operation, though we suspect that only the latter was faulty. **S.B.**

Letters

BUDGET VARIABLE PSU

I am a little concerned about certain aspects of the budget variable power supply (August issue).

First, the 1N4148 diode in parallel with the 2mm LED is presumably included to prevent the LED being subjected to peak inverse mains voltage. This being so the diode is shown the wrong way round – and is in fact shorting out the LED. Also the 47kΩ series resistor needs to be a 1W component in this position. If the shunt diode protection is changed to a series diode (e.g. a 1N4006) the current flows for only half the time and an 0·5W, 47kΩ resistor can be used. It's simpler to run the LED from the rectified secondary side of the supply however.

Secondly there's not a fuse in sight, either on the primary or secondary side of the mains transformer. Good practice dictates that there should be a fuse somewhere.

Thirdly, there are disadvantages in using a bridge rectifier connected across half of the transformer's secondary winding. A 15-0-15V transformer is generally intended to be used with a biphase rectifier circuit (two diodes). The use of a biphase circuit avoids two diode forward voltage drops and shares the load equally across the whole secondary winding. Only two instead of four transient/modulation hum filtering capacitors across the diodes are then needed: the cost saving can contribute towards placing a fuse in series with each diode! A suitable arrangement is shown in Fig. 1, with the indicator LED fed from the unregulated supply to save messing about with LEDs on the mains side.

My fourth point is a bit more involved. It concerns the ammeter shunt arrangement. I note that a 0-1mA meter is suggested. These typically have a d.c. resistance of between 50Ω and 100Ω. Doing the sums for the 100mA shunt first we have, for a 100Ω meter, Rshunt = Rm/(M − 1). For M = 100, Rshunt = 100/(100 − 1) = 1·01Ω. For a 2A shunt, where M = 2,000, we get approximately 50mΩ. For accurate and consistent results the shunt switch needs to have a repeatable resistance of much less than 50mΩ. Typical switch resistance is 10mΩ when new, even for a chunky switch of the type suggested in the article. I believe that the method used could give inconsistent results. A better method switches the meter independently of the load, as shown in Fig. 2. A small double-pole changeover switch of the 3A variety can be used. In this configuration the switch contact resistance in series with the switch is insignificant. The shunts are also independent of each other. Note the split of the wiring to the switch after each shunt, to avoid the wiring behaving as an extension of the shunt.

I also suggest placing the output voltmeter across the power supply's output terminals, where it reads the true output voltage taking into account the voltage drop across the shunts.

Lastly, as a safety measure I think it's a good idea to connect the negative side of the power supply to mains earth if this can be done without introducing earth loop problems.

Keith Cummins,
Holbury, Hants.

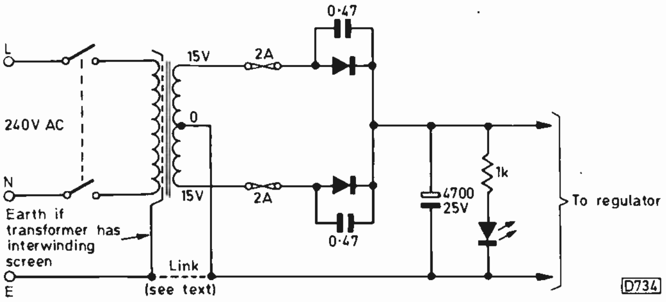

Fig. 1: Suggested rectifier circuit for the budget variable power supply (August issue).

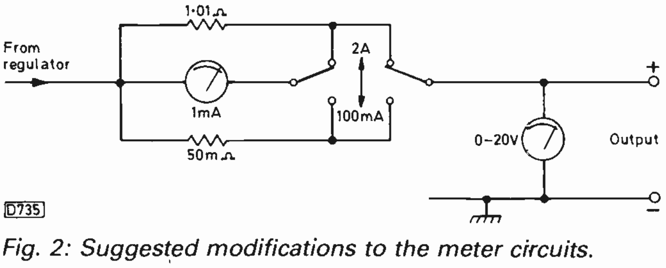

Fig. 2: Suggested modifications to the meter circuits.

CAUTIONARY TALES

An 80 year old enthusiast recently presented us with a dead Hitachi CPT2226TX. Inside we found a letter describing work he'd done on it. The original fault, loss of the top half of the picture, had obviously been caused by a dry joint in the field output module (tapping this had provided a temporary cure). He'd located this but his shaky soldering iron had led to field collapse. While going through what he described as a "trial and error" process in an attempt to cure this he'd added an 0·2μF capacitor and blown the mains fuse. This had been a big mistake! Amongst other things the stabiliser and timebase oscillator chips and a couple of transistors had been destroyed. His bill, which he gratefully paid, came close to £100. This is a cautionary tale of unskilled amateurs. If the set had been brought in to us at the first sign of trouble it would have been repaired free of charge under guarantee.

On another subject, we recently received an invoice for £95·42 trade price for an aerial socket for a Hitachi CPT2650! The moulded aerial socket with nine inch lead is an integral part of the tuner. Fortunately the part was under guarantee, but what happens in a few months' time?

W.H. Clarke,
CSC Electrix Ltd., Belfast.

SERVICE CHARGES AND THE COWBOYS

In the July issue D. Tasker raised the question of servicing charges. The situation in his area (Harrogate) seems to be completely different from that in my part of London (north west). Here, reference to the local papers or Yellow Pages reveals firms that commonly offer "free estimates – no call out charges". No one gets something for nothing of course, and these firms charge a very high price for doing the job. The customer thinks that he has saved money by not paying a call-out charge but doesn't realise that he shouldn't have had to pay so much to have the job done.

In my experience many so-called "TV and video" engineers know little about the equipment they work on. They can deal with the easy faults, i.e. certain simple mechanical problems with VCRs and simple TV faults, but cannot cope with the more complicated faults.

Like D. Tasker we also have a call-out charge. Some accept it, many don't. We can sometimes estimate the total cost of repairs over the phone – if we know the make of TV set, the model and the nature of the fault. Most people however seem to think that say £20 for repairing a set is expensive. I've even had the response "£20 for repairing the telly? – I can get one in the paper for £25". I'd like to see that £25 set! Based on research carried out with our customers we find that we provide an overall cheaper service.

So how do these firms that give free estimates work? It appears that they go to a job and quote a price, saying that they can do it now and either you want the job done or you don't. In other words they don't really want to know and are pressurising the customer to accept their extortionate estimate. Here are a few examples:

(1) A Philips set, G11 chassis, that belonged to an unemployed person. The quote was £80 to replace the line output panel "because it was sparking". A replacement h.t. reservoir capacitor and some resoldering of dry-joints put the set right at much lower cost.

(2) A Panasonic NV2000 which wouldn't record (playback o.k.). According to one repairer it required new heads. According to another it needed a new syscon board. We traced the fault to a switching transistor.

(3) A customer who paid £60 to have the usual rewind kit fitted to a Sony SLC7.

(4) A customer who paid £75 to have a take-up clutch fitted to a piano-key JVC/Ferguson VCR. A few days later a drive belt broke (it should have been replaced along with the clutch). The customer was quoted another £70 as the fault was not the same. He then called us in. Needless to say the bill was considerably cheaper, and the job was done on the spot.

(5) A customer who was quoted £70 for "replacing power transistors" in a TV set. When the set was brought to us we found that the on/off switch was the only defective item.

(6) A customer with a Grundig TV set had pushed the control panel in. The "engineer" had repaired the set by holding the panel in with cable ties. We advised the customer that this was dangerous and replaced the complete panel.

I recently went on a VCR servicing course and was disgusted with the quality of those attending it. Apart from myself only one, out of fifteen of us, knew how to use an oscilloscope. Several couldn't use a multimeter properly.

We all know that electricity is a potentially dangerous form of energy that must be treated with respect. It follows therefore that bodged TV and VCR repairs can be dangerous. I consider that a good, fully qualified engineer is worth good money and is more skilled than a plumber, a carpet fitter or a drain cleaner, but the public obviously doesn't think so. TV sets and VCRs are getting more complex all the time, and the test equipment needed to service them fully is also getting more complex – and expensive. The TV service engineer needs to be aware of the latest technology. If the public is to get a first class service it must (a) be prepared to pay for this while (b) we must find a way of rooting out the cowboys in the business.

It would be interesting to hear some other views on the subject.
M.D. Maurice, Managing Director,
Maurice Electronics Ltd., Wembley, Middx.

INTERFERENCE AND VCRs

While looking through some old issues of *Television* I came across Alex Clapton's letter (May 1987) concerning interference experienced with a VCR on playback. From his comments it would seem that the unwanted signals are being picked up on the braid of the downlead (see page 12 of the Department of Trade and Industry's booklet *"How to improve television and radio reception"* – it's obtainable free from main post offices). The braid acts like a long-wire aerial and the signals picked up flow through the chassis or earthy parts of the receiver (the same will happen with a VCR of course), with the result that r.f. voltages are developed across parts that should be at equal potential. These r.f. voltages give rise to interference in various circuits. The booklet talks about amateur radio transmissions in the 3·5 and 7MHz bands affecting the colour decoder circuits. In a VCR however, 3·5MHz falls within the luminance signal f.m. sidebands, so any unwanted signals at this frequency will find their way into the demodulator during playback and will show up on the picture. In this situation connecting an earth wire to the VCR's case will only make matters worse, since it will improve the performance of the long-wire aerial system (hence the presence of aerial and earth sockets on some SW/MW/LW radio receivers). The DTI advise fitting a braid breaker filter (details are given on page 20 of the booklet) as a cure for this type of interference.

Turning next to the comments in Service Bureau on a G11 chassis with remote control (August 1987 issue), I'd also recommend changing the battery in the handset. Failure here would of course prevent the set being activated via the remote control system. Whilst agreeing with the diagnosis of a possible on/off switch fault (the switch has a mains-on reset contact for the remote control system) replacing T85 and T86 in the power supply circuit is unlikely to cure the fault. Although failure of T85 and T86 will cause shut-down of the h.t. supply removal of connection 4A2 (the bottom three-pin connector with just one connection) will, if the fault is associated with the remote control circuitry, restore operation of the set.

Going back to the battery, I've seen a G11 do odd things when the remote control handset's battery is exhausted – such as illuminate the red LED when the set is not in standby, nor were any commands being sent although attempts at the latter had been made. Fitting a new battery restored normal operation.
R.P. Harris,
Salisbury.

FOR DISPOSAL

I would like to offer a couple of items for disposal to a good home. The first is an Ultra Model 53 v.h.f. TV set which was in full working order when last used several years ago. The second is a v.h.f. pattern generator, mains powered, giving crosshatch patterns etc. Both are available free if someone collects them.
M.A. Cox, 31 Boot Hill,
Grendon, Atherstone, Warks CV9 2EL.

Recording Teletext Subtitles

Harold Peters

How often do you get asked why a VCR won't record teletext? It used to be the "clever lad" but today it's usually the hard of hearing who pose the question – because they'd like to record the page 888 subtitles. In the heat of a Saturday showroom it's not always easy to provide a quick explanation. It may help to keep the following brief notes handy.

Why you can't do it

There are three basic reasons why teletext can't be recorded. First, the teletext information is transmitted at the time when the VCR is switching from one scanning video head to the other. Secondly, with domestic VCR systems the fine picture detail is removed – and with it most of the teletext signal (see Fig. 1). Finally, it's not possible to record the mixed picture and data seen on the screen of your TV set from its video output socket (if it has one) because the decoded teletext information is added to the signal path at a later point.

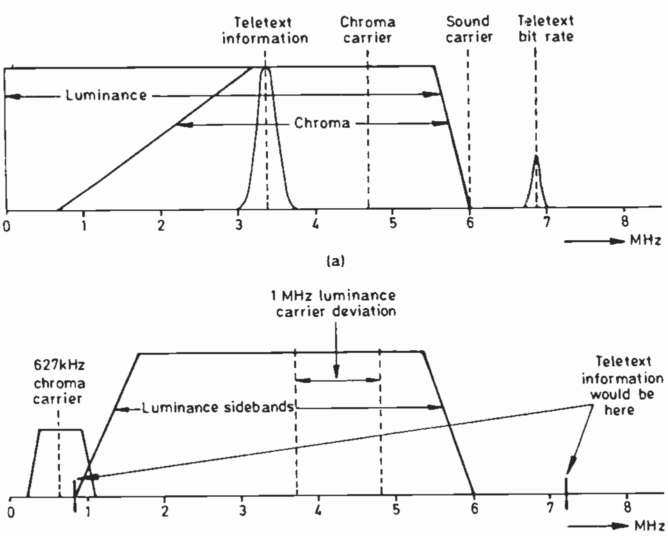

Fig. 1: Comparison of the TV channel spectrum as transmitted (a) and the signal converted for VHS system recording (b). In (a) most of the teletext information is in a narrow band centred on 3·45MHz. Note the blip at bit rate, 6·9MHz, which will be seen on a spectrum analyser even though out of band. In (b) the chroma and luminance signals change position and the teletext information is "out of band" beyond the upper and lower luminance sidebands.

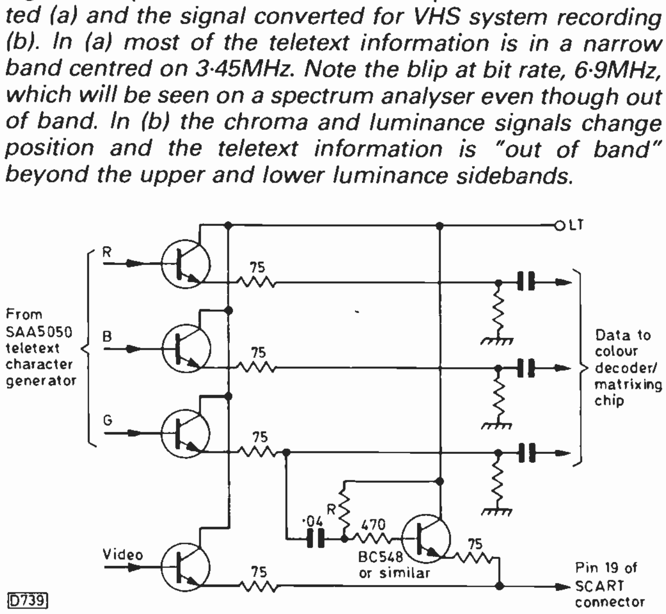

Fig. 2: To add subtitles to a teletext TV set's scart socket output, pass the green data line via a buffer stage to the video output pin. See text for details.

Whilst there is a way round the problem, as we shall see, let's first consider these points in more detail.

Video head switching normally occurs three and a half lines before the end of the picture in each field. Picture start is about 24 lines after the beginning of the next field. This gives the TV set just under 30 lines for the line sync fully to recover from the switching disturbance. The TV set's VCR time-constant is arranged so that the picture is straightened during this period, but the data entry window occurs within this time and with the timebase not yet fully stabilised there's a possibility that the clock run-in pulses, which are essential for data capture, will not be gated correctly, producing errors.

The teletext bit rate is 6·9375 megabits/sec. With the non-return-to-zero format used the highest rate of change is the clock run-in, i.e. the two bytes of 1010101, which represents a frequency of 3·46875MHz. Because of the limitations of VCR systems the luminance information is band limited to 3MHz, losing most of the teletext data. The full HQ format extends the upper luminance sideband of the f.m. modulation beyond 5MHz. This gives little improvement however as the asymmetry of the detected waveform reduces the teletext eyeheight below the data capture level. Teletext should be recordable with the forthcoming S-VHS system, but for the moment it's too early to be sure.

For page 888 subtitles only you would think that it's simply a matter of extracting the detected video from the scart (or similar) connector but since this outlet port carries only the detected picture signal and not the decoded data, which is added during the final matrixing, this is sadly not the case. GEC used to make a unit that did the job, but it's no longer in production – though there may still be some around.

And how you can!

If you have a modern teletext set with a mains-isolated chassis and a scart (or similar) connector and you are prepared to carry out a simple modification there's a way of recording fairly legible subtitles on your video tapes.

The page 888 subtitles are either white, green, yellow or cyan and are put into a black, blue or red box. Thus all the subtitle wording contains green, and the circuit shown in Fig. 2 simply adds the green data line to the video available at the scart connector. By recording this output and the baseband sound from the TV set via the VCR's auxiliary input sockets the subtitles will be superimposed in white, unboxed, on the recording.

Some of you may be wondering why the luminance output from the teletext decoder's character generator isn't used instead. This output normally "punches holes" in the picture when the mixed or graphics mode is being used, so it's of the wrong polarity and is mixed with the blanking which provides the boxes for subtitling and newsflashes. The green channel was chosen to keep the circuit simple and avoid the possibility of white boxes on the tape. Besides, it's a lot easier to find the green data line in the set.

Recording from the TV set's scart output connector has its snags. You can't monitor that the subtitles are "going on", and because the TV set has to be on and set to page 888, with the VCR switched to auxiliary, making timed recordings is impractical unless you are at home with the machine. In operation the VCR usually adjusts the video input to 1V peak, so subtitles on a bright scene reduce the picture level and maintain legibility.

The circuit is not critical. Any general purpose npn transistor will do. The brightness of the recorded text is set by the value of the bias resistor R. With a 5V supply 100kΩ was found to be optimum while 1MΩ was used with a 12V supply. Too high a value gives weak subtitles: too low a value makes the picture distort and cog.

Because you can't monitor the results on the parent TV set in the normal way it's best to watch the VCR's r.f. output on another set whilst fitting the modification. Loading on text with the sets so far modified has been negligible, and only slight on the scart connector's video output. Severe loading of the green data line will produce mauve subtitles in a green box on the set being modified. To cure, reduce the value of the coupling capacitor.

Emitter-followers are shown in Fig. 1 between the teletext decoder's character generator and the colour decoder. These are included to permit text brightness presetting. With later set modifications buffer diodes were used instead – in this case take the data from the colour decoder side of the buffer diode.

The circuit can be mounted on a stamp sized piece of Veroboard which can usually be supported on the three connecting wires, the longest of which is invariably the l.t. feed.

The ED Beta Specification

George Cole

Of the two basic domestic VCR formats, the Betamax system tends to give better pictures than VHS. The reasons for this are Beta's wider luminance carrier deviation (1·2MHz compared with 1MHz for VHS) and the faster writing speed (5·08msec compared with 4·85msec).

The launch of the Sony SLHF950 VCR, which features "Super Beta PRO", marked a further improvement in Beta picture quality. By raising the luminance carrier's nominal frequency by 500kHz the luminance bandwidth was increased and the resolution improved to around 300 lines (the number of vertical lines that can be resolved without blurring). This performance has however been eclipsed by the introduction of Super-VHS (S-VHS) which achieves a resolution of over 400 lines – see Steve Beeching's account in the July issue. S-VHS and the expected launch of extended-definition TV in Japan in 1989 have prompted Sony to introduce a new format, Extended Definition Beta (ED Beta).

Sony originally announced ED Beta in March: an engineering prototype was shown to Japanese journalists and specifications were released. The system promises a definition of 500 lines.

As with S-VHS, the higher specification achieved by ED Beta is the result of several improvements: the luminance bandwidth has been increased, the frequency deviation widened, the chroma and luminance signals do not overlap and high coercivity tape is used. In comparison with S-VHS the luminance bandwidth is wider at about 6MHz compared to 5MHz while the frequency deviation is 1·8MHz compared to 1·6MHz. Further comparative details are shown in Table 1. In ED Beta the luminance white clip is raised to 230 per cent. The dark clip is 70 per cent.

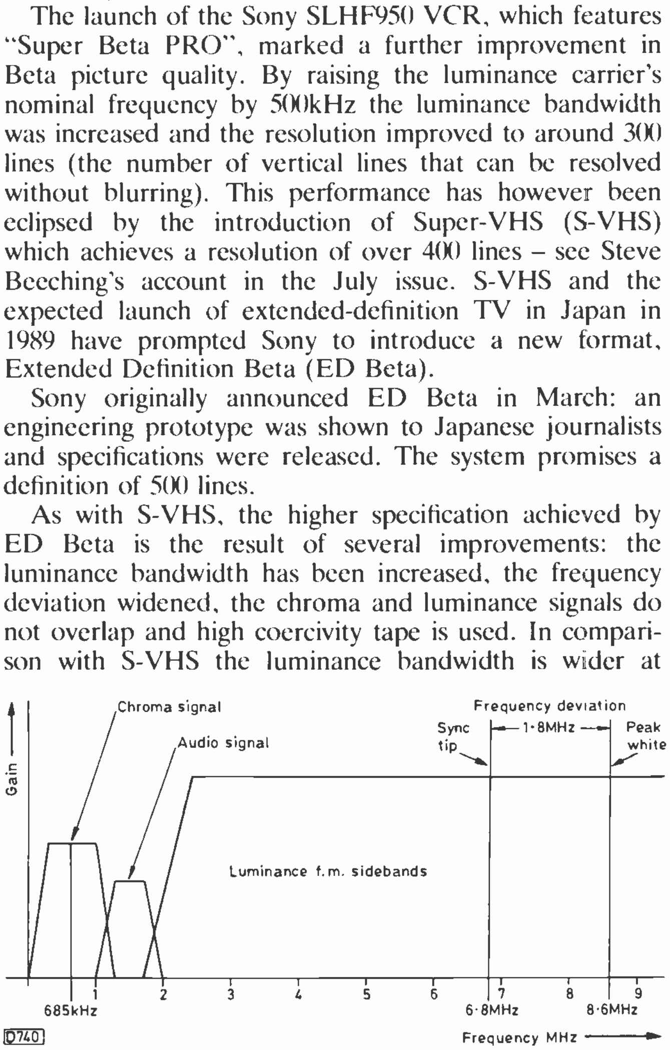

Fig. 1: Frequency spectrum for the ED Beta system.

Unlike the S-VHS system, which uses refined ferric oxide tape, Sony has opted for metal particle tape. The ED Beta tape is relatively thick (19 microns compared to Video-8's 13 microns). It has a very high coercivity – 1,450 Oersteds.

Sony has developed a new video head called a tilted sputtered sendust head (TSS). To date no details of the composition or characteristics of this head have been divulged.

Because of the use of metal particle tape there's no possibility of standard Beta VCRs using ED Beta tape. As with S-VHS, the cassettes have a special identification (ID) hole to ensure that conventional machines cannot play or record with the new tape.

ED Beta recorders will be able to play and record in three modes: standard Beta, Super Beta and ED Beta. Like S-VHS machines, ED Beta VCRs will have separate chrominance and luminance terminals.

Apart from the improved picture quality, Sony claim that third and fourth generation copies should show little picture degradation. Sony intends to release Profeel TV sets with separate Y and chroma sockets.

ED Beta is due to be launched in Japan this autumn. It will probably reach the UK next year. Since Sony is energetically promoting the Video-8 system the launch is likely to be a low-key affair.

Table 1: Format comparisons.

Characteristic	*ED Beta*	*S-VHS*
F.M. peak white	8·6MHz	7MHz
F.M. sync tip	6·8MHz	5·4MHz
Frequency deviation	1·8MHz	1·6MHz
White clip	230%	210%
Dark clip	70%	70%
Tape type	Metal particle	Cobalt-doped ferric oxide
Coercivity	1,450 Oersteds	800-900 Oersteds
Horizontal resolution	500 lines	Over 400 lines

TV Fault Finding

Reports from Philip Blundell, Eng. Tech., Hugh MacMullen, Roger Burchett, Eugene Trundle and Mick Dutton

Focus Faults

A66-701X and A56-701X tubes seem to be prone to a focus fault, usually from cold. What happens is that the picture has a horizontal band of defocusing that changes with picture content. Replacement seems to be the only cure. **P.B.**

Telefunken 615 Chassis

If you suspect that the line output transformer in one of these sets is faulty, look closely at its top to see whether the plastic is blistered and swollen. If so it's a very good bet that the transformer is faulty. **P.B.**

Decca 90 Series Chassis

This set had no picture, just a plain white raster with a blue band on the left-hand side. The video signal was found to be missing at 2TP1 on the decoder panel, so attention was directed to the sandcastle pulses. A check at TP303 on the sync/line timebase panel revealed that the pulse amplitude was 4V instead of 8V. The 22Ω safety resistor R301 was found to be open-circuit. **P.B.**

Sharp C1491

Intermittent no sound or vision was the symptom with this set, and on the rare occasions when the fault showed up R245 in the 12V supply to the i.f. strip and tuner would overheat. A lot of time was spent disconnecting components and soak testing before the culprit was found. It was CF201, a packaged circuit, which was going leaky. **P.B.**

Philips K30 Chassis

This set would switch off after about three hours. If the mains supply was switched off for a few moments then on again the set would continue to operate for hours and hours. The cause of the fault was eventually traced by using a hairdryer inside the set. The culprit was the e.h.t. lead, not with a sparking short but a leak to its braid. **H.MacM.**

Philips G8 Chassis

The picture faded out or went very dim after a couple of hours. We eventually found that the 12V stabilising zener diode D7315 (BZX61/C12) on the decoder panel was going high resistance. It's a difficult fault to diagnose because the voltage change is only about 1V, but this is sufficient to upset the rather critical conditions in the TBA520 chip. **H.MacM.**

Philips CTX-E Chassis

The set was working but there was no sound or vision. A naughty one this: when R3101 (15kΩ) which supplies the 33V tuning voltage stabiliser goes open-circuit there's still 150V from D6583 to burn your fingers. How about a nice high-resistance bleed to tame this condition? **H.MacM.**

Thorn 9000 Chassis

Two of these sets have passed through the workshop recently, both with the same fault. In the first case some time had to be spent over diagnosis. The symptom was no-go and pumping. The cause was that rectifier diode W706 was open-circuit. We use a BY299 in this position as a replacement: it's easy to obtain and seems to be more reliable (at this stage) than the type originally fitted. This one is worth remembering since the diode can fail intermittently, setting a difficult puzzle for the engineer.

Going open-circuit intermittently is a nasty habit of some SKE prefixed diodes, as we've spent many hours learning from Grundig and other TV sets in the past . . . **E.T.**

Panasonic TC2203 (U1 Chassis)

Another horrible intermittent fault: at random and very long intervals the picture would contact and jump, as if the mains supply was arcing. At length we discovered that the way to instigate the fault was to switch on from cold then thrash the channel selector pads with the brightness and contrast at maximum! If the symptom then appeared it could be cleared by turning down the contrast control setting. This dependence of the fault on beam current led us to suspect the tripler – until we found that a diode-split line output transformer is used in this chassis. Replacement of the e.h.t. lead (line output transformer to c.r.t.) cured the problem. **E.T.**

Ferguson TX90 Chassis

Fuse blowing has been a big nuisance with these sets lately. In one case the line output transistor was short-circuit but in others the fuse blowing has been of an intermittent nature. Replacing the BY127 mains rectifier diodes (D120-D123) with Ferguson supplied alternatives (BYD33G) seems to have cured the problem in the sets where the fuse blowing was random.

If you get intermittent lack of line lock, look at the thin tracks roughly in the centre of the board. They tend to lift and crack with repeated thermal cycling. The one in question goes to pin 5 of the TDA4500 chip (pulse feedback). It would be prudent to add wire bridging links to all four of the tracks. **R.B.**

Rediffusion Mk 3 Chassis

Experienced ex-Rediffusion men (and women!) will no doubt laugh their heads off at this one, but here goes. I've come across several of these sets with 5R6 (27Ω) open-circuit. It's a safety resistor that's used as a surge limiter in series with rectifier diode 5D6 (BY298). This diode produces the 270V supply for the RGB output stages and is fed from a winding on the line output transformer. When 5R6 goes open-circuit the 270V supply is no longer present and the result is a bright raster with flyback lines. There's also no tuning voltage supply to the tuner. Up to now replacing 5R6 has provided a complete cure.

On this set 5R6 was open-circuit and the current limiting resistor 2R142 (1kΩ, another safety resistor) in the blue output stage was burnt. After replacing these two resistors I switched on confidently, only to get sound but no raster. There was just time to check the RGB output voltages before the 1·6A time-delay power supply fuse blew with a bang. The regulating thyristor 6ITR1 was now short-circuit cathode-to-gate. After changing this I powered up with the line scan panel unplugged. No bang. Then I cautiously powered up with the tripler disconnected. Sound o.k. Deep breath and try with the tripler connected. Tripping. I see. This job was being done in the field, so it was a question of see you tomorrow morning madam (and sir).

Next day I fitted the new tripler in a trice and switched on. No bangs and no tripping – and no raster either! This turned out to be due to 2D15, a 7·5V zener diode, being open-circuit – it stabilises the voltages at the emitters of the RGB output transistors. Replace this and we were home and dry.

So we had an intermittent tripler fault, only the second time that a tripler has caused me trouble in the Mk. 3 chassis. There was no pinhole when I examined it later, but it must have been breaking down somewhere, and violently too. The moral would appear to be to leave the tripler disconnected whilst making tests when 5R6 is found to be open-circuit. No doubt those more familiar with the Mk. 3 chassis will have their own approach to testing. The worst thing about this saga is that I went to see the set after personal recommendation and then floundered. **R.B.**

Rediffusion Mk 4 Chassis

This set was dead. We removed the back and noted that 4R2 had sprung open. This resistor provides a start-up voltage for the power supply. As we could find no evidence of a short we resoldered 4R2 and switched on. There was still no sign of life and 4R2 quickly got very warm. The culprit was 4D6 (BA157) which had gone short-circuit. It should take over from the start-up supply when the set gets going but, being shorted, was placing a heavy load on 4R2. **M.Du.**

Hitachi NP81CQ Chassis

This set came in because of intermittent field collapse. We solved the problem by removing the thick-film field output module and carefully resoldering all the dry-joints. After running the set for a while we noticed that there was slight field bounce, particularly on channel change. C610 (220μF, 50V) was found to be virtually open-circuit. **M.Du.**

Sharp C1891

No luminance was the problem with this set. Freezer soon, located the cause – transistor Q409 (2SA495). **M.Du.**

Hitachi CPT2051 (NP80 Chassis)

This set was dead. There was no h.t. output from the power supply though voltage was present at the input to the STR440 chopper chip. When we tried to measure this voltage the power supply came to life. The problem was no start-up supply at pin 4 as R902 (82kΩ) had gone open-circuit. **M.Du.**

Thorn 1590 Chassis

The fault, poor sound and a blank white raster, is common with these sets. It's usually caused by a defective i.f. transistor, usually the second one. In this case the voltages were o.k. until we came to the base of the fourth i.f. amplifier transistor VT5, which had no base voltage. R26 (10kΩ) had gone open-circuit. We didn't find this out until after changing the transistor of course! **M.Du.**

Simple Polar Mount Adjustment

John Breeds

Practical experience has proved the following method of setting up a polar mount in a satellite TV receiving system to be both simple and effective. Once the technique has been learnt you'll find that it takes less than five minutes to obtain very accurate geo-arc tracking. The technique eliminates the need to use a magnetic compass, with all the attendant problems of magnetic correction factors, to find true south. There's no need to go half-blind squinting at the sun at lunchtime to study solar transit times – something you shouldn't do anyway. No special high-tech instruments are used, nor is any complicated trigonometry required to calculate the angles. So how's it done?

Key Angles

The installer needs to know three key angles for the receiving site. These are the polar elevation, the apex elevation and the elevation to receive the Intelsat VA-F11 satellite at 27·5°W. The difference between the polar and apex elevation angles automatically gives the correct declination angle, something that's difficult to measure at the best of times. Table 1 shows modified polar and apex elevation angles for various site latitudes – modified simply means that a modifying angle has been added to the polar angle and subtracted from the apex elevation angle to allow very accurate tracking across the whole visible arc (otherwise there will be a small tracking error at extreme azimuths). The modifying angle is dependent on receiving site latitude and is calculated from mathematical fundamentals.

Table 1: Modified polar and apex elevation angles.

Site latitude	*Modified polar elevation (degrees)*	*Modified apex elevation (degrees)*
50	39·3266	32·6856
50·5	38·8294	32·1411
51	38·3323	31·5972
51·5	37·8355	31·0542
52	37·3389	30·5119
52·5	36·8424	29·9702
53	36·3462	29·4294
53·5	35·8501	28·8891
54	35·3543	28·3498
54·5	34·8586	27·8110
55	34·3631	27·2730
55·5	33·8678	26·7358
56	33·3727	26·1993
56·5	32·8778	25·6635
57	32·3831	25·1286
57·5	31·8885	24·5942
58	31·3941	24·0606
58·5	30·8999	23·5278
59	30·4058	22·9957
59·5	29·9120	22·4644
60	29·4183	21·9338

Finding True South

The third angle the installer needs to know, the elevation angle for receiving Intelsat VA-F11 at 27·5°W, enables true south to be located very quickly. This quick but accurate method exploits the VA-F11 satellite's station keeping accuracy. Inability to locate true south is the usual cause of poor quality pictures from one satellite with good pictures from another satellite. The Intelsat VA-F11 elevation angle could be gauged from Fig. 1, but this method is not sufficiently accurate. Another way of determining the angle is to use trigonometry – but how many of us are mathematicians? A simple method of finding the elevation angle for Intelsat VA-F11 has been provided by my whiz son Robert, an undergraduate at Bath University. The following equation he came up with greatly simplifies the workings while retaining an accuracy of within ±0·5° for any receiving site in the UK:

$$\text{Elevation} = 77{\cdot}083 - \text{LAT} + (0{\cdot}386064 \times \text{LONG})$$

where LONG is a positive value if west of south and a negative value if east of south. Mathematically minded readers will notice that the equation is based on an assessment of several straight-line gradient plots across the UK ($Y = MX + C$ where M is the gradient and C is the Y-intercept).

Here's an example of the calculation, for a receiving site at Swindon which is at latitude 51·3°N and longitude 1·8°W:

Intelsat VA-F11 elevation

$$\begin{aligned} &= 77{\cdot}083 - \text{LAT} + (0{\cdot}386064 \times \text{LONG}) \\ &= 77{\cdot}083 - 51{\cdot}3 + (0{\cdot}386064 \times 1{\cdot}8) \\ &= 25{\cdot}783 + 0{\cdot}6949152 \\ &= 26{\cdot}48^\circ. \end{aligned}$$

The actual angle is 26·5°, but this is accurate enough. The procedure may seem complicated but really is simple (it must be, otherwise I couldn't do it!).

Aerial Alignment

Just follow the sequence of adjustments for a particular dish and you'll be able to set up the angles in less time than it takes to boil an egg. As an example, the procedure with the Salora/Luxor dish is as follows.

(1) Set the dish in its apex position, as shown in Fig. 2, i.e. when viewed from behind the square frame is at 90° to the pivot assembly. Temporarily hold the dish in this position by means of the actuator or a similar sized rod. Carefully loosen the bolts that secure the base plate assembly to the central pillar then turn the entire assembly until the dish, in its apex position, points roughly south. Temporarily tighten the bolts.

(2) Determine the latitude of the receiving site from an Ordnance Survey map. Obtain the corresponding modi-

fied polar elevation and apex elevation angles from Table 1.

(3) Carry out the polar elevation adjustment. Place an inclinometer or elevation meter on the rear edge of the square frame. Ensure that the meter or protractor is accurately aligned across the polar axis. See Fig. 3. Adjust the polar axis by means of the two nuts on the polar axis adjuster for the correct polar elevation.

(4) Carry out the apex elevation adjustment. Place the inclinometer or elevation meter on the westerly rear side edge of the dish. Set the apex elevation by means of the two upper adjusters which connect the back ring to the square frame. This adjustment automatically sets the declination offset: be as accurate as possible!

(5) Find true south. First work out the elevation of Intelsat VA-F11 using the equation previously given. Keep the inclinometer on the rear, west side edge of the dish. Move the dish westwards until the angle corresponds with the angle for Intelsat VA-F11 at your receiving site. Hold the dish in this position with the actuator or a similar fixing arm.

Slightly loosen the bolts that secure the base plate assembly to the central mast. Turn the whole upper assembly around the central pillar slowly until a meter used to give an indication of signal strength produces a reading and you get a picture on the TV set (pretune the receiver to Children's Channel or RAI – these have a similar frequency and polarisation). With Salora/Luxor satellite TV receivers use a voltmeter set to read d.c.: connect it to the test point provided. The voltmeter's reading will decrease as the signal strength increases with the Salora/Luxor Model 9570 (Mk 2). With the Salora Model SRV1150 the reading increases as the signal strength rises. Carry out fine adjustment for the appropriate meter reading by rotating around the aerial mast

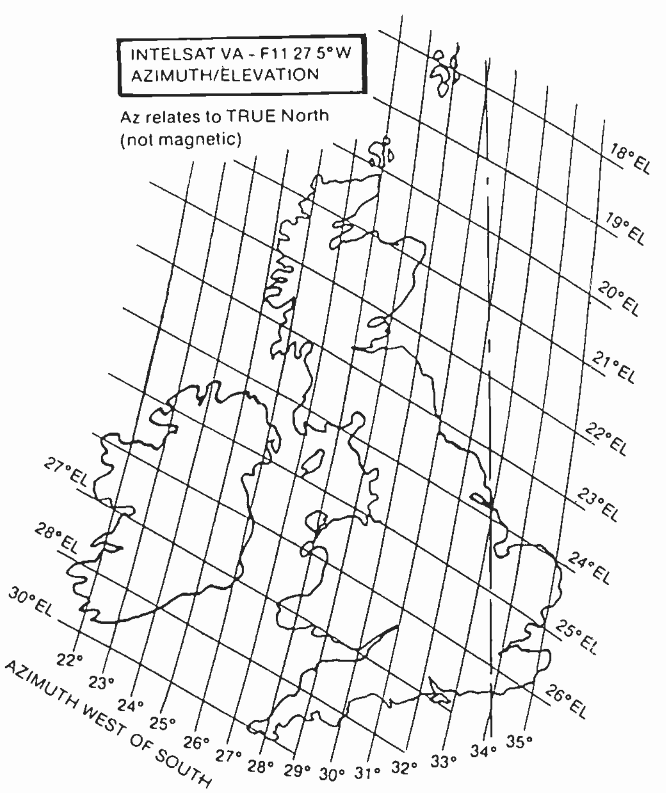

Fig. 1: Dish azimuth/elevation chart for Intelsat VA-F11.

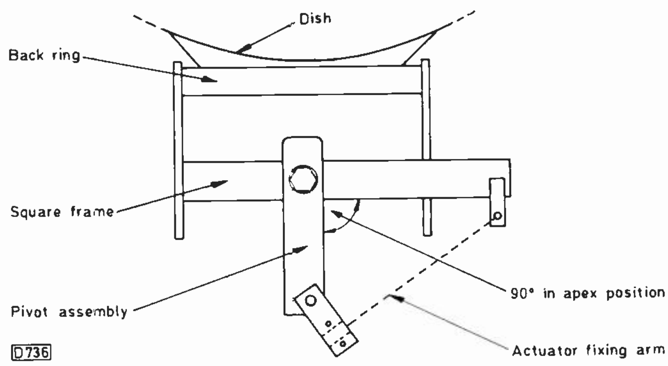

Fig. 2: Rear view of the dish polar assembly, shown in the apex position.

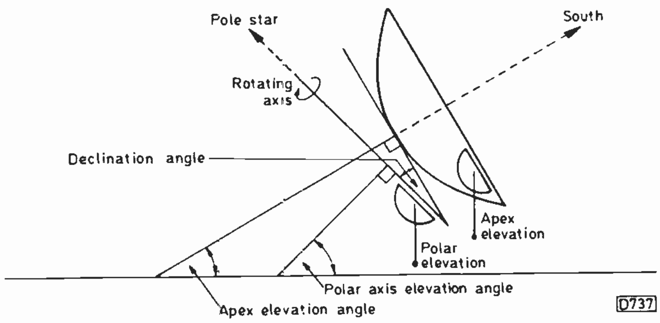

Fig. 3: Polar and apex elevation adjustment.

only – if you alter the polar or apex elevation settings you'll have to start all over again.

This procedure will have automatically set the apex position to point at true south.

(6) Fine tune the polar elevation. Activate the actuator or slacken the fixing rod in order to move the aerial eastwards until you get a picture from the Eutelsat satellite at 13°E. This will be RAI, assuming that you've been receiving Children's Channel from Intelsat VA-F11. Finely adjust the polar setting for the best picture and optimum meter reading.

(7) Move the dish back for reception from Intelsat VA-F11 and recheck the picture. If the picture has deteriorated the true south setting is incorrect. Repeat operation (5).

(8) Note that the polar elevation adjuster has been used for best results with Eutelsat at 13°E and the true south adjustment for best results from Intelsat VA-F11 at 27·5°W.

(9) Carry out polariser offset adjustment as appropriate for the equipment in use.

For a multi-satellite system, set the dish to its apex position then clear the aerial control unit (with the ACU1160 enter code F5 then press store). Twist the assembly to ensure that the pick-up probe is truly vertical or horizontal.

(10) Carry out focal distance adjustment if provided. The distance between the mouth of the feedhorn and the centre of the dish is critical. With the Salora/Luxor aerial there are screw threads at the ends of the three support rods to provide fine adjustment of this position for best results.

Servicing Mechanical VCRs

Part 6

Mike Phelan

The first thing we'll talk about in this final article in the series is the keyboard, or the function key assembly as it's more correctly called.

The Key Assembly

The key assembly (see Fig. 1) consists of a rectangular metal frame that's secured to the deck. The keys are pivoted on a steel rod and located transversely by slots in the frame. Each key consists of an identical metal lever on to which a plastic knob is firmly cemented. Hairpin springs return the keys to the rest position. A pivoted latching bar locks the keys in the down position, with the exceptions of the eject, stop and pause keys. This key locking is accomplished by notches in the latch bar: steps in the key levers locate in these notches. The latch bar is actually in two parts, the smaller one on the left allowing the record and audio dub keys to be latched separately. The stop solenoid engages with a vertical tongue on the longer bar. Except for pause and eject the keys, when pressed, raise the latch bar, releasing the previous function selection. All the keys except the eject key project through slots in the deck. The pause key engages with a lever that slides through a latch, allowing the key to be alternately locked and released independently of the main latch bars.

A bank of sliding levers (the function plates) is arranged at the front of the key assembly. Their purpose is to limit the combinations of keys that can be depressed simultaneously. There's also an interlock with the mechanism to prevent eject or fast wind when the tape is laced up, even though stop has been selected. Details vary with different models. The record interlock is operated by one of these function plates.

The two main function plates A and B extend for the full length of the key assembly and are centralised by two small springs. They both have notches in line with each key lever. These notches are of three types: a wide notch has no effect, a sloping notch allows the key to move the plate, while a narrow notch prevents key depression when the plate is moved by another key. Plate A allows the rewind and fast forward keys to lock all the others; plate B does the same for the play key. Plate E is the record interlock.

A strip of PCB carrying all the microswitches operated by the keys is mounted atop the key assembly. It also carries the record indicator lamp.

Machine Trips after Loading

So much for the good news, now for the bad – though it's not all that bad. The key assembly suffers from a few problems that are not too difficult to put right. The most common problem applies mainly to the 3292/HR3300. It shows up when the machine apparently trips out on completion of the loading sequence. What might at first appear to be an electronic fault is actually due to wear on the play key lever (see Fig. 2) as a result of which the lock plate has a very precarious hold on it: when the loading mechanism clunks to a halt the shock jars the play key free. The cure is to replace the lever or swap it over with either the stop or pause key, as the locking latch is not used with these. The key colour will be different of course. The trouble may recur when this latter course of action is taken, as its root cause is the soft material used for the key levers. This point was put right with the

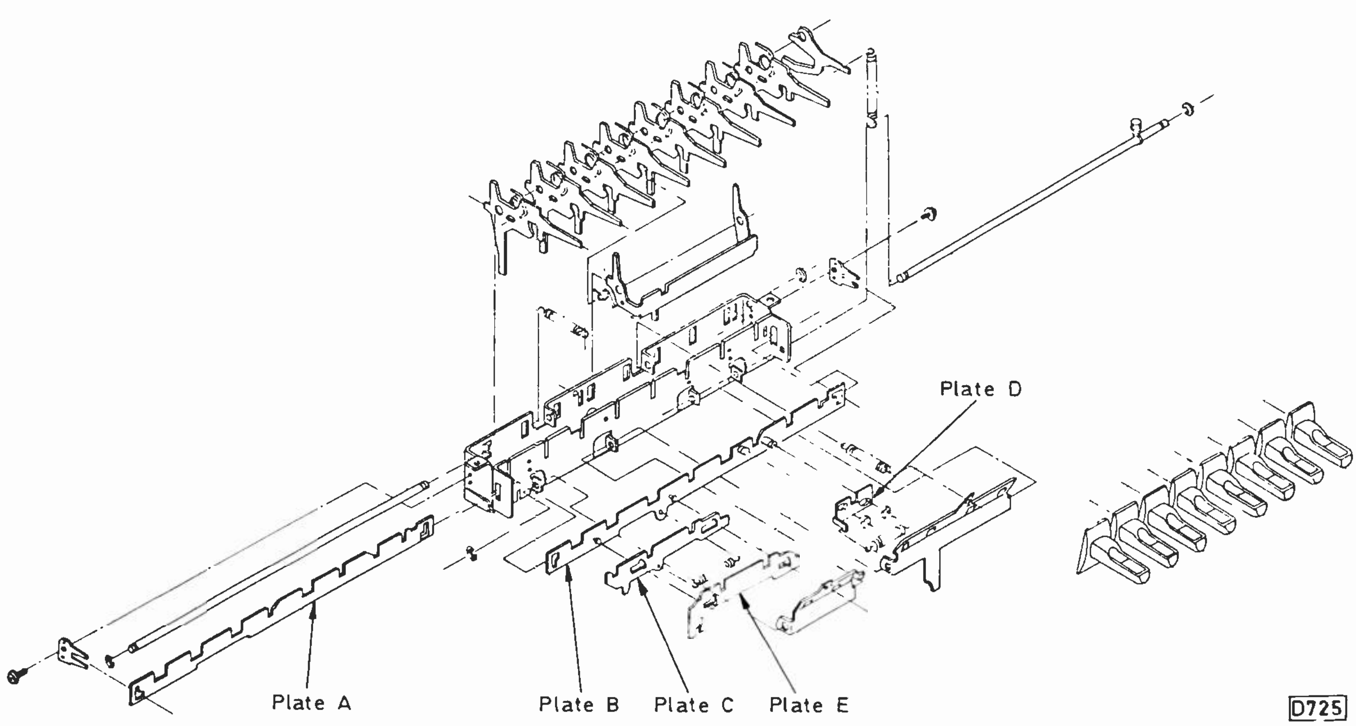

Fig. 1: The function key assembly.

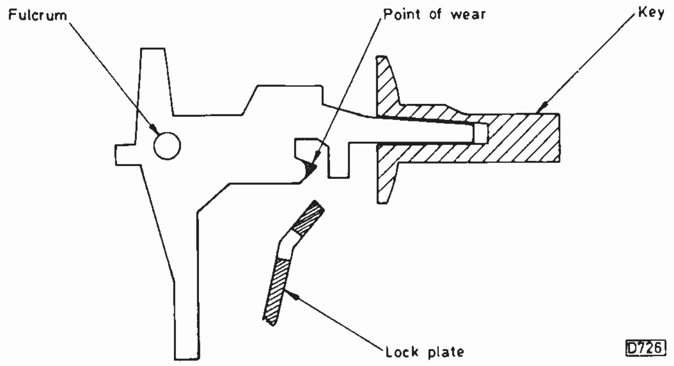

Fig. 2: Key lever assembly.

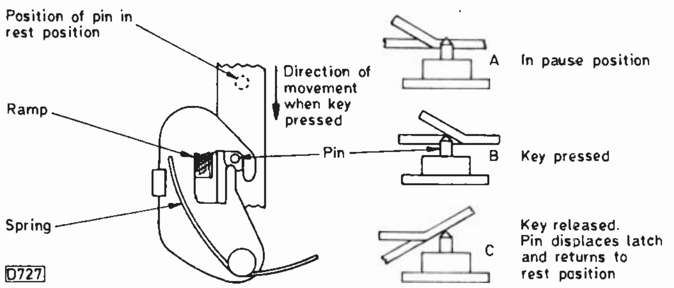

Fig. 3: The pause latch.

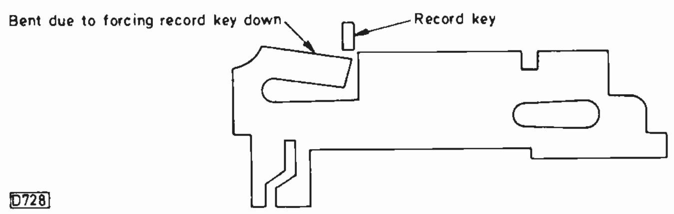

Fig. 4: Problem that occurs with function plate E.

subsequent 3V00/HR3330.

The keys are driven on to the levers and also cemented, so there's little chance of removing one without damage.

Changing a Key Lever

To change a key lever, first remove the cabinet except for the back and right-hand side. Unsolder the record lamp leads from the audio/servo or audio PCB. Remove the function switch PCB and put it out of the way. Remove the cassette carriage, then swing the audio/servo or audio board down. Remove the circlip from the right-hand end of the key pivot bar. Note that there's another similar bar upon which the lock plates pivot. Release all the key springs by unhooking them. Carefully draw out the pivot bar, then lay the freed keys and springs on the bench in order until you reach the required key. Reassemble in the reverse order, applying a touch of moly grease to the key levers. When resoldering the record lamp leads do this neatly as there's a piece of earthed print next to the supply connection. Note also, as should be well known by now, that the rods that operate the audio dub and record/playback switches do not go into the holes in the switches.

Switch Problems

While on the subject of these switches, although this is not strictly a mechanical fault these two switches do cause problems. The symptoms include intermittent sound on record, buzzing, no erase, etc. They can occasionally be cleaned, but more often than not require replacement. Needless to say the same symptoms will occur if there are no screws in the audio/servo board!

Common Faults

Another common fault is caused by the pause latch (see Fig. 3). This operates on a much-used principle employed in light switches, door catches and a multitude of other items. The idea is that a pin on a sliding bar follows a zigzag path in the spring-loaded latch: two back and forth movements are required to complete the path. A ramp releases the pin to the start position. The problem is that the latch is rather delicate and gets bent by heavy-handed use. Don't bother trying to repair it – it's well nigh impossible to get the shape right.

The other common complaint is that the record key can't be depressed. This is because someone has tried to force the record key down with a cassette with the tab knocked out inserted in the machine. The result (see Fig. 4) is that function plate E gets bent and the record key notch closes up. Repair or replace it – if you decide to repair it, note that the plate must be perfectly flat.

The other function plates will be damaged when someone tries to force keys, but can be put right by judicious use of a needle file.

Removing the Key Assembly

It's occasionally necessary to remove the complete key assembly for renewal, or because the machine has been dropped on its front and most of the keys have been bent (in such a case the best way to tackle the job is to remove the assembly). It's a rather daunting prospect but it's not too difficult. The key frame is used as an anchorage point for springs in the brake and reel drive department, so there are several springs to be unhooked above the deck and parts below the deck to be removed to gain access to the fixing screws. The stop solenoid must be detached: ensure that the peg engages with the slot correctly when you reassemble it. Also make sure that the rewind and fast forward key lever tails project into the U-shaped ends of the levers.

Miscellaneous Points

This virtually concludes our treatment of the mechanical side of these machines. Before we come to the end however there are one or two odds and ends that should be mentioned.

The hinge pins for the tuning door fall out and get lost, as does the spring. These pins are not listed as replacement parts, but half inch panel pins with the heads cut off will do. Check that none of the pins are loose inside the machine.

The rubber feet tend to work loose – a spot of cellulose paint on the ends of the screws inside the bottom cover cures this.

Don't stand the machine on a thick pile carpet that obscures the ventilation slots.

The remote pause socket is a prolific source of trouble due to the tags shorting against the chassis metalwork, giving permanent pause.

Well that's it! We hope that this series may prompt those who tend to avoid complicated mechanisms to have a go and revive some of these excellent but dated machines – they'll give service for a few more years yet.

The TDA3562A

Joseph Cieszynski

One of the recent additions to the Mullard range of TV chips is the TDA3562A colour decoder. Although similar to the well-known TDA3561, the new decoder chip incorporates extra features. When fault-finding it's essential to be aware of these.

One of the main features of the TDA3562A is automatic grey-scale compensation. The tube's first anode voltage and the highlights are manually set, but once this has been done the chip automatically controls the background, compensating for any variations in tube emission.

The Auto Grey-scale System

We'll consider first the operation of the grey-scale compensation system. A simplified block diagram is shown in Fig. 1. Compensation is applied to all three guns in the same way: to simplify matters we'll concentrate on the red gun.

All three guns are blanked in the usual way during the field flyback period. On line 23 the red gun is turned on by a test pulse from the i.c. This line is normally off the top of the screen and is thus visible only when the height is reduced. With a good gun the test pulse will produce a 10μA beam, which is the assumed black level. This current is sampled and feedback is applied to pin 18 of the i.c. At 10μA beam current the voltage at pin 18 should be 5V. During the test line the buffer amplifier is switched off to prevent red channel signals reaching the c.r.t. and thus affecting the beam current.

For comparison purposes a 3·48V reference voltage is present at pin 19 of the i.c. During the test period the i.c. checks that the gun is emitting 10μA. If the emission is low the feedback voltage will be less than 5V and a correction voltage will be stored by the capacitor connected to pin 10. This capacitor forms part of the internal feedback system which sets the red amplifier's gain to obtain a 10μA black level. The voltage stored by this capacitor is used throughout the duration of the field scan, after which the process is repeated and the voltage is updated as necessary.

The same procedure is used on lines 24 and 25 for the blue and green guns respectively. The blue storage capacitor is connected to pin 21 and the green storage capacitor to pin 20. Flyback blanking and beam current limiting are overridden during the test period to prevent them interfering with the feedback action.

Cold Start

When the TV set is first switched on there will be no beam current of course. The result could be a bright white raster once the tube has heated up, as the feedback system would turn up the gain of the RGB channels. This momentary bright white raster is undesirable both from the point of view of the customer and the line output stage. To avoid it, a cold-start circuit is employed. The cold-start procedure is as follows.

(1) For the first 1·5 seconds pin 18 of the i.c. is held at chassis potential to prevent feedback while the main supply rails are being established. Feedback during this period could confuse the i.c.'s internal logic. In Fig. 1 this action is performed by Tr1/C1/R1. The time-constant of the charging network C1/R1 is 1·5sec.

(2) From switch on multiple test lines are generated within the chip, at a rate of 20 per field, until beam current is detected. As soon as the first beam current is detected the i.c. blanks the c.r.t. for a further four seconds, the estimated final warm-up time.

(3) Tube blanking is then removed and the picture should stabilise. The total warm-up time takes about 12 seconds.

The usual signs of c.r.t. ageing will not be apparent. This means that the picture is liable to rapid deterioration once the emission has fallen outside the parameters set by the i.c. A way of checking whether the tube is ageing is to measure the voltages at pins 10, 20 and 21 – use a digital voltmeter. A difference of more than 0·2V is a clear indication that the chip is compensating heavily for differing gun emissions and that the tube is deteriorating.

The Sandcastle Pulse

The TDA3562A requires a three-step sandcastle pulse (see Fig. 2) which is fed in at pin 7 – the TDA3561 required a two-step pulse. This three-step pulse is produced by the sync processor/timebase oscillator chip, normally a TDA2578A. The levels are as follows:

(1) 2·5V, derived from the field oscillator. This is used for field flyback blanking. In the event of field collapse a continuous 2·5V d.c. is applied, blanking the screen to prevent phosphor burn. The blanking period is 21 lines.

(2) 4·6V, derived from a line flyback pulse. This is used for line flyback blanking.

(3) 11V, derived from the sync separator. This is used for

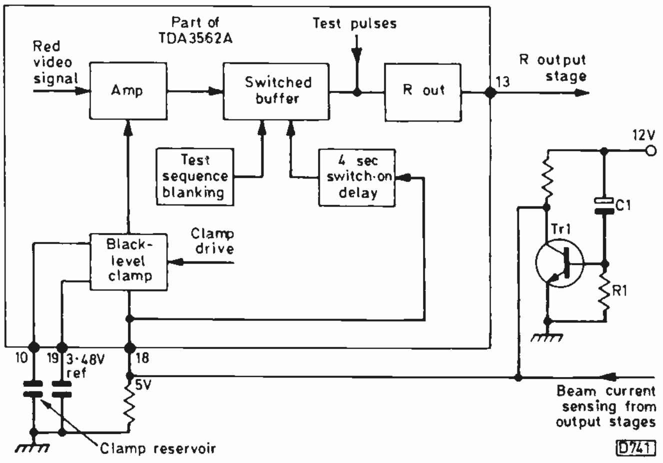

Fig. 1: Block diagram of the automatic grey-scale adjustment system (red channel only shown).

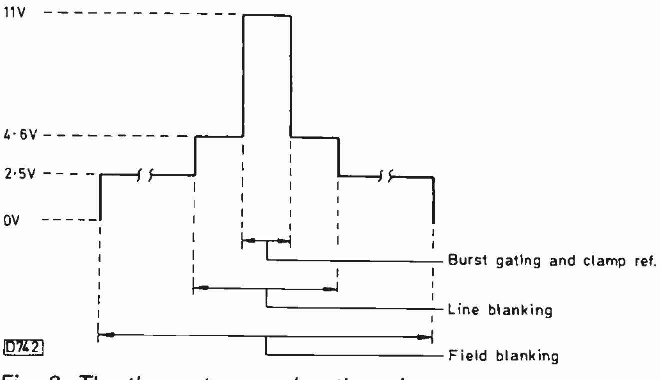

Fig. 2: The three-step sandcastle pulse.

burst gating and as the black-level clamp reference.

The absence or attenuation of any of these three levels will mute the i.c., resulting in a very dark raster which under normal lighting conditions is not visible.

Servicing

Engineers who have to deal with sets that employ this i.c. will be aware of the fact that many faults produce the no raster symptom. In some cases it can be difficult to identify where the fault lies.

An oscilloscope will usually show that the luminance signal is present at pin 8 but that there are no RGB outputs at pins 13, 15 and 17. If the i.c. is mounted in a holder a logical step would be to change it. In most cases however the fault condition will persist. At this point we strongly recommend a check on the sandcastle pulse at pin 7 (or an associated test point), not only to ensure that all three steps are present but also that they are of the correct amplitude. I've had experience of receivers with no raster where each step of the sandcastle was about 1V too low. On the first occasion I came across this I broke the golden rule of oscilloscope use and on seeing the correctly shaped waveform failed to check its amplitude. I eventually noticed that the pulse was about 4V larger at one end of the track than at the other. The cause was an invisible crack in the PCB.

If the sandcastle pulse is correct and the luminance signal is present at pin 8 it's worth checking that the 12V supply has not risen, possibly by only 1V, due to a defective regulator. Also check any external blanking transistors, diodes, etc. It's worth checking that the teletext or scart interfaces are not making the chip blank – this can in many cases be done simply by unplugging the interface input to the i.c.

There are various ways of finding which stage is at fault when the receiver fails to display a raster. As previously mentioned field collapse will result in loss of the first step of the sandcastle pulse and a blank raster. One way to check on this is to use a scope to look at the pulse. Since the field output chip is a power device however it's the most likely culprit. A much simpler check therefore is to short between the grid and cathode of one of the tube's guns — this can easily be done in the field. The relevant gun will then turn hard on, giving an immediate indication as to whether the field timebase is working. A warning is necessary however: this check won't tell you whether the field blanking is correct. In other words it's just possible that a raster will appear but that the first step of the sandcastle pulse is incorrect.

A method of overriding the beam current sensing at pin 18 is to disconnect the feedback from the RGB output stages and apply 5V from an external power supply. The i.c. will then assume that the tube's emission is correct and will attempt to produce a raster. If a raster is obtained by making this check you'll be on your way to identifying the fault. Even if a raster doesn't appear you'll at least have ruled out the auto-grey-scale system and, depending on the fault, you may be able to scope RGB outputs at pins 13, 15 and 17.

In conclusion, when dealing with this chip in a TV set always bear in mind that any fault that would make the tube turn on hard will in most cases result in no raster or the loss of one colour, also that a fault in either timebase will often upset the sandcastle pulse, again leading to a blank screen.

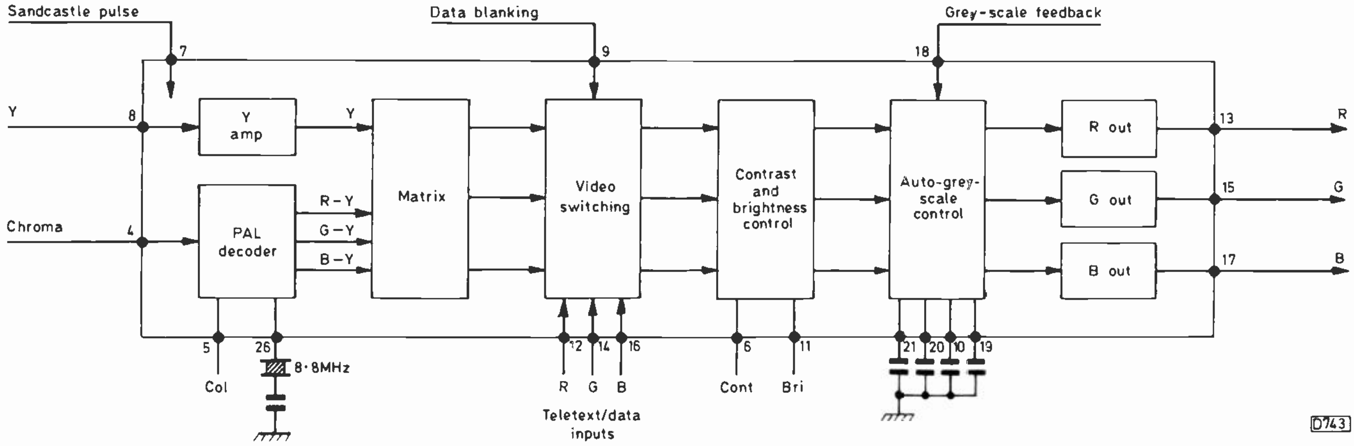

Fig. 3: Simplified block diagram for the TDA3562A.

ECONOMIC DEVICES & QUICK SAVE T.V. SPARES

15/80H	3.71
15/85R	3.30
16039	0.79
16181	1.04
16182	1.04
16334	0.98
16335	0.94
16446	0.98
16600	1.38
16802	1.27
17052	5.61
17053	5.61
17074	9.30
17089	3.45
17127	3.51
17376	1.58
1N4001	0.06
1N4002	0.06
1N4003	0.06
1N4004	0.08
1N4005	0.08
1N4006	0.08
1N4007	0.07
1N4148	0.03
1N4448	0.05
1N5401	0.14
1N5402	0.15
1N5403	0.16
1N5404	0.15
1N5408	0.35
1N914	0.04
IR3403	5.00
1S1555	0.31
1S44	0.10
1S5012A	0.81
1S921	0.10
2N1303	0.38
2N2219A	0.33
2N2222	0.38
2N2646	0.80
2N2904	0.36
2N2905	0.43
2N2906	0.38
2N2926	0.15
2N3053	0.27
2N3054	0.99
2N3055	0.61
2N3442	1.56
2N3702	0.14
2N3703	0.18
2N3705	0.16
2N3706	0.14
2N3707	0.16
2N3711	0.13
2N3771	0.70
2N3772	1.71
2N3773	1:65
2N3819	0.42
2N3823	1.17
2N3904	0.62
2N3908	0.62
2N4101	1.73
2N4240	3.30
2N4444	0.99
2N5293	0.50
2N5294	0.50
2N5296	0.49
2N5297	0.50
2N5298	0.61
2N5771	1.18
2N6109	1.58
2N6130	0.72
2N6133	1.25
2N6180	0.95
2N6292	1.65
2N696	0.43
2N698	0.43
2SA1006	1.50
2SA1011	1.65
2SA1015	0.49
2SA1012	1.25
2SA1020Y	0.89
2SA1027R	0.45
2SA473	0.75
2SA766S	4.95
2SC1173Y	1.25
2SC1474	1.25
2SC1509	1.35
2SD1391RL	3.95
2SA1095	3.74
2SA1103	6.55
2SA329	0.40
2SA489	1.17
2SA490	2.25
2SA493	2.25
2SA562	0.57
2SA564	0.75
2SA614	4.88
2SA628	1.14
2SA639S	1.75
2SA659	0.49
2SA673	1.50
2SA684	1.61
2SA697	1.05
2SA699	1.75
2SA715	0.95
2SA747	10.74
2SA748	1.36
2SA817	0.65
2SA818	1.82
2SA835	2.50
2SA836	0.89
2SA844	0.65
2SA872	0.80
2SA884	2.15
2SA937R	0.97

2SA940	0.59
2SA940-2	2.14
2SA950	0.72
2SA951	1.75
2SA966-Y	1.16
2SA999	1.36
2SB774	1.15
2SB185	1.13
2SB375	3.87
2SB400	0.40
2SB405	1.03
2SB449B	6.98
2SB511	2.26
2SB54	1.39
2SB546	3.75
2SB56	2.80
2SB618A	2.22
2SB631	1.45
2SB643	0.35
2SB669	3.67
2SB681	3.96
2SB695	1.98
2SB75	1.04
2SB774	0.61
2SB819	1.13
2SC1034	6.75
2SC1050	5.06
2SC1096	1.16
2SC1104	3.98
2SC1106	4.54
2SC1114	3.25
2SC1116	4.95
2SC1124	1.28
2SC1129	1.65
2SC1131	0.64
2SC1158	3.33
2SC1162	0.55
2SC1172	2.22
2SC1195	5.80
2SC1212A	1.97
2SC1213	0.89
2SC1226	1.46
2SC1293	0.90
2SC1306	1.98
2SC1316	10.25
2SC1317	0.87
2SC1364	0.49
2SC1383	1.20
2SC1391	2.45
2SC1398	0.79
2SC1413A	3.05
2SC1446	1.25
2SC1447	2.07
2SC1475	0.60
2SC1505	1.00
2SC1514	1.69
2SC1573Q	1.25
2SC1578	8.74
2SC1583	0.50
2SC1617	3.89
2SC675	1.41
2SC1678	1.98
2SC1741	1.25
2SC1810	1.70
2SC1815	0.45
2SC1826	0.67
2SC1829	3.34
2SC1875	5.85
2SC1881K	2.98
2SC1893	3.02
2SC1906	0.98
2SC1921	1.37
2SC1923	0.30
2SC1929	2.25
2SC1942	1.65
2SC1945	7.99
2SC1959	1.18
2SC1957	1.09
2SC1953	1.93
2SC1962	1.93
2SC1969	3.10
2SC1983	2.00
2SC1985	1.55
2SC2009	0.34
2SC2029	2.33
2SC2028	2.11
2SC2063	0.99
2SC2078	3.11
2SC2073	2.25
2SC2085-Q	1.65
2SC2091	1.30
2SC2141	2.44
2SC2166	1.98
2SC2216	0.69
2SC2233	2.20
2SC2236	1.65
2SC2278	1.69
2SC2314	2.17
2SC2335+KIT	13.44
2SC2551	1.26
2SC2565	3.92
2SC2570	2.88
2SC2577	3.58
2SC2578	6.75
2SC2671	1.99
2SC2826	2.07
2SC288A	1.85
2SC3153	6.84
2SC372	1.40
2SC373	1.16
2SC383	1.33
2SC388	0.50
2SC394V	0.81
2SC403C	0.60
2SC41	2.19
2SC458	0.39
2SC495	0.92
2SC515A	2.85

2SC535	0.79
2SC536	0.33
2SC537	0.54
2SC605L	1.16
2SC620	0.95
2SC643A	1.54
2SC668	0.67
2SC681	4.40
2SC682	1.88
2SC684	1.65
2SC693	0.63
2SC710	0.69
2SC711A	0.50
2SC717	1.28
2SC734	1.43
2SC761-Y	0.95
2SC783	3.98
2SC790Y	1.85
2SC828	0.28
2SC867A	3.84
2SC876	0.96
2SC930	0.54
2SC935	4.13
2SC936	8.66
2SC940	4.68
2SD1128	2.90
2SD1138	0.78
2SD1273	1.56
2SD1453	5.39
2SD152K	2.64
2SD198	3.87
2SD234	0.49
2SD235	0.60
2SD24	2.29
2SD257	2.94
2SD292	2.59
2SD313	2.59
2SD325D	2.26
2SD348	16.13
2SD350	5.20
2SD350A	2.80
2SD353	8.38
2SD389	2.41
2SD401	0.97
2SD414	1.98
2SD471	2.13
2SD560	2.95
2SD588A	2.36
2SD600	3.25
2SD601R	0.65
2SD613	1.03
2SD621	12.85
2SD636	0.55
2SD639-R	0.77
2SD655	0.98
2SD657	3.50
2SD661A	0.80
2SD731	1.05
2SD773	0.60
2SD811	7.65
2SD823	1.98
2SD837	1.56
2SD841	2.60
2SD856	1.55
2SD857Q	1.84
2SD882	1.15
2SD894	1.63
2SD898	3.45
2SK105H	2.15
2SK152	2.50
2SK34	0.76
2SK41	1.07
2SK79	2.98
40408	0.50
40594	1.53
40636	1.43
4EX581	0.80
741	0.30
7805-T022	0.63
7806	0.73
7808	0.85
7812-T022	0.35
7815	0.64
7818	0.92
7824	0.64
7905	0.80
9368	10.70
AA133	0.12
AC133	0.12
AC123K	0.43
AC127	0.27
AC128	0.34
AC138	0.24
AC141	0.29
AC142K	0.35
AC151	0.28
AC176	0.30
AC179	0.28
AC183	0.72
AC187	0.39
AC187K	0.43
AC188	0.47
AC188-01	0.49
AC188K	0.43
AC193K	0.65
AC194K	0.65
AD140	1.06
AD143	1.93
AD145	1.60
AD161	0.56
AD162	0.45
AD262	1.25
AF114	2.47
AF115	0.79
AF118	1.20
AF127	0.50
AF139	0.53
AF178	1.45
AF179	0.55

AF180	0.55
AF181	0.53
AF186	0.53
AF239	0.43
AF279	0.88
AL113	1.36
AN115	3.98
AN155	1.89
AN206	2.58
AN208	3.55
AN210	2.28
AN211	3.25
AN214Q	1.50
AN234	5.92
AN236	3.78
AN239	4.68
AN240P	1.25
AN241	1.71
AN245	4.49
AN253	1.10
AN260	3.85
AN262	1.20
AN272	8.25
AN295	5.52
AN301	3.60
AN302	3.99
AN303	4.39
AN305	8.95
AN315	2.46
AN316	5.53
AN318	5.44
AN320	5.47
AN321	2.25
AN322	5.85
AN331	4.59
AN337	3.81
AN340P	1.17
AN355	5.98
AN362	1.50
AN370	3.95
AN5010	5.70
AN5111	2.92
AN5120N	4.50
AN5132	4.39
AN5250	3.98
AN5435	2.80
AN5610	7.42
AN5612	4.68
AN5613	4.63
AN5630	3.95
AN5701N	1.66
AN6250	2.95
AN6300	4.40
AN6310	8.74
AN6320N	4.28
AN6340	10.14
AN6341	2.02
AN6342	2.77
AN6363	16.00
AN6371	9.24
AN6387	10.65
AN6531	1.95
AN6551	1.35
AN6552	0.68
AN6610	2.40
AN6677	10.45
AN7111	1.25
AN7114E	8.54
AN7115	3.38
AN7120	4.65
AN7145	2.80
AN7146	4.35
AN7151	2.26
AN7156	2.85
AN7158	2.32
AN7218	1.64
AN7223	4.25
AU107	3.50
AU110	2.25
AU113	5.25
AY105K	2.08
AY106	1.09
BA524	8.21
B250	2.65
B40	1.55
BA130	0.14
BA1310	1.98
BA1320	1.38
BA1322	3.95
BA1330	2.75
BA145	0.19
BA148	0.25
BA154	0.40
BA155	0.12
BA156	0.05
BA159	0.08
BA182	0.24
BA222	1.66
BA302	1.24
BA311	1.32
BA312	1.05
BA313	0.76
BA317	0.08
BA318	0.02
BA328	1.65
BA333	1.37
BA335	6.27
BA5102A	2.86
BA511	2.92
BA514	2.20
BA521	2.52
BA524	8.94
BA526	7.98
BA527	2.98
BA532	1.56
BA536	1.35
BA6209	4.55

BA656	5.46
BA7100	11.35
BA841A	28.98
BA843	3.96
BA854	5.76
BAV18	0.21
BAV19	0.11
BAV20	0.35
BAV21	0.12
BAW62	0.29
BAX12	0.48
BAX13	0.11
BAX16	0.11
BC107	0.13
BC107A	0.11
BC107B	0.18
BC108	0.15
BC108B	0.15
BC109	0.12
BC109B	0.15
BC109C	0.12
BC113	0.14
BC119	0.36
BC126	0.23
BC132	0.14
BC135	0.14
BC137	0.18
BC138	0.34
BC139	0.28
BC140	0.45
BC141	0.34
BC142	0.23
BC143	0.19
BC147	0.08
BC148A	0.11
BC148B	0.13
BC148C	0.11
BC149	0.11
BC149B	0.13
BC153	0.14
BC154	0.14
BC159	0.36
BC160	0.40
BC161	0.28
BC168	0.36
BC169C	0.16
BC170	0.16
BC171	0.11
BC172	0.13
BC172B	0.27
BC173	0.17
BC174B	0.27
BC177	0.35
BC178	0.26
BC179	0.26
BC182	0.08
BC182L	0.10
BC182LB	0.14
BC183L	0.11
BC183LB	0.26
BC184	0.13
BC184L	0.14
BC184LB	0.26
BC186	0.27
BC187	0.28
BC204	0.16
BC207	0.14
BC212	0.11
BC212B	0.26
BC213L	0.10
BC213LB	0.15
BC214	0.10
BC214LB	0.26
BC225	0.40
BC237	0.10
BC237BJ	0.12
BC238	0.10
BC238A	0.13
BC238B	0.13
BC239	0.12
BC239B	0.25
BC251A	0.31
BC294	0.50
BC300	0.35
BC301	0.45
BC302	0.53
BC303	1.04
BC307	0.18
BC307A	0.14
BC308	0.18
BC308A	0.11
BC309	0.17
BC317A	0.13
BC327	0.15
BC328	0.10
BC337	0.09
BC338	0.34
BC368	0.24
BC440	1.09
BC441	0.44
BC454	0.36
BC460	0.42
BC461	0.35
BC462	1.15
BC463	0.64
BC477	0.37
BC478	0.22
BC479	0.41
BC532	0.28
BC546	0.14
BC547	0.10
BC548	0.10
BC549	0.10
BC550	0.10
BC556	0.10
BC557	0.10
BC558	0.10
BC559	0.10
BC559B	0.11

BC560C	0.14
BC635	0.30
BC636	0.28
BC637	0.24
BC639	0.20
BC640	0.24
BC879	0.39
BC880	0.31
BCX34	0.40
BCY70	0.30
BCY71	0.21
BCY72	0.20
BD115	0.34
BD116	0.70
BD124	1.31
BD124P+KIT	0.69
BD131	0.57
BD132	0.42
BD133	0.53
BD135	0.36
BD136	0.26
BD137	0.36
BD138	0.46
BD139	0.34
BD140	0.29
BD144	1.70
BD150	1.25
BD157	0.67
BD160	1.60
BD163	0.71
BD165	0.62
BD166	0.42
BD168	0.73
BD175	0.20
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	0.40
BD202	0.60
BD203	0.50
BD204	0.61
BD207	1.79
BD208	0.34
BD222	0.44
BD225	0.49
BD228	0.63
BD229	1.05
BD232	0.50
BD234	0.42
BD237	0.47
BD238	0.39
BD239	0.45
BD240	0.57
BD241	0.39
BD242	0.39
BD243A	0.33
BD243C	0.29
BD244	0.51
BD244C	0.79
BD245C	0.99
BD246C	1.25
BD253	1.05
BD278A	0.60
BD317	2.60
BD318	2.85
BD375	0.42
BD380	0.76
BD410	0.52
BD433	0.47
BD434	0.49
BD435	0.49
BD436	0.60
BD437	0.49
BD438	0.40
BD441	1.42
BD442	1.41
BD509	1.65
BD510	0.62
BD519	1.50
BD529	0.62
BD530	1.18
BD533	0.67
BD534	0.53
BD535	0.79
BD536	0.61
BD537	0.80
BD538	1.45
BD544B	0.83
BD598	1.25
BD677	0.69
BD679	0.57
BD680	0.76
BD681	1.48
BD696	2.47
BD699	3.49
BD700	3.70
BD707	0.98
BD709	1.05
BD710	0.80
BD809	0.85
BD810	0.69
BD879	0.74
BD880	0.79
BD895	2.31
BD899	2.48
BD901	0.79
BD902	0.84
BDW83C	1.45
BDW84C	1.56
BDX32	1.75
BDX53A	4.93
BDX53B	1.85
BDX54B	2.16
BDX62A	2.15

BDX63A	1.96
BDY20	1.21
BDY81	1.05
BF115	0.40
BF117	0.66
BF118	0.67
BF121	0.25
BF123	0.21
BF127	0.13
BF137	0.29
BF153	0.58
BF154	0.26
BF157	0.33
BF158	0.18
BF159	0.18
BF160	0.31
BF167	0.38
BF173	0.34
BF177	0.35
BF178	0.40
BF179	0.36
BF180	0.36
BF181	0.32
BF182	0.34
BF183	0.39
BF184	0.43
BF185	0.39
BF194	0.14
BF195	0.14
BF196	0.17
BF197	0.18
BF198	0.17
BF199	0.17
BF200	0.37
BF218	0.36
BF224	0.17
BF237	0.65
BF240	0.17
BF241	0.17
BF245	0.50
BF245A	0.52
BF245B	0.49
BF246A	2.52
BF255	0.20
BF256	0.38
BF256LB	0.42
BF256LC	0.82
BF257	0.34
BF258	0.36
BF259	0.34
BF262	0.57
BF263	0.57
BF271	0.34
BF273	0.20
BF274	0.20
BF324	0.35
BF336	0.33
BF337	0.45
BF338	0.33
BF355	0.31
BF362	0.62
BF363	0.60
BF371	0.50
BF391	0.25
BF417	0.84
BF418	1.87
BF422	0.29
BF423	0.52
BF450	0.35
BF451	0.29
BF457	0.41
BF458	0.26
BF459	0.52
BF460	0.60
BF469	0.22
BF470	0.55
BF471	0.33
BF472	0.33
BF479	0.35
BF480	1.38
BF491	1.99
BF495	0.64
BF506	0.43
BF509	0.41
BF523	0.24
BF532	0.45
BF596	0.18
BF597	0.27
BF694	0.22
BF757	0.59
BF759	0.47
BF761	1.05
BF762	0.50
BF869	0.47
BF870	0.30
BF959	0.42
BF960	0.49
BF970	0.50
BFR39	0.44
BFR61	0.92
BFR62	0.50
BFR79	0.29
BFR81	1.65
BFR86	1.08
BFR89	1.63
BFR90A	0.70
BFT42	0.43
BFT43	0.43
BFT84	0.40
BFW10	0.60
BFX29	0.34
BFX84	0.37
BFX85	0.41
BFX86	0.36
BFX87	0.55
BFX88	0.34
BFX89	0.44
BFY50	0.32
BFY51	0.25

BFY52	0.27
BFY79	0.49
BFY90	0.61
BLY49	2.20
BR100	0.29
BR101	0.65
BR103	0.55
BR303	1.23
BRC116	0.67
BRC300	2.01
BRC5296	0.77
BRC6109	0.83
BRC82	1.08
BRC83	2.19
BRC84	2.08
BRX44	0.60
BRX49	0.67
BRY39	0.69
BSS38	0.87
BSTB0140G	5.25
BSTC0246	6.99
BSTC0233	7.25
BSTCC0143	3.07
BSTD1043	2.85
BSV57B	3.49
BSW68	0.60
BSX19	1.29
BSX20	0.34
BSY52	0.50
BSY79	0.51
BT100A	1.61
BT108	1.45
BT119	1.76
BT120	2.17
BT121	2.48
BT123	1.98
BT151-800R	0.89
BTT6018	2.42
BTT8124	4.89
BU106	2.48
BU108	1.50
BU109	2.65
BU110	5.69
BU111Y	4.16
BU125	2.48
BU126	1.23
BU137	6.53
BU205	1.35
BU206	1.27
BU207	1.65
BU208	1.46
BU208/02	1.97
BU208A	1.12
BU208D	1.95
BU209	1.50
BU226	2.95
BU326	2.00
BU326A	2.20
BU326S	2.20
BU406	1.49
BU406D	1.79
BU407	0.82
BU407D	0.99
BU412	9.15
BU426A	1.13
BU500	1.45
BU508A	1.25
BU536	1.86
BU608	2.72
BU705	1.85
BU806	1.79
BU807	0.80
BU826A	2.15
BUW84	1.39
BUX84	1.00
BUX85	1.10
BUY69A	2.04
BY126	0.13
BY127	0.08
BY133	0.12
BY164	0.44
BY176	0.52
BY179	1.08
BY182	0.95
BY184	0.40
BY187	0.77
BY189	1.79
BY198	1.62
BY201/2	1.50
BY203/20	0.59
BY207	0.22
BY208	0.46
BY210-400	0.19
BY210-600	0.27
BY210-800	0.34
BY218	1.64
BY223	1.23
BY224-600	1.88
BY225-100	1.13
BY226	0.25
BY227	0.49
BY228	0.60
BY229-1000	1.12
BY229-600	0.92
BY255	0.69
BY295-600	1.03
BY298	0.36
BY299	0.45
BY407	0.90
BY409	1.49
BY448	1.35
BY713	1.10
BYW19/1000	0.69
BYW56	0.24
BYX10	0.29
BYX55-600	0.23
BYX71-600	0.90

BYX71-350	0.95
BYX94	0.16
BYY56	1.20
BZY93C30	1.86
BZY88 RANGE	0.10
BZX61 RANGE	0.18
BZX79 RANGE	0.10
C106D	0.46
C106M	0.76
C1129	0.58
CA3046	1.55
CA3089	0.83
CA3090AQ	3.25
CA3094	2.20
CA3131EM	2.95
CBF16848N-071	1.56
CD4001	0.34
CD4002	0.27
CD4008	1.35
CD4011	0.29
CD4012	0.24
CD4013	0.33
CD4016	0.46
CD4017	0.82
CD4020	1.23
CD4021	0.39
CD4023	0.28
CD4025	0.64
CD4028	0.84
CD4040B	0.85
CD4047	1.06
CD4049	0.46
CD4052	0.75
CD4066	0.30
CD4069	0.29
CD4070	0.66
CD4081	0.35
CD4093	0.72
CD4511	1.10
CD4528	2.04
CD4556	1.47
CR02AM-8	1.70
CV12E	4.09
CX095D	3.14
CX104	9.64
CX108	10.50
CX109	7.86
CX130	8.76
CX134	12.32
CX136	11.49
CX139	11.83
CX157	4.84
CX158	5.52
CX177	6.46
CX187	6.84
CX755	12.95
CX885A	6.85
DEC1	2.20
DEC2	2.20
DS3486N	4.33
DS3487N	4.95
E1222	0.40
E5024	0.28
E5386	0.25
E9003	0.46
E9005	0.50
ESM310BP	4.15
FND500	5.78
GC374	1.65
GD243	4.95
GF758	0.84
GH3F	1.82
HA11215	2.45
HA11211	2.53
HA11225	1.50
HA11226	10.44
HA11229	0.85
HA11235	2.48
HA11124	5.25
HA11244	4.02
HA11251	4.47
HA1125	4.29
HA1137W	2.87
HA1138	5.03
HA11414	5.65
HA1144	7.87
HA1156	1.16
HA1160	4.78
HA1166	1.96
HA1166X	6.43
HA1167	5.36
HA11706	9.50
HA11705	8.00
HA11703	4.22
HA11701	4.56
HA11710	9.50
HA11713	9.75
HA11711	20.16
HA11715	3.25
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HA11716	13.10
HA11725	18.26
HA11725MP	16.00
HA117555P	6.23
HA11781	8.90
HA1180	5.15
HA1196	7.43
HA13001	2.25
HA1306	2.26
HA1338	7.50
HA1339	2.33
HA13402	7.87
HA13342	2.65
HA13365	4.02
HA1366WR	1.50
HA1367	4.32
HA1368R	2.45
HA1368	2.07
HA1370	3.30

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

PO BOX 15, WOLVERHAMPTON, WV2 4AZ ☎ TEL 0902 712083

HA1374	4.80
HA1377	4.98
HA1389R	2.05
HA1389	2.39
HA1392	1.65
HA1394	3.95
HA1397	3.76
HA1398	3.98
HA1406	2.47
HA1452	0.85
HBF4030AF	2.48
HD14538	2.07
HD38702-A2	8.95
HD38750A53	11.78
HD38750A-7	7.25
HD38800A50	14.09
HD44801A05	19.98
HEF4001BP	0.67
HISH1010	8.59
HISH1004	6.00
HISH1002	9.50
HM6231	9.81
HM6232	10.65
HM6251	4.95
HM7103	4.85
HM9032	9.98
HM9012	3.22
HM9015	3.24
HT4207	17.16
HT4208	20.65
IN5401	0.11
IR2403	4.25
IR2C05	4.25
IR3P06	2.25
IR3P08	4.95
IR94558	6.25
IS751	2.85
ITT425	0.18
IZ0003GE	5.37
IZ0020GE	5.93
K174YP	3.46
KA2101	2.92
KC581C	6.32
KC582C	3.97
KC583C	6.63
L200CV	1.69
LA1201	1.02
LA1210	1.56
LA1230	1.10
LA1320	2.87
LA1352	1.75
LA1357N	11.07
LA1363	1.05
LA1364	3.02
LA1365J	0.95
LA1385	1.94
LA1387	8.10
LA3155	1.25
LA3301	1.65
LA3350	1.43
LA3361	3.89
LA3365	3.98
LA3390	5.52
LA4030P	3.16
LA4031P	3.20
LA4032P	2.35
LA4100	1.25
LA4101	1.30
LA4102	0.99
LA4112	0.56
LA4125	2.25
LA4138	3.45
LA4140	0.60
LA4192	4.29
LA4220	1.00
LA4250	6.75
LA4400	3.92
LA4420	1.72
LA4422	1.72
LA4430	1.56
LA4440	2.95
LA4445	3.95
LA4460	2.32
LA4461	2.95
LA4505	5.85
LA5112N	1.68
LA7020	13.86
LA7025	11.97
LA7027	10.92
LA7040	9.20
LA7042	3.58
LA7800	1.65
LA7801	1.92
LB1274	3.61
LC7800	9.20
LD3120	1.13
LD3150	2.55
LM1017N	1.75
LM1877	12.50
LM224	1.75
LM2808	6.25
LM2877	5.25
LM317CKC	1.00
LM324N	0.54
LM339N	0.80
LM340K	11.85
LM348N	2.15
LM380N	2.80
LM384N01	3.25
LM567CN	1.71
LM6402/011	10.23
LM6402A093	10.15
LM748	0.69
LM8360	3.87
LM8361	3.57
LR2612	11.95

LR3419	9.37
LR3471	9.37
LU1141	7.27
LU52012	5.95
LU52011	14.95
LU53112	12.37
M193	6.83
M21C	1.13
M23C	2.83
M293	6.95
M51102L	4.95
M5115P	5.24
M51203L	3.15
M51231P	0.95
M5134-9341	4.13
M51353P	5.25
M51381P	5.09
M51393AP	9.35
M51394P	14.05
M5142P	6.85
M5144P	2.97
M51513L	2.06
M51515BL	3.23
M51517L	2.90
M5192	2.20
M5194AP	5.74
M5231L	1.95
M53274P	1.33
M54532P	1.71
M54544L	3.45
M58478P	8.77
M58485P	13.65
MA06	1.07
MA8001	0.82
MA8003	1.16
MB3705	1.98
MB3712	1.85
MB3713	1.69
MB3730	2.94
MC13002	3.69
MC1310P	2.25
MC1327P	1.33
MC1330P	1.45
MC1350P	1.61
MC1351P	3.96
MC1352P	2.50
MC1357P	2.15
MC1358P	1.55
MC14001	2.40
MC14013	0.41
MC14493P	5.64
MC14494P	2.15
MC14497	3.15
MC14510BAL	3.75
MC14511BCP	1.10
MC14528BCP	2.15
MC1712	3.88
MC5192	19.50
MC7724CP	3.49
MC7818C	2.18
MCR100/7	1.65
MCR106-5/6	0.95
MCR220/7	2.28
ME0402	0.17
ME0404/2	0.47
ME0411	0.28
ME6002	0.26
ME6102	0.28
ME8001	0.34
ME0411	0.75
MJ2501	3.30
MJ3001	1.76
MJ481	1.53
MJ802	4.90
MJE2955	1.89
MJE3055	1.05
MJE340	0.49
MJE520	0.49
ML231	3.33
ML232B	3.65
ML237B	2.51
ML238	5.77
ML923	3.35
ML926	3.98
MM5314N	8.99
MM5316N	9.16
MM5318N	3.11
MM5369N	2.01
MM5387AAN	6.20
MM5841N	6.64
MN1400VL	13.65
MN1405	12.95
MN1435VX	12.75
MN6016A	20.56
MP1192	5.07
MP2794	4.00
MP2812	5.07
MP8512	1.57
MPC596	2.13
MPF256C	0.60
MPS6570	0.48
MPSA42	0.65
MPSA56	0.27
MPSA92	0.72
MPSU05	0.86
MPSU10	1.65
MPSU56	0.78
MPSU60	1.98
MR818	0.33
MR854	0.72
MR914	1.20
MSM5816RS	17.35
MSM5840H	9.70
MVS460-02	0.61
NE542	2.65
NE545B	4.86
NE555	0.25
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NE565N	1.33
NE645BN	3.35
NP1106	8.60
OA202	0.11
OA47	0.16
OA91	0.09
OA95	0.12
OC28	2.95
OC29	2.15
OC36	1.28
OC44	0.35
OC45	0.18
OC72	0.44
OC75	0.44
ON236	1.06
ON782	1.98
OT121	1.45
PT6042	2.45
PT8504	4.98
R1038	2.19
R1039	2.19
R2008B	1.33
R2009	1.98
R2010B	1.33
R2029	1.33
R2030	1.33
R2257	3.71
R2265	1.49
R2305	1.18
R2322	0.59
R2323	0.76
R2354A	2.01
R2354B	2.01
R2443	0.88
R2461	1.50
R2540	1.95
R2540X	3.30
R2615	0.67
RCA16029	2.01
RCA16600	1.38
RCA16802	1.08
RCA17074	6.60
RCA17376	1.58
RCA17524	0.83
RCA17523	0.83
RCA2060	2.00
RGP01-15	1.65
RGP10	0.30
RGP30M	0.40
RT402	1.58
RT905A	2.38
S1299	7.98
S175	31.48
S2062D	0.95
S2800D	5.54
S2802	3.47
S2818	4.05
S3702S	6.15
S40W	10.50
S6080B	8.80
SA8063	5.17
SAA1006	1.75
SAA1020	4.76
SAA1025	4.40
SAA1024	2.81
SAA1075	6.25
SAA1121	7.44
SAA1124	3.30
SAA1130	4.99
SAA1174	7.77
SAA1250	4.15
SAA1251	5.98
SAA11351	4.95
SAA3027P	2.55
SAA5000	2.40
SAA5010	5.39
SAA5012	5.20
SAA5020	5.78
SAA5030	8.25
SAA5050	7.74
SAB1009B	5.98
SAB3011	7.34
SAB3013	3.76
SAB3021	7.90
SAB3024	6.36
SAB3209	5.82
SAB3210	3.10
SAF1032P	5.50
SAF1039	3.35
SAS5010	8.39
SAS560S	2.26
SAS560T	5.42
SAS570T	5.42
SAS570S	2.61
SAS580	2.25
SAS6600	1.33
SAS660	2.97
SAS6700	1.33
SAS670	3.96
SAS6710	1.93
SBA750	1.61
SC84203	19.35
SC9504P	1.95
SDA2006	17.95
SDA2112/2	12.85
SG264A	6.45
SG613	10.75
SG629	8.27
SG6533	11.96
SI-1020H	10.89
SI-1125HD	17.63
SI1125H	7.50
SI1225HD	19.27
SI1630HD	21.98
SI6900	12.00
SKE1/02	1.85
SKE2F1/04	1.39
SKE2G3/04	1.05
SKE4F1/06	0.35

SKE4F2/08	1.24
SKE4F2/06	0.44
SKE4F2/10	1.24
SKE4G2/02	0.96
SKE5F3/10	1.60
SKS1/10	2.15
SL1310	3.14
SL1430T	2.32
SL414	3.69
SL432A	3.44
SL439	2.48
SL471	4.78
SL480	3.98
SL490	2.44
SL901B	6.95
SL918A	6.98
SN16861AN0	1.65
SN16862AN	2.98
SN16966N	10.25
SN29717N	7.19
SN29716N	3.66
SN29715N	6.04
SN29722	11.95
SN29723AN	8.77
SN29764AN	0.99
SN29767	4.98
SN29770BN	1.95
SN29772BN	2.95
SN29771BN	1.48
SN29791	2.98
SN29798N	5.56
SN2709	0.44
SN7400N	0.34
SN7401N	0.36
SN7402N	0.65
SN7404N	0.24
SN7408N	0.27
SN7410N	0.27
SN74121	1.60
SN7413N	0.37
SN74141N	2.65
SN74151AN	1.51
SN74154N	1.27
SN74190	1.35
SN7420N	0.34
SN7430	0.49
SN7440N	0.27
SN7472	1.54
SN7474N	0.44
SN7490AN	0.93
SN74LS26N	0.53
SN76001N	1.65
SN76013ND	7.50
SN76023N	5.15
SN76023ND	3.96
SN76033N	3.65
SN76110N	0.90
SN76115AN	1.61
SN76131	1.92
SN76227N	1.33
SN76226DN	1.98
SN76228N	3.27
SN76242	8.95
SN76243	8.50
SN76396	2.90
SN76533N	2.47
SN76532N	2.95
SN76545	1.95
SN76546N	3.47
SN76549	2.59
SN76570	3.08
SN76611	2.59
SN76620	2.59
SN76660N	2.48
SN76666N	1.20
SN76708	4.86
SN76707N	5.11
SN76705N	6.60
SN76730	6.00
SN76810N	0.60
SN76832N	3.25
SN94041	5.54
SN94042	5.54
SP8385	0.55
SPS5384	1.98
ST1702L	0.99
STA401	6.76
STA441C	3.00
STA471C	7.56
STK0029	5.54
STK0039	5.11
STK0040	12.78
STK0050	7.72
STK0080	9.16
STK011	5.08
STK013	9.25
STK014	9.80
STK015	7.75
STK016	8.45
STK022	5.25
STK025	10.32
STK031	12.95
STK040	9.40
STK043	13.34
STK054	7.13
STK058	27.50
STK077	7.67
STK078	8.48
STK080	16.50
STK082	11.86
STK086	13.59
STK1039	5.75
STK2110	7.33
STK2145	16.25
STK2230	7.70
STK2240	14.40
STK2250	18.95

STK3042	9.95
STK3044	5.75
STK4019	4.50
STK430	10.55
STK433	6.25
STK4332	8.25
STK435	5.94
STK4352	12.25
STK436	4.70
STK437	9.65
STK4372	3.85
STK439	7.25
STK441	10.25
STK443	10.29
STK457	13.45
STK460	6.10
STK461	9.68
STK463	11.85
STK466	11.77
STK4833	16.95
STK501	6.32
STK502	5.74
STK5314	12.32
STK5730	3.95
STK7216	14.50
STK772	6.95
STR1096	5.45
STR4090	11.98
STR440	7.85
STR441	3.95
STR451	5.36
STR453	8.16
STR454	7.50
STR6020+KIT	8.31
T6029V	5.75
T6035V	0.73
T6036	0.67
T6037	2.11
T6044V	0.97
T6045	1.20
T6049	1.45
T6052V	0.87
T6058	3.08
T6059	2.77
T9003V	1.25
T9005V	2.38
T9011V	0.49
T9013V	7.22
T9014V	2.60
T9016	1.02
T9019W	1.98
T9034V	1.45
T9035V	1.95
T9051	6.80
T9054V	0.77
T9057V	0.70
T9062V	0.49
T9064	1.03
TA6002	4.35
TA7027	4.80
TA7050	1.74
TA7051	1.74
TA7054	2.55
TA7060AP	0.71
TA7061AP	1.27
TA7069	3.13
TA7070P	1.83
TA7072P	2.57
TA7073P	5.86
TA7074P	1.98
TA7076P	7.80
TA7089P	3.10
TA7092P	8.65
TA7093P	3.99
TA7102P	5.88
TA7108P	1.61
TA7109	3.71
TA7122B/P	0.92
TA7124P	2.34
TA7129P	1.50
TA7130P	1.27
TA7136AP	1.27
TA7137P	0.98
TA7141AP	3.87
TA7146	2.50
TA7146P	4.23
TA7148P	1.67
TA7149P	3.26
TA7152P	2.09
TA7161P	5.45
TA7162P	3.25
TA7169	7.80
TA7172P	1.41
TA7176P	2.48
TA7201P	2.71
TA7203P	2.18
TA7204P	2.16
TA7205P	0.99
TA7206P	6.35
TA7207P	3.34
TA7208P	2.15
TA7210P	3.58
TA7214P	3.63
TA7215P	2.58
TA7217AP	1.45
TA7222	1.95
TA7226	3.57
TA7227P	2.81
TA7229P	4.45
TA7230P	4.98
TA7232P	6.60
TA7233P	3.15
TA7240AP	3.55
TA7245P	5.92
TA7270	7.50
TA7310P	2.15

TA7312P	2.45
TA7313AP	1.36
TA7314	5.94
TA7323P	3.15
TA7325P	1.15
TA7339P	1.85
TA7340P	5.95
TA7607AP	3.10
TA7609	3.91
TA7611AP	3.25
TA7616P	5.25
TA7622AP	12.87
TA7628P	5.06
TA7629P	7.50
TA7630P	1.55
TA7640AP	2.29
TA7672P	2.40
TA7676P	2.81
TA7726P	12.50
TAA320A	1.27
TAA350A	6.45
TAA570	1.74
TAA621AX1	4.85
TAA621A12	2.14
TAA661B	2.62
TAA691	8.58
TAA700	3.75
TAA930	4.87
TAA970	2.83
TAA110	2.52
TAG232-600	0.79
TAG626-600	1.20
TBA120AS	0.85
TBA120SB	1.05
TBA120T	0.65
TBA120U	0.62
TBA120A	1.05
TBA1440	1.80
TBA1441	1.95
TBA1441	2.80
TBA240A	2.65
TBA395	1.10
TBA395Q	1.10
TBA396	2.90
TBA400	2.39
TBA440P	1.55
TBA480Q	1.30
TBA510	2.11
TBA520	1.84
TBA520Q	1.68
TBA530	1.30
TBA530	1.30
TBA540	1.15
TBA540Q	1.15
TBA560C	1.40
TBA560CQ	1.60
TBA570Q	1.60
TBA570A	1.71
TBA641A12	4.13
TBA641B72	3.03
TBA651	0.87
TBA673	2.60
TBA700	1.85
TBA720	2.65
TBA730	3.55
TBA750Q	2.90
TBA760	1.71
TBA800	0.85
TBA810S	1.61
TBA810T	1.50
TBA810AS	1.00
TBA820	1.52
TBA820M	1.10
TBA890	2.50
TBA920	1.53
TBA920Q	2.31
TBA940	1.87
TBA950	1.84
TBA970	3.56
TBA990	1.82
TBA990Q	1.68
TC4001BP	3.25
TC4011BP	3.50
TC4013BP	3.75
TC4016BP	3.15
TC4053BP	4.34
TC4069	2.25
TC4071BP	2.76
TC4081BP	3.25
TC40H000	1.98
TC4514BP	5.44
TC9002BP	11.34
TCA270Q	1.71
TCA270S	1.27
TCA270SQ	1.65
TCA290A	2.39
TCA420A	2.16
TCA440	2.25
TCA530	2.24
TCA640	2.25
TCA650	3.05
TCA660B	2.60
TCA730	3.81
TCA750	2.25
TCA800Q	6.95
TCA830S	2.38
TCA890	5.44
TCA900	2.04
TCA910	2.04
TCA940	2.47
TCA940E	2.93
TCE330	3.89
TCEP100Q	10.25
TCEP100	9.61
TD3406AP	3.98
TD3F800R	4.16
TD3F900H	4.16

TD62105F	2.50
TD62104F	2.50
TD62706F	4.50
TDA1001B	2.31
TDA1003A	2.25
TDA1005A	2.38
TDA1006A	2.11
TDA1010AF	4.25
TDA1011	1.65
TDA1010	1.28
TDA1011A	1.03
TDA1028	2.45
TDA1034B	2.42
TDA1035S	2.95
TDA1035T	1.85
TDA1037	1.78
TDA1037D	2.05
TDA1044	2.41
TDA1047	4.10
TDA1059B	0.98
TDA1054M	1.35
TDA1060	2.60
TDA1082	2.95
TDA1151	1.22
TDA1170S	2.25
TDA1190	2.11
TDA1190Z	3.96
TDA1200	1.50
TDA1235	3.88
TDA1236	4.30
TDA1270	3.55
TDA1327A	1.33
TDA1412	1.05
TDA1420	2.55
TDA1444	3.45
TDA1470	2.25
TDA1470P	4.25
TDA1506	7.85
TDA1510	4.60
TDA1512	3.69
TDA1515	6.98
TDA1559	3.15
TDA1670	4.48
TDA1770	3.85
TDA1905	1.76
TDA1908	1.95
TDA1940	1.95
TDA1950	2.95
TDA2005	3.95
TDA2006	1.55
TDA2004	3.49
TDA2002	0.90
TDA2008	1.75
TDA2010	1.68
TDA2020	1.95
TDA2030	1.99
TDA2140	1.68
TDA2150	6.20
TDA2151	2.07
TDA2160	4.01
TDA2161	1.85
TDA2170	2.88
TDA2270	4.65
TDA2510	7.85
TDA2520	2.37
TDA2522	3.46
TDA2524	4.50
TDA2521	3.71
TDA2525	3.80
TDA2532	2.50
TDA2530	2.55
TDA2541	2.48
TDA2540	2.15
TDA2545Q	5.94
TDA2560	2.17
TDA2575A	0.50
TDA2576A	3.00
TDA2571A	4.45
TDA2578A	2.57
TDA2576A+KIT	12.35
TDA2581	1.65
TDA2582	1.30
TDA2591	2.50
TDA2594	3.26
TDA2593	2.47
TDA2595	2.06
TDA2640	6.50
TDA2611AQ	2.98
TDA2612Q	4.68
TDA2611A	1.05
TDA2610	3.08
TDA2620	2.15
TDA2630	1.96
TDA2631	2.73
TDA2640	2.95
TDA2652	13.45
TDA2653	2.95
TDA2654	6.18
TDA2670	2.54
TDA2680	3.20
TDA2690A	2.65
TDA2740	6.00
TDA2780AQ	5.14
TDA2795	2.78
TDA2791	2.5
TDA2910	13.25
TDA3300T	2.88
TDA3300B	6.98
TDA3330	2.95
TDA3506	7.98
TDA3501	7.25
TDA3500	4.25
TDA3510	4.55
TDA3520	9.71
TDA3540	6.99
TDA3541	1.95

TDA3560	5.25
TDA3571Q	3.48
TDA3576	5.98
TDA3590	5.79
TDA3591	6.45
TDA3650	7.95
TDA3652	2.95
TDA3651AQ	2.95
TDA3651	1.95
TDA3651A	1.75
TDA3950	2.95
TDA4050B	3.95
TDA4280	5.95
TDA4290	4.47
TDA4400	2.27
TDA4420	4.02
TDA4422	3.65
TDA4427S	9.00
TDA4431	2.27
TDA4440	3.26
TDA4442	4.15
TDA4500	4.75
TDA4600	2.10
TDA4610	1.78
TDA4620	4.78
TDA5500	6.03
TDA5700	2.75
TDA7270S	2.25
TDA8190	2.47
TDA9403	2.35
TDA9503	4.20
TDA9513	5.44
TDB1033	2.68
TDE1081	7.05
TE626	1.49
TEA1002	2.30
TEA1009	1.86
TEA1014	2.50
TEA1020SP	8.21
TIC106C	0.61
TIC106M	0.57
TIC116Y100	2.07
TIC44	0.72
TIC45	0.50
TIC47	0.35
TIP120	1.06
TIP110	0.45
TIP112	0.54
TIP117	0.50
TIP121	0.87
TIP126	0.73
TIP132	1.40
TIP137	1.50
TIP29	0.84
TIP2955	0.95
TIP29A	0.46
TIP29B	0.63
TIP29C	0.40
TIP29D	0.75
TIP3055	0.75
TIP30A	0.41
TIP30C	0.16
TIP31A	0.34
TIP31B	0.38
TIP31C	0.50
TIP32A	0.53
TIP32B	0.69
TIP32C	0.40
TIP33	0.85
TIP33A	1.05
TIP33C	0.80
TIP34	1.25
TIP41A	0.49
TIP41B	0.65
TIP41C	0.30
TIP42A	0.49
TIP42B	0.53
TIP42C	0.35
TIP47	0.37
TIP48	0.92
TIP49	3.61
TIP55A	3.65
TIS43	1.43
TIS90	0.28
TL011CP	0.95
TL072	1.85
TL494CN	8.95
TL072CP	2.55
TMP4320	15.00
TMS1024NLL	13.75
TMS1025N	16.95
TMS3720ANS	19.50
TMS3748NS	14.95
TMS3755	13.65
TMS3894NL	19.25
TMS5102NLL	6.25

TUA2000	8.98
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ULN2204	11.45
UPA53C	4.94
UPC1003	5.95
UPC1009C	8.95
UPC1025H	3.00
UPC1026C	1.24
UPC1028H	2.00
UPC1020H	2.77
UPC1032H	0.62
UPC1042C	8.95
UPC1156H	2.96
UPC1158	5.84
UPC1161C	4.98
UPC1182H	1.22
UPC1186H	1.05
UPC1181H	1.25
UPC1185H	1.60
UPC1188	7.40
UPC1212C	1.72
UPC1225H	3.25
UPC1230	1.78
UPC1238	4.09
UPC1263	4.09
UPC1277H	5.85
UPC1278H	5.80
UPC1351C	1.81
UPC1350C	1.40
UPC1353	7.85
UPC1355C	2.13
UPC1363	4.20
UPC1362	2.98
UPC1365C	6.98
UPC1366	2.25
UPC1360C	4.51
UPC1378H	2.44
UPC141C	3.75
UPC1458	8.66
UPC151C	2.95
UPC2002	1.48
UPC30C	2.51
UPC324C	4.17
UPC32C	5.25
UPC339C	4.90
UPC41C	4.10
UPC4558C	2.15
UPC474	5.11
UPC554C	1.85
UPC566H	2.95
UPC574	4.09
UPC575C2	2.40
UPC576H	2.58
UPC577H	1.25
UPC578C	8.70
UPC580C	4.13
UPC587C2	1.34
UPC592H	2.15
UPC595	2.95
UPC596	1.98
UPD1514C	8.95
UPD2819C	4.98
UPD4013B	4.00
UPD4066B	4.95
UPD553-164	19.25
UPD8049C-1	11.50
X0007TA	4.68
X0022CE	5.75
X0029CE	7.09
X0031CE	4.95
X0035TA	5.98
X0040TA	4.50
X0042CE	4.35
X0043CE	2.75
X0056CE	6.25
X0057GE	6.00
X0062CE	8.35
X0065CE	4.60
X0074GE	10.00
X0077GE	15.96
X0079CE	4.95
X0092CE	4.95
X0096CE	5.98
X0109CE	11.25
X0113CE	2.07
X0195CE	7.50
X0204CE	8.74
X0261CE	8.75
X1222AF	3.63
IX0111CE	2.95
Y969	0.82
TDA3310	2.15
ZPY120	3.25
ZTK33	0.43

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The Ferguson TX85 Chassis

J. LeJeune

As the evolution of colour TV chassis progresses more and more of the low-level signal processing circuitry is integrated in all-embracing LSI chips. Ferguson's new small-screen chassis, the TX85, is basically a tidied-up version of the TX90, though with some important changes. Gone are the mains transformer and the unconventional audio and power supply regulator circuits. Advantage has been taken of the redesign to introduce new or up-dated integrated circuits. The result is a neat design without the quirks of the TX90.

Chopper Power Supply

The TX90's mains transformer/rectifier/voltage regulator system has been abandoned in favour of a switch-mode power supply. Loss of the mains transformer removes about 2·5lb of weight, a useful saving in a chassis to be used in portable sets. One consequence of this is reversion to conventional mains-voltage degaussing. The shunt chopper transistor is controlled by a new i.c., type TEA2018A. Three rails are derived from the chopper transformer, 13V, 17V and 95V. The 17V line also feeds a 12V regulator which powers the signal processing sections of the receiver. The 95V rail is used by the line and field output stages while the 13V supply is used by the line driver and the audio stages. Fig. 1 shows the power supply circuit; Fig. 2 gives an idea of the TEA2018A's internal systems.

D3-D6 form a bridge to provide full-wave rectification of the incoming mains supply. Reservoir capacitor C69 charges to approximately 340V to start up the i.c. and supply the primary winding of the chopper transformer T1.

The supply for the i.c. enters at pin 6. In normal operation it's derived from winding 3-2 of the chopper transformer, the rectifier circuit D7/C71 providing 11V d.c. At switch-on the supply is taken from R60/R89/R91 which charge C71 from the rectified mains rail: the voltage has to reach 5·8V before the i.c. will swing into life and deliver drive pulses to the base of the chopper transistor Tr6. C71's capacitance is sufficient to hold the voltage at pin 6 long enough to allow the chopper-derived supply to be established via D7.

Tr6's base drive current is derived directly from pin 5 of the i.c. To ensure rapid and positive turn-off the drive current swings negatively with respect to chassis. For this reason R102/D23/D8/D10 are connected in series between the negative side of the bridge rectifier and chassis. R97 and C74 smooth the supply of approximately −2·2V applied to pin 4.

Regulation of the output voltages is achieved by sensing the feedback provided by pins 2-3 of the chopper transformer. This time the rectifier circuit consists of D20 and C72: R61/RV9/R94 sample the resultant d.c. and pin 8 of the chip senses any changes in the switch-mode power supply's output – the control circuitry aims to maintain the voltage at this pin at a constant 2·5V. The set-h.t. control RV9 should be adjusted for 95V at the cathode of D12.

Unlike previous asynchronous chopper power supplies used by Ferguson, this one's operating frequency is held constant by R92 and C73. Control of the output voltage is achieved in the usual manner, by adjusting the mark-space ratio of the drive waveform produced at pin 5.

Two separate systems are used to provide protection against overload conditions. The first monitors the voltage at pin 3 of the transformer, feeding pin 7 of the chip via R93. This system looks for transformer saturation: the drive to Tr6 is shut-off in the event of saturation being detected. The second senses Tr6's collector current, which flows via R102 – this resistor is in series with Tr6,T1 and D23/8/10 across the rectified mains supply. The ramp produced across R102 is applied to pin 3 of the chip via R95. If the ramp voltage is excessive the drive to Tr6 is shut down. These two shut-down modes are short-term and cope with transitory conditions. A permanent overload will cause the supply to trip cyclically: as a result, T1 will emit a ticking sound.

Tr6 is protected by two networks in its collector circuit. C75/R101/D11 provide rate-of-rise limiting. When Tr6 is turned off, D11 is turned on as its anode voltage rises, connecting the snubber capacitor C75 across Tr6. This effectively diverts the major part of the back-e.m.f. energy away from Tr6. When Tr6 is switched on again, R101 discharges C75 in readiness for the next cycle. D9 and R99 limit the back-e.m.f. and prevent excessive ringing in the transformer. Fig. 3 shows the voltage waveform at Tr6's collector.

Tuner and IF Section

The familiar shape of the Ferguson SC4 tuner should be a reassuring sight to the engineer finding his (or her) way around this chassis. Manual channel selection models have the Preh switch-bank with the tuning tool-a.f.c. switch plunger while remote control models have the same basic system that went into TX90 sets with remote control.

The SC4 tuner's output is pi-coupled to the base of the i.f. preamplifer transistor Tr1. Gone is the i.f. preamplifier chip used in former models. The SAW filter is a new type from SigTech. It doesn't require a balanced input but has a balanced output to interface with current i.f. amplifiers. This results in a simpler and inherently more reliable design, with no loss of performance compared to what went before.

The main i.f. amplification and synchronous detection are carried out in the TDA4501H package (IC2). A feature of this i.c. is the very large number of functions it contains in relation to the peripheral component count. Fig. 4 shows the tuner, the i.f. preamplifier and IC2 circuitry. L4 is the synchronous detector tuning coil. No separate tuned circuit is necessary for a.f.c. – an on-chip 90° phase-shift network takes care of that – but the vision i.f. must be correctly tuned to 39·5MHz for it to work properly since this is the frequency at which the on-board phase shift network operates. The a.g.c. output at pin 5 can be positive-going for tuners with npn transistors or negative-going for tuners with pnp transistors. The polarity depends on the voltage at pin 1: for positive-going a.g.c. this voltage should be 3·5V while for negative-going a.g.c. it should be 8V. The onset can be adjusted by slight variation of these voltages – RV1 is included for this purpose. Pin 5 is connected to an open-collector circuit

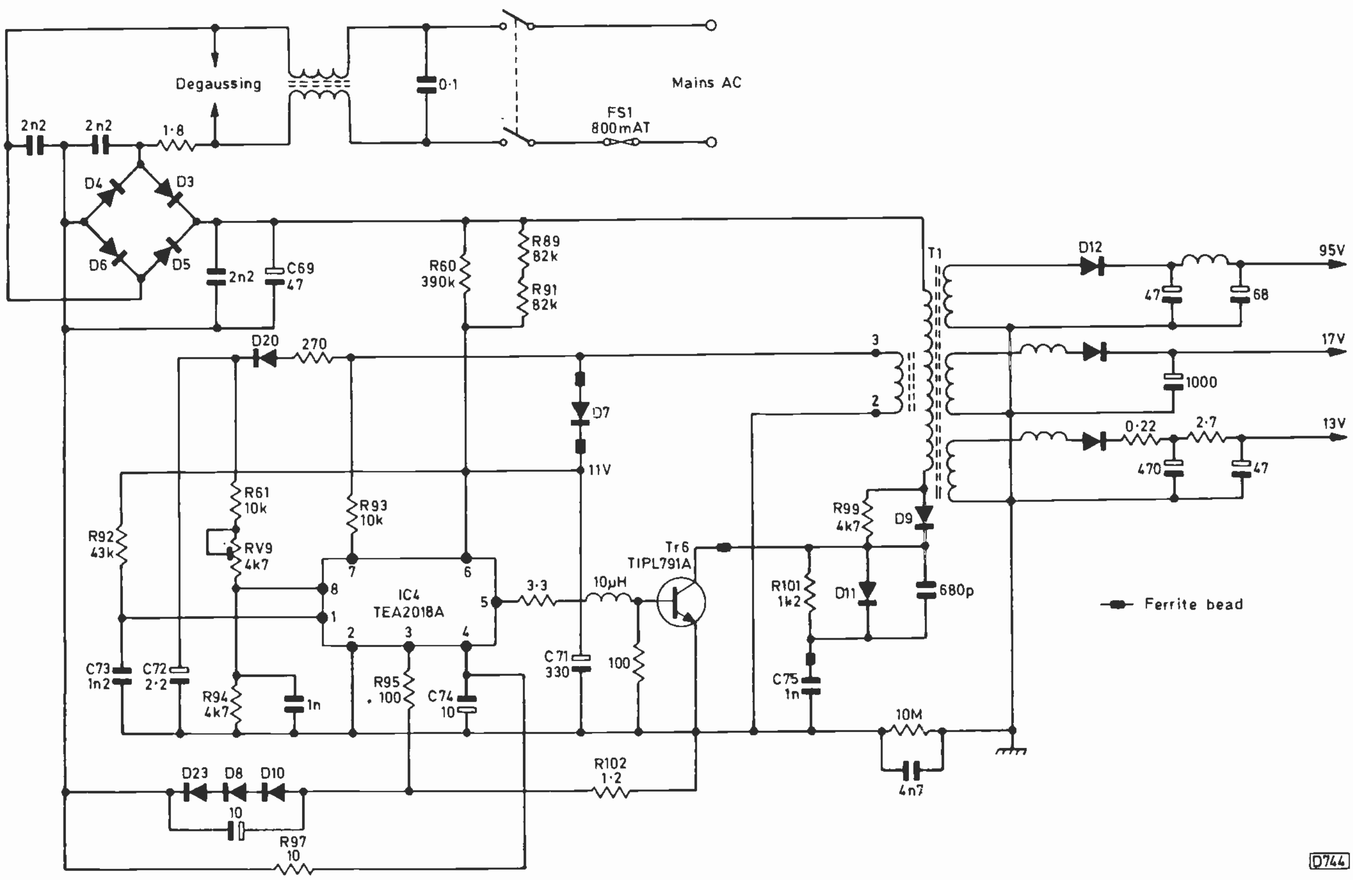

Fig. 1: The TX85's switch-mode power supply circuit.

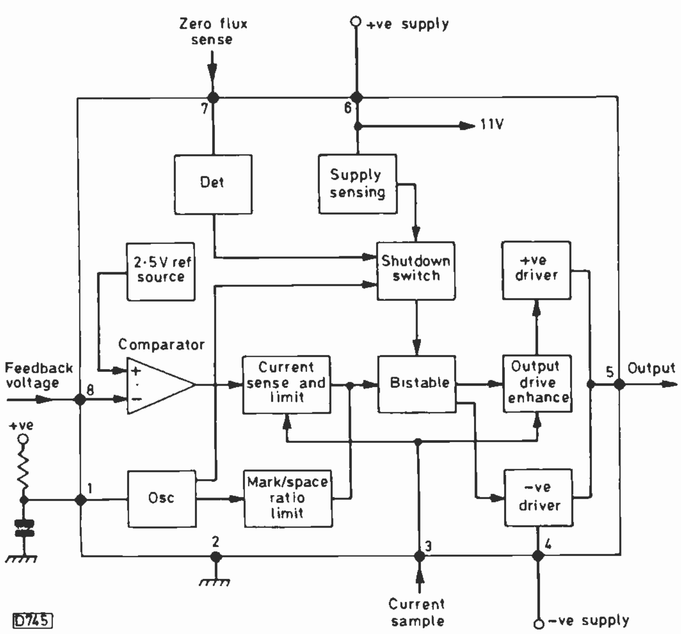

Fig. 2: Simplified block diagram of the TEA2018A chopper control chip.

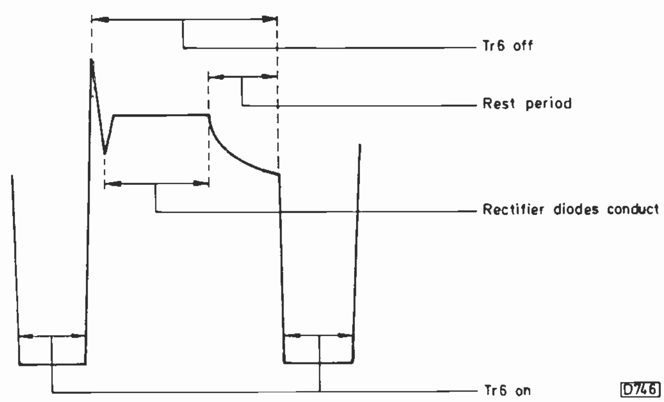

Fig. 3: The chopper transistor's collector voltage waveform.

capable of handling up to 2mA.

A video preamplifier follows synchronous detection. Its output at pin 17 consists of a 2·8V peak-amplitude positive-going video signal with the negative-going sync pulse tips sitting at a d.c. level of 1·5V. The intercarrier sound i.f. signal is also present at this pin. After passing through a 6MHz ceramic filter it re-enters the i.c. at pin 15. The luminance and chroma signals are passed to IC3 (TDA3565) for processing.

The usual quadrature detector is used to demodulate the intercarrier sound signal – L2 is the tuning coil. The detected audio signal passes internally to the d.c. volume control (RV2) section. This is followed by a small audio amplifier stage to enable pin 12 to drive the TBA820M audio amplifier chip directly.

The TDA4501H's Other Circuits

In addition to the i.f. amplifier, synchronous detector, a.g.c., a.f.c., video preamplifier, intercarrier sound channel and audio preamplifier IC2 handles timebase synchronisation and incorporates the generator sections of both timebases. The i.c. offers some very sophisticated features.

Sync Separator

The video signal is passed to the sync separator stage via an internal low-pass filter. R15 determines the sync slicing level. A noise inverter operates on negative-going impulses, disabling the sync separator to prevent false timebase triggering.

Line Generator

The line oscillator timing components C25/R23/RV3 are connected to pin 23 which also receives the output from the flywheel sync circuit via R22. There are the usual (nowadays) two line timebase phase detectors within the chip. The first compares the phasing of the incoming line sync pulses with that of the line oscillator signal. Its output is filtered and applied to the oscillator via the resistor just mentioned (R22). The operating conditions of this phase detector are determined by the strength of the incoming aerial signal (there's a feed from the a.g.c. circuit) and on whether the circuits are in or out of sync. With an unsynchronised signal the sensitivity of the catching circuit is set at 6kHz per μsec, which guarantees a short catching time. As the switching of the operating conditions is done automatically within the i.c. any programme selector button can be used for the AV input, though for psychological reasons one selector is still labelled AV. On a strong synchronised signal the 6kHz/μsec catching rate is operative during the field flyback period to ensure lack of "top flutter" with an AV input: during the field scan this figure is halved (the time-constant is doubled) to 3kHz/μsec. If the input signal is synchronised but weak the time-constant during the field scan is further increased to give a catching rate of 2kHz/μsec to ensure that the picture is steady.

The second phase detector has an external connection at pin 28. It compares the timing of the line flyback pulses with the synchronised line oscillator output and adjusts the timing of the line drive to counter switching-time delays in the line output stage. The reason for this is to maintain correct centring of the picture within the raster over the full range of c.r.t. beam current. A degree of horizontal shift can be achieved by varying the voltage at pin 28. In the TX85 however this voltage is fixed.

A coincidence detector within the chip monitors the in or out of sync conditions by comparing line flyback derived pulses with the line sync pulses. In the synchronised condition the d.c. output at pin 22, smoothed by C27, will be about 9·5V. When synchronism is lost the voltage falls to less than 2·5V. At this voltage the audio channel is muted via an internal connection.

A noise inverter blocks negative-going noise pulses to prevent disturbance of the sync separator. External sync pulses can be fed in at pin 25 if pin 19 is switched to a low state. This feature is important where the chassis is to be used as an RGB or video monitor.

The line drive output appears at pin 26. This is connected to an open-collector transistor whose load is R26. The positive-going edge of the waveform initiates the flyback. Under start-up conditions the "on" portion of the drive waveform is 50 per cent: under normal operating conditions this reverts to 45 per cent.

Field Generator

The TDA4501H incorporates a highly sophisticated field sync divider system. It has three modes of operation: which one is used depends on the quality of the incoming sync pulses. Optimum protection is thus provided against upsets due to interference or noise. The modes are selected by a counter system which looks for valid field sync pulses such as those found with a broadcast standard vision signal. Blanking and top-flutter prevention pulses are also derived from this counter, which measures the time of arrival of the field sync pulses.

If no sync signal is found, only noise, the field divider is reset at line 628. The effect of this is to provide a raster of normal height. With a video signal present the counter operates first in the seek mode, in which it can be reset between the counts of 488 and 722, giving a wide acceptance range. The counter will try to move into the third mode, which has a narrow acceptance range, checking for a field sync pulse between counts 622 and 628 for a 625-line signal or 522 to 528 for a 525-line signal. If no more than six field pulses have been clocked after 16 attempts the wide range mode two is adopted. Should the count of valid field sync pulses be fifteen however narrow mode three is adopted. In this mode the counter is monitoring the timing accuracy of the incoming field sync pulses: it reverts to the wide acceptance range (mode two) if fewer than seven out of 16 successive field sync pulses fall in the narrow acceptance range.

The top-flutter elimination pulse generated by this counter system is applied to the first line sync phase detector, disabling it to avoid disturbance caused by the field sync pulse.

The field blanking pulse derived from the divider system is very accurate. At the 50Hz field rate the duration of this pulse is 21 lines: for 60Hz systems the duration is 17 lines.

The composite field blanking anti-top-flutter pulse is present at pin 27 of the i.c.

The field sawtooth timing components R9 and C19 are connected to pin 2. The d.c. voltage here is 1·5V, with an 0·9V peak-to-peak sawtooth on top of it. Drive to the field output stage is provided at pin 3, with a peak of 0·5V at 1·5mA. Field feedback is applied to pin 4. Internal systems compensate for the 50/60Hz height variation – the difference is reduced to less than five per cent. The internal field failure guard system is also fed from this point. It gives video blanking in the event of the field timebase being inoperative. This is achieved by raising the field blanking to a permanent 2·5V d.c.

Sandcastle Pulse

The TDA4501H provides a sandcastle pulse output at pin 27. Its shape is shown in Fig. 5. The highest level, 7·5V, is the narrow burst gating pulse whose average duration is 4μsec. This is generated by level detection on the line sawtooth signal. The intermediate level 4·5V pulse, of 12μsec duration, is derived from the line flyback pulse. This is used for line blanking. At 2·5V we have the field blanking pulse whose duration depends on the standard, i.e. 50 or 60Hz.

Audio

Pin 11 of the TDA4501H can be used for either a manual d.c. volume control or the d.c. input from a remote control circuit. Minimum volume is with this pin at 0V, maximum at 2·4V. The audio output at pin 12 is taken via a de-emphasis network (R58/C30) to the TBA820M audio chip which delivers 1W r.m.s. at ten per cent total harmonic distortion.

Luminance and Chroma Processing

Luminance and chroma signal processing are carried

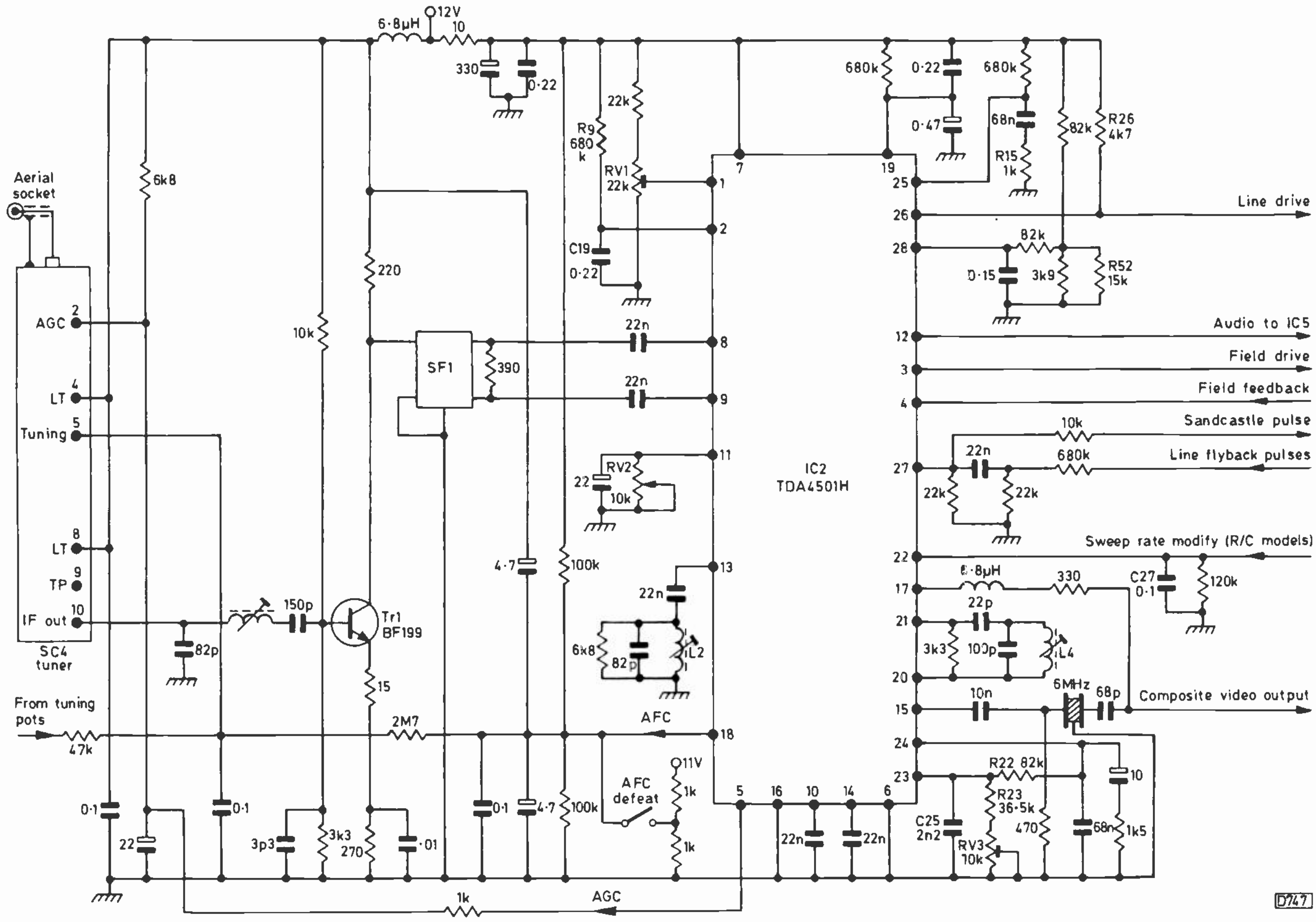

Fig. 4: The tuner, i.f. preamplifier and TDA4501H sections of the chassis.

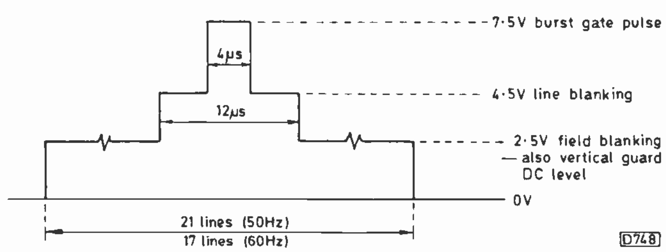

Fig. 5: Characteristics of the three-level sandcastle pulse produced by the TDA4501H chip.

out by a TDA3565 chip (IC3). Fig. 6 shows the circuitry. The composite video signal from IC2 is separated into luminance and chroma in the combined luminance delay line and separation filter DL1. Points to notice about this chip are the use of the red channel black level for proportional black-level clamping, adjusted via the user brightness control, and the single pin connection for the 8·8MHz crystal.

Beam limiting is carried out at the contrast control pin 6. The earthy side of the e.h.t. system is decoupled to

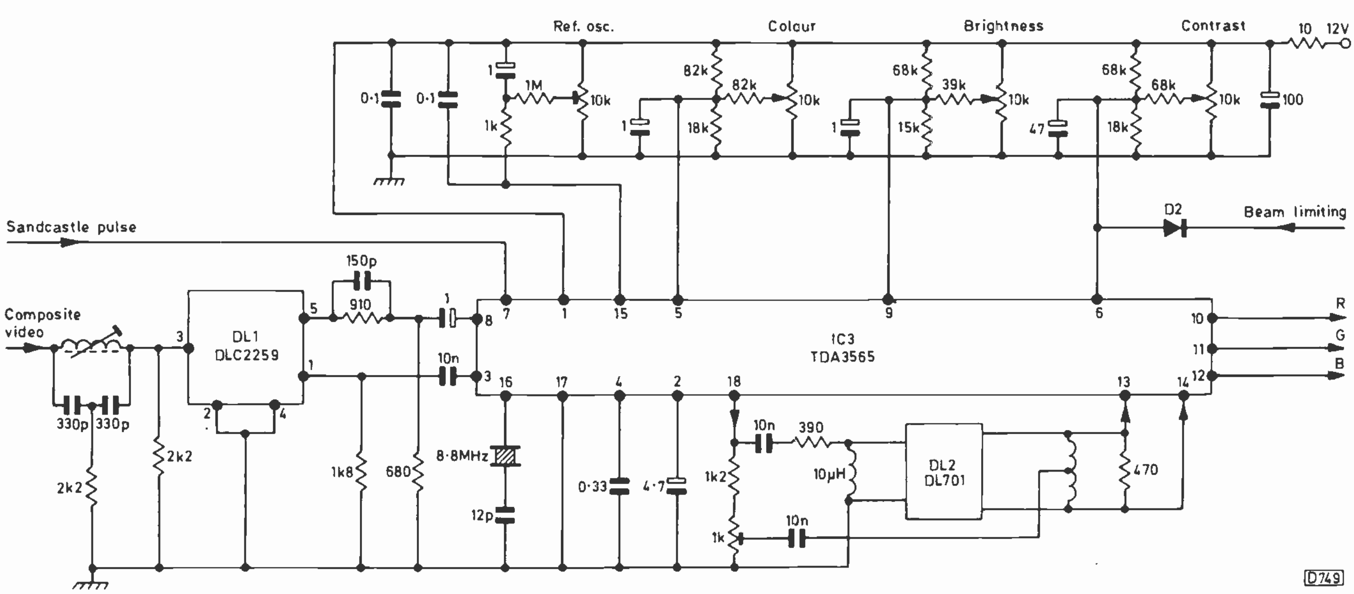

Fig. 6: The luminance and chroma processing section.

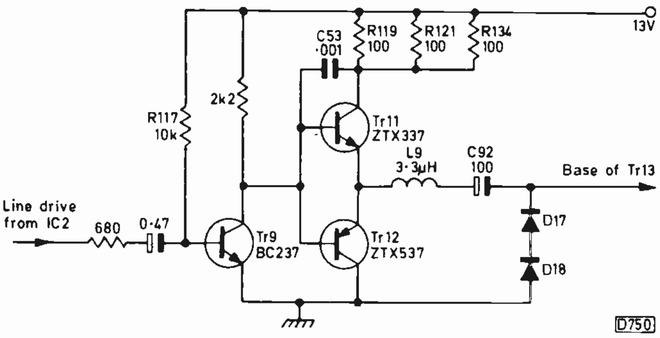

Fig. 7: The line driver stage.

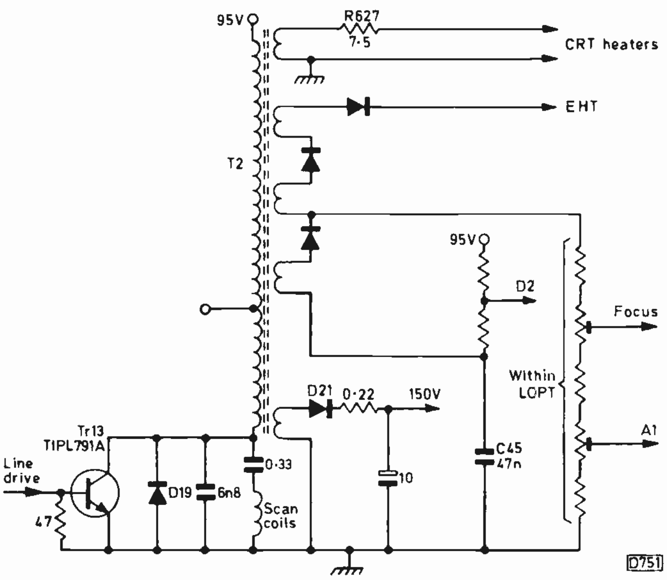

Fig. 8: Line output stage circuit.

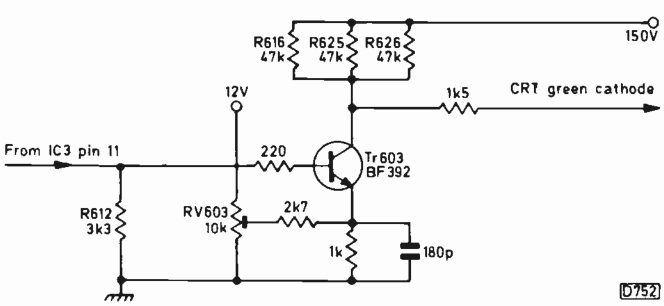

Fig. 9: One of the RGB output stages (green).

chassis by C45. As the beam current rises the voltage across C45 becomes increasingly negative. D2 will conduct at a point set by the voltage applied to pin 6 of the i.c. by the contrast control network and the voltage at its cathode. When it conducts it reduces the voltage at pin 6, preventing excessive video drive. The onset of beam current limiting can be modified by including a link which is in the field scan plug. On 14in. models the limiting is set at 600μA: with larger tube sizes the field scan plug link is added to raise the limit to 1mA (if you have the full circuit, the link adds R56 in parallel with R46).

Line Driver and Output Stages

The line driver stage is particularly interesting as it dispenses with the usual transformer coupling to the output stage. Line output transistors require a low-voltage, high-current base drive which is most easily achieved by using a high-voltage, low-current amplifier coupled to the output transistor by a step-down transformer to give the low-impedance input required.

The needs of the TX85's line output stage can be met more simply by using a complementary-symmetry drive stage (see Fig. 7). With no drive from the TDA4501H chip Tr9 is biased on by R117 and the emitters of Tr11/12 are at near chassis potential. The line output transistor Tr13 is off. A negative-going line drive pulse from IC2 switches Tr9 off. Tr11/12's emitter voltage then rises to a value close to 12V for the duration of the pulse. R119/121/134 form a 33Ω resistor to limit the current flowing via Tr11/12. C53 provides a degree of h.f. roll-off to avoid waveform overshoot. The line drive is coupled to Tr13 by L9 and C92: D17 and D18 limit the negative base drive excursion to 1·4V.

The line output stage (see Fig. 8) is entirely conventional. The output transformer is the same one that was used in the TX90 chassis. It's proved to be very reliable. The three-stage, diode-split secondary winding provides 20kV of e.h.t. There are two other windings. One supplies the c.r.t. heaters, via a 7·5Ω safety ballast resistor (R627). The other feeds a rectifier diode which produces a 150V supply for the RGB output transistors.

RGB Output Stages

A single class A transistor amplifier is used for each of the RGB output stages. BF392 transistors are used as the maximum dissipation in each stage does not exceed 400mW. As the three stages are identical we'll look at just one, the green output stage, see Fig. 9. Pin 11 of IC3 provides a 3V peak-to-peak drive across R612. RV603, which affects the background or low-light tracking, sets Tr603's d.c. operating conditions. No highlight colour adjustment is provided. Three 47kΩ resistors in parallel are used as the load to cater for the dissipation. The use of parallel-connected resistors to obtain the required wattage dissipation is a cost-effective solution for two reasons: first the auto-insertion equipment has to handle only one size of component while secondly the purchase of only one resistor size in large numbers reduces the cost from the component manufacturer. For optimum performance the RGB output stages are mounted on the c.r.t. base panel.

Miscellaneous Points

The field output stage in the TX85 chassis is virtually identical to that used in the TX90.

The TX85 chassis uses narrow-neck (21·5mm) c.r.t.s which have a high deflection sensitivity. The trade-off is in purity reserve, which is no problem as long as a set is operated with an a.c. mains supply. A battery converter (type TA185) which is suitable for use with 12V or 24V d.c. supplies is available and is fitted to some models during production. When a set is operated for long periods with a battery supply, and hence without degaussing, a purity problem may arise. This can be resolved simply by plugging the set into an a.c. mains supply and switching it on. One attempt is usually sufficient.

A remote control version with sweep tuning is also being introduced. The extra circuitry is similar to that used in the TX90 chassis. The TX90 system is not completely compatible with the TX85 however, mainly because the switch-mode power supply requires different standby switching. There is also to be a version with a built-in teletext decoder.

Service Bureau

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SONY SLC5

Lettering on the screen has a sideways wobble to the right and there are horizontal blue lines at different intervals down the screen. We've tried adjusting the tape path guides and the tension regulator arm. The net result is that the top four fifths of the picture flicker and produce double images, though the bottom fifth of the picture is perfect. It seems that the heads are faulty, but in this case why is the bottom of the picture so good?

When the heads are in an advanced state of wear the safety margin between the r.f. carrier level and the clip level becomes very small. As a result, tracking and tape tension become impossibly critical. The better tracking/tension conditions over the last fifth of the tape path account of the picture conditions you describe. A new head disc and careful adjustment of the tape path and tension will put matters right.

RANK T20 CHASSIS

There's a power panel fault in this set. To start with the chopper transistor and h.t. rectifier diode were found to be short-circuit. These were replaced and the board checked over but on applying power the d.c. fuse blew. When we tried again we found that the output rose to 250V before the fuse blew, instead of stabilising at 200V. The control transistor 7VT1 and switching thyristor 7THY1 have been replaced and all the diodes check all right in situ, but we still get BU326 failure and fuse blowing.

The chopper transistor seems to be running out of control. We suggest that you check 7R10 (1Ω) and 7C5 (47μF) and replace 7THY1 as a precaution. Diodes 7D2 and 7D6 and capacitor 7C4 (47μF) in the stabilising part of the circuit can be responsible for this sort of trouble. When testing the unit, start with the slider of the set h.t. control 7RV2 at the 7R6 end – ideally you need a mains variac or some method of adjusting the a.c. input.

FERGUSON 3V29

There's an intermittent fault with timed recordings. On about one in six occasions the machine fails to make the recording, i.e. the tape hasn't moved and the machine hasn't switched on.

The cause of this problem is almost always a slipping loading belt on the underside of the deck. It's not very easy to fit!

HITACHI NP8CQ CHASSIS

When the set is switched on from cold in the morning it remains in standby. If left like this for half an hour everything works normally.

We have on several occasions known this fault to be caused by a faulty 18V regulator chip – IC1601. If replacing this fails to cure the problem suspect the voltage sensing module CP901 in the power supply and the joints in this area, particularly around the chopper transformer, then suspect the transistors in the power supply. Use of a meter and scope when the fault condition is present should considerably narrow the field of search.

HG GRADE TAPES

This machine, a Panasonic NV366, doesn't seem to like HG tape. In record the machine squeals, suggesting increased tape tension due to additional drag over the surfaces of the tape transport system. The squealing also occurs in playback, with picture and sound distortion. E180 tapes work perfectly. The problem occurs with HG tapes of any manufacture but another Panasonic machine is quite happy with them.

Some middle-aged VCRs like this do give trouble with LP and HG tapes, and one sometimes has to accept that they are not compatible. We've found that judicious adjustment of the back tension and/or a check on the take-up torque can be beneficial.

THORN 1697 CHASSIS

Line hold is lost when anything – a light, fridge thermostat, etc. – is switched on or off near the set, the picture ending up as horizontal lines. The only way to restore the picture is to switch the set off for a few seconds. The controls have no effect on the fault.

The main suspect for this fault is the TDA1180 sync separator/line generator chip IC5. Before condemning it however check the following components, preferably by substitution, in the order given: the sync separator bias resistor R73 (3·3MΩ); C71 (4·7μF) in the flywheel sync filter network; the pulse feedback resistor R77 (100kΩ); R70 (820kΩ) associated with the coincidence detector; and the flywheel sync feed resistor R78 (100kΩ).

SONY SLC7

New heads have been fitted but we're having difficulty setting up the machine. The problem is to obtain a steady colour picture free of noise, with good sound. The picture can be resolved at times – clear, sharp and steady – but with noise bars and at the expense of sound quality. The new head disc appears to have only one slug on the underside – the original had two. Known good tapes are being used.

The new heads supplied have only the one tacho magnet fitted. This is of no consequence. Check that the entire tape path is clean, that the new head has less than three microns eccentricity, and that the upper drum is correctly mounted. If all these points are in order the tape path will have to be set up as specified in the SLC7 alignment manual. An alignment tape (or a very good substitute) and a suitable oscilloscope are required for this.

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TELEVISION OCTOBER 1987

GEC 20AX CHASSIS Mk. II

The original fault was a blank white raster with flyback lines. Replacing R281 (82kΩ) in the bias network for the RGB output stages cured this. Now, after about an hour, the brightness slowly increases with flyback lines appearing. Switching the set off and on restores a normal picture for another hour or so.

Check the supply to the TDA2530 colour matrixing/drive chip (pin 9) when the fault is present. If the voltage is outside its limits (11·5-12·5V) replace the 7812 voltage regulator chip (IC205). If the 12V supply is o.k. it's likely that the c.r.t. cathode voltages are falling as a result of problems with one of the zener diodes in the RGB output stages – D212 and/or D218. If the c.r.t.'s first anode voltages rise when the fault occurs check R554 (1·5MΩ).

TEST CASE

298

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

The reliability of consumer electronic equipment has increased by leaps and bounds in recent years. Instead of developing a fault due to a defective component, a fair proportion of the equipment we now receive for repair has been damaged by the user – faults due to liquid spillage for example have been featured in *Television* on several occasions recently.

While moving house one of our customers had an accident with a JVC Model HR2200. Not spillage this time but a violent trip down a flight of stairs. By the look of it the machine had bounced several times during its descent . . .

In the circumstances it appeared to have fared not too badly. There was some superficial damage to the cabinet, but electrically it didn't work at all. Some of the PCBs had hairline cracks, and in locating these we were somewhat misled by the fact that the fluorescent display didn't light up. Cracks in the power supply and servo boards were located and repaired, and after doing this the machine would play back and record satisfactorily – at least it would record from its audio and video line input sockets.

Investigation of the front PCBs revealed a crack across the timer/display panel. After repairing the broken tracks here we thought that our troubles would be over. The channel buttons now worked o.k. but the display panel remained in total darkness. We thought this was due to a further crack we discovered in the filament supply print on the board, but there was still no light after this had been repaired.

Diagnosis rather than repair was the next step: we shoved the soldering iron and fusewire to one side and made meter and scope checks around the display circuit. The −22·8V unswitched line – accelerating voltage – was found to be present and correct, and the filament supply oscillator transistor Q403 was banging away at its prescribed 24kHz or thereabouts. We also found that the filament voltage was being applied between pins 1 and 25 of the display panel. A fault in the segment drive circuits perhaps? Laying a finger along the indicator's leadout pins sometimes lights things up, but not in this case. The ceramic resonator associated with the clock/display microcomputer chip IC401 was next checked and found to be oscillating, which suggested that the chip's supply voltage (10V at pin 21) was present – a meter check confirmed this.

Like all fluorescent displays the segments are pulse fed by a strobe system in order to reduce the number of connections required. A double-beam scope was used to check the digit-control and segment-control pulses simultaneously. They were found to be correct and also changed with the action of the programming keys on the panel. So it seemed that the operating voltage, the filament voltage and the drive pulses to the indicator were all present, but there was no response by way of light.

The cause of the problem was found soon afterwards, and the machine was then restored to full working order. The point to make is that careful inspection, bearing in mind the circumstances, would have led us to the cause of the problem much more quickly. It was something that couldn't have occurred in the very early JVC models – make of that what you can! See this page next month for the answer.

ANSWER TO TEST CASE 297
– page 774 last month –

The fault featured last month was a fairly straightforward one on a simple TV set – a Thorn/Ferguson monochrome portable, Model 4816, fitted with the 1590 chassis. The picture was streaked and shaded, but the main problem was a marked brightness gradation across the screen – the left-hand side was very bright.

The important test point was the 95V line, which supplies the video output transistor. With the scope probe connected to the cathode of the relevant rectifier diode, W14, a heavy line-rate ripple was revealed. It took the form of a misshapen sawtooth waveform. In fact the rectifier's reservoir capacitor C111 (1μF) had dried up, and the ripple waveform was modulating the video signal at the picture tube's cathode. This sort of thing is quite common in older TV sets, though the 1590/1591 chassis is a little unusual in using scan as opposed to flyback rectification to obtain the 95V supply. In designs that employ flyback rectification the fault would more likely brighten the right-hand side of the screen, when the energy from the flyback pulse would be reduced, giving the video output transistor a low operating voltage towards the end of the line scan.

Sage had the required 1μF capacitor ready and handed it to the technician to fit. He had been tempted to precharge it to give its recipient a nip, but could find no suitable voltage source in the 3V53 on which he was working!

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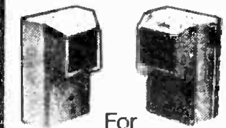

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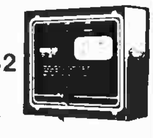

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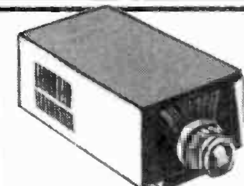

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Fits model numbers:
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Sharp

3HSS(SP) £39.90
Fits model numbers:
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Toshiba

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Sony

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Amstrad/Saisho

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Fisher/Fidelity

3HSS(SF) £29.95
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NV333, NV370 £44.00
NV366 £64.50
NV688, NV777, NV788 £64.50
NV730 £67.50
All others available P.O.A.

Ferguson

3V00, 3V16, 3V22 £49.50
3V29, 3V30 £49.50
3V32 £54.60
3V35, 3V36, 3V38, 3V39 £49.50

Sharp

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VC8300 £66.40
VC9300, VC9500, VC9700 £61.10
VC381, VC383, VC386 £61.10
VC483, VC483 £61.10
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VTC5300, VTC5400 £44.75
VTC9300 £44.75

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SLC9 £54.50

Toshiba

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V8600 £67.50
V31, V33 £54.60
V55, V56 £49.50

Hitachi

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VT6500, VT8000, VT8300 £34.50
VT8500, VT8700 £34.50
VT9300, VT9500, VT9700 £34.50
VT11E, VT14E £34.50
VT17E, VT19E £34.60
VT33E £34.50

Philips

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NV333, NV366 £6.50
NV370, NV830, NV850 £2.80
NV688 £6.50
NV777, NV788 £4.70
NV8600, NV8610 £6.50
NV730 £1.90
NV230, NV430, NV870 £2.80
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Ferguson

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3V23 £3.90
3V29, 3V30 £4.90
3V35, 3V36, 3V38, 3V39 £2.90

Sanyo

VTC5000, VTC5150 £1.90
VTC5300, VTC5400 £4.50
VTC9300 £6.50

Sony

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SLC6 £7.50
SL8000, SL8080 £6.50

Sharp

VC7300, VC7700, VC7750 £6.50
VC8300 £6.50
VC9100, VC9300, VC9500 £6.50
VC381, VC383, VC386 £6.50

Hitachi

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Akai

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REPLACEMENTS

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Ferguson

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3V23 £2.90
3V29, 3V30 £3.50
3V35, 3V36, 3V38, 3V39 £2.20

Sanyo

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VTC5300, VTC5400 £2.50
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Sony

SLC5, SLC7 £3.60
SLC6 £4.95
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Sharp

VC7300, VC7700, VC7780 £3.50
VC8300 £3.90
VC9100, VC9300, VC9500 £2.50
VC381, VC383, VC386 £2.50

Hitachi

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VT8000, VT8300, VT8500 £1.50
VT9300, VT9500, VT9700 £1.50
VT11E, VT14E, VT17E, VT19 £3.90
VT33E £3.90

Akai

VS9700 £3.90
VS2, VS3, VS4, VS5 £3.95
VS9300, VS9500, VS9700 £3.50
Many others available

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Panasonic NV7000 £19.80

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Sharp VC8300 £26.40
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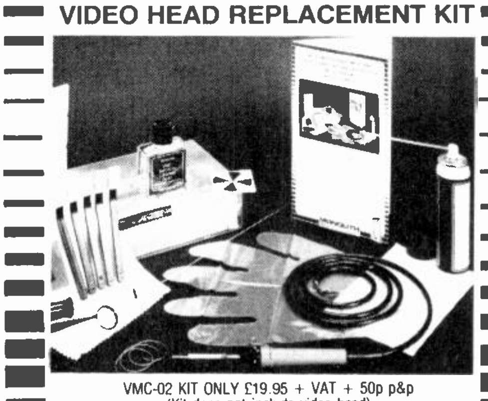

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HR3300, HR3360, HR3660, HR2200 £4.95
3V29, 3V30, HR7200, HR7300 £4.95
3V35, 3V36, 3V38, 3V39 HRD120 £8.90

Sanyo

VTC9100, VTC9300 £4.95
VTC8000, VTC8180, VTC8300, VTC8400 £4.95

Sony

SLC5, SLC7 £5.95
SLC6 £5.95
SL8000, SL8080 £5.95

Sharp

VC7300, VC7700, VC7750 £4.95
VC8300 £4.95
VC9100, VC9300, VC9500 £4.95
VC381, VC383, VC386 £4.95

Hitachi

VT5000, VT5500 £5.95
VT8000, VT8300, VT8500 £4.95
VT9300, VT9500, VT9700 £4.95
VT11E, VT14E, VT17E, VT19 £4.95
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Sanyo

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VC381, VC383, VC386 £3.90
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Hitachi

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VT9300, VT9500, VT9700 £4.75
VT11E, VT14E, VT17E, VT19 £3.96
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Akai

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Fisher

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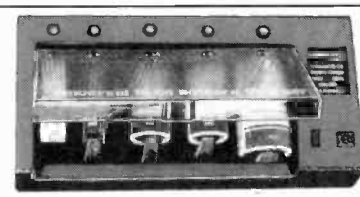

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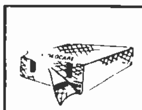

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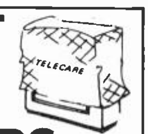

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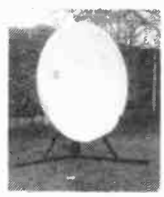

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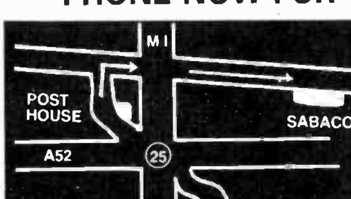

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BF181	20p
BF182	20p
BF183	20p
BF184	10p
BF194	10p
BF195	10p
BF196	10p
BF197	12p
BF198	10p
BF199	10p
BF200	20p
BF222	10p
BF224	15p
BF238	20p
BF240	10p
BF244	40p
BF245b	20p
BF255	20p
BF256	20p
BF257	25p
BF258	25p
BF262	15p
BF263p	20p
BF264	25p
BF271	15p
BF273	10p
BF274	10p
BF324	25p
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BF355	30p
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